MUNICIPAL STANDARDS

October 25, 2023

EAST HANTS

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Contents

1.0 GENERAL

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

These Municipal Standards have been prepared for: setting minimum design and construction standards for Municipal service systems within the Municipality of East Hants (East Hants); to list and suggest limiting values for items upon which an evaluation of such designs will be made; and to establish uniformity of practice within the Municipality. A complete documentation of all parameters relating to the design and construction of Municipal service systems 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 East Hants.

These Municipal Standards shall apply to all new developments in the Municipality of East Hants; however, not all Municipal service systems are available in every area of East Hants.

The purpose of this document is to provide guidance for designers in the provision of Municipal service systems meeting these criteria, but also consistent with cost effective installation, operation and maintenance. The design of these systems must be under the seal of a Professional Engineer in accordance with the Nova Scotia Engineering Profession Act.

This document is not intended to eliminate the necessity for detailed design, rather it is intended to standardize the materials, design criteria and method of construction to be utilized in the installation of Municipal services. Further, it is not the intention of East Hants to stifle innovation. Where 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 acceptance. In considering requests for variations from these design criteria, the Municipal Engineer shall take into consideration such factors as safety, nuisance, system maintenance, operational costs, life cycle costs, environmental issues, natural topography, configuration of bulk land, etc.

Each submission must be accompanied by a statement from a Professional Engineer that the submission is in accordance with these Municipal Standards. If there are variations, the Design Engineer must clearly indicate, in all appropriate documents and plans included with the submission, the specific variances from these Municipal Standards. Also, where the Design Engineer uses

standards other than those outlined in this document, all appropriate documents and plans must clearly indicate those areas of difference.

The acceptance by East Hants 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 East Hants has checked the design for compliance with this document. The Design Engineer retains full responsibility and liability for their work as a Professional Engineer. Where East Hants 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 Municipal Engineer, the provisions of this document still apply.

Land development will impact the natural environment. It is the responsibility of the Design Engineer to take this into account and to minimize the negative impacts of same. Surface water and ground water are two key considerations. The Design Engineer shall assess the possible changes in groundwater movement caused by the development (in particular, the use of pervious bedding material) and shall be responsible for the design of corrective measures to prevent flooding or lowering of the groundwater table as a result of this groundwater movement. If requested by the Municipal Engineer, the Design Engineer must provide a report prepared by a geotechnical engineer on the effectiveness of the proposed corrective measures.

All service systems must conform to this document and to any more stringent requirements established by other authorities having jurisdiction within East Hants. In addition to these design criteria and 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 edition of:

- “Standard Specification for Municipal Services”, by the Nova Scotia Road Builders Association – Consulting Engineers of Nova Scotia – Landscape Nova Scotia Joint Committee on Contract Documents
- “Atlantic Canada Water Guidelines”, by the Atlantic Canada Water Works Association (ACWWA)
- “Atlantic Canada Wastewater Guidelines”, by the Atlantic Canada Water Works Association (ACWWA)
- American Water Works Association (AWWA) standards
- “Water Supply for Public Fire Protection, 1999”, by the Fire Underwriters Survey (FUS)
- Canadian Standards Association (CSA) standards
- National Building Code of Canada (NBCC)
- National Plumbing Code of Canada (NPCC)
- National Fire Code of Canada (NFCC)

- Canadian Electrical Code (CEC)
- Underwriters Laboratories of Canada (ULC) standards
- National Electrical Manufacturers Association (NEMA) standards
- “Geometric Design Guide for Canadian Roads”, by the Transportation Association of Canada (TAC)
- “Manual of Uniform Traffic Control Devices for Canada”, by the Transportation Association of Canada (TAC)

All contract documents prepared for Municipal services within East Hants must contain a clause requiring the Developer and the Developer's contractors and sub-contractors, to carry out all work in compliance with all applicable Federal, Provincial, and Municipal requirements, including the Nova Scotia Occupational Health and Safety Act.

Any available record drawings of Municipal services will be provided to the Design Engineer for their information only. The Developer and the Design Engineer are responsible to verify the information in the field prior to detailed design and construction.

No services shall be constructed until the design has been accepted by the Municipal Engineer. The Municipal Engineer’s decision shall be final and binding in matters of design and construction. No alternatives to the design will be permitted during construction unless approved in writing by the Design Engineer and accepted by the Municipal Engineer.

All permits and approvals from Nova Scotia Environment (NSE), Nova Scotia Transportation and Infrastructure Renewal (NSTIR), and other applicable regulatory authorities shall be obtained by the Developer or their agent. Copies of the permits and approvals must be submitted to the Municipal Engineer prior to commencing construction. Further information on submission requirements is included in Section 9.0 of this document.

East Hants will periodically revise the design criteria, guidelines and specifications contained in this document to conform to advances and improvements in engineering practices. It is the responsibility of the Design Engineer to remain current with revisions to this document.

2.0 DEFINITIONS

a) **Acceptance** means the acceptance of the Municipal Engineer. The decision of the Municipal Engineer will be final and binding in all matters of design and construction. Acceptance will be based on compliance with these Standards and/or other appropriate standards as indicated throughout this document. Tentative Approval and Final Approval are as defined in the Municipality's Subdivision Bylaw.

b) **Base Course** means the granular material which is placed immediately upon the subgrade.

c) **Design Engineer** means the Professional Engineer, representing the Developer, who has affixed their professional seal to the engineering drawings, plans and specifications for the proposed development. This person must be registered and/or licensed to practice engineering in the Province of Nova Scotia.

d) **Developer** means the owner of the area of land proposed to be developed and includes anyone acting on their behalf with their written consent.

e) **Development** means any erection, construction, addition, alteration, replacement or relocation of or to any building or structure, and any change or alteration in the use made of land, buildings or structures.

f) **Diameter** means the nominal internal diameter of the pipe unless noted otherwise.

g) **Feeder Main** means a water main which typically receives flow from a transmission main and which supplies water to several branch mains (distribution mains). The feeder main provides significant carrying capacity or flow capability to a large area.

h) **Floodplain** means the relatively flat or lowland area adjoining a river, stream, watercourse, ocean, lake or other body of standing water which has been or may be covered temporarily with floodwater during storms of specified frequency.

i) **Inspections** means field inspection by the Municipal Engineer at various stages of construction.

j) **Municipal Engineer** means the Director of Infrastructure and Operations of the Municipality of East Hants, acting directly or through an assistant or representative, duly authorized by the Municipal Engineer, and acting only within the scope of the particular duties assigned to them or within the scope of the authority vested in them.

k) **Municipal Service Systems** includes wastewater collection and treatment systems, water distribution and treatment systems, stormwater collection and management systems, and roads and sidewalks which are, or are to be, owned, operated and maintained by the Municipality.

l) **Municipality** means the Municipality of the District of East Hants.

m) **NSE** means Nova Scotia Environment.

n) **NSTIR** means Nova Scotia Transportation and Infrastructure Renewal.

o) **Professional Engineer** means a Professional Engineer who is registered or licensed to practice engineering in Nova Scotia.

p) **Road** means the whole right-of-way consisting of the roadbed and all slopes, ditches, channels, waterways and appertaining structures necessary for proper drainage and protection.

q) **Roadbed** means that portion of the roadway extending from shoulder line to shoulder line, in other words, the subgrade and shoulders considered as a unit.

r) **Roadway** means the portion of the road extending between the extremities of the two back slopes.

s) **Stormwater Lateral** means the pipe that conveys groundwater from the street line or limit of a service easement to the stormwater main.

t) **Service Easement** means in the event that wastewater, stormwater and/or water services are installed outside of public road right-of-way (ROW), the Developer 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.

u) **Street Line** means limit of the public road right-of-way (ROW) or the limit of the service easement.

v) **Subgrade** means that portion of the roadbed upon which the base course is placed.

w) **Subdivision** means the division of any area of land, whether by plan or by metes and bounds or by description or otherwise, into two or more parcels and includes a re-subdivision and a consolidation of two or more parcels.

x) **Surface Course** means the granular material which is placed immediately upon the base course.

y) **Walkway** means an area of land, other than land forming part of a road, used for public pedestrian traffic.

z) **Wastewater** means the spent water from a community consisting of liquid conveying solids from residential, industrial, institutional and commercial buildings but excluding stormwater or surface run-off and groundwater. It does not include contaminated liquid wastes or wastewater at concentrations greater than that commonly found in domestic sewage.

aa) **Wastewater Collection System** means the system consisting of all pipes, mains, equipment, buildings and structures for collecting and pumping of wastewater operated by the Municipality of East Hants. It is designed to collect and convey wastewater from its point of origin to a treatment location.

bb) **Wastewater Lateral** means the pipe that conveys wastewater from the street line or limit of a service easement to the wastewater main.

cc) **Water Distribution System** means the system which is owned and maintained by the Public Water Utility and which consists of water mains, water service laterals from the water mains to street lines and appurtenances carrying and distributing potable water for domestic and/or fire protection purposes and includes any reservoirs.

dd) **Water Utility** means the water utility controlled by the Municipality of East Hants

ee) **Water Lateral** means the pipe that conveys water from the water main to the street line or limit of a service easement.

ff) **Watercourse** means the bed and shore of every river, stream, lake, creek, pond, spring, lagoon, swamp, marsh, wetland, ravine, gulch or other natural body of water and the water therein, including groundwater within the jurisdiction of the Province, whether it contains water or not.

3.0 WATER SYSTEM

3.1 GENERAL

A water distribution system is a complete and functioning system of mains, service laterals, hydrants, valves, reservoirs and appurtenances which are designed to convey and distribute potable water for residential, institutional, commercial, industrial, and fire protection use. The system must be designed to supply adequate flow and pressure to meet the needs of customers.

In addition to the design criteria herein, the Design Engineer must satisfy all applicable codes and standards including those listed in Section 1.0. All water distribution systems must conform to the applicable requirements established by NSE. No system shall be constructed until the design has been accepted by NSE and the Municipality.

The water distribution system must meet the requirements of the Municipality before it will be considered for takeover. The following are minimum requirements for consideration in system design and are intended to provide direction to the Design Engineer responsible for design and construction of Municipal water distribution systems in East Hants.

3.2 HYDRAULIC CRITERIA

3.2.1 SYSTEM CAPACITY

Water distribution systems must be designed to accommodate the greater of fire flow plus maximum day demand or peak hour demand. Hydraulic analysis of the system shall be carried out by the Design Engineer in consultation with the Municipal Engineer. Hydrant flow tests shall be carried out by the Design Engineer in coordination with the Municipality and a copy of the results must be provided to the Municipal Engineer.

Fire flow demand shall be established by the Design Engineer in accordance with the publication “Water Supply for Public Fire Protection” (Fire Underwriters Survey, 1999). This requirement is separate from any calculation for building sprinkler design.

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

- Average day demand: 410 liters per capita per day
- Maximum day demand: 615 liters per capita per day
- Peak hour demand: 1025 liters per capita per day

The water distribution system shall be designed for a gross population density of 45 persons per hectare. In developments where the projected population exceeds this density or in areas of commercial or industrial development, the domestic water demand shall be adjusted accordingly.

3.2.2 MAXIMUM/MINIMUM PRESSURE

A pre-design report with water system analysis is required for Tentative Subdivision Approval.

During peak hour demand, it is desirable to maintain a minimum water pressure of 275 kPa at all points along the distribution mains; during minimum hour demand, it is desirable to maintain a maximum water pressure of 620 kPa.

During fire flow conditions, water distribution systems shall be designed to maintain a minimum pressure of 150 kPa in the water main at the point of withdrawal and a minimum pressure of 140 kPa at all points along the distribution mains.

The normal maximum static hydraulic elevation on the Regional System is 63.000 m. Elevations above 35.000 m will be subject to water pressures below 275 kPa and services require special consideration such as larger diameter lateral and/or premises piping. Private booster pumps are subject to acceptance by the Municipal Engineer and require appropriate backflow prevention.

The maximum static hydraulic elevation on the Shubenacadie System is 80.000 m. Elevations below 17.000 m are subject to water pressure in excess of 620 kPa and services require appropriate pressure reducing valves.

3.2.3 LIMITING VELOCITIES

Water mains shall be sized such that the maximum velocity in the pipe must not exceed 1.5 m/s during peak hour flow conditions and 3.0 m/s during fire flow conditions. The Hazen-Williams formula with a ‘C’ value of 120 for PVC and 110 for DI shall be used for the design of the water distribution system.

3.2.4 LOOPING/INTERCONNECTION

Water distribution systems shall be designed to provide looping of water mains and interconnection with adjacent developments as frequently as road and service easement layout permit. Additional looping may be required to increase the reliability of the system where a need is identified by the Municipal Engineer. Dead-end pipes shall be avoided where possible.

3.2.5 MINIMUM SIZE

The minimum size of pipe shall be 200 mm diameter for local distribution mains and 300 mm diameter for feeder mains. Local distribution mains for crescent streets and permanent dead ends may be reduced to 150 mm diameter at the discretion of the Municipal Engineer provided that adequate service levels and fire flows are maintained.

Transmission, feeder and distribution mains must conform to the Municipality's long-term servicing plan.

3.3 PHYSICAL CRITERIA

3.3.1 PIPE MATERIAL

The following types of pipes are approved for use as water mains when installed in accordance with the manufacturer's recommendations and these Municipal standards:

3.3.1.1 Polyvinyl Chloride (PVC) Pipe

1) PVC pipe to AWWA C900, PC 235, DR18.
2) PVC pipe is approved for installation in all available diameters.
3) Valves, hydrants and metallic fittings shall be installed with an attached zinc anode Z-12-24 to ASTM B418 Type II.
4) Fittings for PVC pipe to AWWA C104, C111 and C153.
5) Tapping sleeves for branch lines over 50 mm diameter to AWWA C223, Type 304 and 304L stainless steel.
6) PVC pipe installation shall include the installation of an approved trace wire system for location purposes.
7) Water lateral taps up to 50 mm diameter must be completed using an approved saddle; direct tapping is not permitted. Wet tapping of PVC pipe is not permitted when the pipe or ambient trench temperature is below 4°C. Adjacent taps in the same pipe length must be staggered circumferentially and separated by a minimum of 450 mm longitudinally. No taps are permitted within 600 mm of the pipe bell or spigot insertion line.

3.3.1.2 Molecularly Oriented Polyvinyl Chloride (PVCO) Pipe

1) PVCO pipe to AWWA C909, PC 235.
2) PVCO pipe is approved for installation in all available diameters.
3) Valves, hydrants and metallic fittings shall be installed with an attached zinc anode Z-12-24 to ASTM B418 Type II.
4) Fittings for PVCO pipe to AWWA C104, C111 and C153.
5) Tapping sleeves for branch lines over 50 mm diameter to AWWA C223, Type 304 and 304L stainless steel.

6) PVCO pipe installation shall include the installation of an approved trace wire system for location purposes.
7) Water lateral taps up to 50 mm diameter must be completed using an approved saddle; direct tapping is not permitted. Wet tapping of PVCO pipe is not permitted when the pipe or ambient trench temperature is below 4°C. Adjacent taps in the same pipe length must be staggered circumferentially and separated by a minimum of 450 mm longitudinally. No taps are permitted within 600 mm of the pipe bell or spigot insertion line.

3.3.1.3 Ductile Iron (DI) Pipe

1) DI pipe to AWWA C151, Class 52, cement mortar lined.
2) DI will be considered for installation over 300 mm diameter subject to acceptance by the Municipal Engineer.
3) DI pipe and fittings must be installed with polyethylene encasement.
4) Valves, hydrants and fittings shall be installed with an attached zinc anode Z-12-24 to ASTM B418 Type II.
5) DI pipe is not approved for installation below the salt water tidal zone.

3.3.2 PIPE COVER

The minimum depth of cover over water mains shall be 1.6 m from the finished grade to the crown of the pipe. The maximum depth of cover shall be 2.1 m. Over-excavation shall be avoided and water mains shall be installed on undisturbed soil whenever practical.

3.3.3 LOCATION

1) Water mains shall be installed at a uniform grade of not less than 0.4 % to avoid localized high points unless accepted otherwise by the Municipal Engineer. Water mains shall be installed in the same trench as gravity wastewater and stormwater pipes and must maintain a minimum 300 mm horizontal and vertical clearance from wastewater and stormwater mains with the water main at the higher elevation. If this clearance cannot be achieved, water mains must be installed in a separate trench with a minimum of 3.0 m undisturbed soil between the trenches.
2) Water mains must maintain a minimum clearance of 300 mm from manholes. Manholes shall be insulated adjacent to the water main where the clearance is less than 1.2 m.
3) Whenever wastewater and stormwater mains must cross under water mains, a clearance of at least 450 mm must be maintained between the wastewater/stormwater main and the water main. When the elevation of the wastewater/stormwater main cannot be varied to meet this requirement, the water main shall be relocated to provide this clearance and reconstructed with restrained fittings for a distance of 3.0 m on each side of the wastewater/stormwater main. One full length of watermain

shall be centered over the wastewater/stormwater main. Concrete thrust blocks shall be used at all bends.

4) When it is not possible to obtain proper horizontal and vertical clearance as stipulated above, the wastewater and stormwater mains shall be designed and constructed to water main standards and shall be pressure-tested to assure water tightness. This requirement shall apply to catch basin leads as applicable.
5) Water mains must be located within the public street right-of-way or within a service easement. Service easements must be a minimum width of 6.0 m in favor of the Municipality. Depending on the length and location of the service easement, an appropriate access road may be required for maintenance and operation purposes. Where service easements contain multiple services, the easement must be a minimum width of 6.0 m plus the distance between pipes.
6) Water mains shall be installed in a straight line within the traveled way portion of the street right-of-way, parallel to and on the street side of the wastewater main. On existing streets without curb and gutter, the watermain may be installed within the gravel shoulder area at the discretion of the Municipal Engineer.
7) Changes in alignment shall be accomplished by the use of manufactured bends. Minor curvature of pipe at joints may be permitted under certain site conditions at the discretion of the Municipal Engineer. Deflection must be within tolerances recommended by the pipe manufacturer.
8) Where there is a need to facilitate future development on adjacent lands, water mains shall be extended to the limit of the property boundary.

3.3.4 VALVES

1) Connections to existing water systems must include a valve so that the extension can be isolated to facilitate construction and testing while maintaining service in the existing main. Dead end stubs for future extensions must be provided with a valve and a minimum of one full pipe length on the downstream side. The pipe and valve must be mechanically restrained to a full pipe length on the upstream side.
2) Shutoff valves shall be provided on water mains to satisfy the following requirements:
    i. Three valves shall be required at each normal four-way street intersection. If there are less than four streets meeting at any intersection, the appropriate number of valves shall be installed to allow complete isolation of the system. The layout must allow isolation from the supply side without interrupting flow to the other streets.
    ii. Valves at intersections shall be mechanically restrained to the tee/cross and to one full length of pipe on the upstream side.
    iii. On straight runs, the maximum spacing for valves shall be 250 m for residential areas and 150 m for commercial/industrial areas. The distance between valves may be increased at the

discretion of the Municipal Engineer based on the ultimate service population that will be affected by a break in the water main.

iv. For looped systems with close intersection spacing, valve spacing may be adjusted at the discretion of the Municipal Engineer provided that adequate shutdown capability is maintained without putting more than 30 customers out of service at any time.

v. Gate valves shall be used on pipes 300 mm diameter and smaller. Direct buried butterfly valves shall be used on pipes over 300 mm diameter.

vi. Water main drains may be required at low points at the discretion of the Municipal Engineer.

3.3.5 HYDRANTS

1) The maximum spacing for fire hydrants shall not exceed 180 m in single family and semi-detached residential areas and 90 m in multi-unit residential, mixed use, commercial, institutional and industrial areas.
2) Hydrants shall be located on the extension of the boundary line between two lots. Hydrants shall be located at high- and low-profile points to act as manual air release and drain points.
3) Hydrants shall be located a minimum of 1.8 m from the edge of a driveway and 3.0 m from a utility pole or street tree.
4) Hydrants shall be located mid-block on cul-de-sacs that have a looped connection to the distribution system.
5) Dead end water mains shall terminate at a hydrant to permit flushing of the distribution system.
6) Hydrant leads shall be 150 mm diameter and shall include a gate valve connected directly to the main using an anchor tee. Hydrant leads shall utilize restrained fittings in addition to thrust blocks.

3.3.6 THRUST RESTRAINT AND ANCHOR BLOCKS

1) Any change in direction of the water main, in excess of the pipe joint deflection tolerance, shall be made using an appropriate fitting and thrust restraint as specified herein. Thrust and anchor block design shall take into account the operating pressure, surge pressure, peak flow velocity and in-situ material bearing strength.
2) Restrained fittings without thrust blocks are permitted on 11.25^{o}, 22.5^{o} and 45^{o} horizontal bends for pipe up to 300 mm diameter provided there are no pipe joints within the ‘minimum pipe length’ specified in the Standard Specification for Municipal Services.
3) Thrust restraint for vertical bends shall be by gravity thrust blocks located below the fitting and shall be connected to the fitting with galvanized tie rods embedded in concrete.
4) Thrust blocks are required for 90^{o} bends, tee joints, caps and hydrants.
5) Anchor blocks are required for gradient restraint on pipes installed at grades steeper than 16%.
6) Anchor blocks are required for valves on PVC pipe over 150 mm diameter.
7) Thrust blocks are required for service lateral connections over 100 mm diameter.

3.3.7 AIR RELIEF AND VACUUM VALVES

Air relief and vacuum valves shall be installed in an approved chamber at all high points in the distribution system and at such other locations as required for efficient operation of the water system.

3.3.8 WATER LATERALS

1) All water laterals shall be constructed with blue PEX or PEXa DR9 tubing.
2) Water laterals shall be buried with a minimum cover of 1.5 m and maximum cover of 1.6 m below finished grade.
3) Water laterals shall maintain a minimum 300 mm horizontal and vertical clearance from gravity wastewater and stormwater lines. The water laterals shall be installed above the wastewater and stormwater lines. In cases where a pressure wastewater lateral will be used or where a gravity wastewater and/or stormwater line is located above or within 300 mm below the water lateral, the water lateral shall be installed in a separate trench with a minimum 3.0 m horizontal clearance.
4) For pipe bedding and surround details, refer to Pipe Trench Detail (Drawing No. EH-S1) in Appendix A.
5) All water laterals, from the main line to the property line, shall be provided by the Developer. A lateral must be installed to each existing lot or potential future lot which could be created under the zoning in effect at the time of construction.
6) All water laterals and hydrant leads shall include looped tracer wire.
7) The minimum diameter for water service laterals shall be 25 mm. The maximum velocity through the service lateral shall not exceed 4.5 m/s. The minimum desirable service pressure is 275 kPa. For services longer than 50 m from the street line and for elevations above 35.000 m on the Regional System, a larger diameter lateral and/or premises piping may be required as determined by the Design Engineer. Private booster pumps require appropriate backflow prevention.
8) New water service laterals shall have not more than one compression fitting per 20 m of length.
9) The installation of a domestic service connection off a sprinkler line is not permitted except under the following conditions:
    i. If the length of domestic service on the public side (within the street ROW) would be more than one third of the street ROW width, connection of the domestic service to the sprinkler line at the property boundary may be allowed at the discretion of the Municipal Engineer;
    ii. If the length of the domestic service on the private side would be longer than 18 m, connection of the domestic service to the sprinkler line at a point at least 1.5 m from the building foundation may be allowed at the discretion of the Municipal Engineer. This type of connection is not permitted for fenced yards, storage areas, etc.
10) Curb stops shall not be located in a driveway, unless approved by the Municipal Engineer. Curb stops located in a driveway must be located inside a main line valve box top section, riser, or a manhole frame and cover, in order to prevent plowing damages.

3.3.9 BACKFLOW PREVENTION DEVICES

Backflow prevention devices are required to be installed on all new services where, in the opinion of the Municipal Engineer, there is a potential risk of contamination of the potable water supply system resulting from back flow or back pressure from the individual service. The type of backflow device will be specified by the Municipality. Backflow devices must be installed in accordance with the applicable standard specifications on the following types of services:

1) Industrial, commercial and institutional buildings.
2) Residential buildings larger than four (4) units.
3) Sprinkler service lines.

3.3.10 ROAD CROSSINGS

For new road construction crossing existing water mains, the Design Engineer shall ensure that:

1) The existing backfill material is excavated over the watermain to the springline of the pipe.
2) 600 mm compacted layers of Type 1 gravel is backfilled for the entire width of the traveled way portion of the proposed road.
3) A minimum of 1.6 m of ground cover is maintained from the top of the existing pipe to finished grade.
4) Adequate drainage for new and existing roads is provided.
5) Where ditches cross the water main, 1.6 m of cover or insulation for frost protection is provided. The minimum cover over the watermain with insulation is not to be less than 900 mm. Insulation shall be 50 mm HI-40 or approved equal. Insulation shall extend the full width of trench or be boxed in.
6) The exact location of the existing watermain is determined by test pits prior to approval of the road crossing design.
7) All related work near water mains must be witnessed by a representative of the Municipality.

For installation of water mains under existing roadways under the jurisdiction of NSTIR, trenchless construction may be required. The method selected must be approved by NSTIR and accepted by the Municipal Engineer.

3.3.11 ANODES

Each direct-buried metallic fitting and valve on non-metallic pipe shall have one zinc anode installed. Fire hydrants shall have one zinc anode installed. Anodes shall be installed a minimum of 500 mm to the side of and 300 mm below the pipe and backfilled with native material. Anode requirements on metallic pipe shall be specified by the Design Engineer and subject to acceptance by the Municipal Engineer.

4.0 WASTEWATER SYSTEM

4.1 GENERAL

A wastewater collection system is a complete and functioning system of wastewater mains, service laterals, lift stations, force mains and appurtenances which are designed to collect and convey wastewater to a wastewater treatment facility.

Industrial, institutional, and commercial wastewater must meet the requirements of the Municipality's Wastewater Bylaw. If the strength of the wastewater is greater than domestic wastewater, pretreatment prior to discharge may be required at the discretion of the Municipal Engineer.

In addition to the design criteria herein, the Design Engineer must satisfy all applicable codes and standards including those listed in Section 1.0. All wastewater collection systems must conform to the applicable requirements established by NSE. No system shall be constructed until the design has been accepted by NSE and the Municipality.

The wastewater collection system must meet the requirements of the Municipality before it will be considered for takeover. The following are minimum requirements for consideration in system design and are intended to provide direction to the Design Engineer responsible for design and construction of Municipal wastewater systems in East Hants.

4.2 GRAVITY SYSTEMS

4.2.1 GENERAL

The wastewater collection system shall be designed for flows generated from all lands naturally tributary to the drainage area as determined from contour plans regardless of the ownership of such lands. Any lands tributary by pumping or regrading which are anticipated to flow through the design area shall be included in the calculated flows for the system being designed. Areas outside of the serviceable boundary or deemed undevelopable by East Hants may be excluded at the discretion of the Municipal Engineer.

The wastewater collection system design shall take into account future extensions so that the mains are installed at sufficient depth and grade to service adjoining lands by gravity where practical.

The wastewater collection system shall be designed for a gross population density of 45 persons per hectare. Increased density may be required depending on the projected land use or zoning of the tributary area. Any increase in population density and wastewater design flows shall be subject to available downstream capacity.

Average dry weather flows shall be calculated on the basis of an allowance of 340 liters per person per day.

Design peak flows shall be calculated based on an allowance of 1 490 liters per person per day plus an infiltration allowance of 25 920 liters per gross hectare per day for new systems. Existing systems may require a greater infiltration allowance at the discretion of the Municipal Engineer.

4.2.2 PIPE

Green, gasketed PVC DR35 or DR26 pipe shall be used for sanitary wastewater main installations. In instances where clearances can't be met or higher pressure rated pipe is required, all 'sanitary' DR18 pipe shall be wrapped with green 150 mm wide, underground warning tape. Tape shall be wrapped around each pipe length continuously, with a minimum of 4 wraps.

4.2.3 HYDRAULIC DESIGN

The capacity of the wastewater collection system shall be calculated by the Design Engineer using the Manning formula with a roughness coefficient of 0.010 for PVC pipe. Other methods used by the Design Engineer are subject to prior acceptance by the Municipal Engineer.

Under design flow conditions from the tributary area when fully developed, wastewater flow velocities shall be a minimum of 0.6 m/s and a maximum of 3.0 m/s. Should site conditions require a higher pipe velocity, special provisions shall be made to protect against displacement by erosion and shock.

Where development in the upper reaches of the service area is expected to be delayed, consideration shall be given to cleansing velocities in each phase.

4.2.4 MINIMUM PIPE SIZE AND GRADE

Wastewater collection system mains shall be a minimum of 200 mm in diameter. Larger diameters may be required at the discretion of the Municipal Engineer.

Wastewater collection system mains shall have a minimum grade of 1 %. Slopes less than 1 % may be permitted at the discretion of the Municipal Engineer where the depth of flow will be at least 30 % of the diameter of the pipe for design peak flow. The slope shall be selected to obtain the greatest practical velocities to minimize settling problems.

4.2.5 DEPTH

In general, wastewater mains shall be deep enough to prevent freezing (greater than 1.2 m of cover) and to prevent wastewater from entering basements. If site specific conditions are such that wastewater mains cannot be placed at a depth to prevent freezing, insulation may be used subject to acceptance by the Municipal Engineer.

The maximum depth of wastewater mains shall not exceed 4.3 m from finished grade to the crown of the pipe. The maximum depth may be increased at the discretion of the Municipal Engineer.

Notwithstanding the above, the depth of wastewater mains shall not be less than the depth required to service adjoining land by gravity subject to acceptance by the Municipal Engineer.

4.2.6 LOCATION

The wastewater mains shall be installed within the road travel surface, preferably on the side with the most service connections. Extra manholes may be required on curves. Locations outside the road travel surface are subject to acceptance by the Municipal Engineer.

Wastewater mains within the road travel surface shall be placed a minimum of 1.5 m from the face of the curb. Deviation from this location is subject to acceptance by the Municipal Engineer.

Construction of wastewater mains outside of road rights-of-way shall be avoided. Where it is necessary, a minimum 6.0 m service easement shall be provided. For service easements containing more than one pipe, the minimum width shall be 6.0 m plus the distance between the pipes. Depending on the soil conditions, depth of pipe, or other site-specific requirements, additional width of service easement may be required at the discretion of the Municipal Engineer. Service easements must be centered on the services and shall be constructed to provide convenient access by maintenance vehicles including service trucks and heavy equipment. Service easements shall be of sufficient width to allow safe access to the main in accordance with the requirements of the Municipal Occupational Health and Safety program and the Provincial Occupational Health and Safety Act.

Wastewater mains adjacent to watercourses shall be located outside the major storm flood level and in accordance with NSE requirements. Where wastewater mains are required to cross watercourses, the alignment should be as perpendicular to the watercourse as possible and free from change in grade. The design and construction of the crossing must be in accordance with NSE requirements.

Where a need is identified to accommodate future development of upstream lands, a service easement shall be provided from the road right-of-way to the upstream limit of the subdivision.

4.2.7 MANHOLES

A manhole shall be provided at any change in pipe size, material, grade, or horizontal alignment, and at all wastewater main intersections and end points. The interval between manholes must not exceed 100 m. Extra manholes may be required on curves; curvilinear wastewater mains are not permitted. Wastewater bends shall not exceed 90 degrees.

Manholes shall be precast concrete. All manhole joints must be watertight and manholes shall have an exterior waterproofing membrane. Sanitary manhole covers shall incorporate 'identifying markers', to be approved by the Municipal Engineer, to distinguish them from stormwater manhole covers.

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

a) The minimum drop across manholes for pipes of similar diameters shall be
    i. Straight run – 30 mm
    ii. Bends up to 45 degrees – 30 mm
    iii. Bends 45 to 90 degrees – 60 mm
b) The crown of a downstream pipe shall not be higher than the crown of an upstream pipe.
c) Where a local wastewater main connects to a trunk wastewater main (300 mm diameter or larger), the local main invert shall be no lower than the 0.75 inside diameter point of the trunk main.
d) A drop manhole shall be constructed when the vertical drop between incoming pipe invert and manhole base exceeds 900 mm.
e) The drop manhole shall be with an:
    i. Exterior drop for 1050 mm diameter manholes, or
    ii. Interior drop for manholes larger than 1050 mm diameter.

All wastewater manholes shall be positioned so as to prevent the infiltration of surface water and groundwater. Manholes should not be located at or near the following locations:

a) Drainage ditch or swale inverts.
b) Roadway gutters or low points.
c) Any location where expected flooding levels during a major storm event will reach the level of the manhole frame and cover.

In some situations where manholes cannot be easily relocated from the areas noted above, the use of berms and/or watertight frames and covers may be required at the discretion of the Municipal Engineer.

The minimum internal diameter of a manhole shall be 1050 mm. The Design Engineer shall ensure that the internal diameter is adequate to accommodate all pipe and appurtenances in accordance with manhole manufacturer's recommendations. At a three-way intersection (three pipes entering the manhole and one exiting), the manhole shall be a minimum diameter of 1200 mm.

Connections to existing manholes must be core drilled and a water tight gasket shall be installed. Kor-N-Tee connections to manholes are not permitted. The type of gasket shall be approved by the Municipal Engineer. If more than one connection is proposed to a single manhole, the spacing of the cores must be verified as appropriate by the manhole manufacturer.

4.2.8 SERVICE LATERALS

Minimum size wastewater lateral piping shall be 100 mm in diameter. The connection to the main must be made with a manhole if the lateral is greater than 100 mm in diameter. Doghouse manholes are permitted when connecting to existing mains.

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

a) All laterals shall be constructed with white PVC DR28 pipe.
b) A single wastewater lateral must be installed to each proposed lot and each potential future lot which could be created under the land zoning in effect at the time of construction.
c) The lateral shall be laid at a minimum grade of 2%. The Design Engineer shall confirm that where the grade is greater than the minimum, it shall adequately service the intended structure.
d) A minimum vertical clearance of 450 mm shall be provided between wastewater laterals and existing water mains with the wastewater lateral being below the water main.
e) For pipe bedding and surround details, refer to Pipe Trench Detail (Drawing No. EH-S1) in Appendix A.
f) All wastewater laterals, from the main to the property line, shall be provided by the Developer or property owner.
g) All wastewater laterals must be inspected and accepted by the Municipality before backfilling.
h) All wastewater laterals shall be tested for exfiltration.
i) All wastewater laterals shall be capped at the lot line with a 50 mm x 100 mm red stake indicating depth of bury. Where a sidewalk is to be constructed on that side, the lateral shall be extended 1.5 m beyond the lot line.
j) The invert elevations of wastewater laterals at the property lines shall be shown on Tentative Approval Drawings and confirmed on the Record Drawings.

A subdivision grading plan with minimum basement floor elevations shall be prepared to mitigate the potential for wastewater backup.

4.2.9 BACKWATER VALVES

Backwater valves are required for any building which has a plumbing fixture located below the level of the road or service easement. The backwater valves are to be located and installed in accordance with the National Plumbing Code of Canada. Building backwater valves must be normally-open and must be readily accessible for maintenance purposes. Maintenance is the responsibility of the property owner.

4.3 PUMPED SYSTEMS

4.3.1 GENERAL

Pumping station structures and force mains shall be designed for the ultimate wastewater flows from the tributary drainage area as stipulated in Section 4.2.1. Pumps and controls shall be designed for the expected 25-year peak wastewater flows.

The pumping station shall include a flow meter. Flow meters shall be located in an external valve chamber.

Pumping stations shall be provided when a gravity system is either not possible or not practical at the discretion of the Municipal Engineer. These specifications govern submersible pumping stations with an ultimate capacity of 75 L/s or smaller. Larger capacity pumping stations will be evaluated by the Municipal Engineer on a site-specific basis.

The design must ensure the safety of operations, in accordance with all applicable Municipal, Provincial and Federal regulations, including the Occupational Health and Safety Act and applicable CSA Standards.

Equipment that starts automatically must be suitably identified to make operators aware of this condition. Lock-outs must be provided for all equipment to prevent the equipment from energizing when maintenance or servicing is being carried out. Moving equipment must have suitable guards to prevent accidental contact.

4.3.1.1 Private Pumps

Where private or on-site pumps are required, such installations must be designed by a Professional Engineer. The Design Engineer shall indicate on the drawings those locations requiring private pumping installations. Private pumps shall be owned and operated by the property owner. Each property must be independently serviced to the Municipal wastewater main.

4.3.2 PUMPING STATIONS

4.3.2.1 Wet Well Size

For any pumping station, the wet well shall be of sufficient size to allow for a minimum of 15 minutes cycle time for each pump. For duplex stations, the volume in cubic meters, between pump start and pump stop shall be 0.225 times the pumping rate of one pump, expressed in L/s. For other numbers of pumps, the required volume shall depend upon the operating mode of the pumping units. 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 a detention time greater than 30 minutes. The Design Engineer must submit calculations for cycle and detention times for future reference, each under the most extreme future scenarios, especially where development will occur in phases. Pumping stations shall be designed such that the incoming wastewater mains will not surcharge under normal or peak flow conditions.

4.3.2.2 Pump Types

The following pump manufacturers are approved for use in wastewater pumping stations:

Submersible pumps shall be Flygt brand as manufactured by Xylem, Inc. or approved equal.

Submersible pumps shall be designed to minimize the deposition of solids in the wet well.

Pumps shall be non-clog, solid handling type, specifically designed for pumping raw, unscreened, domestic wastewater. Pumps shall be complete with electric motors.

The pump supplier must have a minimum:

- Fifteen (15) years of continuous sales and repair service in Canada.
- A replacement mechanical seal, wear plate/ring and impeller for the selected pump in inventory at all times in Nova Scotia.
- Factory trained service personnel available at all times in Nova Scotia.
- All pumps and motors must carry a minimum 24-month unconditional parts and labour warranty from Final Subdivision Approval.

4.3.2.3 Emergency Overflows/Auxiliary Power Supply

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 established by NS Power. In the absence of reliable data regarding the frequency and length of power outages, a minimum retention capacity of 4.5 hours at peak design flow shall be used. An auxiliary power supply may be used as a substitute for retention capacity at the pumping station.

Subject to NSE approval, an emergency overflow pipe may be provided under the following conditions:

The invert of the emergency overflow of the pumping station must be lower than the lowest wastewater lateral at the property line and high enough to prevent backup into the pumping station from the high water mark of the receiving watercourse. The emergency overflow pipe must be provided with a normally-open backwater valve conforming to National Plumbing Code of Canada and readily accessible for maintenance. Where public water supplies, shellfish production, or water used for culinary or food processing purposes exist, overflows are not permitted.

Provisions for chlorination and de-chlorination of overflows must be in accordance with NSE requirements.

4.3.2.4 Pump Selection

Pumping equipment shall be selected to perform at optimum efficiencies under normal operating conditions. Pumping stations and wet wells shall be designed such that all pumps will operate under a continuous positive prime condition during the entire pump cycle. System head calculations and pump selection curves must 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.

4.3.2.5 Flow Velocities

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

a) Minimum cleansing velocity of 0.6 m/s.
b) Maximum velocity of 1.5 m/s for suction lines and 3.0 m/s for discharge lines.

Regardless of the above conditions, piping less than 100 mm in diameter is not acceptable.

4.3.2.6 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; ball check valves are not acceptable. Check valves must be accessible for maintenance.

All valves and other appurtenances must be installed so that they can be operated under normal conditions.

Force mains shall be equipped with shut-off valve and emergency quick-connect discharge connection compatible with Municipal pumps.

4.3.2.7 Wet Well Ventilation

A ventilation system capable of delivering a complete air change to the wet well in 10 minutes or delivering fresh air to the wet well at a minimum rate of 110 L/s at 2.0 kPa static pressure, whichever is greater, shall be provided. A separate circuit with a ground fault interrupter shall be provided for the fan. The ventilation fan shall be controlled by a switch at the pumping station control panel set to operate when the control panel door is opened. The ventilation fan control shall also provide for automatic operation of the fan at least 4 times during a 24-hour period. The operation duration of each time shall be adjustable and shall be 10 minutes minimum. The ventilation fan shall be mounted on the pumping station control panel mounting structure adjacent to the control panel. Above ground ventilation piping must be stainless steel and must be goose-necked with a bird screen on the open end.

Continuous ventilation shall provide a complete change of air in not more than 5 minutes and intermittent ventilation shall provide a complete change in not more than 2 minutes as per NSE requirements.

4.3.2.8 Access

Adequate access hatchways shall be provided in a location acceptable to the Municipal Engineer.
Hatchways shall open in a direction which allows access from the driveway.
Pumping stations shall be provided with an acceptable safety harness connection.
Lift hatches must be able to be “locked-in” in the upright position.
A separate valve chamber shall be provided to provide access to check valves and gate valves.
Locks shall be provided and shall be keyed alike to the Municipality's standard system.

4.3.2.9 Pumping Arrangement

All pumping stations shall have a minimum of two pumping assemblies. If only two pumps are provided, they shall each have the same capacity, with each pump capable of handling the design peak sewage 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 units will have capacity to handle design peak sewage flows, taking into account head losses associated with parallel operation. The pump control circuitry shall be designed to automatically alternate pumps for each pumping cycle.

4.3.2.10 Electrical

Electric motors less than 7.5 kW must be 208 V, 3-phase; electric motors; 7.5 kW and larger must be 600 V, 3-phase.

Run-time meters shall be provided for each pump and an additional meter shall be provided to record run time for two pumps operating simultaneously. The run-time shall be recorded both on SCADA and also locally on mechanical meters mounted in the face of the control panel and facing outwards.

Pumping stations shall have either pressure transducer controls or float switches to control pump starts and stops. The station liquid level shall be displayed both locally and remotely. Pump controls must be provided with two over-rides (over-riding the normal function of the station), both of which shall be operated by float switches (Flygt ENM-10 or approved equal). One float shall be set to lock-out pumps if the liquid level drops 75 mm below the normal pump shut-off level. This condition must provide an alarm that is self-resetting. The other float must be set at the high-level alarm level, both to provide an alarm; but also, to start both pumps if they are not already running.

Pumping station control equipment shall be mounted in a CSA-approved NEMA 4X stainless steel enclosure. Communication software and a SCADA unit shall be provided and must be fully compatible with the central monitoring system used in the Municipality. Each panel is to be equipped with a pump controller (Surfline Model 9015 or approved equal) complete with communications hardware including radio, radio power supply, antenna and interface cables or approved equal. Adequate lightning arrestors shall be provided.

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 monitoring system for that location:

a) Hand-off-automatic selector switch status.
b) Output control through SCADA system.
c) Low level alarm.
d) High level alarm.
e) Panic alarm on panel support structure.
f) Power failure alarm.
g) Illegal entry alarm.
h) Pump information (overload, motor current, pump status and phase monitoring).
i) Any other information at the request of the Municipal Engineer.

Flow measurements at all pumping stations shall comply with NSE Standards and Guidelines Manual. For pumping stations with design peak hourly flow less than 75 L/s, an elapsed time meter used in conjunction with pumping rate tests are the minimum requirement. For pumping stations with a design peak hourly flow greater than 75 L/s, indicating, totalizing and recording flow measurement shall be provided as a minimum.

Electrical service from the transmission main 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.

4.3.2.11 Site Considerations

All pumping stations and control panels must be located off the street ROW in an appropriate area specifically designated for that purpose. The panel back shall face the road to minimize damage due to road salt. The property on which these facilities are located shall be sized to accommodate proper access, maintenance and all features associated with the station. The pumping station shall not be sited in a floodplain. 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. All exposed areas shall be sodded. The station shall blend into the anticipated surrounding development. An access driveway accepted by the Municipal Engineer shall be provided for access to the pumping station. The driveway shall be constructed of 100 mm of Type 1 gravel over 200 mm of Type 2 gravel to a minimum width suitable to accommodate a vacuum truck and a minimum length of 7.6 m; an adequate turning area for service vehicles shall be provided.

4.3.2.12 Operation and Maintenance Manual

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

a) System description.
b) Design parameters, system hydraulics and design calculations (including system curves).
c) As-constructed civil, mechanical and electrical drawings.
d) Pump literature, pump curves and operating instructions.
e) Manufacturer's operation and maintenance instructions for all equipment.
f) Name, address, telephone number of all equipment suppliers and installers.
g) Information on guarantees/warranties for all equipment.

Special tools and standard spare parts for pumping station equipment shall be provided prior to acceptance of the system by the Municipal Engineer.

4.3.3 FORCE MAINS

4.3.3.1 Limiting Velocities

Force mains shall be designed such that a minimum cleansing velocity of 0.6 m/s is maintained. The maximum velocity must not exceed 3.0 m/s. Regardless of the above criteria, the minimum force main diameter shall be 100 mm.

4.3.3.2 Pipe

White, gasketed PVC DR26 or DR21 pipe shall be used for force main installations. Non-PVC fittings used on force main installations shall be wrapped with approved anti-corrosion tape.

The force main, fittings and thrust restraint shall be designed to withstand both normal pressures and surge pressures.

Laterals acting as small diameter force mains shall be green or white PEX or PEXa DR9. The minimum cleansing velocity shall be 1 m/s; regardless, the minimum diameter shall be 40 mm. Small diameter force mains shall be connected to gravity laterals at the property line using pressure fittings. A shutoff valve shall be provided 1.5 m outside the street ROW on the small diameter force main.

The Hazen-Williams Formula shall be used to calculate hydraulic losses in force mains. The roughness coefficient 'C' for PVC pipe shall be 120.

The force main shall be identified by placing underground warning tape at the top of the first backfill layer. The warning tape shall be 150 mm wide polyethylene tape with green background and black lettering. The message on the warning tape shall be "Caution Buried Sewer Line Below" or approved equivalent.

4.3.3.3 Minimum/Maximum Depth

Force mains shall have a minimum cover of 1.2 m and a maximum cover of 2.4 m, measured from the finished surface to the crown of the pipe.

4.3.3.4 Location

Force mains must be located in a separate trench from water mains with a minimum 3.0 m of undisturbed soil between the trenches.

Force mains shall terminate in a benched manhole such that the flow is directed down the barrel of the receiving gravity pipe. The downstream pipe receiving flow from a force main must be of sufficient size and grade to prevent surcharging from the force main.

Where the service easements contain both a force main and a water main, the service easement shall be of a minimum width of 6.1 m plus the distance between the pipes.

4.3.3.5 Valves

Automatic air relief and vacuum valves, suitable for wastewater applications, shall be located in a manhole at high points of the force main or as dictated by the design. The manhole shall be drained, preferably to the wastewater system. A suitably sized vent pipe ending in an above ground goose-neck at the property line shall be provided.

The Municipal Engineer may require valves along the length of the force main.

Drain valves shall be located at low points as determined by the Design Engineer. Unless authorized otherwise by the Municipal Engineer, the valves shall drain to the wastewater system.

4.3.3.6 Thrust Restraint

Changes in direction, in excess of the allowable joint deflection, shall require a bend fitting. Thrust blocks shall be provided at changes of direction and shall be designed with consideration given to the operating pressure, surge pressure, shut-in pressure, peak flow velocity and in-situ material against which the thrust block bears. Thrust blocks must be designed and stamped by the Design Engineer.

Thrust blocks shall be constructed of ready-mix concrete with a minimum 28-day compressive strength of 20 MPa. In the case of vertical bends, the thrust block shall be located below the fitting and shall be connected to the force main through the use of galvanized steel tie rods securely embedded in the concrete. The Municipal Engineer may approve the use of restrained joints in place of a thrust block.

4.3.3.7 Anodes

Each direct-buried metallic fitting and valve on non-metallic pipe shall have one zinc anode installed. Anodes shall be installed a minimum of 500 mm to the side of and 300 mm below the pipe and backfilled with native material.

5.0 STORMWATER SYSTEM

5.1 GENERAL

A stormwater system is a complete and functioning system of stormwater mains, catch basins, service laterals, swales, roads, ditches, culverts, storage chambers, ponds and appurtenances which are designed to collect and convey precipitation to a downstream discharge point. Stormwater may require treatment prior to discharge subject to NSE regulation.

In addition to the design criteria herein, the Design Engineer shall satisfy all applicable codes and standards including those listed in Section 1.0. All stormwater systems must conform to the applicable requirements established by NSE. No system shall be constructed until the design has been accepted by NSE and the Municipality.

The stormwater system must meet the requirements of the Municipality before it will be considered for takeover. The following are minimum requirements for consideration in system design and are intended to provide direction to the Design Engineer responsible for design and construction of Municipal stormwater systems in East Hants.

5.2 DESIGN APPROACH

5.2.1 GENERAL

The stormwater system shall be designed for flows from all lands within the watershed and lands anticipated to be tributary to the watershed, either by future development or regrading. The design is to be based on the greater of winter or annual flow.

5.2.2 MINOR STORMWATER SYSTEM

The minor stormwater system is used for initial stormwater flows, or for flows generated in high-frequency rainfalls. The minor stormwater system, consisting of foundation drains, curbs & gutters, mains, catch basins and culverts, shall be designed to provide safe and convenient use of streets and properties and to minimize street maintenance costs. All pipes within the system shall be designed to carry the runoff from the 1:5 year storm without surcharge. The 1:10 year storm shall be conveyed/contained within the curbed portion of the road system.

5.2.3 MAJOR STORMWATER SYSTEM

The major stormwater system is the path which stormwater will follow during a major storm when the capacity of the minor stormwater system is exceeded and comprises of all overland flow paths. The minor and major stormwater systems together shall be capable of carrying the runoff from the major storm. The systems shall be designed to control the flow of stormwater in a major storm so as to mitigate basement flooding and damage to property, roads and structures. Easements may be required for the designation

and protection of elements of the major stormwater system. The major stormwater system shall be designed to carry the runoff from the 1:100 year storm.

5.2.4 DOWNSTREAM EFFECTS

Pre- and post-development stormwater flows must be balanced as specified herein through the use of stormwater management ponds, oversize pipes, flow control structures, etc. The design of these structures should limit the post development discharge for the 5, 10, and 100 year design storms. The Design Engineer shall determine the available capacity of downstream drainage structures based on their full watersheds. Where sufficient excess capacity exists, the Design Engineer shall limit the increase in post-development flows to a maximum of ten percent (10%). Where no excess capacity exists, no increase in post-development flows will be permitted. Where existing downstream drainage structures are undersized, the Developer may be required to undertake upgrades.

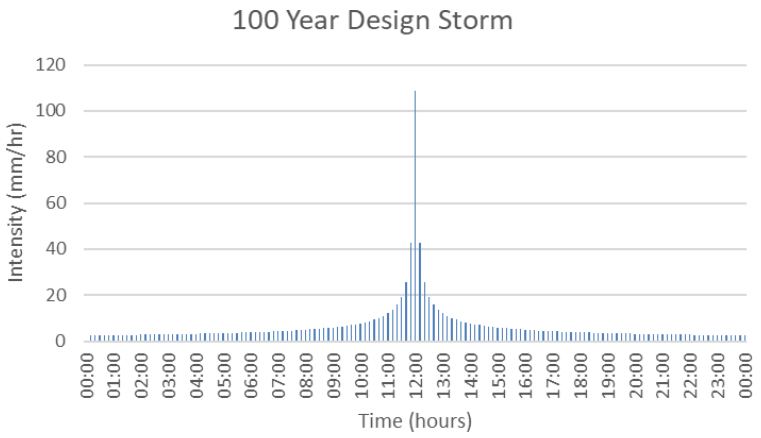
5.2.5 DESIGN STORMS

The following storms shall be used for design of stormwater systems in the Municipality:

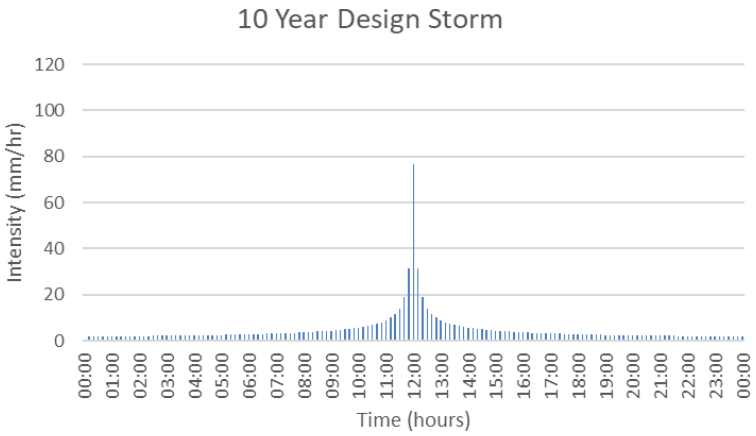
a) Piped systems and driveway culverts: minor storm.
b) The combined capacity of the major stormwater system and the minor stormwater system: major storm.
c) The design capacity of watercourses (including the floodplain), culverts for watercourse, stormwater systems where a minor stormwater system is not provided, and roadside ditches: major storm.
d) Road cross culverts excepting watercourses: 1:100 year storm.

5.3 METEOROLOGICAL DATA

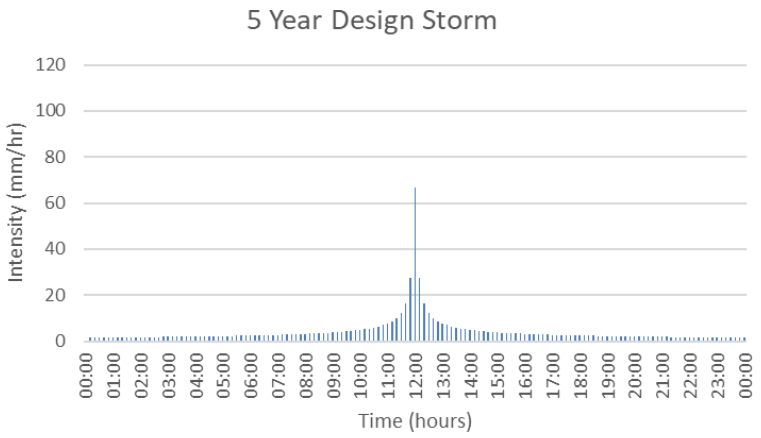
Stormwater system design shall be based on historical data from the Halifax Stanfield International Airport weather station using Chicago Storm distribution per the following graphs/tables:



100 Year Design Storm							
Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)
0:10	2.547	6:10	3.955	12:10	42.876	18:10	3.82
0:20	2.569	6:20	4.027	12:20	25.577	18:20	3.76
0:30	2.592	6:30	4.103	12:30	19.282	18:30	3.70
0:40	2.616	6:40	4.182	12:40	15.870	18:40	3.64
0:50	2.640	6:50	4.266	12:50	13.680	18:50	3.58
1:00	2.665	7:00	4.355	13:00	12.134	19:00	3.53
1:10	2.690	7:10	4.448	13:10	10.974	19:10	3.48
1:20	2.716	7:20	4.547	13:20	10.065	19:20	3.43
1:30	2.743	7:30	4.652	13:30	9.329	19:30	3.38
1:40	2.770	7:40	4.763	13:40	8.719	19:40	3.34
1:50	2.798	7:50	4.881	13:50	8.203	19:50	3.29
2:00	2.827	8:00	5.008	14:00	7.760	20:00	3.25
2:10	2.857	8:10	5.144	14:10	7.374	20:10	3.21
2:20	2.888	8:20	5.289	14:20	7.035	20:20	3.17
2:30	2.919	8:30	5.446	14:30	6.734	20:30	3.13
2:40	2.951	8:40	5.616	14:40	6.465	20:40	3.09
2:50	2.984	8:50	5.800	14:50	6.222	20:50	3.05
3:00	3.019	9:00	6.001	15:00	6.001	21:00	3.02
3:10	3.054	9:10	6.222	15:10	5.800	21:10	2.98
3:20	3.090	9:20	6.465	15:20	5.616	21:20	2.95
3:30	3.128	9:30	6.734	15:30	5.446	21:30	2.92
3:40	3.167	9:40	7.035	15:40	5.289	21:40	2.89
3:50	3.207	9:50	7.374	15:50	5.144	21:50	2.86
4:00	3.248	10:00	7.760	16:00	5.008	22:00	2.83
4:10	3.291	10:10	8.203	16:10	4.881	22:10	2.80
4:20	3.335	10:20	8.719	16:20	4.763	22:20	2.77
4:30	3.381	10:30	9.329	16:30	4.652	22:30	2.74
4:40	3.429	10:40	10.065	16:40	4.547	22:40	2.72
4:50	3.478	10:50	10.974	16:50	4.448	22:50	2.69
5:00	3.530	11:00	12.134	17:00	4.355	23:00	2.67
5:10	3.583	11:10	13.680	17:10	4.266	23:10	2.64
5:20	3.639	11:20	15.870	17:20	4.182	23:20	2.62
5:30	3.697	11:30	19.282	17:30	4.103	23:30	2.59
5:40	3.757	11:40	25.577	17:40	4.027	23:40	2.57
5:50	3.820	11:50	42.876	17:50	3.955	23:50	2.55
6:00	3.886	12:00	108.560	18:00	3.886	24:00	2.53



10 Year Design Storm							
Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)
0:10	1.84	6:10	2.861	12:10	31.367	18:10	2.763
0:20	1.86	6:20	2.914	12:20	18.720	18:20	2.718
0:30	1.87	6:30	2.969	12:30	14.084	18:30	2.674
0:40	1.89	6:40	3.027	12:40	11.573	18:40	2.632
0:50	1.91	6:50	3.087	12:50	9.964	18:50	2.592
1:00	1.93	7:00	3.152	13:00	8.830	19:00	2.553
1:10	1.94	7:10	3.219	13:10	7.980	19:10	2.516
1:20	1.96	7:20	3.291	13:20	7.314	19:20	2.480
1:30	1.98	7:30	3.367	13:30	6.776	19:30	2.445
1:40	2.00	7:40	3.448	13:40	6.330	19:40	2.412
1:50	2.02	7:50	3.534	13:50	5.954	19:50	2.380
2:00	2.04	8:00	3.626	14:00	5.630	20:00	2.349
2:10	2.07	8:10	3.725	14:10	5.349	20:10	2.319
2:20	2.09	8:20	3.831	14:20	5.102	20:20	2.290
2:30	2.11	8:30	3.945	14:30	4.883	20:30	2.261
2:40	2.13	8:40	4.068	14:40	4.686	20:40	2.234
2:50	2.16	8:50	4.203	14:50	4.509	20:50	2.208
3:00	2.18	9:00	4.349	15:00	4.349	21:00	2.182
3:10	2.21	9:10	4.509	15:10	4.203	21:10	2.157
3:20	2.23	9:20	4.686	15:20	4.068	21:20	2.133
3:30	2.26	9:30	4.883	15:30	3.945	21:30	2.110
3:40	2.29	9:40	5.102	15:40	3.831	21:40	2.087
3:50	2.32	9:50	5.349	15:50	3.725	21:50	2.065
4:00	2.35	10:00	5.630	16:00	3.626	22:00	2.044
4:10	2.38	10:10	5.954	16:10	3.534	22:10	2.023
4:20	2.41	10:20	6.330	16:20	3.448	22:20	2.002
4:30	2.45	10:30	6.776	16:30	3.367	22:30	1.982
4:40	2.48	10:40	7.314	16:40	3.291	22:40	1.963
4:50	2.52	10:50	7.980	16:50	3.219	22:50	1.944
5:00	2.55	11:00	8.830	17:00	3.152	23:00	1.926
5:10	2.59	11:10	9.964	17:10	3.087	23:10	1.908
5:20	2.63	11:20	11.573	17:20	3.027	23:20	1.890
5:30	2.67	11:30	14.084	17:30	2.969	23:30	1.873
5:40	2.72	11:40	18.720	17:40	2.914	23:40	1.857
5:50	2.76	11:50	31.367	17:50	2.861	23:50	1.840
6:00	2.81	12:00	76.688	18:00	2.811	24:00	1.824



5 Year Design Storm							
Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)	Time (hr:min)	Intensity (mm/hr)
0:10	1.626	6:10	2.525	12:10	27.44	18:10	2.439
0:20	1.641	6:20	2.571	12:20	16.41	18:20	2.399
0:30	1.655	6:30	2.620	12:30	12.36	18:30	2.360
0:40	1.670	6:40	2.670	12:40	10.17	18:40	2.323
0:50	1.686	6:50	2.724	12:50	8.76	18:50	2.288
1:00	1.702	7:00	2.780	13:00	7.76	19:00	2.254
1:10	1.718	7:10	2.840	13:10	7.02	19:10	2.221
1:20	1.734	7:20	2.903	13:20	6.44	19:20	2.189
1:30	1.752	7:30	2.970	13:30	5.96	19:30	2.159
1:40	1.769	7:40	3.041	13:40	5.57	19:40	2.130
1:50	1.787	7:50	3.117	13:50	5.24	19:50	2.101
2:00	1.805	8:00	3.198	14:00	4.96	20:00	2.074
2:10	1.824	8:10	3.284	14:10	4.71	20:10	2.048
2:20	1.844	8:20	3.377	14:20	4.49	20:20	2.022
2:30	1.864	8:30	3.478	14:30	4.30	20:30	1.997
2:40	1.884	8:40	3.586	14:40	4.13	20:40	1.973
2:50	1.906	8:50	3.704	14:50	3.97	20:50	1.950
3:00	1.927	9:00	3.833	15:00	3.83	21:00	1.927
3:10	1.950	9:10	3.974	15:10	3.70	21:10	1.906
3:20	1.973	9:20	4.129	15:20	3.59	21:20	1.884
3:30	1.997	9:30	4.301	15:30	3.48	21:30	1.864
3:40	2.022	9:40	4.494	15:40	3.38	21:40	1.844
3:50	2.048	9:50	4.711	15:50	3.28	21:50	1.824
4:00	2.074	10:00	4.958	16:00	3.20	22:00	1.805
4:10	2.101	10:10	5.241	16:10	3.12	22:10	1.787
4:20	2.130	10:20	5.572	16:20	3.04	22:20	1.769
4:30	2.159	10:30	5.963	16:30	2.97	22:30	1.752
4:40	2.189	10:40	6.435	16:40	2.90	22:40	1.734
4:50	2.221	10:50	7.018	16:50	2.84	22:50	1.718
5:00	2.254	11:00	7.764	17:00	2.78	23:00	1.702
5:10	2.288	11:10	8.757	17:10	2.72	23:10	1.686
5:20	2.323	11:20	10.166	17:20	2.67	23:20	1.670
5:30	2.360	11:30	12.362	17:30	2.62	23:30	1.655
5:40	2.399	11:40	16.414	17:40	2.57	23:40	1.641
5:50	2.439	11:50	27.440	17:50	2.53	23:50	1.626
6:00	2.481	12:00	66.703	18:00	2.48	24:00	1.612

5.4 RUNOFF METHODOLOGY

The USDA Natural Resources Conservation Service SCS method shall be used to calculate stormwater runoff. Manual calculations are not acceptable and suitable software packages must be capable of:

- Calculating discharge rates from urban areas using the hydrograph method.
- Using the input of the above design storms in the estimating of design discharges.
- Calculating the flows throughout a piped (minor) drainage system coupled to an overland (major) drainage system.
- Calculating the operation of a detention pond and providing the depths and discharges of water during a storm.

Acceptable computer programs include, but are not limited to, the following:

- **EPA-SWMM** from the Us Environmental Protection Agency is used throughout the world for planning, analysis, and design related to stormwater runoff, combined and sanitary sewers systems.
- **PC-SWMM** from CHI is an advanced interface providing a number of sophisticated tools while using the EPA-SWMM calculation engine.
- **XP-SWMM** from Innovyze is a 1D/2D modeling package for stormwater and wastewater problems.
- **OTT-HYMO** from CIVICA is a hydrologic modelling software capable of single event modelling of dendritic drainage systems.

5.5 STORMWATER REPORT

The Design Engineer must prepare a stormwater report to address stormwater and drainage issues related to the development. The report shall include a site engineering analysis to a level consistent with the size of the development, its location within the drainage basin, and the sensitivity of the downstream stormwater system. The sensitivity analysis of the downstream stormwater system should include a visual inspection of all existing infrastructure.

The stormwater report shall 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 flows and all stormwater management alternatives; and output information which shows the main steps in the calculations and the peak discharge at key points in the system.

The drainage plans shall show the location of the proposed development within the topographic drainage area, the drainage area tributary to the proposed and existing stormwater system(s), boundaries of all drainage sub-areas, contours at intervals not exceeding 2 m, site layout including proposed streets and lots, locations of proposed stormwater systems and stormwater management facilities, location of outfalls

or connections into existing services, hydrologic and hydraulic data table and any other information required by the Engineer.

5.6 DESIGN REQUIREMENTS

5.6.1 PIPED STORMWATER SYSTEMS

5.6.1.1 Hydraulic Design

The capacity of the stormwater system shall be calculated by the Design Engineer using the Manning formula with a roughness coefficient of 0.010 for PVC pipe and 0.013 for concrete pipe. Other methods used by the Design Engineer are subject to prior acceptance by the Municipal Engineer.

5.6.1.2 Stormwater Pipe

a) Stormwater mains shall be green PVC DR35 pipe, reinforced ASTM C76 concrete pipe, or green PVC PS320 profile pipe. In instances where clearances can't be met or higher pressure rated pipe is required, all 'Storm water' DR18 pipe shall be wrapped in red 150 mm wide, underground warning tape. Tape shall be wrapped around each pipe length continuously, with a minimum of 4 wraps.
b) All stormwater mains and catch basin leads shall be installed with gaskets.
c) Stormwater mains shall be a minimum of 300 mm in diameter.
d) Pipe size shall not decrease in the downstream direction. The exception is oversized intake piping required to overcome the effects of inlet control and then, only if the main to which the inlet is connected is greater than 600 mm diameter.
e) The minimum stormwater velocity for peak design flows from the fully developed tributary area shall be 0.75m/s.

5.6.1.3 Manholes

A manhole shall be provided at any change in pipe size, material, grade, or horizontal alignment, and at all stormwater main intersections and end points. The spacing of manholes shall not exceed 100 m. Extra manholes may be required on curves; curvilinear stormwater mains are not permitted. Stormwater bends shall not exceed 90 degrees.

Manholes shall be ASTM C-478 concrete and all joints and connections shall have gaskets. Connections to existing manholes shall be made with approved connectors, installed in accordance with the manufacturer's instructions. Connections other than core drilling are subject to approval by the Municipal Engineer.

Stormwater manhole covers shall incorporate 'identifying markers', to be approved by the Municipal Engineer, to distinguish them from sanitary manhole covers.

5.6.1.4 Catch Basins

a) Catch basin concrete covers shall be Shaw CPC 175 or approved equal. Frame and grating shall be IMP S-401/411; IMP S-361 frame and grating are not permitted. Catch basins shall be 1050 mm diameter, ASTM C478 concrete with 450 mm sump. All joints and connections shall have gaskets. Final grade adjustments shall be as specified for manholes.
b) Catch basin concrete cover openings shall be centered 300 ± 75 mm from the curb line and the frame and grate shall be installed abutting and square to the curb line.
c) Catch basins spacing not exceed 100 m.
d) Concrete sluice boxes are required at off-street locations where concentrated flow would otherwise cross a sidewalk or walkway. Pyramid grates are required for uncultivated areas.
e) Catch basins are required at the uphill radius point of curb returns on intersections.
f) Double catch basins may be required at the bottom of sag curves and at the uphill radius point of curb returns on intersections.
g) The interception capacity of the catch basins shall be compatible with the capacity of the stormwater system.
h) Where inlet control devices (ICDs) are specified in catch basins, prefabricated ICDs can be used. Alternatively, ICDs can be installed by minimally extending the lead inside the catch basin to allow the placement of a cap with the appropriate size orifice.
i) In areas where there is a potential for contamination of stormwater (e.g.; service stations, etc.), the Municipal Engineer may require inverted syphons or other specialized features for catch basins. The Design Engineer shall identify the presence of potential sources of contamination within the watershed.

5.6.1.5 Catch Basin Leads

a) Catch basin leads shall be gasketed ASTN C76 concrete pipe or green PVC DR35 pipe and shall be a minimum of 200 mm in diameter.
b) Catch basin leads not connected to a manhole may be connected to a stormwater main with a fabricated fitting provided that the main is larger than the lead. Connections to existing mains shall be made with approved connectors, installed in accordance with the manufacturer's instructions.
c) Catch basin leads shall have a minimum cover of 1.2 m below finished grade.
d) Catch basin leads shall have a minimum slope of 1%.
e) Catch basin leads shall be included in the CCTV report.
f) Catch basin leads shall be connected to a manhole such that the lead invert is no higher than the obvert of the outgoing main or 1 m above the invert of the outgoing main whichever is higher.
g) Catch basin leads shall not protrude into catch basins or manholes by more than 50 mm.
h) Catch basin leads shall incorporate a flexible joint within 450 mm of the outside face of a manhole or main.
i) Catch basin to catch basin connections are only permitted with the approval of the Municipal Engineer.

5.6.1.6 Stormwater Laterals

a) Stormwater laterals shall be a minimum of 125 mm in diameter.
b) Stormwater laterals shall be green PVC DR35.

5.6.2 ROADS

During minor storms, the depth of flow in gutters shall not exceed 50 mm. During major storms, the depth of flow shall not exceed 50 mm above the roadway crown in areas with curb and gutter. In no circumstances shall the flow of stormwater in the road overtop the curb or escape into driveways, except at locations where a major stormwater system is provided. Where there are open ditches, the flow of stormwater in the road shall not escape the ditch or flow into driveways, except at locations where a major stormwater system is provided.

5.6.3 DITCHES/OPEN CHANNELS

Consideration must be given to safety, nuisance and maintenance implications of ditches and open channels.

5.6.3.1 Design

Ditches and open channels shall:

- have a minimum grade of 1.0 % unless approved otherwise by the Municipal Engineer;
- conform to the typical ditch cross section for roads;
- have hydraulic capacity based on the major storm;
- not exceed 1.2 m in depth, from invert to top of the highest bank;
- have side slopes no steeper than 2H:1V unless steeper slopes are supported by the geotechnical report;
- be stabilized with riprap or other acceptable means where the longitudinal grade is greater than 4%.

5.6.3.2 Maximum Velocity

The Design Engineer shall design ditches and open channels with due consideration of the native soil characteristics as noted in the geotechnical report so that erosion and damage to the roadway and adjacent property is mitigated. The Design Engineer must provide calculations for maximum channel velocities for major and minor storms and acceptability of the proposed open ditch and channel materials to handle the same.

5.6.4 CULVERTS

5.6.4.1 Inlets & Outfalls

i. Grades

The crown of outfalls shall be at least 150 mm above the receiving water level during the minor storm. The invert of the outfall shall be above the normal ice level of the receiving water. A factor of safety shall be built into the height of the outfall invert to accommodate the accumulation of debris. Outfall inverts will not normally be permitted below original ground. The minimum grade shall be 1.0 % unless approved otherwise by the Municipal Engineer.

ii. Hydraulic Capacity

Inlet and outlet control methods shall be utilized in determining the hydraulic capacity of culverts in conjunction with the Design Engineer's recommendation.

iii. Headwater Depth

Culverts shall be designed to carry peak design flow without surcharge. Upstream water levels for the major storm shall be shown on the drainage plan. Final development plans shall show watercourses, wetlands and any areas subject to flooding.

iv. Headwalls & Grates

All culverts and stormwater systems require headwalls for inlets and outlets. Culverts longer than 30 m and all stormwater systems require inlet grates with vertical bars; outlet grates are not permitted:

- Headwalls shall be precast concrete as manufactured by Shaw Precast Solutions or approved equal;
- Grates shall be hot-dip galvanized steel as supplied by Shaw Precast Solutions or approved equal;
- Headwalls over 1050 mm high require hot-dip galvanized handrails as supplied by Shaw Precast Solutions or approved equal;
- Type 304 stainless steel anchors shall be used to fasten grates and handrails to headwalls;
- Bedding material for inlet and outlet structures shall be minimum 150 mm Type 1 gravel or as recommended in the geotechnical report;
- All steel components shall be completely fabricated prior to hot dip galvanized;
- Streambed protection shall be installed upstream of the inlet structure and downstream of the outlet structure as per NSE requirements;
- Bell ends of inlet pipes shall be grouted flush with the headwall to provide a smooth transition to the pipe; outlet pipes shall be similarly grouted; non-ferrous, non-shrink grout shall be used.

v. Location

If necessary, the road right-of-way shall be extended to include inlet and outlet headwall structures.

5.6.4.2 Pipe Sizes

Driveway culverts shall have a minimum diameter of 450 mm and shall not be smaller than any upstream culvert. Cross culverts shall have a minimum diameter of 525 mm with a minimum cover of 500 mm. The Drainage Plan or Subdivision Grading Plan shall indicate, in tabular form, the required driveway culvert pipe sizes for each lot in the development.

5.6.4.3 Pipe Materials

Culverts shall be reinforced ASTM C76 concrete pipe, HDPE PS320 dual wall corrugated pipe or PVC PS320 profile pipe.

5.6.4.4 Enclosures of watercourses, ditches and channels

The number of enclosures of an open channel created by roadways or other traffic crossings shall be minimized. For example, if a watercourse crosses the road system in two locations in relatively close proximity, the design shall re-align the road system so that the number of crossings is eliminated or limited to one.

5.6.5 STORMWATER MANAGEMENT PONDS

5.6.5.1 Design Volume

Stormwater management ponds should be designed to ensure sufficient storage volume to limit any increase in post-development discharge to a maximum of ten percent (10%) for the 5, 10, and 100 year design storms. An additional volume allowance must also be made to provide a 300 mm freeboard for the 100 year event. The pond should empty within 48 hours of the design storm event.

5.6.5.2 Flow Control Structures

Flow control structures (typically large diameter manholes with a concrete partition) may have to include multiple orifices to account for the 5, 10, and 100 year design storms. The manhole cover or access hatch must ensure access to both the inlet and outlet sides of the flow control structure in order to permit inspection and maintenance.

5.6.5.3 Low Flow Channel/Minimum Floor Slope

Stormwater management ponds must include a low flow channel from the pond inlet to the outlet or flow control structure. Low flow channels can consist of a concrete channel or half-pipe. A minimum floor slope of one percent (1%) shall be constructed to ensure water drains to the low flow channel.

5.6.5.4 Emergency Spillway

An emergency spillway must be incorporated into the design to accommodate any flows that may exceed the 100-year event or manage overflow in the event that the outlet becomes blocked or fails. The emergency spillway elevation should be set accordingly to meet the freeboard requirements. The design of the spillway should ensure that an overflow event will not negatively impact surrounding property.

5.6.5.5 Fencing/side slopes

Fencing around stormwater management ponds is not permitted and maximum side slopes of 5:1 (H:V) are to be provided to allow for safe exit of the pond. The Municipal Engineer may permit side slopes of 4:1 or fences where it is not possible to provide side slopes of 5:1.

5.6.5.6 Access

The design of the stormwater management pond shall include sufficient space to allow Municipal/Contractor's vehicles access for inspection and maintenance purposes. Sufficient space must be provided to prevent vehicles from having to reverse to gain access to the right-of-way.

5.6.5.7 Future Maintenance

The Design Engineer shall provide an Operation and Maintenance manual for all proposed storm water management ponds which should include all the necessary information relating to inspections and maintenance of the pond.

5.6.6 OWNERSHIP OF SYSTEM

Stormwater from the public system shall not be carried on, through or over private property other than by natural watercourse or a system controlled by the Municipality. Easements may be required to provide for drainage from existing or future upstream development. Watercourses shall be utilized as stormwater conveyances consistent with overall watercourse objectives and subject to NSE approval.
Watercourses draining more than 40 hectares shall be maintained as open watercourses unless designated otherwise in a Stormwater Master Plan as approved or required by the Municipal Engineer. Watercourses shall not normally be permitted to drain to roadside ditches or piped storm systems.

5.7 MINOR STORMWATER SYSTEM CONNECTIONS

5.7.1 FOUNDATION DRAINS

Foundation drains shall normally be connected by gravity to the piped stormwater system. Relative elevations of the storm main and foundation drains shall be such that foundation drains are above the hydraulic grade line of the major storm. Where the stormwater system discharges into a watercourse, ditch or drainage corridor, foundation drains connected to the system shall be above the major storm flood elevation at the point of discharge. Foundation drains are not permitted to directly connect to roadside ditches or municipally owned ditches or swales that do not form part of the roadside drainage system.

5.7.2 ROOF DRAINS

Roof drains are not permitted to be connected to the stormwater system and must not discharge to a driveway or other impervious surface draining to the road.

5.7.3 INSTITUTIONAL, COMMERCIAL AND INDUSTRIAL CONNECTIONS

Commercial, institutional and industrial developments shall employ flow control devices upstream of the stormwater system connection which will limit the peak flow to less than 40% of the uncontrolled fully developed flow.

5.7.4 CONNECTIONS TO PUBLIC PROPERTY

The Municipal Engineer may require an extension of an appropriately sized pipe from the stormwater system to an appropriate location on the boundary of exiting or future public property, such as parkland.

5.8 DISCHARGE TO ADJACENT PROPERTIES

Stormwater shall be self-contained within the development limits except for natural runoff from undeveloped areas or where it is intercepted and directed to a natural stream, watercourse or public stormwater system. Stormwater shall not be directed to adjacent properties unless appropriate easements are provided.

5.9 EROSION AND SEDIMENT CONTROL

Stormwater management systems shall be an integral part of overall site design and development. The Design Engineer shall submit an erosion and sediment control plan in accordance with NSE regulations and guidelines. The plan shall include both short-term measures applicable during construction and long-term measures after completion of construction.

Site design shall make optimum use of existing topography and vegetation and minimize cut and fill operations. During construction, site design shall mitigate surface water flows across and from the construction site. Development of the site shall be based on exposing a minimum area of the site for the minimum time.

The erosion and sediment control plan is the responsibility of the Design Engineer and may include the following:

- Interception and diversion ditches to direct clear water around the construction site;
- Stable diversion berms;
- Sediment traps;
- Covering or seeding of topsoil or other soil stockpiles;
- Isolated stripping of land being developed;
- Vegetation screens or buffers;
- Filter bags in catch basins;
- Settling ponds.

Long-term environmental protection measures shall include designs to minimize erosion and sediment flow, protect outfall areas, minimize disruption of natural watercourses, utilize wetlands for natural filtration, and provide for ground water recharge when possible.

Protection methods shall be based on but not limited to the “Province of Nova Scotia Erosion and Sediment Control Manual and Guidelines for Use on Construction Sites”.

6.0 LOT GRADING

6.1 GENERAL

Lot grading includes requirements for elevations, slopes, swales, downspouts and driveways that make up individual lot drainage systems. The objective of lot grading is to provide for the safe and effective drainage of stormwater while minimizing damage to buildings and property and mitigating effects on adjacent properties and Municipal service systems. The Design Engineer shall submit a Subdivision Grading Plan showing lot grading for each individual lot based on these requirements and best practice subject to acceptance by the Municipal Engineer. Subdivision grading plans are required for all developments serviced by a Municipal wastewater system.

Drainage shall not be directed to adjacent private property without an easement.

In addition to the design criteria herein, the Design Engineer shall satisfy all applicable codes and standards including those listed in Section 1.0.

6.2 DESIGN CRITERIA

6.2.1 GRADING PLAN

Grading plans shall show the following:

- Existing and proposed lot lines;
- Existing topography and contour lines;
- Major storm drainage path and flood lines;
- Flow direction arrows;
- Proposed lot line elevations at corners and grade changes;
- Minimum basement floor elevation;
- Finished grades at building corners;
- Swales and g
- Driveway grades;
- Wastewater lateral invert at street line;
- Manholes and catch basins;
- Centerline road grades;
- Other information that the Municipal Engineer may require.

6.2.2 BUILDINGS

The Subdivision Grading Plan shall indicate minimum basement floor elevations to minimize flooding.

Exterior below-grade stairwells are not permitted.

Downspouts are not permitted to be connected to the building foundation drain and must discharge beyond foundation drainage area via an extension or splash pad. Downspouts are not permitted to discharge to driveways.

The top of foundation walls shall be a minimum of 150 mm above finished grade.

6.2.3 DRIVEWAYS

Driveways shall drain away from buildings toward the road. The minimum driveway grade shall be 2% and the maximum grade shall be 8%. Reverse grades are not permitted unless accepted otherwise by the Municipal Engineer.

6.2.4 YARD GRADES

Yard grades shall not be less than 2% nor steeper than 3H:1V. A slope of 10% is required for a minimum distance of 1.5 m from all foundation walls.

The use of retaining walls is not encouraged. Retaining walls are not permitted within the road right-of-way.

Swales shall have a minimum grade of 2%. Side slopes shall not be steeper than 3H:1V. Swales shall have a minimum depth of 250 mm and a maximum depth of 500 mm. Swales shall be designed to carry the major storm.

Where a swale discharges to a road, a catch basin shall be installed at the street line to intercept flow from the swale. Catch basins outside the street line are otherwise not permitted unless accepted by the Municipal Engineer.

Underdrains such as perforated pipe or French drains are not permitted to discharge to road surfaces, sidewalks or walkways.

6.3 EASEMENTS

Private easements shall be provided for all swales which serve more than 2 lots. A minimum easement width of 4.5 m is required for private easements.

Public easements shall be provided for major storm drainage paths and for all catch basins constructed on private property in accordance with these Standards. A minimum easement width of 6 m is required for public easements.

7.0 ROADS, SIDEWALKS & WALKWAYS

7.1 GENERAL

The intent of these Standards is to facilitate the design and construction of subdivisions in such a manner as to permit the Municipality of East Hants to takeover and maintain the roads therein. Furthermore, it is the intention of these Standards to provide for flexibility in road design, to encourage a more positive impact on neighborhood character without compromising public safety or efficiency.

These Standards cover the more common elements of road design encountered in subdivision development. In situations not covered by these Standards, the Geometric Design Guide for Canadian Roads as published by TAC shall be used as a guide. In general, a design speed of 50 km/h is to be used; lower design speeds may be considered at the discretion of the Municipal Engineer.

The details in Appendix A are intended as a minimum guide only. The Design Engineer must retain a Geotechnical Engineer to prepare a geotechnical report for the proposed subdivision. The report shall include recommendations for the use of existing site materials and the placement of imported materials for the proper construction of the road, sidewalk, walkways, trails and other infrastructure elements.

The geotechnical report, design briefs and calculations used for design purposes must be submitted to the Municipal Engineer for review. The Design Engineer is responsible for any design errors and omissions for a period of not less than 10 years from Final Approval of the subdivision regardless of acceptance by the Municipal Engineer.

7.2 LAYOUT

Where practical, proposed roads shall be laid out as extensions to existing roads, either in the same subdivision or in adjacent subdivisions. Where temporary cul-de-sacs or turning areas exist in previous developments, the Developer shall be responsible for removing the temporary works and reinstating the road to its final design.

Also, where practical, subdivision phases shall include road layouts that eliminate the need for temporary turning areas.

No more than 100 lots plus a remainder lot shall have single road access to a Provincial Road. This requirement may be modified as stipulated in the Municipal Subdivision Bylaw.

Any property subject to alteration as a result of road construction must be contained within the road right-of-way. All slopes (either cuts or fills) must be included within the road right-of-way. Retaining walls are not permitted within the road right-of-way. A minimum 3 m bench shall be provided on cut slopes that

would not otherwise end at the edge of the right-of-way.

The minimum width of road right-of-way shall normally be 20 m. Lessor widths may be permitted at the discretion of the Municipal Engineer.

Cul-de-sacs are not permitted where the land can be effectively serviced by other road layouts. If approved by the Municipal Engineer, cul-de-sacs shall not exceed 230 m in length measured from the centerline of the intersected road to the center of the cul-de-sac bulb. Longer cul-de-sacs may be permitted in un-serviced areas at the discretion of the Municipal Engineer. The grade of a cul-de-sac bulb shall not exceed 4%.

In cases where the proposed road ends within a property and there are plans to extend the road at a future date, the Municipal Engineer may accept a temporary 15 m wide by 10 m deep turning area in lieu of a temporary cul-de-sac. Temporary cul-de-sacs and turning areas shall be constructed to the same standard as the road. In un-serviced areas, the turning area shall be surfaced with gravel. In serviced areas, the normal curb along the front of the turning area shall be deleted and the turning area shall be surfaced with asphalt.

Roadway boulevards are not permitted in residential subdivisions.

The Municipal Engineer, at their sole discretion, may require proposed roads to include traffic calming measures. All traffic calming measures shall be designed and installed in compliance with the current edition of the Canadian Guide to Traffic Calming, published by the Transportation Association of Canada.

The minimum length of road eligible for takeover is 150 m; shorter road lengths may be considered for takeover at the discretion of the Municipal Engineer.

7.3 ROAD RESERVES

Acceptable road reserves to adjacent properties must be identified and deeded to the Municipality. These reserves must be not more than 400 m apart. Road reserves and their spacing are subject to acceptance by the Municipal Engineer. The road reserves will be located along the subdivision boundary in such a manner as to not prejudice development of the adjacent land.

Road reserves must be constructed to the property boundary with the base course and Municipal services installed. A guard rail barricade with WA-8 warning sign shall be installed across the roadbed at the beginning of the road reserve.

The Developer shall be responsible for connecting to and upgrading existing road reserves to the final

design regardless of the level of construction.

7.4 INTERSECTIONS

The maximum number of road approaches to any intersection shall be four.

Within a subdivision, the minimum distance between adjacent intersections on the same side of the road shall be 75 m. The minimum distance between adjacent intersections on opposite sides of the road shall be 50 m; otherwise, offset intersections, including walkways and trails, are not permitted.

Where subdivision roads connect to Provincial roads, the minimum distance between intersections shall be as follows:

Provincial Local Roads ..... 100 m
Provincial Collector Roads..... 150 m
Provincial Arterial Roads ..... 300 m

Connections to Provincial roads require NSTIR approval.

Cross culverts shall be designed for the 1 in 100-year storm with no surcharge. In any case, culverts shall be minimum diameter of 525 mm and shall have minimum cover of 500 mm. Cross culverts shall be reinforced concrete or PVC. Corrugated metal pipe with protective coatings may be considered for watercourses at the discretion of the Municipal Engineer. All cross culverts shall have properly sized and grouted precast headwalls.

All intersecting roads must connect at an angle of 70 to 90 degrees for a minimum distance of 30 m from the centerline of the intersected road. Road grades at intersections must not exceed 2 % for a distance of 15 m from the shoulder or curb line of the intersected road.

Road grades must not exceed 8 %; the minimum road grade shall be 0.5 %. Ditch grades less than 1 % are at the discretion of the Municipal Engineer. Ditch grades in excess of 4 % require erosion protection acceptable to the Municipal Engineer.

Vertical curvature shall not be less than the minimum values indicated in the Geometric Design Guide for Canadian Roads as published by TAC. Headlight control shall be used for sag curves.

Horizontal road curves shall have a minimum centerline radius of 85 m. Reduced curve radius may be permitted on loop roads and permanent dead ends at the discretion of the Municipal Engineer.

Road side slopes shall be not steeper than 2:1 (horizontal to vertical) or as recommended in the geotechnical report.

The centerline of the road shall be concentric with the centerline of the right-of-way except in areas where extra right-of-way may be required on one side and not on the other.

The road right-of-way shall be cleared for its full width. All brush, trees and cuttings shall be chipped and disposed of outside the road right-of-way. All useable wood shall be salvaged. Clearing shall be carried out in a manner that protects watercourses from silt and other contaminants.

All roots, stumps, moss and other organic material within the right-of-way shall be removed and disposed of outside the right-of-way.

The roadway will be constructed with approved native soil or suitable borrow material and compacted in uniform layers to maximum density as recommended in the geotechnical report. Black muck, peat, swamp material and any other unsuitable materials as identified in the geotechnical report shall be removed prior to placing embankment material.

The crown of the roadbed shall be at least 150 mm and a uniform crown shall be maintained at all stages of construction to ensure proper drainage. The subgrade must be well drained with any weak, unstable material or wet areas removed and the grade restored with acceptable material uniformly compacted as recommended by the Geotechnical Engineer. The top 300 mm of subgrade must be free of rocks larger than 150 mm in maximum dimension or as recommended in the geotechnical report.

The Municipality must be notified in advance before construction work begins on any subdivision road. Inspections by the Municipality shall not relieve the Design Engineer of responsibility for inspection of the work. Witness inspections by the Municipality are required at the following stages before construction proceeds to the next stage:

- After clearing;
- After grubbing;
- After completion of subgrade (roll test);
- After completion of base course;
- After completion of surface course;
- Upon project completion.

7.5 TRAFFIC SIGNS AND ROAD MARKINGS

1. All traffic signs and road markings shall be manufactured and installed prior to Final Subdivision Approval being granted.

2. Once the proposed street names have been reviewed and accepted by the Municipality's Civic Addressing Coordinator, the street name signs shall be manufactured and installed by the developer.

7.6 SIDEWALKS

Sidewalks shall be constructed along one side of all new subdivision roads in serviced areas. The minimum width of the sidewalk shall be 1.8 m. All sidewalks and driveway ramps adjacent to sidewalks shall be designed and constructed using concrete.

Pedestrian ramps shall be installed at all intersections where a sidewalk exists, at Canada Post Community Mailbox locations and at walkway and trail locations. The ramps shall have a minimum width of 1.8 m and shall be 150 mm thick with welded wire mesh (WWM) reinforcement. All pedestrian ramps shall have Tactile Walking Surface Indicators (TWSI) as recommended by the Design Engineer and accepted by the Municipal Engineer.

Sidewalks shall be set back from the face of the curb by a 2 m minimum sodded median.

The sidewalk base course shall be 150 mm Type 2 gravel and shall extend 150 mm outside of each edge of the sidewalk. The surface course shall be 150 mm Type 1 gravel and shall extend 150 mm outside of each edge of the sidewalk.

Sidewalk shall be a minimum of 100 mm thick. Driveway locations shall be a minimum of 150 mm thick and shall be reinforced with welded wire mesh (WWM). Driveway ramps shall be 150 mm thick with WWM reinforcement. Driveways shall be of sufficient length to ensure that parked vehicles do not overhang the adjacent sidewalk. Driveway lengths are to be agreed with the Municipal Engineer.

Control joints shall be placed at 1.8 m intervals.

Outside edges and expansion joints shall have tooled edges.

The minimum grade across a sidewalk shall be 2% but not more than 3%.

Construction joints of mastic fibrous material extending through the entire thickness of the concrete slab shall be placed as follows:

- Where concrete is to be placed against existing concrete;
- Where the sidewalk abuts the curb;
- Around all structures abutting the sidewalks including utility poles, catch basins, etc.;
- At maximum 18 m intervals of sidewalk continuous placement.

7.7 WALKWAYS

7.7.1 RURAL WALKWAY STANDARDS

1. The design criteria presented herein applies to walkways located outside Growth Management Areas as defined by the East Hants Official Community Plan. Other facilities such as nature trails and pathways located in Municipal Park areas shall be designed and built-in accordance with the East Hants Parks, Open Space and Active Transportation Master Plan.

2. Selection of locations for walkways shall be in accordance with the East Hants Subdivision Bylaw and shall take into account the requirements for pedestrian circulation for the neighborhood.

3. The walkway shall have a minimum right-of-way width of 6 m. The walkway construction, including any supporting slopes (where required) must be located within the right-of-way. At the discretion of the Municipal Engineer, additional easement or right-of-way width may be required to facilitate construction and maintenance of Municipal infrastructure.

4. The boundary of the right-of-way shall be delineated by permanent markers. The type and spacing of the markers are to be accepted by the Municipality. At the discretion of the Municipal Engineer, the boundary of the right-of-way may instead be cut and blazed in accordance with the following:

Cutting Boundary Lines

- Boundary lines shall be cut and brushed out.
- Cut lines shall follow the boundary being marked, not follow the path of least resistance.
- Boundary lines should have a sight line wide enough to show pinch blazes.
- Boundary lines shall be wide enough so that a person can walk directly along the line without interference from trees and limbs.

Blazing Boundary Lines

- Trees within 0”-28” or one axe handle shall be blazed with 45 deg, pinch blazes.
- Trees directly on line can be blazed fore and aft.
- Trees within 28”-60” or more then and axe handle, can be side blazed only when no pinch blazes are available for long distances (more than 30 m).
- Blazes shall be clearly visible and painted white.
- Line should have ample blazes when available. If no blazes are available for long distances (more than 100 m) angle iron painted white should be set to show line location.

5. The travelled portion of a walkway shall be centered within the right-of-way unless accepted otherwise and shall have a minimum width of 1.8 m.

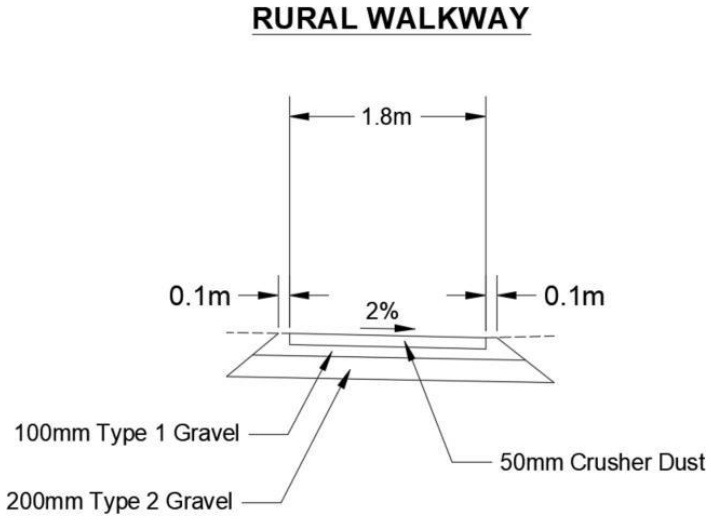
6. A minimum of 150 mm of topsoil and either seed or sod shall be placed on each side of the travelled portion and shall extend for the full width and length of the walkway right-of-way. In order to ensure that the seed/sod establishes; lime, fertilizer, mulch, erosion control agent and required accessories may be required. Sufficient maintenance must be undertaken during the establishment period and grassed areas will be accepted upon completion provided that growth is properly established and the area is free of bare and dead spots. At the discretion of the Municipal Engineer, the existing vegetation may be maintained on each side of the travelled portion of the walkway if the vegetation is healthy and may easily be maintained.

7. Walkways shall be located and designed whenever possible so that the grade of the walkway shall not exceed 8 %. Steeper grades may be permitted only where the topography makes it impractical for grades to be less than 8 %, or to avoid the installation of stairs.

8. The right-of-way shall be graded to control surface water and major drainage within the right-of-way. Landscaped and sodded swales, catch basins, pipe and drains shall be provided to control erosion and maintain a safe surface, if required. Swales shall not be located closer than 600 mm from the edge of the travelled portion.

9. Walkway heads shall be lit and the light shall be oriented so as to benefit from street lighting. This requirement only applies to walkways located within the street light serviced area.

Rural Walkway Cross Section



Notes:

1. Dimensions shown are considered the minimum acceptable.
2. Use of proposed materials and associated thicknesses, compaction, placement, etc. to be supported by a geotechnical report.
3. Backfill material to be approved by a Geotechnical Engineer.

In order to be acceptable, crusher dust should comply with the following grading:

Sieve size (µm)	Percent Passing
9500	100
4750	50-100
2000	30-65
425	10-30
75	5-10

and shall be compacted to 100% Standard Proctor Density.

7.7.2 URBAN WALKWAY STANDARDS

1. The design criteria presented herein applies to walkways located in Growth Management Areas as defined by the East Hants Official Community Plan. Other facilities such as nature trails and pathways located in Municipal Park areas shall be designed and built-in accordance with the East Hants Parks, Open Space and Active Transportation Master Plan.

2. Selection of locations for walkways shall be in accordance with the East Hants Subdivision Bylaw and shall take into account the requirements for pedestrian circulation for the neighborhood. For example, if a walkway ends on a street with a single sidewalk, the sidewalk should be located on the side of the road to meet the walkway. If the layout of the development would require a walkway to terminate opposite a single sidewalk, then a second sidewalk from the walkway to the nearest appropriate roadway intersection shall be required.

3. The walkway shall have a minimum right-of-way width of 6 m. The walkway construction, including any supporting slopes (where required) must be located within the right-of-way. At the discretion of the Municipal Engineer, additional easement or right-of-way width may be required to facilitate construction and maintenance of Municipal infrastructure.

4. The boundary of the right-of-way shall be delineated by permanent markers. The type and spacing of the markers are to be accepted by the Municipality.

5. The travelled portion of a walkway shall be centered within the right-of-way unless approved otherwise and shall have a minimum width of 1.8 m.

6. A minimum of 150 mm of topsoil and either seed or sod shall be placed on each side of the travelled portion and shall extend for the full width and length of the walkway right-of-way. In order to ensure that the seed/sod establishes; lime, fertilizer, mulch, erosion control agent and required accessories may be required. Sufficient maintenance must be undertaken during the establishment period and grassed areas will be accepted upon completion provided that growth is properly established and the area is free of bare and dead spots.

7. Walkways shall be located and designed whenever possible so that the grade of the walkway shall not exceed 8 %. Steeper grades may be permitted only where the topography makes it impractical for grades to be less than 8 %, or to avoid the installation of stairs.

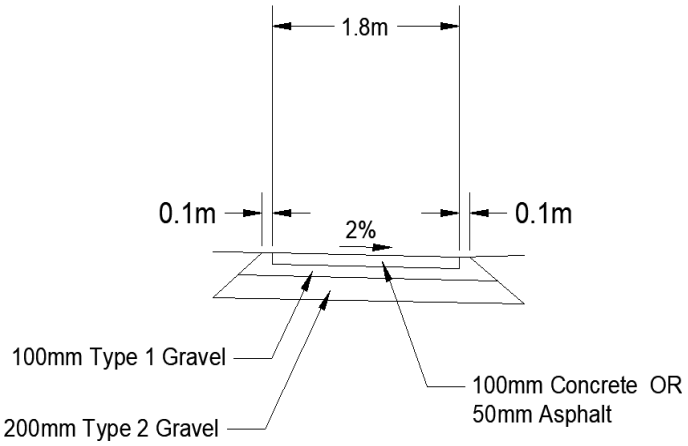
8. A pedestrian ramp shall be constructed at the ends of walkways where curb and gutter are present. Pedestrian ramps shall be placed at all crosswalk locations. All pedestrian ramps shall have Tactile Walking Surface Indicators (TWSI) as accepted by the Municipal Engineer.

9. The right-of-way shall be graded to control surface water and major drainage within the right-of-way. Landscaped and sodded swales, catch basins, pipe and drains shall be provided to control erosion and maintain a safe surface, if required. Swales shall not be located closer than 600 mm from the edge of the travelled portion.

10. Walkway heads shall be lit and the light shall be oriented so as to benefit from street lighting. This requirement only applies to walkways located within the street light serviced area.

Urban Walkway Cross Section

URBAN WALKWAY



Notes:

1. Dimensions shown are considered the minimum acceptable.
2. Use of proposed materials and associated thicknesses, compaction, placement, etc. to be supported by a geotechnical report.
3. Backfill material to be approved by a Geotechnical Engineer.

8.0 STREET TREES

8.1 GENERAL

1. Street trees shall be 45-60 mm caliper at time of planting.

2. Street trees must conform to the newest edition of the *Canadian Nursery Stock Standard*.

3. Street trees must be nursery grown and not collected from the natural environment.

4. Once the street trees have been planted, inspected and accepted, the developer must maintain and warranty the trees for two (2) growing seasons.

8.2 STREET TREE SPECIES

1. Species for street trees must be chosen from the following Street Tree Species List.

2. In order to promote visual coherence each side of an individual street shall be planted with the same species of tree selected from the Street Tree Species List. Selecting more than one species from the Street Tree Species List is encouraged for development with more than one street in order to reduce the number of street trees susceptible to insect and disease outbreak.

STREET TREE SPECIES LIST

Class 1 Trees Over 18 m Mature Height Boulevard Minimum 3m length	Class 2 Trees 9 - 18 m Mature Height Boulevard Minimum 2.5 m length	Class 3 Trees Under 9 m Mature Height Boulevard Minimum 2 m length Suitable Under Utility Lines
Common Hackberry (Celtis occidentalis)	Katsura Tree (Cercidiphyllum japonicum)	Tree Lilac (Syringa reticulate)
Kentucky Coffee Tree (Gymnocladus dioicus)	Turkish Filbert (Corylus corlurna)	Serviceberry (Amelanchier)
Swamp White Oak (Quercus bicolor)	Honeylocust (Gleditsia tricanthos var inermis)	Persian Ironwood (Parrotia persica)
Bur Oak (Quercus macrocarpaa)	Butternut (Juglans cinera)	Amur Maple (Acer ginnala)
Pin Oak (Quercus palustris)	Ironwood (Ostrya virginiana)	Hedge maple (Acer campestre)
Chestnut Oak (Quercus prinus)	Collumnar English Oak (Quercus robur 'Fastigiata')	Leonard Messel Magnolia (Magnolia x loebneri "Leonard Messel")
Northern Red Oak (Quercus rubra)	Japanese Pagodatree (Sophora japonica)	Sun valley maple (Acer rubrum “Sun Valley”)
Black Locust (Robinia pseudoacacia)	Chinese Elm (Ulmus parvifolia)	
European Beech (Fagus sylvatica)	Amur Cork Tree (Phellodendron amurense)	
Red Maple (Acer rubrum)	Callery Pear (Pyrus calleryana)	
London Plane (Platanus x acerfolia)	Amur chokecherry (Prunus maackii)	
Ginkgo (Ginkgo biloba) - male trees only	Black Birch (Betula nigra)	

	Japanese Zelkova (Zelkova serrata)	
	Freeman Maple (Acer x Fremanii)	
	Princeton Sentry Ginkgo (Ginkgo biloba "Princeton sentry")	

8.3 STREET TREE SPACING

Street trees shall adhere to the following spacing requirements found in the Street Tree Spacing Chart.

STREET TREE SPACING CHART

	Class 1 Trees Over 18 m Mature Height	Class 2 Trees 9 - 18 m Mature Height	Class 3 Trees Under 9 m Mature Height
On-Centre Spacing	Average of 9 m	Average of 7.5 m	Average of 6 m
Offset from Light Poles and Buried Services	1.5 m minimum	1.5 m minimum	1.5 m minimum
Offset from Driveways & Fire Hydrants	1.8 m minimum	1.8 m minimum	1.8 m minimum
Offset from Intersections	6 m - 12 m	6 m - 12 m	6 m

9.0 SUBMISSION REQUIREMENTS

This section is intended to assist the Design Engineer acting on behalf of the Developer to prepare a submission for the approval of Municipal Services Systems designed and constructed for the Municipality. Design and construction of systems must be to these Specifications and in accordance with all relevant Municipal Bylaws, Ordinances, Procedures and Regulations where applicable.

Specific requirements vary according to the nature of the application being made. Application for approval must conform with or exceed the following submission requirements:

9.1 TENTATIVE APPROVAL

A copy of the permit to construct from NSE and NSTIR (if applicable) will be required prior to recommending Tentative Approval. Other permits may be required (e.g., CN Rail)

An application for Tentative Approval of Municipal services must conform, but not be limited to, the following:

9.1.1 WASTEWATER COLLECTION SYSTEM

1. An overall plan indicating tributary service areas, the existing wastewater system, and the proposed wastewater system. The proposed wastewater system must include manhole locations, lift station locations, size of pipes, flow direction, means of disposal of effluent and connection point(s) to the existing system and other information as requested by the Municipal Engineer.

2. Specifications and contract documents, as applicable.

3. Design shall comply with any previous servicing studies prepared for the Municipality and as required by the Municipal Engineer.

9.1.1.2 Gravity Systems

1. Plan and profile drawings.

2. Cross-sections and detail drawings.

3. The Design Engineer must provide design calculations for the following:

    - population density
    - peak flow
    - design flow

- pipe size
- slope
- minimum and maximum flow velocity
- depth of flow
- any other relevant information.

9.1.1.3 Pumping Station and Force Main

1. Design calculations and curves for system and pump.

2. Motor horsepower.

3. Detailed drawings for each lift station giving:

    - capacity of selected pumps with flow rates
    - invert elevations for gravity inlet, overflow and force main
    - float, base, and top elevations
    - wet well size and capacity
    - bypass piping arrangement
    - any other relevant information

4. Design calculations and information in tabular form including the following:

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

9.1.2 STORMWATER SYSTEM

9.1.2.1 General

An overall plan indicating tributary catchment areas and downstream areas which may be impacted by the development.

The existing drainage systems and proposed stormwater system.

The proposed stormwater system must include manhole locations, catch basin locations, retention pond locations, ditch and swale locations, oil/water separator locations, size of pipes, flow directions, proposed connection point(s) to existing systems, water courses and other information as requested by the Municipal Engineer.

Specifications and contract documents as applicable.

Design must comply with any previous servicing studies prepared for the Municipality.

9.1.2.2 Gravity Systems

1. Plan and profile drawings

2. Cross section and detail drawings

3. The Design Engineer must provide pre development and post development calculations for:
    - The 1 in 5-year storm
    - The 1 in 10-year storm
    - The 1 in 100-year storm
    - Design flow calculations for infrastructure based on relevant storm periods
    - Pipe and manhole size
    - Slope
    - Flow velocity
    - Depth of flow
    - Any other relevant information

9.1.2.3 Retention Systems

1. Plan and profile drawings

2. Cross section and detail drawings

3. The Design Engineer must provide calculations for the sizing of retention systems as required to balance pre and post storm water flows as required by the Municipal Engineer, including freeboard calculations, time capacity will be at maximum until drained and maintenance recommendations.

4. Any other relevant information

9.1.3 WATER DISTRIBUTION SYSTEM

9.1.3.1 General

1. An overall plan indicating existing and proposed water system including pipe diameter and material, valve locations and hydrant locations.

2. Technical specifications and contract documents, as applicable.

3. Plan and profile drawings

4. The Design Engineer must provide design calculations for:

- population density
- domestic demand
- fire flow rate requirements
- maximum and minimum static pressures under normal operating conditions
- residual pressures under fire flow conditions
- flow velocity in the distribution system at each fire hydrant in the proposed system extension

5. Design shall comply with any previous servicing studies prepared for the Municipality and as required by the Municipal Engineer.

9.1.3.2 Booster Pumping Systems (Domestic and/or Fire Flow Demand)

1. Minimum, average and peak flow rates.
2. Capacity of selected pumps.
3. Motor horsepower and combined electrical/mechanical efficiency.
4. Electrical motor power factor.
5. Details of auxiliary power supply unit and pumphouse building.

9.1.4 GEOTECHNICAL REPORT

The Design Engineer must submit a geotechnical report stamped by a Professional Engineer which has been used to support the design of all systems.

9.2 DRAWING REQUIREMENTS

The complete engineering drawings and design shall be signed and stamped by a Professional Engineer. The drawings shall adequately represent the information needed to assess the design and to construct the services to the satisfaction of the Municipal Engineer and shall include, but not be limited to, the items in this section:

9.2.1 PLAN AND PROFILE

The plan and profile drawings should be drawn to:

i. a horizontal metric scale of 1:500 or 1:200, respectively where greater detail is required;
ii. a vertical metric scale of 1:50.

The plan portion of the engineering drawings shall include, but not be limited to:

i. The location and dimensions of all existing and proposed public streets or highways and private roads and shall have the name of each road printed outside the road lines;

ii. The proposed lot lines;

iii. North arrow referenced to Nova Scotia Grid;

iv. The chainage at 30 m intervals;

v. The control monuments and bench marks within the area of the plan;

vi. The wastewater system showing all relevant infrastructure and the direction of flows with all elevations referenced to Geodetic datum;

vii. The stormwater system including all relevant infrastructure and the direction of flows with all elevations referred to Geodetic datum.

viii. The water distribution system including all valves, hydrants, tees, bends, and all other fittings, showing the lengths, sizes and types of all pipes, with all elevations referenced to Geodetic datum.

ix. Separate wastewater and stormwater hook-ups and water service pipes to proposed and existing lots;

x. The surface drainage and related structures;

xi. Minimum basement floor elevations referenced to Geodetic datum;

xii. Street trees;

xiii. Street lighting services;

xiv. Any other structures within the public street, highway or private road including, street-name and regulatory signs, electrical underground locations, telephone and power poles;

xv. Canada Post community mail box locations

xvi. Any other information deemed necessary by the Municipal Engineer.

The profile portion of the engineering drawings shall include the existing and proposed location and vertical alignment and slope of:

i. The center line of any public street, highway, private road, or service easement;

ii. The complete wastewater system including all appurtenances, and pipe lengths, sizes, types, classifications and slopes;

iii. The complete stormwater distribution system including all related infrastructure

iv. The complete water distribution system including all related infrastructure;

v. Invert elevation for both wastewater, stormwater, and water;

vi. Any other underground services and appurtenances.

The information required on plan and profile drawings shall be shown:

i. At intervals based on sound engineering principles;

ii. To a distance of 20 m beyond each public street or highway or private road line;

iii. For a distance of 50 m where future road extensions may occur; in which case, only the existing and proposed grade of the street at center-line are required;

iv. In reference to Geodetic datum.

9.2.2 CROSS-SECTION AND DETAILS

The cross section and detail portions shall fully illustrate the subject matter.

The cross-section portion of the engineering drawings shall include existing and proposed:

i. ground conditions;
ii. public streets, highways or private roads;
iii. service systems.

9.2.3 DRAWING SIZE

The engineering drawings shall be submitted on standard size 600mm by 900mm sheets unless approved by the Municipal Engineer.

10.0 ACCEPTANCE REQUIREMENTS

Following completion of the construction of any Municipal Services Systems and prior to acceptance of ownership of any of those systems by the Municipality, the following information, deposits, and/or documentation shall be provided:

10.1 GENERAL

1. Record Drawings. As-Recorded engineering drawings in printable document format (pdf) for each Municipal Services System. Engineering drawings shall be submitted on standard size 600 mm by 900 mm sheets unless approved otherwise by the Municipal Engineer. The information shown on the record drawings must be certified by a Professional Engineer. The Developer must submit three paper copies, sealed by a Professional Engineer, of each drawing and submit all information electronically in a format compatible with the Municipality's AutoCAD and GIS software systems. Any electronic information, other than the engineered drawings in pdf format, will not require an electronic seal by a Professional Engineer.

2. Professional Engineer's Post-construction report in compliance with NSE requirements.

3. Summary of each Municipal Service System supply and installation costs.

4. Certification from a licensed surveyor that all services are within streets or service easements being conveyed to the Municipality.

5. Statutory Declaration indicating that all labour and materials used in the construction of the Municipal Services Systems have been paid in full.

6. Statutory Declaration indicating that the Developer carried out all work in compliance with all applicable Municipal, Provincial, and Federal Regulations, as stipulated throughout these Specifications.

7. All deposits, fees, permits, legal documents, supplementary information or other items deemed necessary by the Municipal Engineer and meeting all requirements of the Municipality or other regulatory agencies.

10.2 WATER SYSTEM

1. Records of water distribution system hydrostatic leakage tests and certification of compliance as per NSE's Permit to Construct.

2. Acceptable bacteriological examination results.

3. Professional Engineer's Certificate of Inspection and Compliance.

4. Confirmation that Water and Wastewater staff of the Municipality have received on site familiarization with all water system components such as pump stations, air release valves, altimeter valves, pressure reducing valves, etc.

5. Operation manuals and shop drawings, including recommended annual maintenance.

6. A deposit in a form acceptable to the Municipality, in accordance with section 15.1 a) of the Municipality's Subdivision Bylaw, which must be held for any defects that may have to be corrected by the Municipality for a period of 12 months following the date that the Municipality granted final Subdivision approval. Any remaining deposit will be returned to the developer after this period has expired. Should the cost of repairs during this period exceed the deposit amount, the difference in costs must be paid by the developer within 30 days of invoice by the Municipality for the same. Additional deposits may be requested at this time to cover any remaining defects that may occur within the remaining period.

7. Other testing information and documentation as requested by the Municipal Engineer.

10.3 WASTEWATER SYSTEM

a. Records and report of video inspection, pressure test, manhole tests, mandrel test, drawdown test, etc. A video inspection and report will be required again prior to release of the maintenance deposit. The video inspection report must be in a format acceptable to the Municipality and must at a minimum note metric chainage during the recording as well as the metric chainage of laterals, manholes, etc.

b. Professional Engineer's Certificate of Inspection and Compliance.

c. Confirmation that Water and Wastewater staff of the Municipality have received on site familiarization with all wastewater system components such as lift stations, SCADA, air release valves, etc.

d. Operation manuals and shop drawings, including recommended annual maintenance.

e. A deposit in a form acceptable to the Municipality, in accordance with section 15.1 a) of the Municipality's Subdivision Bylaw, which must be held for any defects that may have to be corrected by the Municipality for a period of 12 months following the date that the Municipality granted final Subdivision approval. Any remaining deposit will be returned to the developer after this period has expired. Should the cost of repairs during this period exceed the deposit amount, the difference in costs must be paid by the developer within 30 days of invoice by the Municipality for the same. Additional deposits may be requested at this time to cover any remaining defects that may occur within the remaining period.

f. Other testing information and documentation as requested by the Municipal Engineer.

10.4 STORMWATER SYSTEM

1. Records and report of video inspection, manhole tests, oil water separator tests, retention facility tests, etc. A video inspection and report will be required again prior to release of the maintenance deposit. The video inspection report must be in a format acceptable to the Municipality and must at a minimum note metric chainage during the recording as well as the metric chainage of laterals, manholes, etc.

2. Professional Engineer's Certificate of Inspection and Compliance.

3. Confirmation that staff of the Municipality have received on site familiarization with all stormwater system components such as oil water separators, bridges, retention facilities, etc.

4. Operation manuals and shop drawings, including recommended annual maintenance.

5. A deposit in a form acceptable to the Municipality, in accordance with section 15.1 a) of the Municipality's Subdivision Bylaw, which must be held for any defects that may have to be corrected by the Municipality for a period of 12 months following the date that the Municipality granted final Subdivision approval. Any remaining deposit will be returned to the developer after this period has expired. Should the cost of repairs during this period

exceed the deposit amount, the difference in costs must be paid by the developer within 30 days of invoice by the Municipality for the same. Additional deposits may be requested at this time to cover any remaining defects that may occur within the remaining period.

6. Other testing information and documentation as requested by the Municipal Engineer.

10.5 TRANSPORTATION SYSTEM (ROADS, SIDEWALKS AND TRAILS)

1. Geotechnical report.

2. Records of sieve analyses of gravels and their compaction tests, asphalt tests, concrete tests (sidewalk and curb), proof rolling reports, etc. water distribution system hydrostatic leakage tests and certification of compliance as per NSE's Permit to Construct.

3. Professional Engineer's Certificate of Inspection and Compliance.

4. Confirmation that staff of the Municipality have visually inspected the transportation systems in the field with the developer or representative of the same.

5. A deposit in a form acceptable to the Municipality, in accordance with section 15.1 a) of the Municipality's Subdivision Bylaw, which must be held for any defects that may have to be corrected by the Municipality for a period of 24 months following the date that the Municipality granted final Subdivision approval. Any repairs during this period exceed the deposit amount, the difference in costs must be paid by the requested at this time to cover any remaining defects that may occur within the remaining period. Periodic grading and snow and ice control services will be the responsibility of the Municipality once the transportation system has been accepted.

   The final road and/or walkway surface paving shall be completed not sooner than 2 years and not later than 3 years after the date that the Municipality granted final Subdivision approval. During this time, the developer must ensure that the road construction does not negatively impact the existing downstream surface water drainage facilities. Prior to receiving final Subdivision approval, a deposit in a form acceptable to the Municipality, in accordance with sections 10.8 or 10.9 of the Municipality's Subdivision Bylaw will be required.

6. Other testing information and documentation as requested by the Municipal Engineer

11.0 SUPPLEMENTARY SPECIFICATIONS

This part of the Municipal Standards shall be used in direct consultation with the current version of the "Standard Specification for Municipal Services", prepared by the Nova Scotia Road Builders Association - Nova Scotia Consulting Engineers Association Joint Committee on Contract Documents.

The following amendments have been made to the sections indicated for greater clarity and applicability to the Municipality:

SECTION 31 20 00 EARTHWORK

PART 2 - PRODUCTS

2.1 Materials

Revise Sub-section 2.1.1 as follows:

Replace “200” with “100” and add the following: Subject to the approval of the Municipal Engineer.

PART 3 - EXECUTION

3.1 Excavation

Revise Sub-section 3.1.7 as follows:

Replace “30” with “20”.

3.6 Dewatering

Delete Sub-section 3.6.5 and replace with the following:

.5 Do not drain water from excavation into wastewater lateral/system under any circumstances.

3.7 Bedding and Backfilling

Delete Sub-section 3.7.1 and replace with the following:

.1 Do not backfill until work has been inspected by the Design Engineer and the Municipal Engineer. Remove all timber, snow, ice, frozen material, and debris from excavation before backfilling. Contractor to provide for inspection at all stages of construction.

Delete Sub section 3.7.2 and replace with the following:

.2 Backfill with materials indicated and as described herein.

Actual bedding material will be dependent on trench conditions at the time. The Contractor shall utilize all practical means to establish dry trench conditions which will permit the use of Type 1 gravel for pipe bedding, haunching and initial backfill. Where in the opinion of the Municipal Engineer, dry trench conditions cannot be achieved or conditions are otherwise unsuitable, clear stone (including placement of geotextile or other approved material to mitigate soil migration and resulting settlement) shall be used in place of Type 1 material. Materials and installation procedure must meet the requirements of the Municipal Engineer before municipal services can be considered for takeover in whole or in part. Remaining backfill material shall be select backfill or other material approved by the Design Engineer and Municipal Engineer.

Delete Sub-section 3.7.5 and replace with the following:

.5 For PVC pipe, after installation of pipe on compacted bedding, place and compact haunching material to horizontal centerline of pipe utilizing hand tools and taking care to ensure that the material is not arched or bridged beneath the haunch of the pipe and all voids are eliminated. Mechanical compaction equipment may be used if directed by the Engineer. When compacting the material underneath and at either side of the pipe, do not allow the tool or the machine to strike the pipe itself. Ensure that the compacting effort does not dislodge the pipe from the correct grade. If compacting effort dislodges the pipe, relay the pipe to the correct grade. Do not compact the initial backfill directly over the top of the pipe unless otherwise directed by the Engineer; compact only the initial backfill material on either side of the line of the pipe. When using machinery other than hand operated equipment to compact the final backfill, place at least 450 mm of material over the top of the pipe before using heavy vibratory equipment on the final backfill.

Revise Sub-section 3.7.7.3 as follows:

Replace “70%” with “80%”.

3.11 Road Gravels

Add the following Sub-sections 3.11.3, 3.11.4 and 3.11.5:

.3 Protect municipal services such as valve boxes, manhole covers, etc. Any items damaged or displaced during preparation of road bed and gravels to be replaced and realigned.

.4 Prevent entry of gravels into sewer valve boxes, valve chambers, etc. during gravel placement and compaction. Remove any material which enters said structures and fittings.

.5 Where construction schedule and/or development activity will preclude completion of road to finished grade indicated on profile for extended period of time which may include winter conditions, provision must be made to ensure that buried piping is protected from frost.

Reference to: SECTION 33 39 00 PRECAST MANHOLES, CATCH BASINS AND STRUCTURES

PART 2 - PRODUCTS

2.3 Gaskets

Delete Sub-section 2.3.1 and replace with the following:

.1 O rings: ASTM C443 standard unless approved otherwise by the Municipal Engineer.

2.4 Metal Castings

Add the following Sub-section 2.4.2:

.2 Acceptable product for adjustable manhole frames and covers: Mueller AJ600 or IMP C-56N. Alternatives may be accepted by the Municipal Engineer. Cover to be IMP R-10 or equivalent.

Reference to: SECTION 33 31 00 SANITARY SEWERS

PART 3 - EXECUTION

3.6 Testing

Revise Sub-section 3.6.5 as follows:

Replace “Engineer” with “Design Engineer and Municipal Engineer”.

Delete Sub-section 3.6.7.1 and replace with the following:

.1 Test section between manholes of sewer including main and service connections by filling section with water to displace air from main and service connections. Fill and maintain nominal head on concrete pipe 24 hours before testing to allow adsorption of water by pipe material.

Delete Sub-section 3.6.7.2 and replace with the following:

.2 Place a plug in the lower end of the pipe and use a stand pipe at the upper manhole to a minimum depth of 3 m above the top of the pipe. Do not exceed net internal head of 8 m.

Reference to: SECTION 33 11 00 WATERMAIN

PART 1 - GENERAL

1.7 Scheduling of Work

Delete Sub-section 1.7.2 and replace with the following:

.2 Notify Engineer, Municipal Engineer and building occupants a minimum of 3 working days in advance of planned interruptions in service.

Add the following Sub-section 1.7.5:

.5 Interruptions to existing services are not encouraged. When necessary, the Municipal Engineer will be notified a minimum of three working days prior to planned interruption.

PART 2 - PRODUCTS

2.2 Ductile Iron Pipe and Fittings

Add the following Sub-sections 2.2.5 and 2.2.6:

.5 All ductile-iron pipe and fittings shall be polyethylene encasement.

.6 Acceptable products: Megalug fittings or approved equal.

2.4 Concrete Pressure Pipe and Fittings

Delete entire Sub-section 2.4.

2.7 Hydrants

Delete Sub-section 2.7.1.6 and replace with the following:

.6 Equip fire hydrants with a standard operating nut which will close the hydrant when rotated clockwise.

Delete Sub-section 2.7.1.8 and replace with the following:

.8 Colour: red with caps and bonnets silver. Paint shall be rust protected with no lead content.

Add the following Sub-section 2.7.1.9:

.9 Acceptable product: McAvity M-67 complete with SD thread connection to meet requirement for 146 mm hose connection in accordance with the Standard Hose Coupling Act of Nova Scotia.

2.12 Valve Boxes

Delete Sub-section 2.12.1 and replace with the following:

.1 Valve Boxes: to AWWA C500 and as follows:

.1 Cast iron, smooth and free from sand holes or other defects
.2 Equipped with cast iron covers at the surface and marked “WATER”, “SPRINKLER” or “HYDRANT” as appropriate.
.3 Have a bonnet and centering wheel on the bottom section which is capable of enclosing and peaking gland section of the gate valve
.4 Consist of one top section and one base section which shall be telescopic with each other and give adjustment for height by sliding suitable for adjustment to future finished asphalt surface.
.5 Acceptable product: Type V.1 as manufactured by IMP or approved equal.

2.13 Service Pipe and Fittings

Add the following Sub-section 2.9.4.1:

.1 Acceptable product: Mueller H-15008 with a Mueller thread inlet and a compression copper outlet or approved equal, complete with drain.

Add the following Sub-section 2.9.5.1:

.1 Acceptable product: Mueller H-15217, inverted key type with compression connections or an approved equal, complete with drain.

Delete Sub-section 2.9.7 and replace with the following:

.7 Service box: telescopic stem type expanding from 5 feet, 6 inches (1.7 m) to 6 feet, 6 inches (2.1 m), cast iron bottom section, cast-iron lid with recessed pentagon nut and internal stem to suit depth of bury. Service box to have appropriate foot piece.

PART 3 - EXECUTION

3.6 Hydrant Installation

Add the following to Sub-section 3.6.3:

Hydrant body to be equipped with specified nozzles prior to installation.

3.9 Connections to Existing Main

Add the following Sub-sections 3.9.4 and 3.9.5:

.4 Where a tee connection is to be made in an existing main, it shall be by tapping sleeve and valve utilizing tapping sleeve with stainless steel strap except where interruption to existing serviced customers can be minimized subject to acceptance by Municipal Engineer.

.5 When a connection is made to an existing main (i.e. inserting tapping sleeve) an inspection of the joints for leakage must be made by the Municipal Engineer while the main is under operating pressure, prior to backfilling.

3.10 Service Connections

Add the following to Sub-section 3.10.2:

Direct tap not permitted in PVC pipe.

Add the following to Sub-section 3.10.6:

Top of service box shall be set 150 mm above the centerline of the finished roadway elevation and not more than 150 mm above finished grade.

Add the following Sub-section 3.10.8:

.8 Water service lateral saddle to be double strap, stainless steel or single strap stainless steel Romac 202N, 202S, 101S or approved equal. Saddle body and strap must be compatible with DR 18 PVC pipe.

3.11 Hydrostatic and Leakage Testing

Revise Sub-section 3.11.4 as follows:

Replace “Engineer” with “Design Engineer and Municipal Engineer”.

Add the following to Sub-section 3.11.12:

Chlorination and pressure test ports to be plugged with solid brass plug after testing complete.

Add the following Sub-section 3.11.13:

.12 Following pressure test, test all hydrant barrels and nozzles for abnormal leakage at working pressure for acceptance by the Municipal Engineer.

3.12 Flushing, Disinfection and Bacteriological Testing

Add the following Sub-section 3.12.17:

.20 Water for flushing and disinfection shall be provided by the Contractor. Water from the Utility may be provided with written permission of the Municipal Engineer. Water Utility valves shall be operated by Water Utility personnel only.

Chlorination and pressure test ports to be plugged with solid brass plug after testing complete.

3.13 Combination Air Relief and Vacuum Valves

.1 3-inch (75 mm) diameter and larger:

.1 Heavy duty cast-iron body with bronze trim and combination of small orifice and large orifice units. Small orifice size shall be 1/8" (3.2 mm). Valves shall be suitable for operation at 145 psi (1 MPa) working pressure and have flanged ends to ANSI B161.

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

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

.4 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.

.5 Valves shall not leak in the closed position when pipeline is filled.

.1 Acceptable products:

.1 G.A. Industries Ltd., Fig 960-C

.2 APCO, Model 147C

.3 Crispin, Model AL30

.4 or approved equal.

.6 Corporation stop: Brass complete with IPS inside and outside thread, size as indicated

.1 Acceptable Products:

.1 Mueller A-218

.7 Service saddle: brass, double strap type

.1 Acceptable manufacturers:

.1 Rockwell

.2 Mueller

.3 Ford

.4 Robar

.8 Stainless steel nipples and ball valve are to be provided between saddle and air relief valve.

.9 Stainless steel gooseneck pipe arrangement to be provided at the threaded outlet for discharge protection.

.2 2-inch (50 mm) diameter and less:

.1 Heavy duty body consisting of metal and nylon reinforced glass fiber high impact plastic, with a combination small and large orifice. Small orifice shall be stainless

steel with a minimum opening of 1/32" (0.8 mm), valve shall be suitable for operation at 218 psi (1.5 MPa) working pressure. Size as indicated.

.2 Operation shall be independent floats located in both orifices.

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

.4 Valves shall have no moving parts except for the floats which shall remain in the throat area, discharging air without blowing shut.

.5 Valves shall not leak in the closed position when pipeline is filled.

.1 Acceptable products:

.1 Bermad, Model No. 4415

.2 Valve matic. Model 201C or 202C

.3 APCO, Model 143C or 145 C

.4 Crispin, Model AL20

.6 Corporation stop: Brass complete with IPS inside and outside thread, size as indicated.

.1 Acceptable product:

.1 Mueller A

.7 Service saddle: brass, double strap type.

.1 Acceptable product:

.1 Mueller

.2 Rockwell

.3 Ford

.4 Robar

.8 Stainless steel nipples and ball valve are to be provided between corporation stop and air relief valve.

.9 Stainless steel gooseneck pipe arrangement to be provided at the threaded outlet for discharge protection.

Reference to: SECTION 33 34 00 PRESSURE SEWERS

PART 2 - PRODUCTS

2.2 Ductile Iron Pipe and Fittings

Delete Sub-sections 2.2.1 and 2.2.2 and replace with the following:

.1 Pipe: to AWWA C151, Class 52, cement mortar lined.

.2 Fittings: to AWWA C110 or C153, cement mortar lined, minimum pressure rating 150 psi (1035 kPa) for cast-iron, 250 psi (1720 kPa) for ductile iron. Fittings are to be wrapped with anti-corrosion tape such as Denso or approved equal.

2.3 Polyvinyl Chloride Pipe and Fittings

Delete Sub-section 2.3.1 and replace with the following:

.1 Pipe and joints: DR 18 to AWWA C900 or AWWA C905, CAN/CSA B137.3-M, cast iron outside diameter, gasketed bell-end joint.

Delete Sub-section 2.3.2.2 and replace with the following:

.2 Gray or ductile-iron: to AWWA C110 or C153, cement mortar lined, minimum pressure rating 150 psi (1035 kPa) for cast-iron, 250 psi (1720 kPa) for ductile-iron. Fittings are to be wrapped with anti-corrosion tape such as Denso or approved equal.

Delete entire Sub-sections 2.4 and 2.5. and replace with the following:

2.4 PVCO Pipe and Fittings

.1 Pipe to ASTM D1784 cell class 12454B.

.2 Gaskets shall meet ASTM F477 for high-head applications.

2.6 Gate Valves

Add the following Sub-section 2.6.1.7:

.7 Acceptable products: Mueller NRS resilient seat A2370-23 or approved equal.

2.9 Valve Boxes

Add the following Sub-section 2.9.1.4:

.4 Acceptable products: IMP model V.1 or approved equal

Add the following Sub-sections 2.14, 2.15 and 2.16:

2.14 Check Valves

.1 Wafer swing check: wafer style, ANSI Series 125, minimum working pressure 290 psi (2 MPa) and as follows:

.1 Body: ductile iron with stainless steel disc or seat.
.2 Spacers: Teflon Buna-N O-rings.
.3 Seat: Teflon Buna-N O-rings.
.4 Acceptable Products:
.1 Check Rite, Model 210.

.2 Ball Check: Acceptable products:
.1 HDL Check Valve.

2.15 Air Relief and Vacuum Valves

.1 75 mm diameter and larger:

.1 Heavy duty cast-iron body with bronze trim and combination of small orifice and large orifice units. Small orifice size shall be 1/8" (3.2 mm). Valves shall be suitable for operation at 145 psi (1 MPa) working pressure and shall have flanged ends.
.2 Operation shall be through independent floating stainless steel balls located in both orifices.
.3 Orifices shall be capable of expelling air at a high rate during filling and at a low rate during operation and admitting air while draining the pipeline. Seats shall be replaceable.
.4 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.
.5 Valves shall not leak in the closed position when pipeline is filled.
.6 Acceptable Products:
.1 APCO

.2 Crispin

.3 or an approved equal.

.2 50 mm diameter and less:

.1 Heavy duty body consisting of metal and nylon reinforced glass fiber high impact plastic, with a combination small and large orifice. Small orifice shall be stainless steel with a minimum opening of 1/32" (0.8 mm), valve shall be suitable for operation at 218 psi (1.5 MPa) working pressure.

.2 Operation shall be through independent floats located in both orifices.

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

.4 Valves shall have no moving parts except for the floats which shall remain in the throat area, discharging air without blowing shut.

.5 Valves shall not leak in the closed position when pipeline is filled.

.6 Acceptable products:

(i) APCO

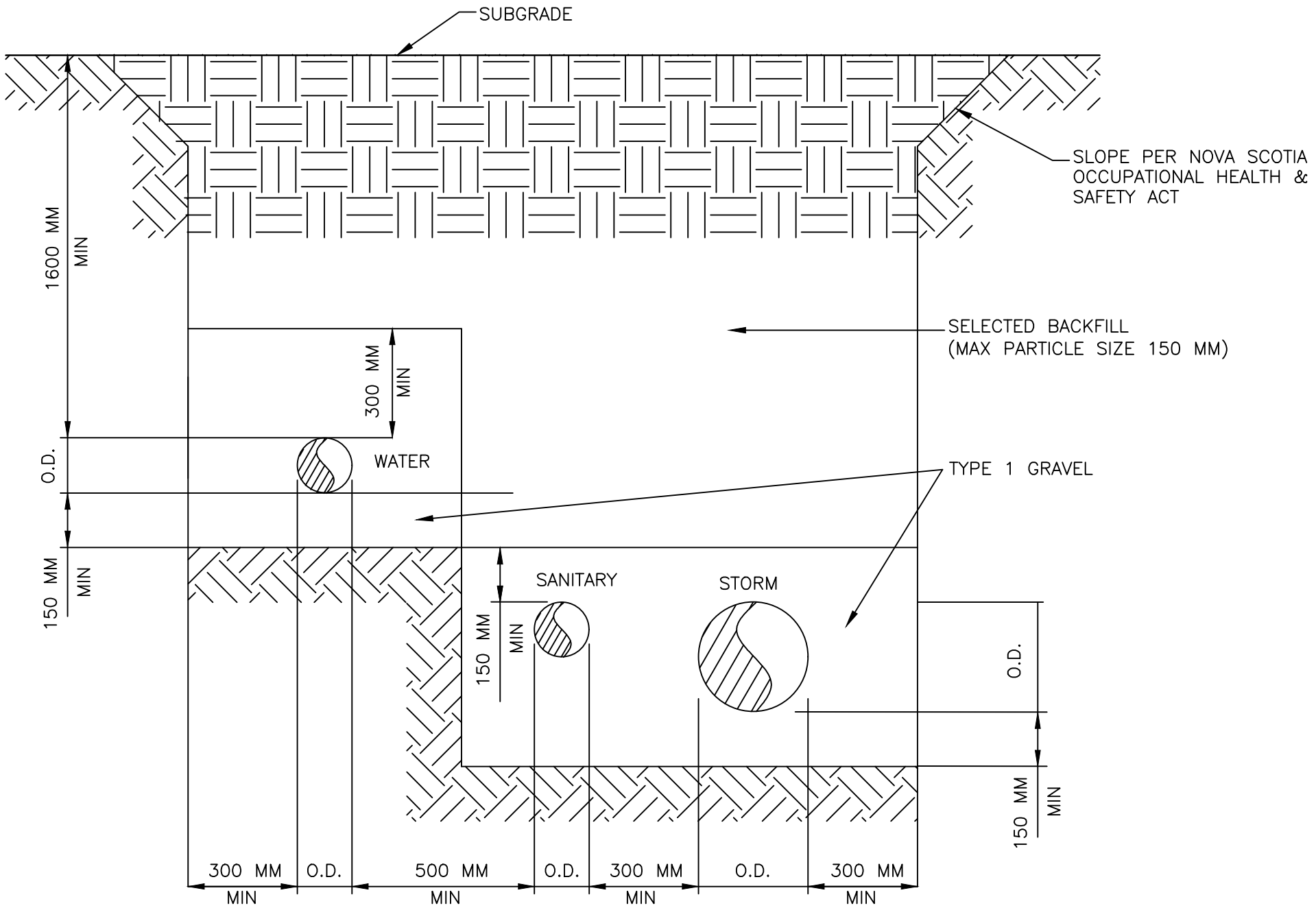
(ii) Crispin.

2.16 Plug Valves

.1 Acceptable products:

.1 Keystone plug valve.

APPENDIX A



EAST HANTS

MUNICIPALITY OF EAST HANTS			
MUNICIPAL STANDARDS			
PIPE TRENCH DETAIL			
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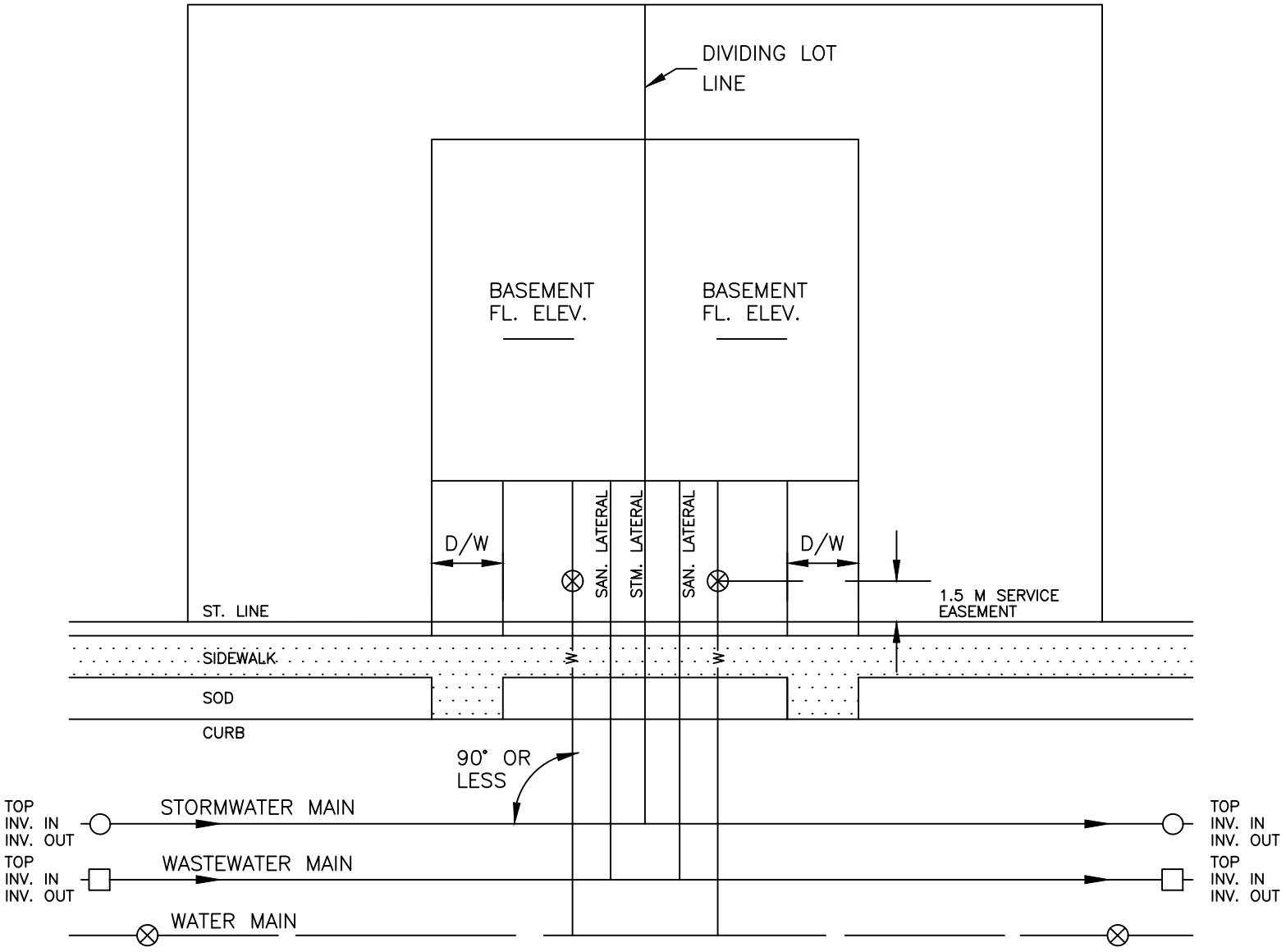
DRAWING NO.	EH-S1	REVISION	

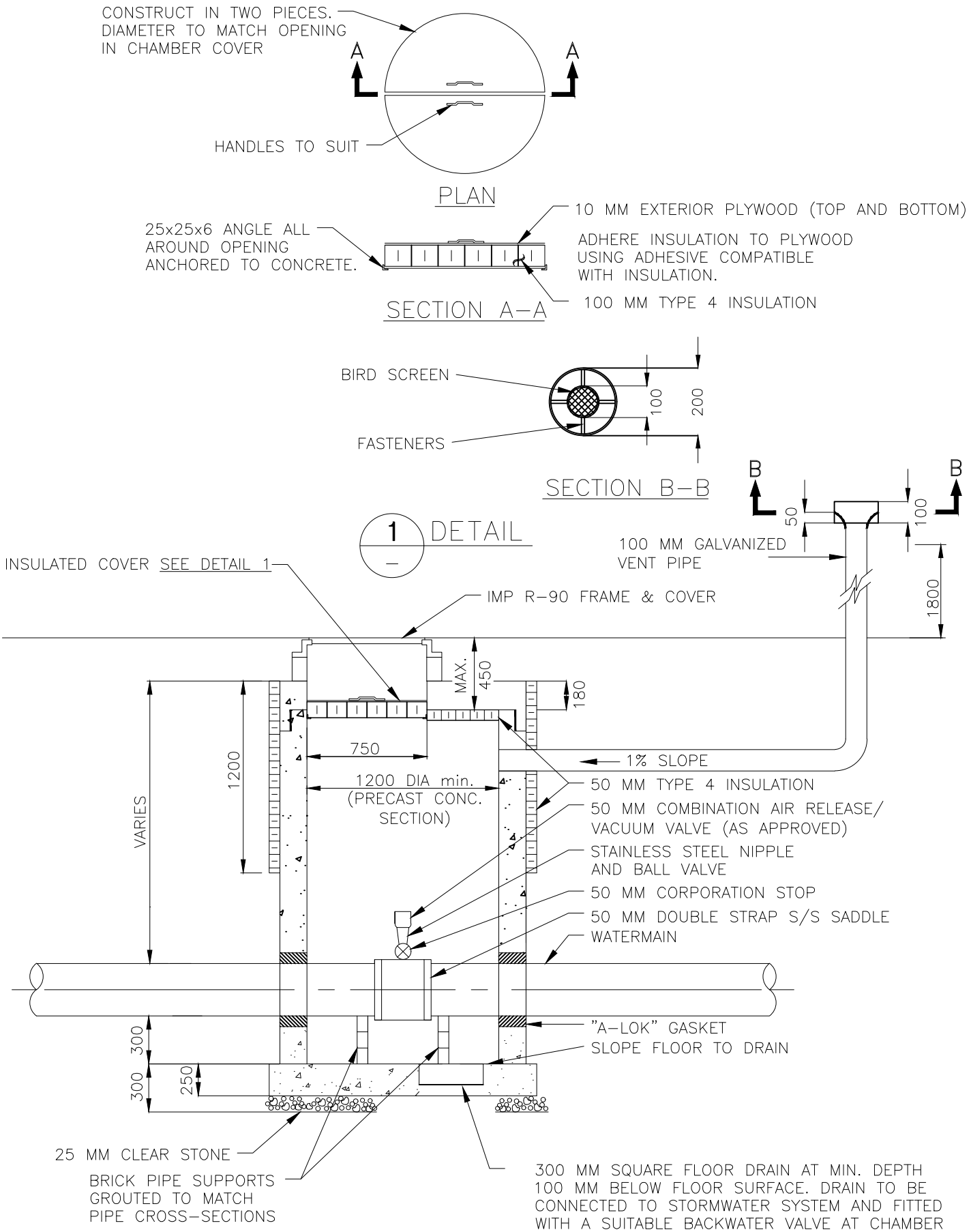


NOTES:

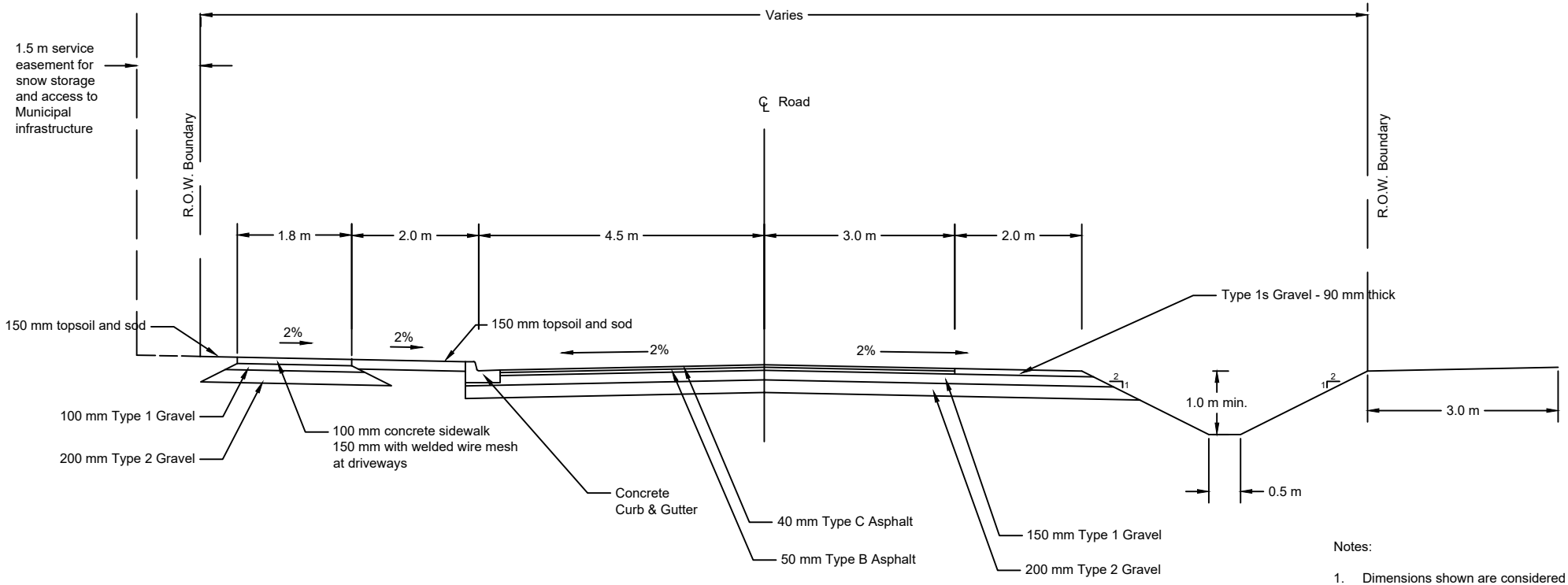
1. WASTEWATER LATERALS TO BE AT 2% MIN. GRADE.
2. ROOF LEADERS ARE NOT PERMITTED TO BE CONNECTED TO THE STORMWATER SYSTEM.
3. LATERAL SEPARATION TO BE 300 MM MINIMUM.
4. LATERALS TO BE INSTALLED AND EXTENDED IN A STRAIGHT LINE.

EAST HANTS

MUNICIPALITY OF EAST HANTS			
MUNICIPAL STANDARDS			
SEMI-DETACHED SERVICE CONNECTIONS			
DATE:	JUNE 2020	SCALE:	NTS
DRAWING NO.	EH-S2	REVISION	



.\East Hants logo.png	**MUNICIPALITY OF EAST HANTS**		
	MUNICIPAL STANDARDS		
	AIR RELEASE/AIR VACUUM VALVE CHAMBER		
	DATE: JUNE 2020	SCALE:	NTS
	DRAWING NO. EH-S4	REVISION	

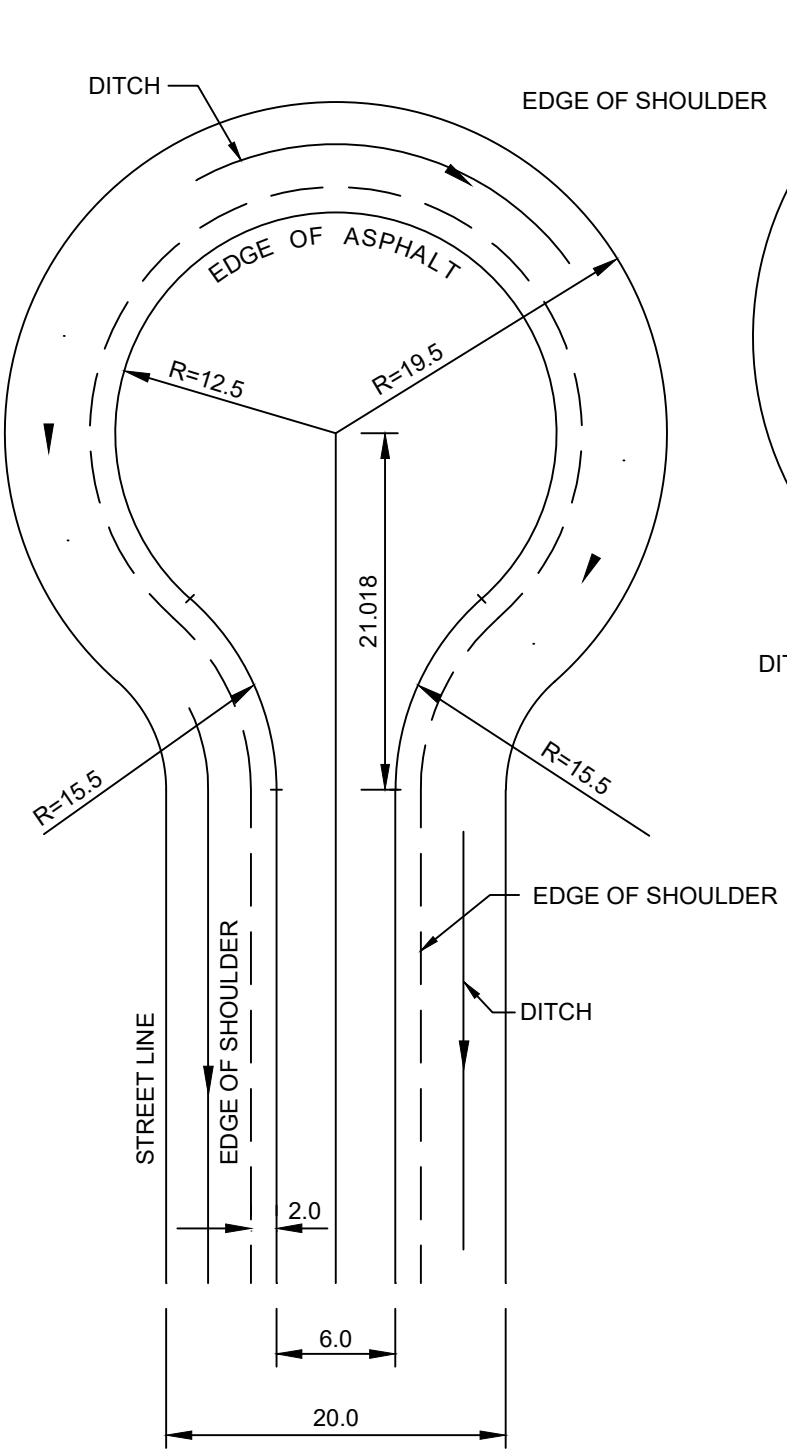


Notes:

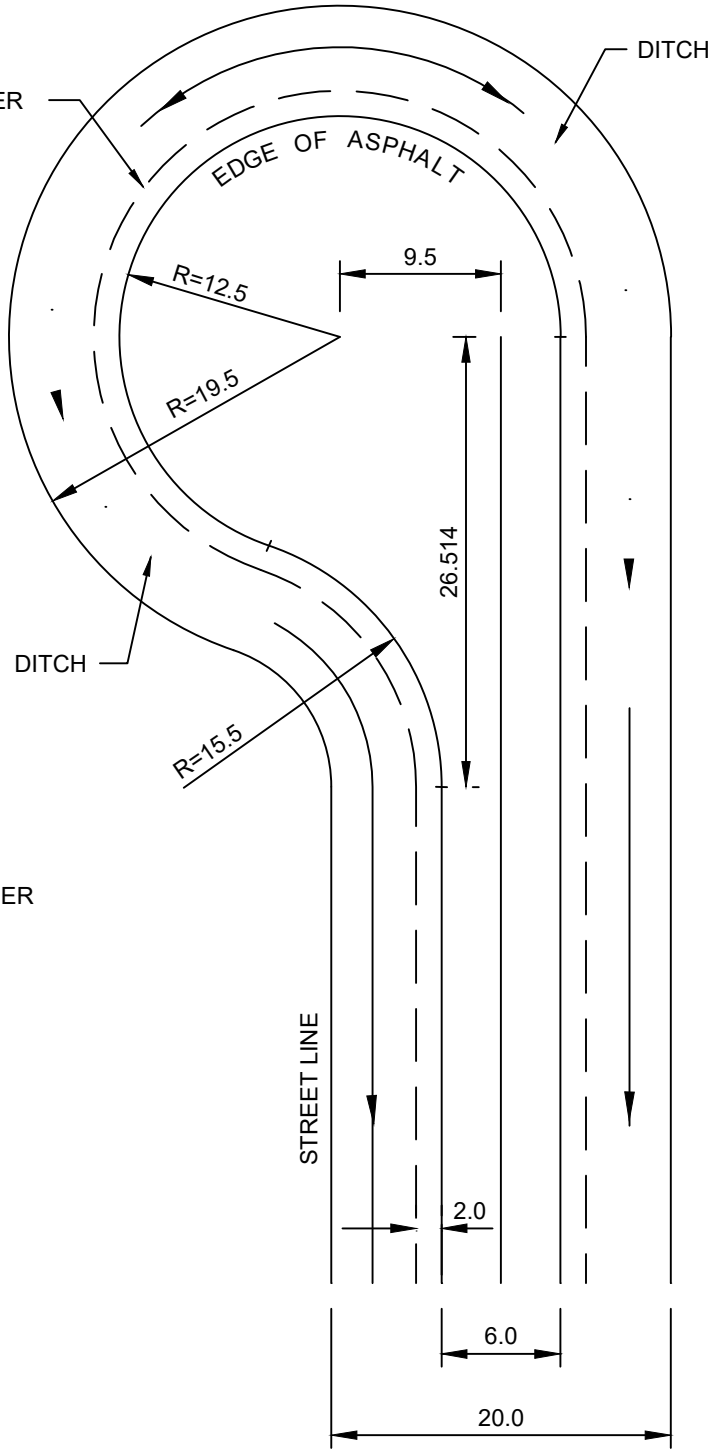
1. Dimensions shown are considered the minimum allowable.
2. Use of proposed materials and associated thicknesses, compaction, placement, etc. to be supported by a geotechnical report.
3. Backfill material to be approved by Geotechnical Engineer.
4. Ditch slopes as shown or flatter as recommended in geotechnical report.

EAST HANTS

MUNICIPALITY OF EAST HANTS			
MUNICIPAL STANDARDS			
TYPICAL ROAD CROSS SECTION			
DATE:	JUNE 2020	SCALE:	NTS
DRAWING NO.	EH-T1	REVISION	



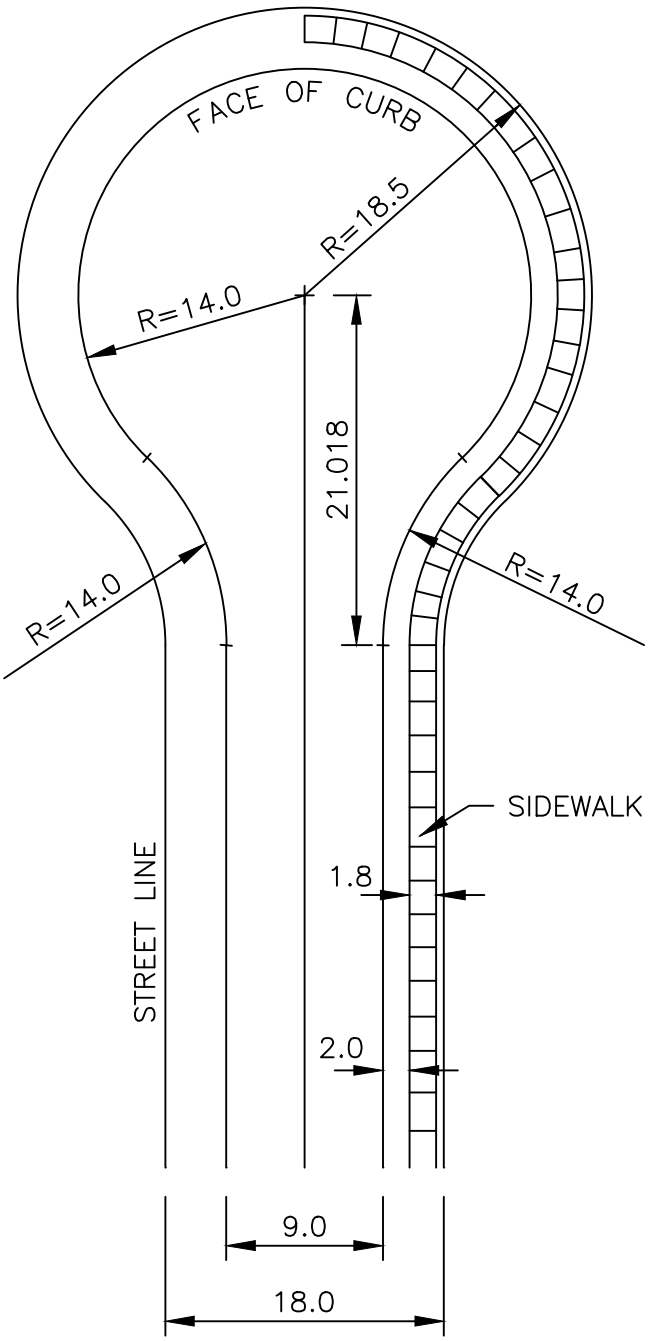
SYMMETRICAL CUL-DE-SAC



OFFSET CUL-DE-SAC

EAST HANTS

MUNICIPALITY OF EAST HANTS			
MUNICIPAL STANDARDS			
RURAL CUL-DE-SAC			
DATE:	JUNE 2020	SCALE:	NTS
DRAWING NO.	EH-T2	REVISION	



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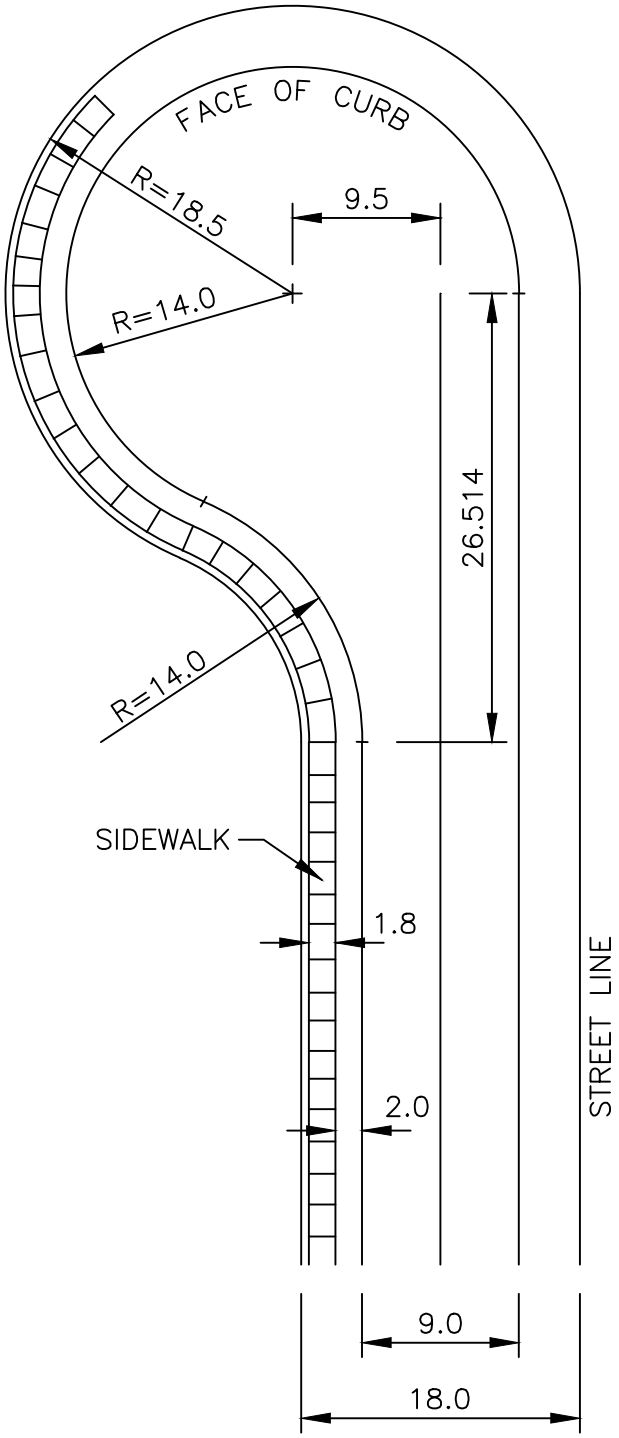
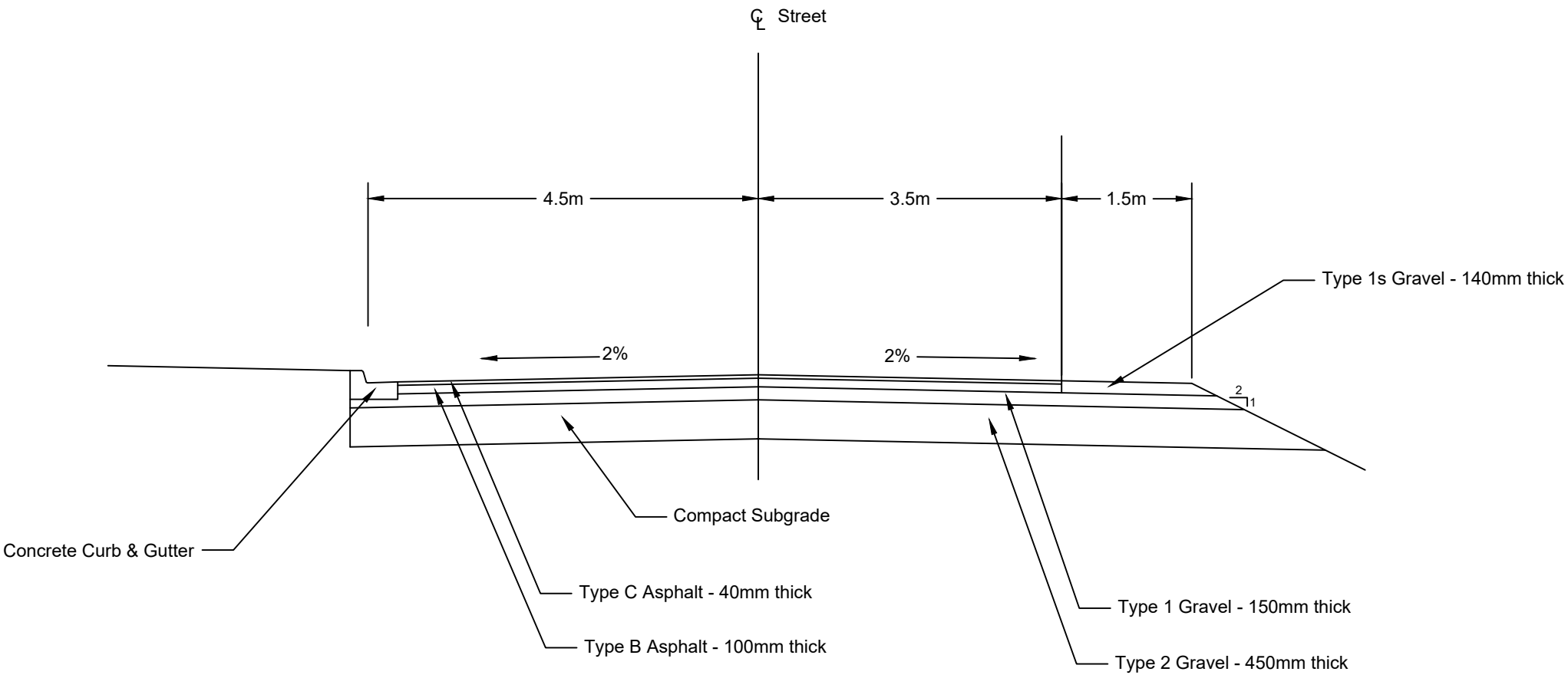


OFFSET CUL-DE-SAC

EAST HANTS	**MUNICIPALITY OF EAST HANTS**		
	MUNICIPAL STANDARDS		
	URBAN CUL-DE-SAC		
	DATE: JUNE 2020	SCALE:	NTS
	DRAWING NO. EH-T3	REVISION	

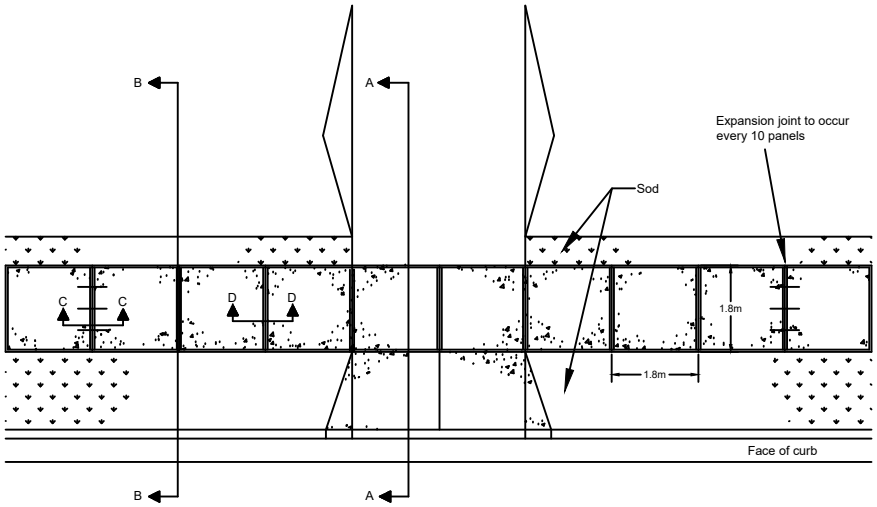


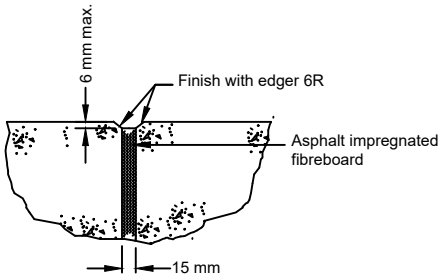
Notes:

1. Dimensions shown are considered the minimum allowable.
2. Use of proposed materials and associated thicknesses, compaction, placement, etc. to be supported by a geotechnical report.
3. Backfill material to be approved by Municipal Engineer.

EAST HANTS

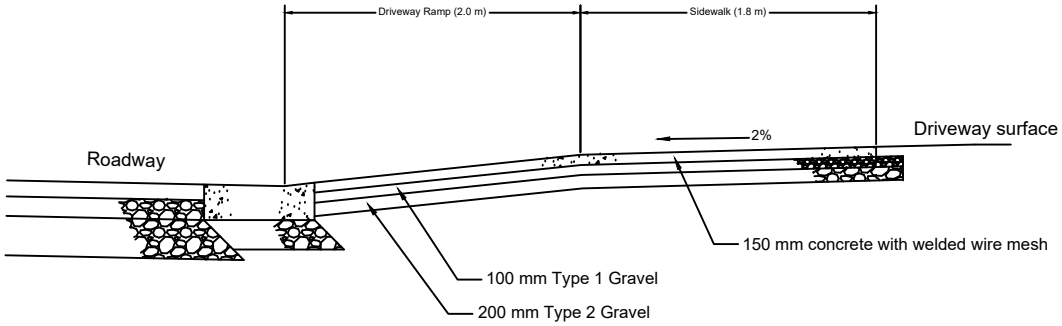
MUNICIPALITY OF EAST HANTS			
MUNICIPAL STANDARDS			
INDUSTRIAL STREET ROAD CONSTRUCTION THICKNESS			
DATE:	JUNE 2022	SCALE:	NTS
DRAWING NO.	EH-T4	REVISION	



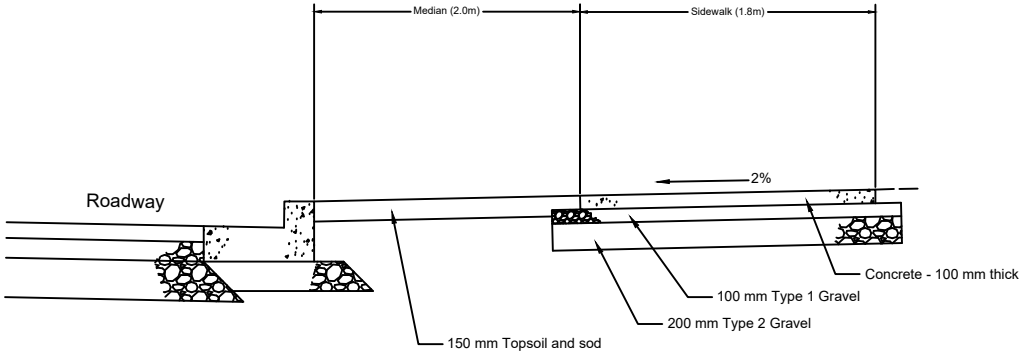


Section C-C
Expansion Joint

Section D-D
Control Joint



Section A-A
Driveway Cross Section



Section B-B
Sidewalk Cross Section

NOTES:
1. Pedestrian and driveway ramps and adjacent sidewalk to be 150 mm with welded wire mesh (152 x 152 MW9.1/9.1).
2. Gravel base to extend 150 mm beyond edge of sidewalk structure.
3. Control joints are to be saw cut.
4. Pedestrian ramps to have Tactile Walking Surface Indicators.
5. During consecutive placements, the end of each placement is to occur at an expansion joint. Where this is not practical, an additional expansion joint is to be installed.
6. Gravel depths are minimum, to be increased if recommended by geotechnical report.

EAST HANTS

MUNICIPALITY OF EAST HANTS			
MUNICIPAL STANDARDS			
TYPICAL SIDEWALK			
DATE:	JUNE 2020	SCALE:	NTS
DRAWING NO.	EH-T6	REVISION	