Township of
SEVERN

ENGINEERING STANDARDS

Water System

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1 General Requirements

Within the boundaries of the Township, the responsibility for the supply, treatment, storage, and distribution of water rests with the Township.

This section provides guidance for the design and construction of any water system components. The design must accommodate the water demand anticipated by all sources. All watermains shall be sized to meet the greater of the maximum day plus fire flow or the maximum hour demand.

2 Other Applicable Acts, Codes, Standards, Legislation, Design Guidelines

Practitioners must be fully familiar and ensure compliance with other applicable acts, codes, standards, legislation, and design guidelines when carrying out municipal servicing design.

Practitioners are fully responsible for obtaining all approvals and permits necessary for the project from the relevant approval authorities.

3 Deviation from Standards

If the practitioner deems that a deviation from these standards is required, they must make a formal request to Town, complete with a memorandum identifying the proposed deviation along with an explanation of the rationale behind the requirement and how it will be of benefit. The Township may approve or reject any/all requests and the practitioner must comply with that decision. If a deviation is approved, a copy of the written approval must be included with any submissions to the Township.

4 Water Demand

The following sections provide guidance on determining the water demand to be used for design purposes. It is recognized that system demand may change between design and construction as more information becomes known, particularly in the case of commercial and industrial uses. The Township reserves the right to request updated water demand calculations and confirmation of design sufficiency prior to building occupancy.

4.1 Domestic Demand

Domestic water demand shall be calculated on the basis of an average day consumption rate of 400 litres per capita per day.

The maximum day and peak hour factors shall be determined from the current MECP design guidelines, although 2.0 and 4.5 are considered minimums for each, respectively.

4.2 Commercial and Institutional Water Demands

The water demand for commercial and institutional establishments may vary greatly. An average day flow of 28 m^3/ha/day shall be used for design purposes to estimate the water consumption for large commercial areas unless more specific data is available.

When specific planning information is available, water consumption for individual commercial and institutional sites may be calculated from the following table.

Table 4-1: Water Consumption Demands by Usage Type

Type of Use	Water Usage
Shopping Centers	2500 – 5000 L/1000m^2/d
Hospitals	900 – 1800 L/bed/d
Schools	70 -140 L/student/d
Campgrounds	225 – 570 L/campsite/d

When using the above unit demands, maximum day and peak hour factors shall be developed by the designer and rationale provided for their use.

For establishments in operation for only a portion of the day, the water usage shall also be factored accordingly.

4.3 Industrial Water Demands

An average design flow of 36 m^3/ha/day shall be utilized for design purposes to estimate the average consumption rate for industrial areas unless more specific data is available.

4.4 Fire Flows

The requirements for fire flows shall be discussed and agreed upon with the Township prior to proceeding with detailed design.

In general, the minimum fire flow requirement shall be as outlined by the MECP, Fire Underwriters Survey, Ontario Fire Code, and N.F.P.A.24.

5 Sizing and Specifications

5.1 Watermain Size

The Hazen-Williams equation shall be used to calculate the flow in watermains as follows:

Equation 5-1: Hazen Williams Equation

$$Q = 0.84918(C)(A)(R)^{0.63}(S)^{0.54}$$

Where:

Q = Flow (m^3/s)

C = Coefficient (pipe friction)

A = Cross-Sectional Flow Area (m^2)

R = Hydraulic Radius (m)

S = Hydraulic Gradient or Slope (m/m)

The following "C" values shall be used in the Hazen-Williams equation, for the design of water distribution systems, regardless of pipe material.

Table 5-1: "C" Values of Pipe Diameters for Hazen Williams Equation

Pipe Diameter (mm)	"C" Value
150	100
200 – 300	110
400 - 600	120
Over 600	130

The above C-factors represent long-term values. A C-factor of 140 shall be used to calculate maximum velocities for transient pressure estimations, or for checking pump motor sizes for runout conditions.

In evaluating existing systems, the C-factor shall be determined by actual field flow tests, wherever possible.

For all watermains designed to carry fire flows, the following minimum sizing for watermains shall apply.

Table 5-2: Minimum Watermain Sizing for Fire Flows

Type of Area	Minimum Watermain Sizing
For Residential areas	150 mm diameter
For Commercial areas	200 mm diameter
For Industrial areas	300 mm diameter minimum - to be sized according to the anticipated water demand

5.2 System Design Pressure

The maximum sustained operating pressure shall not exceed 700 kPa (101.5 psi). If pressure in a localized area is above this level, a pressure-reducing valve shall be installed on each service connection within that area.

Under normal conditions of maximum day demand, the pressure shall not drop below 275 kPa (40 psi) at any point in the water system.

Under conditions of simultaneous maximum day and fire flow demands, the pressure shall not drop below 140 kPa (20 psi) at any point in the water system.

5.3 Transients

Watermain shall be designed to withstand the maximum operating pressure plus the transient pressure to which it may be subjected.

At a minimum, the watermain shall be designed so that pipes and joints are able to withstand the maximum operating pressure plus the surge pressure that would be created by stopping a water column moving at 0.6 m/s.

5.4 Depth of Watermain

Generally, regardless of the type of road, the cover over the watermain and any service connections shall not be less than 1.7 metres.

Where the minimum cover cannot be achieved, the Township may consider a reduced depth of cover for short distances; however, frost protection using high density SM Styrofoam insulation or pre-insulated pipe must be used.

For watercourse crossing, adequate frost protection shall be provided below the bottom of the watercourse. 1.7 m minimum depth of cover, measured below the watercourse invert shall be considered acceptable.

5.5 Location of Watermain

Watermains shall be located as shown on the typical Township roadway cross sections. This location shall generally be on the north or east side of the street.

For replacement of existing watermains, an alignment that will allow the existing watermain to remain in service until the new watermain is commissioned and all water services are transferred to the new main is preferred. The use of temporary watermains is not preferred, but may be allowed where there is no other option than to place the new watermain in the same alignment as the existing watermain.

5.6 Horizontal Separation Requirements

Under normal conditions, watermain shall be designed with a minimum clear horizontal separation of at least 3.0 m from any sewer or sewer maintenance hole. The distance shall be measured from the nearest edges of the pipes or structures.

Under unusual conditions (where a significant portion of the construction will be in rock or where congestion with other utilities will prevent a clear horizontal separation of 3.0 m) a watermain may be laid closer to a sewer, provided the obvert of the sewer is a least 0.50 m below the invert of the watermain. Such separation shall consist of in-situ material or compacted native earth backfill.

In rock trenches, facilities shall be provided to permit drainage of the trench to minimize the effect of the impounding of surface water and/or leakage from sewers in the trench.

5.7 Vertical Separation Requirements

Under normal conditions, watermains shall cross above sewers with at least 0.5 m vertical separation.

When it is not possible for the watermain to cross above the sewer main, the watermain passing under a sewer shall be protected as follows:

- A vertical separation of at least 0.50 m shall be provided between the outside face of the sewer and the top of the watermain.
- The sewer shall be adequately supported to prevent excessive deflection of joints and settling.
- The length of watermain pipe under the sewer shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer. Watermain pipe joints shall be located 1.5 metres (minimum) from the centreline of the sewer (both sides).

Watermains crossing over or under other utilities shall be designed with a 300 mm minimum clear separation between the outside edges of the watermain and the utility.

5.8 Bends and Deflection

Watermain systems are to be designed using commonly available bends (11.25, 22.5, 45 degrees) only. 90-degree bends are not permitted.

Pipe barrel bending/deflection is not permitted.

Pipe joint deflections are discouraged; however, if absolutely necessary, the maximum allowable pipe joint deflection shall be 50% of the manufacturer's specifications.

For concrete pressure pipe, custom pieces shall be used to achieve bends.

5.9 Dead-End Watermain

Water distribution systems shall be designed in grid patterns or looped to avoid dead-end sections.

Minimum pipe size and material for loops is generally 150 mm diameter PVC.

In certain situations, the Township may consider a smaller 50 mm polyethylene watermain loop; however, specific approval is required by the Township.

5.10 Additional Watermain, Stubs, and Fittings, including Sampling Stations

Additional watermain, stubs, fittings, and sampling stations shall be installed in locations at the request of the Township.

Sampling stations are as per Cromer Industries “Test Tap”, or approved equivalent.

5.11 Pipe Classification and Bedding

Acceptable materials for watermain pipe up to and including 300 mm diameter are as follows:

- Polyvinyl Chloride Pipe and fittings (PVC) manufactured in accordance with the latest edition of CSA B137.3 and AWWA C900. A minimum Class 150, DR 18 pipe shall be used.
- Fittings shall be of cast iron or ductile iron; cement lined and shall be manufactured to AWWA C110. All fittings shall be supplied with mechanical joint ends.
- Polyethylene pressure pipe shall be to OPSS 1842.

The class of pipe and the type of bedding shall be selected to suit loading and proposed construction conditions. Pipe bedding and cover shall be homogeneous granular material in accordance with OPS requirements for flexible pipe.

The width of trench at the top of the pipe must be carefully controlled to ensure that the maximum trench width is not exceeded unless additional bedding or higher strength pipe is used.

Where poor soil conditions and high ground water levels are present, special designs may be required to be submitted for the Township's approval.

5.12 Thrust Restraint

Adequate restraint, taking into consideration anticipated soil conditions, must be provided at all fittings, bends, plugs/caps in the water distribution system to prevent pipe movement and subsequent joint failure.

Mechanically restrained joints shall be used for all PVC watermains, including dead-end valves.

The limits of restrained joints must be provided on the engineering drawings and thrust restraint calculations provided to the Township as part of the detailed design.

5.13 Corrosion Resistance

All metallic components in the water distribution system shall be protected from corrosion.

Denso Paste-Petrolatum Tape Primer shall be installed on every valve, hydrant and fitting connected to a non-ferrous watermain.

Fittings shall include bends, tees, crosses, sleeves, reducers, plugs, caps, joint restrainers and couplings etc.

5.14 Tracer Wire

A tracer wire shall be provided along the top of all Polyvinyl Chloride (PVC) watermains, hydrant leads and PE water services, to permit future field tracing. These tracer wires shall

be attached to the top of the watermain and shall be looped up and outside each valve box and drilled in at the top, including hydrant valves and shall also be connected to the bottom flange of all hydrants. Tracer wires shall be No. 12 gauge stranded copper (TWH) complete with plastic coating.

Tracer wire shall be continuous and no spliced in connections will be permitted for fire hydrants, service connections, or other appurtenances. When necessary and only as approved by the Township, such as at end of rolls or for repairs, splicing of tracer wire must be waterproofed in accordance with OPSD requirements or using outdoor waterproof electrical connectors and done in such a way to ensure electrical conductivity.

Tracer wire for horizontal directional drilling and pipe bursting installation shall be in accordance with OPSS.

A continuity test must be completed to ensure there is no damage to the tracer wire following construction.

5.15 Fire Hydrants

All fire protection design requirements shall be reviewed with the Township at the preliminary design stage.

5.15.1 Branch Valves and Boxes

All hydrants installed on watermains up to and including 300 mm in diameter shall be installed with a 150 mm diameter branch valve attached to the watermain with an anchor tee.

All hydrants installed on watermains greater than 300 mm in diameter shall be controlled by a 150 mm diameter, branch valve directly secured to the supply main with flanged fittings or restraining tie-rods.

Fire hydrants shall be Canada Valve Century or Clow Concord D67-M open left with 2 CSA hose ports, one 33 B pumper port and a breakaway type 6” MJ base. The hydrant lead shall be minimum 150 mm with a resilient seated gate valve shut off (“Open Left” by Clow or Meuller) as detailed on the Standard Drawings. The hydrants shall have all drain holes plugged and be installed as per OPSD 1105.010.

5.15.2 Hydrant Spacing

Hydrants shall be installed on all watermains 150 mm in diameter and larger with the following maximum allowable spacing:

- 150 m in residential areas, or to provide for a maximum hose length of 75 m.
- 90 m in industrial and commercial areas.

5.15.3 Location of Hydrants

Wherever possible, hydrants shall be located at corners, 4.0 m back from the street line intersections at the edge of daylighting. All hydrants shall normally be for a 2.0 m depth of trench with provisions for extension at the surface for adjustment to proposed street line grades.

Hydrants shall be located 1.5 m minimum distance from the edge of any driveway or house service connection.

A hydrant shall be placed at the end of every cul-de-sac and dead-end street as well as at high points in roads.

5.15.4 Hydrant Ports

In all areas hydrants shall be equipped with 114 mm dia. Pumper Ports and 2 - 64 mm dia. side ports, all with fire thread.

5.15.5 Direction of Opening

All hydrants shall be equipped with a non-rising stem and shall open in a counterclockwise direction.

5.15.6 Colour of Hydrants

All hydrants shall be factory painted yellow. Bonnet and caps to be shipped in primer, then painted to indicate capacity after fire flow testing.

5.15.7 Hydrant Markers

Each hydrant is to be provided with a standard marker for easy identification in the winter.

5.15.8 Dry Hydrants

In rural areas, where required by the Township, dry hydrants are to be installed in accordance with the Township's standard detail drawings and must comply with the National Fire Protection Association and Ontario Fire Code.

5.16 Valves

5.16.1 Type

Gate valves shall be used on all watermains.

Gate valves shall be Mueller or Clow resilient wedge type with sliding type valve box or approved equal. All valves shall be of the approved type with non-rising stem and a 50 mm square operating nut opening counterclockwise.

All valves on watermains 300 mm in diameter and smaller shall have mechanical joint ends.

All valves larger than 300 mm in diameter shall be installed inside chambers and shall have flanged ends. A flange to plain end spacer and a Victaulic coupling shall be installed inside the chamber to permit removal of the valve, if necessary.

5.16.2 Size

All line valves shall be the same size as the watermain.

5.16.3 Number, Location and Spacing

Generally, three valves are required at a tee intersection and four valves are required at a cross intersection with the valves being located at a point where the projected street line intersects the watermain. All valve boxes and valve chambers shall be located in boulevards and out of pavement areas wherever possible.

Where streets extend for greater than normal distances without intersections, the Township may require an extra valve in the main at an intermediate point.

All valves at points of termination of a stage of construction shall be braced with two additional lengths of watermain pipe beyond the gate valve.

Watermain terminations shall be plugged and braced. Where watermain valves are located under travelled road surfaces, the top of the operating box shall be set flush with the paved surface.

Where the depth of the water valve exceeds 2.0, valve stem extensions shall be specified.

5.16.4 Valve Boxes and Chambers

All valves on watermains 300 mm in diameter and smaller shall have valve boxes and specified direct bury operators must be used.

All valve boxes shall be three-piece, sliding-type, size ‘D’.

All valves on watermains larger than 300 mm in diameter shall be installed within concrete chambers set flush with finished grade. The top of the roof slab of valve chambers shall be at least 0.60 m below the profile of the finished pavement.

5.16.5 Air Relief Valves

Air relief valves shall be installed at all significant high points in the water distribution system.

Air relief valves shall be double-acting type, combination air release/vacuum valve.

Air relief valves shall be housed within a chamber as illustrated in the Standard Drawings and drained to storm sewers, where possible. The chambers are to be equipped with “P” traps to prevent movement of gases.

5.16.6 Drain Valves

Drain valves shall be provided as required by the Township.

5.17 Service Connections

Individual water service connections shall be provided for single, semi-detached, and townhouse dwellings.

5.17.1 Size and Materials

Service connections to be provided for a dwelling located less than 30 metres from the supply main shall be 25 mm dia. and shall be polyethylene pipe, certified to Series 160 or a higher series of CSA B137.1.

All other services will require specific evaluation to determine the minimum size, considering the following factors:

- peak water consumption of the building to be serviced;
- total length of service that will be required to reach the building;
- elevation of the building with respect to the elevation of the watermain;
- available head in the watermain;
- loss of head in the service connection;
- required head at the point of water usage.

5.17.2 Location

Water service connections shall be located as shown on the applicable Standard Drawing. Generally, water services shall be located a minimum of 3.0 m away from any sanitary or storm sewer service, 1.5 m from any other water service, and they shall not be located within 1.0 m of a driveway. In the event that changes to the design occur during construction such that the water service will be located in a driveway, the service must be moved to a location to the satisfaction of the Township.

Where a final connection is not being made after installation, the end of the service connection shall be marked by a 50 mm x 100 mm lumber stake extending from the end of the connection to a point 900 mm above grade. The top of this marker shall be painted blue.

5.17.3 Location of Curb Stop

The curb stop on all water service connections 50 mm in diameter and less shall be located at the property line as shown on the Standard Drawing.

The control valve on water service connections 100 mm in diameter and larger shall be located at the supply main with the valve secured to the supply main by means of anchor

tees, flanged fittings or approved restraining tie rods, as illustrated on the Standard Drawing.

5.18 Connection to Supply Main

Water service connections 50 mm in diameter and smaller may be tapped into the supply main with the following restrictions:

- For PVC watermains, a stainless steel saddle shall be used for all connections.
- The maximum size of connection that can be direct tapped into a 150 mm watermain is 32 mm in diameter. Larger sized service connections shall be connected by a cast iron fitting factory-tapped for the required service connection size.

Water service connections 100 mm in diameter and larger shall be made by installing a tee on the supply main.

Service connections for industrial, commercial, institutional or multiple dwelling use will be considered on an individual basis. Fire connections may be required for industrial, commercial, institutional or multiple dwelling lots.

5.19 Fittings

All fittings shall be mechanical joint ductile iron to meet AWWA/ANSI C153/A 21.53 specification. Also, all mechanical joints shall use either Romac gripper ring restraining glands or Sigma one lock restraining glands.

Water service fittings shall be as follows:

Saddles – Mueller H13481, H12483;

Main stop – Mueller H15028 Coupling;

Curb stop – Mueller 504281 Liner, Mueller 110 Compression connection H15428;

Service Box – Mueller A726 D-1 with 36” stainless steel rod.

5.20 Meters

A water meter and remote reading unit complete with a backflow preventor must be installed for each water service connection as shown on the Standard Drawing.

Water meters and backflow preventers must be installed in an accessible area that allows ease of access for readings and repairs, with no obstructions. Water meters installed in crawl spaces need to be installed adjacent to entry openings, for accessibility.

Remote readers must be installed at the front or side of the property, and cannot be gated or enclosed.

The location of the water meter must be approved by the Township prior to the issuance of a building permit.

Water services for private property shall be installed on the property to be served and in no case cross a property line into, or pass through other private property.

For multi-unit rental buildings, only one water meter will be permitted. The Township will not supply individual meters to each unit for rentals.

For multi-unit buildings, with individually owned units, individual services and meters are required to each unit.

5.21 Watermain Casings

Steel casings and/or tunneling casings may be required for watercourse crossings, railway crossings, large storm culvert crossings, or other structural integrity requirements.

Where casings are necessary, watermain is to be centered in the casing.

Only approved spacers are to be used and runners must be of ultra-high molecular weight (UHMW) polymer or equivalent. Wood blocking is not an approved or equivalent product.

The watermain must be installed as per the specifications of the manufacturer and shall be restrained along the entire length of the casing.

Casing ends shall be sealed, wrapped with high quality rubber (or equivalent) around both the casing ends and the pipe, and secured with stainless steel bands to prevent entry of water or excess moisture.

6 Testing and Acceptance

Connections to existing watermains or water service connections shall not be made until the new watermain has been tested to the satisfaction of the Township and written permission is received from the Township to proceed with connection.

As part of the detailed design, a watermain testing and commissioning plan is to be submitted to the Township for review.

Watermain testing must be completed for the entire system, including service connections to property line and all hydrants. Testing must comply with the requirements of the Township's Drinking Water Work Permit as well as the most current version of the ANSI/AWWA Standard C651 and MECP Watermain Disinfection Procedure.

The backflow protection provisions within ANSI/AWWA C651 shall be mandatory and provisions outlined in ANSI/AWWA Standard C651 for final connections to existing mains are also mandatory.

For chlorination, regardless of the method used, the Township requires that an initial concentration of 100 mg/L be achieved.

Super chlorinated water may not be disposed of to a storm sewer or watercourse unless the residual is reduced to a maximum of 0.5 mg/L.