

### 3.6 Waterworks

#### 3.6.1 General

3.6.1.1 All designs for extensions of the Municipal water system shall be reviewed and approved by a drinking water officer in accordance with the *Drinking Water Protection Regulations* under the *Drinking Water Protection Act*

#### 3.6.2 Materials

##### 3.6.2.1 General

3.6.2.1.1 The class and type of pipe and fittings, together with required class of bedding and trench widths, shall be selected such that the pipe will support the anticipated loads and pressures with a reasonable margin of safety. The Consulting Engineer shall submit design calculations to the Director of Engineering Services for review if requested.

3.6.2.1.2 Pipe product specifications and standards shall be as per the MMCD and the Supplementary Specifications.

##### 3.6.2.2 Mains and Fittings

3.6.2.2.1 All pipe and fittings shall conform to the specifications for a working pressure of 1035 kPa (150psi) Where working pressure exceeds 1035 kPa, materials shall be subject to special design.

3.6.2.2.2 Watermains may be polyvinyl chloride (PVC) or ductile iron.

3.6.2.2.3 When a watermain is located in a right-of-way on private property, it shall be ductile iron pipe.

3.6.2.2.4 Ductile Iron pipe and fittings shall have a cement mortar lining.

3.6.2.2.5 All fittings and appurtenances shall have standard hub ends. Flanges may be approved upon application.

##### 3.6.2.3 Services and Fittings

3.6.2.3.1 19 mm and 25mm water service tubing shall be polyethylene.

3.6.2.3.2 39 mm and 50 mm water service tubing shall be type K soft copper tubing or approved alternative.

#### 3.6.3 Minimum Residual Pressures

3.6.3.1 Water mains shall not be extended unless the residual pressure will be greater than 240 kPa (35 psi) during average daily demand. A watermain shall be capable of delivering a minimum dynamic pressure at the highest building (top floor) of not less than 240 kPa.

#### 3.6.4 Minimum Fire Flows

3.6.4.1 Fire flow demand for shall be in accordance with the current "Water Supply for Public Fire Protection", by Fire Underwriters Survey, for the existing or anticipated land use. Residual pressure at this flow rate shall not be less than 140 kPa (20 psi).

3.6.5 Network Requirements

3.6.5.1 Where a final road pattern of a subdivision creates a weak watermain network, a supplementary connection of a minimum of 150 mm diameter shall be required to an existing main and may necessitate the provision of a Right-of-Way over private property in favour of the Municipality.

3.6.6 Pipe Capacity

3.6.6.1 Minimum Sizes

3.6.6.1.1 Watermains shall be a minimum of 150mm diameter.

3.6.6.1.2 In a cul-de-sac with ultimate length not over 90 metres and no fire hydrants, the watermain size may be reduced to 100mm diameter.

3.6.6.1.3 Water services for single family residential or duplex shall be minimum 19mm. The size may be increased at the direction of the Director of Engineering Services to 25mm to reduce potential headlosses through the service.

3.6.6.2 Friction Factors

3.6.6.2.1 Flow calculations should be done using the Hazen-Williams formula, using the following roughness coefficients:

PVC pipe C = 150

Ductile Iron pipe C = 130

3.6.7 Maximum Headloss

3.6.7.1 Watermains shall be sized such that under maximum day flows, the head loss is no more than 5 metres per 1000 metres.

3.6.8 Locations

3.6.8.1 Watermains shall extend at least 1.25 m beyond the pavement for extendible roads but shall terminate 1.25 m inside the curb line of the extreme end of a permanent cul-de-sac.

3.6.9 Minimum Cover

3.6.9.1 All watermains and services shall have a minimum cover of 1 metre.

3.6.9.2 All watermains 200 mm diameter and larger shall be installed to a designed grade.

3.6.10 Separation to Other Services

3.6.10.1 At any location there shall be a minimum horizontal clearance of 3m between a watermain and a sanitary sewer or storm drain. The Consulting Engineer shall first obtain approval of the Regional Public Health Engineer if an alternative is to be proposed.

3.6.10.2 At any location there shall be a minimum horizontal clearance of 1m between a watermain and any other existing or proposed underground services or open ditches.

- 3.6.10.3 Watermains shall not be located within 1 m of any utility pole.
- 3.6.10.4 Where it is necessary for a watermain to cross other underground services the crossing shall be made at an angle greater than 20°. The vertical clearance between sanitary sewers or storm drains and the watermain at the crossing point shall be not less than 450mm. For all other services, the vertical clearance shall be not less than 150mm.
- 3.6.11 Replacement of A.C. Pipe at Crossings of Other Services
- 3.6.11.1 When another service (e.g., sewer or drain) is installed such that it crosses below an existing asbestos cement (AC) watermain, the existing watermain material shall be replaced with ductile iron pipe for a distance of at least two metres beyond each edge of the trench of the service crossing the watermain.
- 3.6.11.2 The watermain replacement work shall be done by the Municipality at the Applicant's expense, and this shall be indicated on the Design Drawings.
- 3.6.12 Thrust Blocks, Joint Restraints
- 3.6.12.1 Thrust blocks or joint restraint fittings shall be specified at all tees, bends, and caps.
- 3.6.13 Vertical/horizontal Curves
- 3.6.13.1 Watermain pipe may be deflected at each joint in accordance with the manufacturer's recommendations. PVC pipe is not to be bent.
- 3.6.14 Valves
- 3.6.14.1 Valves shall be as per MMCD W3, except that the operating nut shall be 32mm square and the **VALVE SHALL OPEN CLOCKWISE**.
- 3.6.14.2 Valves shall be located so as to direct the flow of water to the required areas and to minimize the portion of the distribution system affected by a single water main break or shut down.
- 3.6.14.3 There shall be at least two valves at a "tee" (other than for hydrants) and three valves at a "cross", although the preference is to have three and four valves respectively. Valves shall be attached directly to fittings on the downstream sides and shall be of the same diameter as the fittings.
- 3.6.14.4 Line valves shall be not more than 350 m apart. For convenience of operations, line valves should be located adjacent to a hydrant tee if there are no connecting mains within 120 metres.
- 3.6.14.5 Line valves or hydrant valves shall not be located closer than 600 mm to a curb line, in a ditch, or above another service.
- 3.6.14.6 On service connections greater than 25 mm, a valve shall be placed on the connection adjacent to the main.
- 3.6.15 Hydrants
- 3.6.15.1 Hydrants shall be as per MMCD W4.

- 3.6.15.2 Hydrants shall be located in the boulevard and should preferably be located at or near a street intersection; otherwise they may be located on the projection of the property line dividing two lots. In selecting the location for a hydrant, the probable route of the fire engine shall be considered.
- 3.6.15.3 A hydrant shall not be located within 3 m of a utility pole or light standard, within 1 m horizontally of underground service pipes or open ditches, or within 2.2 m of the curb line.
- 3.6.15.4 Hydrants shall be located so that every home is within 120 m but with due regard to the location of existing hydrants. Whenever practical, hydrants shall be near the highest and/or lowest point of the watermain.
- 3.6.15.5 Additional hydrants may be required at school, apartment, commercial, or other high value properties. Fire hydrant coverage shall be in accordance with the current "*Water Supply for Public Fire Protection*", by Fire Underwriters Survey.
- 3.6.15.6 The design drawings shall indicate the final elevation to which the hydrant flange is to be set. Any adjustments required after the system is in service will be made by the Municipality at the Applicant's expense.
- 3.6.16 Air Relief Valves
- 3.6.16.1 Air relief valves shall be as per Municipal Standard Drawing W6SS.
- 3.6.16.2 Provision shall be made for expelling air by the installation of air relief valves where necessary.
- 3.6.16.3 Double acting air valves shall be installed at all high points on watermains 200mm and larger.
- 3.6.17 Flush Valves
- 3.6.17.1 Flush valves shall be as per Municipal Standard Drawing W8SS.
- 3.6.17.2 Flush valves shall be installed at all dead ends.
- 3.6.17.3 Provision shall also be made for expelling air during filling by the installation of double acting air valves or test points where necessary. The initial flush shall be through a port which shall be a minimum of ½ the diameter of the main.
- 3.6.18 Service Connections
- 3.6.18.1 Service connections shall be installed to each proposed lot in a development or to each duplex dwelling unit, shall be connected to the main in a road allowance, and shall be installed at right angles to the main, within the boundaries of the lot being served, except in the turning area of a cul-de-sac. No service connection is to be provided to a lot by way of a private easement over another property.
- 3.6.18.2 Service connections shall be separated from other services as per watermains.
- 3.6.18.3 Traffic islands with planting areas shall be provided with a 19mm water service.

- 3.6.18.4 On a panhandle lot, service connections shall be extended from the meter location along the access strip to the main body of the lot at the time of subdivision development.
- 3.6.18.5 If a development requires a private fire line as well as a domestic water service, the fire line shall be completely separate from the domestic service.
- 3.6.19 Backflow Prevention
  - 3.6.19.1 There shall be no physical connection between a public and a private potable water supply system, nor between either a water system and a sewer or appurtenance thereto, which would permit the passage of private water or any sewage or polluted water into the potable public supply.
  - 3.6.19.2 No pipe, valve or fitting which has been exposed to raw sewage shall thereafter be included in a potable water system, either temporarily or permanently.

### 3.7 Roads

#### 3.7.1 Classification and Widths

3.7.1.1 Roads shall be designed to the following maximum standards, based on their classification as determined by the Director of Engineering Services:

Classification	Pavement Width	Design Speed kmh	Min Road Allowance Width	Water Control	Boulevard /Shoulder Width
Cul-de-sac	8.5m	50	15m*	Conc. curb & gutter	2.5m
Residential-Urban	8.5m	50	18m	Conc. curb & gutter	2.5m
Residential-Rural	5.0m	50	20m	N/A	1.0m
Collector	11.0m	50	20m	Conc. curb & gutter	2.5m
Major Road	Special Design as per Transportation Association of Canada (TAC)				

\*Right-of-way for cul-de-sacs or non-extendible roads not greater than 150m in length

#### 3.7.2 Vertical Alignment

3.7.2.1 The vertical alignment of the road shall be set to serve adjacent properties, with access driveways at a grade not steeper than 15%, and conforming to the requirements as shown in Municipal Standard Drawing DES33.

3.7.2.2 The length of a vertical curve shall be calculated using the values in the *TAC Manual* or *Urban Supplement*.

#### 3.7.2.3 Vertical Control

Maximum grade - Collector	12.0%
Maximum grade - Residential	15.0%
Minimum grade	0.5%
Minimum grade at curb returns	0.5%
Maximum grade on turn around at cul-de-sac	8.0%
Maximum grade at residential approach to collector	5.0% for 15m tangent length back from intersecting road edge
Maximum grade at residential or collector approach to major road	3.0% for 15m tangent length back from intersecting road edge
Normal Crown	2.0%

3.7.2.4 Crossfall - the practice of crossfalling a road is acceptable at intersections and where required because of topographical features.

- 3.7.2.5 Superelevation - horizontal curves on residential roads are not to be superelevated. Collector and Major roads may be superelevated as per the *TAC Manual* with Municipal approval.
- 3.7.2.6 Transition - the length of a transition from a normal cross-sectioned road to a section of road where there is superelevation shall in no case be less than 45 metres.
- 3.7.2.7 Extensions - evidence that vertical alignments are satisfactorily extendible will be required.

3.7.3 Horizontal Alignment

- 3.7.3.1 The horizontal alignment of the road shall be centred in the road allowance.
- 3.7.3.2 Centreline chainage stations shall be referenced and dimensioned from an identifiable iron pin.
- 3.7.3.3 Minimum radius of curvature shall be as follows:

Classification	Min Centreline Radius
Residential	90m*
Collector	100m
Major Road	Special Design

\*Subject to the approval of the Director of Engineering Services, curves on crescent shaped residential roads may be reduced to a minimum centreline radius equal to 30m.

- 3.7.3.4 A horizontal curve shall be fully described showing internal angle, radius, tangent length, and arc.

3.7.4 Cross Section and Structural Design

- 3.7.4.1 The cross section of roads shall be designed in accordance with the dimensions and requirements shown on the following Municipal Standard Drawings:

Typical Section	Standard Drawing
Residential Road 8.5m maximum	R2SS
Residential Road 11.0m maximum	R3SS
Collector Road 11.0m maximum	R4SS
Major Road 14.0m maximum	R5SS
Rural Road 5.0m maximum	R6SS

- 3.7.4.2 Reference to or details of the cross-section dimensions and requirements must be shown on each design drawing submitted.
- 3.7.4.3 The toe of a fill slope or top of a cut slope shall not encroach on private property. The containment of these slopes within the road allowance may require the

design of a retaining wall or the widening of the right-of-way to contain the cut or fill slope.

- 3.7.4.4 Where cut slopes are to be made into ground seepage zones or where the extent of the slope would generate surface runoff, curtain drains shall be required at the base of the slopes and connected to the road drainage system or other suitable point of discharge.

3.7.5 Intersections

- 3.7.5.1 Curb returns of 8m radius are required for residential road intersections. Curb returns located on bus routes and on roads within industrial and commercial districts require a larger radius to facilitate trucks and bus traffic.

- 3.7.5.2 When a new residential road with curbs intersects an existing road, curb returns shall be constructed to blend into the existing road width, unless directed otherwise by the Director of Engineering Services..

- 3.7.5.3 Vertical curves at intersections shall terminate prior to the gutter line of the major roadway thereby insuring that the crown on the major roadway is maintained.

- 3.7.5.4 Sidewalk corner ramps and crosswalks at intersections shall be as per Municipal Standard Drawing C9SS.

3.7.6 Turn-arounds

- 3.7.6.1 The design of a turn-around shall conform to Municipal Standard Drawing DES30. The dimensions may have to be increased to meet traffic and vehicular requirements, or where the turn-around is skewed. .

- 3.7.6.2 Under special circumstances the Director of Engineering Services may permit a temporary turn-around The design of a temporary turn-around shall be as per Municipal Standard Drawing DES32.

- 3.7.6.3 The landscape design of a turn-around shall be as per Municipal Standard Drawing DES31.

3.7.7 Driveways

- 3.7.7.1 Driveway grades shall be as per Municipal Standard Drawing DES33.

- 3.7.7.2 Driveway crossings of sidewalks shall be as per Municipal Standard Drawing C7SS.

- 3.7.7.3 Signage for major driveways shall be as per Municipal Standard Drawing DES34.

3.7.8 Walkways

- 3.7.8.1 Walkways shall be as per Municipal Standard Drawing C10SS.

3.7.9 Curb, Gutter and Sidewalk

- 3.7.9.1 Concrete curb and gutter shall be as per MMCD C4 .



- 3.7.9.2 Residential streets that are required to have curbs shall have mountable curbs except at curb returns, where they shall have non-mountable curbs.
- 3.7.9.3 All other streets required to have curbs shall have non-mountable curbs. The design drawings shall indicate where driveways are to be located, so that the curbs can be constructed including driveway drops.
- 3.7.9.4 Sidewalks, a minimum 1.5m wide, shall be separated from the curb by a minimum 1.5m wide boulevard where possible. The sidewalk and boulevard shall crossfall towards the road at 2%. The use of monolithic curb, gutter and sidewalk shall require approval of the Director of Engineering Services.

3.7.10 Catch Basins

- 3.7.10.1 Catch basins shall be constructed as per Municipal Standard Drawings S19SS and S20SS or S24SS.
- 3.7.10.2 Double catch basins shall be installed at locations of high runoff and at the low point of sag curves.
- 3.7.10.3 Catch basins shall be located at the higher end of the curb returns of intersections, at the lowest point of the sag vertical curves, and at a spacing not greater than the following:

Road Width	Maximum Spacing
8.5m	90m
11.0m	75m
14.0m	60m

- 3.7.10.4 On roads with superelevation crossfall the maximum spacing shall be one-half of the above figures. Adequate allowance shall be made to handle runoff from turn-arounds.
- 3.7.10.5 Exceptions to the above maximum spacing of catch basins may be allowed, where paving is to be installed on existing streets and where houses are drained in a manner satisfactory to the Director of Engineering Services.

3.7.11 Appurtenances

- 3.7.11.1 The design drawings shall indicate utility poles that are to be relocated or replaced.
- 3.7.11.2 Handrails shall be as per MMCD C14.
- 3.7.11.3 Rock retaining walls shall be as per Municipal Standard Drawing C17SS. Retaining walls other than per the Standard Drawing shall be designed by the Consulting Engineer to good engineering standards.

3.7.12 Emergency Vehicle Access

3.7.12.1 Emergency vehicle access shall be as per Municipal Standard Drawing C19SS.

3.7.13 Road Closures, Barriers and Gates

3.7.13.1 Road closures shall be as per Municipal Standard Drawing C21SS.

3.7.13.2 Concrete barriers shall be Ministry of Transportation and Highways (MOTH) 690mm CRB-E or approved equal.

3.7.13.3 Metal gates shall be as per Municipal Standard Drawing C20SS.

### **3.8 Street Lighting**

#### 3.8.1 General Principles

- 3.8.1.1 Street lighting designs shall be prepared by the Consulting Engineer and shown on the drawings with all other utilities.
- 3.8.1.2 Street lighting installation will be done by the Municipality at the Applicant's expense. The Municipality will obtain all permits required to install the works.

#### 3.8.2 Materials

##### 3.8.2.1 General

- 3.8.2.1.1 The Municipality will ensure that all materials meet or exceed Canadian Electrical Code requirements and CSA standards.

##### 3.8.2.2 Luminaires and Poles

- 3.8.2.2.1 The Municipality uses 70 watt high pressure sodium ornamental post top luminaires, mounted on 5.5 metre posts, for general residential applications. Each lamp has a photo cell. Lens distribution patterns specified shall be Type 2 or Type 5.
- 3.8.2.2.2 Davit mounted lamps may be specified on streets where they are currently in use. Davit mounted lamps may be specified in other situations with approval of the Director of Engineering Services.

##### 3.8.2.3 Conduits

- 3.8.2.3.1 Conduits shall be PVC, minimum 32 mm diameter.

##### 3.8.2.4 Service Panels

- 3.8.2.4.1 The Municipality uses surface mounted steel boxes for service panels for circuits. Individual poles in a circuit are wired within the pole through a hand hole.

##### 3.8.2.5 Junction Boxes

- 3.8.2.5.1 The Municipality uses concrete Type 37 junction boxes as per MMCD E3.2.

#### 3.8.3 Lighting Design

- 3.8.3.1 Lighting design and street light location shall be in accordance with the Transportation Association of Canada, "*Guide for the Design of Roadway Lighting*" 1992, as amended from time to time and including any successor document.
- 3.8.3.2 Streetlights shall be located with due regard to existing trees and vegetation and other appurtenances such as hydrants, kiosks etc.

#### 3.8.4 Conduit and Circuit Layout

- 3.8.4.1 Circuits shall be designed to follow the alignment of the underground electrical ducts wherever practical. The Municipality will install the conduit in the same trench as BC Hydro when the alignments are the same.

- 3.8.4.2 When streetlight conduit has to be laid across a road in a separate trench to service a streetlight, the crossing alignment shall be perpendicular to the road and a junction box is to be specified at the point of departure from the alignment of the electrical ducts.
- 3.8.4.3 Conduit shall be designed to a minimum cover depth of 0.6 metres.
- 3.8.4.4 Circuits shall be provided with power to the service panel as close to the midpoint of the circuit as practicable.