



**CITY OF
SWIFT CURRENT**
where life makes sense

PART A2

WATER DISTRIBUTION

OCTOBER 2020

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1 GENERAL

The design of the water system shall conform to the *Saskatchewan Environment Code - Water Main Chapter, Waterworks Design Standard* and *Water Pipeline Design Guidelines*, latest editions, as published by the Saskatchewan Ministry of Environment and used as a companion to the applicable Acts, regulations, and other provincial publications and as amended by these Guidelines and Standard Details.

These Development and Design Standards shall be used in conjunction with the related City Construction Specifications.

2 DEFINITIONS

The following definitions are intended to be specific to the Water Distribution System Standards. For additional general definitions refer to Part A1 – General Requirements.

Hazen-Williams Formula: The Hazen-Williams equation is an empirical formula used to model the friction head loss of water flowing through pipe

Hydraulic Analysis: An Engineering analysis determining the water systems minimums to meet city, provincial, or federal requirements.

3 SUBMISSIONS AND APPROVALS

- 3.1.1 All Drawing plans and Engineering documents must be submitted to the City for approval. All design drawings will follow the requirements stated in the drawings section of the General Requirements.
- 3.1.2 All calculations, schematic diagrams, computer printouts, etc. shall be submitted together with the design plans.
- 3.1.3 The certificate from a qualified person stating that the water main design plan satisfies the requirements of the *Saskatchewan Environmental Code – Water Main Chapter* shall be submitted together with the design plans.

4 DESIGN REQUIREMENTS

All water infrastructure (pipelines, booster pumps, hydrants, and appurtenances) that is or will become City owned and operated shall be within and public right of way or easement.

4.1 HYDRAULIC ANALYSIS

- 4.1.1 PVC or HDPE Pipe shall be used and the value of “C” in the Hazen-Williams formula shall be 130 for all types of pipes.
- 4.1.2 Design velocity in pipes shall be a maximum of 1.5 m/s during peak hour flow conditions, and 2.5 m/s during maximum day plus fire flow conditions, and a minimum of 0.6 m/s.

- 4.1.3 The Developer's Engineer shall perform a hydraulic network analysis unless the City approves otherwise. The analysis shall be completed for the complete development area plus all surrounding areas that have the potential to be impacted by the development.
- 4.1.4 The Developer's Engineer shall identify the areas potentially impacted by the development and obtain approval from the City of the area to be analysed.
- 4.1.5 The minimum per capita consumption used for analysis shall be:
- | | | |
|----------------------|---|----------------------|
| Average Daily Demand | - | 415 lpcd |
| Maximum Daily Demand | - | 2.1 x Average Demand |
| Peak Hourly Demand | - | 3.2 x Average Demand |
- 4.1.6 The design population shall be the ultimate for the area under consideration for development or redevelopment
- 4.1.7 For non-residential developments, the minimum population used for design shall be:
- Commercial – 65 persons/ha
 - Institutional – 50 persons/ha
 - Industrial – 25 persons/ha
- 4.1.8 Mains shall be sized such that there will be a minimum residual pressure of 280 kPa (40 psi) at ground level at any location in the system.
- 4.1.9 Analysis shall be made for Maximum Demand plus Fire Flow. The residual pressure at any location at the ground level shall not be less than 140 kPa. (20 psi).
- 4.1.10 In areas of the water system where the pressure exceeds 700 kPa, all services shall be equipped with a pressure reducing valve on the house side of the meter. The lot grading plan shall show services requiring pressure valves.

4.2 FIRE FLOWS

- 4.2.1 Swift Current hydrants are fire flow tested in accordance with *NFPA 291 – Recommended Practice for Fire Flow Testing and Marking of Hydrants, latest edition* and labelled as shown in the following table:

Class	Flow	Label Colour
AA	5675 L/min	Light Blue
A	3785 -5675 L/min	Green
B	1900 – 3785 L/min	Orange
C	1900 L/min	Red

- 4.2.2 Fire flow requirements will vary by development and building type and should generally be calculated in accordance with the *Water Supply for Public Fire Protection* published by the *Fire Underwriters Survey*.
- 4.2.3 Fire flows shall be designed to meet the following minimum classes while maintaining a residual pressure at any location of 140 kPa (20 psi):

Development Type	Class
Single Family	C
Multi-family	B
Institutional	A
Commercial/Industrial	AA

- 4.2.4 Upon completion of the development all hydrants shall be tested in accordance with NFPA 291 – Recommended Practice For Fire Flow Testing and Marking of Hydrants, latest edition and labelled based on their flow

4.3 WATER MAINS

4.3.1 Location

- a. Mains shall be located in accordance with the Roadway Cross-Section Standard Drawings.
- b. Minimum 3.0 m horizontal centreline spacing shall be maintained between a water main and any sanitary or storm sewer main or manhole.
- c. Under unusual conditions where this horizontal separation cannot be maintained, the City may approve a lesser separation distance provided the water main invert is a minimum of 0.5m above the crown of the sewer pipe. Under no circumstances shall the horizontal separation be less than 1.0 m.
- d. Watermains shall cross above sewers wherever possible with a sufficient vertical separation to allow for proper bedding and support of the mains. The minimum clear vertical separation between water main and any sewer main is 0.3 m when the water main crosses above the sewer main. When water has to cross below the sewer, the vertical separation must be 0.6 m from sewer invert to watermain crown
- e. Where a watermain has to cross below a sewer, structural support of the sewer is required to prevent excessive joint deflection and settling. The length of the watermain should be centred at the point of crossing so that the joints are equidistant from the sewer.
- f. Where extreme conditions prevent either the horizontal or vertical separations from being obtained, the sewer shall be constructed of pipe and joint materials which are equivalent to water main standards.

4.3.2 Depth

- a. Mains shall be installed to provide a minimum depth of cover of 2.7 metres from the final finished surface to top of pipe. Maximum depth of cover shall be 3.2 m unless authorized in writing by the City.

4.3.3 Sizing

- a. The sizing of watermains shall be determined by the hydraulic network analysis.
- b. The minimum size of distribution mains shall be 200 mm diameter for residential, unless 150 mm mains are warranted to satisfy technical requirements. The minimum size of distribution mains shall be 200 mm diameter for commercial and industrial.

4.3.4 Looping and Dead Ends

- a. All water mains shall be looped where possible and dead ends minimized. Where a dead end system cannot be avoided, the maximum length of dead end water main shall be 150 m.
- b. Where dead ends are approved a fire hydrant, or other approved flushing device, shall be installed at the end of the main to avoid stagnation.
- c. In designing a feeder main, or a distribution main without services connecting at the high points, an air release valve or hydrant shall be placed at significant high points into the water main profile to allow purging of stale water or trapped air.

4.3.5 Design Considerations

- a. The maximum length of mains between interconnections shall be 150 m, unless otherwise determined by network modelling.
- b. The minimum requirement for pipe bedding shall be in accordance with the Standard Pipe Bedding Detail and Construction Specifications (Drawing C-100).
- c. Where bends are utilized, the long radius type or a combination of 22½ degree bends and straight pipe shall be used.
- d. Water main installation shall be in accordance with manufacturer's requirements and the Construction Specifications.

4.3.6 Water Main Disinfection

- a. All new water mains shall be disinfected and flushed before being out into service in accordance with the latest edition of AWWA Standard C651 for Disinfecting Water Mains.

4.4 HYDRANTS

4.4.1 The maximum allowable spacing between fire hydrants shall be in accordance with the latest edition of *Water Supply for Public Fire Protection*. The City's preferred maximum spacing shall be as follows:

- 150 m in all residential areas except R3;
- 90 m in R3 zones;

- 90 m in institutional/industrial/commercial areas.
- 4.4.2 Hydrant locations shall be such that the distance to any building shall be no greater than 90 meters for buildings.
- 4.4.3 For the case of multi-family and/or commercial buildings with standpipes, the unobstructed driving distances between hydrant and standpipe shall be in accordance with the *National Building Code (NBC)*.
- 4.4.4 Hydrants should be located on the same side of the street as the watermain to minimize the length of the hydrant branch. All hydrants shall be connected to a main with an independent 150mm branch line controlled by an independent 150 mm gate valve.
- 4.4.5 Hydrants on the distribution main will be installed at the projection of property lines, except:
- Where the hydrants are installed at the intersections, they shall be installed adjacent to the cut-off corners of the lot.
 - Where a hydrant and sanitary manhole fall on the same property line projection, the manhole will be moved a minimum of 5 metres away from a hydrant.
- 4.4.6 Hydrants shall be located to conform with curb and sidewalk design and shall be installed as follows:
- The center of the barrel is to be 2 m back of face-of-curb or 0.5 m back of walk. With rural cross-sections, install hydrants 1.0 m from property line.
 - The maximum distance from the face of the curb to the hydrant shall be 3.5 metres.
 - Shall be installed in accordance with the Standard Drawing and the Engineering Specifications outlined in these Documents.
 - A gate valve will be provided on each hydrant lead.
 - Cathodic protection to be installed as per typical details.
- 4.4.7 Hydrant types shall be as specified in the Construction Specifications.
- 4.4.8 Additional hydrants shall be installed at high value properties if deemed necessary by the City.

4.5 VALVES

- 4.5.1 All valve boxes located in streets shall be left flush with the base course asphalt. Immediately prior to the final lift of asphalt being placed, these valve boxes shall be raised to final grade.
- 4.5.2 Valves shall be the same size as the watermain.
- 4.5.3 Valves on the distribution mains will be installed:
- At the projection of a property line at intersections or in mid-block, for urban sections.

- With two (3) valves at a tee and three (4) valves at a cross, except in the case of a hydrant tee, where only the hydrant valve is required.
 - Generally valves shall be spaced between 150 m and 180 m depending on the area and type of development served.
 - Main valves should be located such that no more than twenty (20) single family lots and one (1) hydrant are involved in a shutdown during watermain repair or replacement. There should be no more than four (4) valves required to shut down any section of line.
- 4.5.4 Valves on hydrant branches are to be located according to standard line assignments and shall be spaced a minimum of 1.0 m from the hydrant body to allow for ease of operation.
- 4.5.5 Valves shall be required at each end of the distribution main when the main is contained within an easement.
- 4.5.6 Chambers or pits containing valves, blow offs, meters, or other water distribution appurtenances shall not be directly connected to a storm or sanitary sewer, nor shall blow-offs or air relief valves be directly connected to any sewer.
- 4.5.7 Valve casing shall consist of a PVC bonnet of sufficient size to fit over the valve, and an adjustable PVC top box with lid.
- 4.5.8 Valve cases shall be of suitable length for depth of bury specified for mains, with possible adjustment of 300 mm up or down from this length.
- 4.5.9 Valve casing extensions shall be cast iron suitable for use with the valve box to be installed.
- 4.5.10 All cast iron surfaces to have a bituminous coating for corrosion resistance.

4.6 BACKFLOW PREVENTION AND CROSS CONNECTION

- 4.6.1 Cross-connection is any point in a water pipeline where backflow can occur allowing the potential for contaminants to come into contact with water intended for domestic use.
- 4.6.2 Backflow and Cross Connections are defined and regulated by *“The Water and Wastewater Utility Bylaw”*; which prohibits a cross connection within the water system unless it has been approved by the City.
- 4.6.3 Where cross connection is approved by the City, backflow prevention within the pipe system shall be designed in accordance with Saskatchewan Environment’s *“Water Pipeline Design Guidelines, latest edition”*.
- 4.6.4 Backflow prevention for fire protection sprinkler systems shall be as specified by the NFPA and the sprinkler supplier.

4.7 THRUST BLOCKS

- 4.7.1 At all hydrants, plugs, tees, crosses, bends of more than 22 degrees, and all other points of concentrated thrust, provide reaction blocking (thrust blocks) to prevent movement. Place reaction blocking against solid undisturbed ground.

- 4.7.2 Details provided herein are intended to be general, and are based upon soil load values of 7300 kg/m² or more. Where soil will not provide this load value, provide additional bands and clamps, or provide more substantial reaction blocking, as required to take the anticipated reaction.
- 4.7.3 Place blocking to provide access to pipe and fittings for repairs or future extensions of the line.
- 4.7.4 Thrust blocks will be provided as per the Standard Drawing. Thrust blocking shall be Type 50 sulfate resistant concrete having a minimum compressive strength of 20 MPa at twenty-eight (28) days.
- 4.7.5 Pipe restraint devices shall be used separately or in conjunction with thrust blocks, where identified as being required, and shall be in accordance with the manufacturer's recommendation. All restraint devices shall be stainless steel or suitable, resistant to corrosion, to the satisfaction of the City.

4.8 SERVICES

- 4.8.1 The minimum size of service connections to a single-family dwelling shall be 20mm unless in an area specified as a Fire Protected Area in the "*Building Bylaw*".
- 4.8.2 For residential areas required by the "*Building Bylaw*" to have fire sprinkler systems 25mm water service connections shall be installed.
- 4.8.3 The maximum size of a commercial water service will be based on fire code requirements.
- 4.8.4 For water services sized 50 mm and smaller, the tapping shall be 45° to the horizontal position on the distribution main.
- 4.8.5 Water mains shall be tapped under pressure.
- 4.8.6 All water services to be direct tapped or utilize stainless steel service clamps.
- 4.8.7 Where the water service is 50 mm or smaller in size, the water and sanitary services shall be installed in a common trench 3 m offset by property line. The services shall be installed so that, when facing the lot being served, the water service is on the right of the sanitary service.
- 4.8.8 The minimum depth of cover over the water at the property line shall be 2.6m, as per the Standard Drawing.
- 4.8.9 Corporation main stops and curb stops shall be installed in accordance with the Standard Drawing. Material to be Mueller or approved equal.
- 4.8.10 MUNICIPEX or an approved equivalent pipe should be used for services where possible.
- 4.8.11 Where a copper service is permitted, the water service is to be goosenecked. Service shall be snaked in the trench to allow for thermal contraction.

- 4.8.12 Curb stops shall be installed at property lines and located 3 m from side yard furthest from garage, as shown on the Standard Drawing.
- 4.8.13 All services shall be laid on 75 mm of granular bedding, and the bedding material shall be placed up to springline of the pipe.
- 4.8.14 Painted blue stakes of 50 mm x 100 mm size shall be extended from the end of the service connections to a minimum of 0.70 m above the ground level for water, per the Standard Drawing.
- 4.8.15 The Developer's Engineer shall provide detailed as-built drawings for all installed service connections, with such drawings providing information related to pipe dimensions, invert elevations, depth of service lines, location of services relative to property line(s), manholes and/or watermain valves.

4.9 CATHODIC PROTECTIONS

- 4.9.1 Fittings and valves are to be wrapped with denso tape, or an approved equal.
- 4.9.2 All hydrants shall be cathodically protected with a 5.5 kg Zinc Anode, per standard drawing.
- 4.9.3 Zinc Anodes shall conform to ASTM B418-16a, Type II.
- 4.9.4 Lead Wires No. 10A WG/7, two metres long.
- 4.9.5 Wire shall be connected to fittings with a cadweld or bolt attached.
- 4.9.6 A minimum of three litres of water shall be poured on each Anode to initiate the Anode's operation.

4.10 CONSTRUCTION

- 4.10.1 Prior to commencement of work on construction of a water main a notification number from the minister shall be provided to the City.
- 4.10.2 Prior to commissioning a water main, the certificate from a qualified person stating that the constructed water main meets the requirements in the *Saskatchewan Environmental Code* shall be submitted to the City.

5 LIST OF DRAWINGS

- A-100 Typical Valve and Hydrant Detail
- A-101 Main Valve Casing Detail
- A-103 Blocking and Anchorage
- A-104 Vertical Bend Thrust Block Detail
- A-105 Typical Anode Installation at Valves, Iron Fittings and Hydrants
- A-108 Air Relief Valve and Flushing Chamber
- A-108A Blow-Off Valve
- A-109 Hydrant Access Location off Rural Road

- C-100 Trenching and Pipe Bedding Details
- C-101 Single and Double Service Layout
- C-101A Sewer and Water Service Locations
- C-102 Typical Water Service Connection
- C-105 Water Service Connection Manufactured Home

END OF SECTION