



London
CANADA

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Chapter 7

Water Distribution System

Design Specifications & Requirements Manual

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City of London

Design Specifications and Requirements Manual

The design information contained in this manual is intended to provide guidance beyond legislative and standard design practices for use in the City of London (the City). There will be site specific situations where the design will depart from these practices as it is not possible nor is it the intention of the City to anticipate every situation. The City intends to review and revise the Manual from time to time. The City also acknowledges that other references such as the 'Standard Contract Documents for Municipal Construction Projects' are to be used in conjunction with this manual. The 2012 update of this manual incorporates design information from the City's former 'Subdivision & Development Guide Manual' to provide consistent and current design information for development projects.

The Water Engineering Division reserves the right to accept or reject a design, extend limits of watermain, alter size or material of watermain, services and appurtenances if it deems it necessary to enhance an existing or future development on City and Private property.

Index

Chapter 1	Introduction
Chapter 2	Transportation
Chapter 3	Sanitary Sewer Collection System
Chapter 4	Sewage Pumping Stations
Chapter 5	Storm Sewer Collection System
Chapter 6	Stormwater Management Requirements
Chapter 7	Water Distribution System
Chapter 8	Water Pumping Stations
Chapter 9	Grading
Chapter 10	Erosion and Sediment Control
Chapter 11	Parks and Open Space
Chapter 12	Tree Planting and Protection Guidelines
Chapter 13	Material Substitutions for City of London Projects
Chapter 14	Contact Information
Chapter 15	Installation, Inspection of Water and Sewer Works
Chapter 16	Noise Attenuation Measures
Chapter 17	Trenchless Technologies (for New Construction)
Chapter 18	Drafting and Design Requirements
Chapter 19	Development Compliance Procedure
Chapter 20	Area-Specific Streetscape Standards

Contents

7	Water Distribution System	7-1
7.1	Definition and Purpose	7-1
7.2	Permitted Uses	7-2
7.3	Watermain Design	7-2
7.3.1	Pressure and Flow Requirements	7-2
7.3.2	Design Water Demands	7-2
7.3.3	Fire Demands	7-3
7.3.4	Minimum Pipe Sizes/Acceptable Pipe Sizes	7-4
7.3.5	Water Quality	7-4
7.3.6	Maximum Velocities	7-5
7.3.7	Boundary Conditions	7-5
7.4	Layout of Watermain	7-5
7.4.1	Watermain Location within Road Allowance	7-5
7.4.2	Watermain Pipe Depth	7-6
7.4.3	Pipe Offsets/Bends/Deflection	7-6
7.4.4	Termination of Watermains	7-7
7.4.5	Blow-Offs /Automatic Flushing Devices/Addressing Water Quality ...	7-7
7.4.6	Thrust Restraint	7-8
7.4.7	Watermain and Other Utilities Separation	7-8
7.4.8	Looping of Watermain/Supply Redundancy	7-11
7.4.9	Connections between High-Level and Low-Level Water System	7-11
7.5	Material	7-12
7.5.1	Reference Specifications	7-12
7.5.2	Transitions in Pipe Material - Watermains	7-12
7.5.3	Pipe Materials within a Subdivision	7-12
7.6	Swabbing, Flushing, Disinfecting and Bacteriological Testing of Watermains	7-13
7.7	Location and Spacing of Valves	7-13
7.7.1	Location and Spacing of Watermain Valves	7-13
7.7.2	Valve Locations - Phasing of Subdivision Developments	7-15
7.7.3	Sizing of Valves	7-15
7.8	Fire Hydrants and Fire Department Connections	7-15
7.8.1	Location/Spacing of Hydrants on Public Streets	7-16
7.8.2	Location of Hydrants to Sprinkler or Standpipe Systems	7-16
7.8.3	Hydrants on Dead-end Streets	7-16

7.8.4	Addition or Relocation of Hydrants	7-17
7.8.5	Hydrants on Private Property	7-17
7.8.6	Hydrants for Fire Department Connections	7-18
7.8.7	Protection of Hydrants	7-18
7.9	Water Services	7-18
7.9.1	Fire Services and Private Services	7-19
7.9.2	Minimum Service Size for Single Family Residential Homes	7-19
7.9.3	Pressure Reducing Valves Recommended	7-19
7.9.4	Cathodic Protection	7-20
7.9.5	Residential Services	7-20
7.9.6	Looped Water Servicing Required	7-24
7.9.7	Location and Layout of Water Services	7-24
7.9.8	Approved Deviations in Location of Water Services	7-25
7.9.9	Nonconforming Installation of Water Service or Private Watermain	7-26
7.9.10	Fire Service Design	7-27
7.9.11	Water Service Size or Location Not Determined	7-28
7.9.12	Water Services Valves	7-28
7.9.13	Water Service Entrances	7-29
7.9.14	Protection from Contamination	7-29
7.9.15	Electrical Grounding	7-30
7.10	Corrosion Protection	7-30
7.11	Easements	7-30
7.12	Water Meters	7-31
7.12.1	General Requirements	7-31
7.12.2	Location of Water Meter	7-31
7.12.3	Installation of Water Meters	7-32
7.12.4	Meter Sizing	7-33
7.13	Hydraulic Modeling	7-34
7.13.1	General	7-34
7.13.2	Hydrant Flow Tests for Hydraulic Modelling	7-35
7.13.3	Design Criteria	7-35
7.13.4	Hydraulic Model Input Standards	7-36
7.13.5	Submission Requirements	7-36
7.13.6	Water Alteration Request	7-38
7.14	Water Distribution References	7-38

Tables

Table 7-1: Residential Water Design Densities	7-3
Table 7-2: Design Friction Factors	7-3
Table 7-3: Fire Hydrants Standard Colours	7-16
Table 7-4: Meter sizes	7-33
Table 7-5: Compound meters	7-33
Table 7-6: Standard Units and Precisions	7-36

7 Water Distribution System

7.1 Definition and Purpose

These specifications shall apply to all water services, piping and watermains up to and including 450mm diameter including appurtenances which are located within the City road allowance, or on property which will be transferred to City ownership. These specifications shall also apply to all water meter placements.

The designer shall design to City Specifications and also make reference to the Ministry of the Environment “Design Guidelines for Drinking-Water Systems” and to the Ministry of the Environment “Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit”. If there is a discrepancy between the City Specifications and the MECP Guidelines then the Water Engineering Division shall be contacted to resolve the issue.

Any deviation from these specifications must be submitted in writing to the Water Engineering Division for approval.

For water mains larger than 450mm diameter and for any other water system installation, special specifications must be prepared for and approved by the Water Engineering Division. These specifications are to be used as a supplement to all other specifications approved by the Water Engineering Division for water system installation.

The water distribution system is for the purpose of supplying and distributing water, but does not include plumbing or other works to which the Ontario Building Code (OBC) applies.

“Water Distribution System” means watermains with connections to feeder watermains, feed watermains within subdivision lands, private watermains, water services, fire hydrants, and shut-off valves and all other appurtenances thereto.

A water distribution system may exist for the purpose of distributing potable or non-potable water, however water distribution systems for potable and non-potable water may not be intermixed or cross-connected. Private supplies of potable water may not be cross-connected to the municipal or public water distribution system.

The Water Engineering Division will review and provide commentary on all new development, including water systems on private property as part of the site plan review process.

Watermain Classifications:

- Trunk Main - Large diameter watermain (over 600mm diameter)
- Feeder Main - Large diameter watermain (400mm, 450mm and 600mm)
- Distribution Main – Watermain diameters of 300mm and smaller

“SW” is referred to throughout this section of the DS&RM, and refers to the City of London’s Standard Contract Documents, Supplemental Standards for Sewer and Water.

7.2 Permitted Uses

Permitted and non-permitted uses of water are identified by By-law W-1 - A by-law to provide for the REGULATION OF WATER SUPPLY IN THE CITY OF LONDON.

7.3 Watermain Design

7.3.1 Pressure and Flow Requirements

Watermains shall be sized to maintain the greater of:

- i) maximum day demand plus fire flow at a pressure not less than 140 kPa (20 psi) at any hydrant lateral or potential fire service connection. Pressures to be taken at the most critical locations.
- ii) maximum hourly demand at a pressure not less than 275 kPa (40 psi).
- iii) average day demand at a pressure not less than 275 kPa (40 psi).
- iv) maximum residual pressure should not exceed 550 kPa (80 psi) and a minimum residual pressure shall not be below 275 kPa (40 psi).
- v) All pressures shall be calculated/determined assuming minimum hydraulic grade line conditions apply. Refer to section 7.3.7 of this document and confirm with the Water Engineering Division.

7.3.2 Design Water Demands

7.3.2.1 Total Water Demands

Gross water consumption rate recorded for the City is 470 to 600 L/d (121 IGPd to 132 IGPd) average per capita.

7.3.2.2 Domestic Water Demands

Average day domestic (residential) unit demand for design shall be 255 litres per capita per day.

Peaking factors of 3.5 for maximum day and 7.8 for maximum hour are to be used for design for the purposes of subdivisions and site plans unless written authorization from the Water Engineering Division is received.

For design purposes, the following densities shall be used:

Table 7-1: Residential Water Design Densities

Type of Use	People / Unit
Low density residential	3 people per unit
Medium density residential	2.4 people per unit
High density residential	1.6 people per unit

7.3.2.3 Industrial, Commercial, Institutional (ICI) Water Demands

These demands vary greatly with the type of water using facilities or process present in the development. If the Owner (designer) does not know the required demand they should refer to Ontario Ministry of the Environment “Guidelines for the Design of Water Distribution Systems” or find other suitable references and justification for selecting water demands. The designer can also provide typical demand and peaking factor data. For industrial demands the Owner (designer) shall discuss water requirements with the Water Engineering Division.

7.3.2.4 Friction Factors

The following Hazen-Williams “C” values shall be used for design, regardless of material:

Table 7-2: Design Friction Factors

Pipe Diameter	C-Factor
100 and 150mm	100
200 and 250mm	110
300 to 600mm	120
Over 600mm	130

7.3.3 Fire Demands

To estimate the fire flow requirements for an area of the Municipality, the designer should refer to the guide “Water Supply for Public Fire Protection - A Guide to Recommended Practice” (latest revision) prepared by Fire Underwriters Survey, Insurers’ Advisory Organization. For single family detached low density residential areas, a minimum fire demand of 76 l/s is to be used.

On private property, adequate water for firefighting shall be determined in accordance with the Ontario Building Code.

7.3.4 Minimum Pipe Sizes/Acceptable Pipe Sizes

The minimum size for watermains shall be 150mm diameter except beyond the last hydrant on cul-de-sacs where smaller diameter pipe shall be used which is designed for domestic and maximum hour demands only.

Accepted pipe sizes are 50mm and 100mm (see above), 150mm, 200mm, 250mm, 300mm, 400mm, and 450mm. For larger pipe sizes, the designer should consult with the Water Engineering Division.

7.3.5 Water Quality

The Water Distribution System shall be designed so that water shall not remain unused in the watermain for more than three (3) days under average day demand.

To demonstrate a three (3) day turnover, the designer shall provide a hydraulic analysis as outlined in 7.14 of this document. The hydraulic analysis shall also provide calculations to determine if and where automatic flushing devices are required and determine the appropriate size of the automatic flushing device (25mm or 50mm).

The City of London has primary responsibility to ensure that the minimum chlorine residuals are maintained in the distribution system and therefore reserves the right to require watermain looping and/or automatic flushing devices and/or blow-offs to facilitate the maintenance of the required chlorine residual under the Safe Drinking Water Act. Refer to W-CS-2 sht.1, 2, 3 and W-CS-5.

On private property, where there is a concern that there may be degradation of the water quality (when a three (3) day water turn-over cannot be achieved), the City reserves the right to require perimeter isolation. This shall consist of a testable device (Dual Check Valve Assembly (DCVA)) on the water service and shall be installed at the property line and at the owner's expense.

Where a private water system is connected to the municipal water system by two (2) or more connections, the municipal water system shall be protected by perimeter isolation of the private system. This shall mean the installation of DCVA at the property line. These devices shall be owned and maintained by the owner.

In situations where there is a concern with respect to water quality and perimeter isolation is required, Designers shall also address water quality on private property. The designer is encouraged to consult with the Water Engineering Division.

It will be a requirement that a testable device (DCVA) be installed at property line for all site plans greater than 2 Ha in size with a private watermain connected to the municipal water supply system which services more than one commercial, institutional and industrial building. The testable devices (DCVA) are to be maintained in accordance with the manufacturer's suggested requirements at the owner's expense.

7.3.6 Maximum Velocities

The watermain shall be sized so that the maximum velocity in the pipe shall not exceed 1.5 meters per second during maximum hour domestic flow conditions or 2.4 meters per second during fire flow conditions unless otherwise approved by the Water Engineering Division.

7.3.7 Boundary Conditions

For the purposes of hydraulic analysis the designer shall contact the Water Engineering Division for appropriate boundary conditions rather than using information from fire flow test directly. This is because operating pressures and flows are subject to fluctuation.

In general, the minimum hydraulic grade lines (HGL) for each of the various service areas of the City are:

- 301.8m for the low-level system
- 335.0m for the Springbank / Westmount / Pond Mills / Wickerson Pumping Station high-level system
- 317.0m for Hyde Park and Uplands Pumping Station high-level system
- 319.0m for the Southeast Pumping Station System

The designer shall assume a reservoir with the appropriate HGL for water supply to the area being designed.

7.4 Layout of Watermain

7.4.1 Watermain Location within Road Allowance

- a) Watermains are to be located in standard location as indicated on the City of London Standard Utility Locations for all streets, U.C.C.-1M (UCC1), on straight streets, unless otherwise approved. Deviation from the standard location must be approved by the Utilities Coordinating Committee and Water Engineering Division.
- b) Window Street Right-of-ways - all watermains to be located in a window street right-of-way are to be located in accordance with UCC-2M. Refer to Section 1.1.3 b) for additional details.

On watermain bends, the watermain may deviate from the standard location by up to 1.0 m, provided that the deviation is towards, or closer to the street line.

7.4.2 Watermain Pipe Depth

The objective when designing and installing watermain is to have watermain which is below the frost line and protected from freezing as well as watermain which is constructed with as few offsets or joint deflections as possible.

Urban Roads without a ditch - The designer should have an objective depth of cover of 1.7m when designing watermain. However, a depth of cover up to 2.2m will be permitted in order to address variations in topography and to avoid conflicts with other utilities.

Open Ditch and Unimproved Roads - Watermains shall be laid with a minimum depth of cover of 2.1m measured from the center line elevation of the road, or 1.1m below the bottom of the ditch, whichever is greater.

On unimproved roads within the City, the designer should also review the vertical alignment of the road so that, where possible, future road improvements will not result in an unacceptable watermain depth.

7.4.2.1 Pipe Insulation

Where joint deflections or offsets require the pipe to be laid with less than 1.5m of cover, insulation shall be placed to prevent freezing. Refer to City of London W-CS-68 for insulation requirements.

Where storm drains or culverts cross over or under a watermain, insulation is required per City of London W-CS-68 unless there is a minimum 1.7m separation.

7.4.3 Pipe Offsets/Bends/Deflection

Offsets must be made according to City of London W-CS-12. Offsets are to be used when all other options of avoiding the conflict have been exhausted. Offsets are not to be solely used to avoid a minor obstruction if design options are available to avoid the conflict. Use of offsets must be indicated on the approved plans or in the case of unforeseen obstructions found after approval of the watermain design, written approval of the Water Engineering Division must be obtained.

If using joint deflection, full lengths of pipe must be used. Maximum deflection for various pipe materials to be in accordance with half (1/2) the pipe manufactures specifications. Where it is not possible to lay pipes to the required radius to utilize allowable joint deflection, manufactured pipe bends must be used. Axial deflection (bending of the pipe barrel) is prohibited for P.V.C. pipe. Any change in the direction of the watermain in excess of the pipe joint deflection tolerance shall be made using an appropriate fitting. Thrust or joint restraint shall be provided as in 7.4.6.

7.4.4 Termination of Watermains

Watermains shall be terminated opposite street lines or property lines.

Where caps and plugs are installed without a blow-off to provide for future watermain extension, a 20mm watermain stop shall be tapped into the watermain no further than 0.5m from the cap or plug to release trapped air/pressure from the watermain prior to removal of the cap or plug.

7.4.5 Blow-Offs /Automatic Flushing Devices/Addressing Water Quality

1. The design of the watermain shall be undertaken to ensure adequate water quality requirements are met. Refer to Section 7.14 for requirements relating to Hydraulic Modelling.
2. Dead end watermain which are part of an interim phase of a subdivision build-out shall meet water quality requirements by:
 - i. demonstrating adequate turnover by use;
 - ii. installation of an automatic flushing device.
 - iii. Alternately, consideration can be given to building watermain systems in smaller phases or stages to meet development needs, but reduce the amount of watermain for which water quality must be maintained.
3. Where an automatic flushing device is used to maintain water quality, a water meter (in a meter pit) shall be installed to measure the volume of water discharge. The owner will be charged for the water used. The designer shall provide calculations which indicate the volume of water to be discharged by the automatic flushing device and the sizing of the automatic flushing device as well as indicate the timer settings to be used. This information shall be clearly indicated on the drawings. The Owner's contractor shall initially set up the automatic flushing device to the indicated settings. (prior to Initial Clearance). Subsequent adjustments to the automatic flushing device when the system is operated by the Municipality shall be made by Water Operations, based on approval of information submitted by the Owner's Consulting Engineer.
4. Where an automatic flushing device is not required to maintain water quality a standard 50mm blow-off (W-CS-5) will be required to allow flushing to take place.
5. On cul-de-sac or similar streets, blow-offs, when required, shall terminate in the boulevard. Blow-offs must be operable without the necessity of excavating.
6. Automatic Flushing Devices – notes for Designers with Regard to Automatic Flushing Device Discharge Rates is available in the City of London Standard Contract Documents, W-CS-2 Sheet 3.

7. Automatic Flushing Devices – Where Can be Used
 - i. Automatic Flushing Devices are required to ultimately discharge to a stormwater management pond where the remaining chlorine can be dissipated before being released or discharged to the natural environment.
 - ii. Any water discharged from an automatic flushing device must have a total chlorine in accordance with the Waste Discharge By-Law WM-16.
 - iii. Automatic Flushing devices discharging to storm sewer in turn discharging to a receiving open watercourse shall be fitted with dechlorinating devices and checked regularly to ensure proper operation.
 - iv. If no sewers exist or compliance with this section cannot be met, and automatic flushing devices must discharge directly to a ditch, or to the natural environment, further consultation must take place with Planning and Development, Water Engineering and the Storm Water Management Division to confirm whether the location and the use of an automatic flushing device is appropriate in the situation. Approval will be given on a case-by-case basis.
8. Temporary connections for automatic flushing devices may be made directly to a storm maintenance hole or to a storm catchbasin. If into a maintenance hole, the drainage pipe must outlet just above the benching. When removing the device, the drainage pipe to the storm sewer should be fully grouted and properly bricked and mortared.
9. Location of the last water service on a dead end watermain. The last water service on a dead end watermain which is a permanent dead end or a temporary dead end as part of an interim phase or stage of subdivision; shall be located as close as possible to the Termination of Watermain (within 0.5m of the end or tapped into the end cap) regardless of whether there is a manual blow-off or automatic flushing device installed.

7.4.6 Thrust Restraint

Refer to section 441.07.23 Thrust Restraints of the City of London Standard Contract Documents.

7.4.7 Watermain and Other Utilities Separation

Designers certify that their watermain design comply with the Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit when they complete each Form 1 under the City of London's drinking water license. These criteria must be adhered to and only the province - not the City - may grant exceptions to these criteria. These criteria include separation distances from contamination sources. Where these criteria do not apply, other criteria such as the Ontario Building Code may apply.

Utilities, structures, sewers and/or any other construction or infrastructure, which may impact the watermain, the integrity of its bedding, and/or structural capabilities, shall have design consideration(s) applied to adequately protect the watermain.

7.4.7.1 Parallel Installations of Watermains With Other Infrastructure

All parallel installation of watermains with other infrastructure shall follow the Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit or other codes/legislation as applicable. New watermain design shall be constructable, maintainable, and have regard for its eventual replacement.

7.4.7.2 Crossings of Watermains With Other Infrastructure

All crossings of watermains with other infrastructure shall follow the Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit or other codes/legislation as applicable.

If the watermain is less than 1.5 meters below grade at the crossing, the watermain shall be insulated as per section 441.07.14 of the City of London Standard Contract Documents for Municipal Construction Projects.

Sufficient space is required for proper bedding and/or structural support of the watermain and other infrastructure.

Offsets shall be reduced as much as possible while complying with the design criteria.

7.4.7.3 Utility Crossings of Existing Watermains

It is desirable for new servicing, sewers or PDC to cross above existing trunk watermains wherever possible. The watermain shall be protected by providing:

- vertical separation of at least 0.60 meters between the invert of the sewer or PDC and the crown of the watermain; and
- adequate structural support for the sewers to prevent excessive deflection of joints or settling, and
- that the crossing is not within 2.0 m of a joint in the watermain.

Where it is not possible to cross above the watermain, the sewer or PDC shall pass under the watermain, and the watermain shall be protected by providing:

- i. a vertical separation of at least 0.60 meters between the crown of the sewer or PDC and the invert of the watermain; and
- ii. adequate structural support for the watermain must be provided during construction, and post construction to support the structure and prevent excessive deflecting of the watermain or joints.

It is preferable to design the crossing of the watermain by the utility being constructed so that the crossing is at 90-degree angle. This will reduce the length of the support required during construction. For either situation (crossing over or under and existing watermain) details of the crossing proposed and the method of reinstatement to be used must be approved prior to construction. Refer to W-CS-69 for support requirements for open cut construction.

Where crossing by trenchless methods, it will be a requirement to incorporate deflection monitors which are to be placed directly on the watermain. These will be monitored for baseline information prior to the commencement of construction, continuously during construction, and monitored post construction weekly for a period of 2 months and monthly for the remaining warranty period of the project.

Notes for Designers

For watermains 450mm in diameter and over, it is the intent that a report will be provided during detailed design justifying the decision for the construction method to be used for any crossings of watermain based on relevant factors to be considered, including but not limited to the geotechnical conditions, location relative to the watermain and other utilities, constructability, and other issues relevant to the situation.

These standards and requirements may apply to watermains below 450mm in diameter as well at the discretion of the Water Engineering Division.

When designing a utility crossing of an existing watermain, it is the responsibility of the designer to:

- obtaining a reliable SUE locate for the elevation and location of the watermain and not relying on as-built drawing information for the purposes of the design to be implemented;
- if available, the designer should obtain the shop drawings for the existing watermain pipe from the manufacturer in order to obtain information about pipe design and restraint and additional design information as will be necessary for the purposes of the design. Where shop drawings are not available, it may be necessary to do advanced exploratory excavation to determine the configuration of the watermain or determine pieces to be manufactured.
- the constructability of the crossing;
- the risk posed to the water utility;
- the health and safety of the contractor and their employees who will be undertaking the crossing;
- whether the crossing can be carried out safely with the watermain in operation;
- where the watermain needs to be taken out of operation to perform the crossing safely, the designer shall address shutdown and dewatering requirements and necessary temporary provision of water to customers. All works and all costs

associated with draining the watermain, dechlorinating and discharging the watermain, monitoring of discharges, obtaining necessary approvals from the MOECP for the planned discharge of water as necessary and the setup of temporary bypass watermain shall be designed by the designer, and the costs shall be borne by the Owner of the project.

The Designer is encouraged to consider design alternatives for the utility crossing which pose less risk and operational impact. Crossing by trenchless technology where feasible is encouraged.

Where a utility crossing is to be undertaken by open cut construction, the designer shall identify the acceptable movement or deflection of the pipe being crossed.

It should be noted that when crossing under a concrete or steel watermain pipe by open cut construction that a support system with zero or no deflection must be achieved so as to not negatively impact the watermain. It is also recommended that the pipe be taken out of service for the purposes of working safely.

Where a utility crossing is to be undertaken by trenchless methods, that method needs to be confirmed as a viable method for the geotechnical conditions at the site, and deflection monitoring needs to be undertaken as above.

7.4.8 Looping of Watermain/Supply Redundancy

Water distribution systems shall be designed to exclude any dead-ended pipe, unless meeting the requirements in 7.4.5. Water distribution systems shall be designed so that no more than eighty (80) units with individual water services and meters shall be serviced from a single municipal source of supply. If the looped private watermain is connected to a single municipal watermain, a valve must be installed in the municipal watermain to permit isolation of supplies.

Where looping or supply redundancy is proposed to be achieved from two municipal watermains/supply sources, the hydraulic modelling must include scenarios whereby each water supply source would be a single source of supply, and the watermains will be sized accordingly.

For requirements for looping for private property, see section 7.9.

To better service the water customer, looping is required to minimize the number of customers out of water due to planned and emergency water shut downs. This also provides a water circulation through the system to avoid stagnation in the system.

7.4.9 Connections between High-Level and Low-Level Water System

Areas which are serviced by high-level water distribution systems shall have an appropriate number of interconnections between the high-level and low-level system, by

means of the installation of a checked connection in accordance with W-CS-75. This connection would supply water from the low-level system to the high-level system in a critical scenario, such as a main break if the high-level pumping station were to fail. The purpose of this connection is to ensure redundancy of water supply. These interconnections shall be sized in order to provide adequate water supply under all critical scenarios.

7.5 Material

7.5.1 Reference Specifications

All waterworks material used shall be new and shall conform to those listed in the City of London Standard Contract Documents for Municipal Construction Projects and the latest revision of the Standards of the American Waterworks Association (AWWA).

Material other than that listed in the City of London Standard Contract Documents for Municipal Construction Projects may be used if it is approved in writing by the Product Approval Committee. The Water Engineering Division will designate the AWWA Standard and/or other specifications and conditions applicable for use of such approved material.

The City reserves the right to select any materials or product it deems appropriate for the application. The City also reserves the right to remove from the specifications any product previously approved but found inappropriate for the application. This includes but is not limited to pipe material, valves, or fittings. The designer shall clearly indicate on drawings and contract documents the materials which are acceptable for use in a particular application where the use of one or more of the approved materials list is not acceptable.

7.5.2 Transitions in Pipe Material - Watermains

Transitions from one pipe material to another must be made at a valve or tee. Refer to the City of London Standard Contract Documents for Tracer Wire installation methods where there is a pipe material transition.

7.5.3 Pipe Materials within a Subdivision

Watermains within a new subdivision are to be of the same material, and watermain materials should not be used interchangeably (i.e., either PVC or PVCO is to be solely utilized within an approved subdivision).

7.6 Swabbing, Flushing, Disinfecting and Bacteriological Testing of Watermains

For requirements regarding swabbing, flushing and disinfecting and bacteriological testing of watermains see section 441.07.25 of the City of London Standard Contract Documents for Municipal Construction Projects. The usual test pressure in the London water system is 1035 kPa (150 psi).

7.7 Location and Spacing of Valves

7.7.1 Location and Spacing of Watermain Valves

Shall be in accordance with the Ministry of the Environment, Watermain Design Criteria for Future Alterations Authorized Under a Drinking Watermain Works Permit, Table 2: Shut-Off Valves.

7.7.1.1 Residential Developments

In residential developments, valves shall be located so that any section of watermain serving up to a maximum of sixty (60) residential water services can be isolated by operating not more than four (4) valves. Phasing of developments should be considered and valving should be logical (i.e. at intersections). In residential areas, valves shall be spaced no more than 250 m apart.

With respect to intersecting watermains where intersections are located less than 150m apart, the minimum number of valves specified may be reduced on the recommendation of the design engineer.

7.7.1.2 High Density Residential, Commercial and Industrial Developments

In high density residential, industrial and commercial areas, valves shall be located to be no more than 150 m apart.

7.7.1.3 Feeder Watermains

Feeder watermains (400mm, 450mm and 600mm) should have valves at 400 m intervals.

7.7.1.4 Intersections of Watermains

At intersections where smaller watermains connect to larger feeder watermains, each smaller watermain shall be valved with an isolation valve whereas the larger watermain shall be valved as required above.

7.7.1.5 Valves for Looped Services/Private Watermains

Valves shall be installed on looped services or private watermains to isolate buildings or groups of buildings so that no more than eighty (80) individual water services or apartment complex containing 300 dwelling units or more are on any one valved section. The Owner shall install a valve on the municipal watermain between connections to a looped private watermain if there is not an existing valve, at no expense to the City.

7.7.1.6 Crossings of Watermain, Rivers, Railway, Controlled Access Highways, Bridges

Watermains crossing rivers, railways and controlled access highways shall be valved on each side of the crossing.

7.7.1.7 Hydrant Laterals

Valves shall be located on all hydrant laterals according to City of London W-CS-1.

7.7.1.7.1 Maximum Length of Hydrant Laterals

The maximum length of hydrant laterals (W-CS-1 Sht. 1) shall be 6.1m (one standard pipe length) in order to address concerns of water quality and to meet the requirements of section 441.07.25 of the Standard Contract Documents for Municipal Construction Projects.

7.7.1.8 Location of Valves at Street Intersections

Valves shall be located on the extension of street lines or according to City of London W-CS-45.

7.7.1.9 Location of Valves at Intersections with Roundabouts

Water valves may be placed within the raised roundabout island where possible. However, if placement of the valves creates a potential conflict with the curb & gutter of the island, then the valves are to be placed in the boulevard clear of the curb and gutter of the approaching streets.

7.7.1.10 Valve Boxes and Extensions Rods Required

All valves shall be provided with valve boxes. Valve extension rods as detailed on City of London W-CS-6 shall be installed on every valve and are to be purchased from the City of London Procurement & Supply Division.

7.7.2 Valve Locations - Phasing of Subdivision Developments

Valves shall be located to meet the requirements of 7.7.1. As well, location and number of valves shall take into consideration reducing shutdowns and inconvenience to customers during the construction of additional phases. Valves may be installed on a temporary basis and relocated in order to accomplish this.

7.7.3 Sizing of Valves

For watermain 450mm in diameter and below, valves shall be sized to be the same size as the watermain on which the valve is installed unless otherwise approved in writing by the Water Engineering Division. Restraints for pipe sizes greater than 300mm is not addressed by the City of London Design Standards and Specifications and will have to be designed by the consultant/designer and/or provided by the pipe manufacturer as part of the drawing submissions.

7.8 Fire Hydrants and Fire Department Connections

All fire hydrants situated within the road allowance and on private property are the sole property of the City of London and shall be installed in accordance with The City of London Standard Contract Documents for Municipal Construction Projects, NFPA-24 and shall be maintained by and operated only by the City of London.

The detail of hydrant and valve installations shall be according to The City of London Standard Contract Documents for Municipal Construction Projects (441.05.10) and drawing W-CS-1.

Fire Hydrants and Fire Department Connections

All new PUBLIC hydrants installed are to be flow tested and colour coded in accordance with the requirements of NFPA 61. Colour coding is for the purpose of indicating available fire flows at 20psi residual pressure. Colour coding shall be by means of placing reflective markers on each of the two 65mm hydrant outlets.

In new subdivisions and site plans, the designer shall hydraulically model the rated capacity and identify the associated colour code for all proposed hydrants and include a

table on the drawings showing the results. The hydrant markers shall be installed by Water Operations.

Table 7-3: Fire Hydrants Standard Colours

Class	Rated Capacity	Colour
Class AA	1500 usgpm (5680 L/min) or greater	Light Blue
Class A	1000-1499 usgpm (3785-5675 L/min)	Green
Class B	500-999 usgpm (1900-3780 L/min)	Orange
Class C	500 usgpm (1900 L/min) or less	Red

7.8.1 Location/Spacing of Hydrants on Public Streets

The location of hydrants is subject to the requirements and approval of the City Fire Department in accordance with the Ontario Building Code. As a general guide, hydrants must be located not more than 170 m apart along the length of the watermain and should be located at intersections where possible. Hydrants shall be installed a minimum of 1.5m from the edge of a driveway and from any physical obstruction which may impact the operation of the fire hydrant by fire fighters and operations staff. This clearance also applies to underground utilities around the fire hydrant and fire hydrant lateral.

For a more detailed discussion of hydrant spacing requirements refer to “Water Supply for Public Fire Protection - A Guide to Recommended Practices”.

7.8.2 Location of Hydrants to Sprinkler or Standpipe Systems

For use with sprinkler or standpipe systems the hydrant must be located not more than 45 m from the Fire Department connection.

7.8.3 Hydrants on Dead-end Streets

Hydrants shall not be located on dead-end streets unless such streets exceed 90 m in length. Where located on dead-end street the hydrant shall be located at 90 m from the end and a smaller size watermain (minimum 50mm) shall be used beyond the hydrant so that water quality is maintained.

7.8.4 Addition or Relocation of Hydrants

Regardless of hydrant location shown on accepted subdivision plans, additional hydrants may be required or existing hydrants may have to be relocated due to circumstances unknown at the time of plan acceptance such as the position of a structure, Fire Department connection, driveway or landscaping feature.

Such addition and/or relocation shall be requested when the City approves the service plan and must be done at the expense of the Owner of the subdivision or, if the subdivision has been assumed, at the expense of the Owner of the property for which the additional or relocated hydrant is required.

7.8.5 Hydrants on Private Property

Hydrants shall be located on private property where required to meet spacing in accordance with the Ontario Building Code, subject to the approval of the Building Division.

Private hydrants should be connected internally to a site, not to the fronting municipal watermain. Fire hydrants shall be installed at grades such that they are readily accessible to the fire department.

For average conditions, fire hydrants shall be placed at least 12.2m from the buildings being protected, in accordance with NFPA 24.

Exception: When hydrants cannot be placed at this distance, they shall be permitted to be located closer, or wall hydrants used, provided they are set in locations by blank walls where the possibility of injury by falling walls is unlikely and from which people are not likely to be driven by smoke or heat. Usually, in crowded plant yards, they can be placed beside low buildings, near brick stair towers or at angles formed by substantial brick walls that are not likely to fall.

Fire hydrants shall be located a minimum distance of 3.0m from a fence or other such obstruction.

Fire hydrants shall not be placed near retaining walls where there is danger of frost through the wall, in accordance with NFPA 24.

Where municipal water is not available, and an on-site water supply is utilized for firefighting purposes, a fire hydrant shall not be installed, but instead a standpipe connection, meeting the requirements of the Building Division, Standard Practice Sheet B2.2, On-Site Water Supply for Fire Fighting shall be provided.

In keeping with City by-law W-8, section 6.16, the cost for the supply and installation of hydrants located on private property must be paid by the Property Owner. Private hydrants which are owned and were paid for by any persons other than the City shall only be maintained by such persons through a written agreement with the City,

otherwise they will be maintained by the City. City-owned hydrants located on private property shall be maintained by the City.

Any hydrants situated within a road allowance are the property of the City and shall be maintained by the City. The fire hydrant must meet the specification set out in section 441.05.10 Hydrants, of The City of London Standard Contract Documents for Municipal Construction Projects and drawing W-CS-1 since these become the property of the City of London and are maintained by the City.

7.8.6 Hydrants for Fire Department Connections

Requirements are given in the Ontario Building Code.

7.8.7 Protection of Hydrants

If the placement of a hydrant on public or private property is such that it will be susceptible to damage by vehicular traffic, bollards are to be installed, at the owner's cost, in sufficient number to protect the hydrant. Minimum spacing between any bollard and a hydrant shall be 1.0 meter, and bollards shall be a minimum of 1.0 meter in height. Bollards shall be painted hydrant yellow as per section 441.05.10 of the Standard Contract Documents for Municipal Construction Projects. Bollard construction to be steel with concrete fill.

7.9 Water Services

Water service shall mean the pipe, fittings and shut off valve that convey potable water from a connection on a municipal watermain or private watermain to the meter location.

Acceptable water service sizes are 25mm, 40mm, 50mm, 100mm, 150mm, 200mm, 250mm, and 300mm diameter.

For all properties, including Residential, Industrial, Commercial and Institutional, only one service to property line is permitted, unless looping is required. This single service should be sized and design to satisfy all required conditions listed under section 7.3.

A water service as part of a city-led capital project may be requested by an Owner who has an accepted development application within the project limits. The City's contractor will provide a quote for the installation of the water service, and full payment by the Owner to the City is required prior to this service being installed. A water service will not be installed for any sort of development until engineering drawings are approved as part of the development approvals process. To maintain water quality in the water distribution system, if the owner does not connect to the water stub within one year of construction, the City will require the stub to be decommissioned, at no cost to the City.

7.9.1 Fire Services and Private Services

For the design and materials requirements, all water service pipe and fire service mains on private property, the Ontario Building Code shall apply. It shall be noted that water quality requirements are not addressed in the Ontario Building Code. Where there is a concern that there may be a degradation of water quality in the private servicing the Water Engineering Division reserves the right to require perimeter isolation as per section 7.3.5.

As required by the Ontario Building Code on private property, the minimum size for fire service mains, and water service pipes combined with fire service mains shall be 150mm, in accordance with NFPA 24.

Exception: For mains that do not supply hydrants, sizes smaller than 150mm may be used, subject to:

- the main supplies only automatic sprinkler systems, open sprinkler systems, water spray fixed systems, foam systems or Class II standpipe systems;
- hydraulic calculations show that the main will supply the total demand at the appropriate pressure. Systems that are not hydraulically modelled shall have a main at least as large as the riser.

7.9.2 Minimum Service Size for Single Family Residential Homes

The minimum water service size for single family residential homes is 25mm PEX. It is recommended that the designer determine the water service sizing based on flow requirements. Service size should consider whether the single family homes which are estate homes, will have additional units, have deep setbacks automatic lawn sprinkler systems or fire sprinkler systems are to be used.

For additional Residential Units (ARU's) please see SW 7.0 SHT 3

7.9.3 Pressure Reducing Valves Recommended

In some lower elevation areas of the City, water distribution pressures may exceed 690 kPa (100 psi) and it is recommended that when pressures in the municipal water distribution system exceed 550 kPa (80 psi) that owners provide pressure reducing valves, at no cost to the City.

7.9.4 Cathodic Protection

Cathodic protection is to be provided where a connection is made to steel mains in accordance with W-CS-24 or W-CS-25.

7.9.5 Residential Services

When there are two (2) watermains on a road allowance, the water service shall be laid from the structure to the watermain which, in the opinion of the Water Engineering Division, provides adequate flow and/or pressure. Water services shall not be tapped off transmission Watermains 24" (600 mm) and larger where an alternate source is available.

7.9.5.1 Single-Family Units

Water Services to Residential Dwelling Units (Detached, Semi-detached, Townhouses, Row-housing, etc.):

- a) Each dwelling unit must be serviced with a separate water service connected to a municipal watermain or private watermain.
- b) Water services must front the dwelling unit they service unless otherwise approved in writing by the Water Engineering Division.

Water Services to Residential Dwelling Units in Condominium Blocks:

- c) Each dwelling unit in a private block must be serviced with a separate metre and water service connected to a watermain or private watermain. A dwelling unit being an individually metered account.
- d) Water services may connect to the rear of the dwelling unit if the following measures are included on the site plan and undertaken:
 - i. A sign noting the location of the water service and distance from the unit it is to be placed on the rear outside wall to allow for identification on the curbstop location. The location of the sign shall be horizontally in line with the curbstop and vertically above the rear point of entry. The sign shall be embossed and include the unit number, a rain drop (indicating the water service) complete with a reflective surface (raindrop only), as well as the curbstop distance from the rear face of the unit. The final design of the sign shall be to the satisfaction of the City.
 - ii. A paved 1.5m pathway is to be installed in the back of the units which cannot meander (must be straight). The private water main for the services must be located under this pathway.

- iii. Curbstops to units are to be located 0.3m off the paved pathway in the landscaped area.
- iv. Curbstops shall remain free and unencumbered into perpetuity (not impeded by decks, fences, sheds, etc.)
- v. The development agreement and condo declaration shall specify that: Any and all defects to the paved pathway over the private watermain, or the rear-yard sign indicating curbstop location, shall be repaired by the Owner of the Premises. Should the City become aware of any such defect, and upon written notification to the Owner, the said defect is not repaired, within (7) seven days of the date of the notification or within such time as the Engineer may deem reasonable, then the City may turn off the water supply to the Premises. If the City is ordered under statutory authority to restore the water supply, then the City may repair the defective service extension, private main and meter pit and charge the cost to the Owner and collect such cost according to law, and until paid, such cost shall remain a lien on such Premises, and may also be collected in the like manner as taxes. The Owner shall be held responsible for the cost of restoration.
- e) Where it is proposed that servicing of individual dwelling units is not in accordance with the standard above, bulk metering of the site at the point(s) where the water service enters the property will be required. Individual metering of dwelling units by the City of London will not be provided in this circumstance.

7.9.5.2 Multi-Family Units

Water Services to Multi Family Residential Buildings up to Four units, such as duplexes, triplexes, and quadraplexes:

- a) The building must be supplied by a water service pipe from the municipal watermain in the street to the property line that is adequately sized for the intended use of the building.
- b) The internal plumbing of the building must be arranged in such a manner that each residential unit must have a separate hot and cold-water supply that can be isolated by a main valve and not interfere with the water supply of the other units.
- c) The City of London allows one water service pipe from the municipal watermain to the property line with a shut off valve located 300mm from the property line on the City right-of-way. Once the water service pipe crosses the property line it can be branched off in to two - four separate water services, one for each new customer. Each branch is to have a shut off valve located at 300mm from the property line on private property.

- d) A meter pit will have to be installed for each unit which will house the City of London water meter. From this point the water service pipes will enter the building and be connected to the building plumbing system.

Each residential unit may be individually serviced by a meter pit located in front of the residential unit it is servicing. The developer is to ensure that there is adequate space to locate the meter pits and associated valving in the front and that the meter pit is accessible for maintenance. Regardless of the configuration of the building, it is important to understand that each metered water service consists of a water service pipe, an isolation valve and a water meter. The meter pits are to be located in the front of the residential unit being serviced and the must be accessible for maintenance.

Standard servicing locations for multi-family buildings up to four units are to be as shown in Standard Contract Document SW-7.0 (sheet 2).

Water Services to Stacked Townhomes:

- e) For two-unit, vertically stacked townhomes, each unit may have a separate water meter installed within the unit. The water meter for the lower unit must be placed immediately at the point of entry where the water service enters the building. The water meter for the upper unit must be placed immediately at the point of entry where the water service enters the upper unit. If the upper unit is multiple stories, the water meter must be on the lowest story and cannot be placed in an attic. The water meters for the upper unit is not required to be directly above the water meter for the lower unit, although it would reduce the number of bends in the units internal plumbing. Each unit must have a separate curbstop and water service connection to the private watermain and these water services must be one continuous length of pipe from the curbstop to the water meter. The water services and water meter placement must otherwise follow City of London standards. Standard servicing locations for two-unit, vertically stacked townhomes are to be as shown in Standard Contract Document SW-7.0 (sheet 4).
- f) Servicing stacked townhouses that exceed two-unit, vertically stacked townhouses should be serviced as if they are a triplex or fourplex, depending on the number of units.

Water Services to residential buildings with five of more dwelling units:

- g) Apartment buildings (5 dwelling units or more), shall have one metered water service connected to a watermain or private watermain. Water services must front the dwelling unit they service unless otherwise approved in writing by the Water Engineering Division.

7.9.5.3 Accessory System Servicing

Water Services to Additional Residential Units (ARU's):

- a) Where the municipal water service is adequately sized to service the existing building as well as the proposed ARU, water servicing to the ARU may be branched from the municipal water service once on private property if the ARU is to be provided with its own separate water meter.
- b) Where the municipal and private water services are adequately sized to service the existing building as well as the proposed ARU, the ARU may be serviced from the existing buildings internal plumbing if separate water metering is not required.
- c) Where the municipal water service is not adequately sized to service the existing building as well as the proposed ARU, a new municipal water service (that replaces the existing one) from the municipal watermain to property line will be required.
- d) In accordance with City Standards, full replacement of any existing lead services will be required prior to installing an ARU.

For all scenarios above, a curb stop located 0.3m from property line on the City right-of-way is required to be maintained. Standard servicing arrangements for various ARU's types are shown in Standard Contract Document SW-7.0 (Sheet 3).

Water Services to Swimming Pools/Lawn Sprinkler Systems:

- e) Swimming pool facilities and lawn sprinkler systems must be serviced by connecting to the metered side of a water service that is within a heated structure.
- f) Connections to lawn sprinkler systems are to have backflow prevention devices in accordance with CAN CSA B64 and are subject to the approval of the Building Department. Direct Pool Makeup Water Connections are to have backflow prevention devices in accordance with CAN CSA B64 and are subject to the approval of the Building Department.

7.9.5.4 Commercial and Industrial Mall Services

If a commercial or industrial mall consists of only a single structure, the structure shall be serviced by one metered service connection to the municipal watermain. If there are multiple structures within a commercial or industrial mall, each structure shall have a metered serviced connection off of the private watermain within the site.

If each unit within in a structure is to be individually metered, then a metered water service from each individual unit shall connect to a private watermain fronting the units.

7.9.6 Looped Water Servicing Required

Looped water servicing is required when:

- a) one connection to the municipal system will not supply the required flow for domestic use and fire protection or,
- b) for an apartment complex containing one or more structure totalling more than 300 dwelling units

The looped water servicing must be installed to service the private development from two municipal sources. If two connections from the private water system are proposed to be connected to the municipal watermain acting as a single supply source, an isolating splitter valve must be installed in the municipal watermain to permit isolation of supplies, at no cost to the City.

Where a private water system is connected to the municipal water system by two (2) or more connections, the municipal water system shall be protected by perimeter isolation of the private system. This shall mean the installation of testable device (DCVA) at the property line. These devices shall be owned and maintained by the owner.

7.9.7 Location and Layout of Water Services

The water service pipe shall be installed at right angles to the watermain. Water service pipes up to and including 50mm in diameter shall be installed in a straight line from the watermain to the water meter. Water service pipes over 50mm in diameter shall be installed in a straight line from the watermain to the property line.

Water services connected to a private watermain are subject to the same requirements as water services connected to a public watermain.

Single Family and Semi-Detached Lots:

The standard residential water service will be located as per City of London SW-7.0, and W-CS-8.

Street Townhouse Blocks:

Street Townhouse Block servicing should be in accordance with the City of London's Narrow Lot Servicing Standard, section 18.9.

Water Service Spacing on PVC Watermain:

Where water servicing is installed at the time of watermain construction, manufactured tees or saddles may be installed.

Where water servicing is to be installed after the watermain is commissioned and in service, live service connections or taps must be installed with adequate spacing in accordance with the Uni-Bell PVC Pipe Association PVC Pressure Pipe Tapping Guide. Water service spacing differs based on the size of the watermain and the size of the

connections or taps. While Uni-Bell's Tapping Guide should always be referred to, generally, **water services must be staggered at least 18" apart lengthwise and offset 90° from each other. Thus, the minimum spacing along the same line is 36in. When utilizing multiple sleeve taps, the sleeve manufacturer should be consulted.**

Where multiple live taps are proposed, spacing must be in accordance with Uni-Bell's Tapping Guide above, and the Water Operations Division may require that the watermain be taken out of service for safety reasons. Where there is existing servicing connected to the watermain, the owner may be required to set up temporary bypass water servicing. The watermain will be required to be pressure tested after the installation of the water services.

References:

<https://www.uni-bell.org/Portals/0/ResourceFile/pvc-pressure-pipe-tapping-guide.pdf>

<https://www.uni-bell.org/Resources/Documents/46/installation/tapping-connections>

7.9.7.1 Water Service Pipe Depth

Water services shall have no less than 1.7m nor more than 1.9m of cover from final surface grade. Variations from this cover may be made only if approved on plans or in writing by the Water Engineering Division.

The Owner must ensure that water services and private watermains are located so that "berm" or "mound" type landscaping will not cause excessive cover over water services.

7.9.8 Approved Deviations in Location of Water Services

Deviations from the above may be approved by the Water Engineering Division for the following conditions:

a) Cul-de-sacs, Street Curves and Bends:

On cul-de-sac streets and on street curves and bends the water service stubs may be installed at other than right angles to the watermain and not necessarily through the midpoint of the lot frontage. The water service must be in a straight line from the watermain to the meter.

b) Water Service Cannot be Located in Accordance with SW-7.0:

Where the water service cannot be located in line with the centre of the lot, the water service stub may be installed at any point on the front of the lot but must be at right angles to the watermain and in a straight line from the watermain to the meter and must maintain the appropriate separation distances from other utilities.

- c) Water Service Cannot Extend in a Straight Line from the Watermain to the Water Meter:

In (a) and (b), if the water service stub has been installed on the lot frontage but the water service cannot be in a straight line from watermain to water meter then the water service extension may be installed in a straight line from the curb stop to the meter provided the meter is inside the front wall of the structure.

- d) Water Meter to be Located at the Side of a Structure:

Where the water service entrance must be located at the side of a structure, the water service stub must be located on the front of the lot such that the water service extension can be installed in a straight line from the watermain to a point outside the structure adjacent to the meter. Such a water service shall be a minimum of 1.5 m from the structure and centered about a 3.0 m clear space.

- e) Cold Cellar on Front of Building:

Where there exists a cold cellar on the front of the building and the water service stub has been installed in the standard location on the lot frontage, the water service extension may be installed under the porch or cold cellar in a straight line from the watermain to inside the first heated wall. A maximum distance of 2 metres of water service pipe may be located under the porch or cold cellar floor slab.

The water service shall be continuous between the curb stop and the water meter, with no coupling permitted.

The water meter shall not be located within the cold cellar as this is subject to freezing.

7.9.9 Nonconforming Installation of Water Service or Private Watermain

- a) Water Service does not Conform with Location Requirements:

If the water service stub is to be extended and it is found that the water service will not conform to the above location requirements in Section 7.9, the water service stub shall be disconnected from the watermain and a new stub installed which will conform with the requirements.

- b) Water Service or Private Watermain not in Accordance with Specifications or with Approved Service Drawing:

If a water service stub, a water service or a private watermain is installed that is not in accordance with these specifications or with the service drawing approved by the City, such installation will be required to be removed and relocated to conform with the specifications or approved drawings.

c) Existing Water Service to Relocated, Rebuilt or Replaced Structures:

If an existing water service cannot conform to the above location requirements, or is of lead or other unsuitable material, a new water service must be installed which will conform to the requirements. If a Demolition Permit was issued for an existing structure on the lot, then the existing water service must be abandoned at the watermain and a new water service installed to service the structure.

d) Relocation to be at Owner or Contractor's Expense:

All relocation work required in (a), (b) or (c) shall be at the expense of the Owner or Contractor. The Owner will be responsible, upon approval of the demolition permit, to cut and cap the existing water service(s) at the watermain to City of London standards and at no cost to the City of London.

7.9.10 Fire Service Design

The determination of fire service requirements and the sizing of supply piping shall be the responsibility of the Owner. If a domestic water service is combined with a fire supply service, the Owner is responsible to ensure that the supply pipe is large enough to carry the combined demand. Design and installation of sprinkler and standpipe systems and their supply services shall conform to the requirements of the Ontario Building Code, Section 3.2, and the Fire Code. The design of Fire Services must be approved by the Chief Official (Fire Prevention Office) of the City.

The designer should obtain information from Water Engineering Division regarding flows and pressures available for fire systems. If the flows and pressures required are in excess of the minimum design standards given in Section 7.3.1 and in excess of the actual capacity of the system, the Owner shall install booster pumps and/or storage to satisfy the required demand.

7.9.10.1 Separated Water and Fire Services

Domestic water, sprinkler and standpipe services may be installed as a separated services from the watermain to the structure.

Sprinkler and standpipe services may be combined. The Owner is advised to consult with the Insurance Underwriter before combining these services.

7.9.10.2 Combined Water and Fire Services

A domestic water service may be combined with a sprinkler or standpipe service or with a combined sprinkler/standpipe service. The Owner is advised to consult with the Insurance Underwriter before combining these services.

The owner/designer is advised that water quality should be considered; domestic water demands may not achieve a sufficient turnover rate (see 7.3.5) to prevent poor water quality.

7.9.11 Water Service Size or Location Not Determined

Where water service stub size and/or location for any block cannot be determined prior to street construction the Water Engineering Division will not approve installation of the water service stub.

7.9.12 Water Services Valves

All water service valves and curb stops shall be installed with valve boxes and operating rods in accordance with the City of London Standard Contract Documents for Municipal Construction Projects.

7.9.12.1 Location of Water Service Valves

7.9.12.1.1 Up to 50mm Diameter

On water services up to 50mm, a corporation stop shall be installed at the watermain and a curb stop shall be installed 0.3 m from, and on the street side of, the property line in accordance with City of London W-CS-8 and W-CS-22.

7.9.12.1.2 100mm Diameter and Larger

For water services of 100mm diameter and larger, water service valves shall be placed in accordance with City of London W-CS-31.

Where the watermain cannot be isolated for the water service connection, a tapping sleeve and valve will be required at the watermain. It should be noted that size on size taps (eg; 150mm x 150mm tap) are not allowed and a tee will have to be cut in.

Where the watermain can be isolated and a tee cut into it, or where a new watermain is being installed, a valve shall be installed 0.3m from and on the street side of the property line.

The requirement to use a tapping sleeve and valve or to cut in a tee to make the service connection will be made at the discretion of the Water Engineering Division.

7.9.12.1.3 Water Service Valves when Connected to a Private Watermain

Water services to structures in a complex that are to be connected to a private watermain shall have the curb stop or valve placed 3m from the face of the building. If this distance locates the curb stop in the paved portion of the complex, a deviation in

the curb box location may be requested. All deviations from standard location must be approved by the Water Engineering Division.

7.9.12.2 Locates for Curb Stops or Valves

The layout for water services must be such that the curb stop or valve can be easily found by referring to two directional dimensions from a plaque located on the building where the water service enters.

7.9.12.3 Water Service Control Valves Not to be Covered

The Owner shall ensure that water service control valves on their property are not covered by “mound” or “berm” type landscaping.

7.9.12.4 Valves for Water Services with Private Hydrants

Where a private hydrant lateral connects to a private water service, an additional valve shall be located on the service between the building and the hydrant lateral connection, such that flows to the building may be cut off without impeding the function of the hydrant.

7.9.13 Water Service Entrances

Water services of all sizes shall enter through the building wall or under the wall footing into a heated area, leaving sufficient pipe and working space for meter installation.

A length of between 0.3 and 0.45 metres shall be exposed above the finished floor. The pipe shall enter the building not less than 0.15m and not more than 0.3 from the wall.

For townhomes, the water service may enter through the floor slab further into the building. To do this the service must be installed in a continuous sleeve or casing from 1.0m outside the foundation wall to inside where it enters through the floor slab and the service must be pressure tested.

The sleeve is to be one continuous length of blue HDPE, smooth walled (inside and out) with minimum wall thickness of 6.35mm (0.25in.) and minimum inside diameter of 41.3mm (1.625in.). If the HDPE pipe has been butt fused anywhere along its length, then it will cause problems with sliding the service through.

7.9.14 Protection from Contamination

Connections to the municipal potable water system shall be designed and installed so that non-potable water or substances that may render the water non-potable cannot enter the system. This shall be in accordance with the requirements of the Ontario Building Code, Part 7 Plumbing.

7.9.14.1 Backflow Prevention Devices Required on Water Services in High Elevation Areas of the City

In some high elevation areas of the City, the Owner may be required to install a DCVA on the water service to prevent backflow into the watermain in the event of a loss of pressure in the system.

The Owner will be responsible for the supply, installation and maintenance of any DCVA and protective devices in this situation.

7.9.15 Electrical Grounding

7.9.15.1 New Installations

Effective June 30, 1993 electrical systems of all new developments shall not be grounded to the water system. Refer to Ontario Hydro Electrical Safety Code (Section 10) for grounding requirements.

7.9.15.2 Upgrade of Existing Plant

Where an existing watermain is replaced or upgraded, the grounding of electrical systems to the water service may not be adequate. It will be the Owner's responsibility to ensure grounding is adequate after the watermain is installed.

7.10 Corrosion Protection

Where ductile iron, steel or concrete watermain pipe are to be used, soil samples shall be taken on each street to identify soil class and resistivity for the purposes of designing corrosion protection systems for these pipe materials. The corrosion protection systems for the watermain shall be designed by a consulting engineer who is NACE (National Association of Corrosion Experts) Certified.

7.11 Easements

Easements are required for any municipal watermain which is to be installed outside a road allowance on privately owned property.

The minimum width of easement shall be 6.0m for a single watermain only. When the easement is 6.0m, the watermain will be installed 2.0m from one side of the easement to provide an adequate working area to access and repair infrastructure placed within the easement. Where there are multiple utilities to be located within a single easement, adequate width of easement and separation of utilities for both construction and future access and maintenance shall be provided.

Where a municipal watermain is installed on an easement which is located on private property or between private properties which have or may have a building(s) located on the property(ies) in the future, the watermain shall be installed in a casing.

7.12 Water Meters

7.12.1 General Requirements

Refer to Section 7.9.5 for acceptable servicing configurations.

a) All Domestic Services to be Metered

All domestic water services must be metered.

b) Fire Services Not Metered, Exception

Fire services are not metered with the exception of sprinkler systems located in individually metered dwelling units.

7.12.2 Location of Water Meter

The water meter shall be installed on the water service immediately inside the point of entry of the water service into the building with the exception of slab-on-grade townhomes (see Section 7.9.13 Water Service Entrance). Any variation from this location must be approved in writing by Water Engineering Division.

The Owner shall provide sufficient space for installation and maintenance of the meter. The water meter must be accessible for reading and maintenance and must be protected from freezing and other damage. In accordance with Section 7.9.8, water meters shall not be installed within a cold cellar. Under no circumstances will a meter be installed in a bathroom or a bedroom. A clear area of 600mm around the meter shall be free of any obstructions, to allow for convenient reading and servicing of the meter. The clear area around the meter installation should have a minimum headroom clearance of 2 m. No electronic, electrical, mechanical, and water sensitive equipment or machinery should be placed or installed under the meter installation, or in an area where splash or flow from the meter or pipes could occur during the servicing of the meter.

The meter or piping shall be no closer than 1 metre to any electrical panel or above or below any electrical panel unless provided with a meter enclosure as outlined in 7.13.3.2.

7.12.2.1 Meter Pits will be Required

Meter pits will be allowed only with approval of the Water Engineering Division when no other suitable location is feasible. Meter pit design and installation must be submitted for approval as per section 7.9.5. All costs associated with the supply and installation of the meter pit will be the responsibility of the Owner.

7.12.2.2 Water Meter Enclosures

Water meters installed within one (1) meter of an electrical panel shall have a shield installed between the water meter and the electrical panel. The shield must be of metal construction (or approved alternative) and affixed securely to the wall and must be of sufficient width to isolate the water meter from the electrical panel. It must not impede the maintenance of the water meter.

7.12.3 Installation of Water Meters

Water meters up to 20mm size - single family residential units with individual water services. This applies to single family residential, semi-detached dwelling units and townhouses with individual services (constructed after 1985). Water meters up to 20mm size shall be installed in accordance with City of London W-CS-7.

Water meters larger than 20mm in size shall be installed in accordance with AWWA C700, C701 or C702.

7.12.3.1 Water Meter Valving

All new and replacement installations shall require a valve on each side at the meter.

The City will supply, install and maintain the valve on the inlet side of the meter for 16mm and 20mm meters for water service sizes up to and including 25mm diameter.

The Owner must supply and install the outlet valving and bypass valve (when required) for all sizes of meters and the inlet valve when the water service piping is over 25mm diameter. The Owner will be responsible for maintaining and keeping the meter inlet and outlet valving operational and in good working order.

All meter setting valves must open left (counter-clockwise).

7.12.3.2 Meter Strainers

Meter strainers shall be supplied and installed by the City on 75mm size and larger meter installations in accordance with City of London W-CS-30. The Owner shall consult Water Engineering Division regarding dimensions of supports required for the meter and strainer.

7.12.3.3 Water Meter-by-pass Required

The Owner shall install, at their expense, a meter bypass when any of the following conditions exist:

- i) the water meter is 40mm or larger in size.

- ii) shutting the water supply off for approximately thirty (30) minutes during normal working hours of the City would create a production or other problem to the Owner.
- iii) any water service which supplies coin-operated equipment cannot be shut down for thirty (30) minutes or longer during the normal working hours of the City.

Meter bypasses shall be installed according to City of London W-CS-30. Bypass valves shall be closed and sealed for use by the City only.

7.12.4 Meter Sizing

The size of meters will generally be one size smaller than the water service. Owners should obtain advice from Water Engineering Division on meter sizing. Meter ratings are as follows:

Table 7-4: Meter sizes

Meter Size	Maximum Rating L/min	Continuous Rating L/min
16mm	76	38
20mm	114	57
25mm	189	95
40mm	378	189
50mm	606	303

Table 7-5: Compound meters

Compound Meters	Maximum Rating L/min	Continuous Rating L/min
75mm	1136	568
100mm	1893	946
150mm	3785	1893

7.13 Hydraulic Modeling

7.13.1 General

It is a requirement that all proposed municipal and private watermains & services 50mm and larger for all new developments, including site plans, be hydraulically modelled for all new developments, or as otherwise exempted by the Water Engineering Division. Submit the results of the analyses to the City for review and acceptance and provide an electronic version of the hydraulic model for incorporation in the City's overall hydraulic model.

Include all watermains 50mm diameter and larger, control valves (pressure reducing valves and flow regulating valves), reservoirs and pumping stations.

For phased developments, submit updated hydraulic models incorporating the distribution system for all phases at the first phase stage. It should be noted that phases will need to match with anticipated requests for Initial Clearance to be made. Where a submission is made at a later date for a phase which doesn't match a phase considered during the design studies approval process, additional hydraulic modelling will be required. The City may require hydraulic analyses beyond the development boundaries in situations where the operation of water system facilities such as control valves, reservoirs and pumping stations, are influenced by changing demands in the new development.

The model shall also include calculations to ensure water quality in the subdivision during the buildout of the phases and ultimately as well as in any temporary dead-end watermains and specify the installation of automatic flushing devices as required.

The City has adopted InfoWater as its standard for hydraulic modelling. Other software packages may be used for analysis and reporting, but all model input files provided to the City must be directly readable by InfoWater or EPANET without modification. The accuracy and readability of the input files are the sole responsibility of the developer.

As a minimum, conduct hydraulic analysis for each site plan and proposed development phase under the following demand conditions:

- Average day
- Peak hour
- Maximum day plus fire flow
- Water quality under buildout of the phase, and Water quality under zero-buildout for the phase. The water quality model is to be an extended period (14 day) simulation (subdivisions).

Criteria to be modelled are outlined in Section 7.3

All Hydraulic reports shall include detailed maps/layouts of the watermain system (valves, hydrants, etc.) and shall clearly show the pipe and node numbering.

7.13.2 Hydrant Flow Tests for Hydraulic Modelling

Use of fire flow tests are permitted when requested by the designer or Water Engineering. Fire flow tests are not to be older than 5 years. Water Engineering may require a new fire flow test be completed if the area has seen growth since the last tests. The City of London Water Engineering Division will provide minimum steady-state pressures at the connection node(s). The designer is cautioned that only the pressures provided by the City will be acceptable for the model. Flow tests cannot solely be used for boundary conditions as they are not representative of design flow conditions. Below are acceptable and unacceptable approaches in utilizing hydrant flow information for hydraulic modelling.

Accepted Approach

1. Use the City HGL as the boundary condition for the static pressure (i.e. the first point on the pressure/flow curve where flow is zero).
2. Use the nearest available hydrant flow test(s) (on the same distribution system) to determine the pressure drop (i.e., from the HGL/static pressure) under the tested flows
3. This provides multiple points on the pressure/flow curve which can be interpolated between, or extrapolated out, to determine the system's residual pressure under the calculated fire flow.

Not Acceptable Approach

It is not acceptable to use the fire flow value to directly interpolate a resulting pressure between the static pressure value and the residual pressure value in a hydrant flow test and stating this as the pressure for the site under that water demand scenario.

7.13.3 Design Criteria

In accordance with Section 7.3 Watermain Design.

7.13.4 Hydraulic Model Input Standards

7.13.4.1 Units

Table 7-6: Standard Units and Precisions

Parameter	Units	Precision
Elevation	metres	x.xx
Length	metres	x.x
Diameter	millimetres	x (hard conversion)
Demand	litres per second	x.xxx
Tank diameter	metres	x.
Tank volume	cubic metres	x.xx
Pressure	metres (of water)	x.xx
Power	kilowatts	x.xx
Time	hours	x.x

7.13.4.2 Node Elevations

In metres to geodetic datum and estimated final grading contours.

7.13.4.3 Node and Link Identification

Nodes and links are to be graphically identified on a map.

7.13.4.4 Demands

Use average day demands and global demand multipliers for demand patterns.

7.13.5 Submission Requirements

Submit electronic versions of the following files in EPANET format:

- model input file
- map or shape file
- A report, sealed by an Ontario Professional Engineer, including:
- Demand table to indicate calculated demands under various demand conditions used in the modelling
- Design scenarios for all demand conditions under the various buildout stages or phases including:
 - o Average Day
 - o Peak Hour
 - o Maximum day plus fire flow

- o Water quality modelling of the full buildout and for multi-phase subdivisions, each stage or phase including the zero-buildout scenario
- network map (in colour) for each scenario which identifies node and link numbers relative to the development blocks
- node tables for all scenarios listing node numbers, elevation, demands, and pressures
- link tables for all scenarios listing link numbers (with up and downstream nodes indicated), diameters, lengths, roughness, velocities, flows, headlosses, and age of water calculations
- for multi-phase developments, provide model data and summaries for all phases as part of the first phase submission.
- Water quality under buildout of the phase, and Water quality under zero-buildout for the phase.
 - o Water Quality parameter to be Water Age.
 - o The water quality model is to be an extended period (14 day) simulation (subdivisions).
 - o If automatic flushing devices are required, the devices can be represented in the model as a junction with the demand based on the SCD W-CS-2, Sheet 3, and a demand pattern (constant demand not allowed). The following time options are to be used:
 - Total Duration: 336 hours
 - Hydraulic Time Step: 1 minute
 - Quality Time Step: 1 minute
 - Pattern Time Step: 1 minute
 - Reporting Time Step: 1 minute
 - o Simulation results to include:
 - Color coded model network map, with legend, showing the water age of each element at hour 336.
 - Graphs of all water model pipes and junctions showing Water Age vs Time for the full duration of the simulation (336 hours).
 - Pipe and Junction Tables showing water age of each element at hour 336.

Reports containing results that indicate operating parameters outside the acceptable Design Criteria will be automatically rejected without further review and returned to the Owner for correction.

7.13.6 Water Alteration Request

The owner or their consultant may request changes to automatic flushing device settings based on partial buildout of a subdivision. This request should be submitted to the Planning and Development Compliance Group who will then circulate this request to the Water Engineering Division for review, and to Water Operations for the purposes of making the change to the automatic flushing device settings.

Where this application is being made for a stage or phase of subdivision buildout that has not been fully modelled for fire flow, max day and peak hour, it will be necessary to submit hydraulic modelling for all demand scenarios as well as water quality. If it has been fully modelled, modelling for water quality is all that is required as part of the request to change the automatic flushing device settings.

7.14 Water Distribution References

Fire Underwriters Survey

Water Supply for Public Fire Protection, A Guide to Recommended Practice, (Latest revision)

Ontario Water Resources Act

Public Utilities Act

Ontario Building Code

Corporation of the City of London

Zoning By-law No. Z.-1

Water By-Law W-8

Regulation of Water Supply in The City of London

Ministry of the Environment

[Design Guidelines for Drinking-Water Systems](#) (Latest Revision)

Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit, ([City of London website](#))

[Form 1 - Record of Watermains Authorized as a Future Alteration](#)