

REGION OF WATERLOO

AND

AREA MUNICIPALITIES

DESIGN GUIDELINES

AND

SUPPLEMENTAL SPECIFICATIONS

FOR

MUNICIPAL SERVICES

PART D

CONSTRUCTION SPECIFICATIONS

CONSTRUCTION SPECIFICATIONS

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D.1 GENERAL

D.1.1 ONTARIO PROVINCIAL STANDARDS

All work shall be carried out in accordance with Ontario Provincial Standards (OPS) as referenced herein or in the Contract Documents. The Region of Waterloo and Area Municipal Design Guidelines and Supplemental Specifications for Municipal Services (SSMS or DGSSMS) are supplemental to the Ontario Provincial Standards and thus take precedence over the related specifications (OPSS's) and drawings (OPSD's).

D.1.2 SPECIAL CONDITIONS OR SPECIAL PROVISIONS

These specifications may be altered on a project or Municipal specific basis within the Special Conditions or Special Provisions section of the Construction Contract.

D.1.3 DEFINITIONS

This section is intentionally left blank.

D.1.4 ENVIRONMENT

D.1.4.1 Blasting

At no time is blasting or tunnelling to be undertaken without the prior written approval of the Chief Municipal Engineer.

D.1.4.2 Smog Alert

In the event of a Smog Alert, the Contractor shall work in accordance with the guidelines as specified below. Only Smog Alerts issued by the Municipality by 3:00 p.m. of the previous day will be applicable. A Smog Day Alert is issued with the Air Quality Index (AQI) as reported by the M.O.E. is 50 or greater.

The Contractor shall take the following actions:

- Schedule the use of gas powered equipment to the morning hours.
- Re-fuel equipment before 8:30 a.m. and after 3:00 p.m.
- Reschedule jobs that require the use of oil based paints, solvents and other organic based compounds. This also includes the use of cleaning solvents during daylight hours.

- Avoid unnecessary idling of vehicle engines.
- Reschedule any welding activities.
- Reduce the use of gas-powered lawn mowers, generators, power washers, hedge trimmers, concrete saws, etc.

If, in the opinion of the Contract Administrator, a Smog Alert day restricts work related to a controlling operation from being completed, an extension of the specified working day allowance may be considered.

D.1.4.3 Discharge to Sewers

The discharge of water to the storm and sanitary sewers regardless of the source of water shall be pre-approved by the Chief Municipal Engineer.

D.1.5 TRAFFIC CONTROL

The Contractor's operations shall conform to the Ontario Traffic Manual (OTM) Book 7 (Temporary Conditions).

It will be the Contractor's responsibility to obtain the latest publication of Occupational Health and Safety Act (OHSA) and OTM Book 7.

D.1.6 SAFETY REQUIREMENTS

No excavations regulated under provincial legislation shall commence until the Contractor has notified the Ministry of Labour in accordance with the Provincial Occupational Health and Safety Act and Regulations for Construction Projects, and no excavation shall commence on any existing street (with the exception of the **City of Guelph**) without a "Road Occupancy Permit" issued by the Municipality having jurisdiction.

D.1.7 MATERIALS

All materials shall be as listed in Part C - Materials of these specifications or the Contract Documents.

A complete list of materials to be installed shall be provided to the Contractor Administrator prior to the start of construction or as specified in the Contract Documents.

D.1.8 LAYOUT

Construction layout will be specified in the Contract Documents.

D.1.9 PRE-CONDITION SURVEY

If specified in the Contract Documents, this sub-section provides direction on what pre-construction activities are necessary.

D.1.9.1 Pre-Condition Survey

For reconstruction projects, or where existing structures may be impacted, a pre-condition survey shall be completed to the Municipality's standards.

D.1.9.2 Measurement and Payment

Measurement and Payment of preconstruction inspections will be as specified in the Contract Document.

D.1.10 SITE PREPARATION

This sub-section provides direction on site preparation operations, which may be required prior to initiating any excavation activities necessary for the installation of the works.

D.1.10.1 Clearing and Grubbing

Clearing and grubbing as specified in the Contract Documents

D.1.10.2 Removals

Removals as specified in the Contract Documents

D.1.10.3 Demolition

Demolition as specified in the Contract Documents

D.1.10.4 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment will be in accordance with the Ontario Provincial Standards.

D.1.11 EXCAVATION

This sub-section provides direction on excavation operations that the Contractor is required to perform to meet the technical requirements of the Contract Documents.

D.1.11.1 Temporary Stockpiling of Material

When insufficient space is available to allow placing of excavated material on the right-of-way, the Contractor shall load, haul and stockpile such excavated material at an offsite location arranged for by and at the sole expense of the Contractor. When the underground work has been installed, the Contractor shall, at the Contractor's own expense, bring back as much acceptable material so removed as may be required to properly refill the trench.

All surplus materials shall be disposed in accordance with the contract requirements for impacted materials and current regulations.

The Contractor shall provide a letter from the temporary offsite disposal site property owner accepting the material, placement, grading and restoration and releasing the Municipality of any responsibility to the satisfaction of the Municipality.

D.1.11.2 Surplus Excavated Material

Material excavated during the construction of the works, which is surplus to the requirements for backfilling and which cannot be disposed on Municipal property adjacent to the site, as determined by the Contract Administrator, shall be disposed at locations arranged for, by, and at the sole expense of the Contractor.

The Contractor shall provide a letter from the disposal site property owner accepting the material, placement and grading and releasing the Municipality of any responsibility to the satisfaction of the Municipality.

D.1.11.3 Width Of Trenches

Unless otherwise specified, the trench width at the top of the pipe shall be as specified in the SSMS drawings.

Trench sideslopes shall conform to the requirements of the Occupational Health and Safety Act.

D.1.11.4 Open Trenching

Unless otherwise authorized in the Contract Documents or on the Construction Drawings, all underground works shall be constructed in open trench. When required or where designated, by the Contract Administrator to minimize surface disturbance, the Contractor shall use close sheeting or a trench box in accordance with the Occupational Health & Safety Act.

The Contractor shall not continue excavation and/or pipe installation where any part of a trench is left open for an unreasonable length of time in the opinion of the Contract Administrator. The Contractor shall, when directed by the Contract Administrator, refill the trench or part thereof, and temporarily resurface the same, at the Contractor's own expense, and shall not again open such trench or part thereof until the Contractor is ready to proceed with the construction of the underground works.

D.1.11.5 Trenchless Installations

Trenchless installations shall be conducted in accordance with the Contract Documents and the Construction Drawings.

The Contractor may elect to utilize trenchless techniques; however, written approval shall be obtained from the Contract Administrator and the Chief Municipal Engineer.

D.1.11.6 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment will be in accordance with the Ontario Provincial Standards.

D.1.12 BACKFILLING AND COMPACTION

This sub-section provides direction on the placement, backfilling and compaction operations that the Contractor is required to perform to meet the technical requirements of the Contract Documents. Backfilling and compaction shall be carried out in a manner to not damage or dislodge the pipe, associated appurtenances, or utilities.

D.1.12.1 Bedding

The Contractor shall confirm the specified type of bedding and obtain the Contract Administrator's approval before any backfilling operations are undertaken. Backfilling and compaction shall be carried out continuously and immediately after the specified bedding material has been placed and approved by the Contract Administrator.

Bedding material shall be Granular "A" compacted to 100% Standard Proctor Density. Recycled asphalt shall not be used wholly or in any part of the bedding material.

Where conditions warrant, and with the Contractor Administrator's approval, the Contractor shall sub-excavate to achieve a more stable base and replace with Granular "A" compacted to 100% Standard Proctor Density.

D.1.12.2 Backfill Material

The trench above the specified bedding shall be backfilled with approved native material excavated from the trench or obtained elsewhere on the project, and shall be placed in layers not exceeding 300mm, and shall be compacted to 98% Standard Proctor Density.

D.1.12.3 Imported Backfill

Where approved native material is not suitable in the sole opinion of the Contract Administrator, and there is no approved native surplus material from other sections of the work, the Contract Administrator may order that the trench be wholly or partially backfilled with imported materials as approved by the Contract Administrator.

D.1.12.4 Backfill Under Utilities

Unless otherwise specified in the Contract Documents or by the Utility having justification, backfill the trench under existing utilities using controlled density fill approved by the Contract Administrator. Extend the fill from the bottom of the trench or that level at which full compaction is achieved as specified to the underside of the utility being supported. The controlled density fill shall in all instances be placed across the entire trench width of the trench and shall extend a minimum of 150mm on each side of the utility being supported measured along the length of the trench. Wrap the existing utility with a polyethylene bond breaker.

D.1.12.5 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment will be in accordance with the Ontario Provincial Standards.

D.2 WATERMAINS

This section provides direction on project coordination and notification requirements and also describes how watermains, service connections and associated appurtenances are to be installed, commissioned and tested to meet the technical requirements of the Contract Documents.

D.2.1 ONTARIO PROVINCIAL STANDARD SPECIFICATIONS

The watermain works shall be installed in accordance with Ontario Provincial Standard Specifications 701 and 702 (OPSS 701 & 702) except as amended or extended herein.

D.2.2 PROJECT COORDINATION

This sub-section defines responsibility with respect to project coordination objectives required prior to, during and following the water system construction.

D.2.2.1 Notification of Operating Authority

The Contractor shall notify the local operating authority of the water distribution system at least 48 hours prior to the commencement of any work that may affect the existing water distribution system.

D.2.2.2 Notification of Local Water Users

The Contractor shall notify all local water users who will be affected by the shutting down of any section of a permanent or temporary watermain system. Arrangements shall be made with the local operating authority regarding the methodology of notification.

The Contractor shall provide written hand delivered notification of the water service interruption at least two (2) full working days prior to the interruption to all affected water users. The notification letter / door hanger shall be to the local operating authority's standards and approved by the local operating authority prior to distribution.

The notification shall include:

- 24 hr Contractor contact name(s) and phone number(s)
- start date and time
- duration of service interruption

At their discretion, the Municipality may provide door hangers or similar notices to the Contractor for distribution.

D.2.2.3 Shutting Down or Charging Mains

Only authorized operating authority personnel shall operate valves on existing watermains for the purpose of controlling water. No person other than the authorized operating authority personnel shall shut down or charge any section of existing watermain or operate any valve for the purpose of controlling water from existing watermains.

The Contractor shall provide the local operating authority with at two (2) full working days advance notice when a change in control of the water is required. All necessary water supply interruptions shall be scheduled in cooperation with the local operating authority during normal working hours. If the Contractor elects to have the operating authority make system changes after normal working hours, the Contractor may be responsible for additional costs.

The Contractor shall operate only those valves, hydrants and curb stops installed in their Contract during the construction period prior to final connection to the existing distribution system. After final connection, only the local operating authority may operate the system.

D.2.2.4 Water Interruption

The Contractor shall take all measures reasonable to ensure that water service is not interrupted before 9:00 a.m. and after 4:00 p.m. The Chief Municipal Engineer reserves the right to require that specified water users not be interrupted at all or that the interruption is limited to a certain time span. The Chief Municipal Engineer also reserves the right to require that any water interruptions be conducted outside of normal working hours.

D.2.2.5 Requirements Outside of Contract Limits

The Contractor shall ensure that construction activities will not unduly affect, in the opinion of the Municipality, the water distribution system outside of the contract limit.

D.2.2.6 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment shall be considered to be included in the watermain installation.

D.2.3 TEMPORARY WATER DISTRIBUTION SYSTEM**D.2.3.1 General**

In the event that existing water users must be taken out of service for a period exceeding eight (8) hours, or at the discretion of the Contract Administrator or the Chief Municipal Engineer, a temporary water distribution system shall be provided to all interrupted users.

This sub-section provides direction on the installation of Temporary Water Distribution System that the Contractor is required to perform to meet the technical requirements of the Contract Documents.

The temporary water system shall remain in service and not be removed until the Chief Municipal Engineer has approved the final connection of the new watermain to the existing system and authorized removal of the temporary water system.

In some circumstances the temporary watermain may run with a low flow to maintain the quality of the water (to be determined by Chief Municipal Engineer). If this is the case, the water is to be dechlorinated and discharged to a storm inlet.

Existing fire hydrants removed from service shall be bagged as out of service in accordance with the directions of the municipality.

The watermain commissioning plan template in Appendix E is to be followed for temporary watermain plans (drawing to be included).

D.2.3.2 Layout Plan

Prior to installing the temporary water distribution system, a detailed plan of the system shall be provided by the Contractor and approved by the Chief Municipal Engineer. Allow two weeks for review and approval. The plan shall detail:

- connection points to municipal system
- materials for mainline and services
- mainline and service sizes
- sampling points
- list of addresses of affected properties including unit, apartment and suite numbers
- emergency procedures and After Hours contact information
- other related information about the temporary water system.

The Contractor shall demonstrate that the level of service to the water users will not be impacted and that the temporary system will supply water demands at pressures normal to the existing system. The Contractor (in the **City of Kitchener**, the Consultant) shall identify large or exceptional water users and/or fire protection requirements and incorporate their needs into the temporary water distribution system. The installation of temporary fire hydrants (where required) shall be as outlined in the Contract Documents.

D.2.3.3 Minimum Diameter

The minimum pipe size shall be 50mm for mainlines and 19mm for individual service connections.

The temporary water system shall be adequately sized to provide water at pressures normal to the existing water distribution system including the supply to fire suppression systems in serviced buildings. If temporary fire hydrants are required, the required fire flows shall be specified by the Chief Municipal Engineer. The Contractor may be requested to provide confirmation of the supply adequacy of the temporary watermain system by flow and pressure tests or by calculations.

D.2.3.4 Location

The temporary distribution piping shall be installed behind the sidewalk and service piping shall be installed along the edge of existing driveways to avoid grass-cutting conflicts.

All above ground piping shall be installed with appropriate ramping or burial such that the piping will:

- not to be endangered by equipment or vehicular traffic
- not pose a hazard for pedestrians (tripping, etc)
- provide a barrier-free access
- be constructed to safeguard against vandalism and tampering

D.2.3.5 Isolation Valves

Isolation valves are required at the source water connection, branches (2 on 3 way, 3 on 4 way) and at every service.

D.2.3.6 Source Water Connection

The connection of the temporary water system to the existing distribution system shall be done in a secure location and be vandal and tamper resistant. A backflow preventer is required to separate the two systems as long as the temporary system is in service. The backflow preventer shall be a double check or a reduced pressure type assembly and shall be installed, maintained, and field-tested in accordance with the latest edition of CAN/CSA-B64.10.

At the beginning of the project on the first installation and all subsequent relocations, a certificate of operation shall be completed by an appropriately licensed technician and submitted to the Chief Municipal Engineer prior to the backflow preventer being put into service. The certified backflow preventer may be moved to alternate locations on the project as needed; however, the backflow preventer can not be removed from the site and the certification will be valid for one construction season only. Source water connections to fire hydrants are discouraged unless the Contractor can demonstrate that the hydrant has been disinfected and thoroughly flushed. The Municipality assumes no responsibility for the quality of water obtained from a hydrant. After disinfection, the hydrant shall be pressurized at all times that it serves as a source of potable water.

D.2.3.7 Pressure Testing and Leakage

All above ground piping shall be regularly inspected to ensure leak tight connections at the beginning and during the period that the temporary water distribution is in use.

At the discretion of the Contract Administrator or the Chief Municipal Engineer, buried temporary water distribution piping shall satisfy hydrostatic pressure testing.

D.2.3.8 Chlorine Residual and Bacteriological Testing

After the temporary water system is installed (both mainlines and services) in its final location, but before service piping is connected to the water users, the temporary water distribution system shall satisfy the chlorine residual and bacteriological testing standards and protocols for the commissioning of new watermains. Samples must be collected at the end of each branch (individual services under 50mm exempt unless designated by Contract Administrator) and at maximum 350m intervals.

All sampler qualification, procedural standards, bacteriological and chlorine residual requirements detailed for commissioning new watermain distribution systems apply to testing the temporary water distribution system.

One week after the temporary water system is placed into operation and bi-weekly thereafter, chlorine residual and bacteriological samples shall be taken until the temporary system is decommissioned. The chlorine residual and bacteriological requirements after the temporary system is installed shall be that associated with the existing distribution system.

The Contract Administrator is to be contacted immediately if there is damage or loss of pressure to the temporary distribution system. This will require the contractor to perform another round of bacteriological testing.

If a water sample is shown adverse in accordance with O.Reg. 170/03 after the temporary water distribution system is in service, the Contract Administrator will notify the Contractor as soon as possible. The severity of the problem will be addressed and corrective action determined by the Chief Municipal Engineer. If a Boil Water or Drinking Water Advisory must be issued, or if the temporary water system must be disconnected, the Contractor shall supply bottled water or an alternate acceptable water supply to the interrupted water users. Before the temporary water system can be placed back into operation, it must satisfy the chlorine residual and bacteriological testing standards and protocols used to initially commission the temporary system and/or the requirements of the Medical Officer of Health, Public Health Department, Regional Municipality of Waterloo. The Contractor shall have forces available at all times during the corrective action and testing periods to conduct necessary work or assist with sampling as necessary and will be responsible for any costs incurred by the Municipality for corrective action and/or testing.

Analytical fees for the sampling rounds will be absorbed by the Municipality. At the discretion of the Chief Municipal Engineer, the Contractor will be responsible for fees related to additional samples submitted due to failed results plus any costs associated with providing additional water.

D.2.3.9 Service Connections

The service connection piping shall be installed and disinfected at the same time as the main line in order that disinfection is accomplished on the service piping. The final connection to the water user shall not be made until the chlorine residual and bacteriological testing requirements have been satisfied. During service connections, the Contractor shall minimize the portion of the system depressurized.

A check valve shall be installed on the service connection between the mainline and the connection to the water user.

Prior to connection to water users, individual service lines shall be thoroughly flushed. The final connectors shall be spray-disinfected and swabbed with a minimum 1% and maximum 5% solution to disinfect the fittings. The Contractor shall arrange for the plumbing system to be flushed to remove any elevated chlorine residuals.

A typical service connection to a private building shall be at an outside hose bib. An individual WYE type connector shall be installed. A vacuum breaker shall be installed on the side opposite the service connection. In the event that this scenario is not possible, it is the responsibility of the Contractor to determine how to provide temporary water service to the satisfaction of the property owner. Any excavation on private property or internal plumbing modifications shall only be done after written approval is obtained from the property owner and applicable plumbing permits obtained. A copy of any written approvals shall be provided to the Contract Administrator.

The Contractor is responsible to provide an appropriate connection to the water user. The property owner is under no obligation to allow the temporary water system to be connected to their internal system at any location other than on the public side of the curb stop. In the event that a property owner will not permit an above ground connection as typical, it shall be the Contractor's responsibility to make alternate arrangements to service the property. In lieu of making above-ground temporary servicing, the Contractor has the option to connect the temporary distribution system to the public side of the existing curb stop.

D.2.3.10 Operation

The temporary water distribution system shall be continually pressurized after the bacteriological testing is completed and be capable of supply normal water demands throughout its installation.

In the event of a main or service break, the Contractor shall advise the Chief Municipal Engineer and take immediate steps to minimize water loss and to avoid system contamination. Each end of the broken pipe shall be elevated in a manner to avoid backflow into the pipe. All fittings used in the repair and the pipe ends shall be spray-disinfected and swabbed with a minimum 1% and maximum 5% solution to disinfect the connection. At the discretion of the Contract Administrator or the Municipality, a round of chlorine and bacteriological samples may be taken to ensure the integrity of the system.

D.2.3.11 Off-hours Corrective Action

In the event that corrective action is needed to the temporary water distribution system outside of normal working hours, the Contract Administrator and/or the Municipality will attempt to contact the Contractor to take corrective actions. If, in the sole opinion of the Municipality, the Contractor is unable to make the corrections in a timely manner, the Municipality may direct their own forces to take corrective steps. The Contractor will be responsible for any costs incurred by the Municipality.

D.2.3.12 Relocation of the Temporary Distribution System

The relocation of the temporary water system either in whole or parts by any means without conducting and passing the chlorine residual and bacteriological requirements shall **not** be permitted. Relocation here is defined as depressurising and moving the pipework in order to service other water users.

D.2.3.13 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment of any temporary water systems required to be installed, commissioned and tested shall be considered to be included in the watermain installation.

D.2.4 SOURCE WATER CONNECTION FOR NEW WATER SYSTEM

This sub-section provides information on submission requirement and procedures to be followed by the contractor in order to acquire approval to complete the Source Water Connection for the temporary water system and/or the testing and/or commissioning of the watermain system.

D.2.4.1 Connection Plan

Prior to the use of municipal water for testing and/or commissioning the new water system, the Contractor shall submit a plan detailing the source water connection location via the Contract Administrator to the Chief Municipal Engineer for approval. The Contractor may also include the plan required for chlorine and bacteriological testing with this submission. The Contractor shall allow two (2) weeks for review and approval.

D.2.4.2 Physical Separation

All connection points between the existing water distribution system and new watermains, including temporary water distribution systems, shall be kept physically separated until the watermain has successfully passed commissioning and testing requirements.

D.2.4.3 Use of Fire Hydrants

Source water connections to fire hydrants are discouraged unless the Contractor can demonstrate that the fire hydrant has been disinfected and thoroughly flushed. The Municipality assumes no responsibility for the quality of water obtained from a fire hydrant. After disinfection, the fire hydrant shall be pressurized at all times that it serves as a source of potable water.

D.2.4.4 Temporary Connection and Backflow Preventer

To facilitate watermain commissioning, a temporary connection to the existing water distribution can be made through the use of a temporary or “jumper” connection equipped with a backflow

preventer as detailed in the SSMS standard drawing. The connection to the existing distribution system shall be done in a secure location and be vandal and tamper resistant and shall be no larger than 50mm diameter. Multiple jumpers or larger connections are acceptable with the approval of the Chief Municipal Engineer.

The backflow preventer shall be a double check or a reduced pressure type assembly and shall be installed, maintained, and field-tested in accordance with the latest edition of CAN/CSA-B64.10.

At the beginning of the project on the first installation, and all subsequent relocations, a certificate of operation shall be completed by an appropriately licensed technician and submitted to the Chief Municipal Engineer prior to the backflow preventer being put into service. The certified backflow preventer may be moved to alternate locations on the project as needed; however, the backflow preventer can not be removed from the site and the certification will be valid for one construction season only. At the request of the Contract Administrator or the municipality, the backflow preventer must be re-certified when the unit is relocated. The existing distribution systems and the backflow preventer shall be physically disconnected from the test section during hydrostatic testing.

D.2.4.5 Connection Point Relocation

In the event that the connection point of the new watermain to the existing watermain distribution system is in a location that is impractical to install a temporary jumper connection or carry out testing requirements, the Contractor may elect, or be directed by the Chief Municipal Engineer, to re-locate the connection point to a more suitable location. This situation may occur if the connection point to the existing water distribution system is within the travelled portion of a roadway, would raise safety concerns or may cause environmental or property damage if an excavation were left open or pipe work exposed aboveground.

The Contractor shall carry out the disinfection of the watermain installed to relocate the connection point in accordance with AWWA 651 and the procedures outlined under “Final Connection” for new watermains.

After the watermain connection has been installed, the Chief Municipal Engineer or the Contract Administrator may elect to conduct additional chlorine residual and bacteriological testing in accordance with the requirements outlined for new watermains to verify the disinfection of the watermain. If the watermain connection fails either the chlorine residual or bacteriological requirements, the Chief Municipal Engineer will direct corrective action and the Contractor shall cooperate fully.

D.2.4.6 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment of any source water connections required to be installed, commissioned and tested shall be considered to be included in the watermain installation.

D.2.5 WATERMAIN INSTALLATION

This sub-section provides direction on the watermain installation operations that the Contractor is required to perform to meet the technical requirements of the Contract Documents.

D.2.5.1 Pipeline Layout Drawings

Prior to the Pre-Construction Meeting, Pipeline Shop Drawings for mains larger than 300 mm diameter shall be prepared by the pipe manufacturer or supplier for the pipeline system and shall be stamped and signed by a professional engineer licensed by PEO, with three copies provided to the Contract Administrator for review and additional copies as necessary provided to the contractor for field use. Pipeline Layout Drawings are required regardless of the pipe material to be installed, and shall include as a minimum:

- identification of pipe size and standard for each pipe size
- the locations of all chambers, fittings, etc., related to design chainage
- pipe deflection locations and values, and method of deflection/fittings proposed
- pipe elevations and grades
- restraint length calculations (where not provided on the design drawings)
- restraint lengths and type of restraint for each fitting

D.2.5.2 Watermain Laying Tolerance

The allowable laying tolerance from that shown on the Construction Drawings for all sizes and along the entire length of watermains is as follows:

- Horizontal: 50mm
- Vertical: 25mm

D.2.5.3 Joint and Pipe Deflection

The deflection of joints shall not exceed that recommended by the pipe manufacturer. Pipe barrels shall not be deflected to any degree or placed under lateral or vertical stress.

D.2.5.4 Joint and Thrust Restraint

Joint and thrust restraint, poured-in-place concrete, shall be installed on mains up to and including 300 mm dia.:

- as shown on the SSMS standard drawings
- as shown on the Construction Drawings

- as shown on the pipeline Shop Drawings
- at all horizontal and vertical bends
- as shown on approved shop drawings
- as directed by the Contract Administrator and/or Chief Municipal Engineer.

Mechanical joint restraints shall be installed on mains of all sizes:

- on all main valves, hydrant leads, flushing and swab ports, and all service laterals 100 mm or greater in size
- in areas where concrete thrust blocking to undisturbed soil is impractical
- in areas subject to settlement
- as directed by the Contract Administrator and/or Chief Municipal Engineer.
- all joints to be restrained a minimum 10 m from an appurtenance or as per approved shop drawings

Threaded rod shall not be installed unless written permission is obtained from the Contract Administrator with the approval of the Chief Municipal Engineer.

D.2.5.5 Tracer Wire

The tracer wire shall be installed as per the SSMS standard drawings and taped to the top centre of all non-metallic watermain and service piping at 5m intervals.

Splices and other wire to wire connections shall be made by soldering or using Dryconn #10999 waterproof connectors as shown on Drawing E2-15 or by using copper split bolts.

For soldered connections, wires shall be stripped bare, twisted together, cleaned with soldering paste, soldered, wrapped with dielectric tape and over-wrapped with vinyl tape.

For waterproof connectors, wires shall be stripped bare to the recommended length, twisted together and fastened by twisting on the sealed connector. Connections shall only comprise the approved wire size and quantity combinations specified for the connector.

For copper split bolt connections, the connector and bare wire shall be wrapped with dielectric tape and over-wrapped with vinyl tape.

The tracer wire on non-metallic systems shall **NOT** be connected to new or existing metallic watermain piping and/or associated fittings connected to the metallic watermain in order not to interconnect corrosion protection systems.

An anode shall be installed at the terminus of the tracer wire which is not otherwise connected to an existing tracer wire. For services, the tracer wire shall be connected to the nut provided on the curb stop and connected to the main stop and service saddle (see drawing E2-05).

D.2.5.6 Corrosion Protection

D.2.5.6.1 Non-Metallic Mains

For non-metallic watermains with metallic valves, fittings, appurtenances and non-metallic service laterals, one anode shall be attached to the tracer wire at intervals not to exceed 100 meters. The anode shall be connected to the tracing wire as detailed in the SSMS Standard Drawings.

The tracer wire shall be connected to all metallic fittings as detailed in the SSMS Standard Drawings.

An anode shall be installed at the terminus of tracer wire not connected to an existing tracing wire.

Anodes on CPP watermains shall be placed in accordance with the construction drawings and specifications.

In the **Township of Woolwich, City of Guelph** and in the **City of Waterloo**, the anode shall not be connected to the tracing wire and shall be connected to each metallic fitting. A brass grounding clamp shall be used to connect the anode lead to the fitting. The following anode sizes are required: 6lb for inline fitting, 24 lb for hydrant, 12 lb for curb stop or main stop (on copper service) installed on PVC watermain.

D.2.5.6.2 Metallic Mains

If required for metallic watermains (i.e. DI), the anode placement shall be done in accordance with the construction drawings and contract specifications. The copper lead wire of the anode shall be wrapped once around the watermain before being connected to the watermain or fitting using "Cadweld" type waterproof connection. The copper lead wire is to be connected to copper service connections via main stops provided with electrical ground connectors.

The use of polyethylene bags or wrapping is not an accepted method of corrosion protection.

D.2.5.6.3 Wire Connections

Connections shall be soldered and wrapped with vinyl tape to prevent corrosion.

D.2.5.6.4 Anode Offset

The packaged anode is to be placed parallel to the watermain, 0.3 metres from the pipe.

D.2.5.7 Bolts, Nuts and Washers

Bolts, nuts and washers used on buried fittings shall be Cor-Ten or stainless steel.

All bolts, nuts and washers shall be covered with a petrolatum tape system (regardless of whether it is coated or not), which shall be installed in accordance with the manufacturer's instructions.

D.2.5.8 Warning Tape

Warning tape for non-potable watermains shall be placed on top of the granular pipe bedding over the centreline of the pipe and secured from movement during backfilling.

D.2.5.9 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment for the installation of watermain will be in accordance with the Ontario Provincial Standards. If not otherwise specified, the supply and installation of joint and thrust restraint, tracer wire, warning tape and corrosion protection shall be considered to be included within the watermain installation.

D.2.6 HYDRANT, VALVE AND CHAMBER INSTALLATION

This sub-section provides direction on the installation of hydrants, valves and chambers that the Contractor is required to perform to meet the technical requirements of the Contract Documents.

Backfill for hydrant is 19mm clear stone surrounded with filter cloth and Granular A or approved native backfill as shown on SSMS drawing E2-01. Backfill for valve is 19mm clear stone surrounded with filter cloth from the top of bedding to the upper gland (just below the operating nut) and Granular A from the upper gland to the subgrade. Backfill for chambers is select subgrade material in accordance with OPSS 1010 or as dictated by the Chief Municipal Engineer.

D.2.6.1 Setting of Hydrants

Unless otherwise specified, hydrants shall be installed in accordance with the appropriate SSMS standard drawing.

Hydrants set in areas with a high ground water table shall have the hydrant drain hole plugged as directed by the Contract Administrator.

Horizontal and vertical bends shall not be installed in the hydrant lead unless written approval is obtained from the Chief Municipal Engineer.

For non-metallic watermains and/or hydrant leads, the tracer wire shall be connected to the hydrant boot and flange as per the SSMS standard drawings.

Fire hydrants not in service shall be bagged as out of service as directed by the municipality. In the City of Kitchener, contact 741-2529 for every hydrant called out of service (and back into service).

D.2.6.2 Valves

Unless otherwise specified, valves shall be installed in accordance with the SSMS standard drawings.

For non-metallic watermains, the tracing wire shall not be brought to the surface inside of valve boxes. If directed by the Municipality, the tracer wire may be brought up the outside of the valve box and installed through a grommet near the surface.

Road levellers of any style shall not be installed in the City of Kitchener, Township of Woolwich and City of Waterloo. The valve box must be raised to final grade.

D.2.6.3 Minimum Clearance

D.2.6.3.1 Fire Hydrants

The minimum clearance from above ground obstructions to fire hydrants shall be as follows:

- Behind 0.6 m
- Each Side 2.0 m
- Front clear to the curb line

The installation of bollards shall be as directed by the Municipality.

D.2.6.3.2 Valves

The minimum clearance from above ground obstructions to valves shall be 2.0m.

D.2.6.4 Chambers

Unless otherwise specified, chambers shall be installed in accordance with the SSMS standard drawings. For non-metallic watermains, the tracer wire shall be brought up to the underside of the chamber lid to accommodate connection to a "locator" in a manner to avoid entrance to the chamber. Secure the tracer wire within the chamber within 300mm of the final grade with a minimum of 600mm of loose wire. Fasten the tracer wire neatly within the chamber and at the chamber entrance using acceptable wire fasteners.

D.2.6.5 Valve Box and Chamber Lid Adjustment Tolerance

Maintenance hole frames and lids shall be adjusted so that when tested with a 3 m straight edge in any direction of the surface, shall meet the following grade variance requirements between the bottom of the straight edge and the surface of the asphalt or frame and appurtenance.

+Gap, mm	Action
Up to 7	Acceptable
Greater than 7	Unacceptable

D.2.6.6 Bolts, Nuts and Washers**D.2.6.6.1 Buried Installations**

Bolts, nuts and washers used on buried fittings shall be Cor-Ten or stainless steel.

Bolts, nuts and washers used on fittings in chambers shall be stainless steel.

If the Contractor elects to use Cor-Ten or stainless steel bolts, nuts and washers on buried valves or fittings, the entire connection shall be covered with a petrolatum tape system which shall be installed in accordance with the manufacturer's instructions.

D.2.6.6.2 Chambers

Bolts, nuts and washers within chambers shall be stainless steel plus a petrolatum tape system. The use of zinc or cadmium coated bolts, nuts and washers are not permitted within chambers.

D.2.6.7 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment for the installation of hydrants, valves and chambers will be in accordance with the Ontario Provincial Standards.

D.2.7 SERVICE CONNECTIONS

This sub-section provides direction on the installation of service connections that the Contractor is required to perform to meet the technical requirements of the contract specification.

D.2.7.1.1 Installation

Unless otherwise specified, service connections shall be in accordance with the SSMS standard drawings.

D.2.7.1.2 Live Tapping

Service connections shall be completed under pressure (live tapping) for the following:

- all service connections under 50mm on metallic watermains
- all service connections under 50mm on non-metallic watermains utilising a service saddle.
- all connections utilising a tapping sleeve and valve
- inspect connections to ensure drip tight prior to backfilling.

- all tapping in the City of Guelph shall be arranged with and carried out by City of Guelph staff.

D.2.7.2 Tapping for Connections 100mm and Larger

All tapping of watermains for connections larger than 100mm shall be performed by a designated watermain tapping contractor approved by the Chief Municipal Engineer. All tappings shall be done only when the watermain is under pressure (live tapping) and shall be inspected to ensure a drip tight connection prior to backfilling.

D.2.7.2.1 Pressure Testing

All new services shall be pressure tested. In most instances this will be to the valve or curb stop at the property line.

On reconstruction projects where hydrostatic pressure testing of service connections is not feasible, all joints and fittings shall be inspected under normal water distribution pressure by the Contract Administrator to ensure a drip tight connection.

D.2.7.2.2 Disinfection

All new service material shall be super-chlorinated and thoroughly flushed afterwards.

All services 100mm and larger shall be sampled to ensure these services pass the chlorine residual and bacteriological requirements for new watermains.

Where existing services are connected to a new watermain within the watermain trench, the Contractor shall ensure that the new service material is free of dirt and debris and the connection is made under as clean conditions as possible. The Contractor shall make arrangements to thoroughly flush the service through an inside or outside hose bib for a minimum of 3 to 5 minutes or until the water runs clear and chlorine residuals have reduced to levels normal to the existing distribution system. If there is any question as to the water quality, the Contract Administrator may request a water sample for bacteriological analysis to the standards outlined for new watermains. In the event that the water sample is adverse, the Contractor shall take whatever corrective action is deemed necessary by the Contract Administrator and the Chief Municipal Engineer.

D.2.7.2.3 Union Couplings

Only one (1) union per service will be allowed on copper services over 20m and no unions are allowed for non-metallic services.

Service pipe union couplings shall not be installed under gravel or asphalt road surfaces.

The above does not apply where it is normal to the project that existing services will be connected to a new watermain in the watermain trench. In this case, only one (1) union coupling appropriate to connect the new and old service material shall be installed.

D.2.7.2.4 Marker

For new construction where the new service is not connected to an existing private system, the ends of service connections shall be marked at the curb box by extending a 38 mm x 89 mm timber marker vertically from the curb stop to a height of 1.0m above finished ground level. The exposed end of these marker stakes shall be painted blue.

D.2.7.3 Thrust Restraint

Thrust restraint shall be accomplished by approved mechanical joint restraints or concrete thrust blocks. Redi-rods or threaded rods shall not be installed without the written permission of the Contract Administrator due to long term corrosion problems.

D.2.7.4 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment for the installation of services and associated appurtenances will be in accordance with the Ontario Provincial Standards.

D.2.8 COMMISSIONING

This sub-section provides information on the submission and testing requirements and procedures to be followed by the Contractor to complete the commissioning of the watermain.

D.2.8.1 General

In order for a watermain to be considered for acceptance by the Chief Municipal Engineer, the following procedures and tests shall be successfully completed in the presence of the Contract Administrator:

- swabbing
- hydrostatic pressure test
- disinfection
- de-chlorination
- chlorine residual and bacteriological tests
- final connection
- tracer wire conductivity test
- valve positioning

All field tests conducted in this subsection shall be performed in the presence of the Contract Administrator.

Prior to the initiation of the watermain commissioning procedures, the Contractor shall submit a Watermain Commissioning Plan for review by the municipality. The Watermain Commissioning Plan shall contain a complete description of all the steps the Contractor will undertake to ensure the watermain satisfies all the testing and sampling requirements. The Watermain Commissioning Plan shall be submitted a minimum of two (2) weeks in advance of the initiation of the watermain commissioning. This plan shall also include the specific reporting protocols as described under the particular commissioning procedures in the following sections.

The watermain commissioning plan template in Appendix E is to be followed for temporary watermain plans (drawing to be included).

D.2.8.2 Swabbing

Prior to disinfection, all sections of watermain shall be swabbed using a minimum of four new foam swabs. Swabs shall be polyurethane with a density of 24.7 kg/m³ and shall have a minimum diameter 50mm larger than the diameter of the watermain and have a minimum length of one and one half times its diameter.

The Contractor shall charge the watermain fully with water prior to the commencement of swabbing. The water used to conduct the chlorine residual and bacteriological testing shall be **normal** to the existing water distribution system. In most cases, test water can be supplied by the adjacent existing distribution system; however if this source is not available, or the Contractor elects not to use, then potable water from a prior Municipally approved location within the existing water distribution system may be brought to the watermain under consideration at the Contractor's expense.

For mains 300 mm diameter or smaller, swabs shall be propelled through the watermain at a speed of 0.5 to 1.0 metre/second using potable water. For mains greater than 300 mm diameter and for mains where the Chief Municipal Engineer requires a velocity lower than 0.5 m/s, the velocity calculations provided in the Watermain Commissioning Plan will be reviewed by the Chief Municipal Engineer.

The Contractor shall discharge water to an approved outlet ensuring all required erosion and sediment control and dechlorination measures are followed. The Contractor shall demonstrate how the appropriate swabbing velocity will be achieved.

Stubs for future watermains longer than one (1) pipe length shall be swabbed. Servicing stubs 150mm diameter and larger and longer than one (1) pipe length shall be swabbed only if specified in the contract documents.

The swabbing shall continue until the discharge water runs clear within ten seconds of the last swab exiting the discharge point.

After swabbing has been completed, the Contractor shall flush every fire hydrant lead, stub and service.

The Contractor shall mark, number and demonstrate to the contract Administrator that all swabs, or parts thereof, have been retrieved. The Contractor shall be liable for costs associated with

damage caused by and retrieving swabs that, for whatever reason, escape into the existing water distribution system. The Contractor shall provide a letter co-signed by the Contract Administrator that all swabs were retrieved.

D.2.8.3 Hydrostatic Pressure Test

Hydrostatic pressuring testing shall be carried in accordance with OPSS 701 on the main only. A minimum of the specified test pressure shall be applied to all points (including high points) in the watermain section being tested. The Contract Administrator shall witness the pressure test and provide written confirmation with the attached form provided in Part E.

D.2.8.4 Disinfection

Disinfection shall be carried in accordance with OPSS 701. The chlorine injection concentration and the chlorine concentration at any point in the piping shall not exceed 100 mg/l.

D.2.8.5 De-chlorination

All water wasted shall be discharged into the stormwater system and shall be neutralized to provide a total chlorine residual of less than 0.2 mg/l. The Contract Administrator will monitor the discharge of waste water. Should tests show a residual greater than 0.2 mg/l, the discharge shall be ceased immediately and the procedure modified to meet less than the 0.2 mg/l objective.

Where detrimental effects may be suffered by plants and/or animals in the natural environment, the wasted water shall be neutralized to provide a total chlorine residual of less than 0.002 mg/l (2 ppb) (Provincial Water Quality Objective) at the outfall. The Contract Administrator will monitor the discharge of waste water. Should tests show a residual greater than 0.002 mg/l, the discharge shall be ceased immediately, the Chief Municipal Engineer shall be notified, and the procedure modified to meet the less than 0.002 mg/l objective. Sites within 100m of natural drainage, or with direct discharge to a water body, should be considered high risk. In such instances, the Chief Municipal Engineer may request a dechlorination plan along with contingency and mitigation plans in the event that the chlorine residuals exceed those specified.

The Contractor may be permitted to discharge waste water into the sanitary collection system only upon approval of the Chief Municipal Engineer. The Contractor will need to demonstrate that there are no other available options. The Chief Municipal Engineer may direct the Contractor to de-chlorinate to a specified chlorine residual prior to discharge or limit the discharge rate to the sanitary collection system. The Contract Administrator will monitor the discharge of wastewater to ensure the chlorine residual and discharge limits are not exceeded.

The Chief Municipal Engineer reserves the right to direct the Contractor to dispose of wasted water to a sanitary sewer with chlorine residual not to exceed a specified limit or discharge rate.

The Contractor shall flush every part of the water system including fire hydrant leads, stubs for future watermains and services to remove all super chlorinated water.

D.2.8.6 Chlorine Residual & Bacteriological Testing

D.2.8.6.1 Procedure

Prior to the commencement of chlorination residual and bacteriological testing, the Contractor shall submit a sampling plan detailing the source water location, final connection locations and the sampling locations via the Contract Administrator to the Chief Municipal Engineer for approval. The Contractor shall allow two (2) weeks for review and approval. Appropriate coding or labelling shall be provided on the plan to clearly correlate the sample results to the sampling locations.

Before the watermain can be approved for connection to the existing water distribution system, two (2) consecutive rounds of water samples, taken at least 24 hours apart, shall pass both the chlorine residual and bacteriological standards outlined below for consecutive samples. Prior to chlorine residual and bacteriological testing, all other testing (i.e. hydrostatic, disinfection) shall be completed and any super-chlorinated water removed from all portions of the watermain system under consideration including fire hydrant leads, stubs, branches, services, etc.

The watermain test section shall **not** be disturbed or flushed during the period between the 1st and 2nd sampling rounds, except to obtain a water sample.

The watermain shall be continually pressurized from the start of bacteriological testing until the final connection to the existing system is undertaken.

Only after the tested watermain has passed all chlorine residual and bacteriological requirements and has been approved to be put into service by the Chief Municipal Engineer, shall the watermain be connected to the existing water distribution system.

After the completion of the final connection, the watermain shall be re-pressurized by the existing system as soon as possible.

The Chief Municipal Engineer or the Contract Administrator may request additional bacteriological sampling after the final connection has been made as a precaution against or in response to possible contamination during the final connection.

D.2.8.6.2 Source Water

The water used to conduct the chlorine residual and bacteriological testing shall be **normal** to the existing water distribution system. In most cases, test water can be supplied by the adjacent existing distribution system; however if this source is not available, or the Contractor elects not to use, then potable water from a prior Municipally approved location within the existing water distribution system may be brought to the watermain under consideration at the Contractor's expense.

Should the Contractor elect to undertake a bacteriological sample of source water from a municipal system, the sample must be taken from the new watermain side of the backflow preventer. In the event that this sample is adverse, the Municipality may undertake a sample of the municipal system to verify the results.

D.2.8.6.3 Sample Locations

Chlorine residual and bacteriological testing samples shall be taken:

- at the end of each branch or stub (excluding fire hydrants);
- at end of services 100 mm or larger;
- a maximum of every 350 metres along the watermain test section;
- a maximum of 150m from the source water connection;
- as identified in the Special Provisions;
- as directed by the Contract Administrator;
- as directed by the Chief Municipal Engineer.

Sampling of fire hydrant leads is not required unless the Contractor has elected or is requested to utilize a fire hydrant location to satisfy any of the above sampling location criteria. Regardless of whether fire hydrants are used for a sampling location, all fire hydrant leads shall be thoroughly flushed to remove debris and any super-chlorinated water.

In the event that the maximum distance criteria can not be satisfied or if additional sampling points are required by the Municipality, the Contractor may be directed by the Municipality to install sampling taps on the watermain for the sole purpose of obtaining a water sample. During the completion of the final connection or after the watermain has been commissioned the Contractor shall remove the sampling line and replace the main stop with a plug. Stainless steel plugs must be installed on saddles and brass plugs for ductile iron.

All sampling ports shall be copper or stainless steel lines 25mm or smaller and brought a minimum of 1.0m above the surface. The Contractor shall be available to operate underground valves as necessary during sampling.

D.2.8.6.4 Chlorine Residual Requirements

At each sampling location, the water shall satisfy the chlorine residual requirements as follows:

Sampling Round 1:

- the total chlorine residual in the sample shall be equal to the source water total chlorine residual plus or minus 0.2 mg/L; and,
- the combined chlorine residual in the sample shall be equal to or greater than 0.25 mg/L **or** the free chlorine residual shall be equal to or greater than 0.05 mg/L.

Sampling Round 2:

- the total chlorine residual in the sample shall be no more than 0.2 mg/L above the source water total chlorine residual;
- the total chlorine residual in the sample shall be no less than 50% of the source water total chlorine residual from day one; and;

- the combined chlorine residual in the sample shall be equal to or greater than 0.25 mg/L **or** the free chlorine residual shall be equal to or greater than 0.05 mg/L.

Combined chlorine residual is the total chlorine residual minus the free chlorine residual.

In some rare and unique circumstances (e.g. chlorinated / chloraminated mixed areas, chlorine residuals may not be achievable. Sign off will be at the discretion of the Chief Municipal Engineer or designate.

A single failed chlorine residual parameter will constitute a failure of that entire sampling round, both chlorine residual and bacteriological and will necessitate the Contractor re-initiating Sampling Round 1 testing. The Contractor may elect to re-sample (chlorine and bacteriological) or take other corrective action to achieve two (2) consecutive rounds of acceptable chlorine residual and bacteriological results.

The chlorine readings shall be taken at the same time as the water sample for bacteriological testing is collected.

The source water chlorine residual readings, against which all sampled chlorine residual results are measured, are those chlorine residuals representative of the source water charged into the watermain for the intention of bacteriological testing. The source water chlorine readings are taken only at the beginning of the bacteriological testing protocol. If the watermain is flushed to re-initiate another bacteriological testing protocol, new source water total and free chlorine residuals readings shall be taken. The source water chlorine residual readings (total combined and free) shall be taken within four (4) hours of charging the watermain for bacteriological testing.

In the event that the source water has a combined chlorine residual less than 0.25 mg/L **and** a free chlorine residual less than 0.05 mg/L, the Chief Municipal Engineer shall be notified immediately to take appropriate action.

Only licensed testing personnel as defined in Ont. Reg. 248/03 shall measure and report on total combined and free chlorine residuals. An appropriately licensed Contractor is not precluded from making chlorine residual measurements provided that the measurements are witnessed by the Contract Administrator.

D.2.8.6.5 Bacteriological Requirements

At each sampling location, the water shall satisfy the bacteriological requirements as follows both Sampling Round 1 and 2:

- | | |
|------------------|-----------------------------|
| • E. Coli | A (Presence / Absence Test) |
| • Total Coliform | A (Presence / Absence Test) |
| • Background | <25 (Membrane Filtration) |

Bacteriological samples shall be taken as outlined on the sampling plan. A single failed bacteriological parameter will constitute a failure of that entire sampling round and will necessitate the Contractor re-initiating Sampling Round 1 testing. The Contractor may elect to

re-sample (chlorine and bacteriological) or take other corrective action to achieve two (2) consecutive rounds of acceptable bacteriological results. Corrective action for a failed water sample during the 3rd round (after the final connection has been made) will be addressed by the Contract Administrator in the consultation with the Chief Municipal Engineer.

D.2.8.6.6 Laboratory Submissions

Within the Region of Waterloo, the bacteriological samples for analysis shall be accompanied by fully completed approved forms and shall be submitted by the Contract Administrator to the Regional Municipality of Waterloo Laboratory (100 Maple Grove Road, Cambridge, 650-8275 or 650-8219). Only samples submitted in bottles supplied by the laboratory will be accepted. The laboratory shall be contacted at least 24 hours in advance of the sampling submission.

Within the **City of Guelph**, the laboratory will be designated and submission requirements outlined by the City of Guelph.

Laboratory analytical fees for the initial sampling rounds will be absorbed by the Municipality. At the discretion of the Chief Municipal Engineer, the Contractor will be responsible for fees related to additional samples submitted due to failed results plus any costs associated with providing additional water.

Water samples for analysis will only be received Monday to Thursday 8:30am to 3:30pm. Special arrangements may be made for Friday submission from 8:30am to 3:30pm but only with the prior approval of the laboratory and the Chief Municipal Engineer. The Contractor may be responsible for any additional laboratory fees.

The laboratory can only release results to the Chief Municipal Engineer and will not discuss the results with the Contact Administrator or Contractor. The results are generally released to the Chief Municipal Engineer 26 to 28 hours after the water sample submission.

The Contractor may elect to use a private laboratory to undertake the bacteriological testing. The private laboratory must be accredited by the Province of Ontario to undertake the tests and shall be approved by the Chief Municipal Engineer. If the use of a private laboratory is chosen, the same laboratory must be used for all samples for the first and second rounds of testing plus any final connection samples mandated by the Municipality. The Contractor shall ensure that the appropriate relevant information is provided on the private laboratory sample submission and results form. The Municipality will not be responsible for any costs incurred due to incomplete submission forms or associated re-sampling. The Contractor will be responsible for all analytical fees associated with the use of a private laboratory.

D.2.8.6.7 Custody Control

The Contract Administrator shall conduct or witness all chlorine residual and bacteriological sampling and all water samples shall stay under the control of the Contract Administrator until the samples are delivered to the laboratory.

The laboratory results will be faxed to the Municipal Reviewer. All sampling results shall be reviewed and approved by the Municipal Reviewer before the new watermain can be approved

for connection to the existing water distribution system. The Municipal Reviewer will contact the Contract Administrator who in turn will relay the information to the Contractor.

D.2.8.6.8 Post Final Connection Bacteriological Testing

Contractors are advised that the Contract Administrator and/or the Chief Municipal Engineer has the authority to request a third round of water samples for bacteriological analysis after the final connection has been made to the existing water distribution system to confirm the continued quality of the water within a period of two (2) working days. In the event that adverse water samples occur, the Chief Municipal Engineer will direct the corrective actions to be taken. The Contractor shall cooperate and participate fully in the corrective actions at the Contractors expense.

In the event, the Contractor does not take appropriate measures to correct adverse water samples and/or at the discretion of the Chief Municipal Engineer, the new system may be isolated from the municipal water system and the Contractor will be required to provide two (2) consecutive rounds of chlorine and bacteriological to the standards set out to commission the new water system.

D.2.8.7 Final Connection To Existing Water System

D.2.8.7.1 Procedure

After the pressure, leakage, chlorine residual and bacteriological tests have passed; the Contractor shall obtain written approval from the Chief Municipal Engineer to make the final watermain connection to the existing watermain distribution system.

If a temporary water system has been installed, it shall not be removed until after the Chief Municipal Engineer has accepted the final connection of the new watermain to the existing municipal system and has authorized the removal of the temporary water system.

The local operating authority shall be contacted two (2) full working days prior to the final connection to determine if any special measures shall be taken and/or an appropriately licensed operating authority employee is required to oversee the works. The Contractor will be responsible for all costs for call outs of Municipal staff if the Contractor fails to notify the Municipality that the connection will not take place.

The Contract Administrator shall be present to witness the entire final connection process of the new watermain to the existing water distribution systems.

Watermains shall be cut back to remove all temporary taps. The Contractor shall disinfect the connection watermain as outlined below and shall, using all means possible, dewater the watermains and trench in a controlled manner to not allow backflow into the watermains.

Upon final connection the contractor shall contact the municipality to flush water through a nearby municipally owned hydrant (contractor to provide a minimum 48 hour notice prior to final connection).

If trench water, dirt or debris has entered the watermain during the final connection the watermain shall be aggressively flushed and additional bacteriological samples shall be taken as directed by the Contract Administrator and/or the Chief Municipal Engineer. The Chief Municipal Engineer reserves the right to request the above steps be taken regardless.

The Contractor shall submit written procedures for completing the final connection, including the method of dewatering to ensure the existing or new water system is not contaminated.

D.2.8.7.2 Connections Equal To Or Less Than One Pipe Length

For a final connection length equal to or less than one pipe length, the new piping, fittings and valves required for the connection shall be spray-disinfected and swabbed with a minimum 1% and maximum 5% solution of chlorine just prior to being installed. The Contractor shall ensure that the workers undertaking the disinfection process thoroughly wash their hands with soap and use hygienic practices.

D.2.8.7.3 Connections Greater Than One Pipe Length

In the event that the final connection point of the new watermain to the existing watermain distribution system is in a location that requires a connection length greater than one pipe length. The new piping, fittings and valves required for the connection shall be assembled aboveground, disinfected and tested in accordance with AWWA 651. The connection piping shall satisfy the chlorine residual and bacteriological requirements outlined for new watermains.

The pre-assembled watermain connection shall be drip tight. Only after satisfactory chlorine residual and bacteriological results have been achieved, shall the pre-assembled connection be installed. The pre-assembled watermain shall be maintained under pressure from the start of chlorine residual and bacteriological testing protocol until just prior to the installation. All caps shall be kept in place during the installation procedure until immediately prior to making the connection.

The Contractor shall not hand disinfect one pipe length at a time to circumvent the requirements to preassemble connection piping over one pipe length aboveground.

Should the Contractor find it necessary to deviate from the protocol as outlined in AWWA 651 and above, the Contractor shall submit a Connection Plan to the Chief Municipal Engineer for review and approval. The Contractor shall allow two weeks for review.

D.2.8.7.4 Tracer Wire

During the final connection of the new watermain to the existing distribution system, the Contractor shall insure that the new tracer wire is connected to the existing tracer wire.

D.2.8.8 Tracer Wire Conductivity Test

After the installation of base asphalt or final grading, the Contractor shall demonstrate the integrity of the underground tracer wire by applying a conductivity signal and confirming the

signal on all watermains and services. The Contract Administrator shall witness the conductivity test(s) and provide written confirmation with the attached form provided in Part E.

The intent of this test is to confirm that the tracer wire has been installed on all non-metallic watermains and services as specified. Specifically, the test shall demonstrate the integrity and continuity of the tracer on all watermains and services.

A continuity signal shall be applied to the tracer wire and the signal confirmed over the entire length of all tracer wire installed. The signal shall be detectable for a distance of at least 300m from either side of the signal connection point. At no time shall there be a break in the continuity of the tracer wire.

It shall be demonstrated that the tracer wire on the services is connected to the watermain tracer wire and that the service tracer wire is intact for the length of the service.

The Contractor shall demonstrate that the tracer wire in chambers can be accessed from finished grade and that the signal is detectable on the watermain outside of the chamber.

Acceptable means of undertaking the conductivity test include using traditional locating techniques and/or determining if a low voltage electrical current travels from the connection point to test points.

D.2.8.9 Valve Positioning

The Contractor shall demonstrate that all valves, main line and service, are in the final positioning as outlined in the Contract Documents or as directed by the Contract Administrator.

D.2.8.10 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment for commissioning of the water system shall be considered to be included within watermain installation.

D.3 SEWERS

This section provides direction on how sanitary and storm sewers and their associated service connections and appurtenances are to be installed, commissioned and tested to meet the technical requirements of the Contract Documents and all applicable regulations and acts.

D.3.1 ONTARIO PROVINCIAL STANDARD SPECIFICATIONS

The sewer works shall be installed in accordance with Ontario Provincial Standard Specification 410 & 514 except as amended or extended herein.

D.3.2 SEWER INSTALLATION

This sub-section provides direction on the sewer installation operations that the Contractor is required to perform to meet the technical requirements of the Contract Documents.

D.3.2.1 Laying Tolerance

The allowable laying tolerance for inverts from that shown on the Construction Drawings for all sizes and at any point along the entire length of a sewer is as follows:

- Horizontal: 25mm
- Vertical for slope less than or equal to 1%: 5mm
- Vertical for slope greater than 1%: 10mm

Additionally, pipes shall be installed with no visible ponding.

D.3.2.2 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment for the installation of sewers will be in accordance with the Ontario Provincial Standards.

D.3.3 MAINTENANCE HOLE AND CATCHBASIN INSTALLATION

This sub-section provides direction on the installation operations of maintenance holes and catchbasins that the Contractor is required to perform to meet the technical requirements of the Contract Documents

D.3.3.1 Maintenance Hole Lid Adjustment Tolerance

Maintenance hole frames and lids shall be adjusted so that when tested with a 3 m straight edge in any direction of the surface, the gap shall not exceed 7mm between the bottom of the straight edge and the surface of the asphalt or frame and appurtenance.

The **City of Waterloo, City of Cambridge, Township of Woolwich** and the **City of Kitchener** do not except ring maintenance hole risers.

D.3.3.2 Adjustment Unit Parging

The inside to be parged only between the pre-cast and first modoloc as well as the last modoloc and the frame

D.3.3.3 Maintenance Holes Connections

At new concrete maintenance holes, Kor-N-Seal shall be used to connect flexible pipe on both sanitary and storm sewers and services, and concrete brick and mortar used for connecting a concrete pipe to the concrete maintenance hole. Pipe shall be installed flush with the inside wall of the maintenance hole.

At existing maintenance holes, the opening shall be cored and the connection made as per a new maintenance hole or a sand cone connection.

Only concrete brick and appropriate mortar shall be used to fill void around concrete pipes. Clay bricks, stones and rubble shall not be used. The inside wall of the opening shall have a smooth mortar finish. Parging of brick and mortar connections shall be completed on the exterior of connections.

Flexible pipe with watertight adaptors shall not be parged on the outside. The Chief Municipal Engineer must approve any non Kor-N-Seal adapter.

D.3.3.4 Maintenance Hole Benching

All maintenance holes shall be benched up minimum to springline in sanitary sewers and $\frac{3}{4}$ of the pipe height in storm sewers regardless of the pipe size. All benching shall slope up and away from the pipe at 8% slope.

In catchbasin maintenance holes with outlet pipe diameter 450mm and smaller, a 600mm deep sump shall be provided. All catchbasin maintenance holes with outlet diameter larger than 450mm shall be benched up minimum $\frac{3}{4}$ of the pipe height.

In the **City of Waterloo** and the **City of Cambridge** all catchbasin maintenance holes regardless of outlet pipe size shall be installed with a 600mm deep sump.

In the **City of Kitchener** all maintenance holes shall be benched.

D.3.3.5 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment for the installation of maintenance holes and catchbasins will be in accordance with the Ontario Provincial Standards.

D.3.4 SERVICE CONNECTIONS

This sub-section provides direction on the installation of service connections that the Contractor is required to perform to meet the technical requirements of the contract specification.

D.3.4.1.1 Installation

Lateral service connections for sewers shall be installed in the locations specified on the drawings, in accordance with the Municipality's standard location, or as directed the Contract Administrator.

D.3.4.2 Minimum Pipe Length

Pipe for lateral service connections shall be installed in 4 metre minimum lengths with one cut off to terminate at the property line. The second last pipe shall be shortened to ensure that the last service pipe is not less than 1.2m in length.

D.3.4.3 Line and Grade

The line and grade of all lateral service connections shall be as specified on the drawings as provided by the Contract Administrator. In general all sewer lateral service connections to serve private land shall be constructed at a 2% minimum and 8% maximum grade and to the following depths:

- a) For sanitary, 2.5m below finished grade at the property line unless otherwise specified.
- b) For storm, 1.2 metres (2.5m **City of Guelph**) below finished grade at the property line unless otherwise specified.

D.3.4.4 Mainline Connection

Service connections to the main pipe sewer shall be made using factory made tees or wyes, strap-on-saddles or other approved saddles. Factory-made tees or wyes shall be used for all service connections where the diameter of the main pipe sewer is:

- (a) Less than 450mm; or
- (b) Less than twice the diameter of the service connection.

D.3.4.5 Maintenance Hole Connections

Sanitary service connections to maintenance holes are permitted. All services connected to maintenance holes shall be kor-n-seal. If the invert of the service entering the maintenance hole is 0.61m or more above the lowest invert, a drop pipe must be installed inside the maintenance hole to direct flow to the main channel.

D.3.4.6 Caps

Watertight rubber gasket caps shall be installed in the ends of all lateral service connections. All caps shall be as specified by the pipe manufacturer to insure a watertight seal.

Plugs are not to be installed unless written approval is provided by the Chief Municipal Engineer.

D.3.4.7 Markers

The ends of lateral service connections (and the location of caps) shall be marked by extending a 38 mm x 89 mm timber marker vertically from the cap to a height of 1 metre above finished ground level. The exposed end of these marker stakes shall be painted green for sanitary and white for storm.

D.3.4.8 Measurement and Payment

Unless otherwise provided for in the Contract Documents, measurement and payment for the installation of services and associated appurtenances will be in accordance with the Ontario Provincial Standards.

D.3.5 COMMISSIONING

This sub-section provides information on the testing requirements and procedures to be followed by the Contractor to complete the commissioning of the sewer system.

D.3.5.1 General

In order for a sewer to be considered for acceptance by the Chief Municipal Engineer, the following procedures and tests shall be successfully completed in the presence of the Contract Administrator:

- leakage
- visual inspection
- cleaning and flushing
- deflection

- CCTV Inspections

All field tests conducted in this subsection shall be performed in the presence of the Contract Administrator.

D.3.5.2 Leakage

Leakage tests shall be carried out on completed sewers 1200 mm in diameter and smaller as per OPSS 410. There shall be no visible infiltration for sewers with a diameter greater than 1200 mm.

D.3.5.3 Visual Inspection

The sewers, maintenance holes and all related appurtenances shall be cleaned of all foreign material either by flushing, the use of cleaning buckets, by hand or by a combination of all three.

The sewers shall be inspected by the Contract Administrator for alignment and obstructions. Ponding in gravity sewers will not be accepted.

Regardless of the results of tests as hereinafter provided, all visible or detectable leaks in sanitary and storm sewers shall be repaired by the Contractor as a prerequisite to acceptance of the sewers.

D.3.5.4 Cleaning and Flushing

D.3.5.4.1 Flushing

Sewer sections shall be cleaned using a combination unit with a high velocity jet, approved by the Chief Municipal Engineer. Contractors may obtain water from approved Municipal filling stations only after obtaining permission from the water system operating authority. If the Municipality has allowed a fire hydrant to be used as a filling station, any damage to that, or any other, fire hydrant resulting from misuse shall be the responsibility of the Contractor.

The cleaning equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action in all sizes of pipe. The combination unit shall include a water tank, debris tank, suction mechanism and hydraulically driven hose reel.

Cleaning equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes by use of a vacuum system. The Contractor shall be required to make as many passes as necessary.

If cleaning of an entire section cannot be successfully performed from one manhole, it can be assumed an obstruction is present and cleaning efforts will cease and further investigations done.

D.3.5.4.2 Cleaning Precautions

During cleaning operations, satisfactory precautions shall be taken so that the water pressure created does not damage or cause flooding of public or private property. When possible, the flow of sewage in the sewer shall be utilized to aid in the cleaning process. In older sections of the Municipality, it may be necessary to reduce pressures to less than 7,000 kPa to prevent water damage to homes. A maximum pressure of 11,000 kPa will be used to prevent damage to the sewer lines. The Contractor is responsible for any flooding caused by his flushing operation and must respond immediately to any complaints received.

D.3.5.4.3 Material Removal

Debris such as dirt, sand, rocks, grease and other solid or semi-solid material, which is a result of cleaning, shall be removed at the downstream manhole of the section being cleaned. The Contractor shall plug, bag and/or screen the sewer at the outlet to prevent materials from being flushed into downstream reaches. Passing material from manhole to manhole shall not be permitted due to the risk of a line plugging. This material shall be removed. At the end of each day back flush the last section of sewer cleaned to ensure no build up of debris has occurred.

All catchbasins, double catchbasins and ditch inlets to be cleaned of all construction formed material.

D.3.5.4.4 Disposal of Material

The Contractor shall make provision to properly dispose of all debris in accordance with all provincial legislation and MOE guidelines.

D.3.5.4.5 Re-Inspection

If in the opinion of the Contract Administrator, it is determined that re-inspection is required as a result of inadequate cleaning, the Contractor shall re-clean and re-inspect the sewer at no additional cost to the Municipality.

D.3.5.5 Deflection

Deflection testing shall be carried out on all sewers constructed using plastic pipe

D.3.5.6 CCTV Inspections**D.3.5.6.1 General**

Inspections shall be carried out by the Contractor after the placement of base asphalt and/or finish grading, using television cameras and video recording equipment as specified in OPSS 409. A continuous record of the internal condition of the piping system shall be provided in digital format as specified by the Municipality.

D.3.5.6.2 Acceptance

Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Contract Administrator. If CCTV inspections show the cleaning to be unacceptable, the Contractor is required to re-clean and re-inspect the sewer until accepted by the Contract Administrator.

D.3.5.6.3 Flow Control and By-Pass Pumping

When interruptions of sewer section flows are necessary to effectively conduct inspections, the Contractor shall, subject to the approval of the Chief Municipal Engineer, control flows using plugging and blocking methods.

The Chief Municipal Engineer reserves the right, when necessary, to request bypassing and dewatering of a sewer to be inspected to ensure that the full diameter of pipe is visible.

The contractor will be responsible for any damage to public or private property resulting from the bypass operation or lack thereof. This operation may be requested when the flow depth covers the entire lens for approximately 35% of the line.

A sewer line plug shall be inserted into the line at a manhole upstream from the section to be inspected. The plug shall be designed so that all or any portion of the sewage flows can be released during the inspection. Flows shall be reduced in order to inspect the pipe invert. Sewage levels upstream of the plugged section **shall be monitored at all times**. After the work is completed, flows shall be restored to normal.

D.3.5.7 Measurement and Payment

Unless otherwise provided for in the Contract Documents or the Ontario Provincial Standards, measurement and payment for the commissioning of the sewer system shall be considered to be included within sewer installation.