

**Procedure for
Disinfecting Watermains**

Table of Contents

| | | |
|-------------------|---|----------|
| TS 7.30.01 | SCOPE | 3 |
| TS 7.30.02 | REFERENCES | 3 |
| TS 7.30.03 | DEFINITIONS | 4 |
| TS 7.30.04 | DESIGN AND SUBMISSION REQUIREMENTS – Not Used | 4 |
| TS 7.30.05 | MATERIALS | 4 |
| TS 7.30.05.01 | Disinfectants | 4 |
| TS 7.30.05.02 | De-chlorinating Agents | 5 |
| TS 7.30.06 | EQUIPMENT | 5 |
| TS 7.30.06.01 | Chlorine Residual Testing | 5 |
| TS 7.30.06.02 | Selection, Installation and Testing Backflow Preventer | 5 |
| TS 7.30.07 | CONSTRUCTION | 6 |
| TS 7.30.07.01 | During Watermain Construction and Rehabilitation | 6 |
| TS 7.30.07.01.01 | Installation of Pipes | 6 |
| TS 7.30.07.01.02 | Material Handling | 6 |
| TS 7.30.07.01.03 | Precautions before Disinfection | 6 |
| TS 7.30.07.01.04 | Pressure Testing and Disinfection | 6 |
| TS 7.30.07.02 | Supervision of Disinfection, Inspection, and Testing of Samples | 6 |
| TS 7.30.07.02.01 | Submission of Disinfection Proposal Plan | 6 |
| TS 7.30.07.02.02 | Testing Records | 7 |
| TS 7.30.07.02.03 | Valve Operation | 8 |
| TS 7.30.07.03 | Connection of New Watermain to Watermain in Service | 8 |
| TS 7.30.07.03.01 | Tapping | 8 |
| TS 7.30.07.03.02 | Tapping of Watermains | 8 |
| TS 7.30.07.03.03 | Water Service Pipes and Connections | 8 |
| TS 7.30.08 | DISINFECTION PROCEDURE | 9 |
| TS 7.30.08.01 | General | 9 |
| TS 7.30.08.01.01 | Flushing and Swabbing | 9 |
| TS 7.30.08.01.02 | Valve Operation Sequence | 10 |
| TS 7.30.08.01.03 | Flush to Reduce Turbidity | 10 |
| TS 7.30.08.02 | Standard Chlorination | 11 |
| TS 7.30.08.02.01 | Continuous Feed | 11 |
| TS 7.30.08.02.02 | Slug Method | 11 |

| | | |
|-------------------|--|-----------|
| TS 7.30.08.03 | Flushing after Disinfection | 12 |
| TS 7.30.08.04 | Disposal of Chlorinated Water | 12 |
| TS 7.30.09 | BACTERIOLOGICAL AND WATER QUALITY SAMPLING AND TESTING..... | 12 |
| TS 7.30.09.01 | Qualified Persons | 12 |
| TS 7.30.09.02 | Water Sampling and Bacteriological Testing..... | 12 |
| TS 7.30.09.03 | Re-disinfection..... | 13 |
| TS 7.30.09.04 | Sampling for Short Filler Pieces and Appurtenances | 14 |
| TS 7.30.09.04.01 | Connections Greater than One Pipe Length | 14 |
| TS 7.30.09.05 | Water Quality Parameters for Disinfection Approval | 14 |
| TS 7.30.09.06 | Test Results | 15 |
| TS 7.30.09.07 | Installation of Final Connections and Appurtenances | 15 |
| TS 7.30.09.08 | Sampling of Final Connections and Appurtenances..... | 15 |
| TS 7.30.10 | DISINFECTION OF WATERMAINS DURING CONTRACTED REPAIRS | 16 |
| TS 7.30.10.01 | Sewage or Chemical Contamination..... | 16 |

TS 7.30.01 SCOPE

This procedure covers the disinfection of watermain systems. This procedure applies to new mains, cleaned mains, cleaned and relined mains, repaired mains, temporary mains, service pipes of 100 mm in diameter or greater and mains that have been out of service for a significant period of time.

TS 7.30.02 REFERENCES

Contractors shall comply with all applicable parts of the following Acts, Standards, Specifications or Publications:

Provincial Statute

Ontario Drinking Water Quality Standards
Ontario Regulation 128/04 Certification of Drinking Water System Operators and Water Quality Analysts
Ontario Regulation 170/03 Drinking Water Systems
Ontario Regulation 248/03 Drinking Water Testing Services
Safe Drinking Water Act, 2002

Ontario Ministry of the Environment, Conservation and Parks

Watermain Disinfection Procedure August 2020

City of Toronto Standard Specifications

TS 441 Amendment to OPSS.MUNI 441 (Nov 2016) – Construction Specification for Watermain Installation in Open Cut

City of Toronto Standard Drawings

T-1104.03-4 RP Connection Detail for Above Grade Installation During Disinfection

City of Toronto Form

TS 115 Disinfection Proposal Plan (page 1), Disinfection Record (page 2 and 3) and Exemption (page 4)

TS 116 Hydrostatic Leak Test Record

Toronto Water

Practice No. 8 Watermain, Reservoir and Elevated Tank Disinfection
Municipal Drinking Water Licence Number 010-101
Drinking Water Works Permit #010-201

American Water Works Association

B300 Hypochlorites
B301 Liquid Chlorine
C651 Disinfecting Water Mains
C655 Field Dechlorination
M20 Water Chlorination Principle and Practice
AWWA RF Development of Disinfection Guidelines for the Installation and Replacement of Water Mains

NSF International Standards

NSF/ANSI Standard 60 Drinking Water Treatment Chemicals – Health Effects

Canadian Standards Association

CSA B64.10 Selection and Installation of Backflow Preventers

TS 7.30.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Backflow Prevention means the prevention of a reversal of normal flow that could introduce contamination to the potable water supply; accomplished by an air gap or a CSA approved backflow preventer selected, inserted and tested according to CSA B64.10, Selection and Installation of Backflow Preventers.

Certified Operator means a person who holds a Class I or higher certificate or license issued under the requirement of O. Reg. 128/04 and who conducts operational checks of or who adjusts, tests, or evaluates a process that controls the effectiveness or efficiency of a subsystem and includes a person who adjusts or directs the flow, pressure or quality of water within the subsystem, if that person works in a 'distribution subsystem' or a 'distribution and supply subsystem'.

Service Pipe means the pipe portion of a drinking water system that extends from a watermain to the property line of a property serviced by the watermain (O. Reg. 170/03)

Water Quality Analyst means a person who holds a water quality analyst's certificate issued under section 16 of O. Reg. 128/04 or who holds a conditional water quality analyst's certificate issued under section 17 of O. Reg. 128/04.

Watermain Pipe means any system of pipes and appurtenances used for the distribution of drinking water but does not include plumbing or a pumping facility (O. Reg. 170/03)

Wet Taps means an operational task where a tapping device is used to connect a new watermain or service pipe to a watermain that is full or under pressure and part of the operating system.

TS 7.30.04 DESIGN AND SUBMISSION REQUIREMENTS – Not Used

TS 7.30.05 MATERIALS

TS 7.30.05.01 Disinfectants

Use sodium hypochlorite that meets or exceeds AWWA B300 and is certified against standard ANSI/NSF 60.

Liquid chlorine (gas) according to AWWA B301 and packaged in steel containers.

Calcium hypochlorite according to AWWA B300 in 5 gram tablets or granular form with approximately 65 per cent available chlorine by weight.

TS 7.30.05.02 De-chlorinating Agents

For more information on de-chlorinating agents, see AWWA C655.

TS 7.30.06 EQUIPMENT

TS 7.30.06.01 Chlorine Residual Testing

All chlorine residual field testing shall be performed by using the DPD Drop Dilution Method or High-Range Chlorine Test Kit according to AWWA C651 Appendix A. All test kits shall be calibrated and maintained according to manufacturer's recommendations.

TS 7.30.06.02 Selection, Installation and Testing Backflow Preventer

Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the distribution system and the new main.

The temporary connection shall use a Reduced Pressure Principle (RP) backflow preventor suitable for high or severe hazards according to CSA B64.10. The backflow prevention device shall be installed according to T-1104.03-4.

The following CSA B64.10 installation conditions shall be followed:

- a) Minimum clearance between bottom of RP relief valve and the floor: 300 mm
- b) RP backflow preventers shall not be installed in a below-grade pit or vault.

The backflow preventer shall be field tested upon installation in accordance with the applicable requirements specified for each type of device in CSA B64.10. Field tests shall be performed only by a certified tester that has completed and received a valid Cross-Connection Control Specialist (CCCS) certificate by an accredited organization. Backflow preventer can be relocated within the same day without retesting after the first installation and test, as long as it is relocated by a Certified Operator.

For the purposes of watermain construction and disinfection, the CCCS certificate holder is not required to be a licensed plumber or Certified Operator to qualify as a certified tester of a backflow preventer. Certified Operator or Water Quality Analyst can acquire a CCCS Certificate by the authority of the Ministry of the Environment, Conservation and Parks (MECP) for watermain construction purposes.

Tests shall be performed according to the recommended field test procedure in CSA B64.10.1-11 Annex A as appropriate for the type of Backflow Preventer and testing equipment used. Test results shall be recorded on a form similar to the sample(s) recommended in CSA B64.10 for the appropriate device, and submitted to the Contract Administrator for record keeping and eventually submission to the City along with other contract records.

TS 7.30.07 CONSTRUCTION

TS 7.30.07.01 During Watermain Construction and Rehabilitation

TS 7.30.07.01.01 *Installation of Pipes*

Keep pipes clean and dry. Take precautions to protect the interiors of pipes, fittings, and valves against contamination. Cap all openings with watertight plugs/seals. Remove plugs only when making connections. Complete joints of all pipes in trenches before any stoppage of work, such as at the end of the workday. Pipes shall not be laid in water.

TS 7.30.07.01.02 *Material Handling*

Handle all materials including sealing gaskets and lubricants in a manner to avoid damage and contamination.

TS 7.30.07.01.03 *Precautions before Disinfection*

Contractors shall comply with the following prior to disinfection:

- a) All water required to fill the new main for hydrostatic pressure testing, disinfection and flushing shall be supplied through a temporary connection between the distribution system and the new main. The temporary connection shall include an appropriate backflow preventer according to TS 7.30.06.02, herein.
- b) Provide a minimum 50 mm diameter blow-off at the end of all pipe sections to be disinfected.

TS 7.30.07.01.04 *Pressure Testing and Disinfection*

The Contractor shall pressure test and disinfect all newly installed water mains, hydrant leads and water service pipes 100 mm in diameter and larger. Hydrostatic pressure testing shall be according to TS 441 and test results recorded on form TS 116, Hydrostatic Leak Test Record.

The large diameter water services 100 mm in diameter and greater shall be pressure tested and chlorinated at the same time as the pressure testing and disinfection of the new mainline water main.

TS 7.30.07.02 Supervision of Disinfection, Inspection, and Testing of Samples

TS 7.30.07.02.01 *Submission of Disinfection Proposal Plan*

Contractor performing the disinfection shall submit *Disinfection Proposal Plan* to the Contract Administrator. The Contract Administrator shall review and sign the proposal plan prepared by the Contractor prior to any work commencing. The proposal plan is to include the following:

- 1) Disinfection criteria, including; watermain dimensions, watermain material, disinfection method, contact time, concentration, receiving location and source of supply water. Record this information on form *TS 115 – Disinfection Form* page 1.

-
- 2) Disinfection site map and key map, including; location of mainline valves, backflow preventor, sodium hypo-chlorite application, de-chlorination agent application, flushing, receiving. Record this information on form *TS 115 – Disinfection Form* page 1.
 - 3) Calculation sheets including; chemical volumes, watermain volume, flushing discharge rate and chemical application rates.
 - 4) Hydrostatic leak test records.
 - 5) Emergency response for spills and exfiltration to the distribution or transmission systems.
 - 6) Traffic protection plan—in accordance with the *Occupational Health and Safety Act* (OHSA).
 - 7) Confined space entry procedure—in accordance with the OHSA.

If the *Disinfection Proposal Plan* is determined to be unsuitable by the Contract Administrator, it shall be returned to the Contractor for corrective work to be performed.

All valve or flushing operations on the distribution or transmission systems adjacent to the section of watermain to be disinfected will be suspended until the disinfection activity is completed.

The Disinfection Proposal Plan shall be submitted by the Contract Administrator to Toronto Water along with the valve operation requests for bypass turn on.

TS 7.30.07.02.02 *Testing Records*

The Contract Administrator shall confirm the following before submitting the records:

- 1) That the Contractor has used and fully completed the latest version of the Disinfection Record (Form TS115). Go to www.toronto.ca/ecs-standards "Construction Specifications and Drawings for Sewers and Watermains" to download the latest form.
- 2) That the completed Disinfection Record (Form TS115) Table 2A and 2B, "Post-flushing Water Quality, Sampling and Testing Record" includes turbidity and total chlorine residual test results, field-tested at the same time(s) and at the same location(s) as any bacteriological samples
- 3) That any information entered into the Disinfection Record (Form TS115, Page 2 and 3) is according to the limits set out in TS 7.30 herein.
- 4) That if an exception to installation and disinfection of connections greater than one pipe length and up to a total length of 40 m is present shall be indicated on Form TS 115, Page 4.

Upon completion, all records specified in TS 7.30 herein shall be submitted as one package to the City (DisinfectionResults@toronto.ca) and retained in the contract files for a period of seven years.

Where any errors or omissions are found in the records submission package, Toronto Water retains the right to reject any further valve operation requests until the problems are addressed by the Contract Administrator.

TS 7.30.07.02.03 *Valve Operation*

Any operation of valves and hydrants on the active distribution system shall be performed by a Toronto Water Certified Operator. The Contract Administrator shall notify Toronto Water operational units at least 2 Working Days in advance to make arrangements for the valve operation. Valve operation requests shall be performed on-line using Toronto Water's Water Valve Turn On/Off Appointments scheduling tool.

TS 7.30.07.03 *Connection of New Watermain to Watermain in Service*

TS 7.30.07.03.01 *Tapping*

All wet taps shall be performed by, or under the direct supervision of, a Certified Operator. Certified Operators shall be validated according to TS 7.30.09.01 herein.

TS 7.30.07.03.02 *Tapping of Watermains*

For new watermain replacement projects, the Contractor shall use a tapping sleeve and valve to connect to the existing water distribution system along with a bypass.

The pipe surface at the location of the tap shall be cleaned and disinfected using a minimum 5 per cent sodium hypochlorite solution. Where applicable, the drilling, cutting or tapping bits and all surfaces of main stops, service saddles, tapping sleeves and valves which will come into contact with drinking water shall likewise be cleaned and disinfected using a 5 per cent sodium hypochlorite solution immediately prior to installation. If any of the disinfected surfaces come into contact with the soil or water or both in the excavation prior to use, the cleaning and disinfection procedure shall be repeated.

Upon completion of the wet tapping, a coupon for connections 100 mm in diameter and larger shall be provided to the Contract Administrator.

TS 7.30.07.03.03 *Water Service Pipes and Connections*

Prior to making the connection, the Contractor shall provide each affected customer with a copy of the City's standard *Important Notice* special notice, advising the customer to flush all their taps prior to using the water. The special notice can be found on the City's intranet at <http://insideto.toronto.ca/ppfa/pcu-notification-guide.htm> .

Water service pipes less than 100 mm in diameter shall be installed by wet tapping. The Contractor shall only operate the water service main stop and curb stop. All other valve operations shall be completed by a Toronto Water Certified Operator. The Contract Administrator or inspector shall confirm all wet tapping activities according to this specification herein.

The pipe surface at the location of the tap shall be cleaned and disinfected using a 5 per cent sodium hypochlorite solution. Where applicable, the drilling, cutting or tapping bits and all surfaces of main stops, service saddles, tapping sleeves and valves which will come into contact with drinking water shall likewise be cleaned and disinfected using a 5 per cent sodium hypochlorite solution immediately prior to installation. If any of the disinfected surfaces come into contact with the soil or water or both in the excavation prior to use, the cleaning and disinfection procedure shall be repeated.

TS 7.30.08 DISINFECTION PROCEDURE

All disinfection activities shall be performed according to the MECP Watermain Disinfection Procedure and AWWA C651 Standard.

TS 7.30.08.01 General

A standard disinfection procedure shall ensure the following:

- a) Preventing contaminating material from entering the watermain during storage, construction, or repair.
- b) Removing, by flushing or other means, those materials that may have entered the watermain.
- c) Protecting the existing distribution system with physical separation and backflow prevention during hydrostatic pressure testing and disinfection procedures.
- d) Chlorinating and documenting the process used for disinfection, and then flushing the chlorinated water from the main and disposal of the chlorinated water.
- e) Following disinfection, determining the quality of the water samples collected from the pipe by laboratory testing and ensuring the results meet the requirements of TS 7.30.09.05 herein.
- f) Final connection of the disinfected and approved watermain to the active distribution system.

TS 7.30.08.01.01 *Flushing and Swabbing*

All water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the distribution system and the new main. The temporary connection shall include an appropriate backflow preventer according to TS 7.30.06.02 herein.

Flush and swab new, replaced or relined watermains prior to the start of disinfection. Where achievable, flushing shall attain a scouring velocity of 0.9 m/s.

The physical separation shall consist of two ball valves of a size suitable for the diameter of pipe used for the temporary connection according to T-1104.03-4 and a backflow preventer selected, installed and tested according to TS 7.30.06.02 herein.

When a section of a new watermain is disinfected and the connection(s) to the active (potable) distribution system is completed, it is then considered part of the active (potable) distribution system.

The Contractor shall:

- 1) Confirm watermain is isolated. Blow-off pressure at highpoint of watermain.
- 2) Confirm isolating valve(s) are properly tagged or locked out on site.

Prior to disinfection, all new watermains, branch connections, hydrant leads and service pipes of 100 mm in diameter and greater shall be swabbed.

Swabbing outlets will connect to the new mains and connections using a 45 degree vertical bend and riser pipe that extends above the surrounding ground surface. Swabbing outlets shall be the same diameter as the pipe to which they are connected.

Swabbing outlets will be mechanically capped prior to and after swabbing to prevent entry of debris into watermains and service pipes. During swabbing, discharge water shall be directed to a sanitary sewer inlet. Non-chlorinated or de-chlorinated discharge water shall be discharged to a storm sewer inlet, if not chlorinated. Contractor is to take all necessary measures to avoid flooding and erosion of adjacent properties, and build-up of ice during cold weather.

Swabs shall have a diameter 50 mm larger than the pipe that is going to be swabbed. The new watermain and service pipes shall be filled with water a minimum of 24 hours in advance of the swabbing operation. Swabs shall be propelled using potable water with sufficient velocity to remove debris from the watermain. The swabbing operation should continue until the discharge water runs clear and the last swab is clean. The Contractor shall demonstrate to the Contract Administrator that all swabs or parts thereof have been retrieved from the new watermain.

TS 7.30.08.01.02 *Valve Operation Sequence*

During flushing and disinfection, the new watermain shall be physically separated from the existing water distribution system and a backflow preventer installed.

A Toronto Water Certified Operator, certified under Ontario Regulation 128/04 will operate all distribution and transmission hydrants and valves on the active distribution system.

TS 7.30.08.01.03 *Flush to Reduce Turbidity*

Flush the main at all hydrants and blow-offs to eliminate all air pockets and particulates, and to achieve and sustain a turbidity of less than one nephelometric turbidity units (< 1 NTU) or, at the City's discretion, no higher than that of the incoming water. Do not proceed with chlorination until these turbidity levels are achieved. Verify that the main to be disinfected is isolated from the system and not pressurized. Record the turbidity readings on form TS 115 (Table 1 on page 2).

TS 7.30.08.02 Standard Chlorination

Before beginning chlorination, establish the proper flow rate in the main and adjust the flushing rate and dosage rate as required to achieve the proper chlorine dosage. Document the disinfection process on form TS 115 (Table 1 on page 2) by recording the time and initial chlorine concentrations at each sampling point. Record the chlorine concentrations again after the appropriate contact time has been achieved depending on the disinfection method chosen from Table 1.

The following two methods of chlorination are acceptable for standard disinfection of watermains including temporary bypass systems, and service pipes of 100 mm or greater in diameter and equal or greater than 6.0 m in length.

TS 7.30.08.02.01 *Continuous Feed*

Refer to MOECC, Watermain Disinfection Procedure and AWWA C651 for details.

The flow is adjusted to a constant known rate and sufficient chlorine is added to completely fill the main with chlorinated potable water to produce a homogeneous chlorine solution as specified in Table 1 of this specification. Once this steady state is achieved the chlorinated water is left standing for a specified minimum contact time. For concentration and contact time see Table 1.

To assure that the desired concentration is achieved, the disinfection crew shall measure the chlorine concentration at regular intervals using the appropriate chlorine test kits according to TS 7.30.06.01 herein. Chlorine application is to continue until the entire main is filled with heavily chlorinated water. Document the disinfection process onto form TS 115 – Table 1.

TS 7.30.08.02.01.01 *Total Chlorine Residual at the End of Contact Time*

Successful disinfection is achieved only when the total chlorine residual in the watermain has not decreased by more than 40 per cent of the initial chlorine concentration – to a maximum of 50 mg/L– at the end of the contact time.

TS 7.30.08.02.02 *Slug Method*

Refer to MOECC, Watermain Disinfection Procedure and AWWA C651 for details.

Chlorine and water are applied to the main at a constant measured rate so that a solid column of highly chlorinated water is achieved and moved slowly intact along the watermain so that all interior surfaces have a minimum contact time as specified in Table 1.

The total chlorine residual must be measured at regular intervals as the slug progresses along the pipe. If at any time the total chlorine residual has decreased by more than 25 mg/L, the flow shall be stopped, the chlorination equipment shall be relocated at the head of the slug, and as flow resumes, additional chlorine shall be applied to restore the chlorine concentration in the slug to not less than 100 mg/L. As the slug advances along the pipe, all valves, hydrants and side branches on the isolated side of the system shall be exposed to the disinfection solution.

Table 1: Chlorine concentration and contact time for new watermains¹

| Disinfection method | Minimum contact time | Initial chlorine concentration | Maximum allowable decrease in chlorine concentration |
|----------------------------|-----------------------------|---------------------------------------|---|
| tablet or continuous feed | 24 hours | ≥ 25 mg/L | 40% of the initial chlorine concentration to a maximum of 50 mg/L |
| slug | 3 hours | ≥ 100 mg/L | 25 mg/L |
| spray | 30 minutes | ≥ 200 mg/L | Measurement not required |

¹ At levels over 10 milligrams per litre, a measurement of total chlorine shall be deemed to be equivalent to a measurement of free chlorine.

TS 7.30.08.03 Flushing after Disinfection

Begin final flushing of the heavily chlorinated main only if after the specified minimum contact time has elapsed, the measured chlorine concentration at each sampling point has not decreased more than the "maximum allowable decreases" from Table 1. The heavily chlorinated water shall be completely dechlorinated prior to being discharged into the environment according to TS 7.30.08.04 herein. Flush the main via hydrants and blow-offs until the following water quality parameters are consistently met: turbidity is less than 1 NTU, and total chlorine residual is between 0.50 mg/L and 2.5 mg/L, or at the City's discretion, no higher than that of the incoming water. Once these parameters are achieved, flushing shall continue for an extra 30 minutes as a precaution. Proceed with TS 7.30.09 to determine the bacteriological quality of water samples collected from the pipe.

TS 7.30.08.04 Disposal of Chlorinated Water

After disinfection, discharge the chlorinated water into a sanitary sewer. If a sanitary sewer is not available, do not discharge to a storm sewer, open ditch or watercourse unless the chlorinated water has been de-chlorinated. A list of de-chlorinating (neutralizing) agents can be found in AWWA C655. All discharges must comply with Toronto Municipal Code, Chapter 681 Sewers.

TS 7.30.09 BACTERIOLOGICAL AND WATER QUALITY SAMPLING AND TESTING

TS 7.30.09.01 Qualified Persons

All testing prescribed by the Safe Drinking Water Act, including field-testing of drinking water shall be performed by a Certified Operator or Water Quality Analyst. Certification must be validated on www.OWWCO.ca. If an instance occurs when the name of a person claiming to be a Certified Operator cannot be verified, then the local MOECC Water Compliance Supervisor must be notified immediately.

TS 7.30.09.02 Water Sampling and Bacteriological Testing

After disinfection and final flushing such that normal water quality parameters are met according to TS 7.30.08.03, bacteriological samples shall be collected from sampling points along the main to verify the quality of the disinfection.

Samples from the new main shall be shown on the disinfection site map and taken as follows:

- a) From the first sampling point located approximately 350 metres downstream from the source, and then at every 350 metres interval thereafter, if applicable, with an additional final sampling point at the end of the primary watermain.
- b) From each branch connection of 100 mm in diameter or greater with no minimum length threshold, and then at every 350 metres interval thereafter, if applicable. The aforementioned branch sampling point is encouraged to be used in lieu of a sampling point on the primary watermain as long as the distance between two consecutive sampling points from the perspective of the primary watermain does not exceed 350 metres.

If no branch connection exists, then a sampling point must be tapped into the primary watermain to adhere to the 350 metre interval requirement.

- c) Branch connection include water service pipes of 100 mm in diameter and greater, hydrant leads and side-street connections.

All samples shall be collected in a manner as to avoid contamination from the environment surrounding the main. Collect samples for bacteriological analysis in sterile bottles treated with sodium thiosulfate according to Section 9060 *Standard Methods for the Examination of Water and Wastewater*. Do not obtain samples from a hose or fire hydrant unless there are no alternative sampling points available.

No bacteriological samples shall be taken unless the turbidity and total chlorine residuals levels have first been tested and confirmed to be within the limits set out in Table 2. Turbidity and chlorine residuals test results shall be recorded on the Disinfection Record (TS115 – Table 1). Record the ID of the corresponding Chain of Custody / Sample Submission document used during submission of the samples to an accredited laboratory for testing on the Disinfection Record (TS115 – Table 2). All bacteriological samples shall be tested by a laboratory that is licensed by the Ministry of the Environment, Conservation and Parks (MECP) to test drinking water.

Before approving a main for release, an initial set of samples shall be taken, then after a minimum of 16 hours have elapsed after the initial set without any water use, a second set of samples shall be taken from the same locations. Both sets of samples shall adhere to the water quality parameters in Table 2 prior to approving the release of the watermain.

TS 7.30.09.03 Re-disinfection

If any of the two consecutive bacteriological sample sets fail to meet the water quality parameters in Table 2, the Contract Administrator can request for additional flushing prior to attempting another cycle of two consecutive sets of bacteriological samples. If the bacteriological testing continues to fail even after two additional cycles of sampling, it is recommended to repeat the disinfection steps.

TS 7.30.09.04 Sampling for Short Filler Pieces and Appurtenances

After the Contractor has installed the final connection – filler piece – and appurtenances or both, a Toronto Water Certified Operator shall obtain one water sample from the filler piece for bacteriological testing according to AWWA C651, Section 5.10. The valve separating the disinfected main from the existing distribution system will not be opened until this bacteriological sample has passed.

If the filler piece continues to fail the bacteriological testing, consult with Toronto Water, Customer & Technical Support Services section to develop a site specific plan to resolve the water sample failures.

TS 7.30.09.04.01 Connections Greater than One Pipe Length

Connections greater than one pipe length, generally greater than 6 m shall be undertaken in accordance with Section 4.10.2 of ANSI/AWWA Standard C651. An exception to the procedure described below may be used at the discretion of the Contract Administrator for the installation and disinfection of connections greater than one pipe length and up to a total length of 40 m, if the connection:

- a) Crosses a transportation corridor, the extended closure of which could result in significant community impacts (e.g., traffic congestion, loss of emergency vehicle access, safety concerns), or
- b) Cannot be constructed to within one pipe length of the existing watermain due to the potential for destabilizing an existing thrust block.

If exception used, Form TS 115 (page 4) must document that construction meets one of the two criteria a) and b) for Contract Administrator to grant the use of a limited disinfection exception for pipes up to 40 m in length.

TS 7.30.09.05 Water Quality Parameters for Disinfection Approval

A watermain shall not be approved for release unless the standards in Table 2 below have been met for each verification sample taken:

Table 2: Water quality parameters for disinfection approval

| Parameter | Standard |
|--------------------------------------|------------------|
| Total Coliform | 0 CFU/100 mL |
| E. Coli | 0 CFU/100 mL |
| Background Colony Counts | < 100 CFU/100 mL |
| Heterotrophic Plate Counts | < 500 CFU/1 mL |
| Turbidity ^a | < 1.0 NTU |
| Total Chlorine Residual ^a | 0.50 to 2.5 mg/L |

Note ^a: These must be field-tested at the same time and from the same location as the bacteriological samples. Test results shall be recorded on the Disinfection Record (TS115) next to the associated bacteriological sample. Failure to do so constitutes as a failure of the standard.

In certain circumstances, Toronto Water operations unit may exercise discretion and approve disinfections where a parameter not related to health such as turbidity, fails to be met due to the quality of supply water.

TS 7.30.09.06 Test Results

E-mail scanned copies of all laboratory water quality test results, along with the completed Disinfection Record (TS115 Page 2) to the Contract Administrator. Upon receipt of these documents, the Contract Administrator shall determine if the test results and completed Disinfection Record (TS 115) are acceptable according to this specification. If acceptable, the Contract Administrator shall provide an electronic copy of these completed records to Toronto Water to schedule sampling of the final connection by Toronto Water prior to final release of the new watermain.

The Contract Administrator shall e-mail all test results to DisinfectionResults@toronto.ca to comply with MECP record keeping requirements.

TS 7.30.09.07 Installation of Final Connections and Appurtenances

Once the bacteriological test results have met the Water Quality Parameters specified in Table 2, the final connection of the newly disinfected watermain to the distribution system can begin. Only a Toronto Water Certified Operator is permitted to operate the connecting valve. All installed final connections—also known as filler-pieces—of 6 metres or less in length and applicable appurtenances must be clean from dirt and debris, then sprayed or swabbed with a minimum of 5 per cent solution of freshly prepared sodium hypochlorite solution with a minimum contact time of 30 minutes prior to use. Final connections longer than 6 metres must be disinfected and tested as a new watermain in accordance to TS 7.30 herein.

Final connections – filler pieces – do not need to be physically separated from the active distribution system with a backflow prevention device however, a valve must be used and left in the off position until satisfactory microbiological testing of the final connection is received.

TS 7.30.09.08 Sampling of Final Connections and Appurtenances

Watermains and appurtenances shall be completely installed, flushed, disinfected and satisfactory bacteriological sample results received prior to permanent connections including branch connections being made to the active distribution system. Once the permanent connections are installed, a Toronto Water Certified Operator can be scheduled to verify the quality of disinfection by obtaining one water sample from the final connection for bacteriological testing. Scheduling shall take place according to TS 7.30.07.02.03 herein.

The valve separating the disinfected main from the existing distribution system will remain closed unless for flushing or sampling, until the sample meets the water quality parameters specified in Table 2.

If the final connection continues to fail the bacteriological testing, consult with Toronto Water to develop a site specific plan to resolve the water sample failures.

TS 7.30.10**DISINFECTION OF WATERMAINS DURING CONTRACTED REPAIRS**

All emergency watermain repairs performed by non-City of Toronto Certified Operators shall be considered a Category 2 type break according to the MECP's Watermain Disinfection Procedure. This means that for all cases, a minimum of one bacteriological sample shall be collected by a Toronto Water Certified Operator as soon as reasonably possible after the completion of the repair. Only the Toronto Water Certified Operator is permitted to operate any valves on the watermain. For repair procedures, please refer to the MECP's Watermain Disinfection Procedure (s.3.2) for guidance.

TS 7.30.10.01**Sewage or Chemical Contamination**

If there is evident or suspected sewage or chemical contamination of a watermain, for example petroleum products, liquids of abnormal colour and so on, the Contractor shall immediately notify the Contract Administrator, who will then immediately notify a Toronto Water supervisor. Under no circumstances is the return to normal service of the watermain permitted until further notice by Toronto Water.