

**City of Kawartha Lakes Watermain Commissioning Standard Operating Procedures (SOP)**

**Definitions**

**AWWA** - American Water Works Association.

**Consulting Engineer Inspector (referred to herein as “Inspector”)** - shall be the onsite construction inspector, hired by the Consulting Engineer on record for the subdivision/development project, as approved by the City, to supervise construction activities. For Municipality initiated projects, a CKL Construction Inspector, approved by the Director of Public Works or designate, shall be onsite to supervise construction activities.

**Construction Contractor** – the contracting company undertaking the installation of the servicing works, on record for the subdivision/development or as hired by the City.

**Certified Water Operator Contractor** – shall be a company specializing in regulated water systems, whose personnel have current MOECC Certification as per Ontario Regulation 128/04, as amended, and are approved by the City of Kawartha Lakes Director of Public Works or designate.

**CKL WWW Staff** – City of Kawartha Lakes Water/Wastewater Distribution Chief Operator or designate, holding current MOECC Certification as per Ontario Regulation 128/04, as amended.

**Disinfectants** – shall be calcium or sodium hypochlorite that meets or exceeds AWWA Standards.

**Neutralizing Agent** – shall be sodium thiosulfate that meets or exceeds AWWA Standard C651.

**ODWSR** – Ontario Drinking Water Systems Regulation

**NSF Certified** – National Sanitation Foundation Certified

**Connect to Existing Watermain**

The connections to the existing watermain shall not be made until the new watermain, or a section thereof has been swabbed, pressure tested, flushed, disinfected and sampled to the satisfaction of the Director of Public Works or designate.

All cost associated with steps and procedures required for acceptance of the new watermain, as well as temporary and permanent connections to existing watermains shall be borne by the Construction Contractor. Temporary watermains shall include the installation of isolation valves.

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All work but not limited to swabbing, flushing, disinfection, bacteriological sampling and leakage testing must be performed by a Certified Water Operator Contractor, as per Ministry of Environment Climate Change regulations O'Reg 128/04 Water Resource Act. A copy of the current certificate is to be provided to the City's Quality Management and Policy Coordinator prior to the commencement of work.

Prior to the commencement of work, all hydrants must be installed to the flange final grade elevation, as per approved design. Any hydrant adjustments required after the water system is commissioned must be completed under the direct supervision of CKL WWW Distribution Staff. All work required to be performed by or under the direct supervision of CKL WWW Distribution Staff will be charged back to the Construction Contractor.

Once the final round of bacteriological sample results has passed, the connection to the existing watermain shall be performed.

A sump, minimum 300 mm depth, shall be excavated in the trench bottom, and filled with clear stone, to provide a location to collect and pump water.

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

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 Inspector and/or CKL WWW Distribution Staff, at the Contractors expense.

The Construction Contractor will not be permitted to connect to the existing watermain if the final connection is greater than one pipe length or 6 meters.

When the final connection length is greater than one pipe length, the new pipe required for the connection shall be set up above ground, disinfected and bacteriological sample rounds taken as required for the new watermain. After two consecutive rounds of satisfactory samples have been received for the "pre-disinfected" pipe, the pipe can be used in connecting the new main to the active distribution system. Between the time the satisfactory bacteriological sample results are received and the time that the connection piping is installed, the ends of the pipe must be sealed with clean, disinfected, watertight plugs or caps.

When the connection length is one pipe length or less, the new pipe, fittings and valves required for the connection shall be spray-disinfected, swabbed and/or sprayed with a minimum 1% to maximum 5% as per AWWA solution of NSF certified chlorine,

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immediately prior to being installed. In addition, the existing watermain being connected to; shall be cleaned, in the immediate area of the connection, and spray disinfected with the same solution.

All temporary caps (if required) shall be kept in place during the installation procedure until immediately prior to making the connection.

The existing watermain in the immediate area of the connection, as well as the newly required fittings and valves, shall be cleaned and spray-disinfected with a minimum 1% to a maximum 5% solution of NSF certified chlorine immediately prior to connection.

When the connection of the new PVC watermain is being made to an existing ferrous watermain, a 14.5 kg magnesium anode shall be installed on the ferrous watermain within 1.5 m of the point of connection to the PVC watermain.

Solid sleeve type couplings shall be used to assemble the final connection and shall be prevented from moving along the pipe by installation of mechanical restrainers of each side of the solid sleeve.

All open ends of sections of existing watermain that are to be abandoned in place after the connection is made shall be plugged with 20 MPa concrete. The minimum length of the plug shall be 300 mm.

**Swabbing, Flushing, Disinfection, Leakage Testing and Bacteriological Testing****Introduction****a) Scope- Watermain Installation and Testing Procedures**

This procedure covers the cleaning, disinfection, hydrostatic testing and sampling of watermain. Unless specified otherwise, this procedure applies to all new watermain, above ground bypass watermain and relined watermain.

**b) References**

These procedures are based on, and shall be used in conjunction with, the Ontario Provincial Specifications (OPS), the American Waterworks Association (AWWA C651) Standards, and the Ontario Safe Drinking Water Act, CAN/CSA – B64.10.

**c) General Requirements for Watermain Installation**

Keep pipes clean and dry. Take precautions to protect the interiors of pipes, fittings, and valves against contamination. Cap open ends of each installed pipe with watertight

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plugs. Remove plugs only when connecting pipe or appurtenance. Pipes shall not be laid in water. Existing watermain, which are dead ended during construction, shall have a minimum 25 mm bleeder installed at the dead end. New watermain which are temporarily dead ended shall have a minimum 50 mm blow off installed with a temporary cap.

d) Supervision, Testing, and Records

The Inspector shall witness all cleaning, hydrostatic testing, disinfection, and sampling activities. The Certified Water Operator Contractor carrying out the cleaning and disinfection in conjunction with the Inspector shall take and record measurements on City of Kawartha Lakes approved "Watermain Commissioning Checklist" form. Final sign-off from CKL WWW staff is required on the "Watermain Commissioning Checklist" form.

CKL forces are to be present on site to inspect the swabbing, flushing and pressure testing. If CKL forces are unable to attend at the scheduled time, the inspector shall take documentation (i.e. pictures, videos, reports) to verify the work was completed in accordance with CKL Standards and Procedures.

e) Valve Operation

The Contractor should note that the CKL WWW Staff must perform the operation of all existing valves in service, inclusive of hydrant secondary valves and curb stops. The opening and closing of any valves must be coordinated with the CKL WWW Staff. All residences shall be notified in writing, by the Contractor 48 hours prior to a planned disruption of water service. Notification must be approved by the CKL WWW Staff in advance of distribution to the public.

f) Forms

The following forms shall be supplied by the City of Kawartha Lakes or completion by the Certified Water Operator Contractor and the Inspector: "Watermain Commissioning Checklist."

g) Connection and Testing Procedures Plan

The Contractor shall submit a plan to the Inspector for review prior to submitting to CKL for approval detailing:

- Temporary bypass connections including a backflow preventer
- Connection locations
- Swabbing locations
- Hydrostatic testing
- Disposal of super chlorinated solution

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- Final connection methods
- Isolation valves
- Pipe sizes
- Hydrant
- Blow-offs
- Appurtenances
- A figure shall be submitted showing location of all hydrants, blow offs, swabs etc.

Connections including backflow preventer, connection locations, swabbing locations, hydrostatic testing, chlorination and de-chlorination methods disposal of water, and final connection methods. The Inspector shall review and submit to CKL WWW Staff for approval. If the project is being constructed in phases, this plan shall detail each of these items for each phase. The Inspector shall allow two weeks for CKL WWW Staff to review.

**Watermain Testing Procedure**

This document is to be read in conjunction with the forms entitled “Watermain Commissioning Checklist”. This procedure is to be used in conjunction with the Ontario Provincial Specifications (OPS), the American Waterworks Association (AWWA) and the Ontario Drinking Water Regulations (ODWR).

All required low-end chlorine residual tests shall be performed by the Certified Water Operator Contractor, with an electronic tester such as a Hach Pocket Colourimeter or equivalent, which is to be supplied by the Certified Water Operator Contractor and witnessed by the Inspector. Proof of calcimeter calibration shall be provided as requested.

Temporary bypass piping shall meet all procedures and requirements of new watermain with the exception of hydrostatic pressure testing. A visual check shall be performed at line pressure on a temporary bypass to ensure that it is leak free.

i. Temporary Connection and Backflow Preventer

The temporary connection is to be used for all water supplies to maintain continuous supply of water, unless otherwise noted. The size of the temporary connection shall be; 50 mm diameter for watermains up to and including 200 mm diameter, and 100 mm diameter for watermains 250 mm diameter to 400 mm diameter inclusive. All materials for the temporary connections are to conform to the City's Approved Manufactures List. When the temporary connection is no longer required, it shall be removed and plugged with a brass plug. The procedure shall be witnessed by the Inspector and drip tested for leaks.

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

The existing distribution systems and the backflow preventer shall be physically disconnected from the test section during hydrostatic testing.

ii. Charging of Watermains

The watermain is to be loaded via a temporary connection equipped with a backflow preventer.

iii. Swabbing

The watermain is to be loaded (charged or pressurized) by the Certified Water Operator Contractor prior to the commencement of swabbing. The Certified Water Operator is to record, on the "Watermain Commissioning Checklist" form, the number of swabs inserted and retrieved. The Inspector is to confirm the number of swabs inserted and retrieved. The main valve seat of the hydrant must be removed and a blind seat installed to prevent undermining the soil at the hydrant boot. Full reinstatement of the hydrant shall begin immediately after the swabbing process is completed. All swabs must be inspected prior to insertion and immediately after they exit the watermain to insure that they have remained intact and that pieces of the foam do not stay in the watermain. The swabs should also be numbered and carefully controlled by the Certified Water Operator Contractor- to ensure that all swabs that are introduced into the watermain are retrieved and accounted for. Only new swabs will be permitted for use and under no circumstances will used swabs be allowed. Swabs must be pushed with the temporary connect. The City will not open a valve to push swabs.

All watermain pipes must be swabbed with a minimum of THREE swabs plus a minimum of one swab shall be passed through each hydrant lead, stub or blow-off. Additional swabs shall be used as directed by the Inspector, if discharge water does not run clear within ten seconds of the swab exiting the discharge point. Swabs shall be forced through the watermain using potable water so that they maintain a minimum velocity of 0.6 to 1 meter per second, as per AWWA standards.

The Inspector must approve all methods of disposal of the discharged water. The Construction Contractor shall take the necessary precautions to minimize soil erosion and shall reinstate the area upon completion. All swabbing must be completed before any services are tapped.

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The swabs must be new open cell polyurethane foam, having a density of 1.5 pounds per cubic foot (24 kilograms per cubic meter), and are to be a minimum of 50 mm larger (one pipe size) than the normal pipe diameter with a length at least one and a half times its diameter.

Watermains 300 mm or smaller shall be swabbed through standard pipes. Alternatively, watermains can be swabbed through hydrants upon approval by the inspector.

iv. Hydrostatic Testing

Leakage tests shall be applied to the section of watermain after the swabbing. The Certified Water Operator Contractor shall ensure that no air pockets are present in the section of watermain. The existing distribution systems and the backflow preventer shall be physically disconnected from the test section during hydrostatic testing. The ends of the mains shall be capped and the main filled with potable water under pressure of 150 psi after which all visible leaks shall be stopped. Leakage shall then be measure by the calibrated meter with readings taken at fifteen minute intervals for a period of three hours and recorded on the "Watermain Commissioning Checklist" form. The allowable leakage calculation shall be in accordance with AWWA C605-05 or latest version, and if the leakage exceeds this figure the contractor shall locate and correct the leaks. The watermain is to be tested in sections, where a section is a length of watermain between two valves, or a valve and a dead end. Maximum allowable test section shall be 300 m. Should the contractor wish to test more than one section at a time, the Inspector will calculate the allowable leakage for all sections within the tested portion and the smallest calculated leakage will become the allowable for the entire tested portion.

On the rare occurrence where the test is not successful the leak(s) are to be found, repaired and the hydrostatic test to be applied again until it is successful.

For high density polyethylene (HDPE) pipe the test section is not to include any other materials. A 3 to 4 hour deformation period, maintaining 150 psi, will be required immediately prior to the hydrostatic testing.

As per AWWA, "Pressure testing shall be conducted in accordance with ASTM F2164, Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure. The HDPE pipe shall be filled with water, raised to test pressure and allowed to stabilize. The test pressure shall be 1.5 times the operating pressure at the lowest point in the system. In accordance with section 9.8, the pipe shall pass if the final pressure is with 5% of the test pressure for 1 hour. For safety reasons, hydrostatic testing only will be used."

[Sample Specifications for AWWA High Density Polyethylene Pipe and Fittings](#)



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Temporary above ground by-pass piping shall meet all procedures and requirements of new watermain with the exception of hydrostatic pressure testing. A visual check shall be performed by the Certified Water Operator Contractor at line pressure on a temporary by-pass to ensure that it is leak free.

v. Disinfecting Watermain

The method of disinfection to be used is the continuous feed method. The NSF certified chlorine is to be injected into the system through the access point on the temporary connection. The NSF certified chlorine solution is to be thoroughly mixed prior to pumping it into the system. The Certified Water Operator shall ensure that no air pockets are present in the section of watermain. The NSF certified chlorine solution shall be applied so that the chlorine concentration is a minimum of 50 mg/L throughout the system and does not exceed 100 mg/L and recorded. The chlorine solution is to be flowed through each hydrant and blow off. The high chlorine residual is to be measured by the Certified Water Operator Contractor at each sample location and recorded by the Inspector.

The high chlorine concentration will be isolated in the system for a minimum of 24 hours and recorded on the "Watermain Commissioning Checklist" form. After the required contact time, the chlorine residual is to be taken at each sample location by the Certified Water Operator Contractor and recorded by the Inspector. Flow required sampling for the chlorine residuals shall be provided through the temporary connection. Watermain disinfectant concentration and contact duration shall be as per the chart below.

<b>Table 1: Watermain Disinfectant Concentration and Contact Duration for New Watermains Using Continuous Feed Method</b>		
Contact Duration (hours)	Initial Disinfectant Concentration (mg/L)	Maximum Allowable Decrease in Chlorine Concentration
24	≥ 25 mg/L	40% of the Initial Chlorine Concentration to a Maximum of 50 mg/L

In the event that the chlorine residual is at or less than the required concentration the disinfection process is considered to have failed. The chlorine in the system is to be discharged, and the system is to be re-chlorinated. The Certified Water Operator Contractor has the authority to require further swabbing if the residual is less than 60% the initial concentration.

vi. Removal/Disposal of Super Chlorinated Water



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The watermain is to be flushed to remove super chlorinated water. For the disposal of super chlorinated water, the Certified Water Operator Contractor is to ensure throughout the disposal process that the chlorine residual in the neutralized water does not exceed 0.5 mg/L. The sanitary sewer shall not be considered an option for disposal during this procedure. Super chlorinated water may not be disposed to a storm sewer or watercourse unless the residual is reduced to a maximum of 0.002 mg/L. Methods of disposal include flushing through a neutralizing dam (ensuring 0.5 mg/L being achieved) and/or flushing to a neutralizing tank. Neutralizing Chemicals as per AWWA C651-99 Sec. 6 Appendix C. The neutralized water shall be tested by the Certified Water Operator Contractor for total chlorine residual to ensure that it meets requirements. This test shall be witnessed by the Project Inspector.

vii. Bacteriological Sampling

Before the watermain, or temporary above ground bypass system, can be approved for connection to the existing water distribution system, two (2) consecutive rounds of water samples, taken according to ANSI/AWWA C651-14 Option 'A' or Option 'B' shall pass both the chlorine residual and bacteriological requirements. Prior to chlorine residual and bacteriological testing, all other testing and disinfection shall be completed and any super chlorinated water remove from all portions of the watermain system under consideration including hydrant leads, stubs, branches, services, etc.

Option A:

The initial bacteriological sample shall be taken after the removal of the super chlorinated water has been completed. The second bacteriological sample shall not be taken until a minimum of 16 hours post initial sample.

Option B:

The initial bacteriological sample shall not be taken until 16 hours after the removal of the super chlorinated water. The second bacteriological sample shall be taken a minimum of 15 minutes after the initial sample while sampling taps are left running.

- The Certified Water Operator Contractor will ensure the temporary connection is open and take a bacteriological sample at each sample location and deliver it to a laboratory approved by the City.
- Samples shall be taken from the end of every dead end and, from every 300 metres or less, of new watermain pipe. No hose shall be used in the collection of bacteriological samples. The watermain must remain continually pressurized from the start of bacteriological testing until the connection to the existing system is undertaken.

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## viii. Sample Results

The Certified Water Operator Contractor shall ensure the laboratory provides the sample results, within 49 hours after the samples are delivered. The Licensed Water Operator Contractor will provide the sample results to the inspector and CKL WWW Staff. The laboratory will mail a hard copy of the sample results to the City of Kawartha Lakes Water and Wastewater Supervisor. A single failed bacteriological parameter will constitute a failure of the entire sampling round. If sample results do not meet requirements the failed section must be flushed or re-disinfected, as directed by the Inspector and/or CKL WWW Staff, and re-sampled at sample locations determined by the Inspector and/or CKL WWW Distribution Staff until two (2) consecutive rounds of water samples, taken as per either Option A or Option B for sampling, pass both chlorine residual and bacteriological requirements.

ACCEPTABLE BACTERIOLOGICAL AND CHLORINE RESIDUAL TEST RESULTS	
E. Coli	0 CFU/100 mL
Total Coliform	0 CFU/100 mL
Heterotrophic Plate Count	100 CFU/1 mL
Cl Residual	0.5 mg/L min

If two (2) consecutive rounds of sample results are successful, the sampling results must be attached to the completed form entitled, "Watermain Commissioning Checklist". The completed form, with attached acceptable bacteriological test results, must be provided to CKL WWW Staff for signature at the time of connection.

## ix. Tracer Wire

Tracer wire must be confirmed at the time of installation as per the watermain commissioning checklist.

To ensure there is no damage to the tracer wire during or after construction, the developer shall complete a continuity test on the watermain or tracer wire during the commissioning process and again during the assumption process.

Should the City, Consultant or the Certified Water Operator Contractor performing the tracer wire continuity test find any problems with continuity or installation of the tracer wire, the Contractor/Developer shall be responsible for all repairs and site remediation as required, at no cost to the City.