SUBJECT: New Water Main Testing and Commissioning	**AUTHORITY & SEC:** Safe Drinking Water Act, 2002, S.O. 2002, c. 32 AWWA Standard C651-05 Ontario Provincial Standard Specification 701				
DEPARTMENT: Operations and Engineering	**PAGES:** 12		**DAY**	**MONTH**	**YEAR**
			12	12	08
		REV	12	12	13
APPROVED BY: Director of Operations and Engineering	**CONTACT POSITION FOR INFO:** Director of Operations and Engineering				

The Corporation of the Town of Georgina is responsible for the operation, maintenance and repair of the water distribution system.

This procedure is an integral component of the Towns Drinking Water Works Permit 119-201 (DWWP).

It includes the cleaning, disinfection, hydrostatic testing and bacteriological sampling of all new potable watermains including above ground temporary watermains, private watermain systems and (ICI) Industrial, Commercial and Institutional development and/or redevelopment subject to the Ontario Building Code.

OBJECTIVE

To provide watermain testing and commissioning procedures in accordance with recognized methods and practices while protecting the existing water distribution system from bacteriological contamination and the natural environment from adverse effects that may be caused as a result of this testing procedure.

PURPOSE

To provide contractors, consultants and Town of Georgina staff with a standardized method for the testing and commissioning of new potable watermains.

GENERAL

The new watermain shall not be connected to the existing water distribution system prior to completion of the cleaning, disinfection, hydrostatic testing and bacteriological sampling except temporarily through an approved, certified and tested backflow device unless otherwise approved by the Department of Operations and Engineering Water/Wastewater Division.

At locations where the new watermains are to be connected to the existing watermains they shall be stopped short of the connection point. Swabbing launch points shall be brought to the surface, capped, restrained and fitted with an appropriately sized blow off and valve.

The Contractor carrying out the cleaning, testing, disinfection, hydrostatic testing and bacteriological sampling shall submit a copy of their Watermain Disinfection Policy/Procedure to the Department of Operations and Engineering Water/Wastewater Division for approval prior to commencing work.

All bacteriological sampling performed by the Contractor shall be carried out by persons holding valid Ministry of the Environment Water Distribution or Water Quality Analyst Certificates. Copies of same are to be submitted to the Department of Operations and Engineering Water/Wastewater Division prior to commencing work.

The Department of Operations and Engineering Water/Wastewater Division shall witness all cleaning, disinfection, hydrostatic testing and sampling activities performed by the Contractor. The Contractor carrying out the cleaning and disinfection shall document all activities on the Town of Georgina FORM 009 - Watermain Testing and Commissioning Report. All such records shall be submitted to Department of Operations and Engineering Water/Wastewater Division for approval prior to making final connections to the existing water distribution system.

A proposed work schedule shall be submitted a minimum of three (3) working days prior to commencement of any testing related to this procedure by the Contractor to the Department of Operations and Engineering Water/Wastewater Division for approval. The Building Department shall be notified of the same for all projects under ICI categories.

No deviations from the forgoing procedure shall be permitted unless submitted in writing by the Project Consultant and/or Contractor to the Department of Operations and Engineering Water/Wastewater Division for approval. Any proposed deviations shall reference recognized methods

and practices for the cleaning, disinfecting, hydrostatic testing and sampling of potable watermains.

VALVE OPERATION

All existing water distribution system valves shall only be operated by Town of Georgina Water/Wastewater Division operators unless otherwise approved by a Town of Georgina Water/Wastewater Operator. The Contractor is to contact the Department of Operations and Engineering Water/Wastewater Division to make arrangements for this operation.

TESTING PROCEDURE

Chlorine residuals and turbidity shall be tested with an approved electronic tester such as a Hach Pocket Colorimeter or equivalent. Copies of the manufacturer's calibration certificates must be submitted to the Department of Operations and Engineering Water/Wastewater Division prior to commencing work.

A) Sample Point Drawings

A separate drawing labeled "Sample Point Drawing" is required to be submitted for approval with the submission of engineering drawings for proposed development(s) as per the Town of Georgina development design criteria.

Sample Point Drawings shall show the following information:

1) Location of existing potable water supply indicating "connect to only with an approved and certified backflow device"
2) Swab launch points
3) Sample points
4) Turbidity sample locations
5) All watermains, mainline valves, hydrants and secondary valves
6) All water services
7) De-chlorination points and discharge locations
8) Flow requirements indicating existing water distribution system static pressure at by pass location and achievable flushing velocity
9) Location and size of the by-pass
10) All fire hydrants within the development and immediately bounding outside the development on the existing distribution system denoting flow and residual hydrants for the purposes of flow testing

Where the scope of the work requires the watermain to be tested in phases this shall be indicated on the Sample Point drawing.

All identified locations to be used for any type of sampling or testing must reference municipal addresses as assigned by the Town and/or lot numbers as per the registered M-plan. Where this is not practical, a clear description of the sample or testing location must be given.

NOTE - All sample and test points are to be brought to the surface complete with a valve.

B) Loading of Watermain

Prior to loading of the new watermain all mainline valves and fire hydrant secondary valves in the new system shall be checked to ensure they are in a full open position. This task shall be witnessed by the Department of Operations and Engineering Water/Wastewater Division.

During loading of the watermain, all service connection curb stops and blow offs shall be opened expelling all air from the service line.

The new watermain shall be loaded via the by-pass connected to the existing distribution system or an approved potable water supply as indicated on the Sample Point Drawings. The by-pass shall be used for all water supply unless otherwise noted on the Sample Point Drawings and approved by the Department of Operations and Engineering Water/Wastewater Division.

The minimum size of the by-pass shall be 50mm (2 inch) in diameter, or larger in order to achieve a flushing velocity of .76 m/sec (2.5 ft/sec) and fitted with an approved and certified backflow device. A copy of the inspection record for the device is to be provided to the Department of Operations and Engineering Water/Wastewater Division.

Water Main Size		**Flow Required**	
(mm)	**(inches)**	**(ltrs/sec)**	**(gpm)**
100	4	6.3	82
150	6	12.6	183
200	8	25.2	326
250	10	37.9	509
300	12	56.8	733
400	16	100.9	1304
450 and larger *			

*** Flow requirements to be noted on the Sample Point Drawing.**

All materials used for the by-pass are to be approved for potable water supply and are subject to approval by Department of Operations and Engineering Water/Wastewater Division.
The bypass shall be disconnected during the hydrostatic testing procedure.

The by-pass shall be permanently removed once all testing is completed and accepted. For direct bury installations, the saddles and associated piping shall be removed and repair clamps installed in their place. For chamber installations, the main stops shall be removed and the by-pass opening closed in an approved manner. This task shall be witnessed by the Department of Operations and Engineering Water/Wastewater Division.

C) Hydrostatic Testing

All above ground temporary watermains are not required to complete this section. A visual inspection for leaks shall be completed upon loading of the temporary watermain while maintaining existing water distribution system pressure. Any leaks found shall be corrected prior to swabbing and chlorination.

The watermain hydrostatic test is to be completed in the following manner:

General Procedure

Stage 1

The watermain shall be pressurized to 1035 kPa (150 psi) and maintained there for one (1) hour during which time small pressure drops may be topped up to maintain the 1035 kPa (150 psi) testing pressure. The test section shall not exceed any of the isolated sections as indicated on the sample point drawing where the testing procedure is completed in phases as indicated on the Sample Point Drawings. If the test pressure drops significantly, the test section shall be isolated to a manageable area. At the end of the one (1) hour test period, the volume of water used to maintain the 1035 kPa (150 psi) is to be recorded on the Town of Georgina Watermain Testing and Commissioning Form by the Contractor.

Stage 2

The watermain pressure shall be reduced to 690 kPa (100 psi) and maintained there for one (1) hour with no pressure drops permitted.

When it is determined that the new watermain does not maintain the 690 kPa (100 psi) pressure test, the leak(s) shall be located and repaired and the hydrostatic test applied again beginning at Stage 1 until successful.

Polyethylene Pipe

An initial 3 to 4 hour expansion period, maintaining 1035kPa (150 psi) shall be performed. During this period makeup water may be added to maintain the test pressure. Immediately following the expansion period the test pressure of 1035kPa (150 psi) shall be maintained for a period of two (2) hours.

If the hydrostatic test is not successful, the leak(s) shall be located and repaired and the hydrostatic test applied again until it is successful.

Concrete Pressure Pipe

A 24 hour period of absorption shall be completed prior completion of the hydrostatic test. Following the absorption period the test pressure of 1035 kPa (150 psi) shall be maintained for two (2) hours.

If the hydrostatic test is not successful, the leak(s) shall be located and repaired and the hydrostatic test applied again until it is successful.

D) Swabbing

The watermain shall be loaded via the by-pass expelling all air from the watermain prior to the commencement of swabbing.

No swabs are to be inserted into the watermain during the construction process unless recorded on the Sample Point drawings and approved by the Department of Operations and Engineering Water/Wastewater Division.

All swabs shall be new and sized a minimum of one (1) size larger in diameter than the watermain diameter and one and a half (1 ½) times longer in length of the diameter of the watermain .

All swabs inserted and removed by the Contractor are to be numbered and witnessed by the Department of Operations and Engineering Water/Wastewater Division and recorded on the Town of Georgina **FORM 009 - Watermain Testing and Commissioning Report** by the Contractor.

All sections of the watermain shall be swabbed in such a manner that a minimum of three (3) swabs are used. All fire hydrants shall have a minimum of one (1) swab passed through them. At the discretion of the Department of Operations and Engineering Water/Wastewater Division additional swabs may be required.

All stubs and/or dead ends of the watermain shall be provided with a temporary swab discharge point to allow for the removal of the swabs.

E) Flushing to Remove Turbidity

The watermain shall be flushed to remove any possible remaining air pockets and foreign matter from the watermain.

At the discretion of the Department of Operations and Engineering Water/Wastewater Division flushing of the new watermain via the by-pass shall continue until such time as the turbidity levels taken using an approved Turbidimeter are less than 1 NTU.

The locations where turbidity samples are taken shall be indicated on the sample drawing. The turbidity testing shall be performed by the Contractor and witnessed by the Department of Operations and Engineering Water/Wastewater Division and recorded on the Town of Georgina **FORM 009 - Watermain Testing and Commissioning Report** by the Contractor.

F) Disinfecting Watermain

The method of disinfection to be used is the continuous feed method unless otherwise approved by the Department of Operations and Engineering Water/Wastewater Division.

The chlorine solution shall be applied so that the chlorine concentration is a minimum of 50 mg/l free chlorine residual throughout the new watermain system and does not exceed 100 mg/l free chlorine residual.

The chlorine solution is to be flowed through each hydrant, water service, sample point, blow-off and swabbing launch/discharge points. The high chlorine residual is to be measured by the Contractor at each location and recorded on the Town of Georgina **FORM 009 - Watermain Testing and Commissioning Report** by the Contractor.

Upon completion of the chlorination, the remaining chlorine solution within the tank is to be neutralized and disposed of in accordance with **AWWA C651 Sec.6 Appendix C.**

The chlorinated water shall be isolated in the system for a period of twenty-four (24) hours. After the required contact time, the chlorine residual shall be taken at each sample location by the Contractor and recorded Town of Georgina **FORM 009 - Watermain Testing and Commissioning Report** by the Contractor.

If the residual is above 40% of the original concentration, the chlorinated water is ready to be discharged from the system. (Example: If upon completion of chlorination process the recorded chlorine concentration level was 75ppm, the acceptable level after 24 hours of contact time would be 45ppm).

In the event that the residual is less than 40% of the original concentration of the chlorine, the system shall be discharged and neutralized, swabbed if necessary and re-chlorinated.

G) Removal and Disposal of Super-Chlorinated Water

Super-chlorinated water shall **not** be discharged from the new watermain unless neutralized with approved chemicals as per **AWWA C651 Sec.6 Appendix C.**

The super-chlorinated water shall be flushed from the new watermain via the by-pass through each hydrant, sample, blow-off and swabbing launch/discharge points until the chlorine residual matches that of the existing distribution system (bypass supply location).

The chlorine residual shall be checked at each discharge location by the Contractor, and recorded on the Town of Georgina **FORM 009 - Watermain Testing and Commissioning Report** by the Contractor.

The discharge of super-chlorinated water shall be monitored by the Contractor and witnessed by the Department of Operations and Engineering Water/Wastewater Division. The free chlorine residual shall be tested at adequate intervals ensuring that any chlorine residual remaining will not have an adverse effect on the environment or other discharge locations. The results and times of the test results shall be recorded on the Town of Georgina **FORM 009 - Watermain Testing and Commissioning Report** by the Contractor.

The fresh supply water shall be left isolated within the new watermain system for a minimum of twenty-four (24) hours prior to bacteriological sampling.

H) Bacteriological Sampling

Two consecutive sets of bacteriological samples shall be taken and submitted to the York Durham Laboratory for analysis. The second set of samples is to be taken a minimum of 24 hours after the first set of samples.

A third set of bacteriological samples shall be taken and submitted to the York Durham Laboratory for analysis following the final connection(s) to the existing watermain.

Bacteriological sampling shall be completed by the Contractor unless otherwise approved.

All bacteriological sampling shall be witnessed by the Department of Operations and Engineering Water/Wastewater Division.

All samples must be submitted to the York/Durham Laboratory for analysis on approved York Durham Laboratory Chain of Custody forms.

Copies of the completed York Durham Laboratory Chain of Custody forms are to be provided to the Project Consultant and the Department of Operations and Engineering Water/Wastewater Division.

Copies of the York/Durham Laboratory samples results are to be provided to the Project Consultant and the Department of Operations and Engineering Water/Wastewater Division.

The cost of all bacteriological sampling shall be charged back to the Development Owner unless otherwise specified.

I) Sample Results

Upon receiving two consecutive water sample results from the York Durham Laboratory that meet the requirements of the **Safe Drinking Water Act, 2002** – **Ontario Regulation 169/03** and all other testing procedures have been completed and accepted, the final connections to the existing water distribution system can be coordinated.

If sample results do not meet the requirements of the **Safe Drinking Water Act, 2002** – **Ontario Regulation 169/03** the watermain shall be re-sampled until two consecutive sets of sample results meet the requirements of the **Safe Drinking Water Act, 2002** – **Ontario Regulation 169/03** and /or retested at the direction of the Department of Operations and Engineering Water/Wastewater Division. This may include additional swabbing, flushing, re-chlorinating, de-chlorinating and re-sampling.

J) Final Connections to Existing Mains and Acceptance

All final connections to the existing water distribution system shall be coordinated and witnessed by the Department of Operations and Engineering Water/Wastewater Division

Upon receiving satisfactory bacteriological sample results permanent connections may be made to the existing water distribution system. Construction practices in accordance with **AWWA Standard C651-05** must be followed during installation of the final connection ensuring no contamination occurs to the new or existing water main**.**

All pipe, fittings and valve(s) required for the connection shall be hand swabbed and disinfected with chlorine meeting Town of Georgina Policy **WWW7 - Watermain Disinfection** prior to being installed, if the total length of the

connection from the end of a new main to the existing main is equal to or less than 1 pipe length.

Upon completion of the final connection(s) to the existing water distribution system the new watermain shall be flushed and chlorine residuals taken and recorded on the **FORM 011 - Daily Chlorine Residual Log** by the Department of Operations and Engineering Water/Wastewater Division. A third set of samples shall be taken. The watermain shall remain isolated by way of valves when possible upon completion of the sampling until the results of the third set have met the requirements of the **Safe Drinking Water Act, 2002** – **Ontario Regulation 169/03.**

At the discretion of the Department of Engineering and Public and Works Water/Wastewater Division additional bacteriological may be required prior to the watermain being turned on.

Upon receiving satisfactory bacteriological samples results, the watermain can be turned on to facilitate Fire Hydrant Flow Testing provided the completed **FORM 009 - Watermain Testing and Commissioning Report** has been received and the Department of Operations and Engineering Water/Wastewater Division is satisfied with the same and all other authorities having jurisdiction including but not limited to Town of Georgina Building Department approvals.

The cost of all bacteriological sampling shall be charged back to the Development Owner unless otherwise specified.

K) Additional Bacteriological Sampling

Where alternate methods of testing and commissioning have been approved which alter the procedures describe in Section A to Section J or at the discretion of the Department of Operations and Engineering Water/Wastewater Division additional bacteriological samples may be required be taken at each sample location and submitted to the York/Durham Laboratory for analysis. Upon receiving acceptable sample results any final connections to the existing water distribution may be made and the water supply to the new watermain can be turned on provided the completed **FORM 009 - Watermain Testing and Commissioning Report** has been received and approved by the Department of Operations and Engineering Water/Wastewater Division and all other authorities having jurisdiction including but not limited to Town of Georgina Building Department approvals and water meter installations.

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The cost of all bacteriological sampling shall be charged back to the Development Owner unless otherwise specified.

L) Fire Hydrant Flow Testing

Fire Hydrant flow testing shall be performed to confirm the original design water system analysis and the distribution systems capacity to maintain 140kpa/20psi under maximum day demand plus fire flow conditions as required by the Town's **Drinking Water Works Permit 119-201** is to be performed.

Upon completion of the final connections to the existing water distribution system and meeting all the requirements of this procedure to the satisfaction of the Department of Operations and Engineering Water/Wastewater Division flow testing shall be performed in accordance with NFPA 291.

The fire hydrants to be flow tested including residual pressure hydrants shall be indicated on the "Sample Point Drawing".

Coordination of the flow testing shall be made with the Department of Operations and Engineering Water/Wastewater Division.

The flow testing shall be witnessed by a representative of the Department of Operations and Engineering Water/Wastewater Division.

Flow testing shall take place during the Town's distribution systems Maximum Day Demand periods. Typically this occurs Mon to Fri between the hours of 5:30am – 9:00am or as determined by the Department of Operations and Engineering Water/Wastewater Division.

Copies of the flow test reports shall be provided to the Project Consultant and the Department of Operations and Engineering Water/Wastewater Division in a digital PDF format.

The Project Consultant shall review the results of the fire hydrant flow tests and provide a written, signed and stamped report by a Professional Engineer certifying that the results are consistent with the original design Water System Analysis and requirements of the **Form 1 – Record of Watermains Authorized as a Future Alteration** have been satisfied.

Upon receipt and review of the above noted report to the satisfaction of the Department of Operations and Engineering Water/Wastewater Division and all the requirements this procedure and the **Drinking Water Works Permit 119-201** have been met, the watermain may be turned on and placed into service.

M) On-going Maintenance Prior to Assumption by the Town of Georgina

Upon acceptance of the all testing and commissioning procedures by the Department of Operations and Engineering Water/Wastewater Division and the final connections to the existing watermain have been made the Department of Operations and Engineering Water/Wastewater Division shall ensure that the watermain system remains potable.

Ongoing water quality monitoring in accordance with the Town of Georgina **WWW4 - Water Quality Monitoring** Procedure shall be performed by the Department of Operations and Engineering Water/Wastewater Division.
All costs associated with this practice shall be charged back to the development owner including all water costs, hydrant maintenance, bacteriological sampling and any other associated costs until final assumption of the project by the Town of Georgina.

References and Forms

AWWA Standard C651-05

Drinking Water Works Permit 119-201

Form 1 – Record of Watermains Authorized as a Future Alteration

FORM 009 - Watermain Testing and Commissioning Report

FORM 011 - Daily Chlorine Residual Log

Ontario Regulation 169/03

Ontario Provincial Standard Specification 701

Safe Drinking Water Act, 2002, S.O. 2002, c. 32

WWW4 - Water Quality Monitoring

WWW7 - Watermain Disinfection