



CITY OF WELLAND
INFRASTRUCTURE SERVICES
OP MANUAL-PROCEDURES

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Doc. No.: O&P 1.1	Original Date: October 2005	Developed By: J. Boc
Revision No.:F11	Revision Date: 15/06/10	Authorized By: J. Boc

STANDARD OPERATING PROCEDURES FOR ALL WATERMAIN DISTRIBUTION REPAIR & INSTALLATION

1.0 Purpose

The purpose of this procedure is to ensure that all work being performed for watermain repair, replacement and installation conforms to provincial regulations as well as the City's requirements, so that the City of Welland continues to supply safe drinking water throughout its distribution system.

2.0 Application

This procedure applies to all City certified water operators and/or contractors and anyone else who may conduct work on or that may impact the distribution system.

3.0 Definitions

None

4.0 Associated Processes

A. General Procedures on All Watermain Repairs, All Replacements & Installations

Note: All Waterworks materials and appurtenances utilized and required for the construction of new watermains, installation, repair and replacement to the Watermain Distribution System must conform to the materials for watermains as stipulated within the City of Welland Special Provisions – Supplementary Watermains and Appurtenances.

All waterworks materials must meet AWWA current quality criteria standards and American National Standard ANSI/NSF Standard 61 no lead certification for waterworks material products. Only those products stamped mechanically with letters NSF61 on the body of shipped cartons bearing the marking ANSI/NSF Standard 61, certified by an accredited Laboratory, will be accepted by the Corporation as specified.



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Note: ***Under no circumstances shall any repair, replacement, installation or work be conducted on the Watermain Distribution System and appurtenances without a Certified Water Operator present to oversee the work. A Certified Water Operator must be present to oversee all or any work to the Water Distribution System as per the Safe Drinking Water Act.***

Normal Conditions

1. All precautionary measures must be taken to minimize entry of surrounding trench material or water into the repair portion of the watermain. Preventative and corrective measures, according to AWWA Standard C651-05, to be taken during repair, replacement or construction are as follows:
 - a) Keeping pipe clean and dry. The interiors of pipes, fittings, and valves shall be protected from contamination.
 - b) Openings. Openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.
 - c) Stringing pipe. Pipe delivered for construction shall be strung to minimize the entrance of foreign material.
 - d) Joints. Joints of pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is free of standing water and mud that may enter the pipe.
 - e) Packing materials. Yarning or packing material shall consist of molded or tubular rubber rings, rope of treated paper, or other approved materials. Materials such as jute or hemp shall not be used. Packing material shall be handled in a manner that avoids contamination. If asbestos rope is used, asbestos shall be prevented from entering into the water-carrying portion of the pipe.
 - f) Sealing materials. No contaminated material or any material capable of supporting growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water and shall not contribute odors. It shall be delivered to the job in closed containers and shall be kept clean and applied with dedicated, clean applicator brushes.
 - g) Cleaning and swabbing. If dirt enters the pipe, it shall be removed and the interior pipe surface swabbed with a 1 to 5 percent hypochlorite disinfecting solution. If, in the opinion of the inspector, the dirt remaining in the pipe will not be removed using the flushing operation, then the interior of the pipe shall be cleaned using mechanical means, such as a hydraulically propelled foam pig (or other suitable device acceptable to the inspector) in conjunction with the



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application of a 1 percent hypochlorite disinfecting solution. The cleaning method used shall not force mud or debris into the interior pipe-joint spaces and shall be acceptable to the inspector.

- h) General. Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing these organisms. Therefore, the procedures of this section must be observed to assure that a watermain and its appurtenances have been thoroughly cleaned for the final disinfection by chlorination. Also, any connection of a new watermain to the active distribution system prior to the receipt of satisfactory bacteriological samples may constitute a cross-connection. Therefore, the new main must be isolated until bacteriological tests are satisfactorily completed. Prior to conducting any repair to the watermain system, isolate the repair area and note that valves should not be completely closed, to maintain positive pressure in the main until the main break or area of repair or replacement is exposed through excavation. This prevents backflow into the water system from the area of the break and will no longer poses a threat of contamination from the trench area around the break.
- i) When and where contaminated liquids or substances have been identified entering or within any component of the Water Distribution System during any repair, installation or replacement determined through odour, colour, taste, oily, septic, etc., **IMMEDIATELY** contact the Operator in Charge and the Ministry of the Environment. Do not continue with the work being performed at hand. An assessment will then be conducted to determine the source of the contamination through cross connections or other sources and subsequently determine the remedial measures required. The RMOH may be contacted to assist in the assessment process in determining remedial measures. **AT NO TIME** should any repairs be conducted nor should the water be turned back on prior to completion of remedial procedures being undertaken.
- j) All efforts must be made to keep contaminants out of the watermain system until the repair is completed. Therefore, to protect water quality and prevent contamination of the watermain or service during the repair, water levels in the trench must be kept pumped to a point well below contact with the pipe.
- k) When an existing main is opened either through a main break or planned repairs or installations where the excavation is wet, apply liberal quantities of hypochlorite solution or pucks to the open trench area to reduce the possibility of contamination.
- l) **Clean the interior of all pipe, service material and fittings** used in the installations or repairs by **swabbing with a 5% hypochlorite solution** before installation. In addition, spray all fittings and pipe surfaces with a 5% hypochlorite solution before installation.
- m) Upon completion of repair and/or installation, thorough flushing is required on both sides of the work location. Flushing shall continue until discoloured water is eliminated. Upon completion of **all or any installation**, flush watermain thoroughly to remove any discoloration or foreign particles. When installing



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new services, swab service material with a hypochlorite solution prior to installation and flush out chlorine from service prior to connection to the existing service.

- n) Bacteriological sampling and field testing for turbidity, PH, temperature and chlorine residual shall be taken on each side of the repair/installation after repairs are completed. Microbiological samples must be collected by the next regular working day and submitted to our listed accredited laboratory for analysis on the same day if possible but no later than 48 hours after collection.
- o) If indication of positive bacteriological samples is reported from the Laboratory, flushing is to commence immediately. **Daily sampling shall be continued immediately until two (2) consecutive “non Detect” samples as per City of Welland bacteriological water sampling protocol are reported from the Laboratory.** Should water sampling continue to reveal positive results, the section of main where the repair or installation was conducted shall be isolated, all service connections shut off and the section shall be chlorinated and flushed. Flushing is to continue until the chlorine residual is no higher than in the Distribution System. Bacteriological sampling is then to be performed as stipulated per above.

2. Contaminated Conditions

- a) In the event that material or water within the trench area enters the water system during any repair, replacement or installation, flush watermain thoroughly through the nearest hydrant, or service if repairing water service. Flushing shall continue until discoloured water is eliminated. Upon completion of repair, bacteriological samples shall be taken at each side of the repair and at 200' intervals on each side of the repair, as well as conducting field testing for turbidity, PH, temperature and free chlorine residual readings. Upon receiving “Non Detect” bacteriological water sample results, discontinue all flushing and resample after a 24 hour period to confirm results. If any indication of positive bacteriological samples is recorded, then flushing should commence immediately. Continue daily sampling immediately, until two (2) consecutive “Non Detect” bacteriological samples are reported from the Laboratory. Should water sampling continue to reveal positive results, the section of main where the repair or installation was conducted shall be isolated, all service connections shut off and the section shall be chlorinated and flushed. **Chlorination, flushing and bacteriological sampling shall be conducted as per new watermain protocol and procedures. Should this procedure be implemented, temporary water service feed shall be installed to provide potable water.** Flushing is to continue until the chlorine residual is no higher than in the Distribution System. Bacteriological sampling and field testing is then to be performed as stipulated per above. **Should water sampling continue to reveal positive results, the section of main shall be isolated and cleaned using hydraulically propelled foam pigs in**



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conjunction with the application of not less than 25mg/L concentrated hypochlorite disinfection solution. Chlorination, flushing and bacteriological sampling shall be conducted as per new watermain protocol and procedures O&P 2.1 Section 8, 9 and 10. A temporary water service feed shall be installed to provide potable water.

3. Tapping Sleeve and Valve Installation

- a) When installing a tapping sleeve and valve, the exterior of the main to be tapped and the interior surface of the sleeve shall be thoroughly cleaned with a 5% hypochloride solution. Upon completion of installing the tapping sleeve and valve onto the watermain, conduct a pressure test of 150 psi for one (1) hour to ensure there is no leakage with the connection. Subsequent to leakage test, conduct the tapping of the watermain as per tapping procedures. Upon completion of the tapping process, flush out residue particles from the sleeve and valve by opening the tapping valve to allow thorough cleaning of the sleeve and valve.

4. Hydrant Installation

- a) When installing or replacing hydrants, flush watermain as stipulated above and conduct water sampling on each side of the installation from the existing watermain. Upon completion of the hydrant installation, open hydrant and flush thoroughly to clean out hydrant lead. ***An additional bacteriological water sample should then be taken from the hydrant to ensure that the hydrant lead has been properly disinfected.***

B. New Water Services, Replacements and Repairs (Less than and including services 2 inches in Diameter)

1. Clean the interior of all service material and fittings used in the installation of new services, replacements and all repairs before installations by swabbing and spraying with a 5% hypochloride solution prior to installation and flush out chlorine from service prior to connection to the existing service.
2. Upon completion of installation and connection to the existing service, flush out the entire service by asking the resident to thoroughly flush out his faucets within the residence. During a repair and where it is not possible to flush the service through the residence (ie: the resident is not home and the outside hose bib is not functional), a whip is to be installed to flush the upstream portion of the service of any material or high chlorine residual from disinfecting the service line and parts. Notice must be provided to the resident after the repair to run the tap in the house for 5 minutes or until clear to ensure any



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material or high residual chlorine in the downstream portion of the repaired service is removed prior to use.

3. Bacteriological sampling and field testing for turbidity, PH, temperature and chlorine residual shall be taken upon completion of flushing of service within the residence. If the resident is not home, a field test and a bacteriological test must be taken from the whip installed and used to flush the line. A bacteriological sample can be taken the next business day following a repair but a test must be taken from the building where the service repair was conducted and also another sample either upstream or downstream of the repair. A field test **must** be taken immediately following the repair to ensure effective secondary disinfection. If for any reason there is no opportunity to collect a field test directly from the service line, the closest hydrant or sample station or residence may be used to verify secondary disinfection. When installing, replacing or repairing a water service to a vacant lot, bacteriological samples are to be taken after flushing from the curb stop at the end of the service. Note: New services being installed to a new watermain only require random bacteriological sampling. However, field testing for turbidity, PH, temperature and chlorine residual shall be taken from the first service flushed and connected at the beginning of that day. Subsequent services for each day shall be flushed and field testing for free chlorine residual and temperature only will be required.
4. If any indication of positive bacteriological samples are reported from the Laboratory, flushing is to commence immediately. Daily sampling shall be continued immediately until two (2) consecutive 'Non Detect' samples are reported from the Laboratory. Should water sampling continue to reveal positive results, the water service shall be re-chlorinated and flushed. Bacteriological sampling is then to be performed as stipulated per above.

C. Temporary Water Service Connection

1. When installation of a temporary above ground water service is required, only use FDA Approved potable hose for the provision of water. Prior to installation, disinfect the interior of the hose by inserting a 5% hypochlorite solution and flush out chlorine prior to connection as well as conducting field testing for turbidity PH, temperature and chlorine residual. Upon disassembly and removal of the temporary service, ensure that the potable hose is cleaned to reduce potential of contamination.

D. New Watermains, Extensions & Water Services (Greater than 2 inches in Diameter)

1. Clean the interior of all pipe and fittings used in the installation by swabbing and spraying with a 5% hypochlorite solution before installation. Upon completion of installation, flush piping out thoroughly, **removing all air from**



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the pipeline. Water required to fill the new main for hydrostatic pressure testing, disinfection and flushing shall be supplied until the disinfectant water has been flushed out and satisfactory bacteriological testing has been completed by either of the two (2) means as follows:

(i) The new main or service shall be kept isolated from the active Distribution system by means of a gatevalve that can only be operated by a certified operator and can only be left in the open position when water is being discharged by means of hydrants or a blow-off at the end of the new main or service. The gatevalve must be kept closed at all times when water is not being discharged from the new main or service prior to being commissioned. For security purposes, the gatevalve must be provided by a lock device to prevent unauthorized personnel from opening the gatevalve to prevent cross contamination to the active Distribution System.

Note: Gatevalves that are temporarily utilized to isolate either the new watermain from the existing Distribution System or strictly for isolation of an existing watermain within the Distribution System, must be secured by a locking device to prevent unauthorized personnel from opening the gatevalve in preventing cross contamination to the active Distribution System.

Alternative Method for Isolation

(ii) The new main or service shall be kept isolated from the active Distribution system using a physical separation as illustrated per AWWA Standards C651-05 Disinfecting Watermains, page 6. The temporary connection between the Distribution System (Hydrant) and the new main or service shall include a cross connection control device (backflow preventor) and **shall be disconnected, physically separated, from the new main during the hydrostatic pressure test and during the disinfection process.** It will be necessary to re-establish the temporary connection after completion of the hydrostatic pressure test to flush out the disinfected water for bacteriological testing. Pressure test piping at 150 PSI for a two (2) hour duration and conduct leakage test with an allowable leakage of **.082** litres per millimeter of pipe diameter per kilometer of pipe for the two (2) hour test period as per **OPSS441.07.22.03, formerly OPSS701.07.22.03**. If the measured leakage exceeds the allowable leakage, all leaks shall be located and repaired and the test section shall be retested until a satisfactory result is obtained.

2. After performing leakage test disinfect piping by injecting hypochlorite solution as per attached table to achieve a free chlorine of not less than 25mg/l. The piping shall be left charged with the chlorine solution for a 24 hour period, during which time new valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of the 24 hour



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period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L of free chlorine.

3. Flush chlorine solution from the piping through the use of a dechlorinator to neutralize the chlorine residual and flush the heavily chlorinated water in the pipe until the chlorine residual leaving the pipe is no higher than the chlorine residual within the distribution system. After the 24 hour period, recharge piping with water from the distribution system for another 24 hour period before taking water samples.
4. After the 24 hour period after the piping has been recharged, two water samples must be taken 24 hours apart for bacteriological testing.
5. The commissioning of new watermains and services will be determined through bacteriological water sample test results from both the new watermain as per procedures stipulated within Section D, Sub-section (2) (3) & (4) and from the existing watermain that was utilized to charge the new watermain. Sampling of the existing main is to be conducted during the process of charging the new main.

Water samples must be tested for bacteriological quality in accordance with the Safe Drinking Water Act 2002/Ontario Regulation 170/03. All water sample results must conform to the standards and parameters as stipulated within the City of Welland Bacteriological Sampling Protocol and Procedure as follows prior to commissioning the new watermain:

- (a) -
 - No presence of E. Coli or fecal coliform in any sample;
 - No present of total coliform in any sample;
 - At the time of sampling, water in the new main must contain a minimum free chlorine residual of .05mg/l;
 - No more than 80 background colonies on a total coliform (BKG0 membrane filter analysis;
 - No more than 200 colonies per ml on a heterotrophic plate (HPC) count analysis
- (b) - **Background colonies and heterotrophic plate count sample results from the new watermain must not exceed 10cfu of the existing watermain (comparison sample). Should the existing watermain sample results show higher background or HPC counts than the new watermain, the new watermain will still pass. Water quality staff would flush and resample the existing watermain in accordance with the bacteriological sampling procedure. Once the existing watermain has been flushed and water quality has been restored, water quality staff would flush the new watermain to ensure water quality is maintained.**

Should water samples indicate positive bacteriological results and/or non-conform to both standards (a) and (b) listed above, flushing of the main must be conducted and



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water sampling must be continued until two (2) consecutive samples are taken as per protocol and conform to the above standards and parameters.

The responsibility of commissioning the new watermain rests with Supervisory staff who oversee the installation of the new main based on the water sample test results in accordance with the above criteria. Should the Supervisor, in consultation with the Construction Inspector, have concerns subsequent to an analysis of the water sample results, the Supervisor will ultimately decide and have the authority to provide further water sample tests to ensure proper water quality.

When commissioning a new watermain, the water is to be flushed through a hydrant port, blow off, or other appropriate appurtenance in the system should neither of the first two (2) exist in the new section. Flush water that has been sitting in the new watermain and monitor temperature, chlorine, turbidity and pH. When these parameters are observed to be indicative of “normal” and current water parameters in the distribution system in that area, then the new watermain is considered to be in service. ***Once the new watermain has been connected to the existing watermain and put into service, the new watermain must be treated as a part of the drinking water system and any work done on the watermain must be done so in accordance with the Safe Drinking Water ACT.***

If a new watermain remains dormant for more than two (2) weeks, fourteen (14) calendar days after the watermain has passed the City of Welland's bacteriological sampling criteria and has not been commissioned into service, re-sampling for bacteriological testing must be conducted and water samples must adhere to the City of Welland's commissioning of new watermain procedure as stipulated within the Watermain Operations & Maintenance Manual.

Under no circumstances will a new watermain or service be commissioned subsequent to bacteriological sampling prior to submission of all new watermain inspection data to the Public Works Department. Information shall consist of watermain location, water services, diameter, type of pipe, valving and hydrant locations and component data consisting of make, model and all pertinent information as required for maintenance purposes as per Ontario Reg. 128/04 Section (28) Operations and Maintenance Manuals.

Status Reporting Procedure During Construction of New Watermains

During Normal Working Hours

During the construction of watermain replacement to the existing Watermain Distribution System or during the construction of new watermain installations eg. new subdivisions and site plan developments, the Construction Inspector overseeing the work is to notify the Public Works Division through the Dispatcher of the following:



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- Watermain closures involving shut down and provision of water;
- Reduction of Static Pressure within the existing system, eg. throttling of gatevalves;
- Any deficiency to the existing watermain system created through construction methods and procedures.

After Normal Working Hours

During the construction of watermain replacement to the existing Watermain Distribution System or during the construction of new watermain installations within new subdivisions and site plan developments, it is the responsibility of the Construction Inspector overseeing the work to notify the Public Works Foreman on call when there are any modifications to the existing Water Distribution System at the end of each working day, as per following examples:

- Closure or throttling of any gatevalves to the Distribution System with locations;
- Modifications to the Distribution System that could compromise flow within the system and of which could also potentially compromise legislated chlorine residual requirements within the affected area of the system;
- Isolation of any watermain creating a closed loop and hence creating a dead end watermain;
- Gatevalves that are temporarily closed and secured by a locking device;
- Any watermain repairs and installations to the existing watermain system.

Note: Construction Inspectors are to be notified of the designated Foreman on Call through the Construction Supervisor.

E. All Watermain Repair & Installations - Contaminated Conditions

1. When conducting watermain repair in the vicinity of gas stations, or any site where hazardous or contaminated material may be encountered, eg. Gas, diesel, oil, chemicals, unknown substances, extreme caution should be taken to prevent contamination of the system
2. During a repair, do not completely shut the source of water through the broken line; in an effort to reduce and/or minimize the contaminant from entering the system.
3. When contaminated material or soil is found during an excavation, **do not proceed with the watermain repair; maintain a steady flow of water through the main leak and immediately contact the Ministry of Environment, Technical Standards and Safety Association, and the Regional Environmental Division** to determine remedial procedures.
4. Prior to any repair or installation, ensure that all traces of the contaminated material or liquid is removed from the work area, shut down watermain and



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backfill with dry granular bedding to provide a clean working environment. Upon establishing a dry, clean working trench environment, then proceed with the repair or installation.

5. During the repair process, **maintain a steady flow of water from the leak** and conduct repairing the main under a minimum pressure as physically possible.
6. Should petroleum or contaminants enter the watermain system, total replacement of the affected watermain, fittings or service must be conducted and upon completion, pressure testing, chlorination, flushing, notification, and sampling must be performed as per specifications for new watermains.
7. Should any unknown foreign contamination enter the watermain system, immediately contact the MOE and the Region of Niagara to determine the contaminated substance. Once the contaminated substance is identified, replace the contaminated section of watermain, fittings and services and upon completion of work, chlorination, pressure testing, flushing notification and bacteriological sampling shall be performed as per specifications for new watermains as well as field testing for turbidity, PH, and chlorine residual shall be taken after repairs are completed on each side of the repair.

F. Backflow Prevention on All Watermain Repairs & Installations

1. When repairing, replacing or installing watermains, valves, hydrants, etc. within the vicinity of an Industrial, ***institutional*** or commercial development, precautions must be exercised regarding backflow prevention from the commercial or industrial building.
2. During any repair, replacement or installation near an industrial, ***institutional*** or commercial development, ensure there is no backfeed from the service providing water to the development upon shutdown of the City's Distribution System when performing the work involved. **This can be accomplished by shutting off the valve on the service line feeding the development with prior notification, as illustrated per valve sheets and curb box locations prior to shut down of the City's Distribution System. Upon encountering any potential Industrial or Commercial development, make all attempts to locate the valve servicing the development and close the valve prior to any work. Document all valves and curb stops that were shut off during the repair process on the work order, identifying the development and accompanying address. When shutting off any valve whether it be a service or main line valve, the Operator must ensure that the receiving property(ies) fire protection has not been compromised. For specifics please refer to O&P 1.8 "Shutting off Water Supply to Private Fire Line Systems"**



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3. All disinfection and water quality procedures for all watermain repairs, replacements and installations shall be complied with as per procedures previously outlined for the conditions and type of work at hand.
4. Upon completion of work, conduct water sampling and flushing as outlined previously for the conditions and type of work at hand.
5. Should watermain repairs be conducted within a private development, bacteriological sampling and field testing for turbidity, PH, temperature and chorine residual shall be taken upon completion of repair from both the private portion and City watermain providing water to the private development.

Note: These procedures are intended to establish guidelines and normal protocol involving repairs and installation. Conditions or scenarios outside of the above guidelines may warrant alternative remedial procedures as determined through a thorough analysis of the circumstances involved.

5.0 References

O.Reg 170/03 - AWWA Standards
AWWA Standard C651-01 (See Reference Section 3.4)
AWWA Standard C651-05 (See Reference Section 3.5)

6.0 Process Performance

The current Process Performance metrics = Non-Conformances

Measurement Frequency = Annually

Acceptable Performance Level = 100%

Performance Responsibility = Manager, Public Works

Contact Numbers

Technical Standards & Safety Association	1877-682-8772
Regional Environmental Division	905 685-1571
Ministry of the Environment	All Hours: 1-800-268-6060



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F2	06/01	A. General Procedures; A1 i and j	
F2	06/01	D. New Watermain Extensions & Water Services; D1-Leakage Test	
F2	06/01	A 1 Contaminated Substances in Water Distribution System, A1 j- Contaminated Liquids or Substances	
F2	06/01	A 3 Tapping Sleeve and Valve Installation – Addition	
F3	06/01	Format Revision to Entire Document	
F3	06/01	D. New Watermain Extensions & Water Services; D1.; D1(i), D1(ii) D2	
F3	06/01	E. All Watermain Repair & Installations E3	
F4	07/04	A. General Procedures; Added Notes; Page 1	
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F4	07/04	D. New Watermains, Extensions & Water Services, Page 5; 1.ii	
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F4	07/04	Operating Procedures; Page 6; 10. Microbiological Sampling	
F5	09/04	Alternative Method for Isolation; Page 6; added Fourth Paragraph after	



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		Item(b)	
F6	09/07	Municipal Working Group Work Instruction for the Repair and Construction of Watermains Moved to Work Instruction	
F7	09/10	Moved Reference Document Disinfecting Watermains to Reference Section	
F8	10/02/08	Section B, Item 3; Updated wording in last sentence.	
F9	12/01/20	Note indicating material must conform to Watermain Appurtenances Document	Ray Chamberlain
F10	13/02/13	Reviewed	Ray Chamberlain
F11	15/06/10	Revision to Item F Backflow Prevention on All Wtm Repairs	Ray Chamberlain