1.0 GENERAL

1.1. Scope

1.1.1. This section presents requirements and procedures for disinfecting, flushing and bacteriological testing of all new or modified watermain and, existing watermain that is depressurized for any reason, excluding only emergency repairs, before it may be put into service or returned to service.

1.2. Related Sections

1.2.1. Section 02511 – Watermains

1.2.2. Section 02516 - Water and Sewer Service Connections

1.2.3. Section 0217 – Watermain Hydrostatic Tests

1.3. Bacteriological Sampling Requirements

1.3.1 As stipulated in Saskatchewan Water Security Agency (WSA) document: Bacteriological Follow-up Standard – EPB 505, Section 5.1.2, a minimum of two (2) sets of three (3) bacteriological samples must be taken from the watermain and submitted to the Provincial Water Laboratory.

1.3.2 Each set of three (3) samples must be taken and submitted a minimum of 24 hours apart. Wherever practicable, samples are to be collected from different points along the watermain section.

1.3.3 Watermain may not be placed into service or returned to service until two consecutive sets of three samples have been analyzed and all found to be acceptable.

1.3.4 If a positive (unacceptable) test result occurs in both of the two consecutive sets of samples, then repeat of disinfection, flushing and sampling procedures is required.

2.0 PRODUCT

2.1 Disinfection Chemical Dry Form

2.1.1 Calcium hypochlorite tablets, manufactured to the requirements of AWWA B300 - latest revision and having seventy percent (70%) available chlorine by weight.

2.2 Disinfection Chemical Liquid Form

2.2.1 Sodium hypochlorite manufactured to AWWA B300 - latest revision and having 5 to 15 percent available chlorine by volume. Care must be taken to control conditions and length of storage to minimize its deterioration.

2.3 Adhesive

2.3.1 Waterproof, food grade, one component glue, compatible with disinfection chemical, and conform to ANSI/ NSF 61.

3.0 EXECUTION

3.1 General

3.1.1 Disinfect new watermains and any new branch connections to the requirements of AWWA C651. Become familiar with and strictly adhere to all safety requirements relating to the handling of concentrated chlorine chemicals and solution.

3.1.2 Caution - do not use calcium hypochlorite in powder form in PVC piping as an explosive reaction may result. Use of this chemical in tablet or solution form is safe in PVC piping.

3.1.3 Attach calcium hypochlorite tablets to the inside top surface of the pipe or fitting. Apply adhesive to only one surface of the tablet.

3.1.4 The number of 5 g tablets required per 6.0 m length of pipe for each size of pipe is shown on the following list:

- ♦ 150 mm diameter pipe - 2 tablets
- ♦ 200 mm diameter pipe - 2 tablets
- ♦ 250 mm diameter pipe - 3 tablets
- ♦ 300 mm diameter pipe - 4 tablets
- ♦ 350 mm diameter pipe - 5 tablets
- ♦ 400 mm diameter pipe - 7 tablets
- ♦ 450 mm diameter pipe - 8 tablets
- ♦ 500 mm diameter pipe - 10 tablets
- ♦ 600 mm diameter pipe - 14 tablets

NOTE: The 'tablet method' described in AWWA C651 may not be used in pipes larger than 600 mm. Use either the continuous feed or slug flow methods for pipes larger than 600 mm.

3.1.5 Protect installed tablets from moisture.

3.1.6 For the use of sodium hypochlorite liquid, submit a detailed written procedure to the Engineer for review at least two working days prior to date of disinfection. The submission must describe proposed equipment and procedures. Ensure full compliance with all provisions within the latest edition of AWWA C651.

3.1.7 Inject the sodium hypochlorite solution as near as possible to the tie-in(s) to the existing system as the pipe is being filled.

3.1.8 Provide minimum 20 mm injection and/or discharge points where there are no existing facilities within 3.0 m of the terminal points of the main(s) to be disinfected. Use corporation stops as specified in Section 02516 for these points. Close and cap stops after use.

3.1.9 Employ a shorter contact time using a higher chlorine dosage where, in the opinion of the Engineer, conditions make the 24-hour contact time impractical or unmanageable. Alternate dosage/contact time options are described in AWWA C651. Submit a detailed written description for use of an alternate option to the Engineer for review and approval prior to date of disinfection. Obtain approval from City of Regina and Saskatchewan Water Security Agency (WSA) regarding proposed disposal processes and locations.

3.1.10 Following the contact period, ensure operation of all valves and hydrants on the main to ensure that all parts have been in contact with the chlorine solution. Only City of Regina personnel may operate existing valves and hydrants

3.2 Disinfection Methods and Requirements

3.2.1 Tablet Method

.1 Slowly fill main to be disinfected with water. Try to limit fill velocity to less than 0.3 m/s (1.0 ft/sec).

.2 Once the section to be disinfected is confirmed as being full of water, discontinue filling and leave the main in a static condition for at least one hour if the water temperature is over 5°C and two hours if the water temperature is below 5°C. At the end of this time period obtain a sample from a location on the main close to where the fill water was introduced and a second location at the end furthest from that point. Demonstrate that a minimum 25mg/l residual concentration has been achieved at both locations.

.3 Maintain the high strength solution in the main for at least 24 hours if the water temperature is above 5°C and at least 48 hours if the water temperature is less than 5°C.

.4 At the end of the contact period obtain a sample at each of the previous locations. A minimum 10 mg/l residual must be present at both locations or the disinfection must be repeated.

.5 After successful disinfection, flush the main to waste until the chlorine residual reading is less than 1.0 mg/l. Comply with all requirements for dechlorinating the flushing water being discharged.

3.2.2 Continuous Feed Method

.1 Flush to waste the section of main to be disinfected using chlorinated, potable quality water. Flush at a flowrate that will achieve a velocity of at

least 0.75 m/s (2.5 ft/sec). Use a volume of water that is at least equivalent to the volume contained in the section to be disinfected.

.2 Continue to flush to waste, slow the flow of water through the main to less than 0.3 m/s (1.0 ft/sec) and begin to introduce high strength disinfection solution into the main at the water inlet end.

.3 Continue the flow and disinfection solution introduction and conduct frequent residual tests on the water being discharged until the residual reading achieved is a minimum of 25 mg/l. Ensure that the water being discharged is dechlorinated as required while waiting for the required residual to reach the discharge point.

.4 Maintain the high strength solution in the main for at least 24 hours if the water temperature is above 5°C and at least 48 hours if the water temperature is less than 5°C.

.5 At the end of the contact period obtain a sample at each of the previous locations. A minimum 10 mg/l residual must be present at both locations or the disinfection must be repeated.

.6 After successful disinfection, flush the main to waste until the chlorine residual reading is less than 1.0 mg/l. Comply with all requirements for dechlorinating the flushing water being discharged.

3.2.3 Slug Method

.1 Use this method only with the pre-approval of the Engineer. Prepare and submit a detailed plan to the Engineer for the use of this method.

3.3 Watermain Disinfection, Flushing and Sampling

3.3.1 Water for Disinfection and High Level Testing

.1 The initial fill of water for watermain flush and/or disinfection will be supplied by the Owner at no cost to the Contractor. However, any subsequent volume required due to failure to meet the requirements of the disinfection or hydrostatic tests will be charged to the Contractor at standard City of Regina water rates.

.2 Perform high-level Total residual chlorine tests at a minimum of two locations as previously described or as directed by the Engineer.

3.3.2 Flushing

.1 Upon completion of the 24 hour disinfection period, thoroughly flush the main until the Total Residual Chlorine concentration in the water being discharged is less than 1.0 mg/l.

3.3.3 Bacteriological Sample Collection and Notification of Results

.1 Bacteriological samples may only be taken and submitted by authorized City of Regina personnel. Test results will be forwarded to the City of Regina from the Provincial Water Laboratory. The City of Regina will subsequently advise the designated party of the test results.

3.4 Disposal of Water

3.4.1 Dispose of highly chlorinated water to the existing sanitary sewer system or, where this is not possible, to other receiving facilities, approved by the Engineer, at rates that do not exceed the available capacity of the system at the time of disposal.

3.4.2 Total Residual Chlorine (TRC) in all effluent including water to be discharged must not be more than 0.02 mg/L in accordance with Saskatchewan Water Security Agency (WSA) at the point of discharge to the storm drainage channel or receiving location.

3.4.3 Provide additional chemical complying with NSF/ANSI 60 and temporary dike works necessary to ensure that the free residual chlorine content of this water is less than 0.02 mg/l or as may be dictated by Water Security Agency before it reaches Wascana Creek or Lake or other receiving body.

3.4.4 Carry out residual monitoring in coordination and co-operation with the City of Regina or the Engineer where they are not one and the same.

3.4.5 Chemicals that may be employed to lower chlorine residuals are listed in

AWWA C651.

3.5 Plan, co-ordinate, supervise and provide all labour and Product to carry out all aspects of the disinfection, testing, de-chlorination, monitoring and disposal operations.

3.6 Provide the Engineer with a minimum of forty-eight (48) hours advance notice of requirement for water.

3.7 Availability of water for disinfecting and flushing is subject to the demands on the

City's distribution system at the time and its delivery may be delayed at no additional cost to the Owner. Co-ordinate operation of the fill valves with the Supervisor of Water

Distribution to obtain the correct fill rate

3.8 Provide any additional connections that may be necessary to ensure the complete removal of air from the pipe being filled/tested.

3.9 Watermain Swabbing

3.9.1 In all locations where it is not possible to disinfect new waterlines, as described previously in this section, use the following method:

.1 Disinfect each length of pipe by pulling a chlorine-soaked swab through the inside of the pipe after it has been placed in its final position.

.2 The configuration of the swab must be of the proper dimensions to ensure firm contact with all portions of the interior of the pipe.

.3 Place watermain(s) in service only after completion of required procedures and receipt of satisfactory laboratory results for the bacteriological test(s) from Saskatchewan Water Security (WSA) certified laboratory.

3.10 Chlorine Concentrations in Disinfected Sections

3.10.1 Prior to returning the watermain to potable service the concentrations of Total and Free residual chlorine shall conform to the Saskatchewan Water Security Agency Regulations.

3.10.2 Minimum Free residual chlorine concentration shall not be less than 0.1 mg/l.

3.10.3 Minimum Total Chlorine Residual shall not be less than 0.5 mg/L, or if approved by the Engineer, the residual in the adjacent existing water mains if connecting to an existing water main.

3.10.4 Maximum Total Residual chlorine concentration shall be less than 1.0 mg/l,