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1 PURPOSE

Water supply authorities are required by law to ensure that the water supply system is free from conditions that may be hazardous to public health. The Water Services Act 2021 requires drinking water suppliers to ensure that the drinking water supplied by the supplier is safe.

The purpose of this procedure is to:

- > Prevent contamination of the water supply system by defining the minimum requirements for the disinfection of both new watermains and existing watermains following planned or reactive maintenance
- > Prevent contamination of the water supply system by defining required best practices for workers and materials that come in contact with water. For pressure pipes, provide confirmation that the pipeline is able to sustain a pressure greater than the design pressure without leakage;
- > Ensure compliance with legislative requirements

2 SCOPE

The scope of this procedure is to define the minimum requirements for disinfection across all of the Council water supply system, including but not limited to the following:

- New watermain installations and connections
- Reticulation repairs and maintenance
- Water reservoirs and storage tanks

3 ROLES AND RESPONSIBILITIES

All contractors working on the Council network, or involved in the construction of infrastructure that will be vested to Council, must adhere to the requirements of the QLDC Land Development and Subdivision Code of Practice.

Only QLDC Approved Contractors shall undertake work on the network. Contractors shall ensure that appropriately trained and competent personnel are present to supervise all disinfection activities.

Contractors shall be responsible for annual medical clearance of their water reticulation workers. Contractors shall ensure that their water reticulation workers are medically fit for work on a daily basis.

QLDC may audit the disinfection practices at their discretion to validate that the requirements of this document is being followed.

Any confirmed or suspected contamination to the water supply network must be escalated to QLDC immediately.

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4 DISINFECTION OF TOOLS, MATERIALS AND OTHER EQUIPMENT

4.1 VEHICLES

A high standard of cleanliness shall be maintained in the interiors of all vehicles used for water reticulation works.

Vehicles must be equipped with sanitary wipes or antibacterial liquid for hand sanitation when working on site.

All fittings carried in vehicles must be boxed, capped or sealed with plastic wrapping. All pipes must be capped.

4.2 STORES

A high standard of cleanliness shall be maintained in the interior of all stores.

Water supply and wastewater equipment shall be stored separately. All materials shall be stored and handled to minimise contact with foreign materials. Fittings shall be boxed, capped or sealed with plastic wrapping. All pipes shall be capped.

4.3 TOOLS AND EQUIPMENT

All tools used in the construction or maintenance of the main and fittings that come into contact with the treated water must have been thoroughly disinfected and sprayed or rinsed in a minimum 0.1% chlorine solution (1,000 mg/l) prior to use.

Larger items of plant and equipment including excavators shall be steam cleaned before use on potable water works. Disinfected tools must not be placed directly on the ground prior to use.

4.4 MATERIALS

All materials used in the construction or maintenance of the main and fittings that come into contact with the treated water must be:

1. provided sealed by the manufacturer under hygienic conditions and are not uncovered until immediately before use,

Or

2. thoroughly disinfected and sprayed or rinsed in a minimum 0.1% chlorine solution (1,000 mg/l) prior to use. Disinfected items must not be placed directly on the ground prior to installation.

A bactericidal lubricant complying with AS/NZS4020 shall be used on all rings and gaskets coming into contact with the reticulated water.

4.5 DISINFECTION AND NEUTRALISING CHEMICALS

A minimum 0.1% solution for disinfection of tools, equipment, fittings and materials is made up of 1 part chlorine solution (i.e. commercially available Sodium hypochlorite solution of 12-15% available chlorine) to 9 parts water and shall have a pH value of between 7 and 8. A newly prepared solution shall be made available at least weekly and the old solution disposed of after dechlorination with Sodium Thiosulphate (or suitable alternative).

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4.6 DEVIATION FROM STANDARD PROCEDURES

Where there are deviations from the procedure, for example during emergency works, these works shall be fully documented with supporting information showing the alternative disinfection procedures utilised and the reasons for deviations from the standard procedures. Any changes from the standard procedure needs to be approved by the appropriate service delivery area manager prior to the disinfection being undertaken.

5 NEW WATERMAINS DISINFECTION PROCEDURE

5.1 FLUSHING

The main shall be thoroughly flushed in sections through hydrants, producing sufficient flow velocity to remove all foreign matter. The volume of water used must be equivalent to at least three pipe volumes. The flow of water shall be from one direction at a time and depending on the position of the flushing point(s), flushing may be required to alternate between opposite directions to ensure all of the water is completely flushed out of the pipe.

5.2 CHLORINATION

Each section of new watermain, including all fittings and service connection pipes, shall be disinfected within 10 days before being placed into service.

The pipe shall be drained completely and then slowly filled with potable water that has been pre-mixed with chlorine in a tanker. The water shall be tested for chlorine concentration before use and contain sufficient free available chlorine (FAC) to produce a uniform concentration of between 15 and 25 mg/l in the pipe.

If pre-mixed chlorinated water is not used the chlorine solution must be injected at a continuous rate to ensure a concentration of 15 to 25 mg/l is in contact with every part of the main (Refer to Section 5.3 for chlorine dosage). This can be achieved by pumping in the chlorine solution or by using a chlorine injector while the main is being filled with water.

The chlorinated water shall be introduced at the lowest point of the section of pipe to be disinfected to ensure that no air is trapped. All service pipes and hydrants shall be left open and allowed to run for a couple of minutes. The services and hydrants shall then be closed to allow the highest end of the main to fill completely. Chlorine levels shall be tested and recorded along the length of the main at a minimum of 150m intervals to ensure effective distribution of the chlorine.

The use of hypochlorite powder, granules or tablets dumped into the pipe or through hydrants is not acceptable under any circumstance.

After 12 hours contact time the pH of the water shall be recorded. The effectiveness of hypochlorite as a disinfectant is greatly reduced above pH 8.0. A pH level greater than 9.0 will not be accepted as compliance with the disinfectant requirements and must be repeated using a solution with a pH less than 9.0.

After 24 hours the residual chlorine concentration must be at least 10 mg/l. If this requirement is not achieved, the chlorination procedure shall be repeated. Once this requirement is achieved, the main and service connection pipes shall be flushed with chlorinated water until the chlorine concentration of the water is between 0.5 to 1.0 mg/l. Watermains shall again be flushed with water equivalent to three pipe volumes. Refer to Section 7 for disposal of super-chlorinated water.

Testing takes approximately 24 hours to complete and the main must be connected within 10 days of an acceptable result. Refer to Section 8 for test sample results. The watermain must remain charged during this time to prevent contamination.

The test results must be provided to QLDC.

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5.3 CHLORINE DOSAGES

The required amounts of Sodium hypochlorite must be calculated based on the length and diameter of the main to be disinfected. The steps to calculate the required dose are described below:

- I. Use sodium hypochlorite solution. This solution usually has 10% or 15% FAC
- II. Obtain a clean water tanker, as used for potable drinking water. The tanker should have a known water capacity
- III. Measure the required amount of sodium hypochlorite solution into a beaker and pour it into the empty tanker
- IV. Fill the tanker to the appropriate volume and ensure the solution is well mixed;

Example:

- A. Calculate the volume of the mains to be chlorinated, that is, 85 m of 100 mm dia. main

$$\begin{aligned} \text{Vol.} &= \frac{85 \times \pi \times 0.12}{4} = 0.67 \text{ m}^3 \\ &= 667.6 \text{ litres} \end{aligned}$$

Plus 110 m of 150 mm dia. Main

$$\begin{aligned} \text{Vol.} &= \frac{110 \times \pi \times 0.152}{4} = 1.944 \text{ m}^3 \\ &= 1.944 \text{ litres} \end{aligned}$$

$$\text{Total volume} = 1,944 + 667.6 = 2,611.6 \text{ litres}$$

- B. The total volume of 2,611.6 litres is less than the volume of the water tanker (say 5,000 litres) so calculate how many millilitres of sodium hypochlorite is required for the 5,000 litre tanker to give a final solution of 25 g/m³

$$v = \frac{V \times c}{s \times 10}$$

v = volume of sodium hypochlorite in ml

V = volume of water tanker

c = concentration of final solution in g/m³

s = strength of concentrated hypochlorite in % FAC

$$v = \frac{5000 \times 25}{15 \times 10} = 833 \text{ ml}$$

5.4 NEW MAIN CONNECTION

The connection of a new main to existing reticulation may be treated as a medium risk (refer to Section 11.1 for risk classification) situation provided sanitary construction procedures are followed ensuring no contamination of either the new or existing main by foreign material or groundwater.

If the newly chlorinated main has not been connected to the existing reticulation within 10 days of chlorination, the main shall be retested for E.coli as per the initial testing. If any of the new samples fail the E.coli test the disinfection procedure must be repeated.

New local network main connection procedure:

1. Excavate trench and dig sump under the section of the existing pipe to be removed to allow for the connection. The sump shall be of a depth at least 400mm.
2. Confirm that the new pipe is clear of all foreign matter and clean
3. Shutdown and drain the connecting watermain in accordance with good practice.

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4. Thoroughly clean and disinfect existing connecting pipework/fittings.
5. Any new fittings to be installed shall be kept clear of the surrounding trench material and when unwrapped placed on a clean surface (e.g. impervious plastic sheet) until installed.
6. Spray all surfaces of fittings, and wipe the interior of open ends of the new and existing watermain with a minimum 0.1% chlorine solution (Refer to Section 4.5).
7. After completion of the work, the watermain must be flushed out through hydrants downstream of the new connection. The volume of water used must be equivalent to at least three pipe volumes.

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6 DISINFECTION PROCEDURE FOR RESERVOIRS

Additional guidance for reservoir disinfection is provided in AWWA Standard ANSI/AWWA C652-02 for "Disinfection of Water-storage Facilities".

Network reservoirs shall only be filled and disinfected by a QLDC authorised contractor in accordance with an approved work methodology that includes isolation and disinfection procedures.

6.1 INTENTION

The intention of this procedure is to establish a sustainable reservoir disinfection process that is efficient in the areas of water usage, time and cost. Upon successful completion of this process, the water used for disinfection should be able to be distributed into the network as potable water.

6.2 CLEANING

The reservoir shall be thoroughly cleaned, using a jet-wash and hypochlorite solution, and then inspected by an authorised QLDC representative. Disinfection shall not commence until QLDC has provide approval to proceed.

All equipment used in the disinfection of a reservoir must be oil-free, in good working order, have up-to-date and complete maintenance records and must not pose a contamination risk during the procedure. Use of divers and robotic equipment is subject to specific approval from the QLDC Operations team before the commencement of the procedure.

6.3 RESERVOIR FILLING AND DISINFECTION BY CHLORINATION

The reservoir shall be partially filled with potable water to a volume of 20% of the reservoir's capacity. All inlet and outlet valves on the reservoir shall then be isolated and, if practical, locked prior to disinfection starting.

Chlorine shall be added to the fill volume to result in a FAC of 2.0 mg/L. The water shall then be left to stand for a minimum of 24 hours. Field testing to confirm the chlorine concentration is required using a portable handheld meter; the testing results shall be provided to the QLDC Operations team. Should testing indicate a significant drop in the chlorine concentration, QLDC shall advise how to proceed.

6.4 TESTING

The chlorine concentration shall be measured at the end of the initial 24-hour standing period and, if required, additional chlorine shall be added as the reservoir is filled to the Top Water Level (High) The final chlorine concentration at Top Water Level (High) shall be within the range of 0.6 to 1.0 mg/L. The reservoir shall be filled in such a way that the water is well mixed.

Field testing of the chlorine concentration shall be carried out using a handheld meter with samples taken from representative sample points to confirm the actual FAC concentration. If the reservoir has top and bottom sample points, both points must be sampled. If the concentration is less than the specified minimum, further chlorination and mixing shall be undertaken until this concentration is achieved.

Having achieved the required chlorine concentration from both sample points, the reservoir shall be left to stand for a further 24 hours. Following this period, the reservoir shall be sampled as early as practicable by an IANZ certified laboratory. Sampling must be completed by authorised laboratory personnel only. The required tests are listed in Section 8 of this document.

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Acceptable sample results are given in Section 8 of this document and must be achieved before the reservoir is placed into service. If the results are not satisfactory, the reservoir shall be re-chlorinated and re-tested until acceptable results are achieved.

The reservoir can be placed into service following QLDC receipt of acceptable sampling results.

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7 DISPOSAL OF CHLORINATED WATER – IF REQUIRED

Should the reservoir disinfection process be unsuccessful for any reason, the chlorinated water must be disposed in an appropriate manner, preferably via discharge to the wastewater network. Discharge of water with residual chlorine concentration into the wastewater network requires prior approval from QLDC. The rate of discharge to the sanitary sewer shall be limited to a maximum of 10 litres per second (further restrictions may apply due to location of discharge).

If the disposal of super-chlorinated water into the sanitary sewer system is not achievable then the water must be de-chlorinated to a maximum residual of 0.02 mg/l before discharge to ground or a stormwater system. Alternatively, the super chlorinated water could be retained in a temporary surface storage pond until the maximum residual is less than 0.02 mg/l before being allowed to discharge to the stormwater drainage system, ground, or into a natural watercourse.

8 LABORATORY TEST RESULTS

Laboratories shall be IANZ certified.

The sample results shall be in accordance with Table 1 before the reservoir or pipeline will be considered satisfactory to put into service. Test results shall be provided to QLDC.

Table 1 Acceptable Laboratory Test Results

Parameter	Acceptable Value
Residual Chlorine	Between 0.6 and 1.0 mg/l
Turbidity	<1 NTU
E. coli	<1/100ml

Note 1: For the disinfection of an existing watermain it is likely that the watermain will have been returned to service before the results are obtained. Field tests may be accepted for medium risk whilst waiting for laboratory results.

Note 2: Should E.coli be identified in any sample either prior to, or following the return to service of the reservoir or watermain, then the response should be as per the Drinking Water Standards for New Zealand 2005 (as amended in 2008), section 3.4.1.2.

APPENDIX 1 – WATERMAIN DISINFECTION CHECKSHEET

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Chlorine Type Added		Pipe Length	
TEST RESULTS			
Test Point	Initial (mg/l)	24 Hours (mg/l)	
pH Reading at 12 hours			
Laboratory Results Acceptable (Attach)	<input type="checkbox"/> Yes <input type="checkbox"/> No		

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: _____

Print Name: _____

APPENDIX 2 – RESERVOIR DISINFECTION CHECKSHEET

GENERAL INFORMATION	
Facility	
Asset ID	
RESERVOIR DISINFECTION	
PRE-DISINFECTION INSPECTION	
Date Inspected	
Inspected by	
Cleaned Satisfactorily	<input type="checkbox"/> Yes <input type="checkbox"/> No
INITIAL DISINFECTION	
Date Filled (to 2m depth)	
Chlorine Type, Concentration and Amount Added	
Residual at 24 hours	
Tested By	
Note details of any additional chlorine required	
TESTING AT TOP WATER LEVEL (HIGH)	
Residual Chlorine (Top)	
Residual Chlorine (Bottom)	
Tested By	
Laboratory Results Acceptable (Attach)	<input type="checkbox"/> Yes <input type="checkbox"/> No

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: _____

Print Name: _____