# WQMS WORK INSTRUCTION
# Water Main Disinfection and Commissioning Process

## 1 Purpose

This document provides the instruction and procedures required to ensure water main safety prior to commissioning. Construction of a new water main must pass all appropriate testing before it can be commissioned. Acceptance testing includes pressure testing and water quality analysis to ensure effective disinfection.

This work instruction applies to work conducted throughout the Central Coast Council including prior to connection of new mains, temporary supply mains, bypasses, disused mains prior to putting back into service.

Length and types of main to include, e.g. raise/lower mains (min length), minor extensions, not reactive??

## 2 Roles

| Role | Responsibility |
|---|---|
| Responsible Council Officer (RCO) | The Responsible Council Officer performs the testing, completes the paperwork and manages communication between parties involved. The RCO can be any of the following:<br>• Project Delivery Engineer or delegate, for council contracts<br>• Water Assessments Team for developer-constructed water mains<br>• Minor Construction Team Leader or delegate for council-constructed / repaired water mains<br>• Network Operations Team Leader |
| Civil Works Engineer (CWE) | The Civil Works Engineer in Network Operations determines whether a water main meets commissioning criteria or more work is required |
| Contractor | The Contractor is responsible for providing and constructing the new main. They may be either a council contractor or a developer's contractor |
| Section Managers, Network Operations | The Section Managers, Network Operations are responsible for approving this work instruction, and may be consulted prior to accepting any water main that does not meet the satisfactory criteria detailed in this process |
| The Proponent | Whoever is responsible for construction of new main, e.g. Developer, contractor, Council |

## 3 References

WQMS-FM-NT1- Form Water Main Chlorination and Commission:

If you are using the form electronically, save it to your appropriate work area so you can fill in the information as it becomes available. If you require paper copies to write on, just print and close.

- REF Water Supply code of Australia WSA 03-2002-2.2 Part 3 construction, Clauses 20.0.0, 19.5.3 and 19.5.2 – Sydney Water Edition Version 2
- WQMS-WI-LBK-828 2I Field Determination of free and total chlorine low range
- WQMS-WI-LBK-838 2I Field Determination of free and total chlorine high range
- WQMS-FM-NT1-884 Form Water Main Chlorination and Commission

- WQMS WI6699264 Calibration of Chlorine Meter (HACH Test Kit Chlorine Pocket Colorimeter II Cat No.58700-00)
- WQMS SH7930476 Sample Containers and Preservation
- WQMS WI7467461 Collecting a Microbiological Water Sample
- WQMS SP8688885 Chemical Specification Sodium Hypochlorite 12.5%

# 4 Equipment required

- Sodium hypochlorite
- 250mL sterile container with added sodium thiosulfate- blue lidded (Microbiological)
- 250 mL sterile container -yellow lidded (pH and Turbidity)
- Chlorine meter (calibrated)
- Appropriate PPE
- Turbidity meter or Lab can do this if a sample is collected.
- Standpipe

# 5 Actions

Construction of a new water main must pass all appropriate testing before it can be commissioned. Acceptance testing includes pressure testing and water quality analysis to ensure effective disinfection. All test results and final acceptance must be recorded on:

- WQMS-FM-NT1-884 Form Water Main Chlorination and Commission

When new mains are constructed, the following must occur:

1. The Proponent must provide all relevant documentation and other requirements prior to commencement of disinfection process. This may include WAE, pressure testing, construction quality records. The RCO must ensure all contractual requirements have been met before proceeding.
2. The contractor must arrange a NATA accredited pipe tester to undertake pressure testing on the new main.
3. The Chlorine Disinfection Procedure is carried out by the contractor (external works) or Council crews (internal works).
4. The Chlorine Disinfection Acceptance Procedure is performed by the RCO.
5. New water main samples must be analysed for E.coli, Total coliforms, turbidity and pH. Analysis is typically undertaken by Council's Laboratory. Alternatively, a contractor may choose to send the water samples to a NATA accredited laboratory.
6. If all test results are:
    - satisfactory - the Responsible Council Officer can authorise final acceptance of the new main
    - unsatisfactory - final acceptance of the new main is at the discretion of the Civil Works Engineer

## 5.1 Chlorine Disinfection Procedure

The disinfection of a main is carried out through chlorination via sodium hypochlorite dosing.

The Chlorine Disinfection Procedure must be carried out by either Council crews (for internal works) or the contractor (for external works) using the following procedure:

1. Disinfection water shall not be discharged to the environment. Check with the Tech Services to confirm there is sufficient capacity, before disposing of all flush and test waters via the sewer main. Otherwise, use a tanker to collect and legally dispose of discharge waters. Ensure there is no contamination of the water main during discharge. For example: through contact with a sewer manhole.
2. Flush the new water main at high flow using potable water to remove debris. If potable water is drawn from the reticulation system, suitable backflow prevention must be used.
3. Calculate the volume of water required to fill the main and the required amount of sodium hypochlorite using the following table:

**Water & Sodium Hypochlorite Table**

| | | Pipe Nominal Diameter | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | DN100 | | DN150 | | DN225 | | DN300 | |
| | | $H_2O$ | SH | $H_2O$ | SH | $H_2O$ | SH | $H_2O$ | SH |
| | | KL | L | KL | L | KL | L | KL | L |
| Pipe length (M) | 10 | 0.1 | 0.1 | 0.2 | 0.1 | 0.4 | 0.3 | 0.7 | 0.6 |
| | 20 | 0.2 | 0.1 | 0.4 | 0.3 | 0.8 | 0.7 | 1.4 | 1.2 |
| | 30 | 0.2 | 0.2 | 0.5 | 0.4 | 1.2 | 1.0 | 2.1 | 1.8 |
| | 40 | 0.3 | 0.3 | 0.7 | 0.6 | 1.6 | 1.3 | 2.8 | 2.3 |
| | 50 | 0.4 | 0.3 | 0.9 | 0.7 | 2.0 | 1.7 | 3.5 | 2.9 |
| | 60 | 0.5 | 0.4 | 1.1 | 0.9 | 2.4 | 2.0 | 4.2 | 3.5 |
| | 70 | 0.5 | 0.5 | 1.2 | 1.0 | 2.8 | 2.3 | 4.9 | 4.1 |
| | 80 | 0.6 | 0.5 | 1.4 | 1.2 | 3.2 | 2.6 | 5.7 | 4.7 |
| | 90 | 0.7 | 0.6 | 1.6 | 1.3 | 3.6 | 3.0 | 6.4 | 5.3 |
| | 100 | 0.8 | 0.7 | 1.8 | 1.5 | 4.0 | 3.3 | 7.1 | 5.9 |
| | 200 | 1.6 | 1.3 | 3.5 | 2.9 | 8.0 | 6.6 | 14.1 | 11.7 |
| | 300 | 2.4 | 2.0 | 5.3 | 4.4 | 11.9 | 9.9 | 21.2 | 17.6 |
| | 400 | 3.1 | 2.6 | 7.1 | 5.9 | 15.9 | 13.2 | 28.3 | 23.5 |
| | 500 | 3.9 | 3.3 | 8.8 | 7.3 | 19.9 | 16.5 | 35.3 | 29.3 |
| | 600 | 4.7 | 3.9 | 10.6 | 8.8 | 23.9 | 19.8 | 42.4 | 35.2 |
| | 700 | 5.5 | 4.6 | 12.4 | 10.3 | 27.8 | 23.1 | 49.5 | 41.1 |
| | 800 | 6.3 | 5.2 | 14.1 | 11.7 | 31.8 | 26.4 | 56.5 | 46.9 |
| | 900 | 7.1 | 5.9 | 15.9 | 13.2 | 35.8 | 29.7 | 63.6 | 52.8 |
| | 1000 | 7.9 | 6.5 | 17.7 | 14.7 | 39.8 | 33.0 | 70.7 | 58.7 |

Water ($H_2O$) in kilolitres, Sodium Hypochlorite (SH) in Litres

This will produce a chlorine ($Cl_2$) concentration of about 100mg/L.

4. If source water is from a water truck, add the sodium hypochlorite to all access hatches evenly. Ensure adequate mixing occurs.

5. Dose liquid sodium hypochlorite / water mixture into the new main at a quantity as determined above, sufficient enough to ensure adequate disinfection.
6. Operate and flush all valves, hydrants, water meter ball valves (where fitted) and other fittings to ensure complete disinfection.
7. Allow for a contact time of at least 24 hours for PVC or 48 hours for cement lined mains.
8. The contractor must advise the Responsible Council Officer by email or telephone at the commencement of the contact time.

## 5.2 Chlorine Disinfection Acceptance Procedure

The Chlorine Disinfection Acceptance Procedure must be carried out by the Responsible Council Officer in accordance with:

- WQMS-WI-LBK-828 2I Field Determination of free and total chlorine low range
- WQMS-WI-LBK-838 2I Field Determination of free and total chlorine high range

as follows:

1. Once the chlorine disinfection contact time has elapsed, test the free and total chlorine level in the main. If the free chlorine is below 7.5mg/L the main will require re-chlorination. Repeat from section 5.1 Chlorine Disinfection Procedure
2. Mark the sample collection points on the map, making sure you provide sufficient clarity on the mapped sample location. Council staff should use the reverse side of the form:
    - WQMS-FM-NT1-884 Form Water Main Chlorination and Commission
3. If free chlorine in the main is ≥7.5mg/L:
    a. The contractor / council crew must check with the Civil Works Engineer before water disposal, to confirm there is sufficient capacity, before disposing of all flush and test waters via the sewer main. Otherwise, use a tanker to collect and legally dispose of discharge waters. Ensure there is no contamination of the water main during discharge. For example: through contact with a sewer manhole.
    b. Inform the contractor (for external works) or the council crew (for internal works) that the mains can now be drained and flushed with potable water.
    c. Test the free and total chlorine residuals of the source water.
    d. Flush the new water main at high flow using potable water to remove debris and charge the main. If potable water is drawn from the reticulation system, suitable backflow prevention must be used.
4. Test the residual free and total chlorine level within the recharged main:
    a. If the free or total chlorine is >5mg/L the main must be reflushed until it is ≤5mg/L.
    b. If the free chlorine is <0.2 mg/L, flush and recharge the main (as described in step 3).
    c. Retest. If the free chlorine residual remains <0.2 mg/L, continue to the next step.
5. Record the chlorine results for both the source water and the main on the **WATER MAIN – CHLORINATION & COMMISSION** form.
6. Request advice on how to proceed from the Civil Works Engineer if the main above fails a second time. The CWE shall be contacted by phone and a confirmation of outcomes provided by email. Need to allow at least 2 working days to resolve.
7. Collect sample(s) of the water in the main for analysis at Council's Laboratory.

a. The WQMS WI7467461 Collecting a Microbiological Water Sample instruction must be followed when collecting the water sample.

b. If Contractor using a NATA laboratory then the RCO must be present to witness sampling procedure and record location details. Samples not witnessed by the RCO may be rejected and new samples required to be collected and analysed.

c. Minimum number of samples:

   (i) Length of main <= 12m – one sample

   (ii) Length of main > 12m – minimum two, i.e. one at or near each end of the main

   (iii) One additional sample per 100m of main, e.g 420m of total main length requires 6 samples, i.e. 2 + 4 = 6

   (iv) The RCO may collect additional samples as and when required to ensure confidence that the main is safe to commission.

d. Locations shall be as agreed with or determined by the RCO. The RCO may consult with the CWE. They should generally be evenly spaced and ensure difficult locations are tested, e.g. sidelines, dead ends, sections that are difficult to flush, low lying areas.

8. Deliver the new main sample(s) to Council's Laboratory before 3pm Monday - Thursday. If samples are to be delivered outside these hours, make prior arrangements with lab staff. Record the chlorine readings on the Laboratory Request form.

9. Laboratory to analyse the new water main sample(s) for *E.coli*, Total coliforms, turbidity and pH.

10. Laboratory to notify the RCO of the water quality results by email.

11. If *E.coli* is detected, Council's Laboratory to phone the RCO and the RCO must immediately phone the CWE. RCO and Council's Laboratory to ensure results forwarded to RCO and CWE by email, with all relevant details.

12. See Table 1 for a summary of water quality acceptance criteria

**Table 1: Water Quality Disinfection Acceptance Criteria:**

| Parameter | Laboratory Result (mpn/100mL) Individual Sample | Disinfection Status |
|---|---|---|
| *E.coli* | < 1 | Satisfactory |
| *E.coli* | ≥ 1 | Unsatisfactory |
| Total Coliforms* | < 1 | Satisfactory |
| Total Coliforms* | ≥ 1 | Acceptance at discretion of CWE |
| pH | 6.5 – 8.5 | Satisfactory |
| pH | < 6.5 or > 8.5 | Acceptance at discretion of CWE.<br>Refer to WSAA Code, Table 19.2 (page 192) – pH up to 9.2 may be accepted for cement lined pipes. |
| Turbidity | < 1 | Satisfactory |
| * There are no Australian Drinking Water Guidelines for total coliforms. However increased concentrations may need to be investigated prior to accepting a new main. | | |

13. Any results that are not 'Satisfactory' shall be discussed with the CWE. If any dispute over agreed action to take then the Contractor and the RCO must repeat the process from section 5.1 Chlorine Disinfection Procedure.
14. The RCO must record the water quality results on the **WATER MAIN – CHLORINATION & COMMISSIONING** form.
15. If the new main passes the acceptance testing for pressure testing and disinfection, it can be commissioned for operation.
16. If commissioning of main cannot occur within 14 days of compliant acceptance testing then CWE must be consulted for any additional requirements. Options may include retesting all water quality parameters, re-disinfection.

### 5.3 Records

The RCO shall register the completed **WATER MAIN – CHLORINATION & COMMISSION** form into the appropriate Content Manager location, depending on role and current team procedure. In addition, all forms must be registered in:

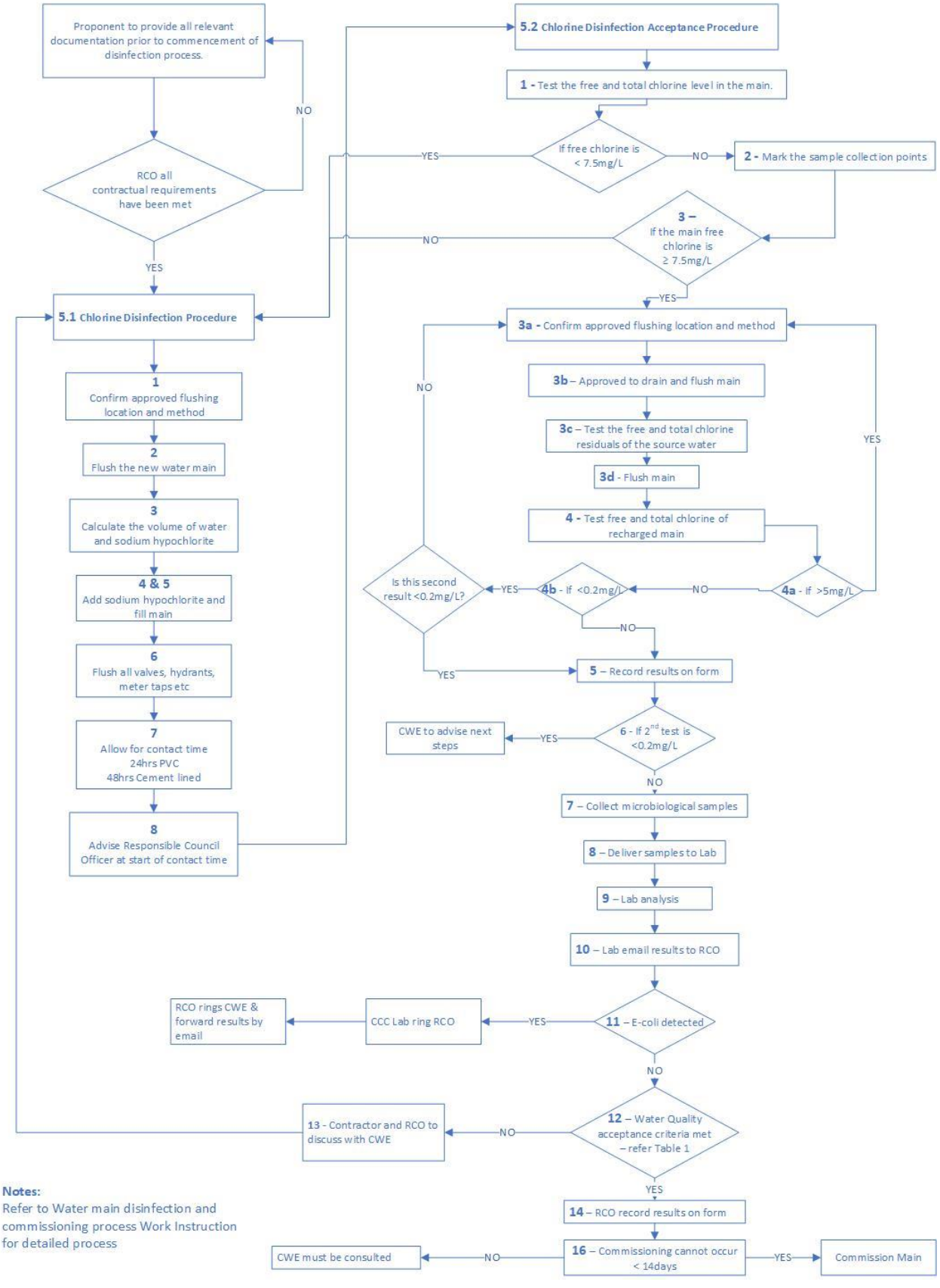
**CM F2020/00494 Water Mains Test Results**

## 6 Process Map

See attached

## Water Main Disinfection and Commissioning Process Map

The Chlorination Disinfection Procedure must be carried out by either Council crews (internal works) or the contractor (external works) using the following procedure




**Notes:**
Refer to Water main disinfection and commissioning process Work Instruction for detailed process