KEMPSEY
Shire Council

Drinking Water Management System

# Annual Report

# July 2020-June 2021

# Document control

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| Document | Drinking Water Management System Annual Report |
| File No | F19/2008 |
| Date | 4th May 2022 |
| Prepared by | Bobbie Brenton, Water Quality Officer Kempsey Shire Council<br>On behalf of<br>Wes Trotter, Manager Water and Sewer Kempsey Shire Council |
| Approved by | Robert Fish, Director Operations and Planning Kempsey Shire Council |

**Report Revision History**

| Version | Date | Details | Review |
|---|---|---|---|
| 0.1 | 04/03/2022 | First Draft | **Internal – Kempsey Shire Council**<br>Wes Trotter – Manager Water and Sewer<br>John Nelson – Coordinator Water and Sewer Operations<br>Scott Brown – Team Leader Water Treatment |
| 0.2 | 11/03/2022 | Second Draft | **Internal - Kempsey Shire Council**<br>Robert Fish - Director Operations and Planning |
| 0.3 | 18/03/2022 | Final Draft | **External - North Coast Public Health Unit**<br>Tennille Lawrence-Haskew – Senior Environmental Health Officer<br>David Basso - Environmental Health Officer |
| 0.4 | 21/03/2022 | Final Draft review | **North Coast Public Health Unit and Kempsey Shire Council Yearly DWMS Review meeting**<br><br>**North Coast Public Health Unit**<br>David Basso - Environmental Health Officer<br><br>**Kempsey Shire Council**<br>Robert Fish - Director Operations and Planning<br>Wes Trotter – Manager Water and Sewer<br>John Nelson – Coordinator Process Water and Sewer<br>Scott Brown – Team Leader Water Treatment<br>Bobbie Brenton – Water Quality Officer |
| 1.0 | 26/04/2022 | Final | **External - North Coast Public Health Unit**<br>David Basso - Environmental Health Officer |

# Executive Summary

Kempsey Shire Council (Council) manages eight (8) water supply systems, providing drinking water to Kempsey - Lower Macleay (KLM), Crescent Head, Hat Head, South West Rocks, Stuarts Point, Willawarrin, Bellbrook, and the Thunggutti Aboriginal Community.

Council has developed this report as part of its requirements to perform an annual evaluation and review of the performances of its water supply systems. The evaluation and review are based on the current regulatory framework, reporting requirements and guidelines of the Australian Drinking Water Guidelines (ADWG) (ADWG; 2011); along with reporting requirements of NSW Health that includes a yearly document submission to the local Public Health Unit (PHU), NSW Health.

This report covers the period of 1 of July 2020 to 30 of June 2021 and satisfies the reporting (Element 10), evaluation (Element 11) and review and continual improvement (Element 12) requirements of Councils Drinking Water Management System (DWMS).

## DWMS document review

Internal workshops during February 2021 were held for the review of the DWMS Overall Manual, Sub plans (8 separate supply systems) and the Water Quality Incident Response and Reporting plan. Identified updates included adjustments to CCPs and monitoring frequencies, these were finalized before 30 June 2021 for commencement at the start of the 2021-2022 reporting period.

Review and updates to the Risk Register and Implementation Plan (IP) where completed post 2020-2021 report period (workshops held in October 2021). Summary is discussed in “Improvement plan implementation”.

## Supply summary and system upgrades

Planning was completed and the Stuarts Point Reservoir refurbishment had commenced in the Stuarts Point supply system; pH correction facilities were added to Willawarrin and Thunggutti supplies, and membrane cleaning system modifications continue in the South West Rocks supply.

## Performance of critical control points

Council had fifty-six (56) fewer Critical Control Point (CCP) exceptions reported compared to 2019-2020 reporting year. The Kempsey - Lower Macleay and Crescent Head supplies showed the greatest improvement from the previous reporting year with only the Willawarrin supply having an increase in the number of captured CCP exceptions. No exceptions were recorded in the South West Rocks or Stuarts Point supplies. A summary of critical control point exceptions is listed in Table E.1.

### Table E.1 - Critical Control Points Summary

| | 2019 -2020 | | | 2020-2021 | | | Difference between report years |
|---|---|---|---|---|---|---|---|
| **Supply System** | Alert | Critical | Total | Alert | Critical | Total | |
| **Kempsey - Lower Macleay** | 35 | 2 | 37 | 13 | 0 | 13 | **-24** |
| **Crescent Head** | 41 | 0 | 41 | 19 | 0 | 19 | **-22** |
| **Hat Head** | 7 | 0 | 7 | 1 | 0 | 1 | **-6** |
| **South West Rocks** | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Stuarts Point** | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Willawarrin** | 2 | 1 | 3 | 3 | 1 | 4 | **+1** |
| **Bellbrook** | 7 | 0 | 7 | 6 | 1 | 7 | **0** |
| **Thunggutti** | 12 | 3 | 15 | 9 | 0 | 9 | **-6** |
| **Total** | **104** | **5** | **109** | **51** | **2** | **53** | **-56** |

## Reservoir inspection programs

No breaches of integrity were detected during in house monthly CCP reservoir inspections.

Three (3) reservoirs (Clybucca, Willawarrin, and Bellbrook) were cleaned and inspected by external contractors during this reporting period.

## Water quality verification

Seventy-eight (78) ADWG and Water Quality Indicators (WQI) exceptions occurred from the combined NSW Health sponsored monitoring program and Council's in house operational monitoring program. This includes four (4) Total Coliform detections and three (3) Nickel detections above the ADWG and WQI.

Total ADWG and WQI water quality exceptions by supply system is summarised in Table E.2.

### Table E.2 Total ADWG and WQI water quality exceptions by supply system

| | Kempsey Lower Macleay | Crescent Head | Hat Head | South West Rocks | Stuarts Point | Willawarrin | Bellbrook | Thunggutti | Total |
|---|---|---|---|---|---|---|---|---|---|
| NSW Health Program | 4 | 3 | 1 | 1 | 0 | 6 | 0 | 4 | **19** |
| Council Program | 0 | 0 | 0 | 0 | 0 | 37 | 0 | 22 | **59** |
| **Total** | **4** | **3** | **1** | **1** | **0** | **43** | **0** | **26** | **78** |

## Consumer enquires

Thirty-six (36) customer enquiries were recorded across all supplies; a decrease 67.6 % from the one-hundred and eleven (111) enquires from 2019-2020. The majority of enquiries were in the Kempsey – Lower Macleay supply; no customer enquiries were recorded at either Stuarts Point or Thunggutti. Table E.3 provides a summary of costumer enquires.

### Table E.3 Customer Enquires for Councils Water Supply Systems

| Supply System | Dirty | Air or Cloudy | Taste & Odour | Illness | Loss of Supply | Other | Total |
|---|---|---|---|---|---|---|---|
| Kempsey – Lower Macleay | 7 | 1 | 0 | 0 | 12 | 0 | **20** |
| Crescent Head | 1 | 0 | 0 | 0 | 0 | 0 | **1** |
| Hat Head | 2 | 0 | 0 | 0 | 0 | 0 | **2** |
| South West Rocks | 4 | 1 | 3 | 0 | 1 | 0 | **9** |
| Stuarts Point | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| Willawarrin | 2 | 0 | 0 | 0 | 0 | 0 | **2** |
| Bellbrook | 2 | 0 | 0 | 0 | 0 | 0 | **2** |
| Thunggutti | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **18** | **2** | **3** | **0** | **13** | **0** | **36** |

## Water quality incidents or emergency

Two (2) Critical Limit exceptions were reported in two (2) separate water quality incidents to the local North Coast Public Health Unit (NCPHU) at time of occurrence. Table E.4 provides a summary of the water quality incidents.

### Table E.4 Water Quality Incidents

| Supply | Date of Event | Location | CCP Number | CCP Parameter | CCP Critical Limit | CCP Result |
|---|---|---|---|---|---|---|
| **Bellbrook** | 1/07/2020 | Clear Water Tank | CCP3 | Free Chorine | 4.0 mg/L | 4.1 mg/L |
| **Willawarrin** | 29/10/2020 | Raw Water | CCP1 | Turbidity | 2 NTU | 3.12 NTU |

## Monitoring programs

Pesticide monitoring from water supplies servicing discrete Aboriginal communities (5 identified within the drinking water supply areas of Council) are funded by the NSW Aboriginal Communities Water and Sewer Program (ACWSP) every five (5) years. No pesticide testing was conducted in 2020-2021, the next program cycle is due to commence in 2022.

The NSW Department of Primary Industries (DPI) inspects the water supply at the Aboriginal communities at least yearly and checks water quality against ADWG and NSW Health recommended indicators for the tested parameters. All supplies at time of inspections met water quality specifications except for the Greenhill community, though it has been identified that the testing location is not a representative location of water that is supplied to this community.

## Staff training and development

Training and development programs completed by the Water Process Team during 2020-2021 is captured in Table E.5.

### Table E.5 Summary of Completed Training during 2020-2021

| Training Details | Trainees | Water Process Operators | Management Team |
|---|---|---|---|
| DWMS Water Quality Incident Response Yearly VOC | 4 | 6 | 4 |
| DWMS Documentation and Process updates from DWMS review | 4 | 6 | 4 |
| Pollution Incident Response Management Plan (PIRMP) Yearly VOC | 4 | 6 | 4 |
| NSW Health Fluoride Plant Operator Certificate | | 3 | |
| Asbestos Awareness | | 5 | 2 |
| Chemical Awareness | 4 | 6 | 4 |
| Apply Fist Aid and Perform CPR | | 1 | |
| Working at Heights | 1 | | |
| Governance and Risk Management 101 | | | 1 |

## Continuous improvement - implementation plan (IP)

Since the establishment of the DWMS in 2014, the IP has been reviewed yearly by the Risk Management Team in conjunction with the Risk Register. Table E.6 provides the status of the IP at the end of 2020-2021 report year (review undertaken in October 2021).

### Table E.6. Implementation Plan progress status based on risk value

| Residual Risk | Removed | Completed | Standing Items | In progress | Ongoing (Long term actions) | Not Started | New | Tasks Remaining |
|---|---|---|---|---|---|---|---|---|
| Very High | 2 | 3 | 0 | 4 | 4 | 1 | 0 | **9** |
| High | 5 | 3 | 4 | 25 | 8 | 3 | 0 | **40** |
| Medium | 7 | 8 | 0 | 13 | 9 | 3 | 0 | **25** |
| Low | 3 | 2 | 3 | 11 | 6 | 2 | 0 | **22** |
| **Total** | **17** | **20** | **9** | **53** | **27** | **9** | **0** | **96** |

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# Tables



# Figures



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# 1. Report Purpose

The *Public Health Act 2010* (NSW) requires that "*a supplier of drinking water must establish, and adhere to, a quality assurance program that complies with the requirements prescribed by the regulations*".

The NSW Guidelines for Drinking Water Management Systems (NSW Ministry of Health 2013) provides guidance on the implementation of a Drinking Water Management System, in accordance with the *Public Health Act 2010* (NSW) and the *Public Health Regulation 2012* (NSW). These Guidelines are based on the Framework for Management of Drinking Water Quality, as outlined in the Australian Drinking Water Guidelines (ADWG) (NRMMC, NHMRC 2011).

This report provides a summary of Councils annual review of the performance of its water supply systems, for the 12-month period form 1 July 2020 to 30 June 2021.

It has been prepared to support; reporting (Element 10), evaluation (Element 11) and review and continual improvement (Element 12) requirements of the Councils DWMS.

This report includes the following areas:

- DWMS document review
- Supply summary and upgrades
- Performance of critical control points
- Reservoir inspection programs
- Water quality verification
- Water quality incidents or emergency
- Customer enquires
- Monitoring programs
- Staff development and training
- Continuous improvement - implementation plan (IP)

# 2. DWMS Document Review

The NSW Guidelines for DWMS require that all water suppliers review their DWMS and major components on an annual basis.

Councils DWMS Risk Management Team undertakes annual internal reviews on the following DWMS documents.

- Overall Manual
- Sub plans (8 separate supply systems)
- Water Quality Incident Response and Reporting plan
- Risk Register and
- Implementation Plan (IP).

Based on the review outcomes, identified components are actioned and documentation updated as required.

External reviews of Councils DWMS occur on a five (5) year basis or when deemed necessary by Council and/or NSW Health. VIRIDIS Consultants facilitated an external review in May 2018; this was finalized in June 2019 and adopted by Council in August 2019.

Table 2.1 details internal review performed by Council during 2020-2021.

**Table 2.1 DWMS Document Revision History**

| Document | Version & Date | Updates | Submitted to NSW Health and date submitted ? |
|---|---|---|---|
| **Overall Manual** | 4.4 24 June 21 | Contact list, Stakeholder organisational names (DoI to DPIE), Spelling change of Thungutti to Thunggutti added to map overview. WaterOutlook as data storage management system, TEAMS (Microsoft) used document storage | Yes, to NCPHU on 14 July 2021 |
| **Incident Response and Reporting Plan** | 1.1 24 June 21 | Contact List, position names, DoI to DPIE | Yes, to NCPHU on 14 July 2021 |
| **Subplans & CCP Procedures** | | Note: Updates to Tables 3 and CCPs will commence at the start of the 2021-2022 reporting period | Yes, to NCPHU on 14 July 2021 |
| Kemspey and Lower Macleay | 1.1 24 June 21 | Table 3, CCPs SOPs, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| Crescent Head | 1.1 24 June 21 | Figure 1, Table 3, CCPs SOPS, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| Hat Head | 1.1 24 June 21 | Figure 1, Table 3, CCPs SOPS and adjustment of CCP1 location, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| South West Rocks | 1.1 24 June 21 | Figure 1, Table 3, CCPs SOPs, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| Stuarts Point | 1.1 24 June 21 | Figure 1, Table 3, CCPs SOPs, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| Willawarrin | 1.1 24 June 21 | Figure 1, Table 3, CCPs SOPs and inclusion of pH correction at CCP3, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| Bellbrook | 1.1 24 June 21 | Figure 1, Table 3, CCPs SOPs, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| Thunggutti | 1.1 24 June 21 | Figure 1, Table 3, CCPs SOPs and inclusion of pH correction at CCP3, DoI to DPIE, position names, data storage change from F:Drive to WaterOutlook | |
| **Risk Assessment** | 2.6 18 Oct 21 | Internal yearly review by Councils DWMS Risk Team and Coordinators for Water Maintenance and Water Operations. Minor review only, update of risks that had comments against them from desktop review before workshop meeting on the 18 October 2021 | Yes, to NCPHU apart of the 2020 - 2021 Annual Report and Review meeting |
| **Implementation Plan** | 8 29 Oct 21 | Internal annual review by the DWMS Risk Team and Coordinators for Water Maintenance and Water Operations on the 18th, 25th and 28th October 2021<br>Update of positions and group names. Added new Status category of "Standing Item", reformatted and defined status categories | Yes, to NCPHU apart of the 2020-2021 Annual Report and review meeting |

# 3. Supply Summary and Upgrades

Kempsey Shire Council is located on the north coast of NSW, covering an area of 3,380 square kilometres, between the Pacific Ocean to the east, Five Day Creek in the west, Grassy Head to the north and Kundabung to the south.

Council manages eight (8) water supply systems, providing drinking water to:

- Kempsey - Lower Macleay (KLM), (includes the Lower Macleay towns and surrounding areas of Frederickton, Smithtown, Gladstone, Kinchela, and Jerseyville)
- Crescent Head
- Hat Head
- South West Rocks
- Stuarts Point
- Willawarrin
- Bellbrook
- and the Thunggutti Aboriginal Community

Figure 3.1 provides locality map of each of the Councils supply systems and Table 3.1 provides a summary of each of the water supply systems and any upgrades that have occurred during the reporting year.

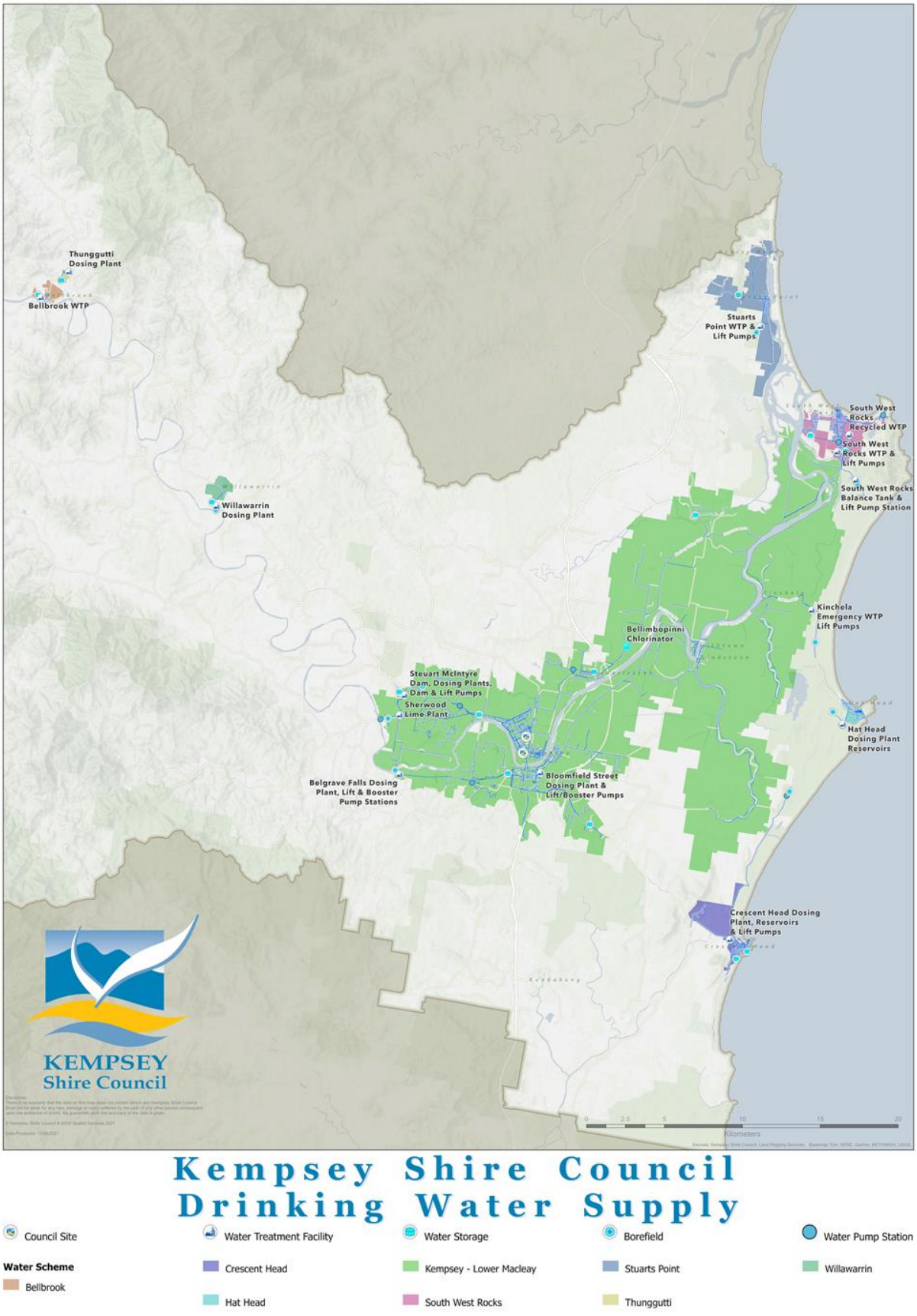



**Figure 3.1 Kempsey Shire Water Supplies**

**Table 3.1. Councils Drinking Water Supply Systems Summary**

| Supply System | Source Water | Treatment | Treatment Capacity | Population serviced | Towns & Communities supplied | System upgrades in 2020/21 |
|---|---|---|---|---|---|---|
| Kempsey and Lower Macleay | Groundwater, Sherwood (from the Macleay River) | Gas chlorine for disinfection and lime dosing for pH correction. | 20 ML/day | ~20 461 | Kemspey<br>Frederickton<br>Gladstone<br>Smithtown<br>Kinchela<br>Jerseyville and surrounding rural regions as depicted on Figure 2.1<br>New Burnt Bridge and Greenhill Aboriginal Communities | No additional upgrades in either treatment train<br><br>Additional Notes:<br>Working on application for Section 60 Endorsement for Option assessment and procurement for preparation of Concept Design. |
| | Steuart McIntyre Dam (Emergency Supply)<br>From Groundwater Sherwood | Aeration and Ultrasound for Algae Control, Chlorine (Sodium hypochlorite) dosing for disinfection. | 38.1 ML/day | | | |
| Crescent Head | Groundwater, Maguires Crossing Hat Head National Park | Lime and CO2 dosing for increasing alkalinity and pH correction.<br>Gas chlorination for disinfection. | 2.6 ML/day | ~1500 permanent population<br><br>~4500 holiday population | Crescent Head<br>Loftus Road Aboriginal Community | No additional upgrades<br><br>Additional Notes:<br>Working on application for Section 60 endorsement options decommissioning of the temporary storage tank to facilitate construction of New WTP. |
| Hat Head | Groundwater, Hat Head National Park | Aerator for iron removal, soda ash for pH correction and chlorine gas for disinfection. | 2.6 ML/day | ~350 permanent population<br><br>~2000 holiday population | Hat Head | No additional upgrades |
| South West Rocks | Groundwater, Hat Head National Park | Aeration, membrane filtration, lime for pH correction, chlorine (sodium hypochlorite) and fluoridation. | 6 ML/day | ~5700 permanent population<br><br>~15 000 holiday population | South West Rock<br>Figtree Aboriginal Community | Membrane renewal and associated system modifications |

| Supply System | Source Water | Treatment | Treatment Capacity | Population serviced | Towns & Communities supplied | System upgrades in 2020/21 |
|---|---|---|---|---|---|---|
| Stuarts Point | Groundwater | Ferric dosing for coagulation and Iron and arsenic removal, sand filtration and chlorine gas for disinfection. | 2.7 ML/day | ~1000 permanent population<br><br>~4000 holiday population | Stuarts Point<br>Fishermans Reach<br>Grassy Head | Reservoir relined apart of the reservoir renewal program |
| Willawarrin | Surface water from Macleay River (bore on edge of river for gravel bed extraction) | Chlorine (sodium hypochlorite) dosing.<br>Soda ash for pH correction (new) | 200 kL/day | ~130 | Willawarrin | pH correction facilities installed at treated water (disinfection) in June 2020<br><br>Additional notes:<br>Ongoing planning of land acquisition for design and Construction of a new WTP. |
| Bellbrook | Surface water from Macleay River (bore within river for gravel bed extraction) | Multi-media filtration including arsenic removal, soda ash for pH correction and chlorine (sodium hypochlorite) dosing. | 140 kL/day | ~100 | Bellbrook | Additional notes:<br>Ongoing planning of WTP augmentation |
| Thunggutti | Surface water from creek (bore on edge of river for gravel bed extraction) | Chlorine (sodium hypochlorite) dosing.<br>Soda ash for pH correction (new) | 110 kL/day | ~120 | Thunggutti Aboriginal Community | pH correction facilities installed at treated water (disinfection) in June 2020 |

# 4. Critical Control Points

A Critical Control Point (CCP) is defined as an "*activity, procedure or process at which control can be applied, and which is essential to prevent a hazard or reduce it to an acceptable level*" (NSW Ministry of Health 2013). These may be processes such as selective abstraction of raw water, filtration, disinfection, or reservoir integrity. For each CCP, a parameter, such as chlorine residual, can be measured to verify the effectiveness of the process or identify when corrective action is required.

Operational Target, Alert Level and Critical Limits are determined for each CCP parameter to identify normal and out of normal operational conditions, where:

- **Operational Target** identifies the normal operational conditions,
- **Alert Level** indicates that the parameter is outside the normal conditions and corrective action may be required.
- **Critical Limit**, if exceeded, indicates that process control has been lost and safe water quality can no longer be guaranteed.

## 4.1 Data Collection and Monitoring

Monitoring of CCPs is undertaken throughout Councils eight (8) supply systems, as per the requirements of Councils Drinking Water Management System (DWMS). System specific CCP Standard Operating Procedures (SOP) Tables (Appendix A) have been established for:

- CCP1 - Abstraction from groundwater (Turbidity),
- CCP1 - Abstraction from Steuart Macintyre Dam – Emergency Supply (Turbidity along with Algae, Toxins, Taste and Odour)
- CCP2 - Filtration (Turbidity)
- CCP3 - Disinfection (Free Chlorine and pH)
- CCP4 - Fluoridation (South West Rocks at WTP and Gregory St Reservoir)
- CCP5 - Reservoirs (Reservoir Integrity)

Monitoring includes sample collection and analysis using laboratory and field instruments and real-time monitoring of online instrumentation for pre and post treated water via telemetry.

## 4.2 Non-Compliant Data

The CCP exceptions, either Alert Level or Critical Limit, are managed by the Water Operators by undertaking corrective actions following the CCP Standard Operating Procedures (SOP) Tables (Appendix A) and through communications with the Team Leader Water Process.

Water Operators enter operational monitoring results into Councils WaterOutlook data management system specific to each supply. If an entered result is outside of the targeted CCP operational range, WaterOutlook automatically records and notifies via email the Water Operators and Water Management team of the CCP exception (either Alert Level or Critical Limit). This email notification triggers the Water Operator to complete an "Incident Report" also within WaterOutlook.

WaterOutlook assigns the incident report an "Incident Batch Number" for future reference and sends out an email copy of the report to the Water Operators and the Water Management Team. The incident report provides a record of the reason for the exception, the corrective actions undertaken and whether any further actions are required to ensure this exception does not occur again.

WaterOutlook tabulates CCP exceptions for each supply into “Monthly Run Reports”, these reports are further tabulated within WaterOutlook to produce “Water Quality Special Reports”. The Water Quality Special Reports displays all monthly exceptions for each supply into a single table, tabulates a combined CCP monthly total and a running “year to date” (financial year) total. The CCP tables are used for reporting purpose to Council Management and to external stakeholders as required (Annual DWMS Water Quality report).

For reporting purposes Alert Levels and Critical Limits are recorded as a discrete number, i.e., once a CCP falls outside of the Alert Level range and is in the Critical Limit range it is recorded at a Critical Limit only and is not counted in the Alert Level totals.

## 4.3 Reporting

In 2020-2021 fifty-three (53) CCP exceptions were reported. A 51% reduction from the one-hundred and nine (109) exceptions from the previous report year.

Fifty-one (51) Alert Level exceptions and two (2) Critical Limit exceptions from seven-thousand, one hundred and sixty (7160) tests (Table 4.1).

Of Councils eight (8) water supply systems, six (6) systems experienced CCP exceptions.

CCP exceptions for the year are discussed for the supply systems in which they occurred in except for:

- CCP1 - Abstraction from Steuart Macintyre Dam (Algae, Toxins, Taste and Odour); when not in use the monitoring details are captured in Section 9 – Monitoring Programs
- CCP5 Reservoir inspections which is discussed in Section 5 – Reservoir Inspections

CCP supply discussions reference the details provided in Table 4.1 and individual supply system CCP monitoring data graphs.

CCP SOP tables for each supply system are provided in Appendix A.

**Table 4.1 Summary of Critical Control Point exceptions 2020-2021 comparison to 2019-2020**

| | | | | | 2019-2020 | | | 2020- 2021 | | | CCP reduced/Increased from previous year | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Supply System** | **CCP Numbers** | **Control Point** | **Hazard** | **Control Parameter** | **Alert Level** | **Critical Limit** | **Total No samples** | **Alert Level** | **Critical Limit** | **Total No samples** | **Alert Level** | **Critical Limit** | **Combined Total** |
| **Kempsey and Lower Macleay** | KLM CCP1 | Raw Water Abstraction (Bores) | All Pathogens | Turbidity | 0 | 0 | 220 | 0 | 0 | 335 | - | - | - |
| | KLM CCP1* | Raw Water Abstraction (SMD) | All Pathogens | Turbidity | 4 | 0 | 335 | Supply not in use | | | -4 | - | -4 |
| | KLM CCP1* | Raw Water Abstraction (SMD) | Toxins | Algae Biovolume | 5 | 2 | 48 | Supply not in use | | | -5 | -2 | -7 |
| | | | Taste & Odour | MIB | 6 | N/A | 48 | | | | -6 | - | -6 |
| | | | | Geosmin | 4 | N/A | 48 | | | | -4 | - | -4 |
| | KLM CCP3** | Disinfection (SMD) | Chlorine sensitive pathogens | Free Chlorine | 0 | 0 | 680 | Supply not in use | | | - | - | - |
| | | | Chemicals | pH | 16 | 0 | 680 | | | | -16 | - | -16 |
| | KLM CCP3** | Disinfection (Bores) | Chlorine sensitive pathogens | Free Chlorine | 0 | 0 | 8 | 0 | 0 | 359 | | - | |
| | | | Chemicals | pH | 0 | 0 | 8 | 13 | 0 | 359 | | - | |
| | **KLM Combined Total** | | | | **35** | **2** | **1979** | **13** | **0** | **1053** | **-22** | **-2** | **-24** |
| | **KLM CCP % to number of Samples** | | | | **1.8%** | **0.1%** | **1.9%** | **1.2%** | **0%** | **1.2%** | | | |
| Crescent Head | CH CCP1 | Raw water Abstraction | All Pathogens | Turbidity | 16 | 0 | 326 | 9 | 0 | 335 | -7 | - | -7 |
| | CH CCP3 | Disinfection | Chlorine sensitive pathogens | Free Chlorine | 3 | 0 | 347 | 1 | 0 | 360 | -2 | - | -2 |
| | | | Chemicals | pH | 22 | 0 | 347 | 9 | 0 | 359 | -13 | - | -13 |
| | **CH Combined Total** | | | | **41** | **0** | **1020** | **19** | **0** | **1060** | **-22** | **-** | **-22** |
| | **CH CCP % to number of Samples** | | | | **4.0%** | **0%** | **4.0%** | **1.8%** | **0%** | **1.8%** | | | |

| | | | | | 2019-2020 | | | 2020- 2021 | | | CCP reduced/Increased from previous year | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Supply System** | **CCP Numbers** | **Control Point** | **Hazard** | **Control Parameter** | **Alert Level** | **Critical Limit** | **Total No samples** | **Alert Level** | **Critical Limit** | **Total No samples** | **Alert Level** | **Critical Limit** | **Combined Total** |
| Hat Head | HH CCP1 | Raw Water Abstraction | All Pathogens | Turbidity | 0 | 0 | 202 | 0 | 0 | 217 | - | - | - |
| | HH CCP3 | Disinfection | Chlorine sensitive pathogens | Free Chlorine | 0 | 0 | 228 | 0 | 0 | 230 | - | - | - |
| | | | Chemicals | pH | 7 | 0 | 228 | 1 | 0 | 230 | -6 | - | -6 |
| | **HH Combined Total** | | | | **7** | **0** | **658** | **1** | **0** | **677** | **-6** | **-** | **-6** |
| | **HH CCP % to number of Samples** | | | | **1.1%** | **0%** | **1.1%** | **0.1%** | **0%** | **0.1%** | | | |
| South West Rocks | SWR CCP1 | Raw Water Abstraction | All Pathogens | Turbidity | 0 | 0 | 333 | 0 | 0 | 321 | - | - | - |
| | SWR CCP2 | Filtration | All Pathogens | Turbidity | 0 | 0 | 327 | 0 | 0 | 322 | - | - | - |
| | SWR CCP3 | Disinfection | Chlorine sensitive pathogens | Free Chlorine | 0 | 0 | 309 | 0 | 0 | 356 | - | - | - |
| | | | Chemicals | pH | 0 | 0 | 309 | 0 | 0 | 356 | - | - | - |
| | SWR CCP4 | Fluoridation Leaving WTP | Chemical | Fluoride | 0 | 0 | 288 | 0 | 0 | 347 | - | - | - |
| | | Gregory St Outlet | | | 0 | 0 | 300 | 0 | 0 | 352 | - | - | - |
| | **SWR Combined Total** | | | | **0** | **0** | **1856** | **0** | **0** | **2054** | **-** | **-** | **-** |
| | **SWR CCP % to number of Samples** | | | | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | | | |
| Stuarts Point | SP CCP1 | Raw Water Abstraction | All Pathogens | Turbidity | 0 | 0 | 211 | 0 | 0 | 180 | - | - | - |
| | SP CCP2 | Filtration | All Pathogens | Turbidity | 0 | 0 | 238 | 0 | 0 | 215 | - | - | - |
| | SP CCP3 | Disinfection | Chlorine Sensitive pathogens | Free Chlorine | 0 | 0 | 220 | 0 | 0 | 247 | - | - | - |
| | **SP Combined Total** | | | | **0** | **0** | **669** | **0** | **0** | **642** | **-** | **-** | **-** |
| | **SP CCP % to number of Samples** | | | | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | | | |

| | | | | | 2019-2020 | | | 2020- 2021 | | | CCP reduced/Increased from previous year | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Supply System** | **CCP Numbers** | **Control Point** | **Hazard** | **Control Parameter** | **Alert Level** | **Critical Limit** | **Total No samples** | **Alert Level** | **Critical Limit** | **Total No samples** | **Alert Level** | **Critical Limit** | **Combined Total** |
| Willawarrin | WW CCP1 | Raw Water Abstraction | All Pathogens | Turbidity | 2 | 0 | 56 | 1 | 1 | 195 | -1 | +1 | 0 |
| | WW CCP2 | Disinfection | Chlorine sensitive pathogens | Free Chlorine | 0 | 0 | 125 | 2 | 0 | 356 | +2 | - | +2 |
| | **WW Combined Total** | | | | **2** | **0** | **181** | **3** | **1** | **551** | **+1** | **+1** | **+2** |
| | **WW % to number of Samples** | | | | **1.1%** | **0%** | **1.1%** | **0.5%** | **0.2%** | **0.7%** | | | |
| Bellbrook | BB CCP1 | Raw Water Abstraction | All Pathogens | Turbidity | 2 | 0 | 125 | 1 | 0 | 136 | -1 | - | -1 |
| | BB CCP2 | Filtration | All Pathogens | Turbidity | 0 | 0 | 45 | 0 | 0 | 117 | - | - | - |
| | BB CCP3 | Disinfection | Chlorine Sensitive pathogens | Free Chlorine | 4 | 0 | 138 | 5 | 1 | 216 | -2 | +1 | -1 |
| | | | | pH | 1 | 0 | 138 | 0 | 0 | 216 | +1 | - | +1 |
| | **BB Combined Total** | | | | **7** | **0** | **446** | **6** | **1** | **685** | **-1** | **+1** | **0** |
| | **BB % to number of Samples** | | | | **1.6%** | **0%** | **1.6%** | **0.9%** | **0.1%** | **1.0%** | | | |
| Thunggutti | TH CCP1 | Raw Water Abstraction | All Pathogens | Turbidity | 1 | 3 | 149 | 1 | 0 | 196 | - | -3 | -3 |
| | TH CCP2 | Disinfection | Chlorine sensitive pathogens | Free Chlorine | 11 | 0 | 227 | 8 | 0 | 242 | -3 | - | -3 |
| | **TH Combined Total** | | | | **12** | **3** | **376** | **9** | **0** | **376** | **-3** | **-3** | **-6** |
| | **TH % to number of Samples** | | | | **3.2%** | **0.8%** | **4.0%** | **2.1%** | **0%** | **2.1%** | | | |
| All Supply Systems | **Total Sum all Critical Control Points** | | | | **104** | **5** | **7185** | **51** | **2** | **7160** | **-53** | **-3** | **-56** |
| | **% to number of Samples** | | | | **1.4%** | **0.1%** | **1.5%** | **0.7%** | **0.0%** | **0.7%** | | | |

Note 1: Multiple exceptions occurring on the same day are recorded as discrete events at each CCP point as they occur. The Total Alert Level, Critical Limit and Combined Yearly Total is the sum of each discrete exception occurrence on any given day from each individual category.

Note 2: Once a CCP exceeds the Alert Level value it is recorded at a Critical Limit only and is not counted in the Alert Level totals.

Note 3: * KLM CCP1 (SMD) –2019-2020 in use for 358 days: 2020-2021 not used

Note 4: ** KLM CCP3 (Bores) - 2019-2020 in use for 8 days: 2020-2021 in use 365days

### 4.3.1 Kempsey - Lower Macleay (KLM) Supply System

Monitoring data for each of the Kempsey - Lower Macleay supply systems CCPs is shown in Figures 4.3.1a, 4.3.1b and 4.3.1c.

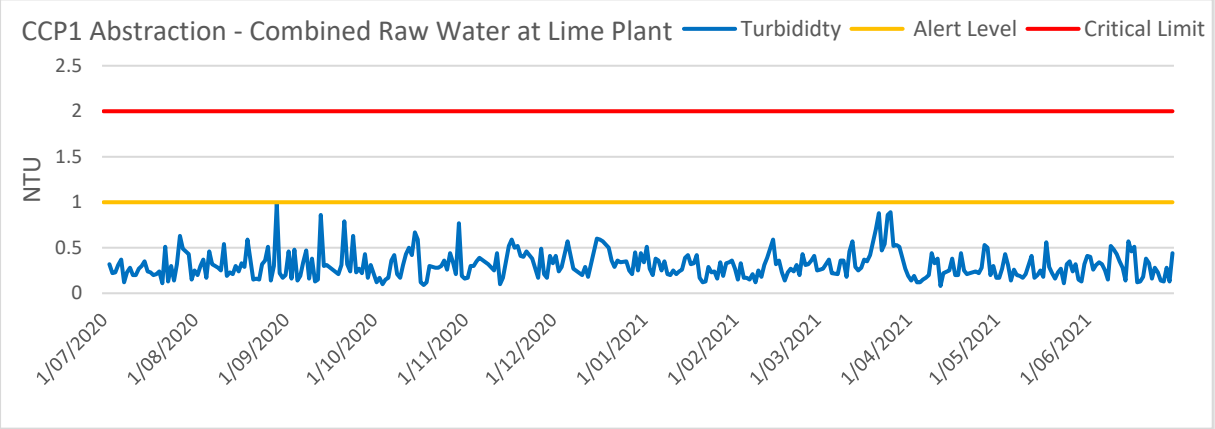



Figure 4.3.1a - CCP 1 Abstraction – Turbidity at combined raw water Lime Plant

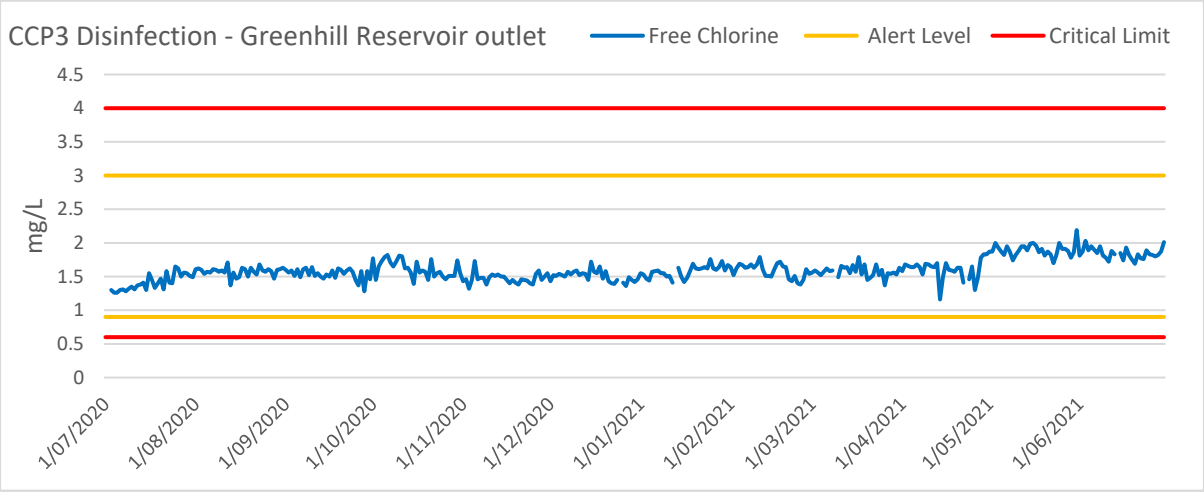



Figure 4.3.1b CCP3 Disinfection – Free Chlorine at Greenhill Reservoir outlet

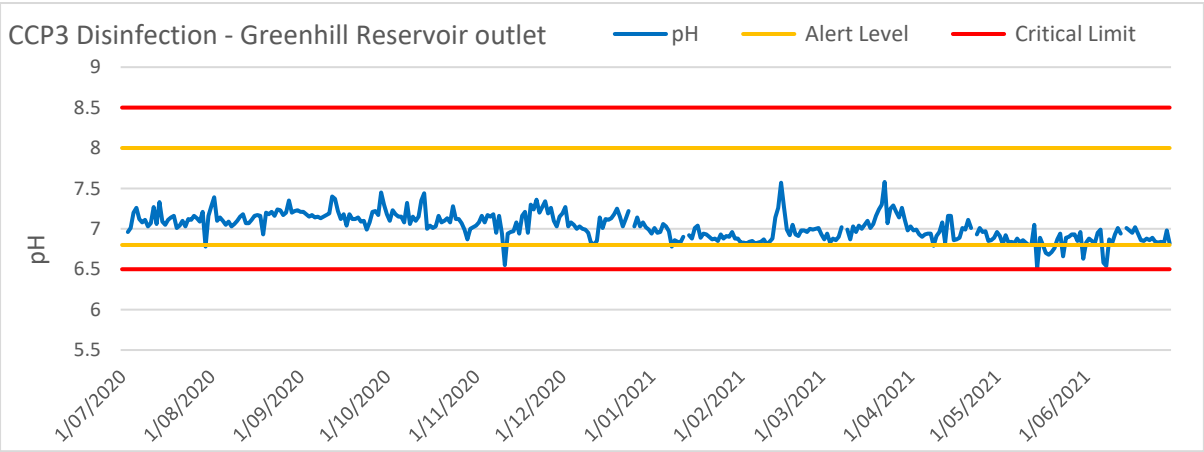



Figure 4.3.1c CCP3 Disinfection – pH at Greenhill Reservoir outlet

No Critical Limit exceptions occurred in the Kempsey - Lower Macleay supply during the 2020-2021 reporting year (Table 4.1 and Figures 4.3.1a, 4.3.1b and 4.3.1c). A reduction of two (2) events from 2019-2020.

Thirteen (13) Alert Level exceptions occurred from one-thousand and fifty-three (1053) samples; a reduction of twenty–two (22) from 2019-2020 (Table 4.1). All exceptions where at CCP3 pH and being a low Alert Level of <6.8 pH (Figure 4.3.1c). Contributing faults include:

- Lime blockages in delivery shute
- Broken agitator
- Float jammed in lime plant causing mixer to over flow
- Lime Plant Stator Pump Fault

Corrective actions involved:

- blockage cleared, checked all dosing equipment and screw feeder
- Acid clean lime plant and replaced dosing line
- Adjusted float in mixer
- Replacement of Pump Stator, clean and check Lime plant.

### 4.3.2 Crescent Head Supply System

Monitoring data for each of the Crescent Head supply systems CCPs is shown in Figures 4.3.2a. 4.3.2b and 4.3.2c.

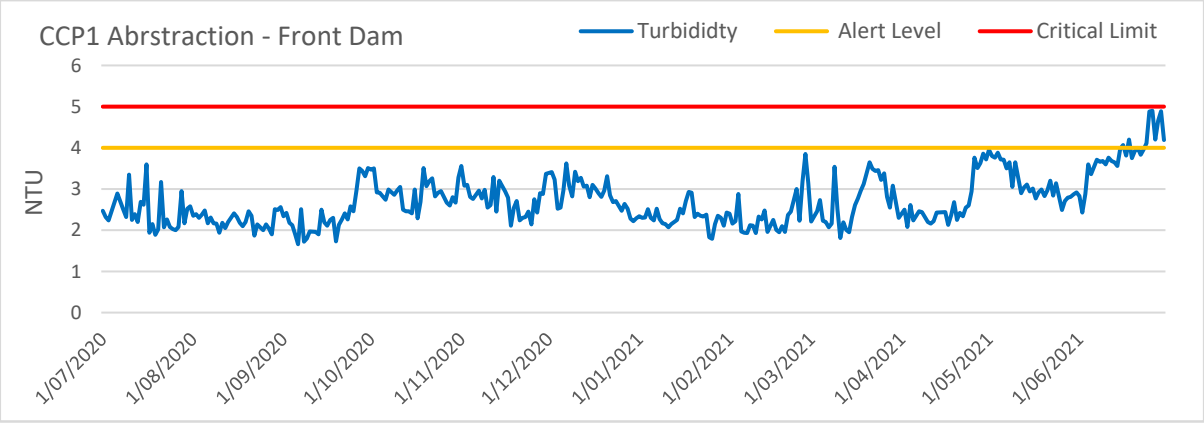



Figure 4.3.2a - CCP 1 Abstraction – Turbidity at Front Dam

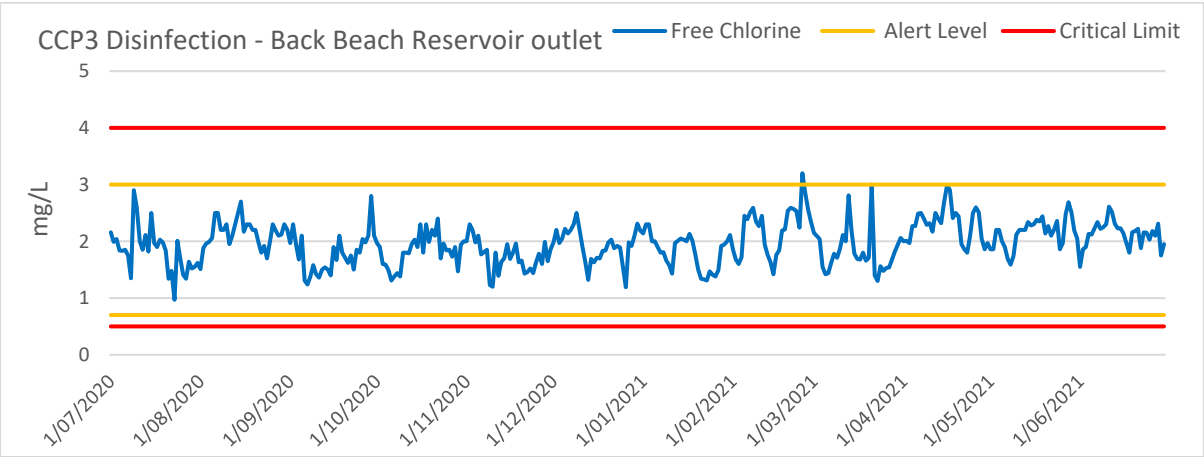



Figure 4.3.2b CCP3 Disinfection – Free Chlorine at Back Beach Reservoir outlet

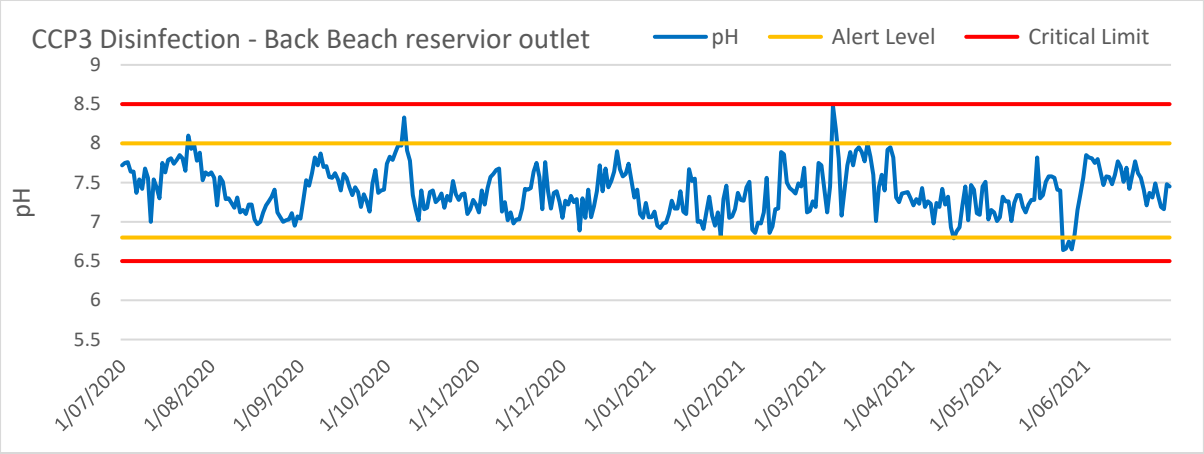



Figure 4.3.2c CCP3 Disinfection – pH at Back Beach Reservoir outlet

No Critical Limits exceptions occurred in the Crescent Head supply in 2020-2021, (Table 4.1 and Figures 4.3.2a, 4.3.2b and 4.3.2c).

Nineteen (19) Alert Level exceptions occurred from one-thousand and sixty (1060) samples. These were reported across the following CCP locations (Table 4.1).

- CCP1 – Abstraction: Turbidity >4 NTU, nine (9) occurrences
- CCP3 – Disinfection
    - Free Chlorine >3 mg/L - one (1) occurrence
    - pH >8.0 - four (4) occurrences
    - pH <6.8 - five (5) occurrences

The nine (9) abstraction Turbidity Alert Levels all occurred in June 2021 (range between 4.07 to 4.90 NTU, Figure 4.3.2a); being a result of declining water quality within the borefield. Bore selection based on water quality testing and scouring of transfer line help to lower turbidity levels at the front dam.

The single Free Chlorine Alert (25/02/2021 – 3.2 mg/L; Figure 4.3.2b) was caused by daily fluctuations in demand due to rainfall. Adjustment to the dosing rate corrected the Free Chlorine concentration back within acceptable operating levels.

The nine pH Alert Levels (Figure 4.3.2c) included:

- Four (4) high Alert Level pH caused by low water levels in the reservoirs that impact lime dilution. The low water levels were caused by:
    - Power outages on 23/07/20. Once power was restored and water fill commenced, the system self-corrected with 24hrs
    - Increased water demand in holiday time drained reservoir faster. Reservoirs fill at off peak energy tariffs. The lime set points where pre-emptive adjusted (decreased) multiple times in the days leading up to the single Alert Level exception and on the day of the exception (7/10/20).
    - A main break in March 2021 caused a rapid water level decrease in the reservoir level; pH self-corrected two days after the main break.

- One (1) marginal (6.79 pH) low pH Alert Level in April 2021 (Figure 4.3.2c). No action was taken the system self-corrected with the following day with a result of 6.88 pH.
- Four (4) low pH Alert Levels in May 2021 from mechanical breakdowns of the pH dosing system; pH was self-corrected a few days after repairs completed.

Future proposed upgrades to the Crescent Head supply include the construction of a Water Treatment Plant for Crescent Head which is in the design and planning stage.

### 4.3.3 Hat Head Supply System

Monitoring data for each of the Hat Head supply systems CCPs is shown in Figures 4.3.3a, 4.3.3b and 4.3.3c.

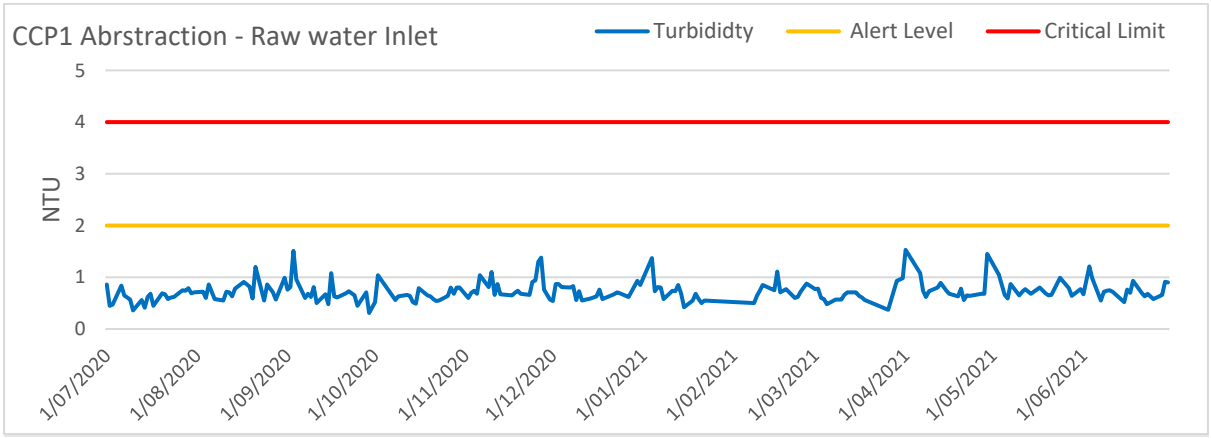



Figure 4.3.3a - CCP 1 Abstraction – Turbidity at Raw water inlet

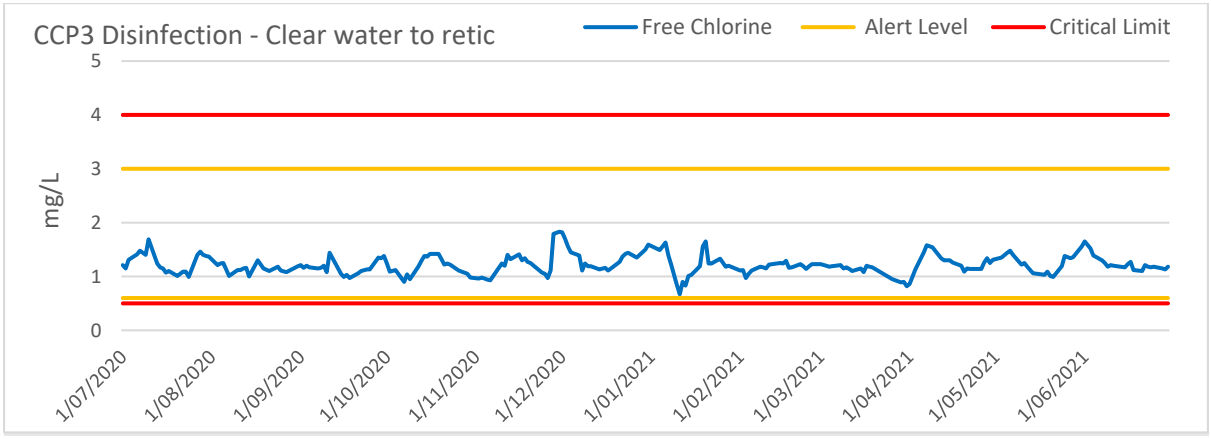



Figure 4.3.3b CCP3 Disinfection – Free Chlorine Clear water to retic

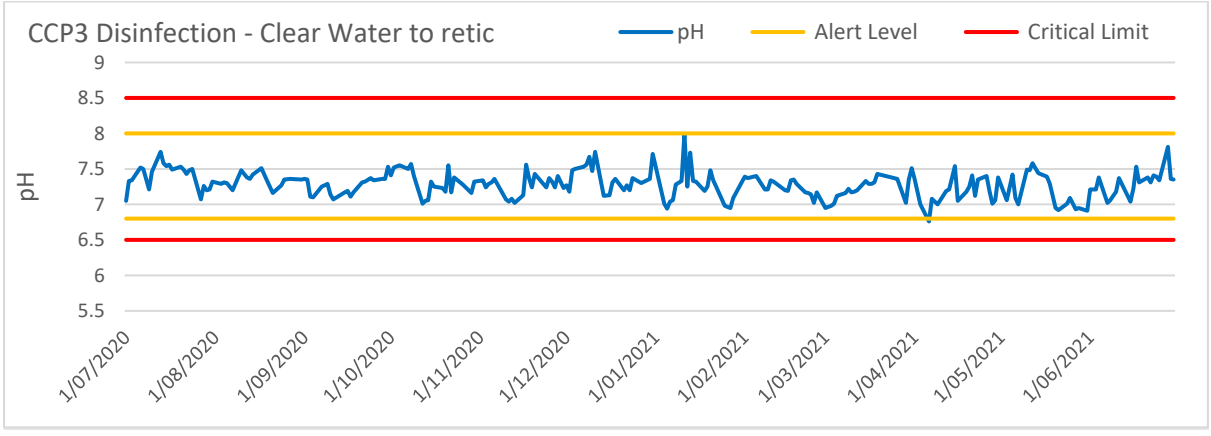



Figure 4.3.3c CCP3 Disinfection – pH Clear water to retic

No Critical Limit exceptions occurred in the Hat Head supply during the 2020-2021 reporting year (Table 4.1 and Figures 4.3.3a, 4.3.3b and 4.3.3c).

A single (1) Alert Level exception was recorded from six-hundred and seventy-seven (677) samples (Table 4.1). This is a reduction of six (6) from 2019-2020. The single Alert Level exception occurred at CCP3 Disinfection (pH) on the 6/04/2021. No action was taken, the system self-corrected, as shown in the trend line of Figure 4.3.3c.

### 4.3.4 South West Rocks Supply System

Monitoring data for each of the South West Rocks supply system CCPs is shown in Figures 4.3.4a, 4.3.4b, 4.3.4c, 4.3.4d and 4.3.4e.

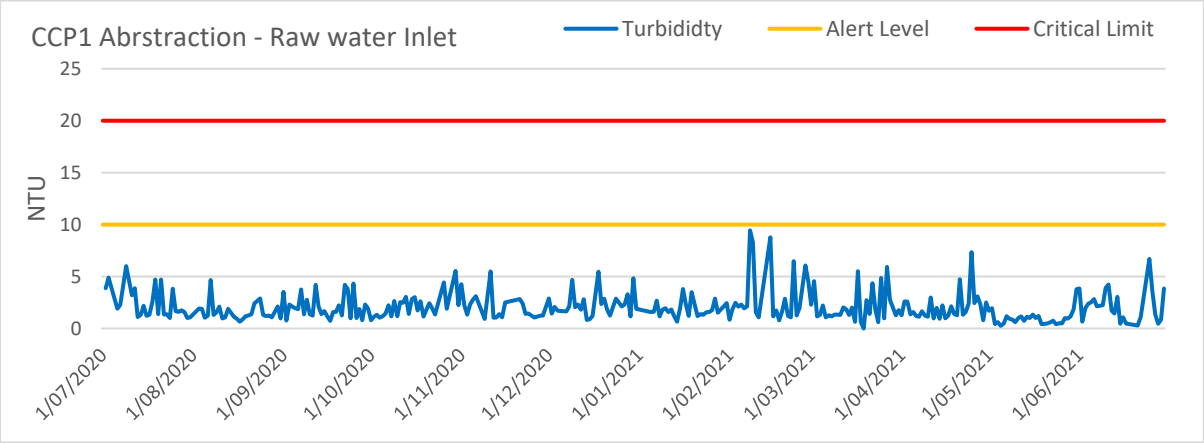



Figure 4.3.4a - CCP 1 Abstraction – Turbidity at Raw water inlet

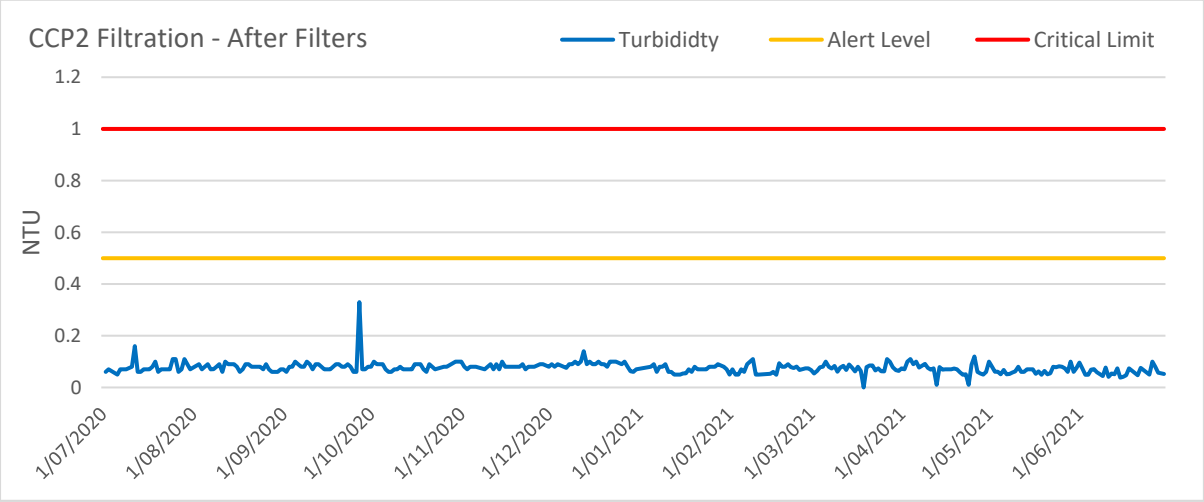



Figure 4.3.4b - CCP 2 Filtration – Turbidity after filters

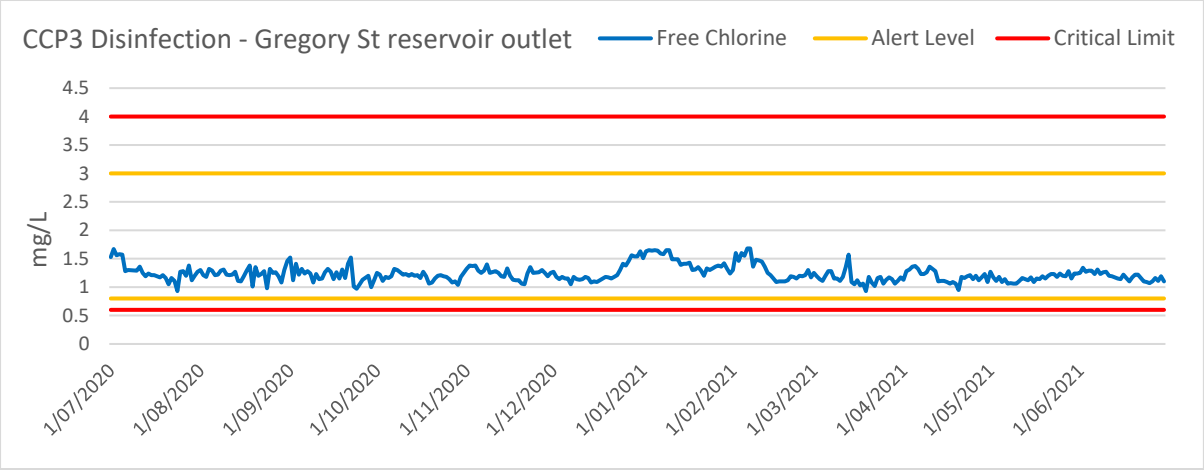



Figure 4.3.4c CCP3 Disinfection – Free Chlorine Gregory Street Reservoir outlet

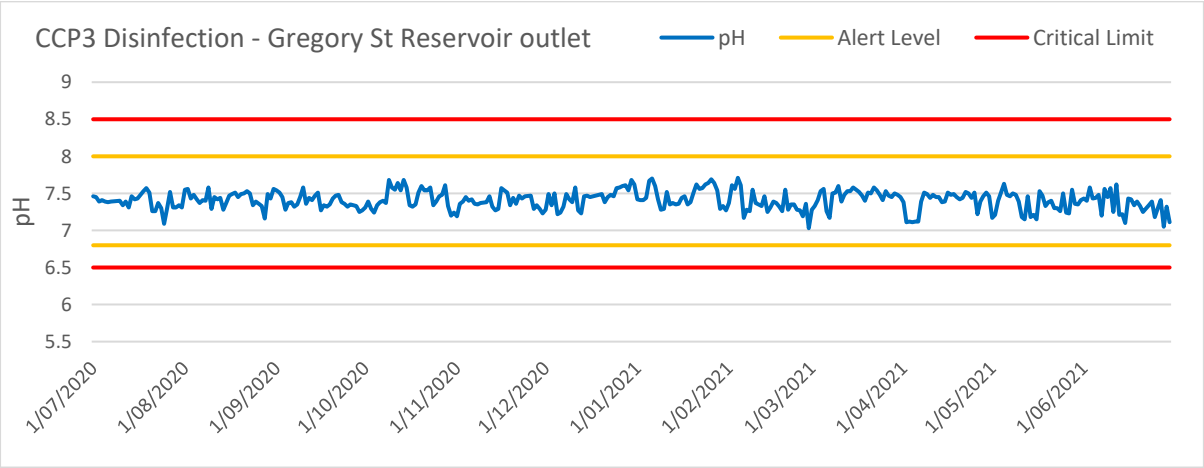



Figure 4.3.4d CCP3 Disinfection – pH Gregory Street Reservoir outlet

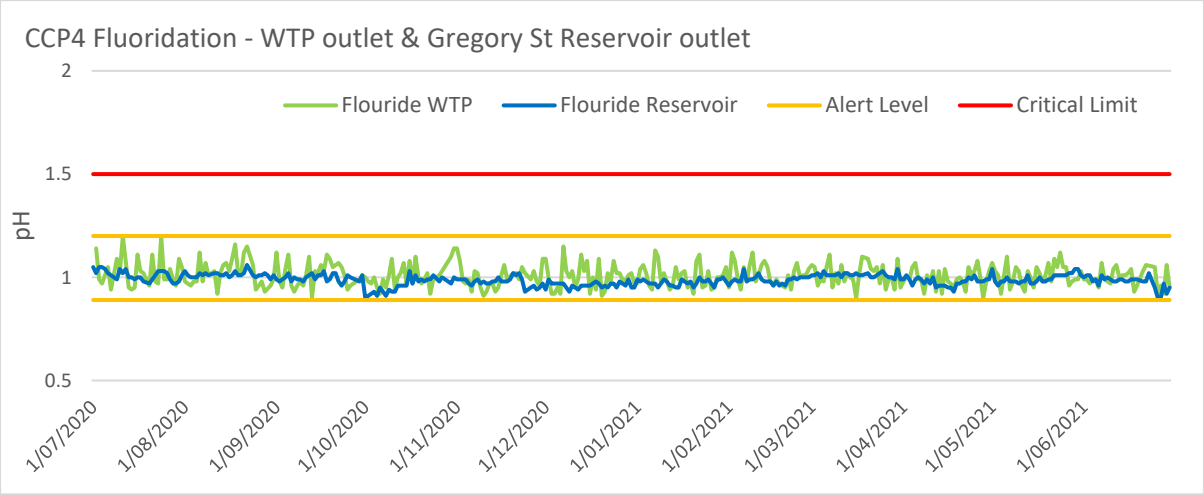



Figure 4.3.4e CCP4 Fluoridation – WTP outlet & Gregory Street Reservoir outlet

No Critical Limit or Alert Level exceptions occurred in the South West Rocks supply during the 2020 – 2021 reporting year (Table 4.1 and Figures 4.3.4a, 4.3.4b, 4.3.4c, 4.3.4d and 4.3.4e). This supply has not recorded any exceptions for the past two (2) reporting years.

### 4.3.5 Stuarts Point Supply System

Monitoring data for each of the Stuarts Point supply systems CCPs is shown in Figures 4.3.5a, 4.3.5b and 4.3.5c.

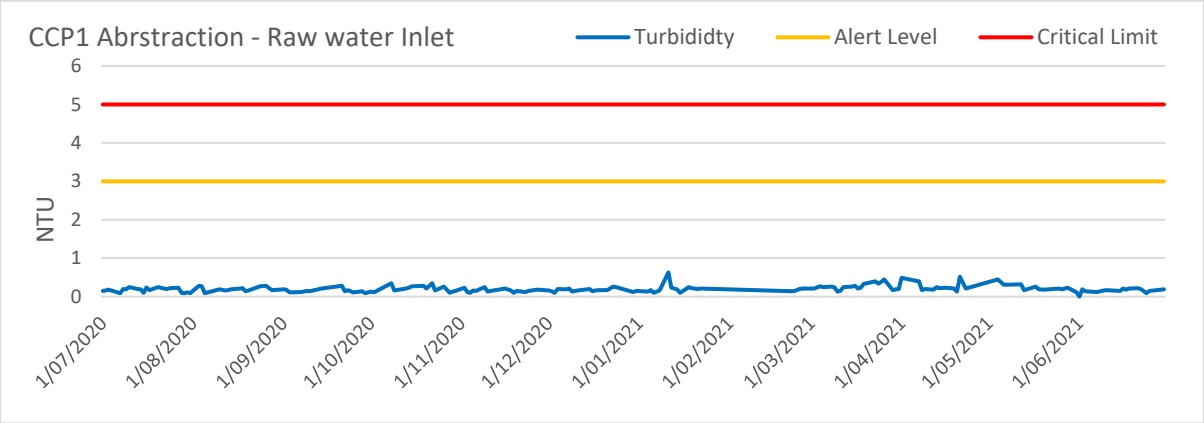



Figure 4.3.5a - CCP 1 Abstraction – Turbidity at Raw water inlet

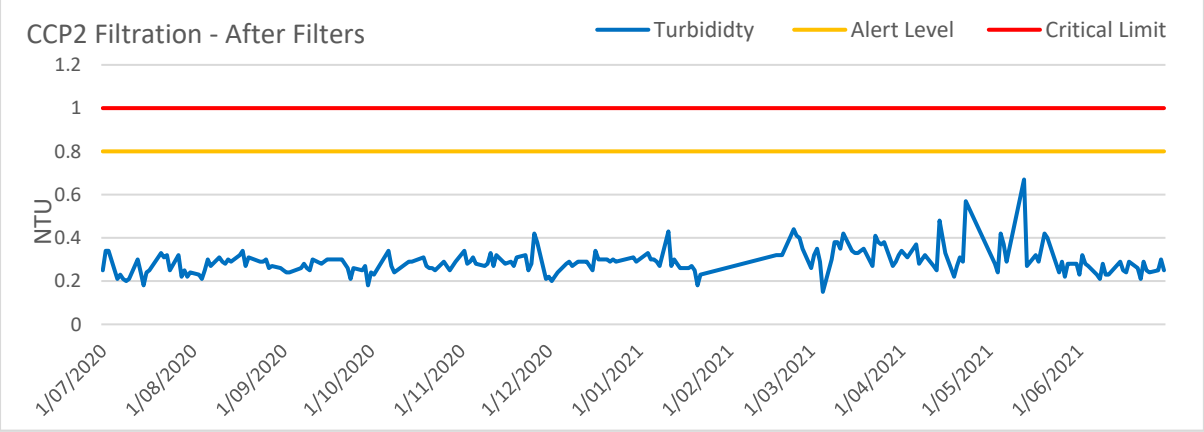



Figure 4.3.5b - CCP 2 Filtration – Turbidity after filters

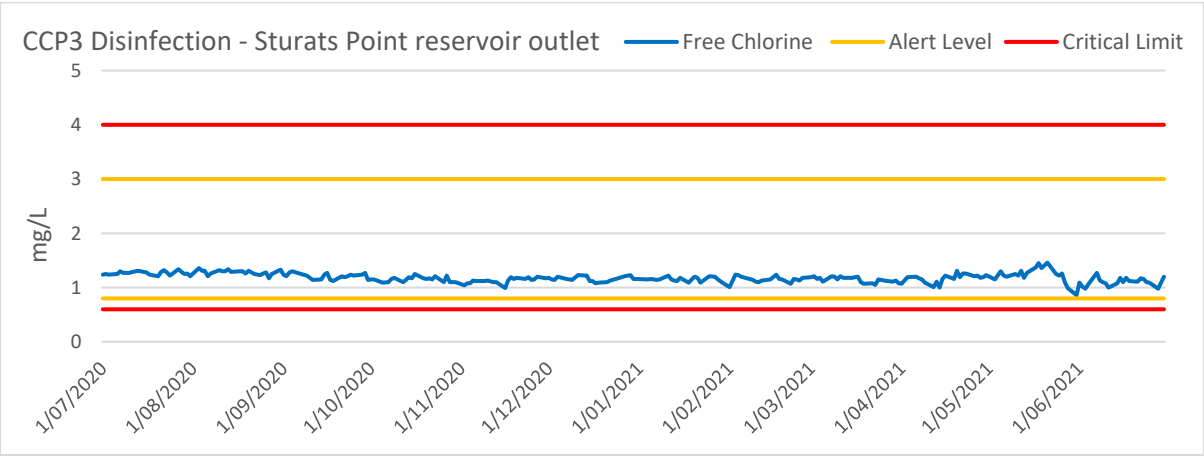



Figure 4.3.5c CCP3 Disinfection – Free Chlorine Gregory Street Reservoir outlet

No Critical Limit or Alert Level exceptions occurred in the Stuarts Point supply during the 2020-2021 reporting year (Table 4.1 and Figures 4.3.5a, 4.3.5b and 4.3.5c). This supply has not recorded any exceptions for the past three (3) reporting years.

### 4.3.6 Willawarrin Supply System

Monitoring data for each of the Willawarrin supply systems CCPs is shown in Figures 4.3.6a and 4.3.6b. Water carting to this supply from KLM occurred intermittently from 23/12/2020 to 11/01/20201 and 18/03/2021 to 13/04/2021 due in wet weather events that impacted source water.

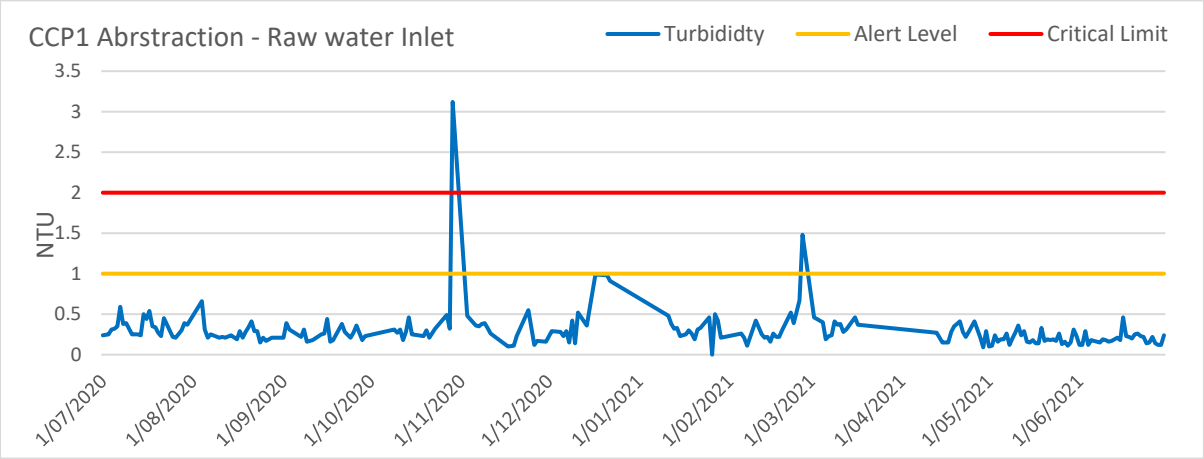



Figure 4.3.6a - CCP 1 Abstraction – Turbidity at Raw water inlet

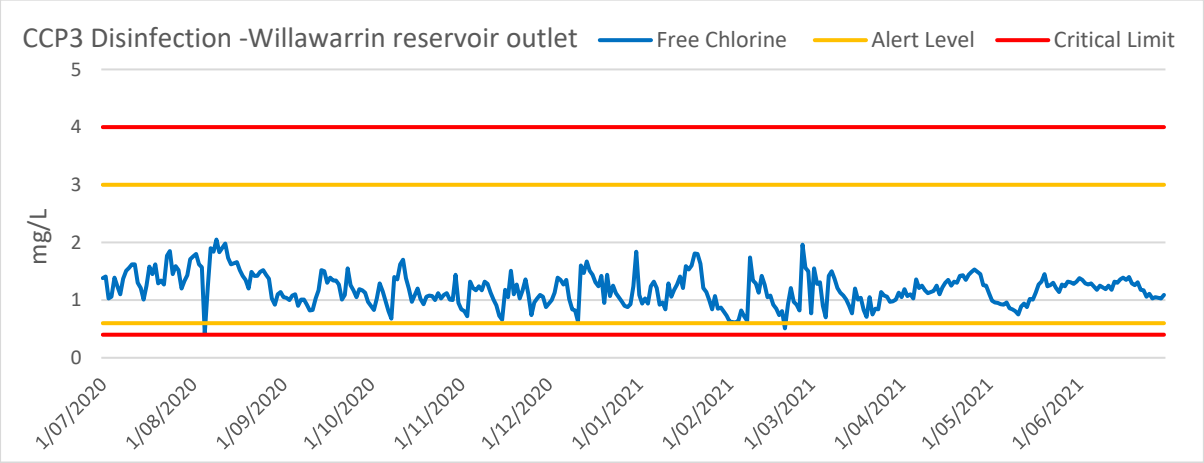



Figure 4.3.6b CCP3 Disinfection – Free Chlorine Willawarrin Reservoir outlet

A single CCP1 Abstraction Critical Limit exception occurred in the Willawarrin supply during the 2020-2021 reporting year (Table 4.1) on 29/10/2020; this is discussed in section 7 Water Quality Incident or Emergency.

Three (3) Alert Level CCP exception occurred from five-hundred and fifty (550) samples (Table 4.1 and Figures 4.3.6a and 4.3.6b) were reported across the following CCP locations:

- CCP1 – Abstraction: Turbidity >4 NTU, one (1) occurrence
- CCP3 – Disinfection: Free Chlorine <0.6 mg/L – two (2) occurrences

The three (3) Alert Levels (Figure 4.3.6a and 4.3.6b) include:

- One (1) CCP1 Abstraction Alert Level (1.48 mg/L) on 26/02/2021 caused by rainfall in the catchment increasing river turbidity. Pre-emptive actions included isolation of the bores and

- initiating water carting to the supply until rain ceased and turbidity levels returned to operational targets.

- Two (2) CCP3 disinfection Alert levels for low Free Chlorine:
    - 4/08/2020 Free Chlorine (0.42 mg/L) due to operator and SCADA alarms errors that ceased the production of chlorinated water to the reservoir that was idented on the 5/08/2020. Corrective actions included, resetting of set points both physically and in the telemetry control system and adding calcium chlorine pills to the reservoir to increase Free Chlorine residual. Preventative action includes operators to check the SCADA system at the end of every shift along with the SCADA alarms limits to be fixed with change access restriction applied.

    - 20/2/2021 Free Chlorine (0.51mg/L) due to the chlorine pump not dosing correctly. Corrective action includes the changing over to the spare pump and adding ½ a Calcium hypochlorite tablet to the reservoir to bring Free Chlorine residuals back to within operational target.

### 4.3.7 Bellbrook Supply System

Monitoring data for each of the Bellbrook supply system CCPs is shown in Figures 4.6.7a, 4.6.7b, 4.6.7c and 4.6.7d. Water carting to this supply from KLM occurred intermittently from 22/12/2020 to 7/01/2021 and from 21/3/2021 to 30/06/2021 due to wet weather and flood events that impacted source water quality.

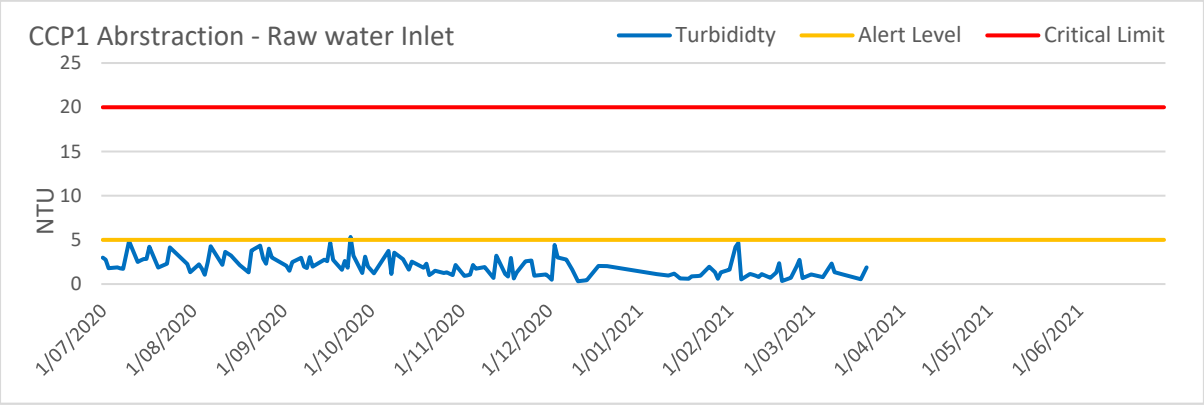



Figure 4.6.7a - CCP 1 Abstraction – Turbidity at Raw water inlet

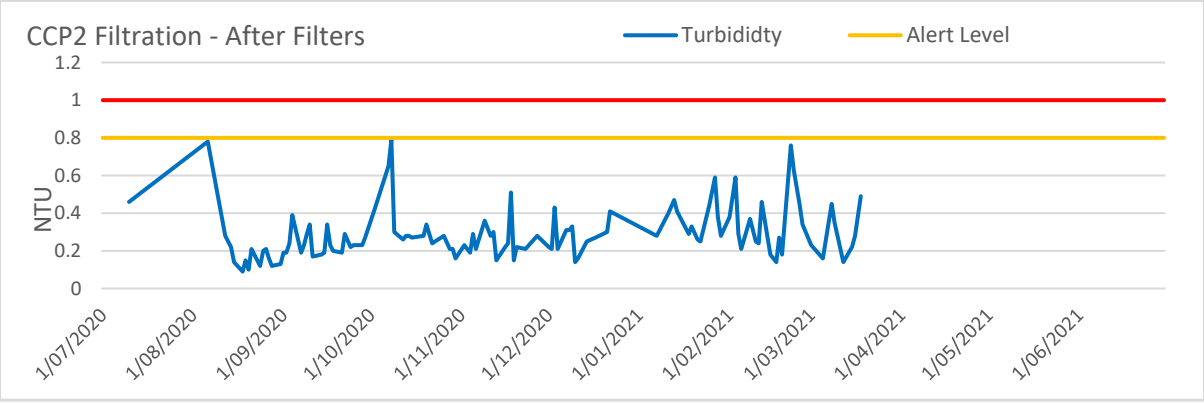



Figure 4.6.7b - CCP 2 Filtration – Turbidity after filters

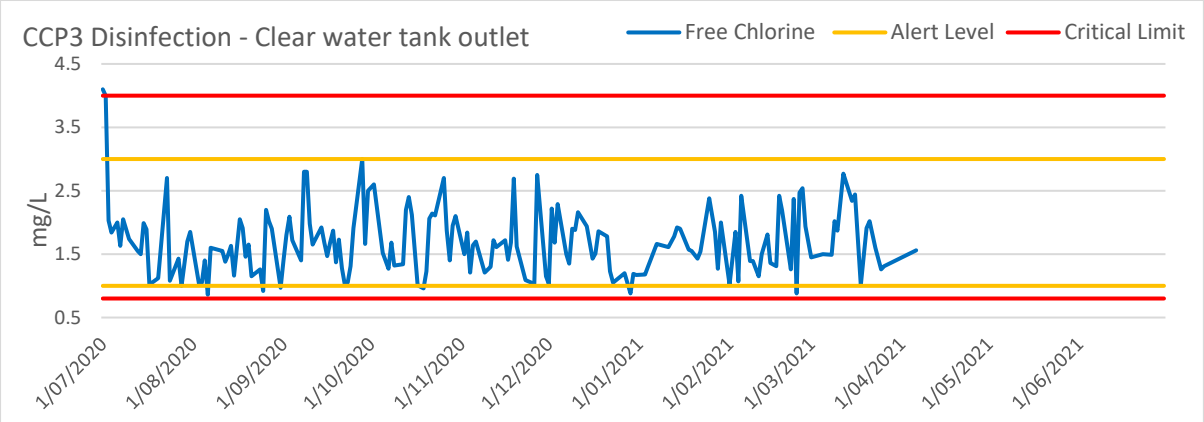



Figure 4.6.7c - CCP3 Disinfection – Free Chlorine Clear water tank outlet

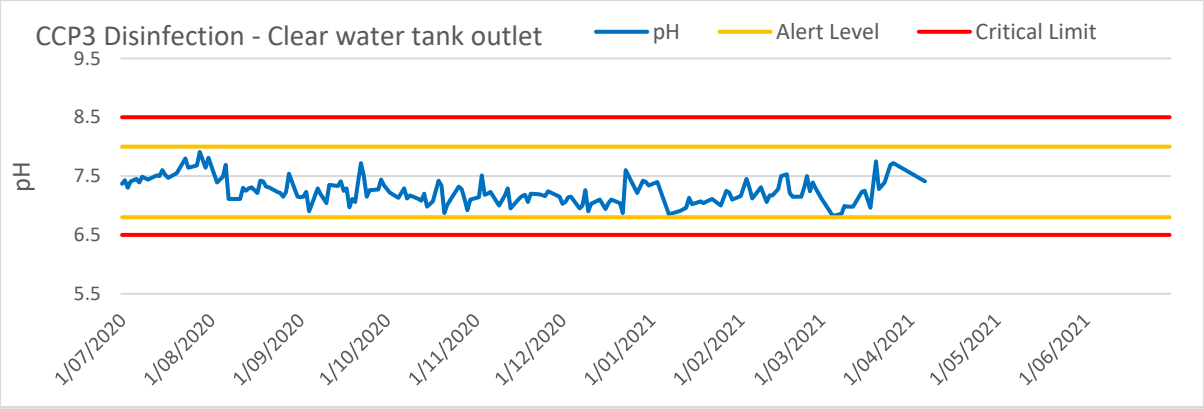



Figure 4.6.7d CCP3 Disinfection – pH Clear water tank outlet

One (1) CCP1 Abstraction Critical Limit exception and an associated Alert Level exception occurred in the Bellbrook supply on the 1/07/2020 (Table 4.1 and Figure 4.6.7c); this event is discussed in Section 7 Water Quality Incident or Emergency.

A further six (6) Alert level exceptions were reported from six-hundred and eighty-six (686) samples. These were reported across the following CCP locations:

- CCP1 – Abstraction: Turbidity >4 NTU, one (1) occurrence
- CCP3 – Disinfection: Free Chlorine <1.0 mg/L – five (5) occurrences

The single CCP1 Abstraction Alert Level on the 24/09/2020 (5.33) NTU; Figure 4.6.7a) was the result of rainfall in the catchment increasing river turbidity. SOPs were followed to ensure that no breakthrough in the filtration system entered the network. This water treatment plant (WTP) has automatic interlocks that shut the plant down if Turbidity levels reach the Critical Limit of 20 NTU.

The five (5) CCP3 Disinfection Alert Levels occurred intermittently throughout the year (Figure 4.6.7c) were caused by high manganese's levels that consumed free chlorine residuals. On each occasion Water Operators followed CCP SOP that included checking dosing equipment and confirming adequate disinfection throughout the network.

### 4.3.8 Thunggutti Supply System

Monitoring data for the Thunggutti supply system CCPs is shown in Figures 4.3.8a and 4.3.8b.

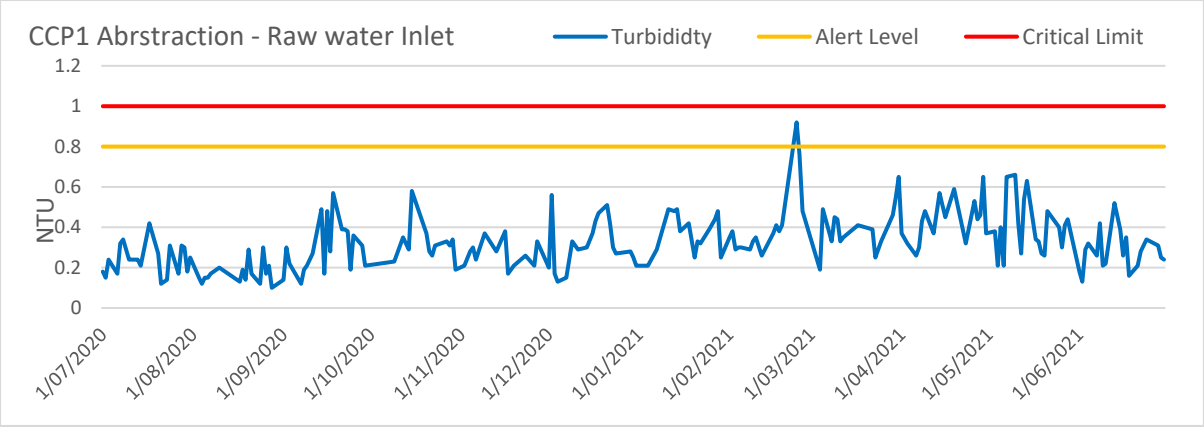



Figure 4.3.8a - CCP 1 Abstraction – Turbidity at Raw water inlet

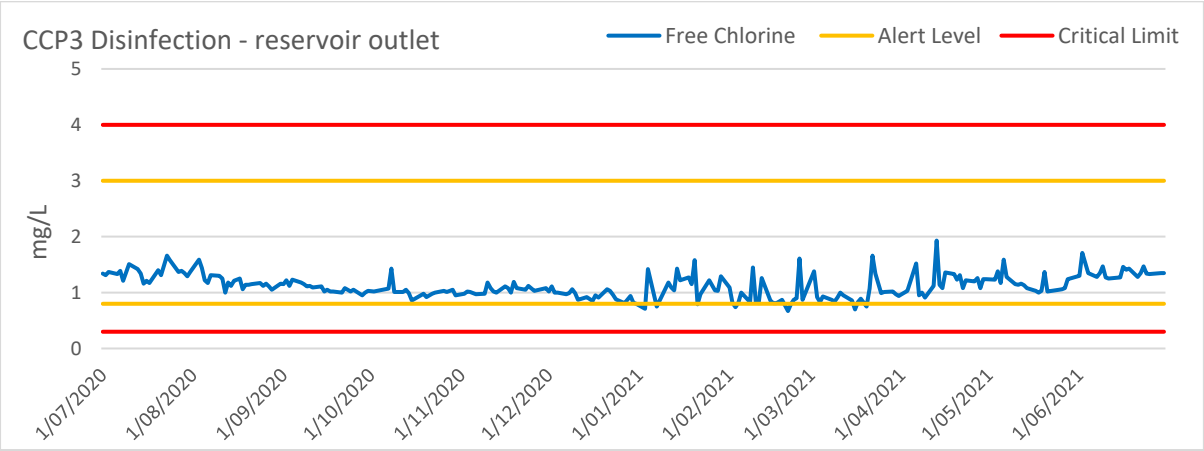



Figure 4.3.8b - CCP3 Disinfection – Free Chlorine Thunggutti Reservoir outlet

No Critical Limit exceptions occurred in the Thunggutti supply during the 2020-2021 reporting year (Table 4.1 and Figures 4.3.8a and 4.3.8b). A reduction of three (3) events from 2019-2020.

Nine (9) Alert Level CCPs exceptions were reported from four-hundred and thirty-eight (438) samples (Table 4.1) These were reported across the following CCP locations.

- CCP1 – Abstraction: Turbidity >0.8 NTU, one (1) occurrence
- CCP3 – Disinfection: Free Chlorine <0.8 mg/L – eight (8) occurrences

The single CCP1 Abstraction Alert Level exception occurring on the 24/02/21 was due to rain in the catchment that saw turbidity levels increase and recover within 24hours (Figure 4.3.8a). This water treatment plant (WTP) has automatic interlocks that shut the plant down if Turbidity levels reach the Critical Limit of 20 NTU.

The eight (8) CCP3 Disinfection Free Chlorine exceptions were all in the second half of the reporting year (Figure 4.3.8b). Contributing factors include:

- Plant interlock isolated plant and was non-operational for two days due to increase Tubridy from rain
- No access to asset due to land slide over road - wet weather induced
- Air lock in dosing pump
- Modem drop outs, shutting plant down – wet weather induced
- Chlorine decay due to inconsistent batching intervals

Corrective actions involved:

- Manually boosting chlorine within reservoir by addition of calcium hypochlorite tablets
- Fresh batching and adjustment of chlorine dosing once access to plant restored
- Degas dosing pump, check dosing lines and check/adjust dosing settings
- Reset plant modem
- Consistent batch intervals

The Thunggutti supply is a part of the NSW ACWSP overseen by DPI, water quality is reported on at the quarterly meetings; This program is further discussed in section 9.1 Aboriginal Communities Water and Sewer Program.

# 5. Reservoir Inspections

Council has fifteen (15) above ground storage reservoirs and manages two (2) reservoirs in the Thunggutti supply as part of the NSW ACWSP. Maintaining Reservoir integrity is included as a CCP for each of Councils water supplies, as this is the last point of contact with the water where control can be affected prior to the network. Maintaining reservoir integrity is critical to a water supply system, to ensure that no contaminants, such as vermin, stormwater, or bird faeces, can freely access the treated stored water. Cleaning and inspection of the reservoirs is crucial to water supply ensuring that the water quality is not contaminated, or sediments are not disturbed.

## 5.1 Data Collection and Monitoring

Councils' reservoirs are inspected monthly by operational staff who complete the "Reservoir Inspection Check List" that is a function of the WaterOutlook program. Any reported issues trigger email notification to the Water Management Team. Tracking of completed inspections can be viewed in a generated "Reservoir Inspection" report which also provides a link to the physical report via individual report batch number. Any breach of integrity detected during Monthly Inspections would be reported as a CCP Critical Limit exception and be reported to the local PHU.

Reservoirs are also inspected by contractors on a three-year rotation, for cleaning and detailed internal and external integrity inspections. These findings are collated, reported, and tracked within the contractor's web database "ASAM RT".

## 5.2 Reporting

No breaches of integrity were detected during inhouse monthly CCP reservoir inspections.

Three (3) reservoirs (Clybucca, Willawarrin, and Bellbrook) have been clean and inspected by external contractors during this reporting period.

Twelve (12) reservoirs have been cleaned and inspected in the previous 24-month period and one (1) reservoir (Greenhill) has been inspected only as it is unable to be isolated for cleaning purposes.

Table 5.1 provides programmed schedule for Councils external contractors and inspection program.

Table 5.2 lists the findings from the previous and most recent inspections that still require rectification or items that were rectified in 2019-2020.

**Table 5.1 Reservoir Schedule for external contractor inspections and cleaning**

| Reservoir | Report Year last inspected | Date Last Inspected/cleaned | Next Due Date Inspection/clean |
|---|---|---|---|
| **Kempsey - Lower Macleay Supply** | | | |
| Green Hill | 2019-2020 | 12/02/2020 | 12/02/2023 |
| John Lane | 2019-2020 | 03/08/2019 | 03/08/2022 |
| Potters Hill | 2019-2020 | 03/08/2019 | 03/08/2022 |
| Billy Goat Hill | 2018-2019 | 26/10/2018 | 26/10/2021 |
| Frederickton | 2018-2019 | 26/10/2018 | 26/10/2021 |
| Clybucca | 2020-2021 | 17/02/2021 | 17/02/2024 |
| **Crescent Head Supply** | | | |
| Back Beach | 2018-2019 | 25/10/2018 | 25/10/2021 |
| Big Nobby | 2018-2019 | 15/11/2018 | 15/11/2021 |
| **Hat Head** | | | |
| Reservoir 1 | 2018-2019 | 28/10/2018 | 28/10/2021 |
| Reservoir 2 | 2019-2020 | 4/08/2019 | 04/08/2022 |
| **South West Rocks Supply** | | | |
| Gregory Street | 2018-2019 | 27/10/2018 | 29/10/2021 |
| New Entrance | 2018-2019 | 27/10/2018 | 27/10/2021 |
| **Stuarts Point Supply** | | | |
| Stuarts Point Reservoir | 2018-2019 | 22/07/2018 | 22/07/2021 |
| **Willawarrin Supply** | | | |
| Willawarrin reservoir | 2020-2021 | 16/02/2021 | 16/02/2024 |
| **Bellbrook Supply** | | | |
| Bellbrook reservoir | 2020-2021 | 17/02/2021 | 17/02/2024 |
| **Thunggutti** | | | |
| **Reservoir 1** | 2018-2019 | 15/11/2018 | 15/11/2021 |
| **Reservoir 2** | 2018-2019 | 15/11/2018 | 15/11/2021 |

**Table 5.2 Reservoir Inspection Report Summary**

| Date | Reservoirs | Findings | Corrective actions |
|---|---|---|---|
| 12/05/2015<br><br>06/08/2019 | Crescent Head Big Nobby | A lot of the aluminium wire ventilation mesh is corroded and should be replaced when the facia support sections are upgraded<br><br>The existing level indicator system needs to be removed to seal the tank against vermin access | Work delayed due to EME radiation hazard |
| 13/05/2015 | Stuarts Point | Corrosion present on the internal ladder. | In Progress – Internal Ladder to be replaced/repaired in conjunction with in planned internal refurbishment expected completion in Sept 2021 |

| Date | Reservoirs | Findings | Corrective actions |
|---|---|---|---|
| 7/07/2017 | Willawarrin | There is no secure compound around the tank. | In Progress - Planning occurring for a WTP at Willawarrin and the construction will include the construction of a secure compound for the WTP and Reservoir. Currently awaiting on land acquisition to build the plant. |
| 12/02/2018 | Greenhill | The two mechanical roof vents need to have mesh fitted to keep out birds and vermin | Work still to be completed |
| 4/08/2019 | Hat Head No2 | There is corrosion present on the sketch plate area. This needs to be recoated ASAP to prevent further damage from occurring | Work still to be completed |
| 5/08/2019 | John Lane | There is significant corrosion appearing around the sketch plate area. The bitumen sealing material is packed too high and water is ponding and contributing to the deterioration | Work still to be completed |
| 17/02/2021 | Clybucca | Corrosion present on wall hatch fixings, hold down bolts, on roof fascia at 3 o'clock, and hand rails on the access stairs | New Items |
| 16/2/2021 | Willawarrin | Calcification and minor seepage present in the concrete walls<br><br>Top fill inlet is disturbing the floor sediments when the water levels are low, and fill is done by tankers<br><br>Frog flap to be fitted at the end of the overflow pipe | New Items |

# 6. Water Quality Verification

The Australian Drinking Water Guidelines (ADWG) (NHMRC 2011) provide an authoritative reference that defines what is safe and good water quality and how this can be achieved and assured, using the latest and best available scientific evidence. The ADWG provide detailed information on the measurable characteristics of drinking water, including microbiological, physical and chemical aspects, and these are grouped into two different types:

- A **health guideline** value – that is the concentration or measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption.
- An **aesthetic guideline** value – that is the concentration or measure of a water quality characteristic that is associated with acceptability of water to the consumer, such as, appearance, taste and odour.

Additional Water Quality Indicators (WQI) recommended by NSW Health include Total Coliforms and Free Chlorine residuals.

- A positive Total Coliforms result when used in operational monitoring, may indicate inadequate treatment, breakdowns in system integrity, or the presence of biofilms.
- Low Free Chlorine of <0.2mg/L is an indication that disinfection of the system may be compromised or lost.

Fluoride is monitored as per the Fluoridation Code (NSW Health 2018); an overdosing incident is the result of the fluoride concentration exceeding 1.5 mg/L in the treated water entering the network and operational exceptions is defined by any failure to maintain the fluoride concentration above 0.9 mg/L. The ADWG health limit is 5 mg/L.

## 6.1 Data Collection and Monitoring

Council participates in NSW Health's sponsored Drinking Water Monitoring Program; network monitoring is undertaken on a routine basis to ensure that Council's customers receive safe and acceptable water quality.

Council tests drinking water for thirty-two (32) health and aesthetic ADWG, and other recommended WQI characteristics. These samples are taken from twenty-five (25) sample sites within the Councils area of operation, all of which are post-treatment.

The water quality characteristics that are monitored as part of this program are specified by NSW Health. Council liaises with NSW Health regarding the total number of samples required for each supply system and the frequency of collection; a yearly sampling schedule is produced by Council to ensure the expected frequency of sampling is met.

Results are recorded in the NSW Drinking Water Database and reported against the ADWG and WQI. A summary of the water quality data for each supply system, obtained directly from the NSW Drinking Water Database is provided in Appendix C.

In addition to monitoring undertaken as part of NSW Health's Drinking Water Monitoring Program, Council also independently monitors water quality parameters as part of our daily operations (pre- and post-treatment at the water supply systems). Results are recorded within WaterOutlook for each individual supply.

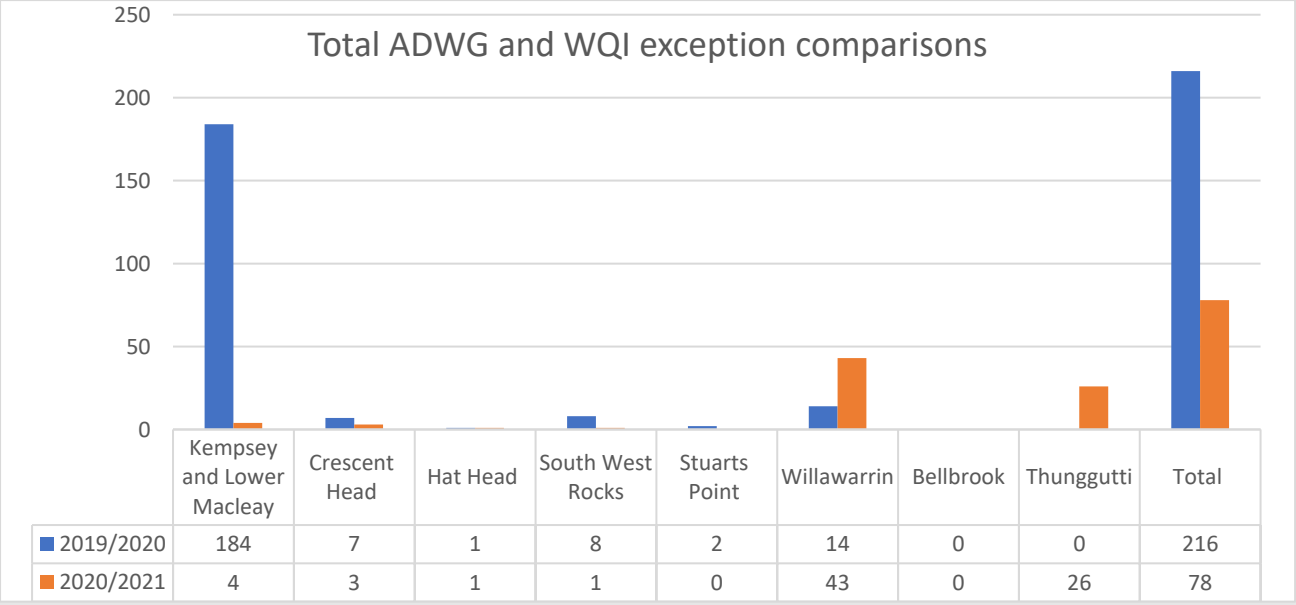
## 6.2 Non-Compliant data

For the NSW Health sponsored monitoring, NSW Forensic & Analytical Science Services (FASS) Laboratory advises Council via email of any ADWG health and/or WQI guideline limit exceptions including positive results for microbiological tests (Total Coliforms and E. coli). Upon receiving email notification Council performs an internal investigation that involves confirmation of water quality at the exception location and from the supply reservoir, checking for potential sources of contamination i.e., breaks and repairs and if required a flush of mains. A resample is collected for confirmational laboratory analysis, and the local PHU is notified (initial phone and follow up emails).

The WaterOutlook application triggers an alert for anomalies found outside of the ADWG and WQI in relation to the daily operations monitoring. Water Operators complete a report within WaterOutlook (cause, action, preventive measures) with email notification sent to the Water Management Team. Monthly ADGW/WQI reports are produced within WaterOutlook that tabulates results into the system that they occurred providing a monthly total with a running "year to date" totals for each supply. External communication to the local PHU of daily results is limited to the Annual DWMS Water Quality report or if there is a gross and/or consistent exceedance.

## 6.3 Reporting

Seventy-eight (78) ADWG and WQI exceptions from both reporting platforms were recorded across Council's water supply systems (Figure 6). This is a 63.9% decrease from the two-hundred and sixteen (216) exceptions recorded in the previous reporting year. The main contributing factors to the decline was the KLM supply change from the emergency supply of SMD back to supply via the Sherwood borefield along with the improved source water quality across each of the supply systems (excluding Willawarrin and Thunggutti) after the 2019-2020 drought broke.




| | Kempsey and Lower Macleay | Crescent Head | Hat Head | South West Rocks | Stuarts Point | Willawarrin | Bellbrook | Thunggutti | Total |
|---|---|---|---|---|---|---|---|---|---|
| 2019/2020 | 184 | 7 | 1 | 8 | 2 | 14 | 0 | 0 | 216 |
| 2020/2021 | 4 | 3 | 1 | 1 | 0 | 43 | 0 | 26 | 78 |

Figure 6: Total ADWG and WQI exception comparison between 2019-2020 and 2020-2021 reporting years

The ADWG and WQI non-compliant results are discussed in the supply systems in which they occurred with reference to Figure 6, and Tables 6.1. and 6.2.

### Table 6.1 ADWG and WQI non-compliances - NSW Health sponsored monitoring program

| Supply Area | Parameter | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Total Coliforms * | Free Chlorine ** | pH | Turbidity | Fluoride *** | Iron | Manganese | Nickel | |
| | No detection (WQI) | < 0.2 mg/L (WQI) | < 6.5 – > 8.5 (A) | >5 NTU (H) | <0.9 - >1.2 mg/L (WQI) | ≥ 0.3 mg/L (A) | ≥ 0.1 mg/L (A) ≥ 0.3 mg/L (H) | ≥ 0.02 mg/L (H) | |
| **KS01 - Kempsey & Lower Macleay** | 3 | 0 | 0 | 0 | N/A | 0 | 0 | 1 | **4** |
| **KS05 - Crescent Head** | 0 | 3 | 0 | 0 | N/A | 0 | 0 | 0 | **3** |
| **KS08 - Hat Head** | 0 | 0 | 1 | 0 | N/A | 0 | 0 | 0 | **1** |
| **KS07 - South West Rocks** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | **1** |
| **KS06 - Stuarts Point** | 0 | 0 | 0 | 0 | N/A | 0 | 0 | 0 | **0** |
| **KS04 - Willawarrin** | 0 | 0 | 5 | 0 | N/A | 0 | 0 | 1 | **6** |
| **KS03 - Bellbrook** | 0 | 0 | 0 | 0 | N/A | 0 | 0 | 0 | **0** |
| **KS09 - Thunggutti** | 1 | 0 | 3 | 0 | N/A | 0 | 0 | 0 | **4** |
| **Combined Total** | **4** | **3** | **9** | **0** | **0** | **0** | **0** | **3** | **19** |

*Total Coliform no ADWG set however a positive result is an indicator for further investigation.
**Free Chorine no minimum ADWG set however minimum level of 0.2 mg/L recommend for maintaining disinfection.
*** Fluoride levels based on Fluoride code; Health ADWG set at ≥5 mg/L
A – Aesthetic ADWG
H - Health ADWG
WQI – No ADWG available, guidelines are based on best practice or codes of practice

### Table 6.2 ADWG and WQI non-compliances - Operational monitoring program

| Parameter | Chlorine (Free) * | Chlorine (Total) | pH | Turbidity | Fluoride ** | Iron | Manganese *** | Totals |
|---|---|---|---|---|---|---|---|---|
| **Guidelines** | < 0.2 mg/L (WQI) | ≥ 5 mg/L (H) | < 6.5 – > 8.5 (A) | ≥5 NTU (H) | <0.9 - >1.2 mg/L (WQI) | ≥ 0.3 mg/L (A) | ≥ 0.1 mg/L (A) ≥ 0.3 mg/L (H) | |
| **Kempsey and Lower Macleay** | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 0 | 0 | N/A | 0 | 0 | **0** |
| **Number of Tests** | 2193 | 2523 | 2190 | 2518 | N/A | 0 | 0 | **9424** |
| **Rate of Exceedances** | 0% | 0% | 0% | 0% | N/A | 0% | 0% | **0%** |
| Crescent Head | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 0 | 0 | N/A | 0 | 0 | **0** |
| **Number of Tests** | 635 | 997 | 634 | 990 | N/A | 15 | 8 | **3279** |
| **Rate of Exceedances** | 0% | 0% | 0% | 0% | N/A | 0% | 0% | **0%** |
| Hat Head | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 0 | 0 | N/A | 0 | 0 | **0** |
| **Number of Tests** | 163 | 393 | 162 | 377 | N/A | 24 | 11 | **1130** |
| **Rate of Exceedances** | 0% | 0% | 0% | 0% | N/A | 0% | 0% | **0.%** |
| South West Rocks | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Number of Tests** | 567 | 923 | 566 | 913 | 77 | 9 | 10 | **3065** |
| **Rate of Exceedances** | 0% | 0% | 0.% | 0% | 0% | 0% | 0% | **0%** |

| Parameter | Chlorine (Free) * | Chlorine (Total) | pH | Turbidity | Fluoride ** | Iron | Manganese *** | Totals |
|---|---|---|---|---|---|---|---|---|
| **Guidelines** | < 0.2 mg/L (WQI) | ≥ 5 mg/L (H) | < 6.5 – > 8.5 (A) | ≥5 NTU (H) | <0.9 - >1.2 mg/L (WQI) | ≥ 0.3 mg/L (A) | ≥ 0.1 mg/L (A) ≥ 0.3 mg/L (H) | |
| Stuarts Point | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 0 | 0 | N/A | 0 | 0 | **0** |
| **Number of Tests** | 380 | 627 | 627 | 562 | N/A | 18 | 17 | **2231** |
| **Rate of Exceedances** | 0% | 0% | 0% | 0% | N/A | 0% | 0% | **0%** |
| Willawarrin | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 33 | 0 | N/A | 0 | 4 | **37** |
| **Number of Tests** | 121 | 477 | 116 | 442 | N/A | 9 | 15 | **1214** |
| **Rate of Exceedances** | 0% | 0% | 28.45% | 0% | N/A | 0% | 26.67% | **3.05%** |
| Bellbrook | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 0 | 0 | N/A | 0 | 0 | **0** |
| **Number of Tests** | 338 | 337 | 338 | 337 | N/A | 0 | 0 | **1350** |
| **Rate of Exceedances** | 0% | 0% | 0% | 0% | N/A | 0% | 0% | **0%** |
| Thunggutti | | | | | | | | |
| **Number of Exceedances** | 0 | 0 | 22 | 0 | N/A | 0 | 0 | **22** |
| **Number of Tests** | 102 | 2343 | 99 | 342 | N/A | 4 | 4 | **894** |
| **Rate of Exceedances** | 0% | 0% | 22.22% | 0% | N/A | 0% | 0% | **2.46%** |
| Totals | | | | | | | | |
| **Number of Exceedances** | **0** | **0** | **55** | **0** | **0** | **0** | **4** | **59** |
| **Number of Tests** | **4499** | **6620** | **4732** | **6515** | **77** | **79** | **65** | **22587** |
| **Rate of Exceedances** | **0%** | **0.%** | **1.16%** | **0%** | **0%** | **0%** | **6.15%** | **0..26%** |

*Free Chorine no minimum ADWG set however minimum level of 0.2 mg/L recommend for maintaining disinfection.
**Fluoride levels based on Fluoride code; Health ADWG set at ≥5 mg/L
*** Manganese Aesthetic ADWG reported only (No Health ADWG recorded)
A – Aesthetic ADWG
H - Health ADWG
WQI –Guidelines are based on Codes of Practice or recommendations from NSW Health

### 6.3.1 Kempsey - Lower Macleay (KLM) Supply System

The KLM supply had a four (4) ADWG and WQI exceptions; all reported from the NSW Health Sponsored monitoring program (Table 6.1). This is a reduction of one-hundred and eighty (180) from the previous reporting year. This significant decline is due from the breaking of the 2019-2020 drought where Council changed the source water supply in June 2020 back to the Sherwood borefield from the SMD emergency supply.

Exceptions during 2020-2021 are reported as: (Table 6.1 and Appendix C; Table C.1)

- One (1) Nickel ADWG health ≥ 0.02 mg/L
  - 21-07-2020 at KS01-348 Setters Way, result of 0.0302 mg/L

- Three (3) Total Coliforms WQI
  - 23-02-2021 at KS01-129 Mahogany Crescent, result of 1 mpn/100mL
  - 2-03-2021 at KS01-798 Edgar Street, result of 1 mpn/100mL
  - 11-05-2021 at KS01-127 Euroka Zone, result of 1 mpn/100mL

Resampling for Nickel was performed on 04/08/2020 (result of 0.0004 mg/L) this is below the ADWG health limit of 0.02mg/L. Since 2018 Council has had re-occurring Nickel results above the ADWG

from across multiple supply systems. For each re-sample, the results have returned below the ADWG. Ongoing investigations of eliminating potential sources of nickel when sampling in the network has included:

- Checking of sample site fittings are non-nickel base coated
- Sampling raw water in the KLM of Nickel levels (KLM supply has had the most re-occurring events with results above the ADWG, including when water carting to other supplies (Willawarrin)
- Eliminating repair works of pipes as a possible source of contamination – cross compared work orders location against sample locations when exceptions been recorded
- Plans to replace detachable goose neck sampling taps with fixed brass taps

For each Total Coliform exception, Council followed SOP as described in 6.2 Non-Compliant data. All resample results returned <1 mpn mg/L for both E. coli and Total Coliform; no further action was warranted for each event.

### 6.3.2 Crescent Head Supply System

No bacteriological (Total Coliforms or E.coli) exceptions were reported (Table 6.1 and Appendix C: Table C.2); in the Crescent Head supply during 2020-2021.

The supply recorded three (3) WQI exceptions; a reduction of four (4) from the previous year (Figure 6). The improved outcomes are due to the re-commencement of the flushing and scouring program of the Loftus Road water main after lifting drought-imposed water restrictions in March/April 2020.

All three (3) exceptions were for the WQI of low Free Chlorine <0.2mg/L, at KS05-321 Loftus Road and reported in the NSW Health Monitoring program (Table 6.1). Breakdown is:

- 28-07-2020 - result of 0.04mg/L
- 08-09-2020 – result of 0.01mg/L
- 29-09-2020 – result of 0.04mg/L

Corrective actions for low Free Chlorine residuals include:

- additional flushing of affected mains and monitoring the network downstream of the supply reservoir.
- checking of dosing equipment
- testing reservoir outlets

### 6.3.3 Hat Head Supply System

No bacteriological (Total Coliforms or E.coli) exceptions were reported (Table 6.1 and Appendix C: Table C.3); in the Hat Head supply during 2020-2021.

A single (>8.50 pH) ADWG aesthetic exception of 8.71 pH was reported in the NSW Health Monitoring program at KS08-123 Fish Tables on the 1/06/2020 (Table 6.1). This site is located at the end of the reticulation and has reduced usage during winter. With no hydrant nearby, flushing is performed through the sample taps only.

### 6.3.4 South West Rocks Supply System

No bacteriological (Total Coliforms or E. coli) exceptions were reported in the South West Rocks supply in 2020-2021 (Table 6.1 and Appendix C: Table C.4).

One (1) ADWG exception occurred in 2020-2021, a reduction of seven (7) from the previous reporting year (Figure 6).

The single exception was reported from the NSW Health monitoring program (Table 6.1) for a Nickel ADWG health detection (≥0.02mg/L) at KS07-121 Primary School on the 01/09/2020; a result of 0.0227 mg/L. A re-sample was collected on the 15/09/2020 albeit at site KS07-126 Little Bay; results returned as <0.0004 mg/L.

Investigations into re-occurring Nickel events are ongoing as per details outlined in 6.3.1 Kempsey - Lower Macleay Supply.

### 6.3.5 Stuarts Point Supply System

No ADWG or WQI exceptions were recorded in the Stuarts Point supply, a reduction of two (2) events from the previous reporting year (Figure 6).

### 6.3.6 Willawarrin Supply System

No bacteriological (Total Coliforms or E. coli) exceptions were reported in the Willawarrin supply during 2020-2021 (Table 6.1 and Appendix C: Table C.6).

The Willawarrin supply had forty-three (43) ADWG and WQI exceptions during 2020-2021 an increase of twenty-nine (29) from the fourteen (14) exceptions reported in 2019-2020 (Figure 6). This increase however remains comparative low to the one-hundred and five (105) exceptions during 2018-2019 (Kempsey Shire Council 2018-2019).

The two main contributing factors for the increase include

1. Increase in the number of days the supply was from its local source water (during 2019-2020 the supply was under water carting for 240 days).
2. Shift in source water acidity after a wet weather event December 2020. Average raw water six months pre wet weather event was 6.96 pH, average pH six months post wet weather event 6.26 pH.

Exceptions during 2020-2021 are reported as (Figure 6, Tables 6.1 and 6.2 and Appendix C; Table C.6):

- Thirty-eight (38) pH ADWG aesthetic <6.5 pH. Five (5) from the NSW Health monitoring program (Table 6.1) and thirty-eight (38) from operational monitoring (Table 6.2). With a minimum of 6.11 pH and maximum of 6.49 pH spread across all of the systems reticulation monitoring sites
    - KS04-121 Football Grounds
    - Ks04-122 St Thomas Church
    - KS04-123 Willawarrin School

  All exceptions occurred from 22/01/2021 after the catchment had received significant rainfall that shifted the source water to a naturally lower acidity; pH correction was added to the system in early June 2021. No pH exceptions were reported after 7/06/2021.

- Four (4) Manganese ADWG aesthetic (>0.1 - < 0.5 mg/L) exceptions were recorded from operational monitoring at the Reservoir outlet between 20/11/2020 to 14/12/2021 (0.18mg/L, 0.193 mg/L, 0.2mg/L and 0.159 mg/L respectively). Future WTP upgrades are to include filtration options for Manganese and Iron removal.

A single Nickel ADWG health (≥0.02 mg/L) (Table 6.1 and Appendix C; Table C.6) occurred on the 16/03/2021 at KS04-123 Willawarrin School; result of 0.0204 mg/L. Resampling was performed on the 30/03/2021 returning a result of 0.0005 mg/L. Investigations into re-occurring Nickel events are ongoing as per details outlined in 6.3.1 Kempsey - Lower Macleay Supply.

### 6.3.7 Bellbrook Supply System

No ADWG or WQI exceptions were recorded in the Bellbrook supply for the past two (2) reporting years (Figure 6).

### 6.3.8 Thunggutti Supply System

The Thunggutti supply had twenty-six (26) ADWG and WQI exceptions during 2020-2021 an 100% increase from the previous year (Figure 6).

Similarly, to the Willawarrin supply, the Thunggutti supply had increasing acidity in the source water of Nulla Nulla creek that lowered pH to below the ADWG.

Twenty-five (25) of the twenty-six (26) detections recorded where for low pH (<6.5 pH); A single Total Coliform exception was additionally recorded (Figure 6, Tables 6.1 and 6.2 and Appendix C: Table C.8).

Like in the Willawarrin supply all pH exceptions were recorded from January 2021 after significant rainfall in the catchment. Sites monitored include the WTP Service line and KS09-121 Community Centre. The minimum result was 6.31 pH. In early June 2021 pH correction facilities were installed at Thunggutti.

The single Total Coliform detection of 1 mpn/100mL occurred on the 25/02/2021 at KS09-121 Community Centre. A re-sample was collected on the 31/05/2021 retuning a result of <1 mpn/100mL. Council followed SOP as described in 6.2 Non-Compliant data.

The Thunggutti supply is a part of the ACWSP overseen by DPI, water quality is reported on at the quarterly meetings; This program is further discussed in section 9.2 Aboriginal Communities Water and Sewer Program.

# 7. Water Quality Incident or Emergency

A water quality incident or emergency is an event where a controlled response is required to ensure that Council continues to protect public health. Although preventative strategies, such as CCP SOP have been developed by Council, some events cannot be anticipated or controlled.

These events need a managed response to ensure the incident is responded to adequately, investigated following the event, and preventative actions are implemented to reduce the risk of the event re-occurring.

Council had two (2) recorded Critical Limits in two (2) separate incidents for this reporting period, these are summarised in Table 7.1.

### Table 7.1 Water Quality Incident or Emergency Summary

| Details of incident/emergency | Actions and Preventive actions undertaken | Investigation & recommendations |
|---|---|---|
| **July 2020 – Bellbrook Supply**<br>Adjustment on chlorine levels (increase) to combat high manganese levels combined with low water level in Clear Water Tank / increased concentration of chlorine due to lack of dilution potential. CCP SOP were followed and confirmed that no impacts on supply water were observed.<br><br>Two (2) Alert Limits and one (1) Critical Limit for Free Chlorine was recorded during this incident at CCP3 Clear Water Tank outlet.<br>30/06/2020 Alert Level 3.7 mg/L<br>1/07/2020 Critical Limit 4.1 mg/L<br>2/07/2020 - CCP3 Alert Level 4.0 mg/L<br>3/7/2020 – CCP3 Target 2.03 mg/L<br><br>**Additional Background information**<br>Plant has been offline from 13/01/2020 to 18/06/2020; with water being carted from the KLM supply due to persistent high manganese levels in source water amplified by the drought event.<br>Plant had been back in operation for 13 days before Critical Limit event.<br>Fresh batch and stronger hypo used (from SMD) delivery on the Monday before the incident<br>Persistent high Iron and Manganese into CWT, impacting analysers causing "trip outs" on low chlorine reads.<br>Main break in system increased the call amount of water being drawn in the system Free Chlorine residuals dilute in larger body of the Reservoir before going to the customer | 30/6/2020<br>~10:38 - WQ test result – Free Chorine 3.7 mg/L (Alert Level)<br><br>~13:30 - Chlorine dosing pumps adjusted (turned down from 85% to 80%)<br><br>1/07/2020<br>~12:05 - WO contacted TL to inform them of likely hood of increased Free Chlorine from the CWT and Chlorine dosing pumps adjusted further (from 80% to 65%to reduce Free Chlorine residuals<br>Analyser faults on Free Chlorine issues unable to automictically inhibit plant<br>~15:15 - WQ test result - Free Chlorine 4.1 mg/L (Critical Limit)<br>~16:00 - Critical Incident Report completed WO checked SCADA in the evening<br><br>02/07/2020<br>~07:00 – analyser trends checked Free Chlorine remains >4 mg/L<br>~07:10 – plant inhibited<br>~07:26 - Email from WO to Management team; update on WQ and planned actions<br>~8:30 – Drain and Clean of Clear Water Tank - Instrument tech fix analyser reader<br>10:18 - Phone notification to NSW Health<br>12: 57 - Follow up email to NSW Health<br><br>03/07/2020<br>14:20 - WQ test result 2.03 mg/L (within operational target) | Automatic interlock shutoff to stop the transfer of water from the Clear Water tank to the Reservoir if Free Chlorine reaches the Critical Limit of >4 mg/L.<br><br>Familiarity of CCP with updated DWMS<br><br>Current DWMS CCP placed at Plant<br><br>**Lessons Learnt**<br>1. What we did well capturing information for investigation purposes<br><br>2. What we can improve on complete incident report at time of incident (Alert not completed on 30/06/2020<br><br>knowledge base of CCPs and confirmation of a secondary testing<br><br>remove email rules to stop alerts from going into inbox<br><br>Instrument maintenance schedule/ regular checks/calibrations |
| **October 2020 – Willawarrin Supply**<br>Upriver catchment area received rainfall in late October that increased turbidity in the Macleay River. The Willawarrin operational bore 1 had a rise in turbidity from 0.32 NTU 28/10/2020 to 3.12 NTU 29/10/2020. Resulting the CCP1 Critical Limit exceedance (limit of 2 NTU).<br>The secondary bore was also tested returning an Alert Level result of 1.91 NTU.<br>**Additional Background information**<br>The plant had not run when the river became dirty; No water was transferred from borefield to the reservoir. Reservoir WQ results were - 1.24 NTU, 1mg/L Free Chlorine, 1.09mg/L Total Chlorine. | 29/10/2020<br>The plant was shut down, and both bores tagged out and inhibited.<br><br>Water Carting arrangement initiated with deliveries to the Willawarrin Reservoir from the KLM supply (Greenhill Reservoir) on 30/10/20, 31/10/20 and 2/11/20.<br><br>2/11/2020<br>Flushing of bores commenced in the afternoon once when river cleared up<br><br>3/11/2020<br>reservoir stated to be filled around 3 pm producing good quality water – result of 0.48 NTU.<br><br>5/11/2020<br>Email sent to LPHU that included full incident report | Isolation of bores pre wet weather events<br><br>Council is progressing with the Willawarrin plant upgrade project that includes filtration.<br><br>Action 2.85 in the DWMS IP relates to the Upgrade the telemetry and SCADA system and online monitoring for all sites to improve operational monitoring capabilities and response times. This action is a rolling project with scheduled upgrades for each financial year. |

# 8. Customer Enquiries

Water quality and loss of service enquiries are received by Councils Customer Services Section. The enquires are entered and tracked via Councils front of house records management system, that includes automated notification to the responsible delegate for actioning within Councils Service Standards timeframes. Investigation findings and any resolving actions are documented against the service request.

Table 8.1 provides a summary of the customer enquiries for the KLM water supply and Table 8.2 provides a summary of the customer enquiries for Councils other seven (7) water supplies. Appendix D provides descriptors for each supply area within the KLM supply.

**Table 8.1 Customer Enquires for the KLM Water Supply System**

| KLM Supply Areas | Dirty | Air or Cloudy | Taste & Odour | Illness | Loss of Supply | Other | Annual Total |
|---|---|---|---|---|---|---|---|
| **Kempsey** | 1 | 0 | 0 | 0 | 0 | 0 | **1** |
| **West Kempsey** | 0 | 0 | 0 | 0 | 1 | 0 | **1** |
| **Aldavilla** | 0 | 0 | 0 | 0 | 2 | 0 | **2** |
| **Smithtown/Gladstone** | 0 | 0 | 0 | 0 | 1 | 0 | **1** |
| **Belmore River** | 1 | 0 | 0 | 0 | 0 | 0 | **1** |
| **Kinchela** | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Frederickton** | 1 | 1 | 0 | 0 | 5 | 0 | **7** |
| **South Kempsey** | 1 | 0 | 0 | 0 | 3 | 0 | **4** |
| **East Kempsey** | 3 | 0 | 0 | 0 | 0 | 0 | **3** |
| **KLM Total** | 7 | 1 | 0 | 0 | 12 | 0 | **20** |

**Table 8.2 Customer Enquires for Councils Water Supply Systems excluding KLM**

| Supply System | Dirty | Air or Cloudy | Taste & Odour | Illness | Loss of Supply | Other | Annual Total |
|---|---|---|---|---|---|---|---|
| **Crescent Head** | 1 | 0 | 0 | 0 | 0 | 0 | **1** |
| **Hat Head** | 2 | 0 | 0 | 0 | 0 | 0 | **2** |
| **South West Rocks** | 4 | 1 | 3 | 0 | 1 | 0 | **9** |
| **Stuarts Point** | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Willawarrin** | 2 | 0 | 0 | 0 | 0 | 0 | **2** |
| **Bellbrook** | 2 | 0 | 0 | 0 | 0 | 0 | **2** |
| **Thunggutti** | 0 | 0 | 0 | 0 | 0 | 0 | **0** |
| **Combined Total** | **11** | **1** | **3** | **0** | **1** | **0** | **16** |

A combined total of thirty-six (36) (Tables 8.1 and 8.2) customer enquiries were recorded by Council for this reporting year; a decrease of 67.5% from the one-hundred and eleven (111) enquiries from 2019-2020. The majority of these were in the KLM supply with twenty (20) enquires received.

No customer enquiries were recorded in the Stuarts Point and Thunggutti water supplies (Table 8.2).

The decrease in the number of customers enquiries is due to the KLM supply reverting to source water supply from the Sherwood Borefield instead of the SMD emergency supply in June 2020 after

the drought broke. Typically, supply from SMD sees an increased in customer enquiries for both dirty water and taste and odour due to the dams' algae loadings.

Loss of supply and dirty water accounted for the majority of the enquires (31) across all the supplies.

The main contributing elements to the received enquiries of loss of supply, dirty water and air or cloudy were from broken mains/pipes and programmed sewer asset renewal projects.

Standard corrective measures include:

- investigation on site
- liaising with customer for additional information
- asset repair/replacement where required
- flushing of mains for minimum of 15min or until water runs clear
- confirmation of onsite water quality testing (Chorine residuals, pH and Turbidity)
- Where deemed necessary sample collection for laboratory analyses to assist in root cause diagnosis including processes of elimination.

In the South West Rocks supply three (3) taste and odour enquires where logged on the 23rd and 24th July 2020 of strong chlorine/bleach odour in the water. System investigations showed no increase in Chlorine residuals at the outlet of Gregory Street Reservoir with Free Chlorine levels of 1.16mg/L and 1.11 mg/L which are slightly less than the operating target of 1.2mg/L. Reticulation water quality results had Free Chlorine at 0.9mg/L. A flush of the system at the properties was performed. No other issues where reported.

# 9. Monitoring Programs

## 9.1 Steuart Macintyre Dam (SMD) Algae Monitoring Program

Algae, along with Methylisoborneol (MIB) & Geosmin (Taste and Odour), samples are collected by Council on a routine basis and form a CCP component when SMD is in use. This sampling program, designed in 2016 and updated in June 2019, considers local conditions, historic data and aligns with the Blue-Green Algae Alert Level Framework. Samples are sent to the Port Macquarie-Hastings Council Laboratory for analysis. Appendix B, Figures B.1 and B.2 depicts monitoring data from 2015 to the end of this reporting period for Cyanobacteria Biovolumes, Phytoplankton groupings, and taste and odour compounds.

## 9.2 Aboriginal Communities Water & Sewage Program

Five (5) discrete Aboriginal Communities are identified within the drinking water supply areas of Council. Council partnerships with DPI and NSW Health to deliver the NSW ACWSP for the following communities:

- Bellbrook (Thunggutti)
- Greenhill (West Kempsey)
- New Burnt Bridge (South Kempsey)
- Loftus Rd (Crescent Head)
- Fig Tree (South West Rocks)

### 9.2.1 Pesticide Testing

Pesticide monitoring from water supplies servicing discrete Aboriginal communities is funded by the ACWSP every five (5) years.

No pesticide testing was conducted in 2020-2021. Table 9.1 provides a summary of last conducted monitoring and when next schedule sampling is due for each community. Pesticide analysis testing includes:

- Acidic Herbicides – Method CET8B
- Glyphosate – Method CET17A
- Organochlorine & Organophosphorus by LCMSMS – Method CET43A
- Organochlorine, Organophosphorus & Synthetic Pyrethroid Pesticides by GCMSM – Method CET7D
- Triazines/Phenylurea & Carbamates – Methods CET19C

**Table 9.1 Pesticide Monitoring at Aboriginal communities**

| Catchment | Location | Last Sampled | Comments | Scheduled Next |
|---|---|---|---|---|
| Thunggutti | Network | 2017 | No Pesticides Detected from 1 sample | 2022 |
| Crescent Head | Network (Loftus Rd) | 2019 | No Pesticides Detected from 1 sample | 2024 |
| South West Rocks | Network (Figtree) | Feb 2017 to Dec 2017 | No Pesticides Detected from 12 samples | 2022 |
| KLM | Burnt Bridge or Greenhill | Dec 2017 | No Pesticides Detected | 2022 |

### 9.2.2 Inspections and Water Quality Testing to ADWG

Along with pesticide monitoring, the water supply and sewerage systems at the Aboriginal communities are inspected by DPI. Inspections includes a water quality testing component that checks the supplied water meets the required ADWG and WQI for the tested parameters.

The Thunggutti community is inspected quarterly, and the Fig Tree, New Burnt Bridge, Greenhill, and Crescent Head (Loftus Rd) communities are inspected yearly (Table 9.2). During this reporting year the inspection timetable was impacted due to resource pressures from ongoing COVID-19.

**Table 9.2. DPE inspection Water Quality results**

| Community | Sample Location | Date Inspected | Turbidity (NTU) | Free Chlorine (mg/L) | Total Chlorine (mg/L) | pH | Colour (pt/Co) |
|---|---|---|---|---|---|---|---|
| Fig Tree | SPS R8 | 16/06/2020 | 0.98 | 0.66 | 0.91 | 7.80 | <1 |
| New Burnt Bridge | SPS K26 | 16/06/2020 | 0.39 | 1.35 | 2.24 | 7.60 | 0 |
| Greenhill | SPS K2 | 16/06/2020 | 1.0 | 0.02 | 0.14 | 8.38 | 0 |
| Loftus Road | SPS C4 | 16/06/2020 | 0.38 | 0.2 | 3.7 | 8 | <5 |
| Thunggutti | Network | 18/08/2020<br>19/01/2021<br>02/06/2021 | 0.35<br>0.64<br>0.21 | 1.46<br>0.88<br>1.22 | 1.62<br>0.97<br>1.38 | 6.55<br>6.64<br>6.5 | 0<br>0<br>0 |

Note: SPS K2 is at a dead-end in the reticulation and off a side line that does not service the Greenhill Aboriginal Community. A more suitable Water Quality testing location would be the NSW Health monitoring site of KS01-122 Armidale Rd.

# 10. Staff Training and Development

Training and development for Water Process personal are based on statuary requirements, position duties, operational needs, and industry best practices.

Minimum Certification requirements for Water Process Operators include:

- Certificate III in Water Industry Operations; Fluoridation certificate; Dam Safety Surveillance certificate and Control Liquefied Chlorine Gas Disinfection certification.

Additional identified training and development along with any recertification and/or verification of competencies (VOC) are conducted as required by either Registered Training providers or in house by subject matter experts.

Training and development are managed by Councils Human Resources department with records held within Councils Training Record Management System.

Council is committed in the training and development of a skilled work force and participates in State funded Traineeship programs for the Water Industry. Councils takes on between four (4) to six (6) Trainees each year to mentor and guide them through the attainment of their Certificate II and Certificate III in Water Industry Operations certification.

Training and development programs completed by the Water Process Team during 2020-2021 is captured in Table 10.1.

**Table 10.1. Completed Staff Training and Development Summary**

| Training Details | Trainees | Water Process Operators | Management Team |
|---|---|---|---|
| Pollution Incident Response Management Plan (PIRMP) Yearly VOC | 4 | 6 | 4 |
| DWMS Water Quality Incident Response Yearly VOC | 4 | 6 | 4 |
| NSW Health Fluoride Plant Operator Certificate | | 3 | |
| Asbestos Awareness | | 5 | 2 |
| Chemical Awareness | 4 | 6 | 4 |
| Apply Fist Aid and Perform CPR | | 1 | |
| Working at Heights | 1 | | |
| Governance and Risk Management 101 | | | 1 |

# 11. Continuous Improvement – Implementation Plan

Councils Implementation Plan (IP) was developed as part of the DWMS to document the improvement actions identified during the detailed risk assessment of the drinking water supplies. The IP encompasses Element 12 of the DWMS and demonstrates Council's commitment to continual improvement of its water supply services from a quality and safety perspective.

Since completion of the DWMS in 2014, the IP has been reviewed yearly by the Risk Management Team in conjunction with the Risk Register. Table 11.1 provides an overview of the IP reviews with a summary of progress of the actions.

Any new actions that are identified in the Risk Register are added into the IP. As actions are completed their status is changed to "completed" and remain in the IP for one review cycle before being marked as "remove" and taken off the IP.

**Table 11.1. Implementation Plan Review History**

| Review Date | Removed * | Completed | Standing Items** | In progress | Ongoing (long term action) | Not Started | Items Added | Total Ongoing |
|---|---|---|---|---|---|---|---|---|
| Nov 2014 & Jan 2015 | 4 | 7 | | 49 | Not Reported | 111 | 23 | 171 |
| Aug & Sept 2015 | 4 | 8 | | 75 | Not Reported | 83 | 0 | 157 |
| April 2016 | N/A | N/A | | N/A | N/A | N/A | 16 | 173 |
| March 2017 | N/A | 24 | | 73 | 64 | 65 | 0 | 202 |
| August 2018 | 14 | 54 | | 51 | 27 | 28 | 0 | 106 |
| Oct 2019 | 48 | 23 | | 63 | 24 | 7 | 18 | 112 |
| November 2020 | 19 | 20 | | 68 | 23 | 6 | 12 | 109 |
| October 2021 | 17 | 16 | 7 | 53 | 27 | 9 | 0 | 96 |

*Removed items are the number of items that have been completed in the previous year review. The figures from "Completed" and "Removed" may not match due to confirmation in the current review year that the task has been completed. If an item is deemed "not-completed" its status is changed back into "in progress"
** Standing Items is a new category added from local PHU 2019-2020 Annual review meeting actions. Standing items are a constant action in the IP that have no end date.

**Table 11.2. Progress on actions based on risk ranking**

| Residual Risk | Removed | Completed | Standing Items | In progress | Ongoing (Long term actions) | Not Started | New | Tasks Remaining |
|---|---|---|---|---|---|---|---|---|
| Very High | 2 | 3 | 0 | 4 | 4 | 1 | 0 | **9** |
| High | 5 | 3 | 4 | 25 | 8 | 3 | 0 | **40** |
| Medium | 7 | 8 | 0 | 13 | 9 | 3 | 0 | **25** |
| Low | 3 | 2 | 3 | 11 | 6 | 2 | 0 | **22** |
| Total | **17** | **20** | **9** | **53** | **27** | **9** | **0** | **96** |

Ninety-six (96) tasks remain outstanding; twenty (20) tasks were assessed as completed and seventeen (17) tasks removed from the IP (i.e., confirmed as completed from the previous year review) (Table 11.2).

Of the seventeen (17) removed tasks, seven (7) had a risk ranking of high or very high and of the sixteen (16) tasks assessed as completed; six (6) had a rating of high or very high.

Nine (9) very high risks tasks remain outstanding in the IP, this is a 25% reduction from the twelve (12) outstanding high-risk tasks from 2019-2020 annual review.

Table 11.3 provides a summary of the actions that have been completed during 2020-2021.

Table 11.4 provides a summary of actions confirmed as competed in 2019-2020 and removed in 2020-2021.

A summary of the remaining IP outstanding actions is included in Appendix E.

**Table 11.3 Summary of Completed tasks in Implementation Plan**

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Comments |
|---|---|---|---|---|---|
| 2.26 | Kem | M | Include the selection of off takes in to the SMD Operational Manual. | 2012 | 31/10/2019 - When Dam is online the water off take level is to be captured in WaterOutLook - When KLM system is operation in WaterOutLook this action can be removed<br>23/12/2020 - Offtakes are to be added into to WaterOutlook WTL to check where in the program this should be added<br>25/10/2021 - gates in WaterOutlook for when SMD in use for recording what gate level is in use - action completed |
| 2.37 | Kem | L | Install online pH monitoring after treatment at the Sherwood Lime plant. | 2012 | 4/11/2019 - on hold until confirmation of new plant at dam - if so will no longer be required<br>23/12/2020 - pH monitoring to be installed at Greenhill regardless of new plant at SMD, money has been allocated<br>18/10/2021 Inlet to GH res has Cl2 and pH online instruments install 2021 |
| 2.38 | Kem | M | Item change to - Ensure that duty pump is available at Greenhill Res only, Alarms are already in place | 2012 | 4/11/2019 - standby pumps do need to be installed , check that alarms are operational<br>3/02/2021 -critical to have standby pump installed for Greenhill, but Belgrave and JL can stay with one dosing pump - ME to action as a reactive job<br>18/10/21 - this action is being closed off - plant will not be utilised until new WTP in place. SMD is only a backup emergency supply |
| 2.42 | Kem/All | H | Back to base security alarm system required for all treatment facilities. | 2012 | 4/11/2019 - BMS into SCADA investigation - scoping yet to begin<br>3-2-21 - Facility management is responsible for security alarming at all facility - in progress (SCADA alarming on Doors on all treatment facilities and dosing buildings)<br>25/10/2021 this action works in with and has been integrated into 7.06 and can be closed off |
| 2.58 | Kem | VH | Propose a water carting fill station installation at Clybucca to encourage turnover of reservoir. | 2012 | 4/11/2019 - MWS working on grants - for water stations for one per scheme<br>3/2/2021 - this project is underway - Clybucca is not on the program, locations include Armidale Rd, Belmore River - Gladstone, Gregory - SWR, River St (moved to Armidale Road), South St (replaced), Stuarts point<br>18/10/21 all fill stations are in. In regard to, Clybucca WQ currently no issues and will also improve more with new WTP. Risk Team has discussed and confirmed that this action is not required. NB back in 2012 SMD was main supply this is no longer the case - it is an emergency supply only |
| 3.98 | BB | M | Current location of final turbidity analyser to be confirmed, and relocated if required to sample location, post filters and prior to pH correction. | Dec-14 | 21/11/2019 - This will be captured and actioned when the plant is upgraded<br>10/2/2021 - as 2019 notes<br>25/10/2021 - Confirmed on the 21/10/21 that analysers are correctly positioned - this action is completed |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Comments |
|---|---|---|---|---|---|
| 4.04 | KLM | M | Confirm that the HMI trends at SM Dam are available and establish a setup of downloading trend data regularly and recording, for historical purposes, until Clear SCADA is established at this site. | Dec-14 | Clear SCADA established<br>21/11/2019 - this is set up however "ME" to confirm data capture is historized<br>5/2/21 -Trends are now in Clear SCADA and historized since 2016 - will be improved in the new SCADA standard<br>23/09/2021 - MC - confirming with Tristan on length of data historization.<br>25/10/2021 MC has confirmed that all tends have been historized into SCADA since 2017 upgrade - Action can be marked as "Completed" |
| 4.18 | All | M | Consider developing an SOP which is a risk-based approach to determining whether a Bacto sample is warranted following a mains break. | Dec-14 | 21/11/2019 - not started yet<br>18/2/21 - yet to be started<br>18/10/2022 - Risk Team discussion that Bacto is not suitable and that SOP in main repairs/flushing and use of flushing calculator is sufficient, along with insitu WQ testing onsite (NTU and CL2) to confirm water is within ADWG. Bacto results take over 24hours to obtain an interim result. |
| 5.14 | Th | H | Integrate SCADA onsite & Door alarms connected to SCADA | Apr-16 | 21/11/2019 - this will be incorporated with the roll out of upgrades across all sites<br>10/2/2021 - This action has been confirmed that it is captured in New Action No 7.06 for all supplies not just Thunggutti |
| 6.07 | SWR | M | Regular Scour programme of delivery line into WTP from borefield | Nov-19 | Develop scour programme - Some engineering controls need to be developed for capture of contaminated water EPA is happy with filter bag to stormwater<br>5/2/2021 - SWR & Crescent Head done yearly, other supplies are pended on budgets<br>18/10/2021 - this action is being closed as it is a duplicate of action item 2.76 which is a Standing item |
| 6.13 | SWR | M | Fluoride - Investigation of design limit so system cannot overdose and set at that level | Nov-19 | TLW to confirm that you cannot overdose - once confirmed this action can be closed<br>18/2/21 - Still to be confirmed<br>25/10/2021 - Conversation with Risk Team, is that we have reduced the risk as much as possible. Manual dose is set to plant max flow. This action is completed |
| 6.17 | ALL | VH | Review optimal operating water levels to confirm accuracy (report recently undertaken) to be checked then remove task F:\UTILITIES\DRAFT New Water Services\WATER SUPPLIES\POTABLE WATER\RESERVOIRS | Nov-19 | PE to confirm data and update if required<br>10/2/2021 - review of the spreadsheet required<br>21/05/21 Health Meeting - verified in real time by MWS this action can be closed off at next review<br>18/10/2021 - Confirmed to be closed off - MWS and risk team, info in spread sheet is correct |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Comments |
|---|---|---|---|---|---|
| 6.19 | All | H | Consider a notification through customer service/Facebook to customers that will experience loss of supply due to power outages at booster pump stations and consider emergency power generation role out plan | Nov-19 | Collaboration between PE, ME and Comms group. Plan to be developed for emergency generator rollout across critical assets<br>5/2/21- generators are request as required & Comms group is notified if required. Outstanding action is the Investigation to continue for emergency generator rollout<br>25/10/2021 - Comms team is notified if there is a loss of service - this action in completed |
| 7.04 | SWR | M | - Update entry signage protocols - electronic key entry only<br>- Check if Master key opens room (it should not)<br>- Check key on double door access " | Nov-20 | 10/2/2021 -Electronic access has been completed - Dec2020<br>Fluoride Master Key with WTL<br>WTL to confirm that all parts have been completed and then this action can be closed off<br>25/10/2021 - confirmed as competed |
| 7.1 | ALL | VH | Tender instrumentation services | Nov-20 | 10/2/2021 - In progress of writing tender plan for the preventative maintenance of all water instrumentation<br>23/09/2021 - Phil (MC) - this is done, and can now be closed - Completed |
| 7.12 | SP | L | Stuarts Point supply Automatic Shutdown interlocks on Turbidity at CCP2 post filtration | Feb-21 | 18/2/2021 - To be investigated<br>25/10/2021 - this action has been incorporated into above action 7.09 |

**Table 11.4 Summary of removed tasks from Implementation Plan**

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Comments |
|---|---|---|---|---|---|
| 2.21 | Kem | M | Consider undertaking a monthly monitoring program for indicator microbiological levels at take-off point of SMD | 2012 | Has been done, will be formalised<br>31/10/2019 - Check schedule and then close off once confirmed<br>23/12/2020 - micro sample taken weekly - action is completed<br>25/10/2021 - Confirmed as completed can be removed for IP |
| 2.72 | Kem | H | Alternative power to be installed for power outages on pressurised zones (Burnt Bridge, Bloomfield St & Everinghams Lane) or investigate alternative water supplies (i.e. tank on tower). | 2012 | 7/11/2019 - to be implemented need to check for power point for generator and/or permanent on site back up power supplier<br>5/2/21 - All sites converted for generator plug in the event of power outages<br>25/10/2021 - this action has been confirmed as completed and can be removed |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Comments |
|---|---|---|---|---|---|
| 2.91 | Kem | VH | KSC to establish a centralised water quality data base for the recording of operational and compliance monitoring, including response to WQ incidents and abnormal results.<br>Field operators need online data entry facilities and automated notification for abnormal results.<br>Implement a regime of regular review water quality results, including daily entry of data by operators and at least weekly review by TLW<br>The data base is to have the ability to produce reports, trend graphs and alert notifications (including site events). | 2012 | Outlook water system is under development<br>7/11/2019 - WaterOutLook developed for the SWR system and will be rolled out across other systems from Nov 2019<br>18/2/21 - WaterOutlook has been rolled out for Water monitoring data - this action can be closed out<br>25/10/2021 - This has been confirmed at completed and can be removed " |
| 3.14 | All (bores) | H | SOP required around the monitoring and selection of best water quality bores | 2014 | 10/2/21 - SOP not required. Bores selection is driven by water quality at each bore and conversions between WO and TLW when WQ begins to deteriorate - this action is to be closed off<br>25/10/2021 - Confirmed as completed can be removed for IP" |
| 3.19 | SWR, SP, BB | H | Develop an SOP for chlorine top-up dosing into clear water tanks | | 10/2/21 - This action/SOP is being incorporated into new action 7.05 slug dosing reservoirs SOP that includes confirmation of calculations by the Team Leader and/or Senior Water Operator - this action is being closed off<br>25/10/2021 - Confirmed as completed can be removed for IP |
| 3.22 | HH, SP, CH, SWR | L | Develop SOP for chlorine - managing increased water demand/supply during holiday periods | 2014 | 10/2/2021 this is managed by daily operations checks and review of trends, chlorine is adjusted accordingly. SOP not required and this action is closed off<br>25/10/2021 - confirmed as completed - this action can be removed |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Comments |
|---|---|---|---|---|---|
| 3.6 | ALL | M | Develop a comprehensive public and media communications strategy and include draft public and media notifications and leverage, where possible, existing mechanisms by which council communicates with the community. Define communication protocols with the involvement of relevant agencies and include in the protocols a contact list of relevant agencies and businesses and their relevant key people and update contact details (also include in DWMS). | 2014 | Council to investigate and check if community strategic plan. Social media (FB) used currently.<br>19/11/2019 - No Update<br>10/2/2021 - Communication team has their own strategy in place to inform the community, Key contacts are in the DWMS contact list. This action is being closed off<br>this action was developed before the new DWMS was implemented and DWMS has protocols for external contacts and when they are contacted<br>25/10/2021 - Confirmed as completed - can be removed |
| 3.88 | ALL | L | Develop internal audit procedures and schedules appropriate to functionality of council and the water supply systems. Identify appropriate personnel to undertake the internal audit and provide training in auditing. | 2014 | Undertaken informally, systems continuously audited, SOP for internal audit to be developed to ensure process is documented<br>21/11/2019 - Water Systems currently done informally Council has recently hired an Internal Auditor and systems at a higher level are currently being develop<br>10/02/2021 - Departmental audits are being completed and are soon to be captured in Councils new VAULT system for findings, actions and their outcomes<br>Council internal reports are kept in Councils Share point system<br>Council has a qualified internal auditor and departmental audits are carried out by staff who are SME. This action is considered to be completed and can be closed off<br>28/10/21 action has been confirmed as completed and can be removed |
| 4.09 | All | H | Council needs to ensure that a log is kept of all changes to SCADA limits and ensure that security controls are in place for changes to CCP levels. Council should also consider an approval process for making these process adjustments. | Dec-14 | All changes logged automatically, including who changed it (the event page)<br>21/11/2019 - Need to double check that dosing set points affecting the CCPs are clamped and that alarms are reviewed<br>5/2/21 - the ongoing review of setpoints is incorporated into action No 3.76. All other parts of this action are completed as noted<br>25/10/2021 this action has been confirmed as completed and can be removed |
| 4.1 | All | L | Council currently only has one test kit for testing hypo strength, and this is located at the Dam. Council should consider purchasing another kit for the upriver sites. | Dec-14 | Will be ordered, may be required for each plant that uses hypo<br>21/11/2019 -confirmation of purchase of additional kits required<br>10/2/2021 Kits have been purchased, kits are located at SMD and SWR. - this action is completed and can be closed off<br>25/10/2021 - this action is confirmed as completed and can be removed |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Comments |
|---|---|---|---|---|---|
| 4.11 | All | M | Council to contact Port Macquarie Lab to determine protocols for micro sampling on weekends if required during a CCP failure. | Dec-14 | Protocol to be discussed, formalising process will be considered<br>21/11/2019 - Process in place with Port Lab. Need to develop SOP for confirmation of steps in the event of CCP failure and taking a non-routine micro sample on the weekend<br>10/2/2021 - this protocol is already captured in the DWMS - incident management plan. A SOP is not required. This action can be closed off<br>25/10/2021 - this action is confirmed as completed and can be removed |
| 5.05 | BB | M | Proper signage should be displayed in the chemical storage areas instead of marker pen written signage on the storage tanks and hazardous chemical signage should be improved | Apr-16 | 21/11/2019 - TLW & PE to conduct an audit of all signage to confirm all correct signage is in place<br>10/2/2021 - this action has been completed and can be closed off<br>18/10/21 - this action has been confirmed as completed and can be removed |
| 6.03 | SMD | H | Investigate options for Destratification (other than aeration) | Nov-19 | Re-visit based on outcome of emergency treatment plant at SMD<br>10/2/2021 - Council is no longer in drought and emergency plant is now not being looked at - however Council is in concept stage at SMD new treatment plant where technologies will mitigate against destratification, and aeration needed - this action is no longer needed and can be closed off<br>18/10/2022 - Action confirmed to be completed and can be removed for IP |
| 6.14 | WW | M | When filling Willawarrin reservoir from a tanker, the tanker should have a spray nozzle diffuser attached/installed to reduce sediment stirring | Nov-19 | 18/2/21 - Spray Nozzle in Reservoir - completed can be removed next review<br>25/10/2021 action confirmed - can be removed |
| 7 | KLM | M | Inspections of aeration line - Create frequency plan of aeration line inspection by divers | Nov-20 | PE - To incorporate into the reservoir cleaning plan<br>10/2/2021 - this action has been completed and can be closed off<br>18/10/21 - confirmed can be removed |
| 7.06 | ALL | M | add plant power generator sizes to the BCP plan for in the event of loss of power at treatment plants due to storm events or planned outages. | Nov-20 | 10/2/2021 - further investigation required<br>23/09/2021 - Phil (MC) - ongoing - MO following this up. (Same as action 4.14) duplicated actions - close off /remove |

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# Appendix A Summary of Critical Control Points (CCP) for each Supply System

## Table A.1a CCP Kempsey and Lower Macleay Water Supply – Sherwood Lime Plant in use

| System | CCP ID | Control Point | Indicator Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Kempsey and Lower Macleay | **Sherwood Lime Plant in use** | | | | | | | | |
| | CCP1 | Raw Water Abstraction | Turbidity | Combined bore water to Sherwood Lime Plant | Continuous online | <1 NTU | 1 NTU | 2 NTU | There is no filtration undertaken, critical limit provides an interim barrier to control contaminant/ microbial load. Plant is shut off at critical limit. |
| | CCP2 | Filtration | Turbidity | NA | NA | NA | NA | NA | NA |
| | CCP3 | Disinfection | Free Chlorine<br>pH | Outlet of Reservoir – Greenhill | Daily grab | 1.2 mg/L<br>pH 7.5 | <0.9 mg/L or > 3 mg/L<br>pH <6.8 or >8.0 | <0.6 mg/L or >4 mg/L<br>pH <6.5 or >8.5 | Lower chlorine critical limit ensures that C.*t* is met at the monitoring location. Upper chlorine critical limit ensures that total chlorine does not get >5 mg/L (health limit). pH correction undertaken. Lower pH critical limit protects asset corrosion. Upper pH critical limit ensures efficiency of chlorination is not compromised (ADWG). |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoir | Reservoir integrity | All Reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Ensures treated water does not get contaminated. |

## Table A.1a.1 SOP for KLM CCP1 Turbidity at Raw Water Abstraction - Sherwood Lime Plant in use

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay – Sherwood Lime Plant in use** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online |
| Monitoring location | Sherwood Lime Plant (SLP) inlet pre disinfection | | |
| What will initiate response? | Confirmation of result with immediate grab sample re-test | | |

| Operating Target<br><1 NTU | Alert Level<br>1 NTU | Critical Limit<br>2 NTU |
|---|---|---|
| • Observe weather and flood warnings<br>• Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity daily<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Visual checks at Bore sites and Bore water monitoring program<br>• Individual Bore testing | **Corrective actions**<br>General:<br>• Confirm with immediate grab sample re-test<br>• Contact Team Leader<br>• Consider shutting SLP down<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample<br>• Check Recharge Channel for any water quality impacts such as flooding<br>• Check borefield for signs of damage to bore or any impacts to sites areas around bores<br>• Investigate operating bores in use at time of sampling to identify source of increased turbidity levels<br>• Check individual production Bores for turbidity & iron and isolate where required<br>• Make arrangements for isolation & repairs to problem bore<br>• Check readiness of alternate supply | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Shutdown the system<br>• Switch to alternate supply, if possible<br>• Check turbidity levels downstream to validate any infiltration to receiving reservoirs<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.1a.2 SOP for KLM CCP3 Free Chlorine and pH at Disinfection - Sherwood Lime Plant in use

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay - Sherwood Lime Plant in use** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection and pH correction | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine residual & pH | Monitoring Frequency: | Daily grab (7 days) |
| Monitoring location | Reservoir(s) outlet: Greenhill | | |
| What will initiate response? | Confirmation of result with immediate grab sample re-test | | |

| Operating Target | Alert Limit | Critical Limit |
|---|---|---|
| Free chlorine 1.2 mg/L<br>pH 7.5 | Free chlorine <0.9 or >3 mg/L<br>pH <6.8 or >8.0 | Free chlorine <0.6 or >4 mg/L<br>pH <6.5 or >8.5 |
| • Routine site and operational checks at Dosing Plant<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments<br>• Chemical dosing rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Instrument calibration and records maintained<br>• Chemical procurement and delivery requirements<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Regular inspection of the lime dosing system including cleaning of injection lines for change over<br>• Flow meter checks<br>• Redox probes within Reservoirs | **Corrective actions**<br>• Confirm result with an immediate re-sample.<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and manually dose if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of Reservoir for any breaches or unauthorised access<br>• Check primary dosing equipment (circulation pumps, injection point)<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.1a.3 SOP for KLM CCP5 Reservoir Integrity - Sherwood Lime Plant in use

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay - Sherwood Lime Plant in use** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| Operating Target<br>No breach of integrity | Adjustment Limit<br>Any sign of integrity breach | Critical Limit<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity.<br>• Increase inspections until repaired<br>• Consider notifying local PHU<br>• Complete *'Initial Incident Report Form'* | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'* |

## Table A.1b CCP Kempsey and Lower Macleay Water Supply – SMD in use

| System | CCP ID | Control Point | Indicator Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Kempsey and Lower Macleay | **Steuart McIntyre Dam in use** | | | | | | | | |
| | CCP1 | Raw Water Abstraction | Turbidity | Combined Bore Water to SM Dam Inlet Race | Continuous online / daily grab | <1 NTU | 3 NTU | 5 NTU | There is no filtration undertaken, critical limit provides an interim barrier to control contaminant/ microbial load into SM Dam. |
| | | Raw Water Abstraction | Turbidity | SM Dam outlet from an active transfer pump | Daily grab | <1 NTU | 3 NTU | 5 NTU | There is no filtration undertaken, critical limit provides an interim barrier to control contaminant/ microbial load. Plant is shut off at critical limit. |
| | | Raw Water Abstraction | Taste & Odour<br>MIB / Geosmin<br>Algae Biovolumes (Toxins) | SM Dam Tower and SM Dam sites 1, 2, & 3 | As per Algae Monitoring Plan | Not detectable<br>Not detectable<br>Below Detection Limit | N/A<br>>2 ug/L<br>Alert Level 1 | N/A<br>N/A<br>Alert Level 2 | Algae Biovolume critical limit is based on the Water Directorate Alert Level Framework for management of cyanobacteria in drinking water. Taste and Odour along with MIB and Geosmin has no set critical limit, as these indicators in detectable levels are aesthetic in nature and not health related. |
| | CCP2 | Filtration | Turbidity | NA | NA | NA | NA | NA | NA |
| | CCP3 | Disinfection | Free Chlorine<br>pH | Outlet of Reservoirs – Greenhill, John Lane, Potters Hill | Daily grab | 1.8 mg/L<br>pH 7.5 | <1.0 mg/L or > 3 mg/L<br>pH <6.8 or >8.0 | <0.6 mg/L or >4 mg/L<br>pH <6.5 or >8.5 | Lower chlorine critical limit ensures that C.*t* is met at the monitoring location. Upper chlorine critical limit ensures that total chlorine does not get >5 mg/L (health limit). No pH correction readily available. Lower pH critical limit protects asset corrosion. Upper pH critical limit ensures efficiency of chlorination is not compromised (ADWG). |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoir | Reservoir integrity | All Reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Ensures treated water does not get contaminated. |

## Table A.1b.1 SOP for KLM CCP1 Turbidity at Raw Water Abstraction at Inlet Race - SMD in use

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay – Steuart McIntyre Dam in use** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online / daily grab (7 days) |
| Monitoring location | Online instrument / daily grab (combined bore water) to SM Dam Inlet Race | | |
| What will initiate response? | Confirmation of result with immediate grab sample re-test from the SM Dam Inlet Race | | |

| Operating Target<br><1 NTU | Alert Level<br>3 NTU | Critical Limit<br>5 NTU |
|---|---|---|
| • Observe weather and flood warnings<br>• Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity daily<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments)<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Visual checks at Bore sites and Bore water monitoring program<br>• Individual Bore testing | **Corrective actions**<br>• Confirm with immediate grab sample re-test<br>• Contact Team Leader<br>• Consider ceasing supply to SM Dam<br>• Following confirmation of online result with grab sample.<br>• Check Recharge Channel for any water quality impacts such as flooding<br>• Check borefield for signs of damage to bore or any impacts to sites areas around bores<br>• Investigate operating bores in use at time of sampling to identify source of increased turbidity levels<br>• Check individual production bores for turbidity & iron and isolate where required<br>• Make arrangements for isolation & repairs to problem bore<br>• Check readiness of alternate supply<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Cease borefeild supply to SM Dam<br>• Check turbidity levels at SM Dam monitoring locations and at Active Transfer Pump to validate any infiltration to receiving reservoirs<br>• Check and confirm SM Dam volume for sufficient level as a supply source<br>• Process Engineer or Manager to call local PHU as soon as possible<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU<br>• Consider switch to Sherwood Lime Plant (alternative supply), if possible<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.1b.2 SOP for KLM CCP1 Turbidity Raw Water Abstraction at Active Pump Transfer – SMD in use

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay – Steuart McIntyre Dam in use** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | daily grab (7/days) |
| Monitoring location | SM Dam outlet from an active transfer pump | | |
| What will initiate response? | Confirmation of result with immediate grab sample re-test | | |

| Operating Target<br><1 NTU | Alert Level<br>3 NTU | Critical Limit<br>5 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity daily<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments)<br>• Maintain dam at required water level<br>• Weekly shore line monitoring for points of erosion (by boat and vehicle)<br>• Routine testing from Dam<br>• Routine monitoring of compressor run times<br>• (7days/wk) and visual checks and maintenance of Aeration line<br>• Aeration system to be run for approx. 7 hours during night to mix water body | **Corrective actions**<br>• Confirm with immediate grab sample re-test<br>• Contact Team Leader<br>• Increase visual monitoring for the formation of surface scum<br>• Check online temperature and DO trends to determine if dam has inverted<br>• Increase algae monitoring from different levels of offtakes as per Algae Monitoring Plan<br>• Select the most suitable offtake level<br>• Check aeration line for correct operation<br>• Adjust aeration system operational times<br>• Increase algae monitoring if algae detected with inclusion of toxin monitoring<br>• Adjust disinfection levels at treatment site.<br>• Check Sherwood Lime plant in readiness for alternate supply<br>• Undertake chlorine decay testing<br>• Consider moving into a higher water restriction level<br>• Source funding and availability of emergency containerised WTP<br>• Contact PHU and DoI<br>• Complete 'Initial Incident Report Form' | **Corrective actions**<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Check turbidity levels downstream to validate any infiltration to receiving reservoirs<br>• Review pH<br>• Review algae species and toxicity<br>• Undertake chlorine decay testing<br>• Consider starting Sherwood Lime Plant (alternative supply) if possible<br>• Consider Boil water alert (based on pH, algae, and chlorine decay testing) until emergency containerised WTP is sourced.<br>• Consider moving into a higher water restriction level<br>• Contact DoI for operational advice as needed<br>• Consider obtaining emergency containerised WTP<br>• Complete *'Initial Incident Report Form'*. |

## Table A.1b.3 SOP for KLM CCP1 Algae, Taste and Odour at Raw Water Abstraction @ In Dam – SMD in use

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay – Steuart McIntyre Dam in use** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | Taste and Odour compounds, Algae levels and Toxins |
| What is being monitored? | Algae Counts, Taste & Odour, & MIB/Geosmin levels | Monitoring Frequency: | As per Algal Monitoring Programme |
| Monitoring location | SM Dam Tower and Monitoring sites 1, 2 and 3 | | |
| What will initiate response? | Operator (in field monitoring) or Team Leader (in response to Laboratory results) | | |

| Operating Target<br>No detected T&O or MIB/Geosmin<br>Algae biovolume below Limit | Alert Level<br>Noticeable T&O or MIB/Geosmin > 2 ug/L<br>Algae biovolume at Alert Level 1 | Critical Limit<br>Algae biovolume at Alert Level 2 |
|---|---|---|
| • Maintain dam at approximately 53m AHD (96% level) when possible.<br>• Observe weather warnings<br>• Weekly visual monitoring for algal blooms (boat and vehicle)<br>• Instrument calibration and records maintained<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments)<br>• Algae monitoring as per the Algal Monitoring Programme<br>• Weekly Operator odour test from grab sample (conducted at same time Tb test)<br>• Routine monitoring of compressor run times<br>• Aeration system to be run for approx.7 hours during night to mix water body<br>• Routine monitoring for nutrients of raw water entering the dam (both in-house and external laboratory testing) | **Corrective actions**<br>• Contact Team Leader<br>• Conduct in-house odour testing of raw & boiled water by operational staff<br>• Review the aeration operation rates and adjust as required<br>• Consider benthic algae inspection and sampling<br>• Increase visual monitoring for the formation of surface scum (boat and vehicle)<br>• Increase algae monitoring as per Algal Monitoring Programme with inclusion of toxin monitoring<br>• Select the most suitable offtake level for use<br>• Adjust aeration system operational times<br>• Check Sherwood Lime plant in readiness for operation<br>• Contact local PHU and DoI<br>• Consider moving into la higher water restriction level<br>• Source availability and funding of emergency containerised WTP<br>• Complete 'Initial Incident Report Form' | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager<br>• Process Engineer or Manager to contact local PHU and DoI<br>• Consider starting Sherwood Lime Plant (alternative supply)<br>• Consider moving into a higher water restriction level<br>• Consider obtaining emergency containerised WTP<br>• Complete *'Initial Incident Report Form'* |

## Table A.1b.4 SOP for KLM CCP3 Free Chlorine and pH Disinfection at multiple reservoirs – SMD in use

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay – Steuart McIntyre Dam in use** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection and pH correction | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine residual & pH | Monitoring Frequency: | Daily grab (7 days) |
| Monitoring location | Reservoir(s) outlet: Greenhill, John Lane, Potters Hill | | |
| What will initiate response? | Confirmation of result with immediate grab sample re-test | | |

| Operating Target | Alert Limit | Critical Limit |
|---|---|---|
| SMD – chlorine 1.8 mg/L<br>pH 7.5 | SMD - <1.0 or >3 mg/L<br>pH <6.8 or >8.0 | SMD – chlorine <0.6 or >4 mg/L<br>pH <6.5 or >8.5 |
| • Routine site and operational checks at Dosing Plant<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments<br>• Chemical dosing rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Instrument calibration and records maintained<br>• Chemical procurement and delivery requirements<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Regular inspection of the lime dosing system including cleaning of injection lines for change over<br>• Flow meter checks<br>• Redox probes within Reservoirs | **Corrective actions**<br>• Confirm result with an immediate re-sample.<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and manually dose if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of Reservoir for any breaches or unauthorised access<br>• Check primary dosing equipment (circulation pumps, injection point)<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete *'Initial Incident Report Form'*, | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Consider boil water alert in consultation with local PHU.<br>• Consider moving into a higher water restriction level<br>• Consider obtaining emergency containerised WTP.<br>• Complete *'Initial Incident Report Form'*, |

## Table A.1b.5 SOP for KLM CCP5 Reservoir Integrity

| | | | |
|---|---|---|---|
| Water Scheme | **Kempsey and Lower Macleay - Steuart McIntyre Dam in use** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| Operating Target<br>No breach of integrity | Adjustment Limit<br>Any sign of integrity breach | Critical Limit<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program | Corrective actions<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity.<br>• Increase inspections until repaired<br>• Consider notifying local PHU<br>• Complete *'Initial Incident Report Form'* | Corrective actions<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'* |

## Table A.2 CCP Crescent Head Water Supply

| Scheme | CCP ID | Control Point | Control Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Crescent Head | CCP1 | Raw Water Abstraction | Turbidity | Front Dam | Daily grab | <1 NTU | 4 NTU | 5 NTU | There is no filtration undertaken, critical limit provides an interim barrier to control contaminant/ microbial load. Plant is shut off manually at critical limit. |
| | CCP2 | Filtration | Turbidity | NA | NA | NA | NA | NA | NA |
| | CCP3 | Disinfection | Free Chlorine | Back Beach Reservoir Outlet | Daily grab | 1.5 mg/L<br>pH 7.5 | <0.7 or >3 mg/L<br>pH <6.8 or >8.0 | <0.5 or >4 mg/L<br>pH <6.5 or >8.5 | Lower chlorine critical limit ensures that C.*t* is met at the monitoring location. Upper chlorine critical limit ensures that total chlorine does not get >5 mg/L (health limit). Lower pH critical limit protects asset corrosion. Upper pH critical limit ensures efficiency of chlorination is not compromised (ADWG). |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoirs | Reservoir integrity | All reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Ensures treated water does not get contaminated. |

Note: Daily grab is taken 7 days/week

## Table A.2.1 SOP for CH CCP1 Turbidity Raw Water Abstraction at Front Dam

| | | | |
|---|---|---|---|
| Water Scheme | **Crescent Head** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Daily grab (7 days) |
| Monitoring location | Front Dam | | |
| What will initiate response? | Confirmation of result with immediate follow up test | | |

| Operating Target<br><1 NTU | Alert Level<br>4 NTU | Critical Limit<br>5 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments).<br>• Monitor and measure raw water turbidity daily at the Front Dam, weekly at the combined Balance Tank and weekly at individual Bores<br>• Visual checks at Bore sites and Bore water monitoring program<br>• Visual Inspections for Algae in Dam daily | **Corrective actions**<br>• Repeat manual test to confirm result<br>• Investigate bore integrity and Collection Tank for contamination<br>• Test turbidity for each bore and Collection Tank and isolate problem bore if required.<br>• Contact Team Leader<br>• Check turbidity at Back Beach Reservoir.<br>• Check Total Chlorine levels at Back Beach Reservoir (refer to Chlorination SOP)<br>• Increase Total Chlorine dose at plant, if needed<br>• Initiate an incident algal monitoring program in Front Dam if required.<br>• Complete *'Initial Incident Report Form'*, following confirmation with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform, Process Engineer or Manager as soon as possible.<br>• Isolate and contain source of high turbidity<br>• Shutdown the Dosing Plant<br>• Consider alternative water supply/storage where possible (i.e. Onsite Raw water tanks)<br>• Maintain appropriate disinfection levels in the network<br>• Check turbidity levels downstream to validate any infiltration to Dosing (if automatic shutdown has failed)<br>• Consider isolation & scour the Collection Tank<br>• Process Engineer or Manager to call local PHU as soon as possible<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete 'Initial Incident Report Form', following confirmation with grab sample |

## Table A.2.2 SOP for CH CCP3 Free Chlorine and pH Disinfection at Back Beach Reservoir

| | | | |
|---|---|---|---|
| Water Scheme | **Crescent Head** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection (chlorine gas and Calcium Hypochlorite pills) and pH correction (lime & $CO_2$) | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine residual & pH | Monitoring Frequency: | Daily grab (7 days) |
| Monitoring location | Back Beach Reservoir outlet | | |
| What will initiate response? | Confirmation of result with immediate follow up test | | |

| Operating Target<br>1.5 mg/L<br>pH 7.5 | Alert Limit<br><0.7 or >3 mg/L<br>pH <6.8 or >8.0 | Critical Limit<br><0.5 or >4 mg/L<br>pH <6.5 or >8.5 |
|---|---|---|
| • Routine site and operational checks at Dosing Plant<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments.<br>• Chlorine gas, CO2 & lime dose rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Instrument calibration and records maintained<br>• Chemical procurement and delivery requirements<br>• Regular inspection of the lime dosing system including cleaning of injection lines for change over<br>• Chemical storage levels monitoring | **Corrective actions**<br>• Confirm result with an immediate re-sample.<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Check primary dosing equipment and gas cylinder weight (physically by rocking)<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and manually dose if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of Reservoir for any breaches or unauthorised access<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete *'Initial Incident Report Form'*, following confirmation with grab sample | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation with grab sample. |

## Table A.2.3 SOP for CH CCP5 Reservoir Integrity at all Reservoirs

| | | | |
|---|---|---|---|
| Water Scheme | **Crescent Head** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs (Back Beach & Big Nobby) | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| Operating Target<br>No breach of integrity | Adjustment Limit<br>Any sign of integrity breach | Critical Limit<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity<br>• Consider notifying local PHU<br>• Complete *'Initial Incident Report Form'* | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'* |

## Table A.3 CCP Hat Head Water Supply

| Scheme | CCP ID | Control Point | Control Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Hat Head | CCP1 | Raw Water Abstraction | Turbidity | Raw Water Inlet | Continuous online / grab sample | <1 NTU | 2 NTU | 4 NTU | There is no filtration undertaken, critical limit provides an interim barrier to control contaminant/ microbial load. Plant is shut off at critical limit. |
| | CCP2 | Filtration | Turbidity | NA | NA | NA | NA | NA | NA |
| | CCP3 | Disinfection | Free Chlorine | Clear water to retic leaving dosing plant | Continuous online / grab sample | 1 mg/L pH 7.5 | <0.6 or >3 mg/L pH <6.8 or >8.0 | <0.5 or >4 mg/L pH <6.5 or >8.5 | Lower chlorine critical limit ensures that C.*t* is met at the monitoring location. Upper critical chlorine limit ensures that total chlorine does not get >5 mg/L (health limit). Lower pH critical limit protects asset corrosion. Upper pH critical limit ensures efficiency of chlorination is not compromised (ADWG). |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoirs | Reservoir integrity | All reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Upon advice from NSW Health. Ensures treated water does not get re-contaminated. |

Note: Grab sample is taken daily (7 days/week). Raw Water Abstraction and Disinfection CCPs have continuous online monitoring.

## Table A.3.1 SOP for HH CCP1 Turbidity Raw Water Abstraction at Plant Inlet

| | | | |
|---|---|---|---|
| Water Scheme | **Hat Head** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online / daily grab (7 days) |
| Monitoring location | Raw Water Inlet to dosing plant | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| **Operating Target**<br><1 NTU | **Alert Level**<br>2 NTU | **Critical Limit**<br>4 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity daily<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments)<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Visual checks at Bore sites and Bore water monitoring program<br>• Aeration system maintenance & operation<br>• Balance Tank cleaning program | **Corrective actions**<br>• Confirm or cross check online turbidity with portable instrument and clean if needed<br>• Contact Team Leader<br>• Check Balance Tank for turbidity and iron levels<br>• Check diffuser/ aeration operation within Balance Tank<br>• Check individual production Bores for turbidity & iron and isolate where required<br>• Dose chlorine to Reservoirs and/or increase dose at plant, if needed<br>• Consider shutting dosing plant down<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Shut down the treatment plant<br>• Check turbidity levels downstream to validate any infiltration to dosing plant (if automatic shutdown has failed)<br>• Consider isolation & scour the Balance Tank<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.3.2 SOP for HH CCP3 Free Chlorine and pH Disinfection at outlet of Reservoirs

| | | | |
|---|---|---|---|
| Water Scheme | **Hat Head** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection (Chlorine gas) & pH correction (Soda ash) | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine residual & pH | Monitoring Frequency: | Continuous (online) / daily grab (7 days) |
| Monitoring location | Clear water to reticulation – leaving dosing plant | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| **Operating Target**<br>1mg/L<br>pH 7.5 | **Alert Limit**<br><0.6 or >3 mg/L<br>pH <6.8 or >8.0 | **Critical Limit**<br><0.5 or >4 mg/L<br>pH <6.5 or >8.5 |
|---|---|---|
| • Routine site and operational checks at DOSING PLANT<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments)<br>• Soda ash and chlorine gas dose rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Instrument calibration and records maintained<br>• Chemical procurement and delivery requirements<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Regular inspection of the Soda ash dosing system Chemical storage levels monitoring | **Corrective actions**<br>• Confirm or cross check online result with portable instrument<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Check primary dosing equipment and adjust as required<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and manually dose if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of Reservoir for any breaches or unauthorised access<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete '*Initial Incident Report Form*', following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.3.3 SOP for HH CCP5 Reservoir Integrity at all Reservoirs

| | | | |
|---|---|---|---|
| Water Scheme | **Hat Head** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| **Operating Target**<br>No breach of integrity | **Adjustment Limit**<br>Any sign of integrity breach | **Critical Limit**<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity<br>• Consider notifying local PHU<br>• Complete '*Initial Incident Report Form*' | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'* |

## Table A.4 CCP South West Rocks Water Supply

| Scheme | CCP ID | Control Point | Indicator Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| South West Rocks | CCP1 | Raw Water Abstraction | Turbidity | Inlet to WTP | Continuous online / daily grab | <5 NTU | 10 NTU | 20 NTU | Plant is shut off for turbidity >20 NTU for membrane protection. [Note: online result is verified with grab sample]. |
| | CCP2 | Filtration | Turbidity | After filters at WTP / on main after transfer pump | Continuous online / daily grab | <0.1 NTU | 0.5 NTU | 1 NTU | Critical limit ensures solids removal and that effectiveness of chlorination is maintained. Protozoa risk is low as source is bores. [Note: online result is verified with grab sample]. |
| | CCP3 | Disinfection | Free Chlorine pH | Reservoir outlet | Daily grab | 1.2 mg/L pH 7.5 | <0.8 or >3 mg/L pH <6.8 or >8.0 | <0.6 mg/L or >4 mg/L pH <6.5 or >8.5 | Lower chlorine critical limit ensures that C.*t* is met at the monitoring location. Upper chlorine critical limit ensures that total chlorine does not get >5 mg/L (health limit). Lower pH critical limit protects asset corrosion. Upper pH critical limit ensures efficiency of chlorination is not compromised (ADWG). |
| | CCP4 | Fluoridation | Fluoride | Leaving WTP & Gregory St Res Outlet | Continuous online / daily grab | 1 mg/L | <0.9 mg/L for >72 hrs OR >1.2 mg/L | >1.5 mg/L | One of the monitoring points is located downstream of dosing but prior to any reservoir/tank, as per Fluoridation Code. Critical limit is set at the health guideline value. |
| | CCP5 | Reservoir | Reservoir integrity | All Reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Ensures treated water does not get contaminated. |

Note: Grab sample is taken daily (7 days/week). Raw water abstraction, Filtration and Fluoridation CCPs have continuous online monitoring.

## Table A.4.1 SOP for SWR CCP1 Turbidity Raw Water Abstraction at Inlet to WTP

| | | | |
|---|---|---|---|
| Water Scheme | **South West Rocks** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online / daily grab (7 days) |
| Monitoring location | Inlet to WTP | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| Operating Target<br><5 NTU | Alert Level<br>10 NTU | Critical Limit<br>20 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments).<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Visual checks at Bore sites and Bore water monitoring program<br>• Aeration system maintenance & operation<br>• Balance Tank cleaning program | **Corrective actions**<br>• Confirm or cross check online turbidity with portable instrument and clean if needed<br>• Contact Team Leader<br>• Check Balance Tank for turbidity and iron levels<br>• Check diffuser/ aeration operation within Balance Tank<br>• Check individual production Bores for turbidity & iron and isolate where required<br>• Consider shutting WTP down<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Ensure automatic interlock has shut down the treatment plant, otherwise shutdown the system<br>• Check turbidity levels downstream to validate any infiltration to WTP (if automatic shutdown has failed)<br>• Consider isolation & scour the Balance Tank<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with the local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.4.2 SOP for SWR CCP2 Turbidity Filtration at Outlet of filters

| | | | |
|---|---|---|---|
| Water Scheme | **South West Rocks** | | |
| CCP ID | CCP2 | | |
| What is the control point? | Membrane Filtration | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online / daily grab (7 days) |
| Monitoring location | After filters at WTP / on main after transfer pump | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| Operating Target<br><0.1 NTU | Alert Limit<br>0.5 NTU | Critical Limit<br>1 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Daily automatic backwashing and extended backwashing of membranes<br>• Regular MIT and Manual initiated clean, ensure membrane replacement and repair program is current and up to date<br>• Actions related to coagulants, pH correction, screen at head of plant, pH correction of membrane sump, etc. Note: Results are recorded and actioned as per GE membrane recommendations<br>• Chemical procurement and delivery requirements | **Corrective actions**<br>• Confirm or cross check online turbidity with manual instrument<br>• Check trans-membrane pressure and initiate a CIP if required<br>• Check turbidity of raw water into plant<br>• Check upstream chemical dosing<br>• Isolation of modules that may be leaking and repair ASAP to ensure full treatment capacity of membrane train<br>• Contact Team Leader<br>• Complete '*Initial Incident Report Form*', following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Automatic shutdown of treatment plant<br>• Check Reservoir Turbidity, if automatic shutdown has failed<br>• Consider isolation & scour of the Reservoir where appropriate<br>• Check turbidity in distribution and flush mains if appropriate<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.4.3 SOP for SWR CCP3 Free Chlorine and pH Disinfection at Reservoir

| | | | |
|---|---|---|---|
| Water Scheme | **South West Rocks** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection (sodium hypochlorite) and pH correction (lime) | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine & pH | Monitoring Frequency: | Daily grab (7 days) |
| Monitoring location | Gregory Street Reservoir outlet | | |
| What will initiate response? | Confirmation of result with immediate follow up grab sample test | | |

| **Operating Target**<br>1.2 mg/L<br>pH 7.5 | **Alert Limit**<br><0.8 or >3 mg/L<br>pH <6.8 or >8.0 | **Critical Limit**<br><0.6 or >4 mg/L<br>pH <6.5 or >8.5 |
|---|---|---|
| • Routine site and operational checks at WTP.<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments.<br>• Lime and Sodium Hypochlorite dose rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Instrument calibration and records maintained<br>• Chemical procurement and delivery requirements<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Regular inspection of the lime dosing system including cleaning of injection lines for change over<br>• Chemical storage levels monitoring | **Corrective actions**<br>• Confirm result with an immediate re-sample.<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Check primary dosing equipment and hypo concentration and adjust as required<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check upstream processes (mixing tanks, pH correction, membrane filters)<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and top up if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of Reservoir for any breaches or unauthorised access<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete '*Initial Incident Report Form*', following confirmation of result with another test. | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of result with another test. |

## Table A.4.4 SOP for SWR CCP4 Fluoride Fluoridation at WTP post dosing and Gregory St Reservoir

| | | | |
|---|---|---|---|
| Water Scheme | **South West Rocks** | | |
| CCP ID | CCP4 | | |
| What is the control point? | Fluoridation | What are the hazards? | Over or under-dose of fluoride |
| What is being monitored? | Fluoride concentration | Monitoring Frequency: | Continuous online / daily grab (7days) |
| Monitoring location | Monitoring point is downstream of dosing but prior to reservoir and outlet of Gregory St Reservoir | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| Operating Target<br>1 mg/L | Alert Limit<br><0.9 for >72 hrs OR<br>>1.2 mg/L | Critical Limit<br>>1.5 mg/L |
|---|---|---|
| • Visual inspection of the system<br>• Raw water testing as required<br>• Daily measurement of volume treated, and weight fluoride dosed with calculation of average daily fluoride concentration<br>• Daily testing at outlet to water filtration plant (after transfer pumps) and outlet from Gregory St reservoir<br>• Flow meter calibrations (MCT & KSC Techs)<br>• Chemical procurement and delivery requirements<br>• Weekly testing in distribution system<br>• Weight records for Fluoride dosing<br>• Regular service by contractor | **Corrective actions**<br>• Confirm or cross check online result with manual instrument<br>• Confirm calculations<br>• Conduct screw feeder and pump drop tests<br>• Confirm current WTP flow rate and fluoride dosing rate<br>• Adjust fluoride powder screw feeder<br>• Test concentration leaving WTP more frequently<br>• Consider temporarily shutting down fluoride dosing system<br>• Contact Team Leader<br>• Complete '*Initial Incident Report Form*', following confirmation of online result with grab sample.<br>• Complete Form 5 and submit to local PHU & NSW Health if fluoride level is <0.9 mg/L for more than 72hrs (3 consecutive days) | **Corrective actions**<br>• Follow Alert Level steps<br>• Shutdown fluoride dosing system<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Test fluoride in Reservoirs and reticulation<br>• Identify cause & rectify problem<br>• Refer to Fluoride Overdose Response Plan<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.4.5 SOP for SWR CCP5 Reservoir Integrity at all Reservoirs

| | | | |
|---|---|---|---|
| Water Scheme | **South West Rocks** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs (Gregory St & New Entrance) | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| Operating Target<br>No breach of integrity | Adjustment Limit<br>Any sign of integrity breach | Critical Limit<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity<br>• Consider notifying local PHU<br>• Complete '*Initial Incident Report Form*' | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'* |

## Table A.5 CCP Stuarts Point Water Supply

| System | CCP ID | Control Point | Control Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Stuarts Point | CCP1 | Raw Water Abstraction | Turbidity | Raw Water Sample point (prior to pH and pre-disinfection) | Grab sample | <0.5 NTU | 3 NTU | 5 NTU | Plant is shut off at critical limit. |
| | CCP2 | Filtration | Turbidity | Post filtration (inlet to clearwater tank) | Continuous online / grab sample | <0.3 NTU | 0.8 NTU | 1 NTU | Critical limit ensures solids removal and that effectiveness of chlorination is maintained. Protozoa risk is low as source is bores. [Note: online result is verified with grab sample]. |
| | CCP3 | Disinfection | Free Chlorine | Stuarts Point Reservoir Outlet | Continuous online / grab sample | 1 mg/L | <0.8 or >3mg/L | <0.6 or >4 mg/L | Lower chlorine critical limit ensures that C.*t* is met at the monitoring location. Upper chlorine critical limit ensures that total chlorine does not get >5 mg/L (health limit). No pH correction undertaken. [Note: online result is verified with grab sample]. |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoirs | Reservoir integrity | All reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Ensures treated water does not get contaminated. |

Note: Grab sample is taken daily (7 days/week). Disinfection and Filtration CCPs have continuous online monitoring.

## Table A.5.1 SOP for SP CCP1 Turbidity Raw Water Abstraction at WTP before disinfection

| | | | |
|---|---|---|---|
| Water Scheme | **Stuarts Point** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Daily grab (5 days) |
| Monitoring location | Raw Water Sample point (prior to pH and pre-disinfection) | | |
| What will initiate response? | Confirmation of result with immediate follow up grab sample test | | |

| **Operating Target**<br><0.5 NTU | **Alert Level**<br>3 NTU | **Critical Limit**<br>5 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity daily at the CCP1 monitoring point and 2/weekly at individual bores<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments)<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Visual checks at Bore sites and Bore water monitoring program<br>• Clearwater Tank cleaning program | **Corrective actions**<br>• Confirm result by re-testing<br>• Contact Team Leader<br>• Re-adjust chemical dosing to accommodate lowered flow rate if appropriate<br>• Check Clearwater Tank for turbidity and iron levels<br>• Check individual production Bores for turbidity & iron and isolate where required<br>• Consider shutting WTP down<br>• Complete *'Initial Incident Report Form'*, following confirmation of result with re-test sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Shutdown the system<br>• Check turbidity levels downstream to validate any infiltration to WTP<br>• Consider isolation & scour the Clearwater Tank<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of result with re-test sample. |

## Table A.5.2 SOP for SP CCP2 Turbidity Filtration at WTP post filtration

| | | | |
|---|---|---|---|
| Water Scheme | **Stuarts Point** | | |
| CCP ID | CCP2 | | |
| What is the control point? | Filtration | What are the hazards? | Heavy metals and pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online & daily grab (5 days) |
| Monitoring location | Post filtration (inlet to clearwater tank) | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| Operating Target<br><0.1 NTU | Alert Limit<br>0.5 NTU | Critical Limit<br>1 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Ferric chloride dosing equipment and dosage rate checks<br>• Chemical procurement and delivery requirements | **Corrective actions**<br>• Confirm or cross check online turbidity with manual instrument<br>• Visually check water quality on top of filters<br>• Adjust air-line and check air-line is working<br>• Check for filter blockage<br>• Check turbidity of raw water into plant<br>• Check upstream chemical dosing<br>• Contact Team Leader<br>• Complete '*Initial Incident Report Form*', following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Automatic shutdown of treatment plant<br>• Check Reservoir Turbidity, if automatic shutdown has failed<br>• Consider isolation & scour of the Clearwater tank where appropriate<br>• Check turbidity in Reservoir and distribution and flush mains if appropriate<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.5.3 SOP for SP CCP3 Free Chlorine Disinfection at Clear Water Tank

| | | | |
|---|---|---|---|
| Water Scheme | **Stuarts Point** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection (chlorine gas) & pH correction (soda ash) when in use | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine residual | Monitoring Frequency: | Continuous online & daily grab (7 days) |
| Monitoring location | Stuarts Point Reservoir outlet | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| **Operating Target**<br>1 mg/L | **Alert Limit**<br><0.8 or >3 mg/L | **Critical Limit**<br><0.6 or >4 mg/L |
|---|---|---|
| • Routine site and equipment checks at WTP<br>• Instrument calibration and records maintained<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments)<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Soda ash and chlorine gas dose rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Chemical procurement and delivery requirements<br>• Chemical storage levels monitoring | **Corrective actions**<br>• Confirm or cross check online result with manual instrument<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Check pre and post chlorine dosing<br>• Check the flow rates coming into plant<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check upstream processes (mixing tanks, pH correction, membrane filters)<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and top up if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of CWT for any breaches or unauthorised access<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete '*Initial Incident Report Form*', following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.5.4 SOP for SP CCP5 Reservoir Integrity at all Reservoirs

| | | | |
|---|---|---|---|
| Water Scheme | **Stuarts Point** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| **Operating Target**<br>No breach of integrity | **Adjustment Limit**<br>Any sign of integrity breach | **Critical Limit**<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity<br>• Consider notifying local PHU<br>• Complete '*Initial Incident Report Form*' | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete '*Initial Incident Report Form*' |

## Table A.6 CCP Bellbrook Water Supply

| System | CCP ID | Control Point | Control Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Bellbrook | CCP1 | Raw Water Abstraction | Turbidity | Inlet to treatment plant prior to raw water tank | Continuous online / grab sample | <5 NTU | 5 NTU for more than 20min | 20 NTU | Plant is shut off for turbidity >20 NTU.<br>[Note: online result is verified with grab sample]. |
| | CCP2 | Filtration | Turbidity | After filters at WTP | Grab sample | <0.5 NTU | 0.8 NTU | 1 NTU | Critical limit ensures solids removal and that effectiveness of chlorination is maintained. |
| | CCP3 | Disinfection | Free Chlorine<br>pH | Clear water tank outlet | Continuous online / grab sample | 1.5 mg/L<br>pH 7.5 | <1 or >3.0 mg/L<br>pH <6.8 or >8.0 | <0.8 or >4 mg/L<br>pH <6.5 or >8.5 | Lower chlorine critical limit ensures that C.*t* is met at the monitoring location. Upper chlorine critical limit ensures that total chlorine does not get >5 mg/L (health limit). pH correction undertaken. Lower pH critical limit protects asset corrosion. Upper pH critical limit ensures efficiency of chlorination is not compromised (ADWG)<br>[Note: online result is verified with grab sample]. |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoirs | Reservoir integrity | All reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Ensures treated water does not get contaminated. |

## Table A.6.1 SOP for BB CCP1 Turbidity Raw Water Abstraction at Inlet to Plat

| | | | |
|---|---|---|---|
| Water Supply System | **Bellbrook** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online / daily grab sample (5 days) |
| Monitoring location | Pre raw water tank | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| **Operating Target**<br><5 NTU | **Alert Level**<br>5 NTU for more than 20min | **Critical Limit**<br>20 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Weather and flood warnings observations<br>• Conduct routine Bore maintenance program<br>• Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments.)<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Raw Water Tank cleaning program<br>• Annual checks for plant auto shut down | **Corrective actions**<br>• Attend site and confirm or cross check online turbidity with portable instrument.<br>• Check River for any water quality impacts, such as flooding.<br>• Check bore for signs of damage to bore or any impacts to sites areas around bores.<br>• Make arrangements for isolation & repairs to problem bore (if issue).<br>• Increase monitoring of raw water turbidity levels until system returns to normal<br>• If flooding is impacting the River, consider plans to commence water carting and consider early shutdown of plant.<br>• Contact Team Leader.<br>• Complete '*Initial Incident Report Form'* following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Ensure automatic interlock has shut down the treatment plant, otherwise shutdown the system.<br>• Ensure that Bore pumps are stopped (and are unavailable to automatic start up).<br>• Management to consider the need to initiate an incident response<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. water carting, boil water alert) in consultation with the local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.6.2 SOP for BB CCP2 Turbidity Filtration at WTP after filters

| | | | |
|---|---|---|---|
| Water Supply System | **Bellbrook** | | |
| CCP ID | CCP2 | | |
| What is the control point? | Filtration | What are the hazards? | Heavy metals and pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Daily grab sample (5 days) |
| Monitoring location | After filters at WTP | | |
| What will initiate response? | Confirmation of result with immediate follow up test | | |

| **Operating Target**<br><0.5 NTU | **Alert Limit**<br>0.8 NTU | **Critical Limit**<br>1 NTU |
|---|---|---|
| • Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Media replacement program (as required)<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Annual checks for plant auto shut down<br>• Maintenance cleaning of Raw Water Tank | **Corrective actions**<br>• Confirm result with immediate follow up test<br>• Look at pressure differentials across filters<br>• Verify turbidity of Raw Water<br>• Check upstream chemical dosing<br>• Contact Team Leader<br>• Complete *'Initial Incident Report Form'* following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible<br>• Verify turbidity in Clearwater Tank, and if it exceeds 1 NTU, consult with Team Leader on actions required (e.g. empty and scour tank)<br>• Check turbidity in Bellbrook Reservoir and if exceeds 1 NTU consider actions with Team Leader<br>• Management to consider the need to initiate an incident response.<br>• Process Engineer or Manager to notify local PHU as soon as possible<br>• Contact DoI for operational advice as needed<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU<br>• Complete *'Initial Incident Report Form'* following confirmation of online result with grab sample |

## Table A.6.3 SOP for BB CCP3 Free Chlorine Disinfection at out of Clear Water Tank

| | | | |
|---|---|---|---|
| Water Supply System | **Bellbrook** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free Chlorine & pH | Monitoring Frequency: | Continuous online/ daily grab sample (5 days) |
| Monitoring location | Clearwater Tank outlet | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| **Operating Target**<br>1.5 mg/L<br>pH 7.5 | **Alert Limit**<br><1 or >3.0 mg/L<br>pH <6.8 or >8.0 | **Critical Limit**<br><0.8 or >4 mg/L<br>pH <6.5 or >8.5 |
|---|---|---|
| • Routine site and equipment checks at WTP<br>• Instrument calibration and records maintained<br>• Equipment correlation checks (Bench meter instruments cross checked results against similar instruments<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Sodium hypochlorite and soda ash dosing rate checks<br>• Disinfection residual checks performed at the outlet of CWT<br>• Chemical procurement and delivery requirements | **Corrective actions**<br>• Confirm online result with grab sample<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Check primary dosing equipment and hypo concentration and adjust as required<br>• Contact Team Leader<br>• Check raw water conditions<br>• Check upstream processes (pH correction & filtration)<br>• Check disinfection levels in Reservoir and top up if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of CWT for any breaches or unauthorised access<br>• Conduct sampling and flushing in the network as required<br>• Complete '*Initial Incident Report Form'* following confirmation of online result with grab sample | **Corrective actions**<br>• Follow Alert Level corrective steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to contact local PHU as soon as possible<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form',* following confirmation of online result with grab sample. |

## Table A.6.4 SOP for BB CCP5 Reservoir Integrity at all Reservoirs

| | | | |
|---|---|---|---|
| Water Scheme | **Bellbrook** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| **Operating Target**<br>No breach of integrity | **Adjustment Limit**<br>Any sign of integrity breach | **Critical Limit**<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity<br>• Consider notifying local PHU<br>• Complete '*Initial Incident Report Form*' | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU<br>• Complete *'Initial Incident Report Form'* |

## Table A.7 CCP Willawarrin Water Supply

| System | CCP ID | Control Point | Control Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Willawarrin | CCP1 | Raw Water Abstraction | Turbidity | Raw water rising main prior to chlorine injection | Daily grab | <0.6 NTU | 1 NTU | 2 NTU | There is no filtration undertaken, critical limit provides an interim barrier to control contaminant/ microbial load. Plant is shut off at critical limit. |
| | CCP2 | Filtration | Turbidity | NA | NA | NA | NA | NA | NA |
| | CCP3 | Disinfection | Free Chlorine | Willawarrin reservoir outlet | Continuous online / daily grab | 1 mg/L | <0.6 or >3.0 mg/L | <0.4 or >4 mg/L | Lower critical chlorine limit ensures that C.*t* is met at the monitoring location. Upper critical chlorine limit ensures that total chlorine does not get >5 mg/L (health limit). No pH correction undertaken. [Note: online result is verified with grab sample]. |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoirs | Reservoir integrity | All reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Upon advice from NSW Health. Ensures treated water does not get re-contaminated. |

Note: Grab sample is taken daily (7 days/week). Disinfection CCP has continuous online monitoring.

## Table A.7.1 SOP for WW CCP1 Turbidity Raw Water Abstraction at Raw Water Rising Main

| | | | |
|---|---|---|---|
| Water Scheme | **Willawarrin** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Daily grab (7 days) |
| Monitoring location | Raw water rising main prior to chlorine injection | | |
| What will initiate response? | Confirmation with immediate follow up grab sample | | |

| Operating Target<br><0.6 NTU | Alert Level<br>1 NTU | Critical Limit<br>2 NTU |
|---|---|---|
| • Weather and flood warning observations<br>• Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity<br>• Equipment correlation checks<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Visual checks at Bore sites and Bore water monitoring program<br>• Operational requirement to maintain Willawarrin Reservoir as full as possible at close of business day | **Corrective actions**<br>• Confirm result with portable instrument<br>• Check turbidity and disinfection levels in Reservoir<br>• Attend site and check river quality and river levels<br>• Contact Team Leader<br>• Check individual production Bores for turbidity & iron (scour to waste during tests) and isolate where required<br>• Shut down bore pumps if required<br>• Flush rising main to remove highly turbid water (using scour at plant)<br>• Consider shutting Dosing Plant down<br>• Initiate water carting protocol (on standby)<br>• Complete *'Initial Incident Report Form'*, following confirmation of result with re-test sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Continue water carting until raw water turbidity drops below 1 NTU<br>• Shutdown the system<br>• Check turbidity levels downstream to validate any infiltration to Dosing Plant<br>• Consider isolation & scour the Balance Reservoir<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of result with re-test sample. |

## Table A.7.2 SOP for WW CCP3 Free Chlorine Disinfection at Reservoir

| | | | |
|---|---|---|---|
| Water Scheme | **Willawarrin** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine residual | Monitoring Frequency: | Continuous online/daily grab (7 days) |
| Monitoring location | Willawarrin reservoir outlet | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| Operating Target<br>1 mg/L | Alert Limit<br><0.6 or >3.0 mg/L | Critical Limit<br><0.4 or >4 mg/L |
|---|---|---|
| • Routine site and equipment checks<br>• Instrument calibration and records maintained<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Sodium Hypochlorite dose rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Chemical procurement and delivery requirements<br>• Sodium Hypochlorite chemical handling and dilution 1:5 requirements<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractor)<br>• Chemical storage levels monitoring | **Corrective actions**<br>• Confirm online result with grab sample.<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Check primary dosing equipment and hypo concentration and adjust as required<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and top up if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of Reservoir for any breaches or unauthorised access<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.7.3 SOP for WW CCP5 Reservoir Integrity at Reservoir

| | | | |
|---|---|---|---|
| Water Scheme | **Willawarrin** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| Operating Target<br>No breach of integrity | Adjustment Limit<br>Any sign of integrity breach | Critical Limit<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program<br><br>Note: Water caters have access to Reservoir during high turbidity events | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity<br>• Consider notifying local PHU<br>• Complete *'Initial Incident Report Form'* | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'* |

## Table A.8 Thunggutti Water Supply

| System | CCP ID | Control Point | Control Parameter | Testing Location | Frequency | Target | Alert Level | Critical Limit | Justification for critical limit |
|---|---|---|---|---|---|---|---|---|---|
| Thungutti | CCP1 | Raw Water Abstraction | Turbidity | Inlet to treatment plant | Continuous online / grab sample | <0.5 NTU | 0.8 NTU | 1 NTU | There is no filtration undertaken, critical limit provides an interim barrier to control contaminant/ microbial load. Plant is shut off at critical limit. [Note: online result is verified with grab sample]. |
| | CCP2 | Filtration | Turbidity | NA | NA | NA | NA | NA | NA |
| | CCP3 | Disinfection | Free Chlorine | At reservoir outlet (bores should be run during off peak usage time – night) | Continuous online / Grab sample | 1.0 mg/L | <0.8 or >3.0 mg/L | <0.3 or >4 mg/L | Lower critical chlorine limit ensures that C.*t* is met at the monitoring location. Upper critical chlorine limit ensures that total chlorine does not get >5 mg/L (health limit). No pH correction undertaken. [Note: online result is verified with grab sample]. |
| | CCP4 | Fluoridation | Fluoride | NA | NA | NA | NA | NA | NA |
| | CCP5 | Reservoirs | Reservoir integrity | All reservoirs | Monthly | No breach of integrity | Any sign of integrity breach | Evidence of contamination | Upon advice from NSW Health. Ensures treated water does not get contaminated. |

Note: Grab sample is taken 5 days/week (Mon-Fri). Raw Water Abstraction and Disinfection CCPs have continuous online monitoring.

## Table A.8.1 SOP for TH CCP1 Turbidity Raw Water Abstraction at Inlet to WTP

| | | | |
|---|---|---|---|
| Water Scheme | **Thungutti** | | |
| CCP ID | CCP1 | | |
| What is the control point? | Raw Water Abstraction | What are the hazards? | All pathogens |
| What is being monitored? | Turbidity | Monitoring Frequency: | Continuous online & daily grab (5 days) |
| Monitoring location | Inlet to Dosing Plant – raw water pre disinfection | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| **Operating Target**<br><0.5 NTU | **Alert Level**<br>0.8 NTU | **Critical Limit**<br>1 NTU |
|---|---|---|
| • Weather and flood monitoring observations<br>• Routine site and operational checks<br>• Instrument calibration and records maintained<br>• Monitor and measure raw water turbidity<br>• Equipment correlation checks<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Visual checks at Bore site and Bore water monitoring program | **Corrective actions**<br>• Confirm result with portable instrument<br>• Clean turbidity sensor if needed<br>• Contact Team Leader<br>• Check creek for any water quality impacts, such as flooding<br>• Check individual production Bores for turbidity & iron and isolate where required<br>• Consider shutting Dosing Plant down<br>• Shutdown bore pumps (if required) and organise repairs (if required)<br>• Consider flushing rising main to remove highly turbid water<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Ensure automatic interlock has shut down the treatment plant, otherwise shutdown the system<br>• Check turbidity levels downstream to validate any infiltration to the reservoirs (if automatic shutdown has failed)<br>• Commence and continue water carting until raw water turbidity drops to below 1 NTU<br>• Consider isolation & scour the Reservoir/s<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.8.2 SOP for TH CCP3 Free Chlorine Disinfection at Inlet Reservoir

| | | | |
|---|---|---|---|
| Water Scheme | **Thungutti** | | |
| CCP ID | CCP3 | | |
| What is the control point? | Disinfection (sodium hypochlorite) | What are the hazards? | Chlorine sensitive pathogens |
| What is being monitored? | Free chlorine residual | Monitoring Frequency: | Continuous online & daily grab (5 days) |
| Monitoring location | At reservoir outlet (bores are run during off peak usage time – night) | | |
| What will initiate response? | Confirmation of online result with grab sample | | |

| Operating Target<br>1 mg/L | Alert Limit<br><0.8 or >3.0 mg/L | Critical Limit<br><0.3 or >4 mg/L |
|---|---|---|
| • Routine site and equipment checks<br>• Instrument calibration and records maintained<br>• Calibration of online instruments (Programmed Instrument Maintenance Program conducted by Instrument Technicians and external contractors)<br>• Sodium Hypochlorite dose rate checks<br>• Disinfection residual checks performed at the outlet of Reservoir<br>• Chemical procurement and delivery requirements<br>• Chemical storage levels monitoring | **Corrective actions**<br>• Confirm online result with grab sample<br>• Validate disinfection levels (using high ranges or dilution methods if required)<br>• Check primary dosing equipment and hypo concentration and adjust as required<br>• Contact Team Leader<br>• Check disinfection levels from primary dosing and adjust as required<br>• Check raw water conditions<br>• Check disinfection levels in Reservoir and top up if required (Refer Reservoir Manual Chlorine Dose Calculator)<br>• Check integrity of Reservoir for any breaches or unauthorised access<br>• Consider scouring, flushing and sampling in the network where appropriate<br>• Complete '*Initial Incident Report Form*', following confirmation of online result with grab sample. | **Corrective actions**<br>• Follow Alert Level steps<br>• Test for total chlorine if free chlorine is >4 mg/L. Total chlorine should not be >5 mg/L.<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Consider taking micro-sample for low disinfection levels<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'*, following confirmation of online result with grab sample. |

## Table A.8.3 SOP for TH CCP5 Reservoir Integrity at Reservoir

| | | | |
|---|---|---|---|
| Water Scheme | **Thungutti** | | |
| CCP ID | CCP5 | | |
| What is the control point? | Reservoir | What are the hazards? | All pathogens and all chemicals |
| What is being monitored? | Reservoir integrity | Monitoring Frequency: | Monthly |
| Monitoring location | All service reservoirs | | |
| What will initiate response? | Any sign of reservoir integrity breach | | |

| **Operating Target**<br>No breach of integrity | **Adjustment Limit**<br>Any sign of integrity breach | **Critical Limit**<br>Evidence of contamination |
|---|---|---|
| • Reservoir inspection program (routine) with records maintained<br>• Scheduled contractor reservoir cleaning and inspection program<br>• Note: Water caters have access to Reservoir during high turbidity events | **Corrective actions**<br>• Conduct visual inspection (outside & inside)<br>• Check disinfection levels in Reservoir and top up if required (Refer to Reservoir Manual Chlorine Dose Calculator)<br>• Increase chlorine dose at plant, if needed<br>• Contact Team Leader<br>• Repair breach of integrity<br>• Consider notifying local PHU<br>• Complete '*Initial Incident Report Form'* | **Corrective actions**<br>• Follow Alert Level corrective actions<br>• Contact Team Leader<br>• Team Leader to inform Process Engineer or Manager as soon as possible.<br>• Take micro-sample if required<br>• Remove contaminants, if safe to do so<br>• Process Engineer or Manager to call local PHU as soon as possible.<br>• Contact DoI for operational advice as needed.<br>• Implement additional response actions (e.g. boil water alert) in consultation with local PHU.<br>• Complete *'Initial Incident Report Form'* |

# Appendix B Steuart McIntyre Dam Algae Monitoring

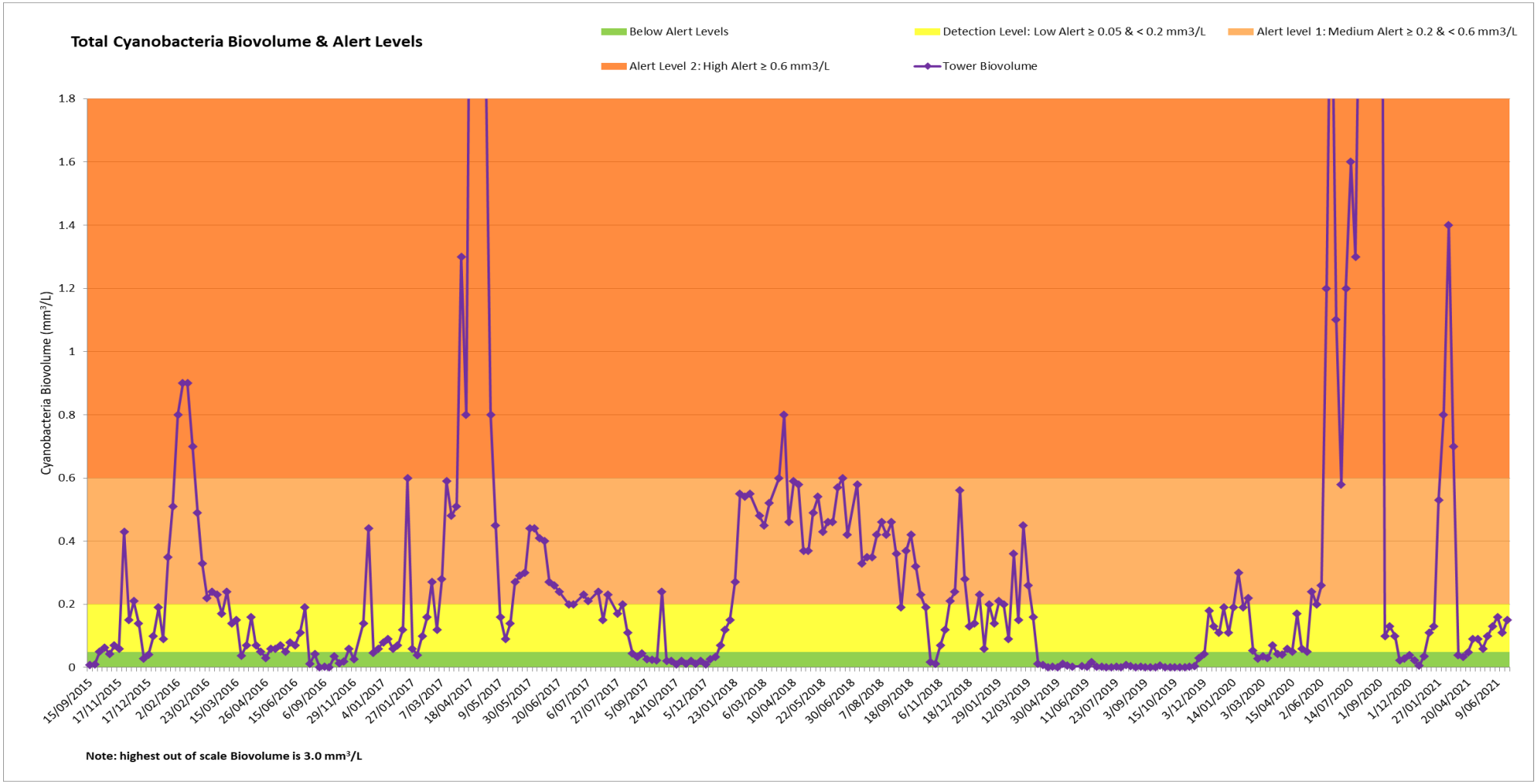


**Figure B.1: Steuart McIntyre Dam Total Cyanobacteria Biovolume and Alert Levels (Sep 2015 to June 2021)**

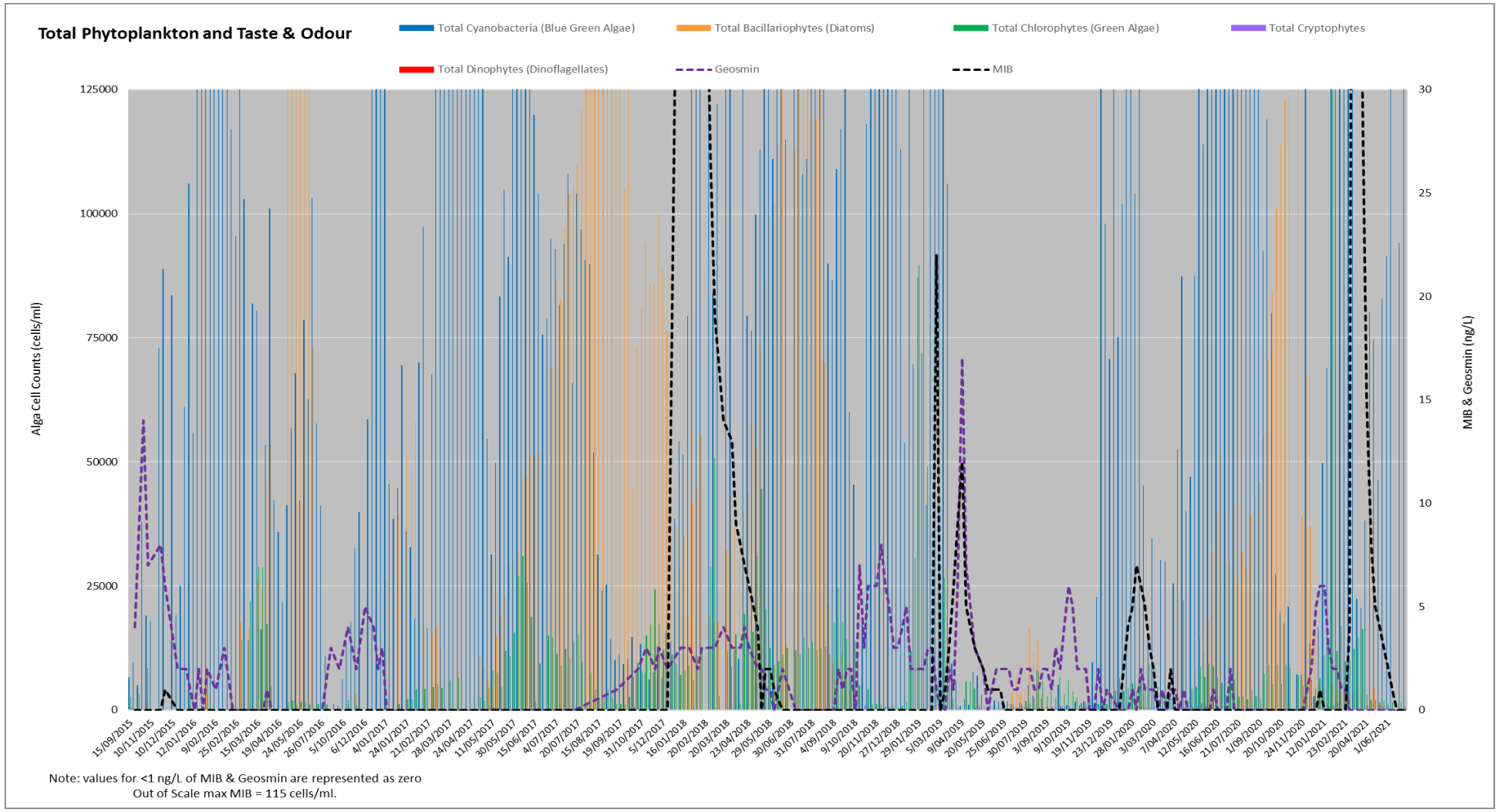


**Figure B.2: Total Phytoplankton and Taste and Odour Results at Tower Intake (July 2015 to June 2021). Algae samples taken from boat using 5m integrated collection method.**

# Appendix C Water Quality Verification Data

Data from Kempsey Shire Council network sampling sites has been collected from NSW Health Database covering the eight drinking water supply systems.

Results in each monitoring program (Physical-Chemical Monitoring, Microbiological Monitoring and Fluoride Monitoring) are attributed to specific sampling regimes.

Turbidity, pH and Fluoride are monitored in two sections, due to the difference in sampling regimes (indicated by the sample count) results of the analysts vary between monitoring programmes.

Fluoride is tested in all supply systems as a standard chemical test as a part of the Physical-Chemical Monitoring.

Fluoride Monitoring only occurs in the fluoride dosed supply system of South West Rocks.

## Table C.1 Kempsey & Lower Macleay Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.02 | 0.01 | 0.05 | 12 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.0005 | 0.0003 | 0.0007 | 12 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.0007 | 0.0005 | 0.002 | 12 | 0 | 100 |
| Barium | 2 | mg/L | 0.0182 | 0.0135 | 0.0276 | 12 | 0 | 100 |
| Boron | 4 | mg/L | 0.0177 | 0.0074 | 0.0247 | 12 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.0003 | 12 | 0 | 100 |
| Calcium | 10000 | mg/L | 28.9 | 18.2 | 37.5 | 12 | 0 | 100 |
| Chloride | 250 | mg/L | 22 | 18 | 27 | 12 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.001 | 0.0005 | 0.003 | 12 | 0 | 100 |
| Copper | 2 | mg/L | 0.06 | 0.003 | 0.279 | 12 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.05 | 0.05 | 0.05 | 12 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.01 | 12 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.013 | 0.005 | 0.04 | 12 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.0007 | 0.0001 | 0.0021 | 12 | 0 | 100 |
| Magnesium | 10000 | mg/L | 6.66 | 5.03 | 9.47 | 12 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.003 | 0.0011 | 0.0082 | 12 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0004 | 12 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0009 | 0.0002 | 0.0037 | 12 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0044 | 0.0002 | 0.0302 | 12 | 1 | 91.67 |
| Nitrate | 50 | mg/L | 5 | 2 | 13 | 12 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 12 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.4 | 7.2 | 7.7 | 12 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0035 | 0.0035 | 0.0035 | 12 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 12 | 0 | 100 |
| Sodium | 180 | mg/L | 15 | 12 | 21 | 12 | 0 | 100 |
| Sulfate | 500 | mg/L | 10 | 9 | 11 | 12 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 136 | 119 | 172 | 12 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 99.5 | 66.2 | 132.6 | 12 | 0 | 100 |
| True Colour | 15 | Hazen Units | 0.7 | 0.5 | 2 | 12 | 0 | 100 |
| Turbidity | 5 | NTU | 0.31 | 0.05 | 0.8 | 12 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0001 | 0.00005 | 0.0001 | 12 | 0 | 100 |
| Zinc | 3 | mg/L | 0.11 | 0.06 | 0.2 | 12 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 162 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 1 | 162 | 3 | 98.15 |
| Free Chlorine | 0.2 - 5 | mg/L | 1.23 | 0.47 | 2.01 | 162 | 0 | 100 |
| Total Chlorine | 5 | mg/L | 1.35 | 0.27 | 2.1 | 162 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.17 | 6.57 | 8.12 | 162 | 0 | 100 |
| Temperature | 30 | C | 20.1 | 13.9 | 28.5 | 162 | 0 | 100 |
| Turbidity | 5 | NTU | 0.73 | 0.11 | 3.39 | 161 | 0 | 100 |

## Table C.2 Crescent Head Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.11 | 0.1 | 0.11 | 2 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.0001 | 0.00005 | 0.00005 | 2 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.0008 | 0.0005 | 0.001 | 2 | 0 | 100 |
| Barium | 2 | mg/L | 0.0041 | 0.0034 | 0.0047 | 2 | 0 | 100 |
| Boron | 4 | mg/L | 0.0105 | 0.0053 | 0.0157 | 2 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.00005 | 2 | 0 | 100 |
| Calcium | 10000 | mg/L | 8.7 | 8.5 | 8.8 | 2 | 0 | 100 |
| Chloride | 250 | mg/L | 42 | 41 | 42 | 2 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.001 | 0.001 | 0.001 | 2 | 0 | 100 |
| Copper | 2 | mg/L | 0.0055 | 0.003 | 0.008 | 2 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.05 | 0.05 | 0.05 | 2 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.01 | 2 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.09 | 0.05 | 0.13 | 2 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.0009 | 0.0008 | 0.001 | 2 | 0 | 100 |
| Magnesium | 10000 | mg/L | 1.79 | 1.73 | 1.84 | 2 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.0035 | 0.0026 | 0.0043 | 2 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0004 | 2 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0001 | 0.0001 | 0.0001 | 2 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0002 | 0.0002 | 0.0002 | 2 | 0 | 100 |
| Nitrate | 50 | mg/L | 0.5 | 0.5 | 0.5 | 2 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 2 | 0 | 100 |
| pH | 6.5 - 8.5 | | 6.8 | 6.8 | 6.8 | 2 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0035 | 0.0035 | 0.0035 | 2 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 2 | 0 | 100 |
| Sodium | 180 | mg/L | 16 | 16 | 16 | 2 | 0 | 100 |
| Sulfate | 500 | mg/L | 1 | 1 | 1 | 2 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 76 | 73 | 78 | 2 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 29 | 28.8 | 29.1 | 2 | 0 | 100 |
| True Colour | 15 | Hazen Units | 5 | 4 | 5 | 2 | 0 | 100 |
| Turbidity | 5 | NTU | 1.1 | 1 | 1.2 | 2 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0001 | 0.0001 | 0.0001 | 2 | 0 | 100 |
| Zinc | 3 | mg/L | 0.07 | 0.05 | 0.08 | 2 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 63 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 0 | 63 | 0 | 100 |
| Free Chlorine | 0.2 - 5 | mg/L | 1.09 | 0.01 | 2.3 | 63 | 3 | 95.24 |
| Total Chlorine | 5 | mg/L | 1.3 | 0.2 | 2.7 | 63 | 0 | 100 |
| pH | 6.5 - 8.5 | | 19.3 | 13.9 | 25.4 | 63 | 0 | 100 |
| Temperature | 30 | C | 2.09 | 0.91 | 4.89 | 63 | 0 | 100 |
| Turbidity | 5 | NTU | 0 | 0 | 0 | 63 | 0 | 100 |

## Table C.3 Hat Head Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.095 | 0.09 | 0.1 | 2 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.0001 | 0.00005 | 0.00005 | 2 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.001 | 0.001 | 0.001 | 2 | 0 | 100 |
| Barium | 2 | mg/L | 0.0132 | 0.012 | 0.0144 | 2 | 0 | 100 |
| Boron | 4 | mg/L | 0.0135 | 0.0095 | 0.0175 | 2 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.00005 | 2 | 0 | 100 |
| Calcium | 10000 | mg/L | 1.5 | 1.4 | 1.5 | 2 | 0 | 100 |
| Chloride | 250 | mg/L | 68 | 67 | 69 | 2 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.0005 | 0.0005 | 0.0005 | 2 | 0 | 100 |
| Copper | 2 | mg/L | 0.01 | 0.01 | 0.01 | 2 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.05 | 0.05 | 0.05 | 2 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.01 | 2 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.11 | 0.06 | 0.16 | 2 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.0004 | 0.0003 | 0.0004 | 2 | 0 | 100 |
| Magnesium | 10000 | mg/L | 3.23 | 2.99 | 3.46 | 2 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.0058 | 0.0057 | 0.0058 | 2 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0004 | 2 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0001 | 0.0001 | 0.0001 | 2 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0005 | 0.0002 | 0.0007 | 2 | 0 | 100 |
| Nitrate | 50 | mg/L | 0.5 | 0.5 | 0.5 | 2 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 2 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.6 | 7.5 | 7.7 | 2 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0035 | 0.0035 | 0.0035 | 2 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 2 | 0 | 100 |
| Sodium | 180 | mg/L | 35 | 35 | 35 | 2 | 0 | 100 |
| Sulfate | 500 | mg/L | 8 | 7 | 8 | 2 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 127 | 121 | 132 | 2 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 16.9 | 15.8 | 18 | 2 | 0 | 100 |
| True Colour | 15 | Hazen Units | 3 | 1 | 4 | 2 | 0 | 100 |
| Turbidity | 5 | NTU | 0.33 | 0.05 | 0.6 | 2 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0001 | 0.00005 | 0.00005 | 2 | 0 | 100 |
| Zinc | 3 | mg/L | 0.02 | 0.01 | 0.02 | 2 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 27 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 0 | 27 | 0 | 100 |
| Free Chlorine | 0.2 - 5 | mg/L | 0.99 | 0.38 | 1.48 | 27 | 0 | 100 |
| Total Chlorine | 5 | mg/L | 1.09 | 0.43 | 1.58 | 27 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.46 | 7 | 8.71 | 27 | 1 | 96.3 |
| Temperature | 30 | C | 21.1 | 14.3 | 26 | 27 | 0 | 100 |
| Turbidity | 5 | NTU | 0.57 | 0.13 | 2.75 | 26 | 0 | 100 |

## Table C.4 South West Rocks Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.03 | 0.02 | 0.06 | 12 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.0001 | 0.00005 | 0.0001 | 12 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.001 | 0.0005 | 0.001 | 12 | 0 | 100 |
| Barium | 2 | mg/L | 0.0105 | 0.0068 | 0.015 | 12 | 0 | 100 |
| Boron | 4 | mg/L | 0.0139 | 0.0018 | 0.0196 | 12 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.0002 | 12 | 0 | 100 |
| Calcium | 10000 | mg/L | 12.7 | 10 | 24.1 | 12 | 0 | 100 |
| Chloride | 250 | mg/L | 34 | 31 | 38 | 12 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.001 | 0.0005 | 0.005 | 12 | 0 | 100 |
| Copper | 2 | mg/L | 0.005 | 0.001 | 0.021 | 12 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.94 | 0.86 | 1 | 12 | 0 | 100 |
| Fluoride (WU result) | 1.5 | mg/L | 0.98 | 0.94 | 1.01 | 12 | 0 | 100 |
| Fluoride Ratio | 0.8 - 1.2 | mg/L | 1.04 | 0.97 | 1.11 | 12 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.01 | 12 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.021 | 0.005 | 0.08 | 12 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.0002 | 0.0001 | 0.0006 | 12 | 0 | 100 |
| Magnesium | 10000 | mg/L | 1.71 | 1.07 | 2.3 | 12 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.0011 | 0.00015 | 0.0035 | 12 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0004 | 12 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0008 | 0.0001 | 0.0063 | 12 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0028 | 0.0002 | 0.0227 | 12 | 1 | 91.67 |
| Nitrate | 50 | mg/L | 0.5 | 0.5 | 0.5 | 12 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 12 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.6 | 7.3 | 7.9 | 12 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0035 | 0.0035 | 0.0035 | 12 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 12 | 0 | 100 |
| Sodium | 180 | mg/L | 20 | 19 | 23 | 12 | 0 | 100 |
| Sulfate | 500 | mg/L | 3 | 3 | 4 | 12 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 91 | 80 | 111 | 12 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 38.8 | 31.1 | 69.6 | 12 | 0 | 100 |
| True Colour | 15 | Hazen Units | 0.7 | 0.5 | 1 | 12 | 0 | 100 |
| Turbidity | 5 | NTU | 0.23 | 0.05 | 0.8 | 12 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0001 | 0.00005 | 0.0001 | 12 | 0 | 100 |
| Zinc | 3 | mg/L | 0.06 | 0.03 | 0.12 | 12 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 64 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 0 | 64 | 0 | 100 |
| Free Chlorine | 0.2 - 5 | mg/L | 0.95 | 0.21 | 1.59 | 64 | 0 | 100 |
| Total Chlorine | 5 | mg/L | 1.05 | 0.38 | 1.63 | 64 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.5 | 7.09 | 8.35 | 63 | 0 | 100 |
| Temperature | 30 | C | 20.75 | 0.43 | 27 | 63 | 0 | 100 |
| Turbidity | 5 | NTU | 0.28 | 0.06 | 0.86 | 63 | 0 | 100 |
| **Fluoride Operational Monitoring** | | | | | | | | |
| Fluoride (daily WU) | 0.9 - 1.5 | mg/L | 1.01 | 0.90 | 1.2 | 359 | 0 | 100 |
| Fluoride (weekly WU) | 0.9 - 1.5 | mg/L | 0.98 | 0.92 | 1.05 | 107 | 0 | 100 |

## Table C.5 Stuarts Point Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.005 | 0.005 | 0.005 | 13 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.0001 | 0.00005 | 0.00005 | 13 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.001 | 0.0005 | 0.001 | 13 | 0 | 100 |
| Barium | 2 | mg/L | 0.0135 | 0.0105 | 0.0178 | 13 | 0 | 100 |
| Boron | 4 | mg/L | 0.0201 | 0.0071 | 0.0246 | 13 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.0001 | 13 | 0 | 100 |
| Calcium | 10000 | mg/L | 49.7 | 41.6 | 58.3 | 13 | 0 | 100 |
| Chloride | 250 | mg/L | 36 | 33 | 39 | 13 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.0007 | 0.0005 | 0.001 | 13 | 0 | 100 |
| Copper | 2 | mg/L | 0.0223 | 0.002 | 0.061 | 13 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.05 | 0.05 | 0.05 | 13 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.01 | 13 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.017 | 0.005 | 0.08 | 13 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.001 | 0.0001 | 0.004 | 13 | 0 | 100 |
| Magnesium | 10000 | mg/L | 2.88 | 2.63 | 3.46 | 13 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.0005 | 0.00015 | 0.0019 | 13 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0004 | 13 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0006 | 0.0003 | 0.0019 | 13 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0014 | 0.0006 | 0.0061 | 13 | 0 | 100 |
| Nitrate | 50 | mg/L | 0.5 | 0.5 | 0.5 | 13 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 13 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.7 | 7.5 | 7.9 | 13 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0035 | 0.0035 | 0.0035 | 13 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 13 | 0 | 100 |
| Sodium | 180 | mg/L | 16 | 3 | 20 | 13 | 0 | 100 |
| Sulfate | 500 | mg/L | 5 | 4 | 5 | 13 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 180 | 167 | 188 | 13 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 136.0 | 115.9 | 159.8 | 13 | 0 | 100 |
| True Colour | 15 | Hazen Units | 0.6 | 0.5 | 1 | 13 | 0 | 100 |
| Turbidity | 5 | NTU | 0.23 | 0.05 | 0.7 | 13 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0002 | 0.0001 | 0.0008 | 13 | 0 | 100 |
| Zinc | 3 | mg/L | 0.16 | 0.11 | 0.24 | 13 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 50 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 0 | 50 | 0 | 100 |
| Free Chlorine | 0.2 - 5 | mg/L | 0.98 | 0.77 | 1.22 | 50 | 0 | 100 |
| Total Chlorine | 5 | mg/L | 1.09 | 0.84 | 1.33 | 50 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.50 | 7.29 | 7.71 | 50 | 0 | 100 |
| Temperature | 30 | C | 20 | 13.4 | 24.2 | 50 | 0 | 100 |
| Turbidity | 5 | NTU | 0.20 | 0.08 | 0.38 | 45 | 0 | 100 |

## Table C.6 Willawarrin Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.011 | 0.005 | 0.04 | 13 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.001 | 0.0006 | 0.0013 | 13 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.002 | 0.001 | 0.004 | 13 | 0 | 100 |
| Barium | 2 | mg/L | 0.0155 | 0.0126 | 0.0195 | 13 | 0 | 100 |
| Boron | 4 | mg/L | 0.0154 | 0.0099 | 0.0239 | 13 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.00005 | 13 | 0 | 100 |
| Calcium | 10000 | mg/L | 19.0 | 12.7 | 37.7 | 13 | 0 | 100 |
| Chloride | 250 | mg/L | 18 | 13 | 27 | 13 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.0012 | 0.0005 | 0.006 | 13 | 0 | 100 |
| Copper | 2 | mg/L | 0.033 | 0.009 | 0.051 | 13 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.05 | 0.05 | 0.05 | 13 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.02 | 13 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.015 | 0.005 | 0.05 | 13 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.0017 | 0.0003 | 0.0055 | 13 | 0 | 100 |
| Magnesium | 10000 | mg/L | 5.78 | 4.66 | 9.03 | 13 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.0141 | 0.0026 | 0.0627 | 13 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0004 | 13 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0007 | 0.0001 | 0.0051 | 13 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0025 | 0.0002 | 0.0204 | 13 | 1 | 92.31 |
| Nitrate | 50 | mg/L | 3.3 | 0.5 | 10 | 13 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 13 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.2 | 6.6 | 7.8 | 13 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0038 | 0.0035 | 0.008 | 13 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 13 | 0 | 100 |
| Sodium | 180 | mg/L | 14 | 5 | 19 | 13 | 0 | 100 |
| Sulfate | 500 | mg/L | 10 | 7 | 13 | 13 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 103 | 82 | 151 | 13 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 71.3 | 50.9 | 131.3 | 13 | 0 | 100 |
| True Colour | 15 | Hazen Units | 0.9 | 0.5 | 1 | 13 | 0 | 100 |
| Turbidity | 5 | NTU | 0.43 | 0.05 | 1 | 13 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0001 | 0.00005 | 0.0001 | 13 | 0 | 100 |
| Zinc | 3 | mg/L | 0.08 | 0.05 | 0.13 | 13 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 26 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 0 | 26 | 0 | 100 |
| Free Chlorine | 0.2 - 5 | mg/L | 0.93 | 0.51 | 1.4 | 26 | 0 | 100 |
| Total Chlorine | 5 | mg/L | 1.1 | 0.6 | 1.59 | 26 | 0 | 100 |
| pH | 6.5 - 8.5 | | 6.92 | 6.33 | 7.54 | 26 | 5 | 80.77 |
| Temperature | 30 | C | 17.0 | 8.2 | 24.8 | 26 | 0 | 100 |
| Turbidity | 5 | NTU | 0.5 | 0.2 | 1.56 | 26 | 0 | 100 |

## Table C.7 Bellbrook Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.012 | 0.005 | 0.03 | 12 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.0002 | 0.00005 | 0.0005 | 12 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.0008 | 0.0005 | 0.003 | 12 | 0 | 100 |
| Barium | 2 | mg/L | 0.0203 | 0.0131 | 0.0257 | 12 | 0 | 100 |
| Boron | 4 | mg/L | 0.0147 | 0.0042 | 0.0298 | 12 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.00005 | 12 | 0 | 100 |
| Calcium | 10000 | mg/L | 20.0 | 9.1 | 36.1 | 12 | 0 | 100 |
| Chloride | 250 | mg/L | 29 | 24 | 33 | 12 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.0014 | 0.0005 | 0.003 | 12 | 0 | 100 |
| Copper | 2 | mg/L | 0.014 | 0.005 | 0.028 | 12 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.05 | 0.05 | 0.05 | 12 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.01 | 12 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.025 | 0.005 | 0.18 | 12 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.0006 | 0.0001 | 0.0017 | 12 | 0 | 100 |
| Magnesium | 10000 | mg/L | 6.12 | 3.35 | 8.81 | 12 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.0181 | 0.0021 | 0.0611 | 12 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0009 | 12 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0011 | 0.00005 | 0.0032 | 12 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0042 | 0.0002 | 0.0128 | 12 | 0 | 100 |
| Nitrate | 50 | mg/L | 3.0 | 0.5 | 13 | 12 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 12 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.7 | 7.6 | 7.9 | 12 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0035 | 0.0035 | 0.0035 | 12 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 12 | 0 | 100 |
| Sodium | 180 | mg/L | 19 | 3 | 25 | 12 | 0 | 100 |
| Sulfate | 500 | mg/L | 7 | 3 | 11 | 12 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 124 | 99 | 161 | 12 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 75.1 | 36.5 | 126.4 | 12 | 0 | 100 |
| True Colour | 15 | Hazen Units | 0.6 | 0.5 | 1 | 12 | 0 | 100 |
| Turbidity | 5 | NTU | 0.63 | 0.05 | 1.7 | 12 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0001 | 0.00005 | 0.00005 | 12 | 0 | 100 |
| Zinc | 3 | mg/L | 0.08 | 0.05 | 0.17 | 12 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 26 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 0 | 26 | 0 | 100 |
| Free Chlorine | 0.2 - 5 | mg/L | 1.21 | 0.51 | 1.82 | 26 | 0 | 100 |
| Total Chlorine | 5 | mg/L | 1.38 | 0.67 | 2.14 | 26 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7.41 | 6.98 | 7.85 | 26 | 0 | 100 |
| Temperature | 30 | C | 17.4 | 6.8 | 26.4 | 26 | 0 | 100 |
| Turbidity | 5 | NTU | 0.82 | 0.32 | 3.37 | 26 | 0 | 100 |

## Table C.8 Thunggutti Supply System Water Quality Data

| Characteristic | Guideline Value | Units | Mean | Min | Max | Sample Count | Exception Count | % Meeting Guidelines |
|---|---|---|---|---|---|---|---|---|
| **Chemistry** | | | | | | | | |
| Aluminium | 0.2 | mg/L | 0.008 | 0.005 | 0.01 | 2 | 0 | 100 |
| Antimony | 0.003 | mg/L | 0.0002 | 0.0001 | 0.0002 | 2 | 0 | 100 |
| Arsenic | 0.01 | mg/L | 0.0005 | 0.0005 | 0.0005 | 2 | 0 | 100 |
| Barium | 2 | mg/L | 0.0134 | 0.0118 | 0.0149 | 2 | 0 | 100 |
| Boron | 4 | mg/L | 0.013 | 0.006 | 0.0192 | 2 | 0 | 100 |
| Cadmium | 0.002 | mg/L | 0.0001 | 0.00005 | 0.0001 | 2 | 0 | 100 |
| Calcium | 10000 | mg/L | 8.1 | 7.9 | 8.2 | 2 | 0 | 100 |
| Chloride | 250 | mg/L | 19 | 17 | 20 | 2 | 0 | 100 |
| Chromium | 0.05 | mg/L | 0.0005 | 0.0005 | 0.0005 | 2 | 0 | 100 |
| Copper | 2 | mg/L | 0.043 | 0.034 | 0.052 | 2 | 0 | 100 |
| Fluoride | 1.5 | mg/L | 0.05 | 0.05 | 0.05 | 2 | 0 | 100 |
| Iodine | 0.5 | mg/L | 0.01 | 0.01 | 0.01 | 2 | 0 | 100 |
| Iron | 0.3 | mg/L | 0.0075 | 0.005 | 0.01 | 2 | 0 | 100 |
| Lead | 0.01 | mg/L | 0.0006 | 0.0006 | 0.0006 | 2 | 0 | 100 |
| Magnesium | 10000 | mg/L | 4.65 | 4.42 | 4.88 | 2 | 0 | 100 |
| Manganese | 0.5 | mg/L | 0.0012 | 0.00015 | 0.0023 | 2 | 0 | 100 |
| Mercury | 0.001 | mg/L | 0.0004 | 0.0004 | 0.0004 | 2 | 0 | 100 |
| Molybdenum | 0.05 | mg/L | 0.0002 | 0.0001 | 0.0003 | 2 | 0 | 100 |
| Nickel | 0.02 | mg/L | 0.0009 | 0.0008 | 0.0009 | 2 | 0 | 100 |
| Nitrate | 50 | mg/L | 0.8 | 0.5 | 1 | 2 | 0 | 100 |
| Nitrite | 3 | mg/L | 0.05 | 0.05 | 0.05 | 2 | 0 | 100 |
| pH | 6.5 - 8.5 | | 7 | 7 | 7 | 2 | 0 | 100 |
| Selenium | 0.01 | mg/L | 0.0035 | 0.0035 | 0.0035 | 2 | 0 | 100 |
| Silver | 0.1 | mg/L | 0.0001 | 0.0001 | 0.0001 | 2 | 0 | 100 |
| Sodium | 180 | mg/L | 15 | 14 | 15 | 2 | 0 | 100 |
| Sulfate | 500 | mg/L | 9 | 7 | 11 | 2 | 0 | 100 |
| Total Dissolved Solids (TDS) | 600 | mg/L | 72 | 65 | 78 | 2 | 0 | 100 |
| Total Hardness as CaCO3 | 200 | mg/L | 39.3 | 38.7 | 39.8 | 2 | 0 | 100 |
| True Colour | 15 | Hazen Units | 0.5 | 0.5 | 0.5 | 2 | 0 | 100 |
| Turbidity | 5 | NTU | 0.3 | 0.1 | 0.4 | 2 | 0 | 100 |
| Uranium | 0.017 | mg/L | 0.0001 | 0.00005 | 0.0001 | 2 | 0 | 100 |
| Zinc | 3 | mg/L | 0.05 | 0.04 | 0.06 | 2 | 0 | 100 |
| **Microbiology** | | | | | | | | |
| E. coli | 0 | mpn/100 mL | 0 | 0 | 0 | 24 | 0 | 100 |
| Total Coliforms | 0 | mpn/100 mL | 0 | 0 | 1 | 24 | 1 | 95.83 |
| Free Chlorine | 0.2 - 5 | mg/L | 1.16 | 0.53 | 2.06 | 24 | 0 | 100 |
| Total Chlorine | 5 | mg/L | 1.27 | 0.60 | 2.15 | 24 | 0 | 100 |
| pH | 6.5 - 8.5 | | 6.75 | 6.40 | 7.15 | 24 | 3 | 87.50 |
| Temperature | 30 | C | 17.1 | 7.9 | 25.8 | 24 | 0 | 100 |
| Turbidity | 5 | NTU | 0.33 | 0.12 | 0.74 | 24 | 0 | 100 |

# Appendix D Customer Enquiry Supply Area Descriptions

**Table D.1 Customer Enquiry Supply Area Descriptions for KLM Supply System**

| Supply System | Supply Areas |
|---|---|
| Kempsey | Kempsey CBD |
| West Kempsey | West Kempsey & Greenhill |
| Aldavilla | Aldavilla & Yarravel |
| Smithtown/Gladstone | Smithtown, Gladstone, Bellimbopinni, Austral Eden |
| Belmore River | Belmore River |
| Kinchela | Kinchela, Jerseyville, Rainbow Reach, Summer Island, Seven Oaks & Plumbers Lane |
| Frederickton | Frederickton, Everinghams Lane, Clybucca |
| South Kempsey | Dondingalong, Euroka, Burnt Bridge, South Kempsey Service Centre |
| East Kempsey | East Kempsey, Verges Creek |

# Appendix E Continuous Improvement - Implementation Plan (IP) Outstanding Actions

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Status | Actions & Comments |
|---|---|---|---|---|---|---|
| 1.02 | All | L | Develop a comprehensive stakeholder/relevant agencies list which identifies all stakeholders who could affect, or be affected by, decisions or activities of the drinking water supplier, identifying the accountabilities and responsibilities of relevant agencies. The list should be stored in the TRIM DWMS document register and referenced in the DWMS and the IERP.<br>Develop a regular review process to update the list of stakeholders | 2012 | Standing item | List exists, but not completed (not formally), will need to be formalised, will also be included in the DWMP<br>Completed in 2019 DWMS update silt of stakeholder in Overall Manual<br>2020 - change from completed to an annual review and update of the Overall manual of the stakeholders and Emergency contacts (page 10) - this should be aligned with the DESP document<br>18/10/21 - this item changed to a "standing item" - contacts are reviewed and updated at least annually - register maintained by WQO |
| 1.04 | All Kem | H | KSC is to prepare SOP for the acceptance and delivery of chemicals to treatment sites, including check sheet.<br>Develop a program to undertake spot checks of chemical quality compliance | 2012 | Ongoing | Under procurement mid ROC process, checklist to be developed, and chemical quality SOP to be developed including QC testing<br>30/10/19 - SOP currently being developed - Need to make a list of Chemicals that can be spot tested and develop procedure.<br>23/12/2020 - there is a chemical supply contract with specifications already in place, the SOPs and quality checks still need to be developed (should include a request of certificate of analysis for every delivery)<br>25/10/2021 - ongoing |
| 1.05 | All | H | Standard operational procedures are to be prepared on the sampling and testing program. | 2012 | Ongoing | Work undertaken; however usable spreadsheets need to be developed & reviewed<br>30/10/2019 - WaterOutlook look currently being rolled out to capture operational WQ data. Table 3 in each Sup plan captures WQ operational requirements with target levels - SOP are currently being developed for operational and verification monitoring<br>23/12/2020 - SOPs only remain on this action<br>25/10/2022 - as comments on 23/12/2020 SOP to be completed |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Status | Actions & Comments |
|---|---|---|---|---|---|---|
| 1.06 | All | H | KSC to document the type of customer complaint relating to water quality issues in the following categories (illness, taste & odour, dirty water, blue water, air or white water, and other), to assist with the characterisation of the issues in the treated water supplies.<br>Water technical operational staffs with appropriate knowledge are to review the incoming complaints, respond to and record relevant water quality data and actions to rectify the issue.<br>Customer complaints database needs development to ensure it contains the ability to extract information for analysis. The record of incoming complaints and response actions will form part of the management reporting requirements. | 2012 | Ongoing | Customer complaint database must be developed. Currently actions aren't captured, Water section must work with customer service to develop this.<br>30/10/2019 - WQO collates complaints monthly through the crystal report - Update process so that the actions and results are sent to the WQO to report on at the time on complaint - TLW to tool box WO on ensuring full completion of work order that include fault, corrective actions and test results<br>one complete WO to forward work order to WQO to complete and close<br>23/12/2020 - Council has changed to Synergy Soft and the reporting side of the data capture is still being developed - WQO to request from Chris Seam (NC) of notification of all main breaks with details of Location and size pipe and work with Kate to developed spreadsheet for work Order capture of pipe repairs<br>18/10/21 - SS yearly downloads available - working on extracting data on a monthly view WQO to work with Admin officer to better capture information |
| 2.01 | Kem | L | KSC to address the long term need for the Belgrave Falls facility and to remove redundant infrastructure if deemed non-operational. | 2012 | Ongoing | Needs to be fenced, more water quality testing to be undertaken. Decision to be made whether or not to decommission this. Some concerns regarding salinity, Alkalinity, also iron. SWA analysis to be undertaken.<br>31-10-2019 further discussion about the future actions based on pending WQ testing.<br>31/10/2019 - need to confirm with Wes on actions plan for this asset<br>TLW - to arrange WQ Chemistry sampling at this asset whilst in drought conditions<br>23/12/2020 - WQ testing done all OK waiting on IWCM outcomes<br>28/10/2021 As above |
| 2.02 | Kem | L | Management to determine the viability of maintaining Kinchela as an emergency supply as the site has operational issues and cannot become operational in a short term. | 2012 | Ongoing | Still under consideration, issues with high metals in bores, and pressure issues. Last time it was run was around 2004. Studies undertaken, pipes upgrades are being rolled out in that area, so capacity increase could allow the use of this.<br>30-10-2019 - WQ testing current being undertaken due to drought conditions - initial results indicate Bore 1 is not viable due high salinity however other bores seem OK - pending completion of full sampling schedule this assts will most likely be kept and assts maintained and upgraded for use<br>23/12/2020 - Some upgrades have been complete on the back of the 2019/2020 drought, waiting on final report from GHD and implement recommendations<br>28/10/2021 - completion and commission planed before end of 21-22 |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Status | Actions & Comments |
|---|---|---|---|---|---|---|
| 2.04 | All | M | Develop a map of high-risk septic tank locations within the catchment for review by DC (Development and Compliance) for integration into their Septic Tank monitoring program. | 2012 | Ongoing | Work undertaken, awaiting finalisation<br>31-10-2019 - Outside Water department this sits with Development and Compliance<br>23/10/2020 - WQO to talk to C&D and GIS team to have a risk layers in GIS<br>25/10/2022 - Meeting with C&D held and risk methodology discussed = Risk Team accepted methodology at IP review 25/10/2020 - WQO/OC to stay in loop with high Risk OSMS development program |
| 2.05 | All | M | Upgrade existing GIS mapping systems with water infrastructure such as pipelines, easements, valve locations, sampling locations<br>Develop a GIS mapping layer identifying high priority risk zones within catchment. | 2012 | Ongoing | Will be captured by new GIS<br>23/12/2020 - TLW to work with GIS team for sampling locations be put into a layer - other items done also refer to above action regarding septic in catchment areas particularly upriver communities<br>25/10/2022 - confirm that all sample location captured (Lachlan Lyttle) and passed onto GIS team " Water and Sewer sites layers - sewer sites captured in separate program with D&C |
| 2.07 | Kem | M | Develop and implement a catchment risk program to identify pathogens of concern in conjunction with NSW Health | 2012 | Ongoing | Work undertaken, summary not written, and awaiting finalisation. Council to contact Water Futures to discuss finalisation.<br>23/12/2020 - Report completed, NSW Health Dan Deer to develop a one-off sampling project<br>28/10/2021 - scoping to confirm catchment risks under the safe and secure funding program for category 5 catchments for chlorine resident pathogens |
| 2.09 | Kem | M | Water treatment plant installation for KLM to control pathogens, turbidity, agricultural chemicals and algae. | 2012 | Ongoing | Expression of interest being completed for concept design for Safe & Secure<br>31-10-2019 - Funding for emergency plant of 12ML waiting for NSW gov approval. Plant is designed for ease of future expansion to 18ML - If funding granted plant potentially operational by end of July 2020<br>23/12/2020 - Funding of $4Mill approved for permanent water treatment plant, options assessment report endorsed by DPE, Concept design tender let and completion due end of 2022<br>28/10/2021 60% concept design workshop with DPE also safety in design review is competed, concept design due Dec 21 |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Status | Actions & Comments |
|---|---|---|---|---|---|---|
| 2.12 | All | M | SOP to be developed on the operation of the bores and recharge channel includes what to do in floods for bore selection | 2012 | Ongoing | 23/12/2020 = Develop a flood response SOP that covers all supply systems<br>25/10/2022 - ongoing - TLW - to assign the development of a SOP |
| 2.15 | Kem | M | KSC to purchase land surrounding the bore field when the opportunity arises, to isolate external risks. | 2012 | Ongoing | 31/10/2019 - This is a long-term action<br>23/12/2020 - Desktop evaluations completed - some adjustments needed. Council Paper to Council before June 2021<br>28/10/21 - ongoing |
| 2.16 | All | M | Fencing around bore pumps to restrict animal access. Restrict use of bores where animal access is possible until fencing able to be undertaken | 2012 | Ongoing | Pending on land purchase for Sherwood<br>23/12/2020 - Implementation of perimeter fences to be placed on OP plan by TLW<br>25/10/2022 - not all bores can be fenced (ease access rights) look at feasibility of bores that can be |
| 2.17 | All | H | Initiate a Bore inspection and preventative maintenance program. | 2012 | Ongoing | 31-10-2019 - The Bore Inspections have been captured as a monthly task in WaterOutLook which is in the rollout stage - COMPLETED<br>To be developed and actioned by Trades - testing currents, checking the low levels, checking for hots spots, flow switches etc<br>23/12/2020 - ongoing MC - To be developed and actioned by Trades team - testing currents, checking the low levels, checking for hots spots, flow switches etc<br>23/09/2021 - Phil (MC) - on-going. working with trades to implement better Preventative Maintenance programs. This has been confirmed at it sits within the Maintenance program |
| 2.19 | Kem | L | Program regular maintenance for the SMD off-take gates. | 2012 | Ongoing | no mechanisms for these operate to maintain tasks to be documented,<br>31/10/2019 - Council yet to decide on an Asset management system platform, decision pending in the next 6 months<br>23/12/2020 - Asset management plan developed but current maintenance repairs are being task to TLW<br>25/10/2021 - ongoing |
| 2.25 | Kem | M | Erosion control around SMD to reduce sediment and nutrient loads during wind and rainfall events. | 2012 | In progress | 31/10/2019 Rip Rap wall installed on dam foreshore - ongoing some area yet to be completed<br>23/12/2020 - this is ongoing<br>25/10/2021 - dam level currently to high - for continuation of this program - revisits when levels drop |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Status | Actions & Comments |
|---|---|---|---|---|---|---|
| 2.28 | Kem | L | A routine maintenance schedule for the SMD aeration line blowers to be developed and incorporated into the AMS | 2012 | Ongoing | Will be captured in AMS, maintenance schedules on hard copies, will be integrated electronically<br>23/12/2020 - To be included in AMS<br>25/10/2021 - AMS still being rolled out - Water and Sewer are last on the roll out program |
| 2.29 | Kem | L | Develop a response procedure for water source changes in KLM. | 2012 | In progress | SOP written, requires review<br>23/12/2020 - WTL to finalise review process<br>25/10/2022 - SOP done by Network (NC) department needs to be sent to Process (TLW) for collation in process side |
| 2.31 | Kem | L | To monitor animal numbers and introduce an 'animal control' program in the secured SMD area when required. | 2012 | Standing item | Number of Kangaroos decreased, inspections undertaken, fenced and blocked off, ongoing task<br>1/11/2019 - sufficient controls are in place and kangaroo numbers have been reduced and numbers are continually monitored - ACTION CLOSED<br>23/12/2020 - Risk Team decided for this to be an ongoing action to keep an eye on animal numbers - animal control program are initiate as required TWL to investigate if this should sit in the OM Dam Manual<br>25/10/2021 - check with Craig Doyle if there is a mention of animal control in the OM dam Manual - TLW to action, if not add into OM Dam Manual - item changes from "ongoing" to "Standing Item" |
| 2.32 | Kem | L | Include SMD perimeter and water surface inspections into site management procedures to monitor and minimise native and feral animal access to storage. | 2012 | In progress | As above<br>4/11/2019 - will be added to WaterOutlook<br>WTL to confirm that perimeter fences are in WaterOutlook SMD 2/weekly inspection<br>25/10/2021 - reviewed not in WaterOutlook TLW to add into WO task list for SafeGroup to action |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Status | Actions & Comments |
|---|---|---|---|---|---|---|
| 2.35 | All | H | Online monitoring to be installed at Sherwood Lime plant & Greenhill Reservoir to measure and control chlorine dosing.<br>Chlorine gas cylinder scales need to be installed and connected SCADA for remote monitoring.<br>And automatic shutoff for chlorine cylinders | 2012 | In progress | 4/11/2019- further information regarding if we need to have online chorine at Sherwood (potential new plant and asset no longer needed.<br>Still need online for Green Hill<br>23/12/2020 - PE = Chlorine audit to be undertaken to comply with new Aust Standards - ME as above 2019 comments<br>23/09/2021 - Phil (MC) - Online monitoring installed at Green Hill. Waiting for report from Murray to see if we still need to upgrade Sherwood & Bellimbopinni with auto-shutoff valves to CL2 gas cylinders (and any other upgrades).?<br>18/10/2021 - Chlorine analyser has been programmed<br>the scales and auto shutoff for chlorine gas will be integrated into new plant at SMD |
| 2.39 | All | VH | Introduce a 'permit to work' approval system for all maintenance and isolations at key dosing sites. Improve communications between KSC business units for prior notification for all contractor works programmed and include training of all staff on the prior notification of works programmed and site visiting requirements - access permit introduction. | 2012 | Ongoing | 4/11/2019 - Waiting on AMS and MMS to be confirmed and rolled out<br>03.02.21 - MWS to discus and provide update with SAP (Erin)<br>28/10/2021 - Awaiting on AMS rollout |
| 2.4 | Kem | L | Introduce a treatment chemical stocktake system to monitor chemical stocks and turnover rates. | 2012 | Ongoing | Stock is ordered as needed, will be in ongoing list<br>4/11/2019 - This will be captured in WaterOutLook and removed shortly<br>3-2-21 - this is to look at chlorine cylinders and how much we are charged - there is no documentation to what is being dropped off at the stores - stock register. KSC also awaiting on chemical report from Murray Thompson in relation to moving, handling of chlorine bottles<br>18/10/2021 - ongoing - potential to resolve when chlorine will be delivered to SMD only when new plant built |
| 2.41 | Kem | L | Install automatic level sensors and alarms for Critical low level on Hypochlorite storage tanks or replace hypo system with chlorine gas system. | 2012 | In progress | SMD chlorine upgrade project underway<br>3-2-21 - SMD upgrade project will incorporate chlorine project - currently in concept design<br>23/09/2021 - Phil (M) - as above Feb comment |

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|---|---|---|---|---|---|---|
| 2.44 | Kem | H | Investigate the possibility of emergency power sources for chemical dosing and transfer pumps to maintain supply and dosing for major reservoirs. | 2012 | In progress | SWR set up for generator, however investigation outcome was that due to the size required, generators are unrealistic<br>4/11/2019 - new plant at KLM designed for generator backup<br>Additional consultation needed between Council and Power supplier regarding maximum time that power can be interrupted<br>Future scoping of additional booster pump station for Green Hill Res water security.<br>23/09/2021 - Phil (MC) - to be a part of SMD WTP. This entire Implementation Plan will need to be brought to the table during the WTP design stage so that items like this are included into the scope of the plant, or, taken into consideration during the design phase |
| 2.49 | All | M | Include inspections after all storm event within the Reservoir Inspection Procedure. | 2012 | In progress | Wil be captured in an SOP<br>4/11/2019 - SOPs are currently being developed and Storm event to be included on the Reservoir Inspection SOP<br>3-2-21 - in progress to be developed<br>25/10/2021 - Reservoir SOP to be completed |
| 2.5 | All | L | Modification required of inlet/outlets on reservoirs or installation of diversion plates, to prevent sediment disturbance. | 2012 | In progress | Mixer at Clybucca and John Lane completed, back beach nozzle also installed.<br>4/11/2019 - This Action is ongoing as new issues are identified<br>3/2/21 - ongoing as required pending of arising issues<br>OC - to provide quarterly updates<br>18/10/2021 - ongoing as above |
| 2.52 | Kem | M | Develop priority planning for online chlorine monitoring and secondary dosing at key reservoirs and implement into capital works program. | 2012 | In progress | ORP probes installed, chlorine analysers on three reservoirs<br>4/11/2019 - Scoping being undertaking to include integration of secondary dosing at all Res yet to have this ability<br>3/2/21 ongoing and pending budget availability<br>25/09/2021 - Incorporate secondary dosing mechanism in to "key" new monitoring sheds (i.e., Tristian shed installs). |
| 2.54 | Kem | H | Interlock control placed on all primary disinfection systems where there is online monitoring of chlorine installed on the reservoirs. | 2012 | Ongoing | Investigation required, may not be feasible<br>3/2/21 - investigation yet to be scheduled OC & MC to investigate and scope<br>23/09/2021 - Interlock to be added into Greenhill res - confirm set point to match Cl2 CCP limit (WTL to confirm set point - MC to implement) |

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| 2.56 | All | VH | Flow meter monitoring or derived flow monitoring on outlet of reservoirs. | 2012 | Ongoing | Need to be confirmed<br>4/11/2019 - Captured current outlet meters in WaterOutlook, Scope installing of flow meters in identified gaps<br>3/2/21 - exiting meters been captured in WO - ongoing identification of gaps of where metres on outlets may be required<br>23/09/2021 - Phil (MC) -this item is ongoing for all future reservoir upgrades. |
| 2.59 | All | VH | To formulate a WQ induction program for all contract staff that have access to water supply facilities and conduct in house training for maintenance staff on WQ protection. | 2012 | In progress | Is undertaken, however may not be formalised<br>4/11/2019 - SOPs to be developed for maintenance/operational staff<br>3/2/21 - SWIMS to be finalised then SOPs to be developed<br>18/10/21 - To be added to WHS0115 |
| 2.6 | Kem | H | Include SOP for alternative or emergency supplies or water restriction implementation if taking Greenhill Res offline in an emergency. | 2012 | In Progress | SOP to be developed<br>4/11/2019 - A desk top plan needs to be completed - then a system check OC & NC A desk top plan needs to be completed including asset capabilities- then a system audit check<br>5/2/21 - Yet to be started - Main lines being place to John Lane for the ability to take GH off line<br>18/10/2021 - NC to scope plan and get project into 2022-2023 program then GH refurb project for 2023-2024 - The GIS layer is for isolation valves of supply water system still to be developed |
| 2.62 | All | H | Upgrade telemetry at reservoir sites and include a review of the critical levels set and associated alarms for individual reservoirs. | 2012 | In progress | Council is currently undertaking related work, will be applied to water section<br>4/11/2019 All Reservoir levels done except for Thungutti - Ongoing review of critical levels<br>3/2/21 - Thunggutti completed review of res critical levels are ongoing<br>23/09/2021 - Phil (MC) - MC to work with opps team to implement spreadsheet of res operational levels set points (MWS to send spreadsheet to MC |
| 2.64 | All | VH | KSC to maintain an up-to-date register of high-risk connections. | 2012 | In progress | 4/11/2019 - this could have already been completed - MWS and WQO to try and locate<br>10/2/2021 - NC to confirm that high risk connection are identified and documented<br>18/10/22 - NC to confirm existence, content and storage location of high-risk connection register |

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|---|---|---|---|---|---|---|
| 2.65 | All | VH | KSC to ensure compliance to plumbing codes for back flow prevention and high-risk areas via a reporting system<br>Consider backflow prevention device inspection program for external/private customers, including maintaining a register | 2012 | In progress | 4/11/2019 - to provide annual report on backflow Compliance<br>Compliance section - external customers are responsible for maintaining and confirming the backflow devices are compliant by having a plumber check and certify them. These records are kept with the compliance section and will need to be chased up to ensure requirements are being met and maintained for a register of compliance<br>5/2/21 0 WQO to chase up compliance for reporting in Annual report<br>25/10/2021 - Registers are kept in Civic View and in Content Manager - but no inspection program done on the registers - MSW/WQO to begin discussion of audit requirements of the backflow registers with manager of D&C |
| 2.66 | All | H | Maintenance crews require separate repair equipment and clothing for water main works and wash down & disinfection procedures TBD for equipment that cannot be duplicated. | 2012 | In progress | SOP to be developed and regularly truck audits conducted to ensure disinfection carried and used<br>5/2/21 - In construction crews only have been separated out to Water and sewer, SOPs to be developed<br>18/10/22 - NC - SOPs are the only outstanding item of this action. Maintenance operations will be covered by SOPs and audit program |
| 2.67 | All | H | Storage of water main repair & installation materials to be improved to prevent contamination from vermin, debris and faecal material. | 2012 | In progress | SOP to be developed<br>7/11/2019 - SOP still in the development stage<br>5/2/21 - SOP still in development<br>18/10/2022 - SOPs delayed but SWIMs completed.<br>NC - SOPs next to be developed |
| 2.68 | All | H | Develop an SOP for chlorination of mains after repairs, to include a sampling and testing regime after repair work is completed.<br>Train staff on SOP | 2012 | In progress | SOP to be developed<br>5/2/21 - Budget recommended to be developed for NTU and Cl2 instruments for maintenance crews. SOPs to be developed<br>18/10/2021 - Ongoing<br>NC - SOP to be developed need to include what post testing is feasible and equipment required |

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|---|---|---|---|---|---|---|
| 2.73 | All | H | KSC to Initiate a routine maintenance program for all supply pressure pumps and records to be stored in appropriate storage location. | | In progress | 7/11/2019 - this is being captured in the WaterOutLook rollout<br>10/2/2021 - was assigned to TLW but moved to ME design of preventative maintenance program<br>23/09/2021 - Phil (MC) - this has already taken place, we now have all the data, and any changes that needed to take place have been done. We still need to standardise and review the booster pumps and continually improve each year as part of the Operational Plan 21-22 - HS01.1.6 - "Refurbish pumping stations across water infrastructure network" -<br>25/10/2021 - location of maintenance reports to be provided to Process team then this action can be closed off -<br>MC to liaise with WQO of location for reporting purposes |
| 2.75 | All | H | Networks staff to be trained on valve operation and flushing after repairs including an implementation of a valve 'Check Sheet' with tagging system. | 2012 | In progress | Training completed, tagging system not completed<br>7/11/2019 - lock out tag out been implemented - however training yet to be performed<br>and the check sheet has been included in the work order completion sheet<br>5/2/21 - LOTO training has been carried out (current staff, missing gaps for new starts) - SOP to be developed<br>18/10/2021 - SOP ongoing, refinement of isolation practices implemented |
| 2.76 | All | H | Control biofilm levels within the distribution by conducting a regular mains cleaning program. Problem areas to be placed on routine flushing programs with the linking of mains where possible and 'dead ends' minimised in new developments. | 2012 | Standing item | Some mains cleaning undertaken in known problem areas<br>7/11/2019 - pigging program being implemented<br>Flushing programme has yet to be developed and placed on temporarily hold whilst water restriction are in place<br>10/2/2021 - Pigging program to commence<br>18/10/2021 - Status changes to a "Standing Item" on going standing flushing pigging programs |
| 2.77 | All | H | Review customer complaints to identify dirty main areas. | 2012 | Ongoing | Tracked in Monthly WQ report<br>7/11/2019 - yet to be developed - potential for the tracking of problem clusters for preventative maintenance to be actioned<br>5/2/21 - Can this be automatically mapped in new synergy soft reports WQO to investigate<br>18/10/2021 yearly report can be produced out of SS - monthly view is still in development to extract data from SS |

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| 2.8 | Kem | L | KSC to investigate a notification procedure to inform carters if there is a main breaks or supply issue for fill stations (4 fill stations for all of KSC). D&C to inform Water division of auditing of carters. | 2012 | In progress | 7/11/2019 - this is two separate actions 1. develop and formalized communication between Water team and Rates for water carters' notification when supply issues from Reservoirs<br>2. Devolvement and Compliance to report on audits of water carters<br>5/2/21 - as notes above<br>NC - 1. develop SOP for communication to TLW and rates of supply loss<br>2. WQO to contact Development and Compliance about obtaining water caters audit results<br>18/10/2021 - as above ongoing |
| 2.81 | All | L | Communication procedure to be initiated between KSC and Rural Fire services and NSW Fire and Rescue for prior notification of RFS & NSW Fire & Rescue exercises to prevent disturbances of mains. | 2012 | To be started | MoU existed, however requires update<br>18/2/2021 - NC to develop plan<br>18/10/21 - still to be stared |
| 2.82 | All | VH | All new mains to be inspected and have a disinfection program and verification before connection. | 2012 | In progress | 7/11/2019 this is being done however SOP needs to be created<br>5/2/21 SOP to be developed - NC - develop SOP based on current work practices<br>18/10/2021 - no change in status, ongoing |
| 2.84 | Kem | H | Introduce a 'water by agreement' (WBA) to customers on rising main that the WQ may be variable for drinking (highly chlorinated).<br>Annual notification sent to customers reminding them of the WBA. | 2012 | To be started | 10/2/2021 - yet to be started. Chris Seam may have some additional information Review meeting with Health 21/05/21 to check if started by Belinda Green<br>18/10/2021 - NC to organise a audit for customers GH, PH, TH, to identify those that a straight of the main - then organise a WBA. Sherwood borefield identified customers to go on to a non-potable agreement MWS - to provide update as required |
| 2.85 | All | H | Upgrade the telemetry and SCADA system and online monitoring for all sites to improve operational monitoring capabilities and response times.<br>On call staff to regularly check SCADA for system alarms. Duplicate (mirrored service) for monitoring for key sites.<br>To increase in-house staff knowledge of the system and introduce security access levels. | 2012 | Standing item | Staff Knowledge completed, rest to be undertaken<br>7/11/2019 - ongoing<br>5/2/21 - this action is a rolling project with scheduled upgrades each financial year NSW Health meeting 21/5/2021<br>Potential moved long term ongoing actions into a new grouping " standing Items" (18/10/2021 this action was taken up during the Oct 21 IP review)<br>23/09/2021 - Phil (MC) - this is happening. Sewer SCADA ASM standards are nearly finished, and these will roll straight over to water sites fairly seamlessly. |

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|---|---|---|---|---|---|---|
| 2.9 | Kem | H | Develop a program for installation of Security (CCTV) on high-risk sites, on priority basis and implement into Capital works program. | 2012 | Standing item | Long term action, will be considered as budget is secured.<br>10/2/2021 - started to be rolled out - MWS - to provide update-based in budget availability and risk assessment of what is a high-risk site<br>28/10/21 HH WTP completed and rest rolled out as infrastructure is upgraded |
| 3.08 | All | H | Consider additional filling points (backflow prevention compliant) for water carters and tankers (with future recycled water filling option i.e. non-potable). Consider a strategy for community information. | 2014 | In progress | 10/2/2021 - new fill station locations have been identified and rollout to be begin. Carters will be notified as each station comes line - ongoing<br>18/10/2020 - this has been completed apart from recycled water - which will be confirmed of possible future outcomes of the IWCM Plan |
| 3.13 | ALL | H | CCP monitoring locations should be identified and appropriately labelled on each treatment site | 2014 | In Progress | 7/1/2019 - in progress and inclusion of retic monitoring sites<br>10/02/21 - in progress for signs to be made and then places at appropriate locations<br>25/10/2022 - proto type sign has been developed - program being rolled out |
| 3.15 | HH | H | Develop an SOP for maintenance of aeration towers and cleaning procedure for the Hat Head aeration tower that includes:<br>* adequate isolation procedures<br>* sufficient flushing prior to recommissioning | 2014 | In Progress | 10/2/2021 - in progress<br>Find SOP and close off -<br>25/10/2021 TLW to get SOP from Craig Doyle for review |
| 3.18 | HH | H | Develop an SOP for Soda ash batching | 2014 | In Progress | 10/2/2021 - in progress<br>25/10/2021 - new dosing system installed new SOP required /updated from SOP that was being developed |
| 3.21 | SWR | H | SOP is required for neutralising after soak clean Items added to action 2021<br>- Contamination from chemical spill into membrane sump<br>- incorrect chemical cleaning practises (not neutralising correctly) Check that there are SOPs if not need to add to SOP development list | 2014 | In Progress | 10/2/2021 this SOP is 90% completed<br>25/10/2021 - ongoing TLW - to provide update on SOP development |

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|---|---|---|---|---|---|---|
| 3.28 | All | H | Council should consider doing a review of existing SOPs to identify where SOP's are required and where gaps are. This review should include a review of existing control measures documented in the Risk Assessments and ensure that these are adequately documented or identified as gaps if not documented. Ensure that all documents are registered into the Document Register in TRIM. Staff will need to undertake competency-based training on all SOP's | 2014 | In Progress | Will be undertaken as part of review 2018<br>19/11/2019 this task will be closed off once the SOPs have been developed. The DWMS review that was completed in June 2019 covered the identification of SOP gaps<br>18/2/21 - SOPs have been identified and assigned to the TLW for development<br>25/10/2021 - as comments of 18/2/2021 |
| 3.29 | All | H | Council should develop or review daily task lists at each treatment plant to ensure general operations are covered. | 2014 | In Progress | Will be included in Water Outlook system, connected with electronic check sheets<br>19/11/2019 - WaterOutlook transfer has started, and operational tasks have been reviewed in the 2019 DWMS<br>10/2/2021 - TLW is currently developing a weekly scheduled Brocken into daily tasks that need to be completed at each WTP, tracking of daily tasks will be captured in WaterOutLook<br>25/10/2021 - in progress as notes on 10/2/2021 - action sites with TLW |
| 3.3 | All | M | A high turnover of staff can result in loss of operational knowledge resulting in operational gaps. Council should develop a procedure for succession planning for key staff members. | 2014 | In Progress | Succession planning is a whole of Council and is being considered<br>19/11/2019 informal system in place to upskill staff in acting positions. Council is in the process of developing a succession plan.<br>10/2/2021 - a work force plan is currently being developed<br>28/10/21 ongoing - workforce plan will be completed by the end of 21/22, and staff regularly act up to upskill |
| 3.38 | CH, HH, SP | M | Consider upgrading the chlorine dosing systems to include automatic shutdowns & shutoff valves, flow switches, scales etc., and integration with SCADA system and automation | 2014 | In Progress | 19/11/2019 - upgrades have started at this water plants<br>5/2/21 -HH initial safety upgrade completed<br>CH to be part of the new treatment plant.<br>SP - ongoing<br>23/09/2021 - Phil (MC) - Awaiting Murray's CL2 report. |
| 3.47 | CH | L | Council to undertake investigations of a dedicated rising main for Big Nobby Reservoir from Back Beach Res/Skyline. | Aug-19 | In progress | 21/11/2019 - MWS to provide update if this is feasible<br>10/2/2021 - NC to liaise with W&S planning to see if a new main is feasible<br>18/10/2021 - NC to investigate assets renew of existing line and scope if new main is feasible |

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|---|---|---|---|---|---|---|
| 3.48 | All | M | Continue removal or replacement of internal ladders with FRP | 2014 | Ongoing | All concrete reservoirs been done, good progress (NE, HH, BB, NB, WW done in 2017/18), ladders will be done when refurbishments are undertaken<br>19/11/2019 - this project is ongoing and progress and schedules are captures in both ASAM and Councils reservoir progress document<br>25/10/2021 - this is a long term project that is incorporated with the res refurb projects and captured in both ASAM and Councils reservoir progress document - TO to continue to provide updates as required |
| 3.7 | ALL | L | Council may consider providing water quality data on residents rates notices and/or publishing some of this data on their website | 2014 | In progress | Used to be on the website, but was removed when NSW Health removed theirs, decision to be made by GM<br>19/11/2019 decision yet to made<br>10/2/2021 - Council has begun to place some WQ information on Councils WEB page and additional information is currently being developed and rolled out |
| 3.76 | ALL | M | Council should strongly consider investing in online monitoring at all CCPs. This would provide greater process control, as immediate notification would be provided in the event an alert limit is exceeded. Importantly, it would also provide the opportunity of an immediate response in the event a critical limit is exceeded (such as triggering a plant shut down). Online monitoring would also provide useful data for analysis of performance of processes used to control hazards at CCPs and would improve understanding of the WTP's effectiveness more generally. | 2014 | In progress | 19/11/2019 - this is ongoing with some of the CCPs having already been captured onto Clear SCADA<br>5/2/21 - ongoing and incorporated into yearly sub plan review<br>23/09/2021 - Phil (MC) - on-going, we need to gather all WTP / Water System SCADA Set Points and review them. We need to set Min and Max allowable Set Points and lock them into SCADA. MC - to double check that dosing set points affecting the CCPs are clamped and that alarms are reviewed |
| 3.84 | ALL | L | Council should consider implementing a monthly water quality performance report to be supplied to councillors and uploaded to Councils website. | 2014 | Ongoing | 10/2/2021 - This is started to be rolled out with some information being displayed on the Web page and communicated weekly via Councils Facebook page - WQO, TLW & PE to discuss what data and what format to be web displayed<br>18/10/2021 - dam levels, rainfall and water usage for KLM supply added weekly to web site - other systems to be rolled out |

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| 3.97 | ALL | M | An SOP for plant start up following a period of shutdown needs to be developed | Dec-14 | Ongoing | 10/2/2021 - This action is being incorporated into each plants operation SOP that is in the progress of being developed. This action can be closed off<br>25/10/2021 - All SOP are still in development - until incorporated into a SOP this action is to remain in the IP |
| 4.01 | All | H | Operators to ensure that reservoir inspections are occurring monthly as required, currently they are not occurring regularly | Dec-14 | Standing item | Monthly inspection sheets are stored in F:Drive and Reviewed by WQO<br>21/11/2019 - this is also being transferred into WaterOutlook<br>10/2/2021 - Reservoir inspection reporting has been transferred into WaterOutlook, which generates reminders to the WO for completion - Lack of completion to be addressed at team meetings<br>25/10/2021 TLW and WQO run a report at least monthly (calendar reminders set) missing inspections are communicated to the operators - status changed to a standing Item |
| 4.05 | KLM | L | New raw water sample location to be established in pump room on Greenhill line, prior to disinfection dosing. Could use existing soda ash dosing point. Currently sampling from 8 m sample at dam which is not ideal. | Dec-14 | In progress | Soda Ash point currently being used, permanent point will be put in as upgrades are done<br>21/11/2019 - A dedicated sample location to be identified and installed<br>10/2/2021 - in progress TLW - to identify sample tap location and organise installation<br>25/10/2021 - sampling done as manual grab at depth, future raw water sampling will be done at new WTP - discuss status at next review meeting |
| 4.14 | All | M | Develop a list of priority meters and power supplies that should be maintained by Council to be used during incident response if required | Dec-14 | In progress | Develop a list of emergency power needed by Council during incident response<br>21/11/2019 - ongoing<br>5/2/21 - currently sizing power requirements for every Council asset (e.g., treatment plants and pump stations) this is to go into the BCP<br>23/09/2021 - Phil (MC) - Actively in progress |
| 4.15 | All | M | Clear SCADA to include reservoir volume as well as level | Dec-14 | In progress | Will be incorporated into Clear SCADA,<br>21/11/2019 - ongoing ME to investigate<br>5/2/21 - ongoing<br>23/09/2021 - Phil (MC) - job in, awaiting ETA. |

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| 4.17 | All | M | An audit of all chemical dosing interlocks for each treatment plant should be undertaken | Dec-14 | In progress | Already undertaken, actions to be followed up<br>21/11/2019 - Need to re-check all audit findings then develop & implemented any actions TLW, OO & MC - Need to re-check all audit findings then develop & implemented any actions<br>5/2/21 - to be looked at - refer to 2019 comments<br>18/10/2021 - SP needs further controls in place as there are no interlocks - other sites still need to be looked at - ongoing |
| 5.02 | All | H | There was no Hazardous substances register, Pollution Incident Response Management Plan or emergency documentation stored on site. A SDS register was on site but it was out of date. The PIRMP needs to be distributed to all WTP's and in the vehicles of the operators. A Hazardous substances register and updated SDS's also need to be provided on this site. Explore the capabilities to utilise KMS. | Apr-16 | In Progress | 21/11/2019 - need to locate or developed a hazardous substance register. Council BCP recently updated that covers pollution incident responses and emergency protocols<br>The rest needs to developed<br>10/2/2021 -SDS have been updated and are in date -<br>- PIRMP currently being updated and training to be given to WO (by WQO)<br>- Outstanding action is updating of the Hazardous goods register (TLW)<br>25/10/2021 - outstanding action is to update the Dangerous Goods registers only all other actions from 10/2/2021 have been completed |
| 5.03 | HH | L | There were no instructions on site for number of soda ash bags to be loaded when batching up the soda ash and the operator was not clear on how many to use. A simple SOP, or work instruction, should be developed for this and be available on site. | Apr-16 | In progress | SOP for batching up will be developed<br>21/11/2019 - SOP yet to be developed TLW - to delegate to WO for development<br>10/2/2021 - SOP in development<br>25/10/21 - as above |
| 5.04 | HH | M | Investigations should also be made into pre dosing Chlorine to help iron oxidization | Apr-16 | In Progress | Council to investigate if this is required<br>21/11/2019 - ongoing<br>10/2/2021 - There is no Zeolite at HH. Investigate pre-dose chlorine for iron oxidization<br>18/10/2021 - Investigations to pre-dose chlorine for iron oxidization is ongoing |
| 5.06 | BB, Th, WW | L | The dilution instructions for the Hypo are written on the storage container and the manual backwash instructions for the arsenic filter is taped to the filter. These should be developed into controlled SOP's and maintained in the O&M Manual | Apr-16 | In progress | SOP to be developed<br>21/11/2019 - Hypo SOP has been started<br>Arsenic filter SOP yet to be started<br>10/2/2021 - SOP in progress<br>25/10/21 - ongoing |

| Action No. | Supply System | Residual Risk | Outstanding Actions | Date Added | Status | Actions & Comments |
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| 5.11 | Th | VH | Permanent ladder access to both reservoirs<br>Safety rail around second reservoir and replace swimming pool fencing on first reservoir and replace with safe access railing (pool fence collects debris on top of the reservoir)<br>Consider security fencing around reservoirs<br>Overflow is an open hole with a mesh covering, this needs to be fixed. | Apr-16 | Ongoing | Overflow completed, rest to be undertaken<br>21/11/2019 - consultation to occur at next quarterly meeting with Health and DoI<br>10/2/2021 - quotes and proposal to be sent to DPE<br><br>25/10/2021 - quotes have not been sent - waiting for next DPE meeting (1/11/2021_ to bundle all projects together |
| 5.12 | Th | L | Reservoir diagrams of all valves, taps, pipes, scouring options and interconnections required<br>Separate scours for each reservoir required (to be done) | Apr-16 | In progress | 21/11/2019 - PE investigate scouring options at Reservoir<br>10/2/2021 Investigation yet to begin<br>18/10/21 - Basic design has been scoped and quoted. Project to be tables with DPE |
| 5.13 | Th | H | Consider Security fencing around Treatment Plant Buildings | Apr-16 | In progress | 21/11/2019 - consultation to occur at next quarterly meeting with Health and DoI<br>10/2/2021 - further discussion required<br>18/10/2021 - still in consultation with DPE |
| 6 | KLM, CH, SP, WW BB Th | M | Chemicals from agricultural runoff near bores - Consult with NSW Health for sponsored sampling programme to test all bores 6monthly over 2-year period to develop base line for protection actions. This could include hydrocarbon testing to capture potential fuel ingress | Nov-19 | To be started | Develop a project brief and send to NSW Health if not approved by Health consider adding into our sampling monitoring program<br>10/2/2021 - Project brief to developed<br>25/10/2021 - brief to be completed TLW & WQO to action |
| 6.01 | KLM | H | Investigate installation of online monitoring at SMD for nutrients e.g., TN & TP | Nov-19 | In progress | To re-assess pending approval of emergency treatment plant. May need to consider move to balance tank<br>5/2/21 - if online Nutrient monitoring required will be implemented in new treatment plant<br>23/09/2021 - Phil (MC) - as previous comment, to be included into new WTP |
| 6.02 | ALL | H | Development of SOP for testing methodologies of Iron and Manganese | Nov-19 | In progress | Development of all spot field methodologies<br>10/2/2021 - SOP in development<br>25/10/2021 - collate all instrument methodologies and distribute to operators TLW - to pass onto WO |

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|---|---|---|---|---|---|---|
| 6.04 | SMD | H | Confirm inspections For SMD are included in the site management procedure - relating to access and contamination from animals | Nov-19 | In progress | inspections to be included in site management procedure. (JN to confirm - then remove 16/09/19)<br>10/2/2021 - Inspections are included in 4.12.4. this action can be closed off<br>25/10/2021 - documentation has changed action to remain in IP until new documentation completed |
| 6.05 | HH & KNCH | H | Aeration at Hat Head - update maintenance programme to a 6 monthly frequency opposed to yearly | Nov-19 | In progress | 6-month inspection to be added with a separate yearly clean. This is to be captured in the plant SOP<br>10/2/2021 - SOP in progress, scheduled to be included in the overall plant SOP<br>25/10/2021 - ongoing |
| 6.06 | SWR | M | Failure of blowers at borefield affecting downstream process<br>Development of SOPs for Blower inspections and investigate automatic plant shut down on interlocks into Clear SCADA | Nov-19 | To be started | 5/2/21 - Not yet started<br>25/10/2021 - MC - investigate SCADA interlocks<br>TLW - to action development of SOP / integrate into WaterOutlook |
| 6.08 | BB, SWR, SP | M | Update and/or development of SOPs for use of coagulants and other chemicals at treatment plants. This Should include the process for Jar Testing - in context of Equipment failure resulting in under dosing chlorine and not precipitating iron and arsenic (chlorine added for oxidation and Coagulation for arsenic) | Nov-19 | In progress | 18/2/21 - In progress<br>25/10/2021 - ongoing TLW - to action |
| 6.09 | SWR & BB | M | Manganese & Iron issue in borefield Long term options are WTP extension with the inclusion of additional pre-treatments | Nov-19 | In progress | 10/2/2021 - BB WTP augmentation is being sort for the plant, this will include review of crypto risk and options for manganese and iron removal<br>SWR long term options are ongoing<br>28/10/21 - ongoing as above |

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| 6.1 | SP | M | reject water from the clarifier enters inlet stream investigate corrective actions to minimise reject water entering clarifier. | Nov-19 | In progress | PE - need to install E1 pump station for reject water<br>ME - trades to investigate leak<br>5/2/21 - initial investigation has begun<br>18/10/2021 - E1 pump still to be investigated - ongoing. OC to brief TO on project requirements |
| 6.12 | SWR | H | investigation required for SWR for CIP - Consider installation of new membrane cleaning tank | Nov-19 | In progress | quotes received for new tank and bund and prep work on chemical storage area<br>10/2/21 - New neutralization tank installed - progressing with CIP connection to new tank<br>18/10/2021 - tank installed awaiting on design |
| 7.01 | KLM | H | Automated overflow cone valve testing program | Nov-20 | In progress | 10/2/2021 -This in in the budget for 21-22, completion by June 22<br>23/09/2021 - Phil (MC) - in progress, MC arranging with Engineering Trade's Team |
| 7.02 | ALL | H | Investigate installing of aqua-jetter/mixer on required Reservoirs (PH, FREDO, New Entrance, upgrade of BB from static and JL) | Nov-20 | To be started | 10/2/2021 -Needs investigation of scope of works and to be incorporated into future budgets<br>18/10/21 - Investigation yet to begin |
| 7.05 | ALL | L | When performing manual slug dosing of reservoirs/Clear Water Tanks the Team Leader or Senior Water Operator need to be informed beforehand to double check dose rate calculations | Nov-20 | Standing Item | 10/2/2021 - SOP to be developed and then Tool boxed to team also to be added to Water Outlook<br>25/10/21 - Slug dose amount column has been added to WaterOutlook - SOP still to be developed |
| 7.06 | ALL | VH | Investigate having the door alarms connected to each Water locations - can be either to security company ,SCADA or other security control also Back to base security alarm system required for all treatment facilities (old action number 2.42) | Nov-20 | To be started | 10/2/2021 - Investigate to confirm alarms on all Water Assets treatment plant main access doors and begin scope of works investigation for alarms on reservoir hatches<br>25/10/2021 - Action is to liaise with facility Management for alarming at water assets |

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|---|---|---|---|---|---|---|
| 7.07 | ALL | VH | Investigate of cameras on key assets | Nov-20 | Ongoing | 10/2/2021 - Started to investigate sites and proposed money allocation been requested into the 22-23 budget for SWR and the SMD at this stage<br>23/09/2021 - Phil (MC) - ongoing, installed at Hat Head WTP in 2021. These will initially be stand-alone systems that record locally, with the cabinet key living with Manager Water & Sewer for security reasons. We will need to review when and how we access these systems remotely with the help of IT.<br>18/10/21 - Hat Head cameras completed, other plants yet to be done |
| 7.08 | ALL | M | Develop re-order sheets for each plant with identification at what minimal chemical levels should be carried | Nov-20 | To be started | 10/2/2021 - Develop SOP that covers all plants minimal Chemical levels and for it to be listed, this list then to be incorporated into SCADA as an alert alarm for when to re-order<br>25/10/2021 - yet to begin |
| 7.09 | ALL | H | review SCADA alarms at each plant (Hat Head STP is completed) | Nov-20 | Ongoing | 10/2/2021 -Ongoing review of all SCADA systems and Plant functional description across all water and sewer<br>23/09/2021 - Phil (MC) - ongoing as part of Council SCADA systems upgrade. |
| 7.11 | SP | L | Online monitoring to be installed at Stuart Point combined raw water at CCP1 AND CCP2 for automatic shutdown capabilities | Feb-21 | To be started | 18/2/2021 - To be investigated<br>23/09/2021 - Phil (MC) - as 18/2/2021 comment - to be investigated. |