




21 May 2021.



Water Futures Pty Ltd
ABN: 97 109 956 961
A: 66 Merrivale Road 2073
T: +61 409 283 737
E: dan@waterfutures.net.au

Document Information

Version	Prepared By	Issued To	Format	Date	Reviewed
Client draft report	Dan Deere	Peter Martin	PDF	10 April 2021	Peter Martin
Final report	Dan Deere	DRDMW	PDF	21 May 2021	DRDMW

Contact for this report:	<p>Dr Dan Deere T: +61 409 283 737 E: dan@waterfutures.net.au</p> 
Citation:	Deere, D. (2021) DRDMW HSC DWQMP Audit 2021. Report. Document produced for Hinchinbrook Shire Council and Water Futures Pty Ltd.
File Name:	HSC 2021 DRDMW DWQMP Audit Report V2.docx
Project Director:	Peter Martin
Project Owner:	Hinchinbrook Shire Council
Name of Project:	DRDMW HSC DWQMP Audit 2021.
Name of Document:	Report
Cover:	Logos are © Hinchinbrook Shire Council and Water Futures Pty Ltd. Images are © Water Futures Pty Ltd.
Sensitivity:	This document is copyright and confidential. The document, its concepts and contents are not for citation, circulation or duplication without permission.

Contents

1. ACRONYMS AND ABBREVIATIONS	4
2. EXECUTIVE SUMMARY	5
2.1. PURPOSE	5
2.2. METHODOLOGY	5
2.3. RESULTS	5
2.3.1. Accuracy of data provided to the regulator	5
2.3.2. Compliance with the DWQMP and its conditions.....	6
2.4. ACKNOWLEDGEMENTS	6
2.5. SUMMARY OF AUDIT FINDINGS AGAINST AUDITABLE ELEMENTS	7
3. AUDIT OVERVIEW	9
4. PROPOSED AUDIT TIMETABLE.....	11
4.1. DAY 1 MORNING. THURSDAY 8 APRIL 2021. DESKTOP AND DEPOT AUDIT.	11
4.2. DAY 1 AFTERNOON. THURSDAY 8 APRIL. NOMINATED SCHEMES.	12
4.3. DAY 2. FRIDAY 9 APRIL 2021. NOMINATED SCHEMES.....	12
5. AUDIT REPORT.....	13
5.1. VERIFY ACCURACY OF MONITORING AND PERFORMANCE DATA COMMUNICATED TO DRDMW.....	13
5.1.1. Verification monitoring	13
5.1.2. Operational monitoring	13
5.1.3. Additional monitoring and performance data (if any) as provided in the Annual Report 13	
5.2. IMPLEMENTATION OF THE DWQMP	14
5.2.1. Implementation of all preventive measures for managing hazards and hazardous events (including those applied in the distribution/reticulation network)	14
5.2.2. Implementation of operational and maintenance procedures (including instrument calibration), including availability and currency of procedures	19
5.2.3. Implementation of the process for managing incidents and emergencies including reporting requirements to the regulator	19
5.2.4. Implementation of the operational (including critical control points, as relevant) and verification monitoring programs	19
5.2.5. Implementation of the risk management improvement program	21
5.2.6. Maintaining records using the systems as described	22
5.3. ASSESSMENT OF COMPLIANCE WITH DWQMP CONDITIONS.....	22
5.3.1. Reporting incidents in relation to events that are beyond the control of the service provider and have the potential to impact public health and for failing to meet water quality criteria as defined in the approval notice, and whether preventative measures taken were adequate to control the hazard.....	22
5.3.2. Undertaking regular reviews at the frequency specified in the approval notice. 22	
5.3.3. The provisions and conditions in the approval notice	22
6. PHOTOGRAPHS ILLUSTRATING ONSITE OBSERVATIONS	23

1. Acronyms and abbreviations

Acronym or abbreviation	Meaning
[the] Act	<i>Water Supply (Safety and Reliability) Act 2008 (Qld)</i>
ADWG	Australian Drinking Water Guidelines
CCP	Critical Control Point
DNRME	Department of Natural Resources, Mines and Energy
DRDMW	Department of Regional Development, Manufacturing and Water
DWQMP	Drinking Water Quality Management Plan
NATA	National Association of Testing Authorities, Australia
NHMRC	National Health and Medical Research Council
HSC	Hinchinbrook Shire Council (Services Provider SP62)
NTU	Nephelometric Turbidity Units
OFI	Opportunity for Improvement
PDF	Portable Document Format
SCADA	Supervisory control and data acquisition
WSAA	Water Services Association of Australia
WTP	Water Treatment Plant

2. Executive Summary

2.1. Purpose

This report summarises a standard regular audit of the way in which Hinchinbrook Shire Council (HSC), the Services Provider number SP62, complies with its approved *Drinking Water Quality Management Plan* (DWQMP). The objective of that audit was to:

- audit the monitoring and performance data provided to the regulator under the plan;
- assess the service provider's compliance with the plan; and
- assess the relevance of the plan in relation to the provider's drinking water service.

The audit was conducted on behalf of the Department of Regional Development, Manufacturing and Water (DRDMW, formally the Department of Natural Resources, Mines and Energy (DNRME)) under the *Water Supply (Safety and Reliability) Act 2008* (Qld) (the Act). The findings of the audit are hereby reported to DRDMW.

2.2. Methodology

The principal documents that set the standard for the audit were as follows:

- Chapter 2 Infrastructure and service, Part 4 Service provider obligations, Division 2 Audit reports and reviews, Clauses 108 to 109 and Section 99(2)c of the Act.
- *Drinking Water Quality Management Plan Review and Audit Guideline* (DNRME 2019).
- *ISO 19011:2011 - Guidelines for auditing management systems* (the generic auditing Guideline).

The audit involved review of hard copy documentation, review of electronic records, interview with staff and inspection of assets and systems.

The version of the DWQMP audited was the *Drinking Water Quality Management Plan*, Revision E, 14 May 2018. The audit covered the HSC drinking water supply scheme including the recharge area, bores, water treatment and distribution systems.

Although some notice was given as to which sites were to be visited, there was only very general guidance given as to precisely what would be inspected in each area.

All assets were considered potentially subject to audit and some were randomly inspected during the field audit.

All records from within the audit period were considered to be within scope and portions of these records were randomly selected for inspection during the desktop and field audit.

2.3. Results

2.3.1. Accuracy of data provided to the regulator

Data from three principal sources were audited:

- Third-party laboratory verification monitoring.
- HSC field verification.
- HSC operational monitoring.

The data provided to the regulator was found to be accurate, This included online monitoring by instruments, operational monitoring by HSC operators and third-party laboratory monitoring laboratories that maintain relevant NATA accreditation.

In summary, the auditor concluded that HSC had provided accurate data to the regulator.

2.3.2. *Compliance with the DWQMP and its conditions*

The HSC system was audited to assess compliance with its obligations under the Act, Regulations and Audit Guidelines. The audit covered HSC's infrastructure, documents and records covered under the DWQMP as it currently stands.

The HSC water supply system was consistent with its description in the DWQMP and there was adequate compliance between the current version of the DWQMP in use by HSC and the observations made during the audit.

The DWQMP was found to be fully relevant, representing an accurate reflection of HSC's infrastructure and the way in which it is operated. In summary, the auditor concluded that HSC's DWQMP was accurate, current and relevant.

Some recent high wind damage had resulted in some preventive measures not operating as per their design intent and by the time of the field audit these had yet to be rectified. Specifically, the hatch and vent structure on one of the treated water storage tanks had become damaged and a number of other potential ingress points were noted in treated water storage tanks due to loose-fitting roof sheets and other minor damage. HSC was in the process of seeking support to repair these during the field audit but doing so had taken some time.

Consideration was given on the day of the field audit as to whether the risks posed by the damaged water tank roof structures were sufficient that they triggered a non-compliance or the need for immediate notification to DRDMW.

Immediate notification to DRDMW was not considered warranted given that the damaged tanks were not overhung by vegetation that the damage was downstream of chlorine dosing at a water treatment plant with a history of reliable chlorine disinfectant. In addition, it was noted the HSC was in the process of rectifying the defects so the situation wasn't unnoticed or intending to be left as observed.

At the time of the field audit it was considered that the risk warranted a non-compliant finding due to the loss of the integrity of the preventive measure associated with the water tank as identified in the DWQMP. However, evidence was provided that all of the identified defects were rectified prior to completion of the follow up actions associated with auditing and reporting. Therefore, by the time of completing the audit report the situation was considered to be compliant.

In summary, a compliant audit finding has been made by the auditor under the Act on behalf of DRDMW.

A number of opportunities for improvement (OFIs) were identified during the audit. These OFIs, summarised in Table 2-1 and in context in the body of the audit report, may help improve efficiency, reliability or reduce the risk of future non-compliances.

2.4. *Acknowledgements*

The auditor wishes to acknowledge the full and proactive participation of all HSC staff involved in this audit and thank them for their openness and preparedness for the interviews.

In particular, Peter Martin (Utility Services Manager), Haydn Grazioli (Technical Officer) and Neil Fredericks (WTP Operator) are thanked for their time throughout the audit.

2.5. Summary of audit findings against auditable elements

Table 2-1 provides a summary of audit findings against auditable elements.

Table 2-1. Summary of results presented against auditable elements.

Topic area	Compliance
<i>Audit topic</i>	<i>Summary of compliance status</i>
<i>Verify accuracy of monitoring and performance data communicated to DRDMW</i>	
Verification monitoring	Compliant
Operational monitoring	Compliant
Additional monitoring and performance data (if any) as provided in the Annual Report	Not applicable
<i>Assessment of compliance with the DWQMP</i>	
Implementation of all preventive measures for managing hazards and hazardous events including those applied in the distribution/reticulation network)	<p>Compliant</p> <p>As OFIs HSC may wish to consider:</p> <ul style="list-style-type: none"> • Setting criteria for treated water storage tank integrity preventive measures to ensure they act as barriers to the entry of ingress from vermin and runoff as far as reasonably practicable. Undertaking the works required to raise the standard of treated water storage tank integrity preventive measures to reach or exceeded the agreed criteria. Embedding safe and practicable asset and/or operational management systems to inspect treated water storage tanks and maintain and repair them in a preventive manner. • Preparing for future revisions to guidelines and regulatory obligations that are likely to require risks from protozoan pathogens to be explicitly assessed and appropriately mitigated. HSC can begin by sourcing evidence of groundwater security such as collecting raw water data on <i>E. coli</i>, conductivity and turbidity and measuring the hydraulic response of production bores to rain events and assessing their connectivity to potential protozoan pathogen sources. HSC could define well head protection zones and reliably protect those zones from protozoan pathogen sources. • Making a decision on the level of physical security required for its treated water storage tanks and seeking to maintain protection at those levels.

Topic area	Compliance
Implementation of operational and maintenance procedures (including instrument calibration), including availability and currency of the procedures	Compliant
Implementation of the process for managing incidents and emergencies including reporting requirements to the regulator	Compliant
Implementation of the operational (including critical control points, as relevant) and verification monitoring programs	Compliant
Implementation of the risk management improvement program	Compliant As an OFI HSC may wish to consider: <ul style="list-style-type: none"> The benefits associated with upscaling both its field operations and back office support functions by approximately one person each.
Maintaining records using the systems as described	Compliant
<i>Assessment of compliance with DWQMP conditions</i>	
Reporting incidents in relation to events that are beyond the control of the service provider and have the potential to impact public health and for failing to meet water quality criteria as defined in the approval notice, and whether preventative measures taken were adequate to control the hazard	Compliant
Undertaking regular reviews at the frequency specified in the approval notice.	Compliant
The provisions and conditions in the approval notice	Compliant

3. Audit overview

Item	Details
Title	Regulatory audit of Hinchinbrook Shire Council's Drinking Water Quality Management Plan.
Provider	Hinchinbrook Shire Council (HSC).
Water service	The HSC water supply scheme.
Auditor	Daniel Deere.
Audit completed	21 May 2021
Audit period	April 2017 (post the previous audit) to 21 May 2021 (the date upon which the review of evidence and reporting was completed).
Field assessment dates	8 and 9 April 2021
DWQMP audited	HSC <i>Drinking Water Quality Management Plan</i> , Revision E, 14 May 2018
Objective	<ul style="list-style-type: none"> To provide a 'standard regular' audit of the way Council complies with its approved <i>Drinking Water Quality Management Plan</i> (DWQMP). The objective of that audit is to: <ul style="list-style-type: none"> verify the accuracy of the monitoring and performance data provided to the regulator under the plan; assess the service provider's compliance with the plan; and assess the relevance of the plan in relation to the provider's drinking water service. To conduct that audit on behalf of the Department of Regional Development, Manufacturing and Water (DRDMW) under the <i>Water Supply (Safety and Reliability) Act 2008</i> (Qld) (the Act) and to report the findings of the audit to DRDMW.
Audit standard	<p>The principal documents that set the standard for this audit are as follows:</p> <ul style="list-style-type: none"> Chapter 2 Infrastructure and service, Part 4 Service provider obligations, Division 2 Audit reports and reviews, Clauses 108 to 109 and Section 99(2)c of the Act. <i>Drinking Water Quality Management Plan Review and Audit Guideline</i> (DNRME 2019) <i>ISO 19011:2011 - Guidelines for auditing management systems</i> (the generic auditing Guideline).

Item	Details
Scope	<ul style="list-style-type: none"> • Audit type: 'Standard regular' audit of the DWQMP. • Criteria: <ul style="list-style-type: none"> ○ Relevant clauses of the Act, associated DRDMW regulations and guidelines and any relevant notices provided to Council by DRDMW. ○ Relevant components of the Australian Drinking Water Guidelines (ADWG). ○ Follow up of recommendations from previous audits. • Sites: The audit sampled randomly selected sites as agreed with the service provider. • Records: The audit sampled randomly selected records as agreed with the service provider. • Services: Drinking water.
Milestones	<ul style="list-style-type: none"> • March 2021: Selection of sites and records to review and finalisation of audit agenda. • March 2021: Supply of background data and information to the auditor. • April 2021: Desktop and field audit and follow up review of audit evidence. • May 2021: Draft audit report to Council for review. • May 2021: Final audit report and statutory declarations to Council and DRDMW.

4. Proposed Audit Timetable

4.1. Day 1 morning. Thursday 8 April 2021. Desktop and depot audit.

Time	Audit topic	Location	Audit questions and actions
07:30	Introduction and welcome	Office	Clarify the audit period Finalise the audit agenda
07:45	Changes and updates	Office	What has changed since the close of the previous regular audit? These changes may include personnel, procedures, documents, records, responsibilities, environment, infrastructure, regulations, legislation, guidelines or organisational structure and contractors. How has the system description, risk assessment and other aspects of the DWQMP been updated to reflect those changes? How are improvement needs identified and how are improvements made and managed? How have significant changes been reported to DRDMW?
08:00	Verification monitoring	Office	How does Council ensure compliance between the DWQMP and the verification (i.e. lab testing) monitoring program? How does Council ensure the reliability of monitoring results? Consider sampling site selection, sampling, transport of samples, analysis, quality assurance and control, reporting and communication. Audit some records of a sample of results through from sample receipt to reporting. How have such monitoring results been reported to DRDMW?
09:00	Operational monitoring	Office	How does Council ensure compliance between the DWQMP and the SCADA systems? How does Council ensure the reliability of monitoring results? Consider analyser sample line site selection, verification and calibration of instruments, reporting and communication. Audit some records of a sample of results from the SCADA systems through to reporting. How have such monitoring results been reported to DRDMW?
10:00	Morning break		
10:30	Incident management	Office	How does Council maintain readiness to respond to water quality incidents? Consider detection and communication of incident triggers, duty arrangements, incident management facilities and documents. Have there been any examples of incidents during the audit period? How have incidents been reported to DRDMW?
11:00	Materials and chemicals	Council Depot	How are materials that may come into contact with water (e.g. pipes and jointing compounds) sourced, stored and quality assured? How is sewage to potable water cross-contamination mitigated? How is suspected contamination of compromised mains identified and mitigated? How are temporary water supplies provided?
12:00	Lunch		

4.2. Day 1 afternoon. Thursday 8 April. Nominated schemes.

Time	Scheme	Location	Audit questions and actions
1 to 3:30 pm Actual times to suit and fit in with operational staff	Lower Herbert	Inner catchment or recharge area Dam, weir or bore Intake WTP Treated water storage Network (PS, PRV, hydrants, and works in progress if applicable) Meter connection Compliance sampling tap	How does the infrastructure in the field compare to the DWQMP description? Field inspect random samples from the catchment, reservoir or bore, treatment and network for the selected system and compare to the DWQMP description. How are assets maintained in a secure, functional and readily operable state in order to protect water quality outcomes? What are the operational monitoring instruments reading during the audit, how does that compare to the DWQMP, and how are the instruments and SCADA outputs routinely verified and calibrated? What are the SCADA system process control set points during the audit, how do they compare to the DWQMP, and how are they modified and controlled? How are chemicals, standards and reagents stored and maintained to ensure their quality and efficacy? Consider both treatment chemicals that are added to the water and laboratory chemicals used for monitoring instrument calibration and verification. How are records retained and reported as they relate to water quality operational monitoring? Who is responsible for operating the system and what are their credentials with respect to training, experience and qualifications?

4.3. Day 2. Friday 9 April 2021. Nominated schemes.

Time	Scheme	Location	Audit questions and actions
7:30 am to 11 am Actual times to suit and fit in with operational staff	Forrest Beach	As above	As above
12 to 3:30 pm Actual times to suit and fit in with operational staff	All: Contingency	Office	Contingency period for follow up. Audit writing up. Preparation for closing meeting.
3 to 4 pm	All: Closing meeting	Office	Summary of audit highlights, observations, opportunities for improvement and non-compliances. General discussion on water quality management, emerging trends and issues and feedback on performance against appropriate and best practices.

5. Audit Report

5.1. *Verify accuracy of monitoring and performance data communicated to DRDMW*

5.1.1. *Verification monitoring*

Observations

The reliability of drinking water quality verification monitoring was audited. A sample selection of three of the approximately 50 sampling sites used by HSC were checked in the field against those identified in the DWQMP. Sample taps were physically inspected at:

- SP1: Hurley's, Bemerside;
- SP7: End of Allamanda Avenue, Forrest Beach; and
- SP37: End of Pangola Street, Forrest Beach.

The location of the sites was checked against those in the DWQMP and supporting documentation – all were found to align. The sites were listed as well as being mapped on ARC GIS pro with all relevant references aligning. The tap sampling fittings themselves were well-housed. Some used taps within an elevated sample box and were directly sampled following flaming. Others were in a ground-level sample box that was sampled following attachment of a gooseneck sampling fitting. This very clear identification of sample points combined with their protection within casings helps to reduce the risk of misleading water quality test results.

The selection of sites was technically logical providing coverage across the reticulation system. The HSC verification monitoring program is delivered by the Townsville City Council (TCC) and Forensic and Scientific Services (FASS) NATA accredited laboratories. Microbiological analyses are undertaken by TCC with chemical analyses delivered by FASS. HSC provided examples of multiple test results, all of which were signed by the NATA signatory.

Findings

HSC was Compliant with respect to the accuracy of its verification monitoring program.

5.1.2. *Operational monitoring*

Observations

Operational monitoring is focused on measurements of free and total chlorine and pH using hand-held colourimeters both at the WTP and within the network. Council has a good body of daily records going back throughout the audit period relating to this operational monitoring. These records are discussed in section 5.2.4.

Findings

HSC was Compliant with respect to the accuracy of its operational monitoring program.

5.1.3. *Additional monitoring and performance data (if any) as provided in the Annual Report*

Additional monitoring and performance data was not provided and so this audit item was considered not applicable.

5.2. Implementation of the DWQMP

5.2.1. *Implementation of all preventive measures for managing hazards and hazardous events (including those applied in the distribution/reticulation network)*

Implementation audit scope

This year, two systems were selected for audit from the three systems operated by HSC:

- Lower Herbert Water Supply (Scheme 2)
- Forrest Beach Water Supply (Scheme 3)

The key preventive measures identified in the DWQMP included:

- using bore rather than surface water;
- source protection of the bores;
- depth of the bores (≈ 5 to 10 m to the top of first screen according to the bore logs);
- pre-treatment by aeration and sand filtration (and for Forrest Beach pre-chlorination and clarification);
- lime (Forrest Beach) or soda ash (Macknade) dosing;
- treatment by sodium hypochlorite chlorination; and
- closed distribution system.

Source protection barriers

HSC was found to be exclusively using the bore water source and not the surface water – this was in compliance with the DWQMP.

For all of the water sources audited the principal source water protection preventive measures in place were aligned with those set out in the DWQMP. Specifically, the bores were set in locations away from high levels of chemical or pathogen contamination and were drawing water from several meters deep (with the top of the screened part of the casing starting at typically between 5 to 8 m). It wasn't possible to inspect the condition of the bore casings but a superficial inspection of the bore headworks and fenced containment areas found those checked to be in largely good condition. Inspections included Forrest Beach bores (Figure 6-1, Figure 6-2 and Figure 6-3) and Macknade bores (Figure 6-4 and Figure 6-5). Specifically:

- No evidence was found of significantly cracked or damaged concrete aprons or grouting, casing surface structures or cable entries. Minor damage was found to a plastic cap on an access point to the outer casing of Forrest Beach bore number 7 (Figure 6-3). An OFI is not raised here as this was related to a broader problem of minor defects not being rectified due to organisational capacity which is discussed in section 5.2.5.
- No high-risk proximal faecal contamination sources were evident near the bores during the audit within the immediate hygienic protection zone of the bores.
- The closest potential pollution sources within the potential recharge areas and wellhead protection zones of the bores were:
 - Potential Brahman cattle grazing in the paddock adjacent to, and within approximately 10 to 100 m of, the Forrest Beach bores (Figure 6-2). The density of stock surrounding the Forrest Beach bore is not thought to be high with some beef cattle being observed in the distance but no evidence of recent grazing in

the swampy area near the bores. It is more probable that, if and when grazed, this area is accessed during the drier periods of the year.

- Potential pesticide applications from cane farms surrounding some of the Macknade bores – with one of the bores being within the cane farm (Figure 6-4). It was possible that the farmer might permit stock to access the verge of the cane farm between the edge of the crop and the fenceline at the same location.
- Potential septic seepage from unsewered residences that sit within approximately 100 m of one of the Macknade bores (Figure 6-5).
- Toilet facilities are present at each WTP within the same compound as the bores. These receive minimal use from operators and potentially from contractors working on site.

A key question for HSC relates to whether there is sufficient groundwater protection from these relatively low intensity source of protozoan pathogens that the current treatment process (aeration, media filtration without coagulation (and without clarification at Macknade), followed by chlorine) is sufficient.

The bores do not meet the default 'secure groundwater' criteria given in the WSAA HBT Manual since the depth to groundwater and pump is less than 10 and 15 m, respectively. However, whilst the production depth is not an aquifer confined beneath an aquitard the bores are not set in karstic or fractured material and sit within a floodplain with consolidated topsoil, clay, sand and gravel. It is possible that the recharge area and area surrounding the bore surface structures can be maintained in a sufficiently secure state that specific treatment for protozoan pathogens will be unnecessary. Therefore, as an OFI, HSC may wish to consider preparing for future revisions to guidelines and regulatory obligations that are likely to require risks from protozoan pathogens to be explicitly assessed and appropriately mitigated. HSC can begin by sourcing evidence of groundwater security such as collecting raw water data on *E. coli*, conductivity and turbidity and measuring the hydraulic response of production bores to rain events and assessing their connectivity to potential protozoan pathogen sources. HSC could define well head protection zones and reliably protect those zones from protozoan pathogen sources.

Drinking water treatment barriers

The principal drinking water treatment barriers for the audited systems were described in the DWQMP:

- pre-chlorination (Forrest Beach but not Macknade) (to help with iron removal);
- passive trickling aeration (to help with iron removal);
- media filtration without coagulation (for particulate and iron removal);
- clarification (at Forrest Beach but not Macknade) (for particulate and iron removal);
- chlorination (for primary disinfection); and
- lime (Forrest Beach) or soda ash (Macknade) dosing (for pH control).

Recirculation pumps are used to continually dose the clearwater tank to provide primary chlorination.

Booster chlorination is undertaken at the Forrest Beach treated water storage tank which accepts water fed from the Ingham system as well as from Forrest Beach WTP. Free residual chlorine and pH is measured on the line from Ingham and the supply heading out to town.

Primary chlorine dosing is controlled by pumps that start and stop as water flows from the bores into the treated water storage tanks. The Multitrode sensors in the treated water storage tanks triggers pumps to start and stop – both the bore and chlorine pumps. This chlorine dosing system is simple and, to date, has proved reliable. The residual chlorine is not used to control the dose but alarms are set at low level. Battery backup, UPS and generators are on site to provide backup power (Figure 6-12 and Figure 6-13).

The chlorine dosing system and equipment is largely retained indoors. However, the facilities are not kept cool. The Forrest Beach site houses sodium hypochlorite chlorine at the primary and secondary booster dosing points in a tin shed where it may become hot (Figure 6-10). The Macknade site houses the sodium hypochlorite in a besser block building that provides some thermal mass but would still become hot at times. Therefore, in future, it is possible that the strength of sodium hypochlorite may have to be reduced and/or its turnover increased and/or the storage facility kept cool to keep chlorate within potential future guideline values (the guideline value is likely to be somewhere in the range 0.3 to 0.8 mg/L). No OFI is noted at this stage but if any upgrades or changes are made to the WTPs, to future-proof those upgrades the risks associated with chlorate should be considered.

Protecting drinking water from contamination entering treated water storage tanks

Treated water storage tanks were inspected at multiple locations including the five tanks at the Macknade WTP, the clear water tank and the treated water storage tank at Forrest Road WTP and the Forrest Road high level water tower. The following observations were made:

- Overhanging vegetation was largely absent from the tanks which reduces the risk of defecation from roosting and nesting animals, improves inactivation of pathogens by heat and light from sun irradiation and reduces the risk of debris building up on roofs impeding drainage of water from the tank roof structures.
- All tanks had some form of physical security with at the very least having a locked ladder access point and/or being retained within a locked, fenced compound. A security camera was in place at the Forrest Beach WTP treated water storage tank. Some tanks had three levels of physical security (locked compound, ladder access and hatch), with others having only two or one. There is no evidence or history of vandalism, graffiti or malicious acts on the tanks. However, as an OFI, HSC may wish to make a decision on the level of physical security required for its treated water storage tanks and seek to maintain protection at those levels.
- All tanks were roofed and vermin-proofed and secured to runoff ingress by design. No tanks had gutters that may become blocked leading to water flowing back into the tanks. However, the integrity of the vermin-proofing and runoff protection varied across the tanks. The tanks at Forrest Beach WTP and the Forrest Beach water tower had some potential runoff entry and vermin access points on the roof surrounding the hatch, cable or pipe entry points (Figure 6-14, Figure 6-16 and Figure 6-19). The design of the tanks at the Macknade WTP was sound with works being undertaken in the past to vermin-proof them (Figure 6-21) and a new plastic molded tanks at Macknade WTP being, on the face of it, fully secured (Figure 6-22). However, the older tanks with corrugated metallic sheet roof coverings no longer had credible protection against vermin or runoff due to high wind damage resulting in the loss of a vent cap and hatch (Figure 6-23) and damaged roof sheeting (Figure 6-26).

Fortunately, HSC works hard to maintain reliable chlorine disinfection residuals within treated water storage tanks. Nonetheless, as part of multiple barrier protection it is important to exclude as much ingress as is reasonably practicable.

Whilst there is no clear pass/fail standard for protecting treated water storage tanks against ingress from vermin and runoff, the location and size of the entry points was considered to be non-compliant at the time of the field audit with a reasonable definition of a 'closed' treated water storage tank preventive measure. Therefore, the physical infrastructure was not compliant with the DWQMP at the time of the field audit with respect to the integrity of this preventive measure.

In summary, at the time of the field audit, the preventive measures relating to the integrity of the treated water storage tanks as barriers to ingress from vermin and runoff was considered non-compliant. The non-compliance was mitigated to being insignificant from a health risk perspective given the reliable chlorine dosing systems that were in place and the good history of chlorine residuals and *E. coli* results in the treated water storage tanks and the reticulation system. HSC was in the process of rectifying these defects. As a result, DRDMW was not notified immediately. The non-compliance was mitigated to being insignificant from a management system perspective given that Council was already aware of the defects – hence the system was 'working' – and was triggering action to rectify the defects when resources permitted.

During the follow up and reporting period following the field components of the audit, and before the audit report was completed, HSC successfully rectified all of the identified issues at Forrest Beach (Figure 6-15, Figure 6-17 and Figure 6-20) and Macknade (Figure 6-24, Figure 6-25 and Figure 6-27). It was excellent to see such a rapid response to the recent wind events and to have had direct feedback from HSC on their consideration of the audit observations. This actions was considered to have removed the non-compliance by the time the audit closed. Nonetheless, to help prevent future non-compliances, as an OFI, HSC may wish to consider:

- Setting criteria for treated water storage tank integrity preventive measures to ensure they act as barriers to the entry of ingress from vermin and runoff as far as reasonably practicable. Undertaking the works required to raise the standard of treated water storage tank integrity preventive measures to reach or exceeded the agreed criteria. Embedding safe and practicable asset and/or operational management systems to inspect treated water storage tanks and maintain and repair them in a preventive manner.

Protecting drinking water from contamination flowing back into the water supply network

The backflow prevention program was an excellent achievement by Council. The program demonstrated a firm and ongoing commitment to this challenging area of risk management. HSC has an in-house Plumbing Inspector, with administrative support, and has been able to set up and maintain a register of the backflow hazard for its potable water connections along with details of how they are protected. The register is supported by photographs of the backflow prevention devices to provide an evidence trail and help with illustrating devices for communication and location. A database summarises these connections and has copies of the relevant test certificates scanned and retained on file. This photographic record and database covers both third party customers and Council sites. To help make the scheme sustainable customers are charged an annual fee to cover the cost of registering, reminding and overseeing drinking water protection using backflow prevention

Council writes to customers to remind them of their need to have devices that are compliant and, where relevant, tested. Council's own plumbers from its Water and Sewerage team undertake the installation, repair, replacement and testing of Council's devices (e.g. at sewer pump stations and relevant HSC sites and buildings). Council then uses reminders and personal

communication with customers to help remind them and follow-up with them to help maximise compliance. In that way Council sets an example of good practice through its own program and doesn't lose sight of backflow prevention by others.

Going beyond its minimal compliance requirements, Council provided an example of how it proactively liaises with customers to provide outreach and education. Council writes to potable water tanker drivers to advise them to ensure a top fill arrangement with an air gap of at least two pipe diameters. In addition, HSC liaises with farmers to ask that they ensure an air gap when filling up stored water rather than leaving hoses sitting in that stored water with the ability to back-siphon.

Examples were provided for some nominated customers:

- A photo and test certificate were sighted for a reduced pressure zone device (RPZD) at the hospital with its most recent test date of 20/8/2020. The device was compliant.
- A photo and test certificate were sighted for a RPZD at the United Petroleum site with its most recent test date of 17/12/2019. The device was not compliant and was replaced.

HSC provided examples of its standing stock of standard water meters and these were shown to include dual check valve backflow protection (Figure 6-35).

Protecting drinking water from contamination entering via weaknesses in the reticulation system

The water supplies are pressurised by high level water storage tanks that are in turn fed by pumps. Whilst the pressures are relatively modest (approximately 30 to 35 m) the pressure is reliably maintained using the high-level water towers. A system of online monitoring and telemetry of reservoir levels provides early warning if reservoir levels run low rising loss of adequate pressure (Figure 6-18 and Figure 6-28). Pumping to fill the reservoirs is triggered by the low level setpoint on the Multitrode to maintain system head. Online monitoring and telemetry of pressure at distal points within the distribution system provides good evidence of pressure maintenance as well as a system for warning in the event of pressure loss. These distal pressure monitoring points represent an excellent innovation with telemetered sim-card-enabled devices being placed at most of the approximately 50 drinking water quality verification monitoring points. The use of the largely gravity-fed pressure security from the storage reservoirs, backup power for pumps to supply the reservoirs, and presence of pressure monitoring with the reticulation system provides a sound set of processes to provide for, and monitor, the positive pressure preventive measure.

Protecting drinking water from contamination due to the use of unfit materials

The stores, gang truck and water maintenance trailer were inspected and network operator was interviewed. All parts and fittings found within the stores and on the maintenance vehicle and trailer were fit-for-purpose (e.g. bearing the WaterMark stamp and/or showing AS 4020 compliance markings). The parts and fittings were stored in hygienic conditions undercover away from sun damage. The major parts and fittings in use were the larger diameter PVC pipes and associated couplings (Figure 6-32) and Vinidex PE PN 12.5 smaller diameter pipes (Figure 6-33). Smaller parts (Figure 6-34) and meters (Figure 6-35) were suitable and appropriately stored. The water trailer (Figure 6-36) securely housed appropriate parts and fittings (Figure 6-37).

Findings

HSC was compliant with respect to the implementation of preventive measures for managing hazards and hazardous events by the time of the close-out of the audit, albeit temporarily non-compliant during the field audit with respect to treated water storage tank condition following storm damage, as discussed above.

5.2.2. *Implementation of operational and maintenance procedures (including instrument calibration), including availability and currency of procedures*

Details of audits of the implementation of operational and maintenance procedures and related observations are summarised in detail in section 5.2.4 and hence are not repeated here.

5.2.3. *Implementation of the process for managing incidents and emergencies including reporting requirements to the regulator*

Observations

HSC provided good evidence of having an ‘incident-ready’ workplace culture – probably reflecting its experience with cyclones and major low pressure events.

Chlorine trends were reviewed during the audit for various time windows during the audit period for various chlorinators. A low chlorine reading was noted at the Macknade chlorinator on 6 January 2021 that was considered to be something that should have triggered an incident. This was followed up during the audit. HSC provided evidence of a having notified that event on 6 January 2021. The notification indicated that a storm had resulted in failure of the recirculation pump at Macknade. This in turn resulted in a boil water notification being issued. The notification explained that the boil water alert was issued as a precaution due to failure of the chlorine dosing system and recirculating pump during a severe storm event at the Macknade Water Treatment Plant followed by an inability of repair crews to be able to access the site due to recent flooding and severe storms. Both DRDMW and the Townsville Public Health Unit were notified of the event as appropriate. The boil water advisory was lifted pending evidence of chlorination having been restored along with laboratory evidence of no detectable *E. coli*. The incident was closed out and the investigation report was delivered to the regulator on 22 February 2021.

Findings

HSC was compliant with respect to the implementation of the process for managing incidents and emergencies including reporting requirements to the regulator.

5.2.4. *Implementation of the operational (including critical control points, as relevant) and verification monitoring programs*

Observations

Operational monitoring is focused on measurements of free chlorine and pH using online monitoring instruments at the WTPs and at dosing points. These readings are in turn cross-checked against daily operational checks undertaken by operational staff. The operational staff check a wide range of parameters including cross-checking the free chlorine and pH reading on the online analyser against those measured on a hand-held colourimeter. The online analyser

is adjusted in the event of significant discrepancies. Other variables, such as pump hours, sodium hypochlorite storage levels and turbidity are checked.

The alarm settings in the SCADA system were found to be consistent with the DWQMP with the low level critical limit for chlorine triggering a low level alarm notification and a second low-low level alarm having also been configured along with a high level alarm (Table 5-1). During the audit the SCADA scaling was checked and found to be consistent (Table 5-2).

Table 5-1. Comparison of the DWQMP setpoints with SCADA settings.

Instrument	Critical limit	Target limit	SCADA settings (if different to DWQMP limits).
Forrest Beach WTP free chlorine (mg/L)	0.6	1.5 (normal) 1.75 (high rainfall)	Low-low, Low, high and high-high alarms set at 0.3, 0.6, 3.0 and 3.0, respectively. The low alarm is aligned to the critical limit and is understood as such. This was considered adequate.
Macknade WTP free chlorine (mg/L)	0.6	1.5 (normal) 1.75 (high rainfall)	Low-low, Low, high and high-high alarms set at 0.5, 0.6, 3.0 and 3.0, respectively. The low alarm is aligned to the critical limit and is understood as such. This was considered adequate.

Table 5-2. Comparison of online and SCADA display readings.

Instrument	Online	Time	SCADA	Time	Comparison
Forrest Beach WTP free chlorine (mg/L)	1.04	10:19	1.04	10:19	Consistent
Forrest Beach WTP pH (pH units)	7.86	10:19	7.74	10:19	Consistent
Macknade WTP free chlorine (mg/L)	1.42	11:57	1.41	11:57	Consistent
Macknade WTP pH (pH units)	6.78	11:57	6.81	11:57	Consistent

Results from operational monitoring were audited. Daily checks for free and total chlorine and pH for were audited both from the hard copy and electronic records.

The SCADA systems were found to be functioning fast and effectively and were displaying the pH and chlorine analyser readings for selected time windows during the audit period. A low chlorine dip on 6 January 2021 was observed and this was followed up. HSC had notified this to the relevant parties as discussed in section 5.2.3.

In addition, records were observed from selected hard copy operational monitoring of daily checks from samples collected throughout the audit period. The standard of record-keeping was excellent with clearly legible records being retained consistently and useful information being noted where alongside the results that were entered (Figure 6-30 and Figure 6-31). The performance recorded showed good chlorine residuals and pH being measured.

Evidence was provided of instrument technician checks and servicing preventive maintenance activities from both Evoqua and TRILITY during the audit period for instruments. Evidence included detailed records of the works supplied to HSC but the contractor as well as stickers on the instruments to keep a local onsite record of that work and serve as a reminder to complete the work the following year (Figure 6-11). The records of this and related preventive maintenance activities undertaken by HSC are captured within the TechOne asset management system maintained by HSC.

Verification monitoring is undertaken at approximately 50 reticulation system taps across the network and at treated water storage tank and WTP sites. In addition, raw water monitoring takes place. Records were provided from the audit period including both the summary worksheets and examples of the laboratory reports (as discussed in section 5.1.1). Results were well-summarised – being broken down by specific sampling points but readily presented by location and system. Compliance had been good within the audit period.

Findings

HSC was compliant with respect to the implementation of the operational (including critical control points, as relevant) and verification monitoring programs

Some of the operational monitoring is relatively informal (e.g. groundwater recharge area and treated water tank inspections). The level of formalisation of tank roof integrity inspections could be improved to help guide future repair, maintenance and cleaning activities. Such inspections are challenging due to the need to ensure worker safety at the same time as conducting the inspections. An OFI is not noted here since this was discussed in section 5.2.1.

5.2.5. Implementation of the risk management improvement program

Updating the DWQMP

HSC has been significantly updating its DWQMP and improving its mitigation of risks during the audit period. The DWQMP is a comprehensive and detailed document and at the same time is well-structured and user-friendly which is a difficult combination to achieve. In a few areas there were minor differences between some of the finer details in the DWQMP and the on-ground observations (e.g. fine details of the process schematics) and some ground-truthing is planned before finalising the update of the DWQMP for the regulator. It is important that this ground-truthing take place.

It was noted that recommendations from the previous regular audit had been addressed:

- A major non-compliance was found in relation the Herbert River raw water source being inadequately treated to control protozoa risk. That surface water source is no longer in routine use which addresses that non-compliance.
- The audit noted two minor non-compliances in relation to the ability of operators to change alarm settings for critical limits and tracking changes in those limits. HSC has set up a tiered process for authorities for adjusting SCADA settings to prevent accidental or inappropriate adjustment of critical limits by persons not sufficiently authorised or familiar with the DWQMP. This authorisation process was considered to adequately address this non-compliance.

An OFI from the previous audit related to updating flow diagrams – these have been updated during the audit period and are being further updated to reflect changes in system operation over time.

Technical and organisational and capacity to maintain and improve

HSC was found to have the required technical capacity to provide safe drinking water. All staff interviewed demonstrated a good understanding of the water quality aspects and importance of their roles. However, the Water and Sewerage team as a whole has very limited organisational capacity. In addition, there are limited very experienced system operators and head office staff with long-term knowledge and experience of the water supply system.

In the field some preventive maintenance and system improvement works had evidently fallen behind, particularly at WTPs, bores and treated water storage tanks. A significant number of items requiring preventative maintenance, repair and rectification were building up – most of which in and of themselves were relatively minor, but that had the potential over time to collectively undermine barrier performance. Investments in increasing capacity to permit a more preventive approach to infrastructure maintenance and operation are likely to yield benefits in terms of reduced failures, less incidents, lower costs and improved water quality.

At the head office, some DWQMP, data analysis, reporting and interpretation actions are not yet being undertaken permitting best use to be made of data or allowing for systems optimisation and improvement. Investments in such optimisation are likely to yield benefits in terms of reduced costs and improved water quality.

Additional organisational capacity will help to support succession and contingency planning and corporate knowledge retention. To improve compliance with its obligations, as an OFI, HSC may wish to consider the benefits associated with upscaling both its field operations and back office support functions by approximately one person each.

5.2.6. *Maintaining records using the systems as described*

Council has a good body of daily records going back throughout the audit period. A full set of operational monitoring and verification monitoring records was provided for the audit period for inspection. These records were discussed in section 5.2.4.

5.3. *Assessment of compliance with DWQMP conditions*

5.3.1. *Reporting incidents in relation to events that are beyond the control of the service provider and have the potential to impact public health and for failing to meet water quality criteria as defined in the approval notice, and whether preventative measures taken were adequate to control the hazard*

The reporting and management of incidents is discussed under report section 5.3.1.

5.3.2. *Undertaking regular reviews at the frequency specified in the approval notice.*

The DWQMP is currently being fully reviewed and updated as discussed in section 5.2.5. During the audit HSC was in the process of liaising with the regulator to enhance its DWQMP.

5.3.3. *The provisions and conditions in the approval notice*

No special conditions were audited within the scope of this audit.

6. Photographs illustrating onsite observations



Figure 6-1. Forrest Beach borefield showing bores in fenced off area but noting the Brahman cattle paddock adjacent to it. During the audit there was no evidence of recent cattle activity in the paddock. The area was swampy so access if it occurs is more likely during drier periods.



Figure 6-2. Forrest Beach bore number 8 in good surface condition but with a Brahman grazing area in the background.



Figure 6-3. Forrest Beach bore number 7 in with small crack in PVC access point.



Figure 6-4. One of the Macknade bores in a cane farm.



Figure 6-5. One of the Macknade bores in a road reserve on Mill Road with good surface structures but sitting within 50 to 100 m of several onsite sewage management systems on private properties.



Figure 6-6. Forrest Beach WTP aerator.



Figure 6-7. Forrest Beach WTP sand filter.



Figure 6-8. Forrest Beach WTP clarifier.



Figure 6-9. Forrest Beach WTP lime hopper.



Figure 6-10. Sodium hypochlorite store at Forrest Beach.

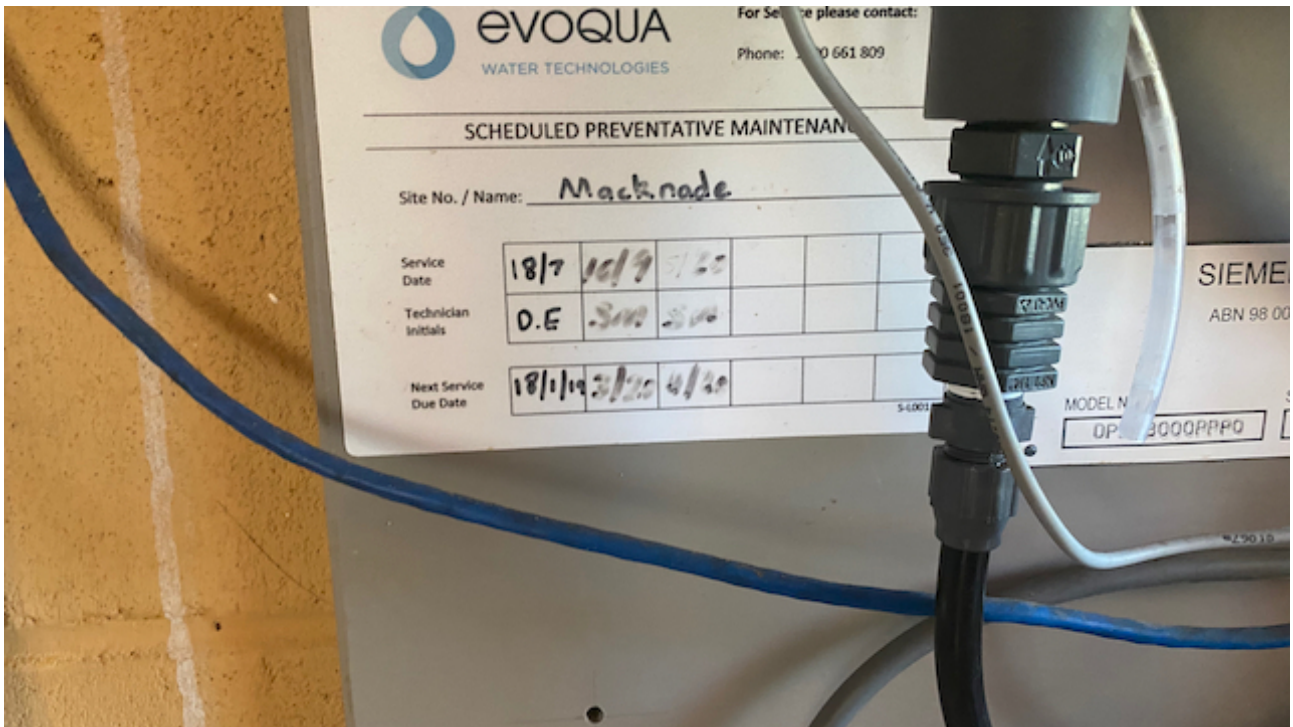


Figure 6-11. Chlorine analysers at Macknade WTP showing evidence of annual service technician maintenance by Evoqua and TRILITY.



Figure 6-12. Forrest Beach WTP generator.



Figure 6-13. Macknade WTP generator.



Figure 6-14. Forrest Beach clearwater storage tank with potential runoff and vermin ingress point.



Figure 6-15. Photo from Council showing the repair to the Forrest Beach clearwater storage.



Figure 6-16. Forrest Beach treated water storage tank with potential runoff and vermin ingress point.



Figure 6-17. Photo from Council showing the repair to the Forrest Beach treated water storage tank.



Figure 6-18. Example of online pressure transmitter at the Forrest Beach water tower.



Figure 6-19. Forrest Beach water tower with potential runoff ingress point and vermin.



Figure 6-20. Photos from Council showing the repair to the Forrest Beach water tower.



Figure 6-21. Grouted vermin-proofed corrugations on treated water storage tank at Macknade.



Figure 6-22. Intact moulded plastic treated water storage tank at Macknade.



Figure 6-23. Wind-damaged vent cap and vent on treated water storage tank at Macknade allowing potential vermin and runoff entry.



Figure 6-24. Photo from Council showing the repair to the wind-damaged vent on treated water storage tank at Macknade.



Figure 6-25. Photo from Council showing the repair to the wind-damaged vent cap on treated water storage tank at Macknade.



Figure 6-26. Wind-damaged sheeting fastenings on treated water storage tank at Macknade allowing potential vermin entry.



Figure 6-27. Photo from Council showing the repair to the wind-damaged sheeting fastenings on treated water storage tank at Macknade.



Figure 6-28. Example of excellent sampling tap and covering with online pressure transmitter (Pangola Street, Forrest Beach).



Figure 6-29. Example of an older design of covered sampling tap and covering (Allamanda Avenue, Forrest Beach).

Hinchinbrook Shire Council - Water and Sewerage Department

FORREST BEACH WTP

Daily Log Sheets

W-F0003

MONTH - DECEMBER				YEAR - 2020			
Date	CI2 Reading			pH			Conductivity
	Auto	Manual	Calibrate Y/N	Auto	Manual	Calibrate Y/N	Treated
Prev	1.32	1.27		7.11	7.24		117.5
1	1.44	1.88	Y	7.82	7.91		
2	1.32	1.09		7.71	7.82		
3	1.24	1.22		7.57	7.86		
4	1.26	1.14		7.43	7.60		
5	1.50	1.17/1.21	Y	7.48	7.70		
6	1.32	1.21		7.31	7.77		
7	1.49	1.62	Y	7.41	7.62		
8	1.50	1.45		7.26	7.63		109.2
9	1.20	1.11		7.21	7.65		
10	1.19	1.04	Y	7.30	7.67		
11	1.13	1.43		7.26	7.51		
12	1.34	1.51	Y	7.26	7.62		
13	1.40	1.38		7.24	7.61		
14	1.34	1.74		7.30	7.65		
15	1.86	0.72		7.26	7.54		
16	1.28	0.93	Y	7.22	7.64		
17	1.05	1.53	Y	7.63	7.90		
18	0.96	1.28	Y	7.92	7.95		
19	1.26	1.24		7.95	7.90		
20	1.11	1.13		8.04	8.25		
21	0.9	1.85		7.01	7.1		
22	1.56	1.85		7.24	7.76		108.4
23	1.65	1.73/1.78	Y	7.57	7.98/7.99		
24	1.48			7.83	8.14/8.08		
25	1.50	1.1	Y	7.52	7.5		
26	1.42	1.3		7.64	7.6		
27	1.18	1.0		7.31	7.6		
28	1.55	1.2		7.17	7.4		
29	1.46	1.0	Y	7.32	7.0		
30	1.47	1.57		7.35	7.87		
31	1.20	1.32	N	7.38	7.88		111.9
Total							

Hi
leaves

Page 6 of 7

Figure 6-30. Example of excellent operational monitoring record-keeping – for Forrest Beach WTP.

Hinchinbrook Shire Council - Water and Sewerage Department		MACKNADE WATER TREATMENT PLANT						W-F0009		
Daily Record Sheets		MONTH - MARCH						YEAR - 2021		
		Cl2 Reading			pH			Conductivity Combined		
Date	Time	Auto	Manual	Calibrate	Auto	Manual	Calibrate	Auto	Manual	Calibrate
Prev	9.40	1.35	1.05	Y	6.94	7.61				
1	2.30	1.20	1.7	Y	6.96	7.2				
2	14		FLOOD							
3	1420	1.30	1.10		7.07	6.97				
4	1040	1.31	1.44		7.11	6.90				
5	1050	1.21	1.31		7.17	6.89				
6	7.45	1.32	1.2		6.88	7.0				
7	7.30	1.27	0.9		6.90	6.9				
8	2.00	1.82	1.5		7.02	7.1				
9	13.22	1.29	1.40		7.01	7.09				
10	13.25	1.36	1.42		7.00	6.87				
11	11.05	1.44	1.45		6.98	6.94				
12	13.00	1.39	1.42		7.03	6.66				
13	7.55	1.26	0.99		6.92	7.11				
14	11.05	1.38	1.18		6.99	7.15				
15	2.30	1.28	1.2		7.05	7.1				
16	15.30	1.26	1.38		7.07	7.11				
17	2.10p	1.31	1.36		7.01	7.06				
18	9.30	1.21	1.23		6.89	6.81				
19	2.03	1.27	1.30		7.01	6.98				
20	7.00	1.32	1.36		6.93	6.86				
21	6.30	1.35	1.42		6.93	7.07				
22	2.00	1.20	1.2		7.04	7.1				
23	11.00	1.38	1.45		6.99	6.98				
24	8.30	1.28	1.30		6.97	7.03				
25	11.25	1.30	1.37		7.05	7.01				
26	11.10	1.31	1.55	Y	7.01	7.01				
27	8.07	1.27	1.20		6.97	7.22				
28	7.45	1.21	1.06		6.83	7.24				
29	10.45	1.52	1.45		6.95	7.00				
30	10.30	1.27	1.35		6.60	6.89				
31	14.20	1.27	0.97	Y	6.64	7.03				
Total										

© Water and Sewerage New Water & Sewerage Water Operation & Maintenance W-F0009_Macknade WTP Daily Log Sheet

Page 1 of 10

Figure 6-31. Example of excellent operational monitoring record-keeping – for Macknade WTP.



Figure 6-32. Larger-diameter water pipes stored in good conditions indoors.



Figure 6-33. Smaller-diameter water pipes stored in good conditions indoors.



Figure 6-34. Water parts and fittings stored in good conditions indoors.



Figure 6-35. Water meters with dual check valves.



Figure 6-36. Dedicated water works trailer.



Figure 6-37. Dedicated water works trailer properly equipped with appropriate parts and fittings.