

Drinking Water Management system
Bogan Shire Council

Annual Report 2017



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Executive Summary

This report provides the performance of drinking water system and the review of DWMS implementation and is based on the current reporting requirements and guidelines in place with the Australian Drinking Water Guidelines (ADWG; 2011), and the reporting requirements of NSW Health.

Critical Control Points(CCP)

	CCP1 Settling Process (Turbidity)	CCP1 Settling Process (pH)	CCP2 Filtering Process (Turbidity)	CCP3 Disinfection Process (Free Cl)	CCP4 Fluoridation Process (Fluoride)
Number Of Exceedances	0	0	111	0	N/A

Critical Operating Points (COP)

	COP1 Turbidity in Raw Water (Turbidity)	COP2 Fluoride in Reticulation (Fluoride)	COP3 Free Chlorine in Reticulation (Free Cl)	COP4 pH in Reticulation (pH)	COP5 Turbidity in Reticulation (Turbidity)
Number Of Exceedances	0	N/A	26	0	0

Water quality (NSW Health Comparison Report)

Characteristics	Sample Count	Number Of Characteristics	Number Of Characteristics Non-Compliant	Percent Compliant
Physical Characteristics	1	5	0	100%
Chemical Characteristics	1	19	0	100%
E coli	54	1	1	100%

Action and improvement plan

	Completed	In progress	Short term not started	Long term	Total
Number of actions	30	20	0	12	62

DWMS Reviews

Regular water quality committee meetings are held with Council as part of a broader Lower Macquarie Water Utilities Alliance project. Council prepares the water quality report which is used as the basis of discussion at these meetings. During these meetings, Hunter H2O reviews the

Council's water quality data, critical control points and compliance, customer complaints and progress with implementation of continuous improvement plan actions.

<i>Date</i>	<i>Reviewer</i>	<i>Scope</i>	<i>Summary of outcomes</i>	<i>Actions taken</i>
19/02/2015	Glenn Frnandes	Reviewing Chlorination system	Calculation of C.t value	Confirm the effective disinfection
		Reviewing Chemical dosing system	Proposed an alternative dosing arrangement	If current process fails only
	Lisa Procter	Reviewing CCPs and introducing COPS. Health Based Targets (HBTs) Limits were reviewed to more closely align with ADWG.	Reviewed CCPs and new COPS.	Reviewed 4- CCPs and 5 new COPS

Reservoir inspections

The entry hatch covers are not sealed and they need to be replaced with sealed hatch design. The existing hatches may cause to contaminate the drinking water. Upper cages on the internal ladder has to be removed to make the tank safe for diving.

<i>Date</i>	<i>Reservoirs inspected</i>	<i>Recommendations</i>	<i>Category</i>	<i>Corrective actions</i>
15/07/2014	Cobar St	Seal the entry hatch	Priority-1	Hatch has been sealed.
		Remove the upper cage of internal ladder	Priority-4	In progress
15/07/2014	Terangion St	Seal the entry hatch	Priority-1	Hatch has been sealed.
		Remove the upper cage of internal ladder	Priority-4	In progress

Contents

EXECUTIVE SUMMARY	I
Critical Control Points.....	i
Water quality.....	i
Action and improvement plan	i
DWMS Reviews	i
Reservoir inspections	ii
1 REPORT PURPOSE	1
2 SCHEME SUMMARY	1
3 DWMS DOCUMENT CONTROL	2
4 CRITICAL CONTROL POINTS	3
4.1 Critical limit exceedance.....	4
5 WATER QUALITY.....	6
5.1 Data collection.....	12
5.2 Non-compliant data.....	14
5.3 Water quality discussion	15
6 CONSUMER COMPLAINTS (OPTIONAL)	16
7 WATER QUALITY INCIDENTS	16
8 ACTION PLAN/IMPROVEMENT PLAN	167
9 REVIEW OF DWMS IMPLEMENTATION	20
10 RESERVOIR INSPECTIONS	23
APPENDIX A WATER QUALITY DATA	A-1
A.1 Water quality graphs.....	A-1
A.2 Water quality data summary.....	A-1
A.2.1 Raw Water	A-1
A.2.2 Treated Water	A-1
A.2.3 Reticulation.....	A-1
A.2.4 Verification monitoring (optional).....	A-2
APPENDIX B IMPROVEMENT / ACTION PLAN	B-3

Tables

Table 4-1. Summary of critical control points.....	3
Table 4-2. Summary of critical control points (CCP s) and critical operating points (COP s).....	3
Table 4-3. Critical control points (CCP s) exceedance.....	4
Table 4 4. Critical operating points (COP s) exceedance.....	5
Table 5-1. Summary of non-compliant water quality data.....	14
Table 7-1. Summary of incident and emergencies, recommendations and corrective actions	16
Table 8-1. Action/improvement plan activities that have been completed during the period 2012/2018.....	17
Table 8-1. Summary of internal reviews	20
Table 9-2. Summary of external reviews	20

Figures

Figure 4.1. Critical Control Points of Nyngan Water Treatment Plant	B-1
Figure 5.1. COP1 – Turbidity in Raw Water.....	6
Figure 5.2. CCP-1 – Settling Process - pH.....	7
Figure 5.3. CCP- 1 – Settling Process -Turbidity.....	7
Figure 5.4. CCP -2 – Filtering Process - Turbidity.....	8
Figure 5.5. CCP-3– Disinfection Process- Chlorine.....	9
Figure 5.6. COP-2– Fluoride in Reticulation System.....	9
Figure 5.7. COP -3 – Free chlorine in Reticulation system.....	10
Figure 5.8. COP -4 – pH in Reticulation system.....	11
Figure 5.9. Turbidity in Reticulation system.....	11

1 Report purpose

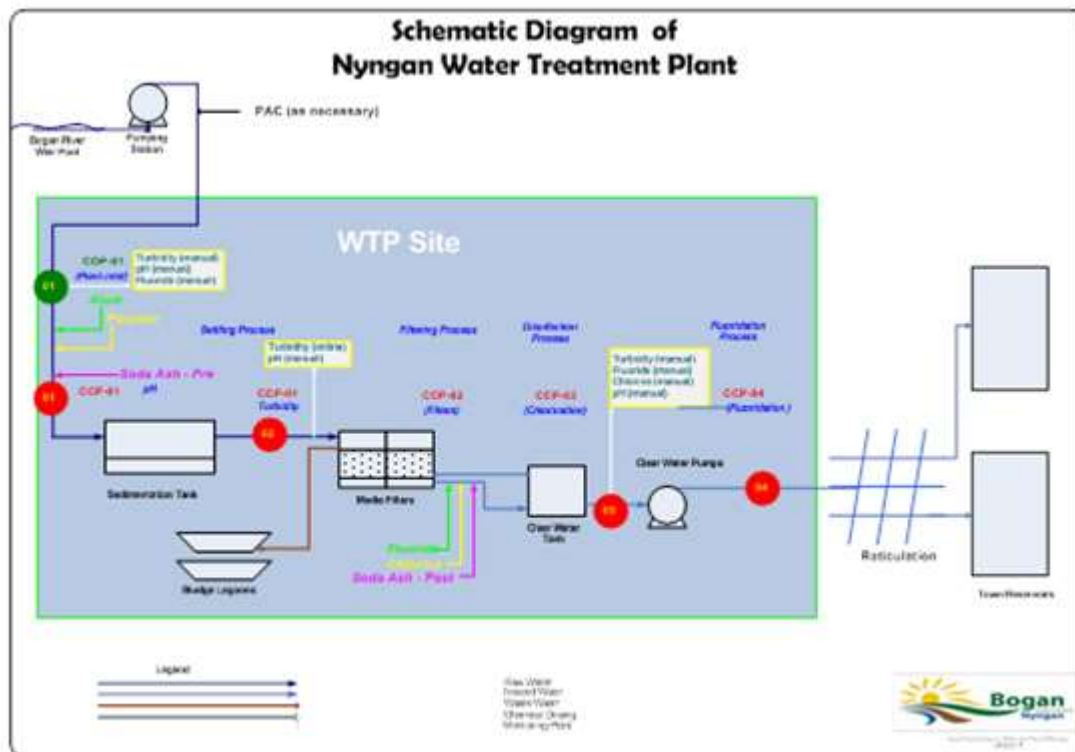
This reports documents DWMS implementation and drinking water performance for 2017 and satisfies the reporting (Element 10), evaluation (Element 11) and review and continual improvement (Element 12) requirements of Councils Drinking Water Management System (DWMS).

2 Scheme summary

The Bogan WTP pumps potable water to reticulation system and to two town reservoirs in reticulation system. Potable water is sourced from the Bogan River weir pool. The treatment plant consists of PAC dosing, coagulation, flocculation, sedimentation and filtration prior to disinfection and fluoridation. Fully automated new fluoridation plant has been granted by NSW Health but yet to be commissioned. Nyngan WTP has been upgraded with new clear SCADA system in 2017 and treated water is tested and delivered via pumping into the distribution system to over 1079 connections in Nyngan town supply

The Council is due to start fluoride dosing and are in the process of pre-commissioning the dosing system. Once the new SCADA is installed, commissioning will commence. The new SCADA is for the whole plant. And will incorporate additional monitoring (eg on-line turbidity meters for each of the 5 filters as well as the sedimentation tanks and clear water.

Additionally, the sodium hypochlorite dosing system was upgraded, with new pumps to be installed and the system will be connected to SCADA.



Checklist

Have there been any system upgrades within the reporting period?	<input checked="" type="checkbox"/>
Upgrade or system improvements details have been provided	<input checked="" type="checkbox"/>

3 DWMS document control

Any updates to DWMS documentation should be summarised here. Major changes should be submitted to NSW Health. The updated CCPs and new COPs are given below.

CCP number	Monitoring Parameter	Target criterion	Adjustment limit	Critical limit
1. Settling Process after Pre-Chemical Dosing Process	pH Turbidity	6 to 7 < 3 NTU	6 > pH > 7.8 5 > NTU > 3	5 > pH > 8 NTU > 10
2. Filtering Process After Dual Media Filters	Turbidity	0.2 NTU	0.2 > NTU > 0.5	NTU ≤ 0.2 for 95% pm NTU > 0.5 for 5% pm
3. Disinfection Process After Filtering	Chlorine (Free)	2.0 mg/L	2.5 > mg/L > 1.5	1 > mg/L > 4
4. Fluoridation Process After Filtering	Fluoride	1.0 mg/L	1.1 > mg/L < 0.9 (5% of lower and upper limits)	1.5 > mg/L > 0.9 mg/L for grater than 72 hours
COP - Critical Operating Points				
1. Turbidity in Raw Water	Turbidity	N/A	N/A	NTU > 500
2.				
3. Fluoride in reticulation System	Fluoride	1.0 mg/L	1.1 > mg/L < 0.9 (5% of lower and upper limits)	1.5 > mg/L > 0.9 mg/L for grater than 72 hours
4. Free Chlorine in Reticulation System	Chlorine (Free)	0.5 mg/L	2.5 > mg/L > 0.2	mg/L < 0.2
5. pH in Reticulation System	pH	6 to 7	6 > pH > 7.8	5 > pH > 8
6. Turbidity in Reticulation System	Turbidity	< 3 NTU	5 > NTU > 3	NTU > 10

Council is holding regular drinking water quality meetings, with the purpose of discussing water quality performance, customer complaints, progress with the improvement plan actions and identify new continuous improvement initiatives. Participants in these meetings include various Council employees such as operators, supervisors, technical support and managers as well as the local NSW Health representative and are facilitated by Hunter H2O. These meetings meet the requirements of a number of the Australian Drinking Water Guideline (ADWG) elements such as

- **Element 1** - commitment to drinking water quality management (e.g. management attending meetings)
- **Element 4** - Operational procedures and process control (e.g. review of results)
- **Element 5** - Verification of drinking water quality (e.g. review of sample locations, data, customer complaints)
- **Element 7** - Employee awareness and training (e.g. communication, participation, issue discussion)

Further water quality committee meetings are planned to be held during 2018.

Document	Version	Updates	Submitted to NSW Health and date submitted?
1 st Draft	Version-1	12/02/2018	23/02/2018

4 Critical control points

The initial CCPs were reviewed during year 2017 to work towards achieving the ADWG targets. Following changes were adopted

Table 4-1. Summary of critical control points (CCP s) Changes

CCP number	Monitoring Parameter	Initial Critical Limit	New Critical limit	Reasons
1. Settling Process after Pre-Chemical Dosing Process	Turbidity	NTU < 5	NTU < 10	pH and Turbidity parameters are monitored under one CCP 1 (Settling Process After Pre dosing)
2. Filtering Process After Duel Media Filters	Turbidity	NTU < 1.5 (Critical) 0.5 NTU (Target) 0.8 NTU (Adjustment)	NTU < 0.5 (Critical) 0.2 NTU (Target) 0.5 NTU (Adjustment)	Filtered water sampling point was changed to filter outlets and filtered water can be achieved lower turbidity value than earlier. However Health Based Targets cannot be achieved without any filter improvement. Filtering process is monitored as CCP 2
3. Disinfection Process After Filtering	Chlorine (Free)	> 3.5 mg/L	1 > mg/L >4	Free Chlorine level in Clear Water Sump is monitored to check the disinfection process as CCP 3.

Five (5) new **COPs** (Critical Operating Points) were added during 2017. The latest CCPs (Critical Control Points) implemented during 2017 for Nyngan Town Water system are shown in Table-4.2

Table 4-2. Summary of critical control points (CCP s) and critical operating points (COP s)

CCP number	Monitoring Parameter	Target criterion	Adjustment limit	Critical limit
5. Settling Process after Pre-Chemical Dosing Process	pH Turbidity	6 to 7 < 3 NTU	6 > pH > 7. 8 5 > NTU > 3	5 > pH > 8 NTU > 10
6. Filtering Process After Duel Media Filters	Turbidity	0.2 NTU	0.2 > NTU > 0.5	NTU <= 0.2 for 95% pm NTU > 0.5 for 5% pm
7. Disinfection Process After Filtering	Chlorine (Free)	2.0 mg/L	2.5 > mg/L > 1.5	1 > mg/L >4
8. Fluoridation Process After Filtering	Fluoride	1.0 mg/L	1.1 > mg/L < 0.9 (5% of lower and upper limits)	1.5 > mg/L > 0.9 mg/L for grater than 72 hours
COP - Critical Operating Points				
7. Turbidity in Raw Water	Turbidity	N/A	N/A	NTU > 500
8.				
9. Fluoride in reticulation System	Fluoride	1.0 mg/L	1.1 > mg/L < 0.9 (5% of lower and upper limits)	1.5 > mg/L > 0.9 mg/L for grater than 72 hours
10. Free Chlorine in Reticulation System	Chlorine (Free)	0.5 mg/L	2.5 > mg/L > 0.2	mg/L < 0.2
11. pH in Reticulation System	pH	6 to 7	6 > pH > 7. 8	5 > pH > 8
12. Turbidity in Reticulation System	Turbidity	< 3 NTU	5 > NTU > 3	NTU > 10

4.1 Critical limit exceedance

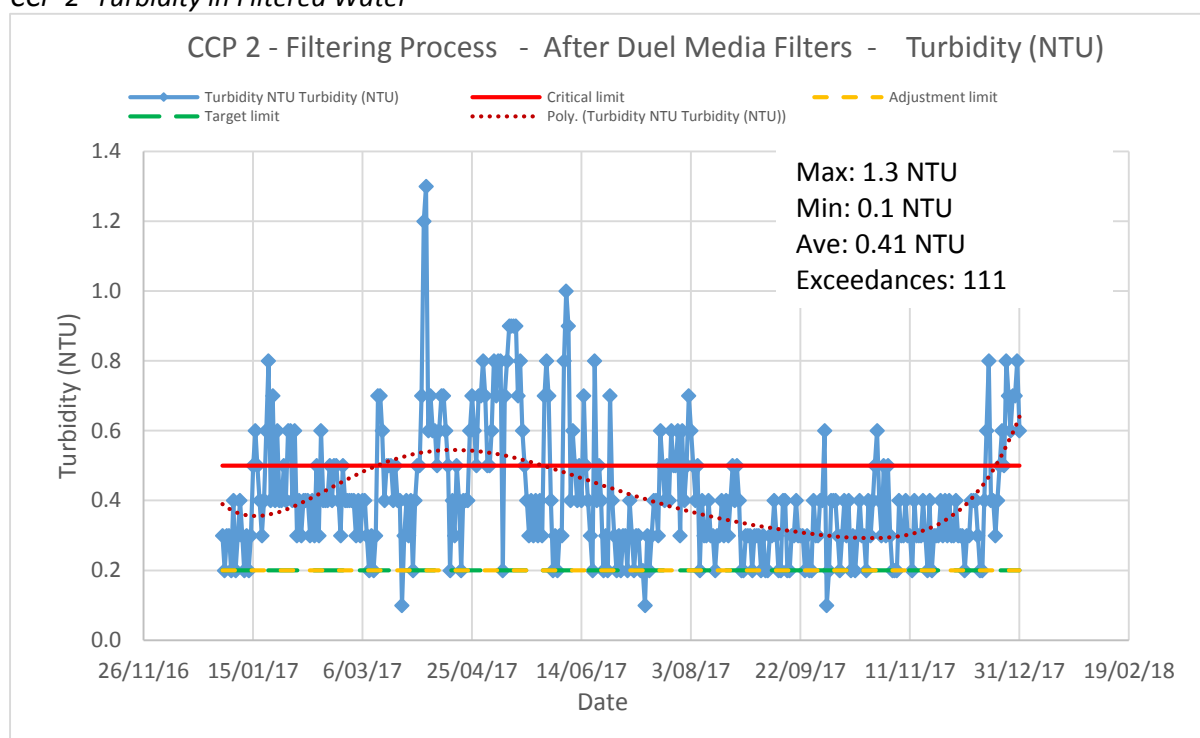
The performance of the critical control points should be reported in this section. A monitoring template is available that can be used to record and plot monitoring data.

Table 4.3 CCP2 (Filtered Water Turbidity) Critical Control Point (CCP) Exceedances

Critical Control Process	Parameter	Min	Ave	Max	Lower Critical Limit	Upper Critical Limit	Number of Exceedances	No. of Samples	% Compliance
CCP 1 Settling Process	Turbidity (NTU)	0.7	2.9	8.0		10.0	0	364	100%
	pH	5.8	6.5	7.5	5	8	0	365	100%
CCP 2 Treated Water Filters	Turbidity (NTU)	0.1	0.4	1.3		0.5	111	365	70%
CCP 3 Disinfection Process	Free Cl (mg/L)	1.6	2.2	3.0	1.0	4.0	0	365	100%
CCP 4 Fluoridation Process	Fluoride (mg/L)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

The more stringent upper critical limit for turbidity of <0.5 NTU was introduced in October 2017. The compliance results are based on assessment against this more stringent limit.

CCP-2- Turbidity in Filtered Water

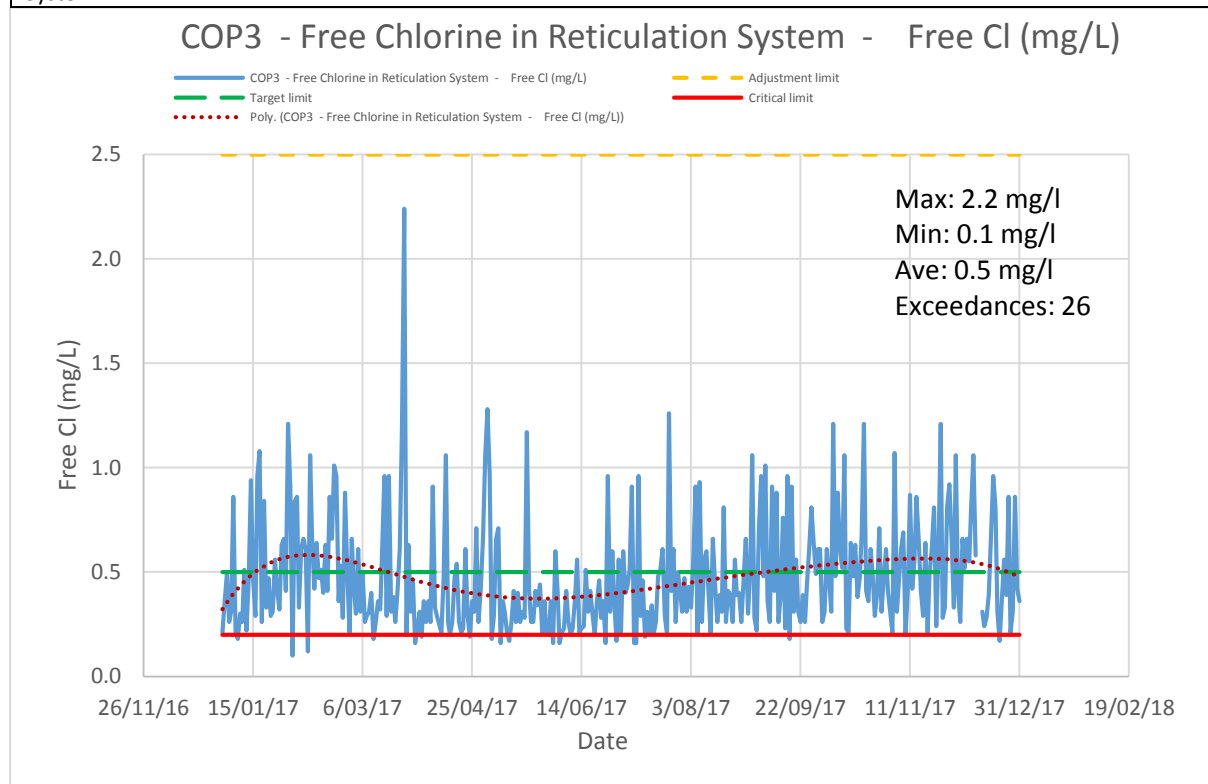


Filtered water turbidity of individual filters should be ≤ 0.2 NTU for 95% of the month and should not > 0.5 NTU for 15 consecutive minutes to meet the health based targets. However, the 99% of the turbidity values of filtered water are above the 0.2 NTU value and 30% of turbidity values are above 0.5 NTU. Automation of the backwash system, replacing of filter valves and filter media have been identified to overcome this situation. Funding has been requested under Safe and Secure Water Program (SSWP).

Critical Operating Point (COP) Exceedance

Table 4.4 Critical Operating Point (COP) Exceedance -COP-3- Free Chlorine in Reticulation System

Critical Operating Process	Parameter	Min	Ave	Max	Lower Critical Limit	Upper Critical Limit	Number of Exceedances	No. of Samples	% Compliance
COP 1 Raw Water Plant Inlet	Turbidity (NTU)	3	23.2	135	N/A	500	N/A	365	100%
COP 2 Fluoride in Reticulation System	Fluoride (mg/L)	N/A	N/A	N/A	0.9	1.5	N/A	N/A	N/A
COP 3 Free Chlorine in Reticulation System	Free Cl (mg/L)	0.1	0.5	2.2	0.2	3.5	26	367	93%
COP 4 pH in Reticulation System	pH	7.1	7.5	7.9	5	8	N/A	365	100%
COP 5 Turbidity in Reticulation System	Turbidity (NTU)	0.2	0.7	1.2	N/A	5	N/A	365	100%



As per the Australian Drinking Water Guidelines (ADWG) it is hard to maintain the free chlorine level at 0.2 mg/l throughout the reticulation system. There are 26 exceedance events have been recorded in 2017 and achieved only the 93% of ADWG compliance. This causes aged water in two town reservoirs and not having an inline chlorine booster in systems at reticulation boundaries. Therefore, aged water mixing systems for reservoirs and Chlorine booster system for reticulation system were identified to maintain the 0.2 mg/l chlorine residual water through-out the reticulation system. Funding has been requested under Safe and Secure Water Program (SSWP).

5 Water Quality

Reviewing of water quality data and longer term trends from 2008 to 2017.

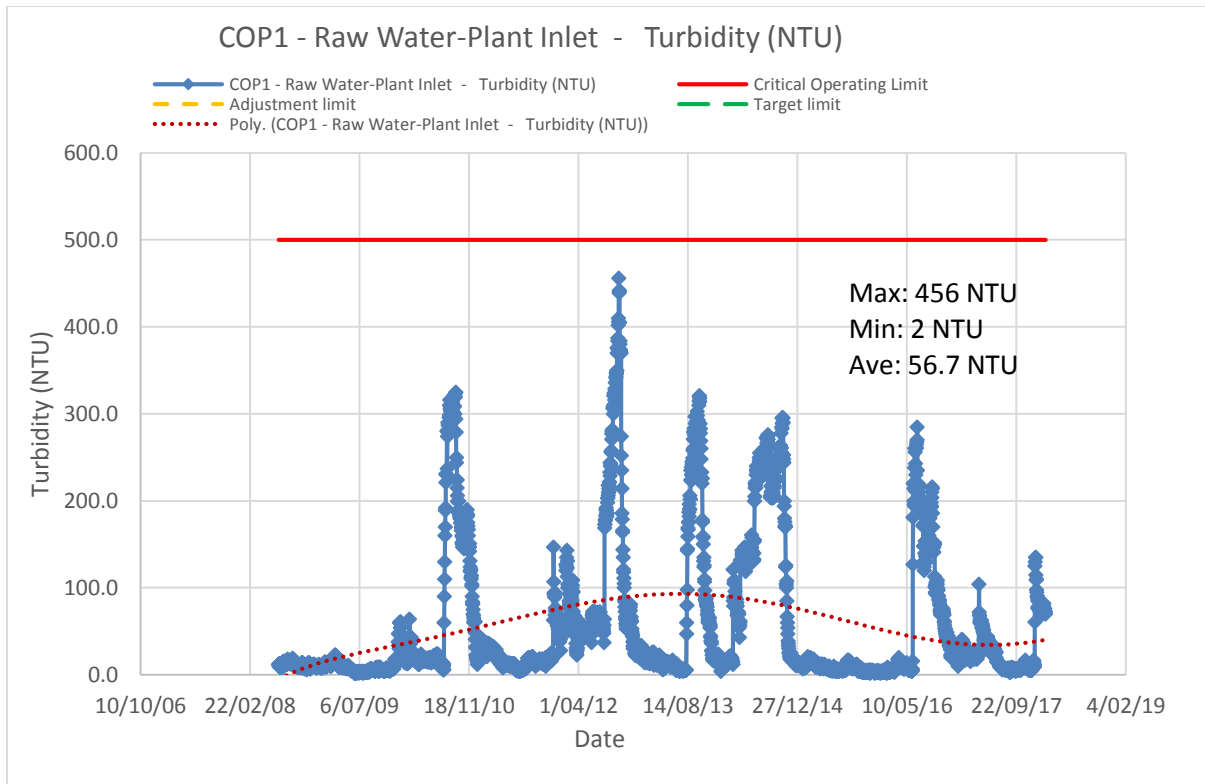


Figure 5.1: COP1 – Turbidity in Raw Water

Generally, Nyngan gets heavy rains in spring time from September to November. During this season Bogan river flows with high turbid water. This is the only time Nyngan water supply can use the river water. Otherwise Nyngan gets low turbid water from Albert Priest Chanel. As per the trend we could expect some high turbid Bogan flows in spring seasons.

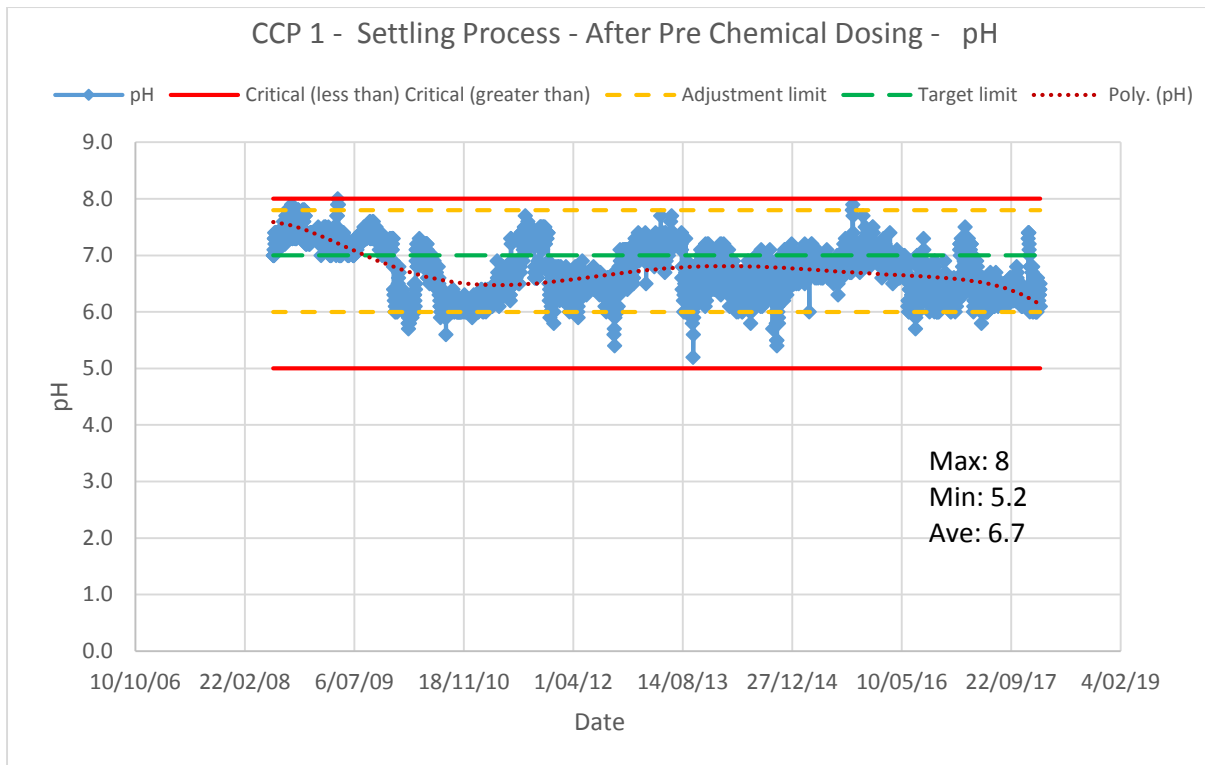


Figure 5 2 - CCP-1 – Settling Process - pH

Pre dose soda ash dosing system does operate reliably within the adjustment limits since 2008. There were no incidents recorded since 2008 and pH correction is consistence and uniform over the period.

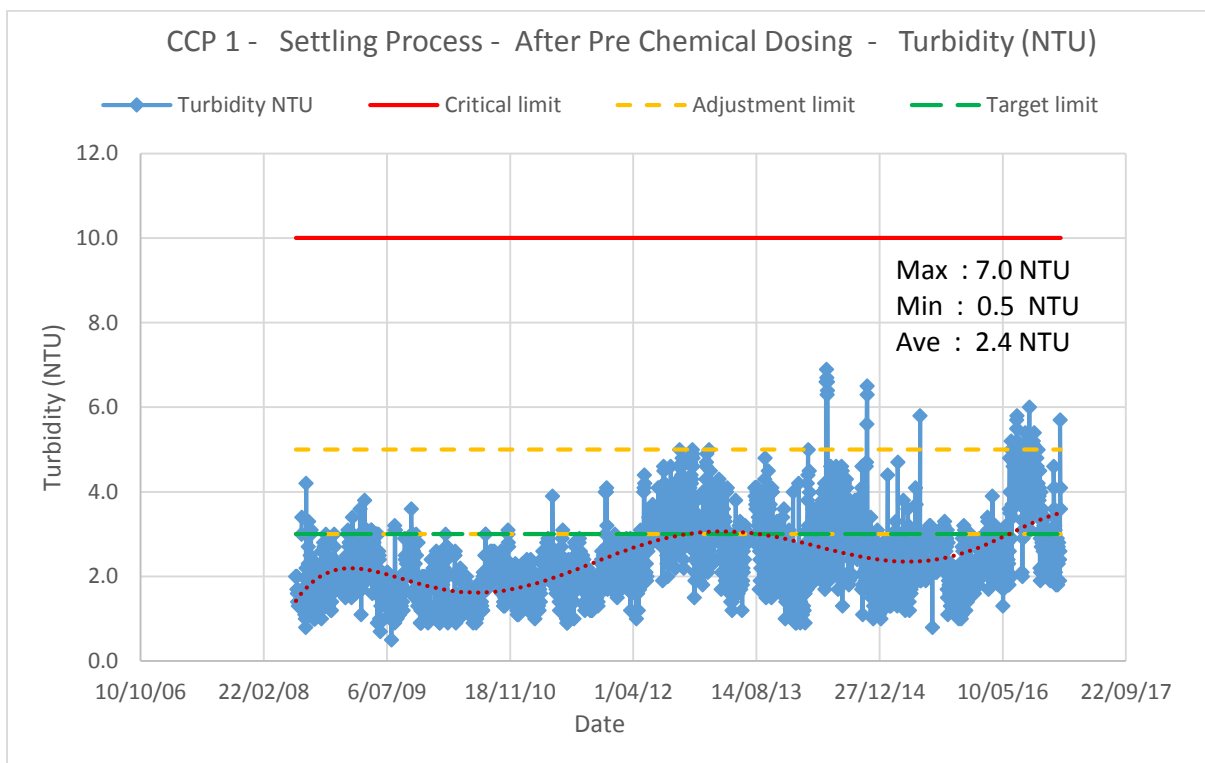


Figure 5.3 - CCP- 1 – Settling Process -Turbidity

Water flocculation and sedimentation process is within the critical control limits over a period of 8 years. Trend line shows that this system produces average of 2.4 NTU water.

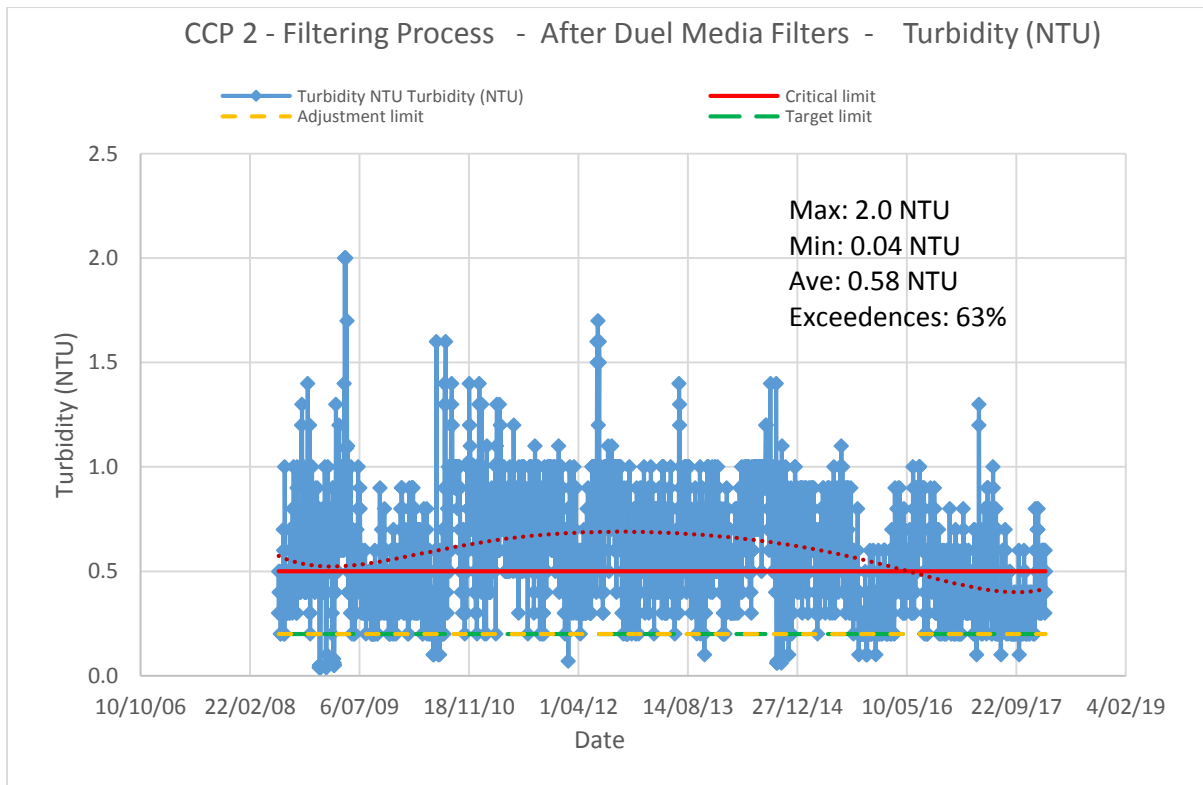


Figure 5.4 - CCP -2 – Filtering Process - Turbidity

There was an error of sampling procedure .Samples have been taken out from the distribution line to monitor the filtered water turbidity since 2008. Therefore 15 exceedances were recorded .However this error was rectified by taking samples from filter outlets from mid of 2015 and trend of filter operation has been improved to average of 0.6 NTU.

However, comparison with the Health Based Targets (HBT), the Nyngan filtered water does not achieve the target of 0.2 NTU for 99% of its operations. Even with the comparison of upper limit of HBT, 0.5 NTU, still 63% exceedance events have been recorded since 2018 to 2017.

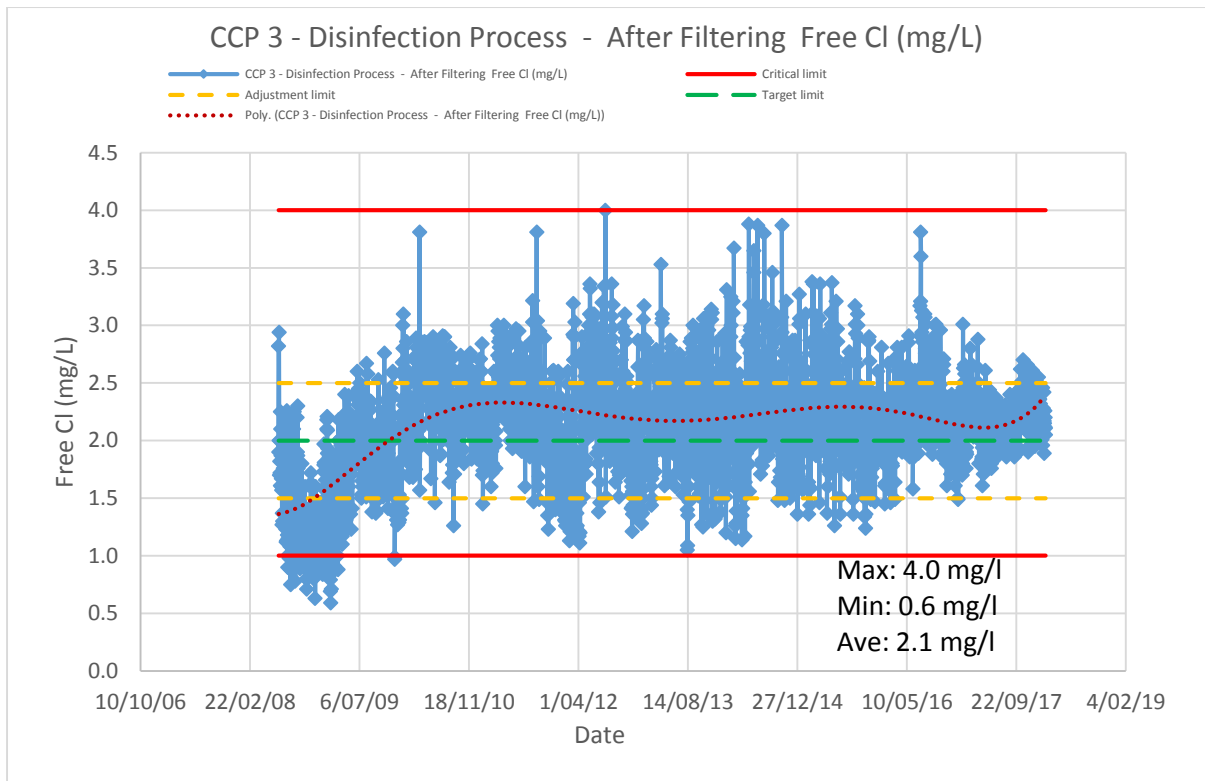


Figure 5.5 - CCP-3– Disinfection Process- Chlorine

There were 58 exceedance events were recorded in 2008 and after 2008, hypochlorite dosing process operates within the critical control limits. Trend shows that the free chlorine level of treated water has been gradually increased and approximately fluctuating around 2.5 mg/L to maintain the free chlorine level in reticulation.

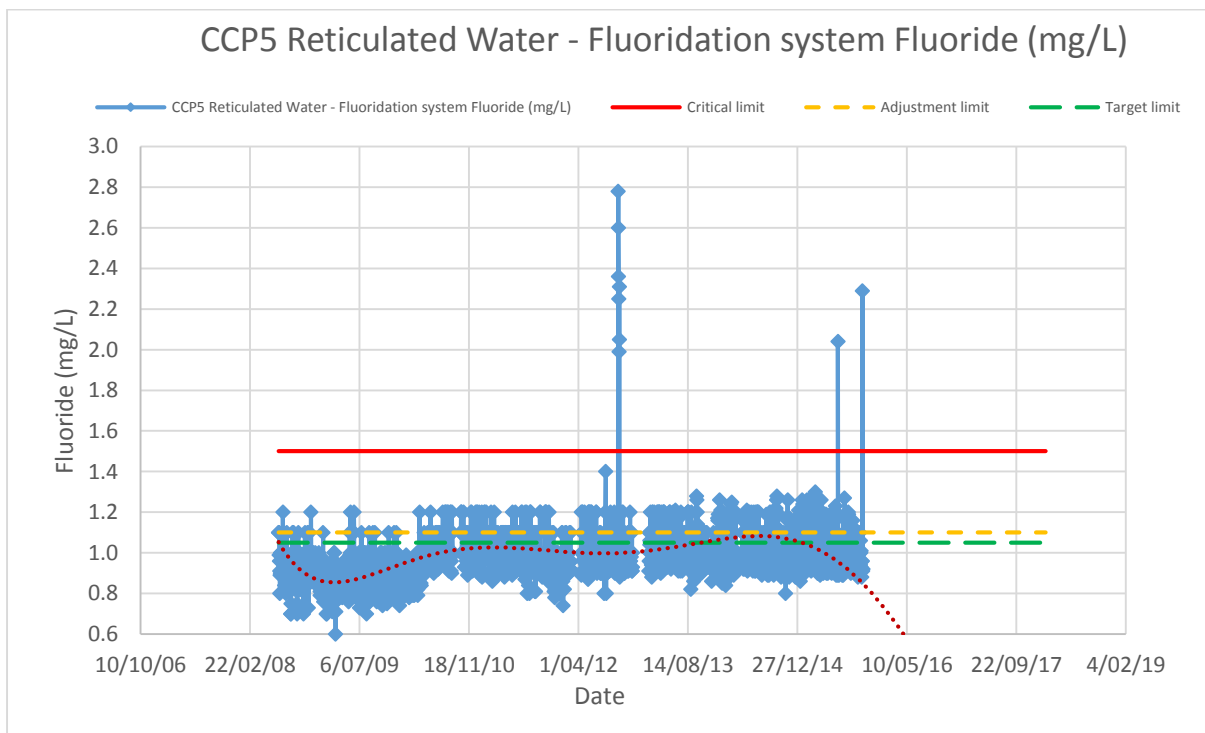


Figure 5.6 - COP-2– Fluoride in Reticulation System

The existing Fluoridation system is not compliant with the NSW guidelines. There were 513 noncompliance incidents were recorded over a period of 8 years and the percentage of exceedence is 21%. There is a trend of increasing fluoride concentration with current operation. However, the fluoridation system was shut down from 23rd of October 2015, due to reporting of high concentration of fluoride in reticulation system. New fluoride plant to be commissioned soon.

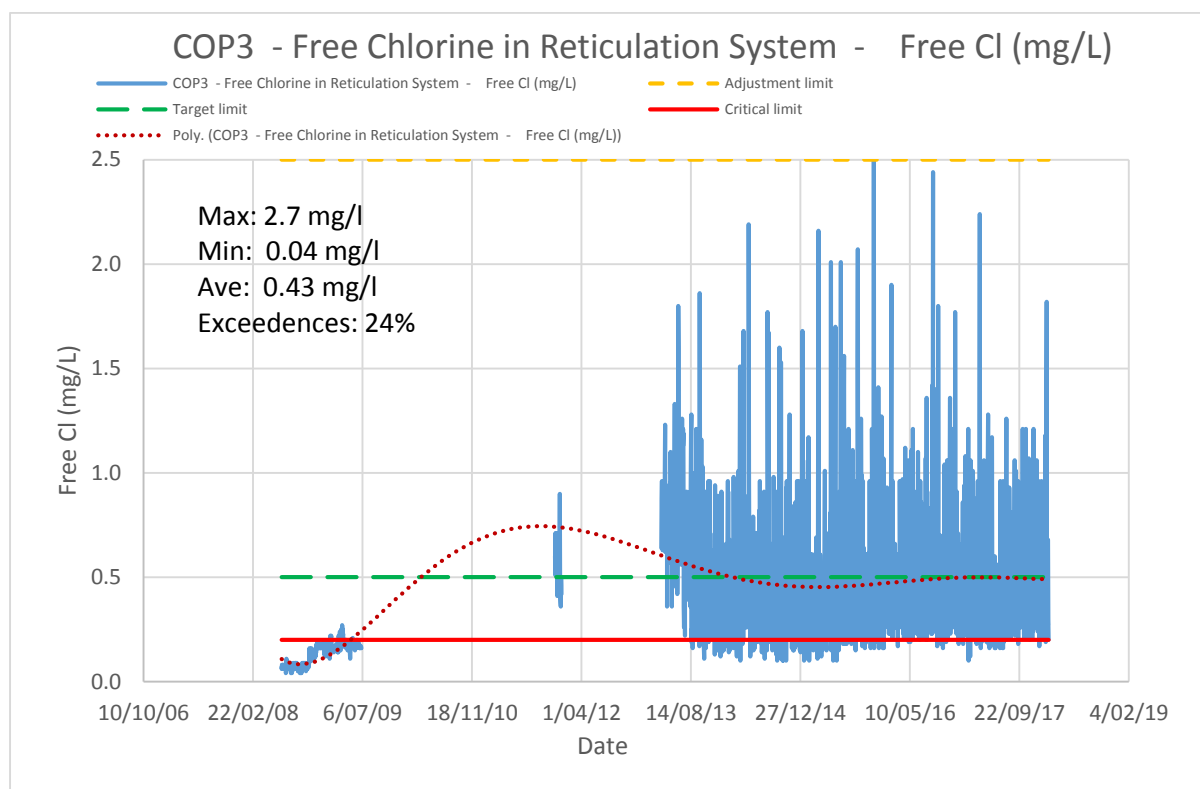


Figure 5.7 - COP -3 – Free chlorine in Reticulation system.

Data available only for four year period since 2012. There were 138 incidents recorded as exceedances in last four years. The major issue is to maintain the minimum free chlorine concentration above the 0.2 mg/L level in reticulation system. Trend line shows that average level of free chlorine level is increasing approximately from 0.5 to 1. Therefore, aged water mixing systems for reservoirs and Chlorine booster system for reticulation system were identified to maintain the 0.2 mg/l water through-out the reticulation system. Funding has been requested under Safe and Secure Water Program (SSWP).

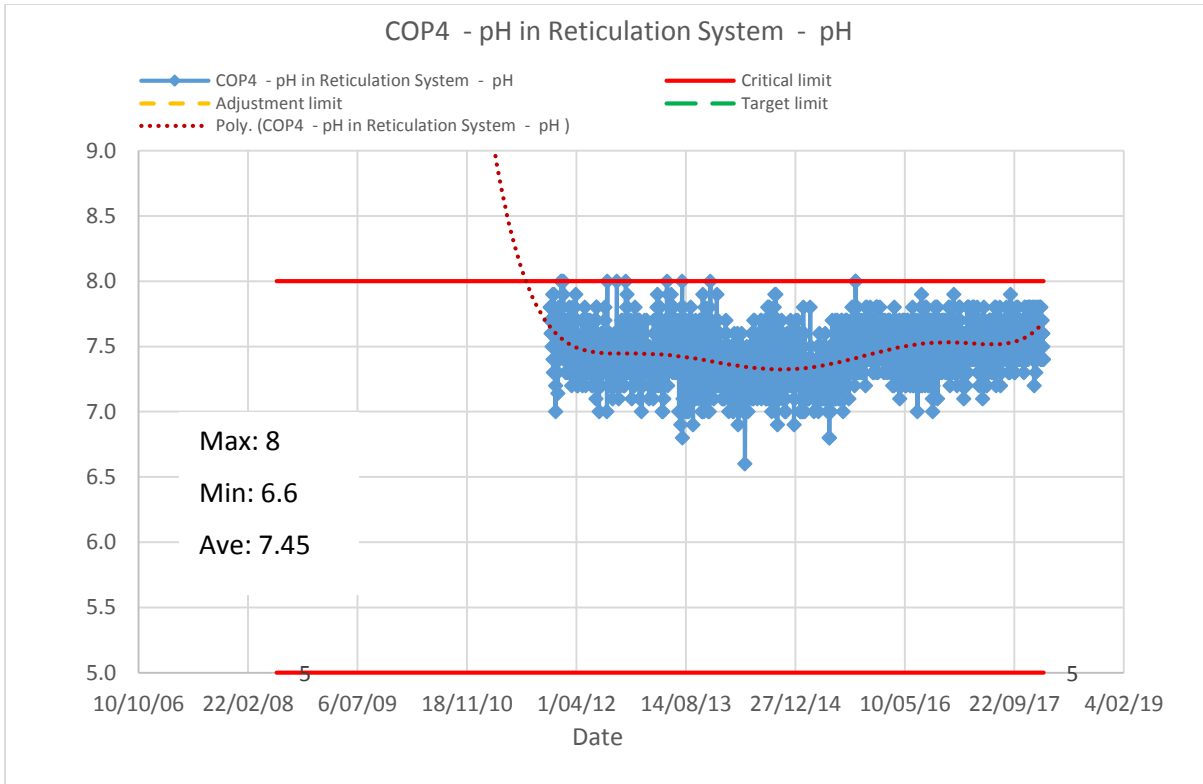


Figure 5.8 - COP -4 – pH in Reticulation system.

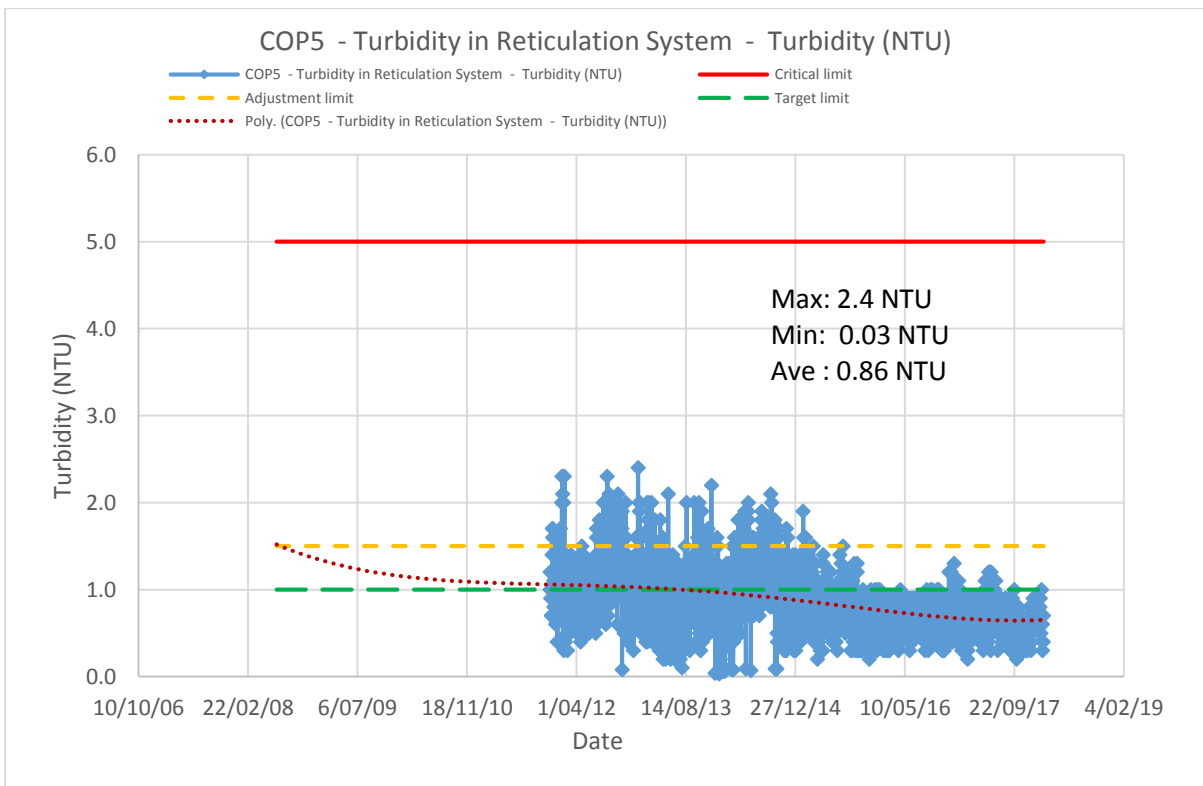


Figure 5.9 - COP -5 – Turbidity in Reticulation system.

5.1 Data collection

Nyngan water supply system has established daily data collection and weekly data entering system. Four data sheets provide the all relevant data for critical control point monitoring. Each data sheet provides following information.

Water Data Sheet 1

- *Weather condition (temperature) , River water levels and Channel operations*

Water Data Sheet 2

- *Raw water quality (Turbidity, Colour, pH, Fluoride)*
- *Treated water quality (Turbidity, Colour, pH, Free Chlorine, Total Chlorine, Fluoride)*
- *Clarifier water quality (Turbidity, pH)*
- *Chemical usage (Alum, Soda Ash (pre),Soda Ash (post),Polyelectrolyte, Pre– Chloride, Post-Chloride, Fluoride)*

Water Data Sheet 3

- *Raw water flow rate, rated water flow rate, backwash flow rate, Sludge pumping rate*

Water Data Sheet 4

- *Water quality of reticulation system (pH, Free Chlorine, Total chlorine, Fluoride, Turbidity)*

Water data collection procedure is given bellow.



WATER PROCEDURES DATA ENTRY

Weekly Water Data Inputs

Water 1 - Water & Filtration Plant Report – Blue Sheet

In the first section:

Find this data off the internet by going into the site:

<http://www.bom.gov.au/climate/dwo/201309/html/IDCJDW2103.201309.shtml>

Select the month and enter off the data

All the rest follow the sheets as the setup is the same as the document you are entering off just look for the tabs and columns that correspondence.



Water 1 – Water & Filtration Plant

Water 2 – Filtration Plant Water Quality – Green Sheet

Water 3 – Water Consumption Report – Pink Sheet

Water 4 – Reticulation System Quality Samples – White Sheet



All in one excel documents under different tabs down the bottom.

Where to find it to enter:

<S:\Engineering\Water and Sewerage\REGISTER - WATER.xlsx>

5.2 Non-compliant data

Except the recorded eight incidents with high total coliform in reticulation system no any non-compliant data findings or water quality issues in addition to critical limit exceedances during the reporting year.

Table 5-1. Summary of non-compliant water quality data (Source of data: NSW Health)

Date	Location	Parameter	Exceedance	Correction	Corrective action	Notes
10/01/2017	Reticulation	Total Coliforms	4 mpn/ 100 ml	Flushing, retest	Review of maintenance schedule	Pipe break
31/01/2017	Reticulation	Total Coliforms	25mpn/ 100 ml	Flushing, retest	Review of maintenance schedule	Pipe break
08/02/2017	Reticulation	Total Coliforms	1 mpn / 100 ml	Flushing, retest	Review of maintenance schedule	Late sample
28/02/2017	Reticulation	Total Coliforms	2 mpn/ 100 ml	Flushing, retest	Review of maintenance schedule	Pipe break
04/04/2017	Reticulation	Aluminium	0.38 mg/l	Flushing, retest	Review of maintenance schedule	Sudden increase of raw water turbidity and high dosage of alum
11/07/2017	Reticulation	E.coli	1 mpn/ 100 ml	Re sample	Review the sampling procedures	Sample error
11/07/2017	Reticulation	Total Coliforms	1 mpn/ 100 ml	Flushing, retest	Review of maintenance schedule	Pipe break

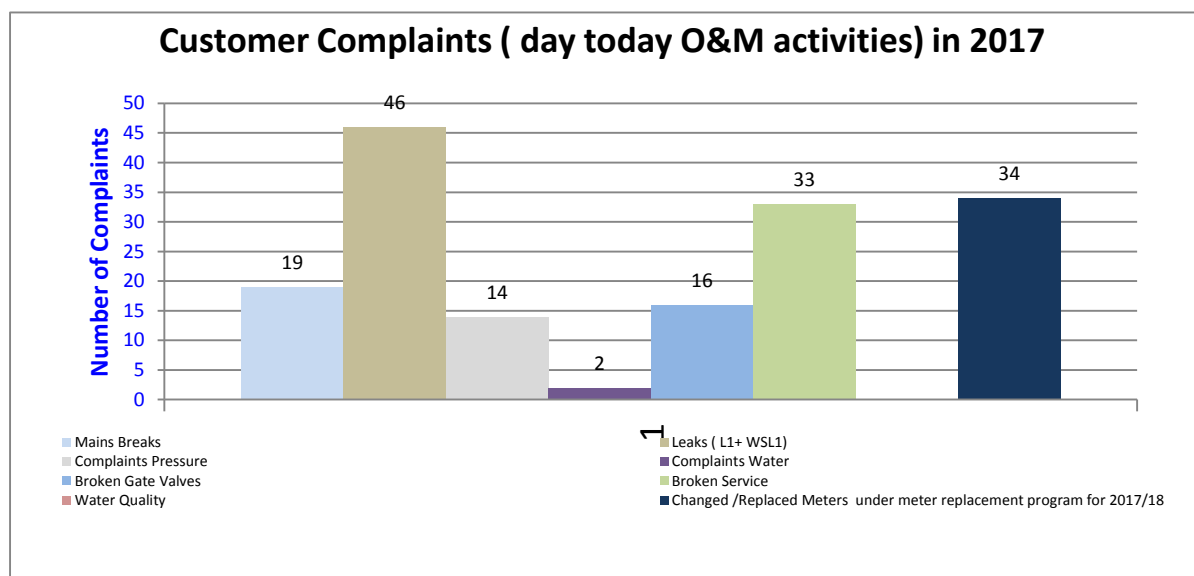
Analysis Type	Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline
Chemistry	Aluminium	0.2000	mg/L	0.3800	0.3800	0.0000	0.38	0.38	1	1	0.38	0.38	0.00
	Antimony	0.0030	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	1	0	0.0005	0.0005	100.00
	Arsenic	0.0100	mg/L	0.0005	0.0005	0.0000	0.0005	0.0005	1	0	0.0005	0.0005	100.00
	Barium	2.0000	mg/L	0.0590	0.0590	0.0000	0.059	0.059	1	0	0.059	0.059	100.00
	Boron	4.0000	mg/L	0.0500	0.0500	0.0000	0.05	0.05	1	0	0.05	0.05	100.00
	Cadmium	0.0020	mg/L	0.0003	0.0003	0.0000	0.00025	0.00025	1	0	0.00025	0.00025	100.00
	Calcium	10000.0000	mg/L	21.50000	21.50000	0.0000	21.5	21.5	1	0	21.5	21.5	100.00
	Chloride	250.00000	mg/L	42.00000	42.00000	0.0000	42	42	1	0	42	42	100.00
	Chromium	0.0500	mg/L	0.0025	0.0025	0.0000	0.0025	0.0025	1	0	0.0025	0.0025	100.00
	Copper	2.0000	mg/L	0.0025	0.0025	0.0000	0.0025	0.0025	1	0	0.0025	0.0025	100.00
	Fluoride	1.5000	mg/L	0.1900	0.1900	0.0000	0.19	0.19	1	0	0.19	0.19	100.00
	Iodine	0.5000	mg/L	0.0300	0.0300	0.0000	0.03	0.03	1	0	0.03	0.03	100.00
	Iron	0.3000	mg/L	0.0100	0.0100	0.0000	0.01	0.01	1	0	0.01	0.01	100.00
	Lead	0.0100	mg/L	0.0030	0.0030	0.0000	0.003	0.003	1	0	0.003	0.003	100.00
	Magnesium	10000.0000	mg/L	10.1300	10.1300	0.0000	10.13	10.13	1	0	10.13	10.13	100.00
	Manganese	0.5000	mg/L	0.0100	0.0100	0.0000	0.01	0.01	1	0	0.01	0.01	100.00
	Mercury	0.0010	mg/L	0.0001	0.0001	0.0000	0.00005	0.00005	1	0	0.00005	0.00005	100.00
	Molybdenum	0.0500	mg/L	0.0025	0.0025	0.0000	0.0025	0.0025	1	0	0.0025	0.0025	100.00
	Nickel	0.0200	mg/L	0.0050	0.0050	0.0000	0.005	0.005	1	0	0.005	0.005	100.00
	Nitrate	50.0000	mg/L	0.5000	0.5000	0.0000	0.5	0.5	1	0	0.5	0.5	100.00
	Nitrite	3.0000	mg/L	0.0500	0.0500	0.0000	0.05	0.05	1	0	0.05	0.05	100.00
	pH	6.5 - 8.5		7.9000	7.9000	0.0000	7.9	7.9	1	0	7.9	7.9	100.00
	Selenium	0.0100	mg/L	0.0010	0.0010	0.0000	0.001	0.001	1	0	0.001	0.001	100.00
	Silver	0.1000	mg/L	0.0010	0.0010	0.0000	0.001	0.001	1	0	0.001	0.001	100.00
	Sodium	180.0000	mg/L	28.0000	28.0000	0.0000	28	28	1	0	28	28	100.00
	Sulfate	500.0000	mg/L	14.0000	14.0000	0.0000	14	14	1	0	14	14	100.00
	Total Dissolved Solids (TDS)	600.0000	mg/L	168.0000	168.0000	0.0000	168	168	1	0	168	168	100.00
	Total Hardness as CaCO3	200.0000	mg/L	95.4000	95.4000	0.0000	95.4	95.4	1	0	95.4	95.4	100.00
	True Colour	15.0000	Hazen Units (HU)	2.0000	2.0000	0.0000	2	2	1	0	2	2	100.00
	Turbidity	5.0000	NTU	0.0500	0.0500	0.0000	0.05	0.05	1	0	0.05	0.05	100.00
Zinc	3.0000	mg/L	0.0200	0.0200	0.0000	0.02	0.02	1	0	0.02	0.02	100.00	
Microbiology	E. coli	0.0000	mpn/100 mL	0.0185	0.0000	0.1361	0	1	54	1	0	0	98.15
	Free Chlorine	0.2 - 5	mg/L	0.7882	0.5200	0.6197	0.21	2.78	57	0	2.01	0.29	100.00
	pH	6.5 - 8.5		7.5632	7.6000	0.1789	7.1	7.9	57	0	7.9	7.3	100.00
	Total Chlorine	5.0000	mg/L	1.0561	0.9100	0.5903	0.2	2.9	57	0	2.28	0.41	100.00
	Total Coliforms	0.0000	mpn/100 mL	0.6111	0.0000	3.4390	0	25	54	5	2	0	90.74
	Turbidity	5.0000	NTU	0.6463	0.7000	0.2213	0.2	0.94	57	0	0.9	0.2	100.00

5.3 Water quality discussion

There were no positive microbiological results recorded in this reporting year (except for 1 result, which was the result of a sampling error).

A summary of water quality data available as an Appendix.

6 Consumer complaints (Day today Operational and Maintenance Activities)



7 Water quality incidents

No Incidents

Table 7-1. Summary of incident and emergencies, recommendations and corrective actions

Details of incident/emergency	Investigation recommendations	Corrective action undertaken
<i>E coli reported in a sample</i>	<i>Repeat sampling Inform to NSW Health</i>	<i>Repeat sampling Clarified it as a sampling error. Review the sampling procedures</i>

8 Action plan/Improvement plan

A summary of the action/improvement plan activities that have been implemented during the period 2012/2015 is included in Table 8-1. The full action and improvement plan is included in Appendix B.

Table 8-1. Action/improvement plan activities that have been completed during the period 2012/2018

Action no.	Item	Status
4.1	<i>Develop and implement a reticulation monitoring program to ensure the free chlorine residual in the distribution system is in-line with the NOW office of Water guidance (greater than 0.2 mg/L throughout the system).</i>	<i>Implemented as CCP 3</i>
4.2	<i>Develop procedures and log sheets for the calibration of chemical dosing systems</i>	<i>Instrument calibration LMWUA s project- In progress</i>
5.4	<i>Document daily testing procedures including the review of the water quality results at the water treatment plant.</i>	<i>Implemented</i>
5.5	<i>The DWMS document must be updated to state who is responsible for reviewing the results in the NSW Drinking Water Database. Reviews must be conducted after the results of each microbial sample and monthly for trends and water quality implications.</i>	<i>Implemented- In progress</i>
5.6	<i>Document daily testing procedures including who undertakes the daily review of the water quality results at the water treatment plant.</i>	<i>Implemented</i>
6.8	<i>Develop a contact list of key people, agencies and businesses for a water quality emergency in line with the NSW Guidance.</i>	<i>Part of IRP</i>
6.9	<i>Document in the DWMS where controlled copies of the emergency contact list is kept.</i>	<i>controlled</i>
6.10	<i>Document which agencies should be notified and under what circumstances and who is authorised to notify.</i>	<i>Part of IRP</i>
11.9	<i>C.t should be calculated.</i>	<i>Done by Public Work</i>
1.13	<i>Ensure Staff and Councillors are aware of the National Health Guidelines which include the development of a Drinking Water Quality Management Plan.</i>	<i>Implemented</i>
2.14	<i>Prepare relevant SOPs and make sure they are practised by the operators.</i>	<i>Implemented</i>
3.15	<i>Ensure Critical Control Points are documented.</i>	<i>Implemented</i>
3.16	<i>Ensure Critical Control Points are monitored.</i>	<i>Implemented</i>
4.17	<i>Implement the operational procedures that were developed</i>	<i>Implemented</i>
4.18	<i>Include these procedures in the O&M manual and ensure they are also located where the activity is undertaken</i>	<i>Displayed in the plant room</i>
4.19	<i>Document corrective actions for critical control points</i>	<i>Implemented</i>
5.20	<i>Document all operational procedures</i>	<i>Implemented</i>
6.21	<i>Formalise how incidents and emergencies and reviewed and protocols updated.</i>	<i>Implemented</i>
1.22	<i>Ensure regular (weekly or fortnightly) toolbox style meetings are held with technical and operational staff to ensure staff understands the practical implications and application of formal and regulatory requirements and to allow two way communication of issues. Minutes should be kept of these meetings.</i>	<i>Implemented</i>

Action no.	Item	Status
2.23	<i>Develop a formal maintenance schedule for sludge rake and other equipment in the water supply system.</i>	<i>Implemented</i>
2.25	<i>Consider daily recording of weather conditions and river flows with raw water turbidity.</i>	<i>Implemented</i>
2.26	<i>Consider installing an on-line turbidity meter to measured filtered water</i>	<i>Implemented</i>
2.27	<i>Consider automating filter backwash</i>	<i>SCADA system-In progress</i>
2.28	<i>Monitor filtered water turbidity data over a filter run to determine filter characteristics</i>	<i>SCADA system-In progress</i>
2.29	<i>Formalise reticulation testing program and log all results. Test for chlorine prior to flushing.</i>	<i>Implemented</i>
4.30	<i>Ensure these procedures are held in an operations and maintenance manual</i>	<i>In progress</i>
4.31	<i>Extend the documentation to include the daily monitoring;</i>	<i>Implemented</i>
4.32	<i>Document all corrective actions and formalise associated communication protocol</i>	<i>In Progress</i>
5.33	<i>Ensure turbidity, Cl, pH and F are added to the daily log sheet.</i>	<i>Implemented</i>
5.34	<i>Formalise water quality monitoring schedule for the distribution.</i>	<i>Implemented</i>
5.35	<i>Improve complaint recording through TRIM</i>	<i>In progress</i>
6.36	<i>Document what information is assessed for the NOW performance reporting forms</i>	<i>Implemented</i>
7.37	<i>Regular (weekly or fortnightly) toolbox style meetings should be held with technical and operational staff to ensure two way communication of issues. Minutes should be kept.</i>	<i>Implemented</i>
7.38	<i>Develop and maintain a formalised training program for the employees.</i>	<i>Implemented- In progress</i>
7.39	<i>Share knowledge among the members of LMWUA and other neighbour Councils.</i>	<i>Implemented- In progress</i>
8.40	<i>Ensure water quality is considered during the community consultation as planned under objectives 6 and 7 of SBP 2007/08.</i>	<i>Implemented- In progress</i>
9.42	<i>Participate in research programs and technical/operational workshops organised by LMWUA.</i>	<i>Implemented - In progress</i>
9.43	<i>Undertaking investigative work to determine suitable upgrading method for the existing Nyngan WTP</i>	<i>SCADA system-In progress</i>
11.44	<i>Long term water quality and performance data logs including trends and results should be kept in a designated electronic file location</i>	<i>Implemented SCADA system-In progress</i>
4.50	<i>Ensure sufficient funds are available to fund asset maintenance and replacement, through the development of the management plan or strategic business plan</i>	<i>Implemented \$60,000 budget allocated for main replacement in 2015</i>
5.52	<i>Document how customer complaints are used to inform system maintenance programs (e.g. flushing programs or pipeline replacement).</i>	<i>Implemented- Mainly on breaks and asset life – In progress</i>
5.53	<i>Document internal and external reporting measures for water quality monitoring.</i>	<i>Implemented</i>
5.54	<i>Document corrective procedures and communication systems for other non-conformances.</i>	<i>Implemented- In progress</i>

Action no.	Item	Status
6.55	<i>Develop formal incident log sheets for recording of incident and management actions undertaken and for use in debriefing sessions</i>	<i>Implemented- In progress</i>
6.56	<i>Develop and incident and emergency response plan which contains information to guide staff in an incident and emergency. Ensure hard copies are controlled and available.</i>	<i>Part of IRP</i>
8.57	<i>Review Council's involvement in the Save Water alliance to improve communication with consumers.</i>	<i>Implemented with LMWUA</i>
11.61	<i>Establish procedures for long term performance evaluation of the water business within LMWUA.</i>	<i>Involved in the Water Security Program – In progress</i>
12.62	<i>Formalise management review of the water business</i>	<i>Involved in the Water Security Program – In progress</i>
4.67	<i>Replace the existing fluoridation system with a new system that complies with the NSW Code of Practice for Fluoridation of Public Water Supplies.</i>	<i>In progress with NSW Health and Public Work Dept</i>

9 Review of DWMS implementation

NSW Public Works has done a review on 19h February 2015

Table 9-1. Summary of internal reviews

<i>Element</i>	<i>Component</i>	<i>Finding</i>	<i>Action</i>
N/A	N/A	N/A	N/A

Table 9-2. Summary of external reviews

<i>Date</i>	<i>Reviewer</i>	<i>Scope</i>	<i>Summary of outcomes</i>	<i>Actions taken</i>
19/02/2015	Glenn Frnandes	Reviewing Chlorination system	Calculation of C.t value	Confirm the effective disinfection
		Reviewing Chemical dosing system	Proposed an alternative dosing arrangement	If current process fails only
	Lisa Procter	Reviewing CCPs and introducing COPs. Health Based Targets (HBTs) Limits were reviewed to more closely align with ADWG	New CCPs and new COPs. Level of Turbidity of filtered water	Established 4- CCPs and 3- COPs

Additionally, Council commenced holding regular drinking water quality committee meetings in November 2016 and these meetings include an agenda item to identify any actions that can improve the management of and quality of drinking water supplied to the community. Actions identified in these meetings are shown in Table 9 1.

Action number	Update/action	Due	Action By	Progress	Status
NynSC Sept16.1	Review of water quality data to include June – Sept and Sept – Dec	December 2016	Bogan SC	Mar 17: this assessment has been undertaken	Complete
NynSC Sept16.2	Review Gap Improvement Items and provide update	December 2016	Bogan SC		Ongoing
NynSC Sept16.3	Provide the Risk Assessment improvement plan for review next meeting	December 2016	Bogan SC		
NynSC Sept16.4	Update the Turbidity limits to reflect the ADWG levels on the reporting sheets	December 2016	Bogan SC	Mar 17: Council is considering lowering the critical limit to 1NTU July 2017: Target and alert limits have been lowered. Still to consider whether to adjust the critical limit	Complete
NynSC Dec16.1	Review the CCPs: <ul style="list-style-type: none"> The CCP for the Clear Water Tank could be reduced to 1 NTU There was discussion on the reservoir arrangement, and potentially the need to set a Critical operational target (COP) for the reservoirs inspections and reticulation for turbidity and chlorine The CCP for Fluoride required checking against the NSW Fluoridation Code of practice 	Mar 2016	Bogan SC	July 17: NSW Health requirements for fluoride are as follows: <ul style="list-style-type: none"> Daily results should be as close as possible to 1 mg/L, and in the range of 0.9 mg/L to 1.5 mg/L Any fluoride monitoring (calculated or tested) returns a result of greater than 1.5 mg/L needs to be notified via a form 5 to NSW Health Three consecutive daily monitoring results are less than 0.9 mg/L needs to be notified via a form 5 to NSW Health 	Complete
NynSC Mar17.1	Council to provide the latest copy of CCP's for the next meeting	July 2017	Bogan SC	July 17: Latest CCP's included in the quarterly report	Complete
NynSC Mar17.1	Consider modifying for CCP for filtered water turbidity: <ul style="list-style-type: none"> Operational target 0.2 to 0.5 NTU (current value <0.5 NTU) Adjustment Limit 0.5 to 1 NTU (current value >0.8 NTU) Critical Limit 1 NTU (current value >1.5 NTU) 	July 2017	Bogan SC	July 17: Filtered water turbidity operational target and adjustment limit have been modified Oct 17: Additional text added to fluoride CCP	Complete

Action number	Update/action	Due	Action By	Progress	Status
	The CCP limits for fluoride were discussed. It was suggested that the target limit be 1mg/L, in line with NSW Health requirements. Also, it is recommended that the lower alert limit has the following added " <i>for greater than 72 hours</i> ".				
NynSC Jul17.1	It is recommended that the following changes be adopted for the CCPs and COPs: <ul style="list-style-type: none"> • CCP2 – reduce the filtered water turbidity critical limit from 1.5NTU to 1 NTU in line with the ADWG for effective disinfection • CCP4 – modify the target criteria to 1mg/L in line with NSW Health requirements • CCP4 – modify the lower adjustment limits from <1.1mg/L to <0.9mg/L • CCP4 – modify the low critical limit from >0.9mg/L to <0.9mg/L for 72 hours 	December 2017	Bogan SC	Oct 17: Complete	Complete
NynSC Jul17.2	It is recommended that the scape on graph COP4 (pH in the reticulation system) be adjusted from 0-14 to 5-9.	December 2017	Bogan SC	October 17: Graph changed in quarterly report	Complete
NynSC Oct17.1	It is recommended that the following changes be adopted for CCP2 – reduce the filtered water turbidity critical limit from 1.5NTU to 1 NTU in line with the ADWG for effective disinfection	March 2018	Bogan SC		
NynSC Oct17.2	Council advised that there are regularly inspecting the reservoirs. Recommend including evidence of inspection in the next quarterly (eg copies of checklists, list of identified issues and rectification actions taken).	March 2018	Bogan SC		

10 Reservoir inspections

Reservoir inspection progress

Date	Reservoirs inspected	Issue	Corrective actions
15/07/2014	Cobar St	Entry hatch is not sealed	Hatch has been sealed.
		Upper cage of internal ladder needs to be removed	In progress
15/07/2014	Terangion St	Entry hatch is not sealed	Hatch has been sealed.
		Upper cage of internal ladder needs to be removed	In progress

Appendix A Water quality data

A.1 Water quality graphs

- *Provided in Section-5*

A.2 Water quality data summary

This section includes the summary of available water quality data over the reporting period:

- *Raw water – Council reported data*
- *Treated water - Council reported data*
- *Reticulation - Council reported data*
- *Verification – NSW Health reported data*

A.2.1 Raw Water

Parameter	Min	5 th per-centile	Median	95 th per-centile	Critical Limits	No. samples
Turbidity (NTU)	3	5	18	72	500	366
Colour (HU)	50	50	80	200	N/A	366
pH	6.8	7	7.2	7.5	8	366
Fluoride (mg/L)	N/A	N/A	N/A	N/A	N/A	N/A

A.2.2 Treated Water

Parameter	Min	5 th per-centile	Median	95 th per-centile	Critical Limits	No. samples
Turbidity (NTU)	0.1	0.2	0.4	0.8	0.5	366
Colour (HU)	0	0	0	0	0	366
pH	7.1	7.3	7.6	7.8	8	366
Fluoride	N/A	N/A	N/A	N/A	0.9-1.5	N/A
Free Chlorine (mg/L)	1.61	1.86	2.17	2.51	4.0 -1.0	366

A.2.3 Reticulation

Parameter	Min	5 th per-centile	Median	95 th per-centile	Critical Limits	No. samples
Turbidity (NTU)	0.2	0.3	0.7	0.9	1.5	366
pH	7.1	7.3	7.6	7.8	8	366
Fluoride	N/A	N/A	N/A	N/A	1.5	N/A
Free Chlorine (mg/L)	0.1	0.2	0.4	1.0	1.5	364

A.2.4 Verification monitoring (optional)

A summary of NSW Health's Drinking Water Quality Monitoring Program data is included here.

Parameter	Location	Min	5 th per- centile	Median	95 th per- centile	ADWG Limit	Unit	No. excee- d- ances	No. samples
E. coli	Reticulation	0	0	0	0	0	mpn /100ml	1	54
Free Chlorine	Reticulation	0.21	0.29	0.52	2.01	0.2-5	mg/L	0	57
pH	Reticulation	7.1	7.3	7.6	7.9	6.5-8.5		0	57
Turbidity	Reticulation	0.2	0.2	0.7	0.9	5	NTU	0	57

NSW Health Performance comparison report for Nyngan water supply system

Physical Sample Count	Number Of Physical Characteristics	Number Of Physical Characteristics Non Compliant	Physical Percent Compliant	Chemical Sample Count	Number Of Chemical Characteristics	Number Of Chemical Characteristics Non Compliant	Chemical Percent Compliant	Micro Sample Count	Number Of Ecoli Non Compliant	Micro Percent Compliant	Micro Allocation	Chemical Allocation
2	5	0	100%	1	19	0	100%	54	1	98%	52	2

Note:

One E coli sample was recorded due to sampling error.

Appendix B Improvement / Action Plan

- Element 1 Commitment to Drinking Water Quality Management
- Element 2 Assessment of the Drinking Water Supply System
- Element 3 Preventive Measures for Drinking Water Quality Management
- Element 4 Operational Procedures and Process Control
- Element 5 Verification of drinking water quality
- Element 6 Management of incidents and emergencies
- Element 7 Employee awareness and training
- Element 8 Community involvement and awareness
- Element 9 Research and development
- Element 10 Documentation and record keeping
- Element 11 Evaluation and audit
- Element 12 Review and continual improvement

Task No	Element	To Do Actions	Time	By whom	By when	Completed
1	4	Develop and implement a reticulation monitoring program to ensure the free chlorine residual in the distribution system is in line with NSW Office of Water (NOW)	DWMS			A typical format has been provided
2	4	Develop procedures and log sheets for the calibration of chemical dosing systems	DWMS			
3	4	Council must develop procedures for the delivery of chemicals	DWMS			Council to develop procedures based on the templates provided in the DWMS
4	5	Document daily testing procedures including the review of the water quality results at the water treatment plant.	DWMS		30/09/12	Has been prepared. Operators implement
5	5	The DWMS document must be updated to state who is responsible for reviewing the results in the NSW Drinking Water Database. Reviews must be conducted after the results of each microbial sample and monthly for trends and water quality implications.	DWMS			
6	5	Document daily testing procedures including who undertakes the daily review of the water quality results at the water treatment plant.	DWMS			Procedure to be developed

7	5	Document communication system to deal with unexpected water quality results at the water treatment plant.	DWMS			Not completed
8	6	Develop a contact list of key people, agencies and businesses for a water quality emergency in line with the NSW Guidance.	DWMS			Part of the IRP
9	6	Document in the DWMS where controlled copies of the emergency contact list is kept.	DWMS			Control
10	6	Document which agencies should be notified and under what circumstances and who is authorised to notify.	DWMS			As shown in the IRP
11	9	C.t should be calculated.	DWMS			NSW PW
12	11	An internal and external audit schedule should be developed in consultation with NSW Health and NOW.	DWMS			NSW Health
13	1	Ensure Staff and Councillors are aware of the National Health Guidelines which include the development of a Drinking Water Quality Management Plan.	Immediate			Complete
14	2	Prepare relevant SOPs and make sure they are practised by the operators.	Immediate		30/09/12	Have been prepared. Operators implement
15	3	Ensure Critical Control Points are documented.	Immediate		30/09/12	Have been prepared. Operators implement
16	3	Ensure Critical Control Points are monitored.	Immediate		30/09/12	Have been prepared. Operators implement
17	4	Implement the operational procedures that were developed	Immediate			
18	4	Include these procedures in the O&M manual and ensure they are also located where the activity is undertaken.	Immediate		30/09/12	These are displayed in the plant room.
19	4	Document corrective actions for critical control points	Immediate		30/09/12	Have been prepared. Operators implement
20	5	Document all operational procedures	Immediate		30/09/12	Have been prepared.

						Operators implement
21	6	Formalise how incidents and emergencies and reviewed and protocols updated.	Immediate		30/09/12	Have been prepared. Operators implement
22	1	Ensure regular (weekly or fortnightly) toolbox style meetings are held with technical and operational staff to ensure staff understands the practical implications and application of formal and regulatory requirements and to allow two way communication of issues. Minutes should be kept of these meetings.	Short term			Minutes to be kept.
23	2	Develop a formal maintenance schedule for sludge rake and other equipment in the water supply system.	Short term			The sludge rake is identified as critical. This needs to be addressed

24	2	Consider participating in CMA catchment management programs.	Short term			
25	2	Consider daily recording of weather conditions and river flows with raw water turbidity.	Short term			Done
26	2	Consider installing an on-line turbid meter to measure filtered water turbidity.	Short term		2017	Test chlorine sample on site rather than bring back to lab. There is a common turbid meter on-line, however it would be more beneficial to add individual turbid meters with the SCADA upgrade.
27	2	Consider automating filter backwash	Short term		2018	Included in SCADA upgrade
28	2	Monitor filtered water turbidity data over a filter run to determine filter characteristics.	Short term		2017	Included in SCADA upgrade
29	2	Formalise reticulation testing program and log all results. Test for chlorine prior to flushing.	Short term		2018	In progress
30	4	Ensure these procedures are held in an operations and maintenance manual;	Short term			

31	4	Extend the documentation to include the daily monitoring;	Short term		2017	Done
32	4	Document all corrective actions and formalise associated communication protocol.	Short term			
33	5	Ensure turbidity, Cl, pH and F are added to the daily log sheet.	Short term			This may be element 4 rather than 5.
34	5	Formalise water quality monitoring schedule for the distribution.	Short term			Done
35	5	Improve complaint recording through TRIMS.	Short term			Currently only a spreadsheet.
36	6	Document what information is accessed for the NOW performance Reporting Forms	Short term			
37	7	Regular (weekly or fortnightly) toolbox style meetings should be held with technical and operational staff to ensure two way communication of issues. Minutes should be kept.	Short term			Done
38	7	Develop and maintain a formalised training program for the employees.	Short term			Done
39	7	Share knowledge among the members of LMWUA and other neighbour Councils.	Short term			Done
40	8	Ensure water quality is considered during the community consultation as planned under objectives 6 and 7 of SBP 2007/08.	Short term			on-going
41	8	Council must develop an education program to ensure consumers understand the quality difference between the raw water and potable system.	Short term			Village water is non-potable. Advising rental agencies in currently in progress
42	9	Participate in research programs and technical/operational workshops organised by LMWUA.	Short term			Done
43	9	Undertake investigative work to determine suitable upgrading method for the existing Nyngan WTP	Short term		2017	Included in the SCADA upgrade
44	11	Long-term water quality and performance data logs, including trends and results should be kept in a designated electronic file location.	Short term		2017	Included in the SCADA upgrade
45	12	Implement the actions identified in the drinking water quality management improvement plan (Reference 3)	Short term			

46	1	When the Water Strategic Business Plan is updated ensure that levels of service include public health/water quality objectives	Medium term		Not Yet	The next WSBP will be in 2016
47	1	When the Water Strategic Business Plan is updated document public health/water quality implications of the operating environment review	Medium term		Not Yet	The next WSBP will be in 2016
48	1	When the Water Strategic Business Plan is updated ensure the operating review captures responsibilities in other documents such as Codes of Practice and Standards.	Medium term		Not Yet	The next WSBP will be in 2016
49	2	Ensure the risk assessment is reviewed every five years or if conditions or system knowledge changes.	Medium term		Not Yet	The next WSBP will be in 2016
50	4	Ensure sufficient funds are available to fund asset maintenance and replacement, through the development of the management plan or strategic business plan	Medium term			Mains replacement program in is progress. \$80k/year for pipe replacement work. 2014/15 there has been 500m of AC pipe replaced.
51	4	Formally document the maintenance program.	Medium term			
52	5	Document how customer complaints are used to inform system maintenance programs (e.g. flushing programs or pipeline replacement).	Medium term			Mainly on breaks and asset life
53	5	Document internal and external reporting measures for water quality monitoring.	Medium term			Done - Every Monday put onto Council database
54	5	Document corrective procedures and communication systems for other non-conformances.	Medium term			CCP report quarterly
55	6	Develop formal incident log sheets for recording of incident and management actions undertaken and for use in debriefing sessions	Medium term			Done
56	6	Develop and incident and emergency response plan which contains information to guide staff in an incident and emergency. Ensure hard copies are controlled and available.	Medium term			IRPs

57	8	Review Council's involvement in the Save Water alliance to improve communication with consumers.	Medium term			15 December - TV ads, school programs, info inserts with customer bills. \$5k/year allocated
58	9	Replace or upgrade the WTP with affordable appropriate technology.	Medium term		2017	
59	10	Formalise document control system.	Medium term		2017	On-going - formalised with the SCADA upgrade
60	10	Formalise documentation review system.	Medium term		2017	On-going - formalised with the SCADA upgrade
61	11	Establish procedures for long term performance evaluation of the water business within LMWUA.	Medium term			Involved in the Water Security Program - \$10M grant for 2000ML off-river storage

62	12	Formalise management review of the water business	Medium term		Not Yet	
63	4	Provide a calibration cylinder for the sodium hypochlorite dosing pumps	Immediate			
64	4	Rearrange the chemical dosing points as shown in this report and assess the performance.	Immediate			
65	4	After completion of switchboard replacement and SCADA upgrade, flowpace all chemical dosing systems with the starting and stopping of the plant.	Immediate			
66	5	Measure chlorine residual at the outlet of the town reservoir from the sample point recommended by NSW Public Works.	Immediate			
67	4	Replace the existing fluoridation system with a new system that complies with the NSW Code of Practice for Fluoridation of Public Water Supplies.	Immediate			
68	4	Investigate replacing Alum with PACI for coagulation.	Medium term		Not Yet	
69	4	Consider diluting sodium hypochlorite to 6% for storage. Calculate the sodium hypochlorite	Medium term		Not Yet	

		dosage (for 6% solution strength) and check if the dosing pump capacity is suitable				
70	4	Install on-line turbidimeter and backwash filters on turbidity breakthrough once SCADA upgrade is completed.	Medium term		Not Yet	
71	4	Interlock starting and stopping of the fluoride dosing system with the operation and flowrate of the plant.	Medium term		Not Yet	

Figure: 4.1 CCP (Critical Control Points) –Nyngan Water Treatment Plant

