



# **Drinking Water Quality Management Plan (DWQMP) Report**

2014 - 2015

**ISAAC REGIONAL COUNCIL**

SPID: 00486

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## Glossary of terms

ADWG 2004	Australian Drinking Water Guidelines (2004). Published by the National Health and Medical Research Council of Australia
ADWG 2011	Australian Drinking Water Guidelines (2011). Published by the National Health and Medical Research Council of Australia
<i>E. coli</i>	<i>Escherichia coli</i> , a bacterium which is considered to indicate the presence of faecal contamination and therefore potential health risk
HACCP	Hazard Analysis and Critical Control Points certification for protecting drinking water quality
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
MPN/100mL	Most probable number per 100 millilitres
CFU/100mL	Colony forming units per 100 millilitres
<	Less than
>	Greater than

# 1. Introduction

This report documents the performance of Isaac Regional Council's drinking water service with respect to water quality and performance in implementing the actions detailed in the drinking water quality management plan (DWQMP) as required under the Water Supply (Safety and Reliability) Act 2008 (the Act).

## 2. Overview of Operations

This DWQMP applies to eight drinking water schemes within the Isaac Regional Council - Carmila, Clermont, Dysart, Glenden, Middlemount, Moranbah, Nebo, and St Lawrence.

### *Carmila*

Raw water is extracted from Carmila Creek and pumped to the WTP inlet where it is treated using the following treatment process:

- Aluminium sulphate (Alum) dose to aid flocculation due to clear raw water supply;
- Aerator;
- Flash mixer dosing with flocculent aid (Magnofloc LT20);
- Chlorination (Calcium hypochlorite);
- Coagulation and clarification; and
- Sand filtration.

### *Clermont*

Raw water is extracted from the Theresa Creek Dam and pumped to the WTP inlet where it is treated using the following treatment process:

- Pre-Soda Ash dosing for pH adjustment;
- Oxidation for manganese control by chlorination dosing;
- Coagulation using aluminium sulphate in rapid mix tanks (Flash Tank);
- Clarification (activated carbon);
- Sand filtration; and
- Disinfection with chlorine gas.

### *Dysart*

Raw water is extracted from the Mackenzie River and pumped to BMA's turkeys nest located to the south west of the WTP site. Water is pumped on demand from the turkeys nest to the inlet where it is treated using the following treatment process:

- Oxidation for manganese control by chlorination dosing;
- Pre-lime dosing for pH adjustment;
- Coagulation using (allum or Ultrion potable coagulant) in rapid mix tanks (Flash Tank);
- Clarification;
- Sand filtration; and
- Disinfection with chlorine gas.

### *Glenden*

Raw water is extracted from the Bowen River Weir, stored in 100 ML Mine Dam and pumped to the WTP inlet where it is treated using the following treatment process:

- Pre-Soda Ash dosing for pH adjustment;
- Coagulation using poly aluminium conglomerate in rapid mix tanks (Flash Tank);
- Clarification;
- Sand filtration; and
- Disinfection with calcium hypochlorite.

### *Middlemount*

Raw water is extracted from the McKenzie Weir, pumped to Bingegand Dam and finally to a raw water storage dam on site and pumped to the WTP inlet where it is treated using the following treatment process:

- Pre-Soda Ash dosing for pH adjustment (as required);

- Oxidation for manganese control by chlorination dosing;
- Coagulation using (Ultrion potable coagulant) in rapid mix tanks (Flash Tank);
- Clarification within one of two tanks;
- Sand filtration through one of four filters; and
- Disinfection with chlorine gas.

#### *Moranbah*

Raw water is extracted from the Burdekin Dam (occasionally Eungella Dam and possibly from the Braeside Borefield) and pumped to the WTP inlet where it is treated using the following treatment process:

- Pre-lime dosing for pH adjustment;
- Oxidation for manganese control by chlorination dosing (as required);
- Coagulation using aluminium sulphate in rapid mix tanks (Flash Tank);
- Clarification (activated carbon);
- Sand filtration (old system) and multimedia filters (new system);
- Post-lime dosing for pH adjustment (as required);
- Disinfection (chlorine gas); and
- Fluoridation, dose with sodium fluoride.

#### *Nebo*

Raw water is currently pumped from 4 bores. Bores 4 and 5 are preferred as the primary bores for raw water supply as they are better quality (lower alkalinity and hardness). Bores 2 and 3 are standby and are used during peak demand periods and to manage water allocation usage. Water pumped from the bores is disinfected with sodium hypochlorite before it is pumped to the water tower.

#### *St Lawrence*

Raw water is extracted from St Lawrence Creek and pumped to the WTP inlet where it is treated using the following treatment process:

- Pre-Soda Ash dosing for pH adjustment and taste;
- Pre-chlorine dosing using calcium hypochlorite;
- Manganese control by dosing with potassium permanganate (as required);
- Coagulation using aluminium sulphate in rapid mix tanks (Flash Tank);
- Clarification;
- Sand filtration; and
- Disinfection by chlorine using calcium hypochlorite.

### 3. Actions taken to implement the DWQMP

Original consultants developed the Isaac Regional Council Drinking Water Quality Management Plan and updates have been completed by City Water Technology (CWT).

#### **Progress in implementing the risk management improvement program**

Site based management plans have been developed and implemented at the sites and ongoing upgrades will ensure an improved risk management program. Table 1 included in Appendix A, outlines the implementation of the risk management program.

Staffing levels and regular audits of current site can affect progressive implementation of site improvements.

#### **Revisions made to the operational monitoring program to assist in maintaining the compliance with water quality criteria<sup>1</sup> in verification monitoring**

Currently all verification monitoring is carried out by a NATA Certified Laboratory located at Mackay Regional Council. Results are propagated on MonitorPro, a web based data site that has the ability to send alerts and alarms for non-compliant results. In house monitoring is conducted daily by the onsite operator as per the site based management plan (SBMP).

#### **Amendments made to the DWQMP**

No amendments were required at this stage as per consultant's report from City Water Technology.

<sup>1</sup> Refer to *Water Quality and Reporting Guideline for a Drinking Water Service* for the water quality criteria for drinking water.

## 4. Compliance with water quality criteria for drinking water

Verification monitoring has shown current water quality to Isaac customers is of a very high standard with very few issues or non-compliances. Details of the verification monitoring results including reticulation *E. coli* verification monitoring for Isaac Regional Council are included in Tables 2 and 3 in Appendix B.

## 5. Notifications to the Regulator under sections 102 and 102A of the Act

This financial year there were 2 instances where the Regulator was notified under sections 102 or 102A of the Act.

### Non-compliances with the water quality criteria and corrective and preventive actions undertaken

Reporting of these 2 incidences was an oversight due to change within the upper management team. Preventative actions have been detailed in the report submitted for these non-compliances.

### Prescribed incidents or Events reported to the Regulator and corrective and preventive actions undertaken.

No incidents or events were reported.

## 6. Customer complaints related to water quality

Isaac Regional Council is required to report on the number of complaints, general details of complaints, and the responses undertaken.

Throughout the year the following complaints about water quality were received:

**Table 4 - complaints about water quality, (including per 1000 customers)**

	Suspected Illness	Discoloured water	Taste and odour	Total
CARMILA	0	0	0	0
CLERMONT	0	0	0	0
DYSART	0	1	0	1
GLENDEN	0	0	0	0
MIDDLEMOUNT	0	2	0	2
MORANBAH	0	6	2	8
NEBO	0	0	0	0
ST LAWRENCE	0	0	0	0
Total	0	9	2	11

### Suspected Illness

Complaints are sometimes received from customers who suspect their water may be associated with an illness they are experiencing. Isaac Regional Council investigates each complaint relating to alleged illness from our water quality, typically by testing the customers tap and closest reticulation sampling point for the presence of *E. coli*.

During 2014-2015 there were no confirmed cases of illness arising from the water supply system.

### Discoloured water

Potable water mains flushing was carried out until supplied water ran clear.

No further complaints received after this process was carried out.

### Taste and odour

Potable water mains flushing was carried out until supplied water ran clear.

No further complaints received after this process was carried out.



## 7. Findings and recommendations of the DWQMP auditor

City Water Technology arranged for Jacquelyn Osborne to conduct a regular review of the DWQMP during 2015, covering the time period from 2014-2015. The purpose of the review was to verify the accuracy of the monitoring and performance data provided to the Regulator; assess compliance with the DWQMP and to assess the relevance of the DWQMP in relation to the service provided. A summary of the Review report is included below:

Table 5 included in Appendix C details the proposed verification monitoring frequency for each scheme. The proposed verification monitoring has been assessed on the basis of the available data for the scheme and the specific scheme risk parameters that need to be verified. All these verification tests are to be completed on water supplied to the consumer (i.e. the treated water). Verification monitoring currently conducted at each of the IRC WTPs is documented in each site's water quality section.

As part of the City Water Technology update of the IRC DWQMP, some changes to the frequency and monitoring requirements have been suggested. Appropriateness of these new suggested frequencies will need to be confirmed before implementation by analysing all available test results to determine whether levels are stable and unlikely to impact on water quality. For example, results that have been stable over >2 years of testing may be eligible for reduction or removal from the verification monitoring program.

## 8. Outcome of the review of the DWQMP and how issues raised have been addressed

The next internal review of the DWQMP is due before 2017.

### **Hazards and hazardous events that affected the quality of drinking water during the year and which were not addressed in the DWQMP**

No hazards or hazardous events occurred that affected the quality of drinking water during the year and which were not addressed in the DWQMP.

As a result of the findings of the review, some changes have been made to the DWQMP as per the actions required.

## Appendix A – Implementation of the DWQMP Risk Management Improvement Program

Current progress is limited due to staffing levels and current water levels due to extended dry periods.

**Table 1 – Progress against the risk management improvement program in the approved DWQMP**

#	Process Step	Hazardous Event	Improvement Action	Timeframe	Status	Comments
GEN1	General Issues	Out of date Standard Operating Procedure	Update Standard Operating Procedure across all WTPs to ensure consistency across the region	Dec-13	In Progress	Will roll out to each site between 2013 to 2015
GEN2	General Issues	Emergency procedures not included in SOP	Update Standard Operating Procedure across all WTPs to ensure consistency across the region	Dec-13	In Progress	See GEN1
GEN3	General Issues	Poor information recording system	Streamlining information / record keeping procedure to be implemented	Jun-14	In Progress	
GEN4	General Issues	Poor water quality data record keeping	Provide central storage of test results report (Electronic, Graphical format) to allow instantaneous data retrieval as circumstances require	Jun-14	In Progress	
GEN5	General Issues	Poor distribution channel of new operational procedure / new regulation requirements	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
GEN6	General Issues	Inadequate or irregular water main flushing	A general flushing procedure for water mains and reservoir to be developed.	Jun-14	In Progress	
GEN7	General Issues	Lack of pressure monitoring of water network	Council is progressing with water network modelling to identify low flow zones	Jun-17		
GEN8	General Issues	Lack of formalised communication protocol with BMA/Sunwater	Establish a communication protocol with BMA/Sunwater regarding quantity and quality of raw water as well as alerts for rapid change of raw water quality	Jun-14	Overdue	
GEN9	General Issues	Lack of formalised communication protocol with BMA/Sunwater	Establish a communication protocol with Xstrata/Bloomfield regarding quantity and quality of raw water as well as alerts for rapid change of raw water quality	Jun-14	Overdue	
GEN10	General Issues	Fragmented/Incomplete Record Water Complaints	Streamline recording of water quality complaints and reporting to Supervisors and Managers. Additional details of complaints and resolution should be included in the record.	Jun-14	In Progress	TechOne has improved the capture of complaints
GEN11	General Issues	Poor water quality data record keeping	Establish procedure for compilation of external test results and graphical and statistical analysis. Include annual review of results to establish any required changes in testing frequencies.	Dec-16	Pending	More details regarding future operational and verification monitoring recommendations can be found in Section 23 of the DWQMP
CL1	Clermont Dam / Catchment	Algal Bloom	Algal toxin monitoring is to be included as part of verification/external testing regime	Dec-13	Complete	Testing procedure to add to the new SOP
CL2	Clermont Dam / Catchment	Rapid Variation in raw water quality	The current WTP process combined with operator input is considered capable of dealing with iron and manganese.	#N/A	N/A	
CL3	Clermont Dam / Catchment	Rapid Variation in raw water quality	The current WTP process combined with operator input is considered capable of dealing with most turbidity events. However, if future data shows that this system becomes unreliable, a raw water turbidity meter and/or SCM with alarms should be considered in future to assist operators in chemical dosing adjustments.	Jun-15	Overdue	To be considered in future if monitoring shows future instrumentation to be necessary. SCM ~ \$50k, Turbidity ~ \$15k

CL4	Clermont Dam / Catchment	Rapid Variation in raw water quality caused by stormwater flows	<p>Current barrier (WTP process and turbidity monitoring) is considered sufficient for treating colour. The operating procedure including the charts which operators use needs to be formalised.</p> <p>The colour testing procedure needs to be revised. Since the raw water is dosed with chlorine, True colour should be tested in samples sent to Queensland Health. Any sample that is above 15 HU should also be tested for THMs (this is a requirement in ADWG). These THM levels should be recorded and checked against ADWG limits. Further action may be required if THMs above 0.25mg/L are detected.</p>	Dec-13	Overdue	Testing procedure to add to the new SOP
CL5	Clermont Dam / Catchment	Chemical use in catchment areas (e.g. Weed spray)	Pesticide monitoring to be included as part of verification monitoring programme.	Dec-13	Complete	Testing procedure to add to the new SOP
CL6	Clermont Dam / Catchment	Heavy metal	Heavy metals to be monitored as part of verification monitoring programme.	Dec-13	Complete	Testing procedure to add to the new SOP
CL7	Clermont Dam / Catchment	Accidental Spills	<p>The campground caretaker to be educated on the dam as a potable water source.</p> <p>Information sheets to be provided for the caretaker to assist him in passing on this message to campers.</p> <p>An information board to be posted at the boat ramp.</p>	Dec-13	Complete	Cost allowance for communication between Water and Sewerage team and the campground caretaker
CL8	Clermont Dam / Catchment	Human Access	As for item CL7	Dec-13	Complete	
CL9	Clermont Dam / Catchment	Wildlife Access (native and feral) and unrestricted livestock	Online chlorine analyser with alarm would assist operators to ensure that chlorine residual is always maintained.	Jun-17		
CL10	Clermont Dam / Catchment	Wildlife Access (native and feral) and unrestricted livestock	The current operational measures are considered to be appropriate for dealing with this risk and it is considered to be as low as practicable.	#N/A	N/A	
CL11	Clermont Dam / Catchment	Changes in surrounding land use	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
CL12	Clermont Dam / Catchment	Heavy Rainfall / Flooding	<p>Operator actions as described are considered to be appropriate to mitigate this risk.</p> <p>Consideration to be given to online raw water instruments with alarms (as per item CL2) to assist operators.</p>	Jun-17		
CL13	Clermont Dam / Catchment	Drought / Bushfires	<p>Operator actions as described are considered to be appropriate to mitigate this risk.</p> <p>Consideration to be given to online raw water instruments with alarms (as per item CL3) to assist operators.</p>	Jun-15	Overdue	
CL14	Clermont Dam / Catchment	Equipment Failure	Operator actions as described are considered to be appropriate to mitigate this risk and the risk is considered to be as low as practicable.	#N/A	N/A	
CL15	Clermont Dam / Catchment	Demand Increase	Drought management plan to be implemented to provide triggers for water restrictions and raw water storage capacity to be reviewed.	Jun-18	Pending	W&S Manager to review the drought management practice and evaluate need for additional raw water storage
CL16	Clermont Dam / Catchment	Demand Increase	<p>Operator actions as described are considered to be appropriate to mitigate this risk.</p> <p>Consideration to be given to online raw water instruments with alarms (as per item CL3) to assist operators.</p>	Jun-15	Overdue	



CL17	Clermont Dam / Catchment	Failure of the dam	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CL18	Clermont Storage Reservoirs and Intakes	Open reservoirs and aqueducts / uncovered storage	No further action. It is considered that reasonable preventative measures are taken by the operators and the risk is minimised. An analyser as per CL9 would assist operators.	#N/A	N/A	
CL19	Clermont Storage Reservoirs and Intakes	Human Access	Investigate whether further protection from human access could be implemented at the surge tank.	Jun-16	Pending	
CL20	Clermont Storage Reservoirs and Intakes	Animal access including birds and vermin	An analyser as per CL9 would continuously monitor chlorine level at plant outlet and advise operators if disinfection is compromised.	Jun-15	Overdue	
CL21	Clermont Storage Reservoirs and Intakes	Depletion of reservoir storage	No further action. It is considered that reasonable steps are being implemented by the operators to minimise this risk.	#N/A	N/A	
CL22	Clermont Storage Reservoirs and Intakes	No alternative water sources	Formalise this risk as part of the Emergency Response Plan. Operational monitoring revised to include more parameters as well as more extensive verification monitoring programme.	Jun-14	Complete	Cost of developing Emergency water supply plan
CL23	Clermont WTP General	Significant Flow variations	Implementation of flow paced chemical dosing during future control system upgrade if this becomes a high risk in future.	Jun-17	Pending	Cannot be completed until the control system is replaced. Cost estimate to be completed at the time of control system upgrade.
CL24	Clermont WTP Inlet/ Flocculation	Process control incapability	Verification monitoring of aluminium to be implemented.	Dec-13	Complete	
CL25	Clermont WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that reasonable preventative measures are taken by the operators and the risk is minimised. Turbidity and pH analysers with alarms could be considered to assist operators.	Jun-17	Pending	
CL26	Clermont WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that reasonable preventative measures are taken by the operators and the risk is minimised to as low as practicable.	#N/A	N/A	
CL27	Clermont WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that reasonable preventative measures are taken by the operators and the risk is minimised to as low as practicable.	#N/A	N/A	
CL28	Clermont WTP Inlet/ Flocculation	Chemical dosing failures	No further action. It is considered that reasonable preventative measures are taken by the operators and the risk is minimised to as low as practicable.	#N/A	N/A	
CL29	Clermont WTP Inlet/ Flocculation	Equipment malfunction	Alarm on failure of inlet flowmeter.	Jun-15	Overdue	Site control system upgrade is planned. Should ensure these additional alarms are included. The estimated cost is only for addition of alarming.
CL30	Clermont WTP General	Use of unapproved or contaminated water treatment chemicals	No further action. It is considered that reasonable steps have been taken to minimise this risk and the risk is as low as practicable.	#N/A	N/A	
CL31	Clermont WTP Inlet/ Flocculation	Inadequate mixing	Install baffles in flash mixer or alternative method of mixing at WTP inlet.	Jun-15	Overdue	

CL32	Clermont WTP Inlet/ Flocculation	Poor reliability of process	An online turbidity meter for treated water (as per item CL3) would assist operators.	Jun-15	Overdue	
CL33	Clermont WTP General	Formation of disinfection by-products	Verification monitoring of THMs to be implemented.	Dec-13	Complete	
CL34	Clermont Clarification	Chemical dosing failure / Equipment Malfunction	Algal toxin monitoring is to be included as part of verification/external testing regime	Dec-13	Complete	
CL35	Clermont Filtration	Process control incapability	Online filtered water turbidity analyser for filtered water with alarm would assist operators.	Jun-15	Overdue	
CL36	Clermont Filtration	Inadequate filter operation	Online filtered water turbidity analyser for filtered water with alarm would assist operators (as per CL35)	Jun-15	Overdue	
CL37	Clermont Filtration	Inadequate filter operation	No further action. It is considered that reasonable steps have been taken to minimise this risk and the risk is as low as practicable.	#N/A	N/A	
CL38	Clermont Filtration	Equipment malfunction	No further action. It is considered that reasonable steps have been taken to minimise this risk and the risk is as low as practicable.	#N/A	N/A	
CL39	Clermont Filtration	Equipment malfunction	Some valves will be replaced in 2013 with new (more reliable) valves which can be manually closed by the operator.	Jun-14	Overdue	Valves have not yet been replaced. Leaking valve seals on air lines should also be investigated and replaced if required.
CL40	Clermont Filtered Water	Ineffective disinfection	Install online treated water pH, turbidity and chlorine analyser with alarming (as per CL35 and CL9)	Jun-15	Overdue	
CL41	Clermont Filtered Water	Chemical dosing failure	Install online treated water pH, turbidity and chlorine analyser with alarming (as per CL35 and CL9)	Jun-15	Overdue	
CL42	Clermont Reservoirs	Human/animal access	No further action. It is considered that reasonable preventative measures have been taken to protect the system and the risk is minimised to as low as practicable.	#N/A	N/A	
CL43	Clermont Reservoirs	Build up of sediment and slime	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	Flushing procedure will be standardised as part of SOP update
CL44	Clermont Reservoirs	Aged infrastructure / corrosion. Inadequate repair and maintenance	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
CL45	Clermont Reticulation	Build up of sediment and slime	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	Flushing procedure will be standardised as part of SOP update
CL46	Clermont Reticulation	Aged pipes (AC)	Council to continue the current reactive maintenance replacement programme. It is considered that adequate procedures are in place to ensure repairs are undertaken in a timely manner.	Ongoing	N/A	
CL47	Clermont Reticulation	Corrosion	No further action. It is considered that reasonable preventative measures have been taken to protect the system and the risk is minimised to as low as practicable.	Ongoing	N/A	
CL48	Clermont Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	No further action. It is considered that reasonable steps have been taken to minimise this risk and the risk is as low as practicable.	Ongoing	N/A	

CL49	Clermont Reticulation	Biofilms, sloughing and re-suspension, regrowth	Critical sample locations are to be established from network modelling. Once established, samples for testing are to be taken from these locations. Operational monitoring of chlorine in the reticulation to be increased to daily to ensure operators have the data necessary to set the correct chlorine dose rate on a daily basis.	Jun-15	Overdue	
CL50	Clermont Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
CL51	Clermont Reticulation	Flow variability, inadequate pressures	Increase operational monitoring of chlorine residual in reticulation to ensure better compliance.	Dec-13	Complete	Network modelling being commissioned separately
CL53	Clermont Reticulation	Inadequate maintenance of chlorine residual	As per CL51	Dec-13	Complete	
CL54	Clermont Reticulation	Natural Disaster	No further action. It is considered that reasonable steps have been taken to ensure procedures are in place for natural disasters.	#N/A	N/A	
CL55	Clermont Consumers	Inappropriate plumbing or construction materials. Leaching of metals.	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
CL56	Clermont Whole System	Chemical dosing failure	Treated water is currently tested for dissolved iron and manganese. The ADWG requires testing for Total Iron and Total Manganese. Operators to test these at least weekly as per ADWG. Raw water from the dam (prior to the first chlorine dose point) should be tested for iron and manganese. The number of chlorine dose points should be re-evaluated to ensure they are all required.	Dec-13	Overdue	
CL57	Clermont Whole System	Power Failure	Shutdown is considered to be the best option on power failure as this ensures that the water treatment process does not reduce in effectiveness. It is considered that this minimises the risk to consumers during power failure.	#N/A	N/A	
CL58	Clermont Whole System	Sabotage	No further action. It is considered that reasonable steps have been taken to protect the system and minimise this risk to a level as low as practicable.	#N/A	N/A	
CL59	Clermont Whole System	Capacity	Population to be monitored on at least a 5 yearly basis.	Jun-17	Pending	
CL60	Clermont Dam / Catchment	Rapid Variation in raw water quality	Monitor iron and manganese in raw water more frequently (prior to chlorine dosing) as part of operational monitoring.	Dec-16	Pending	Chlorine doses must be adjusted regularly based on the dissolved metals concentration in the raw water, which can vary rapidly. THM risk should also be evaluated.
CL61	Clermont WTP Inlet/ Flocculation	Chemical dosing failure	Upgrade all chemical dosing systems to include duty/standby dosing pumps (with auto changeover on pump fault) and calibration tubes (Priority 1 Change). Configure flow paced dosing (Priority 3 Change).	Dec-16	Pending	Current dosing systems have limited redundancy.
CL62	Clermont WTP Inlet/ Flocculation	Equipment malfunction	Minimise number of starts of WTP by running as continuously as possible and ramp up flows on start up.	Jun-17	Pending	

CL63	Clermont Clarification	Chemical dosing failure	Install new polymer batching and dosing system to aid in coagulation/ flocculation during extreme dirty water events.	Jun-18	Pending	Anecdotal evidence of high turbidity events occurring in summer. Existing polymer system is in poor condition and may risk reliable operation
CL64	Clermont Filtration	Inadequate filter operation	Inspect filters and refurbish/replace if required (including internal epoxy coatings, media, underdrains, nozzles, launders and valves).	Dec-16	Pending	All filters appeared to be in poor condition during a site visit in August 2015.
CL65	Clermont Filtration	Inadequate filter operation	Develop SOP for filter backwash to ensure manual backwash is completed more regularly (Priority 1). Reconfigure and automate backwash sequence based on headloss, turbidity and/or filter run time (Priority 2).	Dec-16	Pending	Auto initiated backwash sequence is available but fails for unknown reasons.
CL66	Clermont Filtered Water	Disinfection failure	Install carrier water on the chlorine gas dosing system to ensure adequate disinfection. Include interim chlorine testing in operational monitoring (i.e. chlorinated water from the dam and after additional chlorine dosing at WTP inlet).	Dec-16	Pending	Efficacy of raw water chlorine dosing unknown due to lack of operational monitoring of chlorine in plant processes (excluding treated water).
CL67	Clermont Filtered Water	Disinfection failure	Install auto changeover capability from 920 kg chlorine gas drum to 70 kg chlorine gas cylinders.	Dec-16	Pending	Potential loss of disinfection when relying on manual change over.
CL68	Clermont Filtered Water	Disinfection failure	Install regulator on each 70 kg chlorine gas cylinder to allow each cylinder to drain down separately.	Jun-17	Pending	Reduces reliance on operator awareness and need for intervention.
CL69	Clermont Filtered Water	Disinfection failure	Procure and install scales for each 70 kg chlorine gas cylinder.	Dec-16	Pending	Current setup relies on operator knowledge of chemical usage for changeover of cylinders.
CL70	Clermont Filtered Water	Disinfection failure	Include alarms for chlorine dosing failure.	Jun-17	Pending	
CL71	Clermont Filtered Water	Chemical dosing failure	Install carrier water on the chlorine gas dosing system to ensure adequate disinfection. Include interim chlorine testing in operational monitoring (i.e. chlorinated water from the dam and after additional chlorine dosing at WTP inlet).	Dec-16	Pending	
CL72	Clermont Reticulation	Inadequate disinfection	Undertake an assessment to confirm which users (if any) are receiving inadequately chlorinated water.	Jun-17	Pending	It is suspected the filtered water is not receiving any chlorine gas to the dosing point due to the lack of carrier water and limited suction at that point in the system. This should be rectified once CL66 is completed and may not require further action.
CL73	Clermont Chlorine System	Chlorine dosing failure Chlorine leak Exposure of operators to Chlorine gas	Audit chlorine system against Australian Standard (AS/NZS 2927) and upgrade as required	Dec-16	Pending	Chlorine system may no longer be compliant with the Australian Standard. Upgrading system will improve safety compliance and best practice operation of dosing system.
MO1	Moranbah Raw Water	Algal Bloom	Event-based algae and algal toxin monitoring is to be included as part of verification/external testing regime.	Dec-13	Overdue	Develop a Blue Green Algae Management Plan for all IRC systems (should be based on Qld Water Directorate) which will include sampling and response requirements
MO2	Moranbah Raw Water	Rapid Variation in raw water quality	The current WTP process combined with operator input is considered capable of dealing with most turbidity events and increases in iron and manganese. However, if future data shows that this system becomes unreliable, a raw water turbidity meter and/or SCM with alarms should be considered in future to assist operators in chemical dosing adjustments.	Jun-17	Pending	To be considered in future if monitoring shows future instrumentation to be necessary.

MO3	Moranbah Raw Water	Rapid Variation in raw water quality caused by stormwater flows	Current barrier (WTP process and turbidity monitoring) is considered sufficient for treating colour. Consider instruments as per MO2. The colour testing procedure needs to be revised. Since the raw water is dosed with chlorine, True colour should be tested in samples sent to Queensland Health. Any sample that is above 15 HU should also be tested for THMs (this is a requirement in ADWG). These THM levels should be recorded and checked against ADWG limits. Further action may be required if THMs above 0.25mg/L are detected.	Dec-13	Overdue	Include in SOP
MO4	Moranbah Raw Water	Chemical use in catchment areas (e.g. Weed spray)	Undertake monthly test for 2 years before reviewing the frequency.	Dec-13	Complete	
MO5	Moranbah Raw Water	Heavy metal in raw water	Heavy metals added to verification monitoring testing programme.	Dec-13	Complete	
MO6	Moranbah Raw Water	Wildlife Access (native and feral) and unrestricted livestock	Increase operational testing of chlorine residual in reticulation.	Jun-17	Pending	
MO7	Moranbah Raw Water	Wildlife Access (native and feral) and unrestricted livestock	Consider online raw water instruments with alarms (as per item MO2) to assist operators.	#N/A	N/A	
MO8	Moranbah Raw Water	Heavy Rainfall / Flooding	Consider online raw water instruments with alarms (as per item MO2) to assist operators.	Jun-17	Pending	
MO9	Moranbah Raw Water	Drought / Bushfires	Consider online raw water instruments with alarms (as per item MO2) to assist operators.	Jun-17	Pending	
MO10	Moranbah Raw Water	Equipment Failure	No further action. It is considered that reasonable equipment redundancy measures are in place to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO11	Moranbah Raw Water	Demand Increase	No further action. There have been no problems with water allocation to date.	#N/A	N/A	
MO12	Moranbah Raw Water	Animal access including birds and vermin	Increased operational monitoring of chlorine residual in the reticulation. Some chlorine results have been outside the limits. More frequent monitoring should assist operators with increasing dosing when necessary to maintain residual.	Dec-13	Complete	
MO13	Moranbah Raw Water	No alternative water sources	No further action. It is considered that reasonable steps have been taken to minimise this risk with an alternative water supply in place.	#N/A	N/A	
MO14	Moranbah WTP General	Significant Flow variations	Consider implementation of chemical dose flow pacing during future control system upgrade if this becomes a high risk in future.	Jun-17	Pending	Cannot be completed until the control system is replaced. Cost estimate to be completed at the time of control system upgrade.
MO15	Moranbah WTP Inlet/ Flocculation	Process control incapability	Verification monitoring of aluminium to be implemented.	Dec-13	Overdue	
MO16	Moranbah WTP Inlet/ Flocculation	Process control incapability	Raw water turbidity and pH analysers or streaming current monitor with alarms could be considered to assist operators (refer MO2).	Jun-17	Pending	To be considered in future if monitoring shows future instrumentation to be necessary.
MO17	Moranbah WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that operator takes reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO18	Moranbah WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that operator takes reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	

MO19	Moranbah WTP Inlet/ Flocculation	Chemical dosing failures	No Action. Chemical dosing system has recently been fixed. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
MO20	Moranbah WTP General	Use of unapproved or contaminated water treatment chemicals	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO21	Moranbah WTP Inlet/ Flocculation	Inadequate mixing	Mud balls have recently been removed from filters and additional media installed. Treated water turbidity results in future to be monitored to ensure compliance.	Dec-13	In Progress	Use filtered turbidity to detect breakthrough
MO22	Moranbah WTP Inlet/ Flocculation	Poor reliability of process	As per MO21	Dec-13	In Progress	
MO23	Moranbah WTP General	Formation of disinfection by-products	As per item MO3. Verification monitoring programme has been revised to include regular THM monitoring.	Dec-13	Complete	
MO24	Moranbah Clarification	Chemical dosing failure / Equipment Malfunction	Algal toxin monitoring is to be included as part of verification/external testing regime.	Dec-13	Complete	
MO25	Moranbah Filtration	Process control incapability	As per MO21	Dec-13	In Progress	Use filtered turbidity to detect breakthrough
MO26	Moranbah Filtration	Inadequate filter operation	As per MO21	Dec-13	In Progress	Use filtered turbidity to detect breakthrough
MO27	Moranbah Filtration	Inadequate filter operation	As per MO21	Dec-13	In Progress	Use filtered turbidity to detect breakthrough
MO28	Moranbah Filtration	Equipment malfunction	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO29	Moranbah Filtered Water	Ineffective disinfection	As per MO12	#N/A	N/A	
MO30	Moranbah Filtered Water	Chemical dosing failure	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO31	Moranbah Reservoirs / Water Towers	Human/animal access	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO32	Moranbah Reservoirs / Water Towers	Build up of sediment and slime	Regular inspection and maintenance of 8ML reservoir.	Jun-15	Overdue	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
MO33	Moranbah Reservoirs / Water Towers	Aged infrastructure / corrosion. Inadequate repair and maintenance	Regular inspection and maintenance of 8ML reservoir.	Jun-15	Overdue	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
MO34	Moranbah Reticulation	Build up of sediment and slime	Council to develop flushing and maintenance programme.	Jun-14	In Progress	Flushing procedure will be standardised as part of SOP update
MO35	Moranbah Reticulation	Aged pipes (AC)	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO36	Moranbah Reticulation	Corrosion	Council to ensure a maintenance / replacement programme is compiled for galv service connections.	Jun-14	Overdue	
MO37	Moranbah Reticulation	Mixing of different source waters	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	

MO38	Moranbah Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO39	Moranbah Reticulation	Biofilms, sloughing and re-suspension, regrowth	Chlorine testing at reticulation as per MO12	Dec-13	Complete	
MO40	Moranbah Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO41	Moranbah Reticulation	Flow variability, inadequate pressures	Chlorine testing at reticulation as per MO12	Dec-13	Complete	
MO42	Moranbah Reticulation	Fire fighting increasing demand on the network	Chlorine testing at reticulation as per MO12	Dec-13	Complete	
MO43	Moranbah Reticulation	Inadequate maintenance of chlorine residual	Chlorine testing at reticulation as per MO12	Dec-13	Complete	
MO44	Moranbah Whole System	Chemical dosing failure	Chlorine analyser with alarms would continuously monitor chlorine level and inform operators if disinfection is compromised.	Jun-14	Overdue (In Progress)	Chlorine analyser has been installed on the WTP filtered water line but final commissioning is still in progress. Analyser is inline only, with no alarms as yet (Aug 2015)
MO45	Moranbah Whole System	Power Failure	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO46	Moranbah Whole System	Capacity	Continue monitoring growth and development (Ongoing)	Dec-13	In progress	
MO47	Moranbah Whole System	Sabotage	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MO48	Moranbah General	Operator involvement and intervention in plant function too great	Upgrade Moranbah WTP to SCADA system and PLC control for ease of operation and improved treatment and monitoring	Jun-18	Pending	
MO49	Moranbah General	Process upset on plant startup	Minimise number of starts of WTP by running as continuously as possible and ramp up flows on start up.	Jun-19	Pending	May not be feasible without remote monitoring as it will require additional operators to monitor plant operation. Can be implemented once MO48 is complete.
MO50	Moranbah General	Process control incapability	Connect and make operational inline pH, turbidity and chlorine analysers on WTP filtered water line and equip with alarms (Priority 1). Install inline analysers for pH, turbidity and chlorine on Boby Plant filtered water line (Priority 2)	Dec-16	Pending	Data storage options should be investigate to allow for review and trends. Boby Plant analysers are lower priority as this plant is typically duty assist only
MO51	Moranbah General	Chemical dosing failures	Consider installing a service water system to supply dilution water for all chemical dosing at a ratio of 10:1 to assist in even dispersion and mixing.	Jun-19	Pending	
MO52	Moranbah Raw Water	Variable raw water quality	Develop and implement communication protocol with Sunwater/ BMA for notification of raw water source and quality changes	Jun-17	Pending	Raw water quality can change quickly and drastically.
MO53	Moranbah Raw Water	Unknown flow entering WTP	Install new flowmeter on raw water main at existing instrument tapping point (Priority 1). Flow pace raw water chemical dosing based on this instrument (Priority 3).	Dec-16	Pending	Optimises plant operations and chemical consumption
MO54	Moranbah WTP Inlet/ Flocculation	Capacity	Capacity of flash mixer should be increased to enable max flow (potentially up to 200 L/s)	Jun-18	Pending	Continue monitoring growth and development in are (as per MO47)

MO55	Moranbah WTP Clarification (Boby and WTP)	Sludge blanket poorly defined	Trial polymer dosing to improve sludge blanket definition	Dec-16	Pending	
MO56	Moranbah WTP Clarification (Boby and WTP)	Sludge blanket poorly defined	Install level sensors to monitor sludge blanket level and optimise sludge bleed operation	Jun-19	Pending	
MO57	Moranbah Boby WTP Filtration	Process control incapability	PLC and control panel should be installed for automatic control of the backwash sequence	Jun-17	Pending	
MO58	Moranbah Boby WTP Filtration	Inadequate filter operation	Upgrade air scour system (including additional air lines) for operation without operator intervention	Jun-18	Pending	Operator must manually connect and disconnect lines during air scour
MO59	Moranbah Boby WTP Filtration	Process control incapability	DP cells need to be installed to backwash based on headloss instead of time	Dec-16	Pending	
MO60	Moranbah WTP Filtration	Inadequate filter operation	Existing DP cells need to be connected to PLC for headloss trigger function	Dec-16	Pending	
MO61	Moranbah WTP Filtration	Inadequate filter operation	Upgrade air scour system, including new duty/common standby blowers and new air lines	Jun-18	Pending	Air scour not currently available at WTP due to malfunction and damage to blower and air lines. Wastewater isolation valves must be replaced prior to replacement of the air lines to prevent more damage (as per MO62)
MO62	Moranbah WTP Filtration (both Boby and WTP)	Inadequate filter operation	Backwash valves (including wastewater isolation valves for the WTP) should be replaced to prevent further leaking and damage of air lines	Dec-16	Pending	Improvement required for both treatment streams (Boby and WTP).
MO63	Moranbah WTP Filtration (both Boby and WTP)	Backwash discharging to Finger Dam	Finger Dam discharges should be reviewed in line with best practice processes and EPA requirements	Jun-17	Pending	Alternative thickening and drying process should be investigated to minimise offsite discharging
MO64	Moranbah WTP Filtration (both Boby and WTP)	Process control incapability	Install online turbidity analysers with alarms on common filter outlet of both Boby and WTP (Priority 1). Install online turbidity analysers on outlet of each filter (priority 3).	Dec-16	Pending	Level of monitoring should be based on log removal credits required
MO65	Moranbah Filtered Water (Boby and WTP)	Process control incapability	Install treated water flowmeters on both treatment streams (Boby and WTP) (Priority 1). Flow pace treated water chemical dosing based on this instrument (Priority 2).	Jun-17	Pending	Optimises plant operations and chemical consumption
MO66	Moranbah Filtered Water	Chemical dosing failure	Post chemical dosing order should be changed to chlorine gas, fluoride followed by lime as per best practice configuration	Jun-19	Pending	Current process is lime, chlorine gas followed by fluoride
MO67	Moranbah Filtered Water (Boby WTP)	Process control incapability	Online analysers with alarms should be installed on the Boby WTP treated water to monitor chlorine residual, pH and turbidity	Jun-17	Pending	
MO68	Moranbah Chlorine Dosing	Disinfection failure	Install a second regulator on the standby drum and provisions for auto-changeover	Dec-16	Pending	A second set of scales will be required when auto-changeover is enabled
MO69	Moranbah Chlorine Dosing	Disinfection failure	Install standby pump with auto-changeover capabilities on failure	Jun-17	Pending	
MO70	Moranbah Chlorine Dosing	Disinfection failure	Install common standby ejectors and chlorinators in case of failure or required maintenance	Jun-18	Pending	
MO71	Moranbah Chlorine Dosing	Disinfection failure	Upgrade chlorine system to enable automatic shutdown of WTP and dial out alarms in the case of dosing failure. SCADA connection and remote control should also be considered for online, remote operation and monitoring	Jun-18	Pending	



MO72	Moranbah Reservoirs / Water Towers	Aged Infrastructure- corrosion	Rust affected areas on weir boxes at inlet to treated water reservoirs should be replaced or repaired	Jun-17	Pending	Repairs include sandblasting or repainting
MO73	Moranbah Reservoirs / Water Towers	Animal access including birds and vermin	Weir boxes on treated water reservoirs should be enclosed to prevent contamination from vermin and birds	Dec-16	Pending	
G1	Glenden Raw Water	Algal Bloom	Implement Event-based algae and algal toxins monitoring based on observation of turkey nest and Xstrata/Sunwater WQ information	Dec-13	Overdue	Develop a Blue Green Algae Management Plan for all IRC systems (should be based on Qld Water Directorate) which will include sampling and response requirements
G2	Glenden Raw Water	Rapid Variation in raw water quality	The current WTP process combined with operator input is considered capable of dealing with turbidity events. However, if future data shows that this system becomes unreliable, a raw water turbidity meter and/or SCM with alarms should be considered in future to assist operators in chemical dosing adjustments.	Jun-17	Pending	To be considered in future if monitoring shows future instrumentation to be necessary.
G3	Glenden Raw Water	Rapid Variation in raw water quality caused by stormwater flows	Installation of Raw water Turbidity analyser would assist operators with indication of when coagulant adjustment is required.	Jun-15	Overdue	
G4	Glenden Raw Water	Chemical use in catchment areas (e.g. Weed spray)	Undertake monthly test for 1 year before reviewing the frequency.	Dec-13	Complete	
G5	Glenden Raw Water	Heavy metal in catchment (e.g. mining)	Undertake testing quarterly or annually (dependant on the heavy metal) as per revised verification monitoring programme.	Dec-13	Complete	
G6	Glenden Raw Water	Wildlife Access (native and feral) and unrestricted livestock	Operational monitoring record of chlorine to be included for reticulation.	Dec-13	Complete	To add to new SOP
G7	Glenden Raw Water	Wildlife Access (native and feral) and unrestricted livestock	No further action. It is considered that reasonable operational actions have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G8	Glenden Raw Water	Heavy Rainfall / Flooding	Current barriers (Intake screening, WTP process, disinfection and turbidity monitoring) is considered sufficient. During Dec 2010 (high rainfall month) the treated water turbidity was compliant. Instruments as per G2 could be considered to provide additional assistance to operators.	Jun-17	Pending	
G9	Glenden Raw Water	Drought / Bushfires	Current barrier (WTP process and turbidity monitoring) is considered sufficient. Instrumentation as per G2 could be considered as required in future to assist operators with monitoring.	Jun-17	Pending	
G10	Glenden Raw Water	Equipment Failure	A maintenance schedule for the main items of process equipment to be implemented.	Jun-14	Overdue	Awaiting finalisation of Asset Register
G11	Glenden Raw Water	Demand Increase	Drought management plan to be implemented to provide triggers for water restrictions.	Dec-13	Complete	W&S Manager to review the drought management practice
G12	Glenden Raw Water	Uncovered storage	As per G6	#N/A	N/A	
G13	Glenden Raw Water	Depletion of turkey's nest storage	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G14	Glenden WTP General	Significant Flow variations	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G15	Glenden WTP Inlet/ Flocculation	Process control incapability	Aluminium testing to be included in verification monitoring programme.	Dec-13	Complete	

G16	Glenden WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that the operator completes reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	
G17	Glenden WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that the operator completes reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	
G18	Glenden WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that the operator completes reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	
G19	Glenden WTP Inlet/ Flocculation	Chemical dosing failures	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G20	Glenden WTP Inlet/ Flocculation	Equipment malfunction	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G21	Glenden WTP General	Use of unapproved or contaminated water treatment chemicals	Current coagulant (alum) creates white solids in the base of the tanks creating maintenance problems. Consider alternative chemical supplier. This is an operational issue and will not be included in risk improvement programme.	#N/A	N/A	
G22	Glenden WTP General	Clarifier sludge return to Turkey Nest	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G23	Glenden WTP Inlet/ Flocculation	Inadequate mixing	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G24	Glenden WTP Inlet/ Flocculation	Poor reliability of process	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
G25	Glenden WTP General	Formation of disinfection by-products	No chlorine pre-dosing at present but is being considered. THM monitoring added to verification monitoring programme on at least a monthly basis.	Dec-13	Complete	
G26	Glenden Clarification	Chemical dosing failure / Equipment Malfunction	Algal monitoring added to the verification monitoring programme.	Dec-13	Complete	
G27	Glenden Filtration	Process control incapability	Installation of treated water monitoring (turbidity, pH and chlorine) instrumentation with alarms would assist in assessing contamination.	Jun-15	Overdue	Use filtered turbidity to detect breakthrough
G28	Glenden Filtration	Inadequate filter operation	Installation of treated water monitoring (turbidity) instrumentation with alarms would assist in assessing filter performance. As per G23.	Jun-15	Overdue	
G29	Glenden Filtration	Inadequate filter operation	Consider recording filter run time and backwashing after a set runtime rather than weekly.	Jun-14	Overdue	Procedure to add to the new SOP
G30	Glenden Filtration	Backwash recovery tank sludge return to Turkey Nest via sludge pond	Online turbidity & chlorine analyser and guidance will provide detection of turbidity spikes or low residual chlorine, as per G27	Jun-15	Overdue	Use filtered turbidity to detect breakthrough
G31	Glenden Filtration	Backwash recovery tank sludge return to Turkey Nest via sludge pond	Online turbidity & chlorine analyser and guidance will provide detection of turbidity spikes or low residual chlorine, as per G27	Jun-15	Overdue	Use filtered turbidity to detect breakthrough
G32	Glenden Filtration	Equipment malfunction	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	

G33	Glenden Filtered Water	Ineffective disinfection	Chlorine residual test results for the reticulation not currently available. Testing to be added to the operational monitoring programme.	Dec-13	Complete	
G34	Glenden Filtered Water	Chemical dosing failure	Process upsets will be detected by online turbidity and chlorine analysers and the respective alarms, as per G27	Jun-15	Overdue	Use filtered turbidity to detect breakthrough
G35	Glenden Clear Water Tank / Water Tower	Human/animal access	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G36	Glenden Clear Water Tank / Water Tower	Build up of sediment and slime	Storage tank and water main flushing maintenance procedures to be formalised.	Jun-14	Overdue	Flushing procedure will be standardised as part of SOP update No problem has been reported
G37	Glenden Clear Water Tank / Water Tower	Aged infrastructure / corrosion. Inadequate repair and maintenance	Develop a more robust testing programme. As per G33	Dec-13	Complete	
G38	Glenden Reticulation	Build up of sediment and slime	Council to implement flushing and maintenance programme	Jun-14	In Progress	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
G39	Glenden Reticulation	Aged pipes (AC)	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G40	Glenden Reticulation	Corrosion	Addressed by maintenance programme, as per G38	Jun-14	Overdue	
G41	Glenden Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G42	Glenden Reticulation	Biofilms, sloughing and re-suspension, regrowth	Addressed by more comprehensive residual chlorine and E Coli testing, as per G33	Dec-13	Complete	Flushing procedure will be standardised as part of SOP update
G43	Glenden Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G44	Glenden Reticulation	Flow variability, inadequate pressures	Addressed by more comprehensive residual chlorine and E Coli testing, as per G33	Dec-13	Complete	
G45	Glenden Reticulation	Fire fighting increasing demand on the network	Addressed by more comprehensive residual chlorine and E Coli testing, as per G33	Dec-13	Complete	Also, commence network modelling study
G46	Glenden Reticulation	Inadequate maintenance of chlorine residual	Addressed by more comprehensive residual chlorine and E Coli testing, as per G33	Dec-13	Complete	
G47	Glenden Whole System	Power Failure	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G48	Glenden Whole System	Sabotage	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
G49	Glenden Whole System	Capacity	Monitored as the population increases and reviewed every year	Jun-17	Pending	Ongoing monitoring as growth is sensitive to new mine development/ expansion
G50	Glenden Raw Water	Inadequate signage	Install signage indicating raw water filling station (not for consumption).	Dec-16	Pending	

G51	Glenden WTP General	Stop/ start plant operation	Adjust plant start and stop Clearwater Tank levels to increase run times. Additionally, variable speed drives (VSDs) can be installed on the raw water pumps to downrate plant for ideally 20 hrs/day operation.	Dec-16	Pending	
G52	Glenden WTP General	Equipment failure or incorrect calibration	Redevelop operator checksheet to include more frequent plant checks including: chemical dosing pump drop tests, sodium hypochlorite concentration testing and instrument calibration.	Dec-16	Pending	
G53	Glenden WTP General	Poor reliability of process	Addition of SCADA and telemetry, plus online analysers with alarms (as per G27) to provide immediate notification of process failure.	Jun-18	Pending	
G54	Glenden WTP Inlet/ Flocculation	Chemical dosing failures	Install calibration tubes on all chemical dosing pumps. Complete drop tests regularly (as per G52).	Jun-17	Pending	
G55	Glenden WTP Inlet/ Flocculation	Chemical dosing failures	Consider installing a service water system to supply dilution water for all chemical dosing at a ratio of 10:1 to assist in even dispersion and mixing.	Jun-19	Pending	
G56	Glenden WTP Inlet/ Flocculation	Chemical dosing failure	Configure flow paced dosing for all chemicals.	Jun-18	Pending	
G57	Glenden WTP Inlet/ Flocculation	Equipment malfunction	Minimise number of starts of WTP by running as continuously as possible and ramp up flows on start up.	Jun-18	Pending	
G58	Glenden WTP Clarification	Aged infrastructure / corrosion. Inadequate repair and maintenance	Corrosion observed in flocculation zone of clarifier. Clarifier interior should be resealed.	Jun-17	Pending	
G59	Glenden Filtration	Inadequate filter operation	Inspect filters and refurbish/replace if required (including internal epoxy coatings, media, underdrains, nozzles, launders and valves).	Jun-17	Pending	All filters appeared to be in poor condition during a site visit in August 2015.
G60	Glenden Filtration	Inadequate filter operation	Develop SOP for filter backwash to ensure manual backwash is completed more regularly (Priority 2). Reconfigure and automate backwash sequence based on headloss, turbidity and/or filter run time (Priority 3).	Jun-17	Pending	Media loss observed while backwashing during site visit in August 2015.
G61	Glenden Filtration	Process control incapability	Individual, online filtered water turbidity analysers with alarms would assist operators. Existing treated water turbidimeter should have alarms associated and be regularly calibrated (as per G52).	Dec-16	Pending	
G62	Glenden Filtration	Inadequate filter operation	Investigate the need to install oxidation with chlorine prior to the filters if dissolved metals are consistently a problem in the raw water or increased concentration is seen in treated water	Jun-18	Pending	Cease the practice of 'super' chlorination as it is likely doing more damage than good
G63	Glenden WTP Filtered Water	Ineffective disinfection	Install standby sodium hypochlorite dosing pump (Priority 1 Change) with auto changeover on fault (Priority 3 Change).	Dec-16	Pending	
G64	Glenden WTP Filtered Water	High turbidity levels in filtered water	Include turbidity monitoring at the filter outlet (individual filters) as part of operational monitoring	Dec-16	Pending	
G65	Glenden WTP Filtered Water	Process control incapability	Install treated water flowmeter (Priority 1). Flow pace treated water chemical dosing based on this instrument (Priority 2).	Jun-17	Pending	Optimises plant operations and chemical consumption
N1	Nebo Bores	Unconfirmed/shallow aquifers	Revised operational and verification monitoring programme to be implemented to provide more regular chlorine residual monitoring.	Dec-13	Complete	
N2	Nebo Bores	Groundwater under direct influence of surface water	As per N1	Dec-13	Complete	
N3	Nebo Bores	Inadequate well head protection and unhygienic	As per N1	Dec-13	Complete	

		practices				
N4	Nebo Bores	Uncased or inadequately cased bores	As per N1	Dec-13	Complete	Inspection procedure and WQ testing to be added to the new SOP
N5	Nebo Bores	Contaminated aquifers from onsite septic tanks discharge	Revised operational and verification monitoring programme to be implemented to provide additional turbidity data. Further assessment of turbidity data may result in further treatment being required.	Dec-13	Complete	
N6	Nebo Bores	Contaminated aquifers from onsite septic tanks discharge	As per N1. Additional testing will provide the operators with more information on which basis to adjust chlorine dosing to appropriate levels.	Dec-13	Complete	
N7	Nebo Bores	Pesticides use in the area	Pesticide monitoring included in new verification testing programme.	Dec-13	Complete	
N8	Nebo Bores	Heavy Rainfall	As per N1	#N/A	N/A	
N9	Nebo Bores	Drought	Investigate the feasibility of hiring a water softening plant during drought conditions to reduce hardness.	Jun-14	Complete	
N10	Nebo Bores	Sabotage	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
N11	Nebo Bores	No alternative water sources	IRC is working with DEWS on water supply to Nebo and Moranbah (already in progress).	Jun-14	In progress	Ongoing liaison with DEWS
N12	Nebo Bores	Equipment Failure	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
N13	Nebo Bores	Equipment Failure	Install a chlorine analyser on the inlet to the water tower with alarm on high/low chlorine.	Jun-15	Overdue	
N14	Nebo Reservoirs	Human/animal access	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
N15	Nebo Reservoirs	Build up of sediment and slime	Council to compile maintenance / flushing programme.	Jun-14	In Progress	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
N16	Nebo Reservoirs	Aged infrastructure / corrosion. Inadequate repair and maintenance	As per N15	Jun-14	In Progress	
N17	Nebo Reticulation	Inadequate disinfection	Undertake an assessment to confirm which users are receiving inadequately chlorinated water. Any users that require increased contact time could have a pipework coil installed in their connection to the reticulation. Alternatively, storage which allows contact time can be provided in a location that allows all consumers to be supplied appropriately disinfected water.	Jun-14	Overdue	Additional monitoring to confirm adequate chlorine residual for connections upstream of the Water Tower
N18	Nebo Reticulation	Build up of sediment and slime	As per N15	Jun-14	In Progress	Flushing procedure will be standardised as part of SOP update
N19	Nebo Reticulation	Aged pipes (AC)	Council to monitor asset condition and complete maintenance programme as per N15	Jun-14	In Progress	
N20	Nebo Reticulation	Corrosion	Council to monitor asset condition and complete maintenance programme as per N15	Jun-14	In Progress	
N21	Nebo Reticulation	Mixing of different source waters	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	

N22	Nebo Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
N23	Nebo Reticulation	Biofilms, sloughing and re-suspension, regrowth	As per N15	Jun-14	In Progress	
N24	Nebo Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
N25	Nebo Reticulation	Flow variability, inadequate pressures	Some chlorine residual results not within limits and some Ecoli samples also not within limits. Increase operational monitoring of chlorine in reticulation to give operators more data and ensure that chlorine dose rates are increased when required to maintain the necessary reticulation residual.	Dec-13	Complete	
N26	Nebo Reticulation	Fire fighting increasing demand on the network	As per N25	Dec-13	Complete	
N27	Nebo Reticulation	Inadequate maintenance of chlorine residual	As per N25	Dec-13	Complete	
N28	Nebo Whole System	Power Failure	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
N29	Nebo Whole System	Sabotage	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
N30	Nebo Whole System	Capacity	Monitored as the population increases and reviewed every year	Dec-13	In progress	Ongoing monitoring as growth is sensitive to new mine development/ expansion
N31	Nebo General	Variation of raw water quality	Include weekly monitoring of iron and manganese in raw and treated water as part of operational monitoring. Include weekly iron and manganese testing in treated water as part of verification monitoring.	Dec-16	Pending	During site visits, there was no indication that these metals were tested
N32	Nebo Bores	Turbulent water as a result of using Bores 3,4 & 5 together	Extend pipework on either side of the flow meter (generally 10 diameters on either side is required, but is dependent on manufacturer) or move the flowmeter to reduce turbulence and improve accuracy of flow paced chlorine dosing	Jun-17	Pending	Only occurs when Bores 3,4 and 5 are in operation together
N33	Nebo Whole System	Failure/ incorrect chlorine dosing	Install an online chlorine analyser with alarms on the inlet to the water tower	Jun-17	Pending	
N34	Nebo Reticulation	Insufficient contact time for effective disinfection	Change configuration of the inlet and outlet to water tower to prevent short circuiting and allow sufficient contact time for effective disinfection	Dec-16	Pending	ADWG 2011 includes a guideline C.t value of 15 min.mg/L, which is based on the World Health Organisation's recommendation that effective disinfection for bacteria and viruses can generally be achieved by applying a 30 minute contact time to a free chlorine concentration of 0.5 mg/L.
N35	Nebo Reticulation	Capacity	Install treated water reservoir with minimum three days storage in the reticulation	Jun-18	Pending	
CA1	Carmila Bores	Unconfirmed/shallow aquifers	Operational monitoring is to be revised to include more regular monitoring of some parameters.	Dec-13	In progress	Inspection procedure and WQ testing to be added to the new SOP
CA2	Carmila Bores	Groundwater under direct influence of surface water	As per CA1	Dec-13	In progress	

CA3	Carmila Bores	Inadequate well head protection and unhygienic practices	No further action. Data shows that reasonable steps have been taken by operators to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA4	Carmila Bores	Uncased or inadequately cased bores	No further action. Data shows that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA5	Carmila Bores	Contaminated aquifers from onsite septic tanks discharge	Complete testing and sampling as per revised operational and verification testing programme to ensure all necessary parameters have been tested, documented and can be further actioned as required.	Dec-13	In progress	Verification testing programme has been updated to include parameters as per recommendations in the DWQMP Operational testing programme needs to be expanded further and is detailed in Section 23: Future Monitoring of the DWQMP
CA6	Carmila Bores	Contaminated aquifers from onsite septic tanks discharge	No further action. Data shows that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA7	Carmila Bores	Contaminated aquifers from Carmila Creek and upstream tributaries (grazing, recreation use)	As per CA5	Dec-13	In progress	Verification testing programme has been updated to include parameters as per recommendations in the DWQMP Operational testing programme needs to be expanded further and is detailed in Section 23: Future Monitoring of the DWQMP
CA8	Carmila Bores	Contaminated aquifers from Carmila Creek and upstream tributaries (grazing, recreation use)	No further action. Data shows that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA9	Carmila Bores	Heavy Rainfall	As per CA5	Dec-13	In progress	Verification testing programme has been updated to include parameters as per recommendations in the DWQMP Operational testing programme needs to be expanded further and is detailed in Section 23: Future Monitoring of the DWQMP
CA10	Carmila Bores	Drought	No further action. Data shows that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA11	Carmila Bores	No alternative water sources	Emergency plan of water supply (Potable Water Tanker) to be developed.	Jun-16	Pending	Develop plan for emergency water supply
CA12	Carmila WTP General	Significant Flow variations	No further action. Operators complete reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA13	Carmila WTP General	Emergency Bypass valve accidentally opened	Bypass valve handle can be taken off and/or locked to further minimise this risk.	Dec-13	Overdue	To be inspected by Water and Sewerage Supervisor by July 2013
CA14	Carmila WTP Inlet/ Flocculation	Process control incapability	Aluminium testing to be included in verification monitoring programme.	Dec-13	Complete	Testing to be added to the new SOP
CA15	Carmila WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that the operator taking reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA16	Carmila WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that the operator taking reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA17	Carmila WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that the operator taking reasonable steps to minimise this risk and it is as low as practicable.	#N/A	N/A	

CA18	Carmila WTP Inlet/ Flocculation	Chemical dosing failures	Install final water turbidity analyser with alarms to continuously monitor treated water turbidity and detect spikes	Jun-17	pending	
CA19	Carmila WTP Inlet/ Flocculation	Equipment malfunction	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA20	Carmila WTP General	Use of unapproved or contaminated water treatment chemicals	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA21	Carmila WTP Inlet/ Flocculation	Inadequate mixing due to mixer failure	Online turbidity monitoring and alarms, as per CA18	Jun-17	Pending	Use filtered turbidity to detect breakthrough
CA22	Carmila WTP Inlet/ Flocculation	Poor reliability of process	Online turbidity monitoring and alarms, as per CA18	Jun-17	Pending	Use filtered turbidity to detect breakthrough
CA23	Carmila WTP General	Formation of disinfection by-products	Verification monitoring to be undertaken for 6 months for THMs to ensure no problem.	Dec-13	Complete	
CA24	Carmila Filtration	Process control incapability	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA25	Carmila Filtration	Inadequate filter operation	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA26	Carmila Filtration	Inadequate filter operation	As per CA18	Jun-17	Pending	Use filtered turbidity to detect breakthrough
CA27	Carmila Filtration	Equipment malfunction	Check spare pump availability from suppliers and keeping spare at Council depot.	Jun-15	Overdue	
CA28	Carmila Filtration	Equipment malfunction	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA29	Carmila Filtered Water	Ineffective disinfection	Operational monitoring of treated water chlorine level from weekly to daily testing (Priority 1 Change). Install online treated water pH and chlorine analyser with alarms (Priority 5 Change)	Jun-17	In progress	pH / chlorine analyser (\$15k) Priority 1 change complete
CA30	Carmila Reservoirs	Human/animal access	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA31	Carmila Reservoirs	Build up of sediment and slime	Council to continue/improve maintenance / flushing programme.	Jun-14	In Progress	Flushing procedure will be standardised as part of SOP update
CA32	Carmila Reservoirs	Aged infrastructure / corrosion. Inadequate repair and maintenance	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA33	Carmila Reticulation	Build up of sediment and slime	As per CA31	Jun-14	In Progress	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
CA34	Carmila Reticulation	Aged pipes (AC)	As per CA29	Jun-14	In progress	As per CA29
CA35	Carmila Reticulation	Corrosion	As per CA31	#N/A	N/A	
CA36	Carmila Reticulation	Mixing of different source waters	No further action.	#N/A	N/A	



CA37	Carmila Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA38	Carmila Reticulation	Biofilms, sloughing and re-suspension, regrowth	Ecoli and chlorine residual within reticulation have been within limits. Chlorine residual and Ecoli to be tested more frequently as part of new operational monitoring programme.	Dec-13	Complete	Testing to be added to the new SOP
CA39	Carmila Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	As per CA38	Dec-13	Complete	
CA40	Carmila Reticulation	Flow variability, inadequate pressures	As per CA38	Dec-13	Complete	Pressure measurement should also be carried out.
CA41	Carmila Reticulation	Fire fighting increasing demand on the network	As per CA38	Dec-13	Complete	Pressure measurement should also be carried out.
CA42	Carmila Reticulation	Inadequate maintenance of chlorine residual	As per CA38	Dec-13	Complete	
CA43	Carmila Whole System	Power Failure	No further action. It is considered that the safest option during power failure is plant shutdown as this ensures that there is no breach of ADWG.	#N/A	N/A	
CA44	Carmila Whole System	Sabotage	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
CA45	Carmila General	Process control incapability	Raw water turbidity and pH, clarified turbidity and filtered turbidity should be tested daily as part of operational monitoring (Priority 1 Change). Additionally, online monitoring with alarms should be installed to measure raw water turbidity and pH (Priority 3 Change), filtered water turbidity and final water pH, turbidity and chlorine residual (Priority 2 Change).	Dec-16	Pending	Note different priorities in Improvement Action
CA46	Carmila General	Process control incapability	SCADA should be installed with remote access to reduce operator reliance	Jun-19	Pending	
CA47	Carmila General	Stop/ start plant operation	Adjust plant start and stop Clearwater Tank levels to increase run times. Additionally, variable speed drives (VSDs) can be installed on the raw water pumps to downrate plant for ideally 20 hrs/day operation.	Jun-17	Pending	
CA48	Carmila General	Aging infrastructure	Reassess condition of package plant following sand blasting (to be completed FY 2015/16)	Dec-16	Pending	May require replacement even with sandblasting
CA49	Carmila Raw Water	Rapid variation in raw water quality	Raw water to be tested for iron and manganese as part of operational sampling. Pre-chlorine dose rate should be adjusted accordingly to oxidise any soluble metals	Dec-16	Pending	
CA50	Carmila WTP Inlet/ Flocculation	Over dosing of polymer	Install separate dosing pump and pipework for each dose point for better management of dosing	Jun-17	Pending	
CA51	Carmila WTP Inlet/ Flocculation	Chemical dosing failure	Configure flow paced dosing for all chemicals.	Jun-18	Pending	
CA52	Carmila WTP Inlet/ Flocculation	One dosing point for chlorine at head of WTP	Install second chlorine dosing point at inlet to Clear Water Tank for disinfection and residual	Dec-16	Pending	

CA53	Carmila WTP General	Equipment failure	Incorporate cleaning of batching tanks as an operator task to be performed at least quarterly	Jun-17	Pending	Frogs, grasses and debris were visible in the batching tanks during site visit (August 2015)
CA54	Carmila WTP General	Lack of bunding around chemicals	Install bunds on chemical tanks in site building and chlorine storage shed	Dec-16	Pending	Bund for chlorine storage being installed in FY2015/16
CA55	Carmila WTP Inlet/ Flocculation	Aging infrastructure	Replace aerator and consider installing new injection point for chlorine into raw water line prior to aeration	Dec-16	Pending	
CA56	Carmila WTP Inlet/ Flocculation	Poor reliability of process	Trial alternative chlorine dosing point (as per CA54) and install flocculator in floc zone of package plant	Jun-18	Pending	
CA57	Carmila Filtration	Inadequate filter operation	Backwash sequence should be adjusted to allow filter to drain down to 100 mm above the media before water wash begins	Jun-17	Pending	No differentiation between drain down and water wash was observed during site visit (August 2015)
CA58	Carmila Filtration	Inadequate filter operation	Install air scour system and integrate into backwash sequence to improve backwash effectiveness	Jun-18	Pending	Air scour during backwashing is best practice when polymer is dosed to improve media cleanliness and reduce likelihood of mudballs
CA59	Carmila Filtration	Inadequate filter operation	Consider replacement of media after sand blasting of package plant has occurred. Review underdrains and nozzles in filter and consider upgrades if required	Jun-17	Pending	
CA60	Carmila WTP General	Backwash water draining to unknown location	Investigate EPA requirements for discharging waste streams and consider alternatives for discharging backwash water	Jun-17	Pending	Operator advises backwash water does not flow to drying beds (clarifier blow down is directed to drying beds only)
CA61	Carmila WTP General	Equipment malfunction	Install new level sensor in filter interlocked with automatic filtered water outlet valve	Jun-17	Pending	
CA62	Carmila Filtered Water	Human/animal access	Investigate options to replace hatch and lid so that it can be safely opened and closed by the operator to check water level (Priority 1 Change). Install level sensor in Clearwater Tank (Priority 3 Change)	Dec-16	Pending	No level sensor installed in tank, operator checks level daily through hatch. Operator advises the hatch is very heavy and cannot be moved safely and easily
CA63	Carmila Filtered Water	Corrosion of treated water pumps	Investigate replacement options	Dec-16	Pending	
CA64	Carmila Reservoirs	Ineffective disinfection	Increase operational monitoring in reticulation at additional sampling points during the summer months	Dec-16	Pending	Recently replaced roof that hasn't been tested during summer months yet; consider implementing increased operational sampling sooner than Priority 1 (suggested Summer 2015)
CA65	Carmila Reservoirs	Human/animal access	Ensure Elevated Reservoir is fully sealed and vermin proofed. Conduct regular inspections and cleaning of reservoirs.	Dec-16	Pending	Frogs were observed in Elevated Reservoir during site visit (August 2015)
SL1	St Lawrence Catchment	Rapid Variation in raw water quality	The current WTP process combined with operator input is considered capable of dealing with most turbidity events. Install raw water turbidity analyser with alarms to alert operator of water quality changes.	Jun-17	Pending	To be considered in future if monitoring shows future instrumentation to be necessary.
SL2	St Lawrence Catchment	Rapid Variation in raw water quality caused by stormwater flows	The colour testing procedure needs to be revised. Since the raw water is dosed with chlorine, True colour should be tested in samples sent to Queensland Health. Any sample that is above 15 HU should also be tested for THMs. These THM levels should be recorded and checked against ADWG limits. Further action may be required if THMs above 0.25mg/L are detected.	Dec-13	Overdue	Additional sampling and testing required. Cost will be ongoing due to increased sampling/testing. Include testing process in SOP.

SL3	St Lawrence Catchment	Algal bloom	Implement Event-based algae and algal toxins monitoring as part of external testing programme	Dec-13	Overdue	Testing to be added to the new SOP. Develop a Blue Green Algae Management Plan for all IRC systems (should be based on Qld Water Directorate) which will include sampling and response requirements
SL4	St Lawrence Catchment	Chemical use in catchment areas (e.g. Weed spray)	Testing for pesticides on a regular basis is not required under the ADWG unless potential exists for contamination of the water supply. Annual test added to verification programme.	Dec-13	Complete	Testing to be added to the new SOP
SL5	St Lawrence Catchment	Wildlife Access (native and feral) and unrestricted livestock	No further action. It is considered that reasonable operational steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL6	St Lawrence Catchment	Wildlife Access (native and feral) and unrestricted livestock	No further action. It is considered that reasonable operational steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL7	St Lawrence Catchment	Changes in surrounding land use	Council to regularly review plans for industrial developments in the area.	Jun-17	Pending	Land use in catchment is largely grazing (rural).
SL8	St Lawrence Catchment	Heavy Rainfall / Flooding	No further action. It is considered that reasonable steps are being taken by the operator to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL9	St Lawrence Catchment	Drought / Bushfires	No further action. It is considered that reasonable steps are being taken by the operator to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL10	St Lawrence Catchment	Equipment Failure	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL11	St Lawrence Catchment	Demand Increase	Drought management to be implemented to provide triggers for water restrictions.	Jun-14	Complete	Review the current drought management practice
SL12	St Lawrence Catchment	Demand Increase	New operational and verification monitoring programmes to be put in place for more regular data collection.	Dec-13	Pending	Verification testing programme has been updated to include parameters as per recommendations in the DWQMP. Operational testing programme needs to be expanded further and is detailed in Section 23: Future Monitoring of the DWQMP
SL13	St. Lawrence Catchment	Septic Tank Discharge	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL14	St. Lawrence Catchment	Septic Tank Discharge	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL15	St Lawrence Catchment	No alternative water sources	New operational and verification monitoring programmes to be put in place for more regular data collection. This will also provide more information for operators to use when adjusting treatment process.	Dec-13	Pending	As per SL12
SL16	St Lawrence WTP General	Significant Flow variations	Operating manual to be compiled.	Dec-13	Overdue	
SL17	St Lawrence WTP Inlet/ Flocculation	Process control incapability	Aluminium testing to be included in verification monitoring programme.	Dec-13	Complete	
SL18	St Lawrence WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered that reasonable steps have been taken by the operator to minimise this risk and it is as low as practicable.	#N/A	N/A	

SL19	St Lawrence WTP Inlet/ Flocculation	Chemical dosing failures	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL20	St Lawrence WTP Inlet/ Flocculation	Equipment malfunction	No further action.	#N/A	N/A	
SL21	St Lawrence WTP General	Use of unapproved or contaminated water treatment chemicals	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL22	St Lawrence WTP Inlet/ Flocculation	Inadequate mixing	Clarified (settled) water turbidity testing to be added to operational monitoring programme as this provides indication of adequate flocculation.	Dec-13	Overdue	Testing to be added to the new SOP
SL23	St Lawrence WTP Inlet/ Flocculation	Poor reliability of process	As per SL22	Dec-13	Overdue	
SL24	St Lawrence WTP General	Formation of disinfection by-products	Verification testing programme amended to include THMs.	Dec-13	Complete	Testing to be added to the new SOP
SL25	St Lawrence WTP General	Uncontrolled recycle of backwash water	Additional operational and verification monitoring will show if there are any additional chemical contaminants that are building up.	Dec-13	Pending	As per SL12
SL26	St Lawrence WTP General	Uncontrolled recycle of backwash water	Operating procedure to be prepared to minimise operational error. More extensive operational testing to be completed (e.g. Daily turbidity monitoring).	Jun-14	Overdue	Testing to be added to the new SOP. Recycle should be limited to 10% of raw water inflow to WTP
SL27	St Lawrence Filtration	Process control incapability	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL28	St Lawrence Filtration	Inadequate filter operation	Turbidity analyser for treated water would assist operator to identify turbidity spikes.	Jun-17	Pending	
SL29	St Lawrence Filtration	Inadequate filter operation	As per SL28	#N/A	N/A	Use filtered turbidity to detect breakthrough
SL30	St Lawrence Filtration	Equipment malfunction	Install spare backwash pump.	Jun-15	Overdue	
SL31	St Lawrence Filtered Water	Ineffective disinfection	Operational monitoring of treated water chlorine level from weekly to daily testing (Priority 1 Change). Install online pH and chlorine analyser with alarms (Priority 5 Change)	Jun-17	Pending (Priority 1 change complete)	
SL32	St Lawrence Filtered Water	Chemical dosing failure	Future online pH and chlorine analyser, As per SL31	Jun-17	Pending	Use filtered turbidity to detect breakthrough
SL33	St Lawrence Filtered Water	Aging Carbon Filter	Install bypass pipework to allow flow bypass the carbon filter tank.	Jun-14	Overdue	
SL34	St Lawrence Reservoirs	Human/animal access	Install access gate	Jun-15	Complete	
SL35	St Lawrence Reservoirs	Build up of sediment and slime	Council to compile maintenance / flushing programme.	Jun-14	In progress	Flushing procedure will be standardised as part of SOP update
SL36	St Lawrence Reservoirs	Aged infrastructure / corrosion. Inadequate repair and maintenance	As per SL35	Jun-14	In Progress	
SL37	St Lawrence Reticulation	Aged pipes (AC)	As per SL35	Jun-14	In progress	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.

SL38	St Lawrence Reticulation	Corrosion	As per SL35	Jun-14	In Progress	
SL39	St Lawrence Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
SL40	St Lawrence Reticulation	Biofilms, sloughing and re-suspension, regrowth	Ecoli and chlorine residual within reticulation have been within limits. Chlorine residual to be tested more frequently as part of new operational monitoring programme.	Dec-13	Complete	Testing to be added to the new SOP
SL41	St Lawrence Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	As per SL40	Dec-13	Complete	
SL42	St Lawrence Reticulation	Flow variability, inadequate pressures	As per SL40	Dec-13	Complete	Pressure monitoring to be undertaken.
SL43	St Lawrence Reticulation	Fire fighting increasing demand on the network	As per SL40	Dec-13	Complete	Pressure monitoring to be undertaken.
SL44	St Lawrence Reticulation	Inadequate maintenance of chlorine residual	As per SL40	Dec-13	Complete	
SL45	St Lawrence Whole System	Chemical dosing failure	As per SL40	Dec-13	Complete	
SL46	St Lawrence Whole System	Power Failure	Backup generator should be considered.	Jun-15	Overdue	
SL47	St Lawrence Whole System	Sabotage	WTP fencing/entrance gate to be put in place, as per SL34.	Jun-15	Complete	
SL48	St Lawrence WTP General	Aging infrastructure	Package plant should be recoated or replaced	Dec-16	Pending	
SL49	St Lawrence General	Variable water quality	Raw water turbidity and pH, clarified turbidity and filtered turbidity should be tested daily as part of operational monitoring (Priority 1 Change). Additionally, online monitoring with alarms should be installed to measure raw water turbidity and pH (Priority 3 Change), filtered water turbidity (Priority 1 Change) and final water pH, turbidity and chlorine residual (Priority 2 Change).	Dec-16	Pending	Note different priorities in Improvement Action
SL50	St Lawrence General	Process control incapability	SCADA should be installed with remote access to reduce reliance on operator	Jun-18	Pending	
SL51	St Lawrence General	Power Failure	Install lightning rod to protect electrical systems and operators	Dec-16	Pending	Anecdotal evidence of frequent lightning strikes at WTP and raw water pumps
SL52	St Lawrence Whole System	Equipment failure	Procure and install a standby chlorine dosing pump with auto-changeover capabilities	Dec-16	Pending	
SL53	St Lawrence Whole System	Process control incapability	Installation of appropriately sized calibration tubes on all dosing pumps. Include regular drop tests as part of operator checks	Jun-19	Pending	
SL54	St Lawrence Whole System	Chemical dosing failures	Consider installing a service water system to supply dilution water for all chemical dosing at a ratio of 10:1 to assist in even dispersion and mixing.	Jun-19	Pending	
SL55	St Lawrence Whole System	Chemical dosing failure	Install raw water flowmeter and configure flow paced dosing for all pre- dosed chemicals.	Jun-18	Pending	

SL56	St Lawrence WTP Inlet/ Flocculation	Inadequate mixing	Install new mixer that can achieve a velocity gradient of 30 to 150/s	Jun-18	Pending	Severe corrosion observed on flocculator during site visit (August 2015)
SL57	St Lawrence WTP Inlet/ Flocculation	Inadequate mixing	Install new soda ash dosing point on the filter outlet after final chlorine dosing point	Jun-18	Pending	
SL58	St Lawrence Filtration	Backwash with primary filtered water	Configure system to use treated water as backwash water	Dec-16	Pending	
SL59	St Lawrence Filtration	Contamination of filtered water	Configure filter outlet valve operation to open and close (based on plant start/stop) to reduce potential for dry bedding to occur	Dec-16	Pending	Dry bedding or filter overflow will occur due to current setup
SL60	St Lawrence Filtration	Inadequate filter operation	As per SL49, filtered water turbidity should be monitored at least daily as part of the operational monitoring programme. Online turbidity meter should be installed to filter outlet and final treated water.	Dec-16	Pending	
SL61	St Lawrence Filtration	Inadequate filter operation (secondary filter)	Consider disconnecting secondary filter (limited knowledge of setup, including underdrain system and media configuration) until the filter can be inspected with view for full refurbishment or replacement	Jun-17	Pending	Use of filter in its current state may be more detrimental than beneficial
SL62	St Lawrence Filtered Water	Process control incapability	Treated water online monitoring of chlorine residual, turbidity and pH with alarms should be added	Jun-17	Pending	
SL63	St Lawrence Reservoirs	Aged infrastructure / corrosion. Inadequate repair and maintenance	Replaced hatch and roof of Final Water Reservoir	Dec-16	Pending	
SL64	St Lawrence Reticulation	Dead ends in reticulation	Council to compile maintenance/flushing program as per GEN6	Jun-14	In Progress	
MI1	Middlemount Raw Water	Algal Bloom	Implement Event-based Algae and Algal Toxin monitoring as part of external testing regime based on observations of Turkey Nest and Sunwater WQ information	Dec-13	Complete	
MI2	Middlemount Raw Water	Rapid Variation in raw water quality	The current WTP process combined with operator input is considered capable of dealing with turbidity events. However, if future data shows that this system becomes unreliable, a raw water turbidity meter and/or SCM with alarms should be considered to assist operators in chemical dosing adjustments.	Jun-15	Overdue	To be considered in future if monitoring shows future instrumentation to be necessary.
MI3	Middlemount Raw Water	Rapid Variation in raw water quality caused by stormwater flows	The colour testing procedure is adequate for coagulant adjustment, but needs to be revised to ensure THMs are dealt with since the raw water is dosed with chlorine. True colour should be tested in samples sent to Queensland Health. Any sample that is above 15 HU should also be tested for THMs. These THM levels should be recorded and checked against ADWG limits. Further action may be required if THMs above 0.25mg/L are detected. Verification monitoring programme has been adjusted and will be followed in future.	Dec-13	Overdue	Testing to be added to the new SOP
MI4	Middlemount Raw Water	Chemical use in catchment areas (e.g. Weed spray)	Pesticide testing added to verification monitoring programme.	Dec-13	Complete	Testing to be added to the new SOP
MI5	Middlemount Raw Water	Heavy metals (mining)	More comprehensive testing of metals added to verification testing programme.	Dec-13	Complete	Testing to be added to the new SOP
MI6	Middlemount Raw Water	Wildlife Access (native and feral) and unrestricted livestock	No further action. It is considered that reasonable operational steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	

MI7	Middlemount Raw Water	Wildlife Access (native and feral) and unrestricted livestock	No further action. It is considered that reasonable operational steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI8	Middlemount Raw Water	Changes in surrounding land use	Monitor land use changes (ongoing)	Dec-13	Ongoing	Testing to be added to the new SOP
MI9	Middlemount Raw Water	Heavy Rainfall / Flooding	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI10	Middlemount Raw Water	Drought / Bushfires	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI11	Middlemount Raw Water	Equipment Failure	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI12	Middlemount Raw Water	No alternative water sources	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI13	Middlemount WTP General	Significant Flow variations	Link treated water turbidity analyser outputs to alarms	Dec-13	Complete (but need to change limits)	SCADA and telemetry modifications
MI14	Middlemount WTP Inlet/ Flocculation	Chemical dosing failures	Turbidity spikes detected by online analysers, as per MI13	Dec-13	Complete (but need to change limits)	
MI15	Middlemount WTP Inlet/ Flocculation	Equipment malfunction	An operating procedure for manual operation of the plant should be included in the operating manual. (As per GEN2)	Dec-13	Overdue	
MI16	Middlemount WTP General	Use of unapproved or contaminated water treatment chemicals	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI17	Middlemount WTP Inlet/ Flocculation	Inadequate mixing	As per MI13	Dec-13	Complete	
MI18	Middlemount WTP Inlet/ Flocculation	Poor reliability of process	As per MI13	Dec-13	Complete	
MI19	Middlemount WTP General	Formation of disinfection by-products	Incorporate THMs testing as part of regular external testing regime	Dec-13	Complete	Testing to be added to the new SOP
MI20	Middlemount Filtration	Chemical dosing failure / Equipment Malfunction	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI21	Middlemount Filtration	Process control incapability	Connect filtered water turbidity monitor to PLC with alarms as per item MI13	Dec-13	Complete	Use filtered turbidity to detect breakthrough
MI22	Middlemount Filtration	Inadequate filter operation	No further action. It is considered that reasonable steps are being taken by operators to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI23	Middlemount Filtration	Inadequate filter operation	No further action. It is considered that reasonable steps are being taken by operators to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI24	Middlemount Filtration	Equipment malfunction	No further action. It is considered that reasonable steps have been taken to provide standby equipment and thus minimise this risk and it is as low as practicable.	#N/A	N/A	
MI25	Middlemount Filtration	Equipment malfunction	Dry bedding will cause turbidity to spike. Turbidity alarm as per MI13 will assist the operator to identify there is a problem.	Dec-13	Complete	Use filtered turbidity to detect breakthrough

MI26	Middlemount Filtered Water	Ineffective disinfection	Online final water chlorine analyser to be connected to the PLC for alarms	Dec-13	In Progress	SCADA and telemetry modifications. Chlorine analyser is online and connected to SCADA, but no alarms as yet (Aug 2015)
MI27	Middlemount WTP General	Sludge drying beds supernatant return to Turkey Nest	As per MI13 (link treated water turbidity to alarms), and MI25 (link chlorine meter to alarm).	Dec-13	Complete	
MI28	Middlemount Reservoirs	Human/animal access	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
MI29	Middlemount Reservoirs	Build up of sediment and slime	No further action. It is considered that reasonable steps have been taken to inspect the system and thus minimise this risk and it is as low as practicable.	#N/A	N/A	Flushing procedure will be standardised as part of SOP update
MI30	Middlemount Reservoirs	Aged infrastructure / corrosion. Inadequate repair and maintenance	Corrosion observed in the roof. Repair works to commence in 2012/13 and progressively completed in coming years.	Jun-17	Pending	
MI31	Middlemount Reticulation	Build up of sediment and slime	Council to compile maintenance / replacement programme.	Jun-14	In Progress	Flushing procedure will be standardised as part of SOP update
MI32	Middlemount Reticulation	Aged pipes (AC)	as per MI31	Jun-14	In Progress	
MI33	Middlemount Reticulation	Corrosion	as per MI31	Jun-14	In Progress	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
MI34	Middlemount Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	Complete system pressure monitoring to ensure low pressure zones properly identified.	Jun-17	Pending	
MI35	Middlemount Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	Chlorine testing in reticulation either not done or not recorded. To be added to operational monitoring programme to assist operators with maintaining an adequate residual.	Dec-13	Complete	Testing to be added to the new SOP
MI36	Middlemount Reticulation	Flow variability, inadequate pressures	As per MI34	Jun-17	Pending	
MI37	Middlemount Reticulation	Fire fighting increasing demand on the network	As per MI34	Dec-13	Pending	Network modelling to be commissioned separately
MI38	Middlemount Reticulation	Inadequate maintenance of chlorine residual	As per MI35	Dec-13	Pending	Testing to be added to the new SOP
MI39	Middlemount Whole System	Chemical dosing failure	As per MI13 and MI25	Dec-13	In Progress	Chlorine analyser is online and connected to SCADA, but no alarms as yet (Aug 2015)
MI40	Middlemount Whole System	Power Failure	No further action. It is considered that shutdown is the best option to protect the plant in the case of power failure and thus minimise this risk of inappropriate treatment.	#N/A	N/A	
MI41	Middlemount Whole System	Sabotage	No further action. It is considered that reasonable steps have been taken to secure the system and thus minimise this risk and it is as low as practicable.	#N/A	N/A	
MI42	Middlemount WTP General	Rapid Variation in raw water quality	Increase frequency of iron and manganese operational monitoring in raw and treated water in order to accurately assess chlorine doses for oxidation	Dec-16	Pending	



MI43	Middlemount Raw Water	Rapid Variation in raw water quality	Install potassium permanganate dosing system for improved oxidation of soluble metals	Dec-16	Pending	Utilise existing tapping at raw water pumps for injection point
MI44	Middlemount WTP Inlet/ Flocculation	Chemical dosing failure	Configure flow paced dosing for all chemicals.	Jun-18	Pending	
MI45	Middlemount WTP Inlet/ Flocculation	Chemical dosing failure	Install standby dosing pumps for coagulant. Add auto changeover on pump fault (Priority 1 Change). Install caustic soda dosing system (to replace soda ash system), including duty/ standby dosing pumps (Priority 2 Change).	Dec-16	Pending	
MI46	Middlemount WTP Inlet/ Flocculation	Poor reliability of process	Consider changing order of raw water dosing to achieve optimal results (recommend soda ash dosed first, followed by chlorine then coagulant). PAC dosing (when required) should also be dosed prior to the flash mixer.	Jun-19	Pending	There are available dosing points so changes can be trialled easily. When PAC and chlorine/ potassium permanganate are both required, PAC can be dosed into flocculation zone (as per the current setup).
MI47	Middlemount Whole System	Equipment Failure	PE hosing should be changed to a suitable material for contact with chlorine	Dec-16	Pending	Recommend replacing with CPVC
MI48	Middlemount WTP Clarification	Poor clarification	Install polymer dosing system to aid in coagulation/ flocculation	Jun-17	Pending	
MI49	Middlemount WTP Inlet/ Flocculation	Equipment malfunction	Downrate the plant upon startup to minimise floc carryover to filters	Jun-18	Pending	
MI50	Middlemount Filtration	Inadequate filter operation	Reconfigure backwash sequence to improve filter performance and minimise media loss	Jun-17	Pending	Recommend more operator involvement in filter backwash process (i.e. checking filter media level biannually)
MI51	Middlemount Filtration	Process control incapability	Install online turbidity analysers on outlet of each filter.	Jun-18	Pending	
MI52	Middlemount Filtration	Process control incapability	Install level sensors in filters and reconfigure the backwash drain down sequence to be based on level	Dec-16	Pending	This will achieve sufficient drain down to enable appropriate bed expansion during backwashing
MI53	Middlemount Filtration	Inadequate filter operation	Install standby air blower for air scour	Dec-16	Pending	
MI54	Middlemount Filtration	Process control incapability	Change limits on filtered water turbidity analyser to be in line with ADWG recommendations	Dec-16	Pending	ADWG 2011 targets less than 0.2 NTU at filter outlet, with a critical limit of 0.5 NTU
MI55	Middlemount Whole system	Disinfection failure	Procure and install scales for each 70 kg chlorine gas cylinder	Dec-16	Pending	Current setup relies on operator knowledge of chemical usage for changeover of cylinders.
MI56	Middlemount Whole system	Disinfection failure	Install auto changeover capability on 70 kg chlorine gas cylinders	Dec-16	Pending	
MI57	Middlemount Whole system	Process control incapability	Clean and calibrate chlorine analyser regularly as part of operator checks (Priority 1 Change). Install call out alarms on low and high chlorine residual (Priority 2 Change).	Dec-16	Pending	
MI58	Middlemount Whole system	Animal access to Clearwater Tanks including birds and vermin	Repair or replace mesh where vermin and birds can access Clearwater Tank #1	Dec-16	Pending	
MI59	Middlemount Whole system	Aged infrastructure/ corrosion	Hatch on Clearwater Tank #1 should be replaced.	Dec-16	Pending	Consider replacing entire roof
MI60	Middlemount Town Reservoir	Aged infrastructure/ corrosion	Areas of corrosion visible in roof. Repair or replace roof.	Jun-17	Pending	

MI61	Middlemount Town Reservoir	Ageing infrastructure and sludge buildup	Desludge Town Reservoir	Dec-16	Pending	Operators advise it is difficult to maintain a residual in the reticulation and the sediment built up in the reservoir is likely making this more difficult
MI62	Middlemount Town Reservoir	Inadequate maintenance of chlorine residual	Install new booster chlorine dosing system at Town Reservoir with online monitoring and alarms	Jun-17	Pending	
MI63	Middlemount Whole system	Tankered sewage discharges at Middlemount WTP	Discharge tankered sewage at Middlemount Sewage Treatment Plant only	Jun-17	Pending	
D1	Dysart Raw Water	Algal Bloom	Implement Event-based Algae and Algal Toxin monitoring as part of verification monitoring based on observations of Turkey Nest and Sunwater WQ information	Dec-13	Complete	
D2	Dysart Raw Water	Rapid Variation in raw water quality	The current WTP process combined with operator input is considered capable of dealing with turbidity events. However, if future data shows that this system becomes unreliable, a raw water turbidity meter and/or SCM with alarms should be considered to assist operators in chemical dosing adjustments.	Jun-17	Complete	To be considered in future if monitoring shows future instrumentation is necessary
D3	Dysart Raw Water	Rapid Variation in raw water quality caused by stormwater flows	The colour testing procedure needs to be revised. Since the raw water is dosed with chlorine, True colour should be tested in samples sent to Queensland Health. Any sample that is above 15 HU should also be tested for THMs. These THM levels should be recorded and checked against ADWG limits. Further action may be required if THMs above 0.25mg/L are detected. This requirement has been added to the verification monitoring programme.	Dec-13	Overdue	Testing to be added to the new SOP
D4	Dysart Raw Water	Chemical use in catchment areas (e.g. Weed spray)	Pesticide testing added to verification monitoring programme.	Dec-13	Complete	Testing to be added to the new SOP
D5	Dysart Raw Water	Chemical use in catchment areas (mining)	Testing for metals added to the revised verification monitoring programme.	Dec-13	Complete	Testing to be added to the new SOP
D6	Dysart Raw Water	Wildlife Access (native and feral) and unrestricted livestock	No further action. It is considered that all reasonable operational steps are being taken by the operator minimise this risk and it is as low as practicable.	#N/A	N/A	
D7	Dysart Raw Water	Wildlife Access (native and feral) and unrestricted livestock	No further action. It is considered that all reasonable operational steps are being taken by the operator minimise this risk and it is as low as practicable.	#N/A	N/A	
D8	Dysart Raw Water	Heavy Rainfall / Flooding	No further action. It is considered that reasonable step are being taken by the operator treat the changes in raw water and this risk is as low as practicable.	#N/A	N/A	
D9	Dysart Raw Water	Drought / Bushfires	No further action. It is considered that reasonable step are being taken by the operator treat the changes in raw water and this risk is as low as practicable.	#N/A	N/A	
D10	Dysart Raw Water	Equipment Failure	No further action. It is considered that reasonable steps have been taken by including redundancy and this risk is as low as practicable.	#N/A	N/A	
D11	Dysart Raw Water	Chemical dosing failure / Equipment Malfunction	No further action. It is considered that reasonable steps have been taken by including redundancy and operator action and thus this risk is as low as practicable.	#N/A	N/A	
D12	Dysart WTP General	Significant Flow variations	No further action. It is considered those reasonable steps are being taken by the operator to ensure the flocculation process is effective and this risk is as low as practicable.	#N/A	N/A	

D13	Dysart WTP Inlet/ Flocculation	Process control incapability	Verification monitoring to include more regular testing of aluminium.	Dec-13	Overdue	
D14	Dysart WTP Inlet/ Flocculation	Process control incapability	No further action. It is considered those reasonable steps are being taken by the operator to ensure the coagulant dose is appropriate. This risk is as low as practicable.	#N/A	N/A	
D15	Dysart WTP Inlet/ Flocculation	Chemical dosing failures	No further action. It is considered those reasonable steps are being taken by the operator to ensure the coagulant dose is appropriate. This risk is as low as practicable.	#N/A	N/A	
D16	Dysart WTP Inlet/ Flocculation	Equipment malfunction	Alarm on failure of inlet flowmeter and/or alarm on treated water turbidity measurement will alert the operator that there is a problem.  Operating manual to be put in place to assist operators with manual operation (priority 2)	Dec-13	Complete	SCADA and telemetry modifications
D17	Dysart WTP General	Use of unapproved or contaminated water treatment chemicals	No further action. It is considered that reasonable steps have been taken to minimise this risk and it is as low as practicable.	#N/A	N/A	
D18	Dysart WTP Inlet/ Flocculation	Inadequate mixing	No further action. It is considered those reasonable steps are being taken by the operator to ensure the coagulant dose is appropriate. This risk is as low as practicable.	#N/A	N/A	
D19	Dysart WTP Inlet/ Flocculation	Poor reliability of process	No further action. It is considered those reasonable steps are being taken by the operator to ensure the coagulant dose is appropriate. This risk is as low as practicable.	#N/A	N/A	
D20	Dysart WTP General	Formation of disinfection by-products	Verification monitoring programme to include defined timeframe for THM testing.	Dec-13	Complete	
D21	Dysart Filtration	Process control incapability	Alarm on treated water turbidity to be implemented as per D16.	Dec-13	Complete	Use filtered turbidity to detect breakthrough
D22	Dysart Filtration	Inadequate filter operation	Alarm on treated water turbidity to be implemented as per D16.	Dec-13	Complete	Use filtered turbidity to detect breakthrough
D23	Dysart Filtration	Inadequate filter operation	Alarm on treated water turbidity to be implemented as per D16.	Dec-13	Complete	Use filtered turbidity to detect breakthrough
D24	Dysart Filtration	Equipment malfunction	No further action. It is considered that duty/standby equipment ensures that this risk is as low as practicable.	#N/A	N/A	
D25	Dysart Filtration	Equipment malfunction	It is considered that adequate steps have been taken to minimise this risk. No further action.	#N/A	N/A	
D26	Dysart Filtered Water	Ineffective disinfection	Online chlorine analyser probe is to be replaced/upgraded and included in the PLC for alarms.	Dec-13	Complete	
D27	Dysart WTP General	Sludge pond supernatant return	As per D16 and D26 to detect abnormal process conditions	#N/A	N/A	
D28	Dysart Reservoirs	Human/animal access	It is considered that adequate steps have been taken to protect the system and this risk is as low as practicable.	#N/A	N/A	
D29	Dysart Reservoirs	Build up of sediment and slime	Council to compile flushing/ maintenance programme.	Jun-14	Complete	Flushing procedure will be standardised as part of SOP update
D30	Dysart Reservoirs	Aged infrastructure / corrosion. Inadequate repair and maintenance	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
D31	Dysart Reticulation	Build up of sediment and slime	As per D29	Jun-14	Complete	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.

D32	Dysart Reticulation	Aged pipes (AC)	As per D29	Jun-14	Complete	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
D33	Dysart Reticulation	Corrosion	As per D29	Jun-14	Complete	Programme to be put in place for maintenance and inspection on a regular basis for all water schemes in the Isaac Regional Council area. Cost is dependent on frequency required.
D34	Dysart Reticulation	Infiltration and ingress of contamination from cross connections, backflow (soil and groundwater)	No further action. It is considered that reasonable steps have been taken to minimise this risk.	#N/A	N/A	
D35	Dysart Reticulation	Biofilms, sloughing and re-suspension, regrowth	Chlorine testing in reticulation either not done or not recorded. To be added to operational monitoring programme to assist operators with maintaining an adequate residual. New flushing procedure is necessary	Dec-13	Complete	Testing to be added to the new SOP
D36	Dysart Reticulation	Pipe bursts or leaks. Inadequate repair and maintenance, inadequate system flushing and reservoir cleaning. Commissioning new mains.	As per D35	Dec-13	Complete	
D37	Dysart Reticulation	Flow variability, inadequate pressures	Council to ensure that test results of pressure readings are recorded or a model produced for the reticulation network to identify any issues.	Jun-17	Pending	Network modelling to be commissioned separately
D38	Dysart Reticulation	Fire fighting increasing demand on the network	As per D35	Dec-13	Complete	
D39	Dysart Reticulation	Inadequate maintenance of chlorine residual	As per D35	Dec-13	Complete	
D40	Dysart Whole System	Power Failure	No further action. It is considered that shutdown is the best option to protect the plant in the case of power failure and thus minimise this risk of inappropriate treatment.	#N/A	N/A	
D41	Dysart Whole System	Sabotage	No further action. It is considered that reasonable steps have been undertaken.	#N/A	N/A	
D42	Dysart Whole System	Capacity	Monitor population on a yearly basis and assess against plant capacity. (ongoing)	Dec-13	In progress	
D43	Dysart General	Process control incapability	Complete matrix calibration to finalise commissioning of LiquiD analyser	Dec-16	Pending	LiquiD calibration and commissioning to be finalised prior to commencement of Phase 2 Upgrades commissioning
D44	Dysart General	Process control incapability	Ensure analysers are regularly calibrated as part of operator checks	Dec-16	Pending	
D45	Dysart General	Chemical dosing failure / Equipment Malfunction	Develop more robust chemical ordering process to ensure constant supply of required reagents for online analysers	Dec-16	Pending	Council should consider implementing annual chemical supply contracts to improve ordering and procurement process
D46	Dysart General	Process control incapability	Determine alarm limits and assign priorities, including shutdown and call out alarms, in SCADA	Dec-16	Pending	Limits and call out priorities should be consistent with CCPs
D47	Dysart WTP Clarification	Process control incapability	Include operator changeable clarifier sludge blowdown setpoint on SCADA to increase control of frequency	Jun-17	Pending	

D48	Dysart General	Out of date Standard Operating Procedure	Develop/ Revise SOPs for new treatment processes at Dysart (as per GEN1) and all chemical systems	Dec-16	Pending	Require updated SOPs for operation and maintenance of all chemical systems (e.g. filling poly and potassium permanganate hoppers, flushing poly dosing lines)
D49	Dysart General	Equipment malfunction	Develop spare parts list for whole of plant	Dec-16	Pending	Various new processes at WTP that require on the shelf spares
D50	Dysart Filtration	Inadequate filter operation	Confirm SCADA settings and capability for auto backwash trigger on high turbidity alarm	Dec-16	Pending	Refurbished filters are to have functionality to automatically backwash based on run time, headloss or high filtered water turbidity
D51	Dysart General	Process control incapability	Ensure SCADA is showing all instrument and equipment values correctly	Dec-16	Pending	

## Appendix B – Summary of compliance with water quality criteria

The results from the verification monitoring program have been compared against the levels of the water quality criteria specified by the Regulator in the Water Quality and Reporting Guideline for a Drinking Water Service.

The reported statistics do not include results derived from repeat samples, or from emergency or investigative samples undertaken in response to an elevated result.

Verification monitoring was carried out as per the DWQMP and no changes are required.

Results of the current verification monitoring plan need to continue for a further 12 months to build a database for further review or reduction of current analyse carried out.

**Table 1 - Verification monitoring results**

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of reporting	Laboratory name
Carmila	Reticulated Water	pH-AE	pH	Daily/Weekly	161	0	0	7.200	7.900	7.741	6.5-8.5 <sup>a</sup>	In house
Carmila	Reticulated Water	Chlorine-AF	Mg/L	Daily/Weekly	161	0	0	1.000	3.000	1.515	5 <sup>h</sup>	In house
Carmila	Reticulated Water	Iron-AG	Mg/l	Weekly/Fortnightly	46	0	0	0.000	0.000	0.000	0.3 <sup>a</sup>	In house
Carmila	Reticulated Water	Manganese-AH	Mg/l	Weekly/Fortnightly	48	0	0	0.000	0.004	0.001	0.001 <sup>a</sup>	In house
Carmila	Reticulated Water	Turbidity-AJ	NTU	Daily/Weekly	161	0	0	0.100	1.000	1.266	5 <sup>a</sup>	In house
Clermont	Reticulated Water	pH-AL	pH	Daily	365	0	1	6.450	9.890	7.206	6.5-8.5 <sup>a</sup>	In house
Clermont	Reticulated Water	Iron-BA	Mg/L	Weekly/Fortnightly	38	0	0	0.001	0.900	0.041	0.3 <sup>a</sup>	In house
Clermont	Reticulated Water	Turbidity-AN	NTU	Daily	365	0	0	0.090	1.980	0.355	5 <sup>a</sup>	In house
Clermont	Reticulated Water	Nitrates-AW	Mg/l	Weekly/Fortnightly	35	0	0	0.010	3.400	1.777	50 <sup>h</sup>	In house
Clermont	Reticulated Water	Nitrites-AX	Mg/l	Weekly/Fortnightly	31	0	0	0.001	0.124	0.016	3 <sup>h</sup>	In house

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of reporting	Laboratory name
Dysart	Reticulated Water	pH-BX	pH	Daily	361	0	0	6.530	8.270	6.862	6.5-8.5 <sup>a</sup>	In house
Dysart	Reticulated Water	Chlorine-CE	Mg/l	Daily	361	0	0	0.090	4.900	2.262	5 <sup>h</sup>	In house
Dysart	Reticulated Water	Turbidity-BZ	NTU	Daily	172	0	0	0.030	1.700	0.350	5 <sup>a</sup>	In house
Dysart	Reticulated Water	Manganese-CC	Mg/l	Daily/Weekly	328	0	7	0.000	1.700	0.096	0.5 <sup>h</sup>	In house
Glenden	Reticulated Water	pH-AT	pH	Daily	365	0	0	6.750	7.700	7.222	6.5-8.5 <sup>a</sup>	In house
Glenden	Reticulated Water	Chlorine-AU	Mg/l	Daily	364	0	0	0.150	2.000	0.955	5 <sup>h</sup>	In house
Glenden	Reticulated Water	Aluminium-AW	Mg/l	Daily	364	0	0	0.000	0.170	0.042	0.2 <sup>a</sup>	In house
Glenden	Reticulated Water	Turbidity-AX	NTU	Daily	365	0	0	0.010	1.020	0.153	5 <sup>a</sup>	In house
Middlemount	Reticulated Water	pH-BX	pH	Daily	326	0	0	0.000	8.460	7.233	6.5-8.5 <sup>a</sup>	In house
Middlemount	Reticulated Water	Chlorine-CE	Mg/l	Daily	327	0	1	0.000	6.300	2.371	5 <sup>h</sup>	In house
Middlemount	Reticulated Water	Iron-CB	Mg/l	Daily/weekly	98	0	0	0.000	0.100	0.010	0.3 <sup>a</sup>	In house
Middlemount	Reticulated Water	Manganese-CC	Mg/l	Daily	286	0	1	0.000	4.500	0.114	0.5 <sup>h</sup>	In house
Middlemount	Reticulated Water	Turbidity-BZ	NTU	Daily	328	0	0	0.000	1.390	0.106	5 <sup>a</sup>	In house
Moranbah	Reticulated Water	Fluoride-EB	Mg/l	Daily	361	0	0	0.150	0.820	0.608	1.5 <sup>h</sup>	In house
Moranbah	Reticulated Water	Chlorine-EA	Mg/l	Daily	365	0	0	0.070	4.120	2.113	5 <sup>h</sup>	In house
Moranbah	Reticulated Water	Manganese-EG	Mg/l	Daily/weekly	94	0	0	0.000	0.071	0.010	0.1 <sup>a</sup>	In house
Moranbah	Reticulated Water	Iron-EE	Mg/l	Daily/weekly	86	0	0	0.000	0.040	0.011	0.3 <sup>a</sup>	In house
Moranbah	Reticulated Water	Aluminium-EH	Mg/l	Weekly	41	0	0	0.000	0.029	0.010	0.2 <sup>a</sup>	In house
Moranbah	Reticulated Water	pH-DZ	pH	Daily	364	0	0	6.850	8.240	7.548	6.5-8.5 <sup>a</sup>	In house
Moranbah	Reticulated Water	Turbidity-DY	NTU	Daily	364	0	1	0.130	6.190	0.483	5 <sup>a</sup>	In house

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	Limit of reporting	Laboratory name
Nebo	Reticulated Water	pH-AE	pH	Daily	365	0	0	6.400	7.750	6.994	6.5-8.5 <sup>a</sup>	In house
Nebo	Reticulated Water	Chlorine-AF	Mg/l	Daily	365	0	0	0.040	1.840	0.563	5 <sup>h</sup>	In house
Nebo	Reticulated Water	Turbidity-AI	NTU	Daily	365	0	0	0.100	0.900	0.209	5 <sup>a</sup>	In house
St Lawrence	Reticulated Water	pH-AE	pH	Daily	365	0	0	6.400	7.750	6.994	6.5-8.5 <sup>a</sup>	In house
St Lawrence	Reticulated Water	Chlorine-AF	Mg/l	Daily	365	0	0	0.040	1.840	0.563	5 <sup>h</sup>	In house
St Lawrence	Reticulated Water	Turbidity-AJ	NTU	Daily	365	0	0	0.100	0.900	0.209	5 <sup>a</sup>	In house
St Lawrence	Reticulated Water	Iron-AG	Mg/l	Daily/Weekly	34	0	0	0.000	0.000	0.000	0.3 <sup>a</sup>	In house
St Lawrence	Reticulated Water	Manganese-AH	Mg/l	Daily/Weekly	44	0	0	0.000	0.250	0.017	0.5 <sup>h</sup>	In house

\* Guideline Values used: h – Health; a - Aesthetic



Table 2 - Reticulation *E. coli* verification monitoring

Drinking water scheme: CARMILA

Year	2014-2015											
Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
<b>No. of samples collected</b>	2	4	4	4	4	4	4	4	4	4	4	4
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	24	26	28	30	32	34	26	28	30	32	34	36
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: CLERMONT

Year	2014-2015											
Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
No. of samples collected	6	16	11	17	14	9	12	9	18	9	9	12
No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)	0	0	0	0	0	0	0	0	0	0	0	0
No. of samples collected in previous 12 month period	112	121	123	131	134	137	107	104	116	119	117	120
No. of failures for previous 12 month period	0	0	0	0	0	0	0	0	0	0	0	0
% of samples that comply	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Compliance with 98% annual value	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: DYSART

Year	2014-2015											
Month	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
<b>No. of samples collected</b>	8	8	8	8	8	8	4	4	5	4	4	5
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	82	82	82	80	82	84	88	84	83	81	77	74
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: GLENDEN

<i>Year</i>	<i>2014-2015</i>											
<i>Month</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>
<b>No. of samples collected</b>	10	10	13	15	9	15	12	12	11	15	12	12
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	83	91	96	101	103	114	87	89	94	101	103	107
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: MIDDLEMOUNT

<i>Year</i>	<i>2014-2015</i>											
<i>Month</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>
<b>No. of samples collected</b>	8	6	6	7	6	28	8	4	6	8	6	6
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	72	72	72	73	75	99	52	53	56	62	65	68
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: MORANBAH

<i>Year</i>	<i>2014-2015</i>											
<i>Month</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>
<b>No. of samples collected</b>	14	12	10	12	12	12	12	12	14	12	10	14
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	136	138	136	136	136	140	137	137	139	140	138	142
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: NEBO

<i>Year</i>	<i>2014-2015</i>											
<i>Month</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>
<b>No. of samples collected</b>	3	4	1	0	1	1	2	3	18	16	14	10
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	41	42	38	32	30	28	49	46	61	74	85	86
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Drinking water scheme: ST LAWRENCE

<i>Year</i>	<i>2014-2015</i>											
<i>Month</i>	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>	<i>May</i>	<i>Jun</i>
<b>No. of samples collected</b>	2	4	4	4	4	4	4	4	4	4	4	4
<b>No. of samples collected in which <i>E. coli</i> is detected (i.e. a failure)</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>No. of samples collected in previous 12 month period</b>	24	26	28	30	32	34	26	28	30	32	34	36
<b>No. of failures for previous 12 month period</b>	0	0	0	0	0	0	0	0	0	0	0	0
<b>% of samples that comply</b>	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
<b>Compliance with 98% annual value</b>	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES



## Appendix C – Recommended changes to verification monitoring/external testing regime

**Table 5 – Verification monitoring/external testing changes recommended**

Recommended Changes to Carmila Verification Monitoring/External Testing Regime			
Testing Frequency	Proposed Monitoring Frequency	Notes	Planned Action
Monthly	Iron and Manganese	Both total and dissolved iron and manganese should be tested. If large fluctuations in concentration or discrepancies between external and in house testing are seen then these parameters should be increased to weekly.	To leave the same as results have not indicated the need for weekly testing.
	Disinfection By-products: THMs	Analyse results and determine if reduction to quarterly or annual sampling can be made. THM testing during periods of high colour may be sufficient.	In progress
	Fluoride	Check levels for one year. If fluoride is absent, move to annual testing until such time as fluoride is dosed	In progress
	Inorganics: Arsenic, fluoride, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide,	Analyse results and determine if reduction to annual sampling can be made.	In progress
Quarterly	Radionuclides	Analyse results and determine if reduction to 2 yearly sampling can be made.	In progress
	Pesticides	Analyse results and determine if increase in frequency is required.	In progress
Annually	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
	Radionuclides	Analyse results and determine if increase in frequency is required.	In progress

Recommended Changes to Clermont Verification Monitoring/External Testing Regime			
Testing Frequency	Proposed Monitoring Frequency	Notes	Planned Action
Monthly	Iron and Manganese	Both total and dissolved iron and manganese should be tested. If large fluctuations in concentration or discrepancies between external and in house testing are seen then these parameters should be increased to weekly.	To leave the same as results have not indicated the need for weekly testing.
	Disinfection By-products: THMs	Due to spikes in colour in the raw water and the dosing of chlorine for iron and manganese removal, there is potential for THMs to be formed. Therefore, external testing shall be completed at least monthly. THM monitoring may need to be increased to weekly during periods of increased organics and algal toxins.	In progress
	Fluoride	Check levels for one year. If fluoride is absent, move to annual testing until such a time as fluoride is dosed	In progress
	<i>E. coli</i>	One additional sample per month per monitoring zone (in addition to weekly monitoring)	In progress
	Algal toxins	Analyse results and determine if reduction to seasonal sampling can be made.	In progress
	Inorganics: Arsenic, fluoride, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide	Analyse results and determine if reduction to annual sampling can be made.	In progress
Quarterly	Radionuclides	Analyse results and determine if reduction to annual sampling can be made.	In progress
	Pesticides	Analyse results and determine if reduction to annual sampling can be made.	In progress
	Pesticides	Analyse results and determine if increase in frequency is required.	In progress
Annually	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
	Radionuclides	Test frequency to be re-assessed if detected	In progress

Recommended Changes to Dysart Verification Monitoring/External Testing Regime			
Testing Frequency	Proposed Monitoring Frequency	Notes	Planned Action
Monthly	Algal Toxins	Increase algal toxin monitoring during periods of elevated algae concentrations. A blue green algae management program should be developed for all IRC supply systems to outline testing requirements.	Currently monitoring is being carried out by a liquid ID unit and treatment is based on these readings.
	Iron and Manganese	Both total and dissolved iron and manganese should be tested. If large fluctuations in concentration or discrepancies between external and in house testing are seen then these parameters should be increased to weekly.	To leave the same as results have not indicated the need for weekly testing.
	Fluoride	Check levels for one year. If fluoride is absent, move to annual testing until such time as fluoride is dosed.	In progress
	<i>E. coli</i>	One additional sample per month per monitoring zone (in addition to weekly monitoring)	In progress
	Disinfection By-products: THMs	Analyse results and determine if reduction to quarterly or annual sampling can be made. THM testing during periods of high colour may be sufficient.	In progress
	Inorganics: Arsenic, fluoride, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide	Analyse results and determine if reduction to annual sampling can be made.	In progress
Quarterly	Radionuclides	Analyse results and determine if reduction to 5 yearly sampling can be made.	In progress
	Pesticides	Analyse results and determine if reduction to annual sampling can be made.	In progress
	Pesticides	Analyse results and determine if increase in frequency is required.	In progress
Annually	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
	Radionuclides	Analyse results and determine if increase in frequency is required.	In progress

Recommended Changes to Glenden Verification Monitoring/External Testing Regime			
Testing Frequency	Proposed Monitoring Frequency	Notes	Planned Action
Weekly	Aluminium	To be tested as long as aluminium based coagulant is being dosed	Tested daily in house and weekly to NATA lab.
	<i>E. coli</i>	One sample per week per monitoring zone (also refer to monthly monitoring)	Samples sent to NATA weekly.
	Colour, DO		Daily in house testing.
	Iron, Manganese	Both total and dissolved concentrations should be tested. If large fluctuations in concentration or discrepancies between external and in house testing are seen then these parameters should be increased to weekly.	To leave the same as results have not indicated the need for weekly testing.
Monthly	Disinfection By-products: THMs	THM monitoring may need to be increased to weekly during periods of increased organics and algal toxins.	In progress
	Fluoride	Check levels for one year. If fluoride is absent, move to annual testing until such time as fluoride is dosed	In progress
	Algal toxins	Analyse results and determine if reduction to seasonal sampling can be made.	In progress
	<i>E. coli</i>	One additional sample per month per monitoring zone (in addition to weekly monitoring)	In progress
	Pesticides	Analyse results and determine if reduction to annual sampling can be made.	In progress
	Inorganics: Arsenic, fluoride, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide	Analyse results and determine if increase in frequency is required or whether testing can be reduced to annual.	In progress
	Radionuclides	Analyse results and determine if reduction to 5 yearly sampling can be made.	In progress
Quarterly	Pesticides	Analyse results and determine if increase in frequency is required.	In progress
	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
Annually	Radionuclides	Analyse results and determine if increase in frequency is required.	In progress

Recommended Changes to Middlemount Verification Monitoring/External Testing Regime			
Testing Frequency	Proposed Monitoring Frequency	Notes	Planned Action
Monthly	Iron and Manganese	Both total and dissolved iron and manganese should be tested. If large fluctuations in concentration or discrepancies between external and in house testing are seen then these parameters should be increased to weekly.	To leave the same as results have not indicated the need for weekly testing.
	Disinfection By-products: THMs	Analyse results and determine if reduction to event based monitoring only is practical. THM monitoring may need to be increased to weekly during periods of increased organics and algal toxins.	In progress
	Fluoride	Check levels for one year. If fluoride is absent, move to annual testing until such time as fluoride is dosed.	In progress
	<i>E. coli</i>	One additional sample per month per monitoring zone (in addition to weekly monitoring)	In progress
	Inorganics: Arsenic, fluoride, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide	Analyse results and determine if increase in frequency is required or whether testing can be reduced to annual.	In progress
Quarterly	Radionuclides	Analyse results and determine if reduction to 5 yearly sampling can be made.	In progress
	Pesticides	Analyse results and determine if increase in frequency is required or whether testing can be reduced to annual.	In progress
	Pesticides	Analyse results and determine if increase in frequency is required.	In progress
Annually	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
	Radionuclides	Analyse results and determine if increase in frequency is required.	In progress

Recommended Changes to Moranbah Verification Monitoring/External Testing Regime			
Testing Frequency	Proposed Monitoring Frequency	Notes	Planned Action
Weekly	Iron, Manganese	Both total and dissolved iron and manganese should be tested.	To leave the same as results have not indicated the need for weekly testing.
Monthly	Disinfection By-products: THMs	THM monitoring may need to be increased to weekly during periods of increased organics and algal toxins.	In progress
	<i>E. coli</i>	Three additional samples per month per monitoring zone (in addition to weekly monitoring)	In progress
	Algal toxins	Analyse results and determine if reduction to seasonal sampling can be made.	In progress
	Inorganics: Arsenic, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide	Analyse results and determine if reduction to annual sampling can be made.	In progress
	Radionuclides	Analyse results and determine if reduction to 5 yearly sampling can be made.	In progress
	Pesticides	Analyse results and determine if reduction to annual sampling can be made.	In progress
Quarterly	Pesticides	Analyse results and determine if increase in frequency is required.	In progress
	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
	Radionuclides	Analyse results and determine if increase in frequency is required.	In progress

Recommended Changes to Nebo Verification Monitoring/External Testing Regime			
Testing Frequency	Proposed Monitoring Frequency	Notes	Planned Action
Monthly	Iron and Manganese	Both total and dissolved iron and manganese should be tested. If large fluctuations in concentration or discrepancies between external and in house testing are seen then these parameters should be increased to weekly.	To leave the same as results have not indicated the need for weekly testing.
	Disinfection By-products: THMs	Analyse results and determine if reduction to quarterly or annual sampling can be made. THM testing during periods of high colour may be sufficient.	In progress
	<i>E. coli</i>	One sample per month per monitoring zone	In progress
	Inorganics: Arsenic, fluoride, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide	Analyse results and determine if reduction to annual sampling can be made.	In progress
	Radionuclides	Analyse results and determine if reduction to 2 yearly sampling can be made.	In progress
Quarterly	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
	Radionuclides	Analyse results and determine if increase in frequency is required.	In progress

**Recommended Changes to St Lawrence Verification Monitoring/External Testing Regime**

<b>Testing Frequency</b>	<b>Proposed Monitoring Frequency</b>	<b>Notes</b>	<b>Planned Action</b>
Weekly	Aluminium	To be tested as long as aluminium based coagulant is being dosed	Daily in house testing is carried out and weekly samples sent to NATA lab.
Monthly	Disinfection By-products: THMs	Analyse results and determine if reduction to event based monitoring only is practical. THM monitoring may need to be increased to weekly during periods of increased organics and algal toxins.	In progress
	Fluoride	Check levels for one year. If fluoride is absent, move to annual testing until such time as fluoride is dosed.	In progress
	Inorganics: Arsenic, fluoride, selenium, lead, mercury, ammonia, cadmium, chromium, nickel, zinc, copper, hydrogen sulphide,	Analyse results and determine if increase in frequency is required or whether testing can be reduced to annual.	In progress
Quarterly	Radionuclides	Analyse results and determine if reduction to 5 yearly sampling can be made.	In progress
	Pesticides	Analyse results and determine if increase in frequency is required.	In progress
Annually	Inorganics: Tin, silver, beryllium, uranium, iodide, molybdenum, boron, barium	Analyse results and determine if increase in frequency is required.	In progress
	Radionuclides	Analyse results and determine if increase in frequency is required.	In progress