# Annual Report 2011-2012

## Wivenhoe Drinking Water Quality Management Plan

# Contents

# 1. Executive Summary

The *Wivenhoe Drinking Water Quality Management Plan Annual Report* (July 2011 to June 2012) summarises Seqwater's implementation of the *Wivenhoe Drinking Water Quality Management Plan* (WDWQMP) and the management of risks and issues encountered over the reporting year.

Over the reporting year, Seqwater has met the majority of the WDWQMP approval conditions as specified in the under section 99 (1)(b) of the *Water Supply (Safety and Reliability) Act 2008*. The outstanding approval condition relating to the integration of the WDWQMP and the *Recycled Water Management Plan* (RWMP) is scheduled for completion in September 2012 and is on schedule to meet this timeline.

Revisions have been made to the risk assessment framework underpinning the WDWQMP to provide greater alignment and transparency and these changes will be implemented in early 2013 to align with a planned revision and update of the WDWQMP.

The operational monitoring program within the WDWQMP has progressed significantly with a number of key plans and processes being finalised over the course of the year. Additionally, a significant number of improvements have also been realised or progressed and these are on track for completion as scheduled. This information will be updated in the planned review for 2013.

Over the course of the reporting year, 44 416 analyses were conducted as part of the verification monitoring program. During this time, 548 exceedences of the Wivenhoe Corrective Action Procedure were recorded. Significantly, over 50% (305) of these related to conductivity exceedences, the majority in the mid-Brisbane and Lockyer system and to a lesser extent in the upper Wivenhoe System. This has been attributed to the return of baseflows from saline aquifers following the floods (and groundwater recharge) and this change in risk profile will be incorporated as part of the 2013 review. Other exceedences of significance related to algae (cyanobacteria) and algal metabolites, metals, pathogen indicators and turbidity. All triggers were responded to according to the Wivenhoe System Catchment Water Quality Corrective Action Procedure.

# 2. Introduction

## 2.1 Purpose

The *Wivenhoe Drinking Water Quality Management Plan* (WDWQMP) has been prepared under requirements of Section 141 (1a) of the *Water Supply (Safety and Reliability) Act 2008*. The purpose of this annual report is to provide the Office of the Water Supply Regulator (the Regulator) with information on the overall performance of the WDWQMP for the period 1 July 2011 to 30 June 2012. In accordance with the requirements of the Act, the following details our compliance with the conditions for the annual report.

| Annual Report Condition | Seqwater Compliance |
|---|---|
| 141 (1) A service provider must prepare an annual report that complies with section 142 –<br>(a) for each financial year after a financial year in which a strategic asset management plan, system leakage management plan or drinking water quality management plan has been approved; | The WDWQMP was approved on 29 June 2011, with the first annual report being required 120 business days following the end of the July 2011 to June 2012 financial year; identified as 18 December 2012. |
| 142 For an annual report mentioned in section 141(1)(a) that relates to a drinking water quality management plan, the report must— | There are currently no guidelines prepared by the OWSR for annual reports. Seqwater has endeavoured to provide an update on the implementation of the WDWQMP following the guiding principles of the *Drinking Water Quality Management Plan Guideline* (2010) |
| (a) be prepared in accordance with the guidelines, if any, made by the regulator about the preparation of annual reports | |
| (b) document the actions taken by the drinking water service provider to implement the plan | Section 3 of this report |
| (c) state the outcome of any review of the plan in the financial year to which the annual report relates, and how the service provider has addressed matters raised in the review | Section 6 of this report |
| (d) include details of the findings of, and any recommendations stated in, an audit report about a regular audit given to the regulator in the financial year | Section 5 of this report |
| (e) include details of the information given to the regulator under sections 102 and 102A in the financial year | Section 3 and 4 of this report |
| (f) include details of the provider's compliance with water quality criteria for drinking water | Section 3 and 4 of this report |
| (g) if the provider supplies drinking water to customers—include details of any complaints made to the provider about the provider's drinking water service. | The Seqwater *Drinking Water Quality Management Plan* (PLN-00004) covers the total drinking water quality management activities of Seqwater supply of drinking water to customers. It is not in the scope of the WDWQMP to provide information on drinking water supplies however Section 3 of this report discusses water quality reporting for both internal and external (Toowoomba Regional Council) customers. |

## 2.2 Plan Overview

The WDWQMP (reference PLN-00021) has been developed to comply with Section 207 of the *Water Supply (Safety and Reliability) Act* (QLD, 2008) (the Act) for a drinking water storage to which recycled water (other than coal seam gas water) may be augmented. The current WDWQMP was submitted to the OWSR on 12 May 2011 following original submission and review on 13 September 2010, and was approved on 29 June 2011 (approval details in Section 3).

This plan is a part of the corporate drinking water quality management system that Seqwater has implemented to cover all of its drinking water assets and activities that are captured by the Act. The Seqwater water quality management system has been developed to be consistent with the *Drinking Water Quality Management Plan Guideline (2010)* issued under the Act as well as the *Framework for the Management of Drinking Water Quality* within the *Australian Drinking Water Guidelines (ADWG, 2011*).

The following diagram (Figure 1) depicts the holistic catchment to tap management philosophy of drinking water, representing the barriers that exist in South East Queensland systems. Seqwater is responsible for the first four of these barriers, which include:

- catchments
- storages and dams
- water treatment
- disinfection.

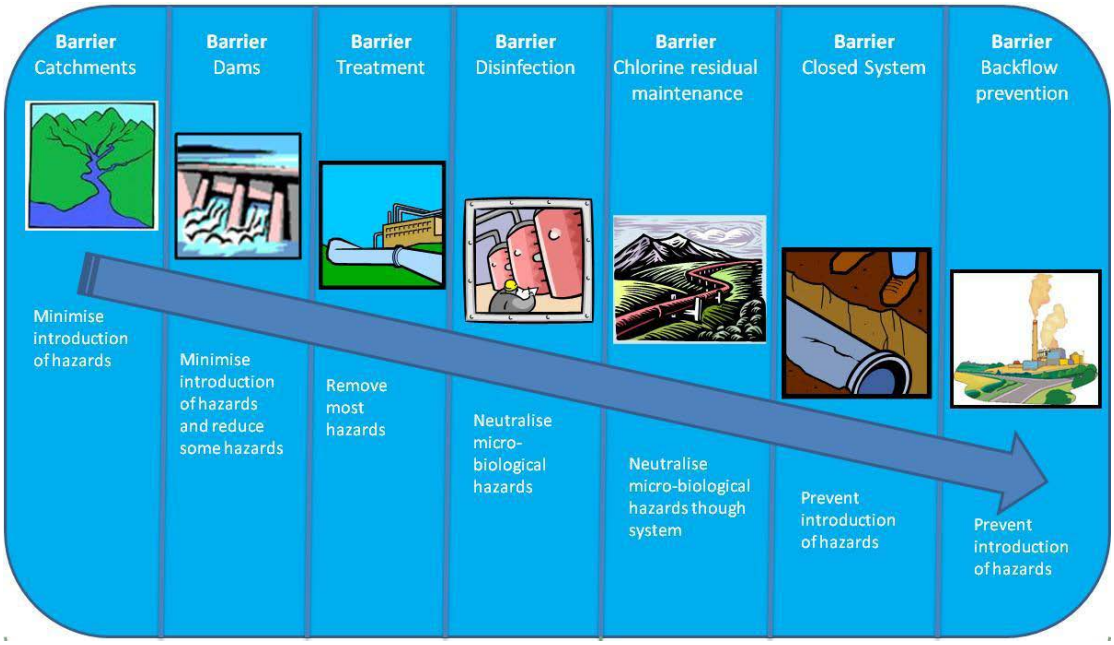


**Figure 1: Illustrating multiple barriers. The scope of the Seqwater's operation is limited to the first four barriers.**

Recently, the State Government have announced further reform to reduce the costs of supplying bulk water; this includes the abolishment of the Queensland Water Commission and the merger of the three bulk water entities. A single bulk water entity is to be operational from 1 January 2013, which will likely impact a number of drinking water management plans and schemes but it is not expected to have an impact to the WDWQMP. However, this will be reviewed in line with current review schedule and as changes are identified (refer Section 6). The WDWQMP applies to only the first two barriers for the supply of raw water to the Seqwater owned and operated drinking water treatment plants – Esk, Lowood, Wivenhoe Dam, Mt Crosby Eastbank and Mt Crosby Westbank and to Toowoomba Regional Council's Cressbrook Dam. The Seqwater *Drinking Water Quality Management Plan* (PLN-00004) covers the total drinking water quality management activities of Seqwater for all other drinking water treatment plants managed by Seqwater. It is not in the scope of the WDWQMP to cover population projections, number of connections and demands for each of the communities, these aspects are dealt with in the Seqwater DWQMP for each specific water treatment plant scheme.

# 3. Implementation of plan

## 3.1 Approval Conditions

The WDWQMP was given conditional approval on 29 June 2011 under section 99 (1)(b) of the *Water Supply (Safety and Reliability) Act 2008*. The approval conditions, and Seqwater's progress towards them, are detailed in Table 1.

**Table 1: Drinking Water Quality Management Plan Approval Conditions and Seqwater's progress towards their completion.**

| Condition | Progress to completion |
|---|---|
| No. 1. Periodic Reporting | |
| A periodic report must be prepared in accordance with any relevant guidelines made by the regulator. The periodic report must include a summary of progress to implement the following items from Appendix 5.17 Wivenhoe Drinking Water Quality Management – Improvement Plan described as follows: | There are currently no guidelines for the preparation of periodic reports. |
| Update the operational protocol between Water Secure and Seqwater | Appendix PM16 – Corporate - Operating Protocol Seqwater WaterSecure (CON-00009) of the WDWQMP was amended to reflect the merger between Seqwater and WaterSecure. Additionally, a number of updates were made to the associated operating protocols under the market rules as described in the January 2012 Periodic Report. This operating protocol is now an internal procedure (PRO-01377). |
| Create fully revised and integrated WDWQMP and WCRW RWMP after 1 July 2011 once WaterSecure and Seqwater merge | The review of these plans following the merger was completed by 30 June 2012 as conditioned by the WCRW RWMP approval conditions (Condition 7.3 regular reviews). This included a review of the Scheme Manager risk assessment for the RWMP which was completed in May 2012 and review of associated documentation and supporting programs. The integration of these plans was completed with an amendment to the WCRW RWMP planned for submission to the OWSR in September 2012.The revised RWMP will contain an updated communication plan to link with the WDWQMP. |
| Ensure all procedures referred to in the WDWQMP and site specific documents have been registered on Q-pulse | This was completed in late 2011 and was detailed in January 2012 periodic report. |
| No. 2. Plan review upon commencement of supply of Purified Recycled Water | |
| You must conduct a review of the WDWQMP within 12 months of the commencement of purified recycled water to Lake Wivenhoe. This condition is imposed to ensure that any additional unforseen risks due to the addition of purified recycled water to the lake are incorporated into the plan as required. This condition may be satisfied by conducting a planned regular review within the 12 month period. | Rule 9.1 of the System Operating Plan, which states that:<br>*When the total volume of water stored by key water grid storages (Grid 12) falls below 40 per cent of the total water storage capacity of these storages:*<br>*(2) The supply of manufactured water to Wivenhoe Dam from the Western Corridor* |

| | |
|---|---|
| | *Recycled Water Scheme shall be maximised, subject to appropriate approvals from the Office of the Water Supply Regulator and operational constraints.*<br><br>Current levels of the Grid 12 as reported on 29 June 2012 are 94.6%, indicating a significant time period prior to consideration of augmentation. In addition, a number of assets in the WCRW scheme have been placed in standby. However, In June 2012 the Queensland Government announced a further review of the operation of the WCRW Scheme and when this direction is known plans will be made accordingly to ensure preparedness. |
| No. 3. Financial Outlays | |
| The State accepts no liability for any financial outlay incurred by you in complying with the drinking water quality management plan and the conditions in this approval | This has been acknowledged by Seqwater in our planning and budgeting process. |

## 3.2 Risk Assessment

Seqwater has recently reviewed the water quality risk assessment framework to better align processes between the catchment water quality and drinking water quality assessments. This has not resulted in fundamental changes to the risk assessment process as detailed in the WDWQMP, rather an improvement in the way risk assessments are captured and documented to ensure transparency and consistency in the approach. The most significant change is the inclusion in the HACCP risk registers of the inherent risk and source water preventive measures, leading to a single risk register for each asset utilised for both plans. The inherent risk assessment process assumes the preventive measures identified in the unmitigated risk assessment are no longer present in an attempt to gauge their effectiveness. This alignment is summarised in figure 2. This process is currently being trialled in the Somerset region as part of the rollout of the Catchment WQ Management Framework (PLN-110) and is scheduled for rollout in the Wivenhoe System in early 2013 (Refer Section 6).

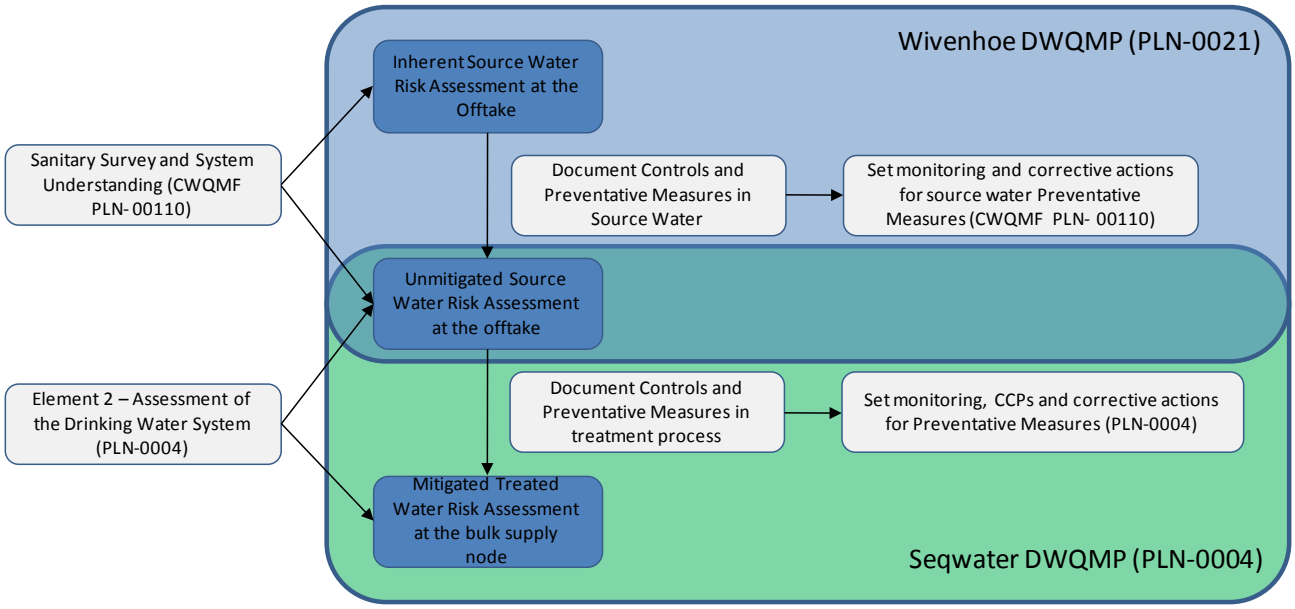


**Figure 2: Alignment of risk assessments across the WDWQMP and the Seqwater DWQMP.**

## Sanitary Survey

As part of the continual improvement of the risk assessment framework, Seqwater has introduced a Sanitary Survey program in the catchments to better identify risks associated with microbiological organisms, such as may occur from sewage outfalls, stormwater outfalls, riverine discharges, bathers and agriculture. The sanitary survey helps to understand the significant causes of contamination within the catchment and the circumstances in which contamination can occur by combining on ground assessments and inspections of potential issues, spatial analysis, simplistic modelling and WQ data to better inform the risk assessment and targeting of pollution reduction measures (WSAA, 2003). To support the existing understanding of the sanitary risks within the Wivenhoe and Mid-Brisbane Catchment, a sanitary survey was undertaken between December 2011 and March 2012.

The following presents a summary of the findings from the Wivenhoe and Mid-Brisbane Sanitary Survey:

- Whilst the main area of water supply in this catchment is the Lake Wivenhoe sub-catchment, the primary conduit of pathogen and pesticide contamination is Lockyer Creek. When flows from Lockyer Creek reach the Brisbane River they can also be expected to entrain sediment loads, which make the removal of pathogens and pesticides by water treatment processes more difficult. The Lockyer Creek sub-catchment is highly developed for agricultural and other commercial purposes, as well as with low-density residential development; all of which provides a large number and variety of both point and diffuse sources of contamination. The existing understanding of water quality through the monitoring of Lockyer Creek is incomplete, and so attribution of particular areas or point sources to water quality degradation is difficult to support with observed data.
- With the identified knowledge gap regarding contaminant inputs in the Lockyer Creek sub-catchment, substantial effort was made during this survey to better characterise the potential sources of pathogens and pesticides in this area.
- The sewage treatment plant (STP) sites within the greater catchment that connect to waterways present the most identifiable pathogen risks to water supply. Other large point sources present a spectrum of potential pathogen risks; with some sites demonstrating effective approaches to wastewater handling, and others having access restrictions due to production concerns about biosecurity, or a reluctance to respond to enquiries as to their operational practices.
- The Lowood Water Treatment Plant (WTP) can be seen as a point of vulnerability to pathogen and pesticide risks, with multiple risk sources identified, and few measures currently available to mitigate these risks.
- On-site system functionality in this catchment appeared to be good, with a 6% application area and system failure rate in the Wivenhoe catchment and 14% application area and system failure rate in the Mid Brisbane River catchment.
- Cattle access to Lake Wivenhoe is extensive, particularly to the northern and western shores. While this presents an uncontrolled pathogen risk to water quality, the water quality in the lake as measured by faecal indicators monitoring is relatively good. Cattle grazing in the Mid-Brisbane River sub-catchment is prevalent, however stock access to the waterways in this area is generally more restricted.

## 3.3 Operational Monitoring

Operational monitoring in the WDWQMP includes the planned sequence of measurements and observations to assess and confirm the performance of preventive measures identified for particular hazardous events. Measurements are of operational parameters that will indicate whether processes are functioning effectively. For catchment management activities, the parameters don't generally relate to water quality parameters but more management practices such as audits or reviews of third party management plans, operational licences or recreation management plans. The operational monitoring of the preventive measures is listed in the Wivenhoe Scheme Preventive Measures and Operational Monitoring Procedure (Appendix 5.1). The majority of the preventive measures in the catchment are long-term programs and as a result any monitoring of these reflects the protracted timeframes, however Table 2 provides a summary of the progress or outcomes of these operational monitoring tools.

**Table 2: Operational Monitoring Program Summary and update**

| Preventive Measure | Related Hazardous Events | Operational Monitoring | Status |
|---|---|---|---|
| Farm Management Plans | Significant Inflow Event<br>Bushfire<br>Agricultural Activities<br>Algal Bloom<br>Cattle access to water<br>Cattle Grazing | Auditing of farm Management Plan | Auditing of farm management plans under the Natural Asset Management Framework is currently under review following organisational change |
| | | Seqwater Watershed Condition Assessment Scorecard (REF-00242) | The Watershed condition assessment scorecard (WCAS, REF-00242) for 2011-12 was completed in October 2012. There are eight Level 6 sub-watersheds in the Wivenhoe watershed. Based on the WCAS calculations, grades ranged from D+ to B across the sub-watersheds. The Brisbane River Watershed had the worst grade (Grade D+), whereas the Upper East Brisbane Watershed had the best grade (Grade B). The Land Use/Sediment Mobility Indicator made the biggest contribution of the three indices to the condition assessment grade for every sub-watershed of the Wivenhoe basin. Overall, efforts to encourage best management practice in forestry and grazing are well placed for this system. |
| Extension and education programs in partnership with SEQ Catchments | Significant Inflow Event<br>Bushfire<br>Agricultural Activities<br>Algal Bloom<br>Cattle access to water<br>Cattle Grazing | Seqwater's MOU with SEQ Catchments is reviewed every three years including value, achievements and performance. Priorities can be reviewed during this period. | The MOU was reviewed and renewed in October 2012 and aims to capitalise on the mutual interest of both parties in sustainable catchment management, restoring and protecting resilient watercourses and working with the community, landholders and stakeholders to restore and protect water quality and health. Under the MOU, a number of collaborative projects relating to the Wivenhoe and Mid-Brisbane Catchments have been developed and are in the assessment and approvals process. A number of projects have been approved and are in progress including:<br>• Riparian Restoration Plans (Wivenhoe, Lockyer, Mid- Brisbane)<br>• Pine Stanley Collaboration Study<br>• Mid Brisbane Restoration Strategy: Community Consultation & Planning Engagement Plan<br>• Maintenance of 2011-12 Mid Brisbane riparian restoration sites |

| Preventive Measure | Related Hazardous Events | Operational Monitoring | Status |
|---|---|---|---|
| | | | These will be included in future revisions of the Operational Monitoring and Corrective Actions Procedure (Appendix 5.1: PRO-01142 Wivenhoe System Preventive Measures and Operational Monitoring Procedure). |
| Buffer provided by large reservoir of water | Significant Inflow Event<br>Bushfire<br>Agricultural Activities<br>Algal Bloom<br>Cattle access to water<br>Cattle Grazing | Development and testing of a three dimensional hydrodynamic model of Lake Wivenhoe | Refer improvement RMI-5 (Section 3.5) |
| Limited Third Party Advice for approval of onsite systems- only if referred, with the exception of declared catchment areas | Onsite wastewater treatment systems | None current | Refer improvement RMI-3 (Section 3.5) |
| Seqwater Development Guidelines | Onsite wastewater treatment systems | None current | Refer improvement RMI-2 and RMI-3 (Section 3.5) |
| Recreation Management | Recreational Activities | Ranger Patrols | Patrols are now coordinated in conjunction with QPS and MSQ to maximise resources. Patrols are scheduled around activity at the recreational areas with increased frequency of patrols during higher volume periods. Records kept of infringements and prosecutions during patrols. Network of CCTV cameras are also installed regionally to monitor illegal access and have also resulted in prosecutions. |
| Legislation restricting pesticide use | Kilcoy, Woodford Stormwater | Regulation by the APVMA | None |
| DEHP DA/licensing program | Kirkleagh, Woodford, Kilcoy, Woodford Jail, Woodford Folk Festival, Kilcoy Abattoir, Esk, Toogoolawah, Lumley Hill, Wivenhoe Information Centre, Cormorant Bay, Coominya Meatwork, Laidley, Gatton, Lowood and Fernvale WWTP and sewer network | Regulation by DEHP | The Sanitary Surveys provide an assessment o these sites regarding performance of infrastructure and likely risk and will be included in future revisions of the Operational Monitoring and Corrective Actions Procedure (Appendix 5.1: PRO-01142 Wivenhoe System Preventive Measures and Operational Monitoring Procedure). |
| WCRWMP | PRW introduction-measured | WCRWMP | Refer improvement RMI-6 (Section 3.5) |

| Preventive Measure | Related Hazardous Events | Operational Monitoring | Status |
|---|---|---|---|
| Control of PRW release using online monitoring and controlling releases | against ADWG<br>PRW Shortcutting | PRO-01377 Scheme Manager Communication Procedure | |
| Removal of Chlorine through SBS dosing at diversion of PRW to Lake Wivenhoe | | | |
| IROL for Lockyer Creek<br>Moreton ROP | Significant inflow event | Resource Operating Plans | No changes were made to the IROL or the ROP for the Moreton Basin (including Lockyer) in this reporting year. |
| Program to investigate salinity reduction in Blacksnake Creek with SEQ Catchments and Landcare Groups | Blacksnake creek | Seqwater's MOU with SEQ Catchments is reviewed every 3 years including value, achievements and performance. Priorities can be reviewed during this period. | The MOU was reviewed and renewed in October 2012 and aims to capitalise on the mutual interest of both parties in sustainable catchment management, restoring and protecting resilient watercourses and working with the community, landholders and stakeholders to restore and protect water quality and health. Discussions are currently being held with stakeholders in this area, including Ipswich Council for collaborative opportunities. A groundwater visualisation model was also developed for the Lockyer and Mid-Brisbane Catchments which can be used in the interpretation of impacts from water quality in these systems. |
| Control of dam releases to limit bank slumping – required under the Water Act | Bank slumping | Appendix PM25 - ISP-325-2 Wivenhoe Dam Annual Inspection | The Wivenhoe Dam Annual inspection was completed in September 2011 with another planned for September 2012. Despite this being outside the reporting period, it was important to capture the most recent information where relevant. |

## 3.4 Verification Monitoring

Seqwater has an overall commitment to implement and improve management practices within the Wivenhoe system to meet water quality objectives for drinking water use, recreational use and to protect aquatic health. These objectives have been documented in the Seqwater Catchment Water Quality and Reporting Framework (WDWQMP Appendix 6.1). Measurement of performance against these objectives ultimately determine if a when risk mitigation measures are implemented to improve water quality.

The Seqwater Catchment Water Quality and Reporting Framework (Appendix 6.1) captures all water quality monitoring requirements and the implementation of monitoring programs to meet the requirements for catchment management in accordance with environmental, recreational and drinking water quality objectives. Monitoring programs are implemented in accordance with this framework. The water quality monitoring programs for the Wivenhoe System are described in:

- PLN-00012 - Lakes Wivenhoe and Manchester and Mid-Brisbane River Catchment and Storage Monitoring Plan
- PLN-00133 – Lockyer Creek Catchment and Storage Monitoring Plan
- PLN-00132 – Lake Somerset Catchment and Storage Monitoring Plan

The routine monitoring program for the Wivenhoe System saw 44,416 analyses conducted over this reporting period. Specific results and trends from these analyses are presented in Section 4.

The corrective action procedure for the Wivenhoe System's Verification Monitoring Program covers the source water triggers and corrective actions for the Lake Wivenhoe and Mid-Brisbane Catchments (WDWQMP Appendix 6.5 PRO-01143 Wivenhoe System Catchment Water Quality Corrective Action Procedure).Table 3 provides a summary of triggers exceeded over the course of the reporting year.

**Table 3: Summary of triggers hit in the Wivenhoe System Catchment Water Quality Corrective Action Procedure for 2011/12**

| Parameter | Number of exceedences of CAP |
|---|---|
| Aluminium | 4 |
| Arsenic | 3 |
| Atrazine | 5 |
| Conductivity | 305 |
| *Cylindrospermopsis raciborskii* | 4 |
| Total Cyanobacterial Biovolume | 59 |
| Total Cylindrospermopsins | 3 |
| Dissolved Iron | 1 |
| Dissolved Manganese | 27 |
| *E.coli* | 10 |
| Geosmin and MIB | 110 |
| Metolachlor | 5 |
| Lead | 1 |
| 4-Chlorophenoxy acetic acid | 1 |
| Total Coliforms (TRC) | 7 |
| True Colour (TRC) | 1 |
| Turbidity | 1 |
| Turbidity (TRC) | 1 |

All triggers were responded to according to the Wivenhoe System Catchment Water Quality Corrective Action Procedure. Ongoing elevated levels of TDS and hardness (as indicated in the CAP by conductivity) lead to the addition of specific TDS and hardness testing routinely and the development of an investigative project and development of a groundwater visualisation model with Seqwater's research partners to better understand what was driving these elevated levels. This work has demonstrated that changes seen in the source water quality in the Mid-Brisbane River can be attributed to the reconnection of groundwater to surface water in the Lockyer creek catchment following significant recharge after the 2011 floods (Cox, Raiber, James and Hawke, 2012). This has

enabled Seqwater to identify specific areas in the catchment to monitor and set targets around to ensure WTP operation is able to meet supply and quality requirements. An additional online WQ instrument has been installed at Burton's bridge on the Mid-Brisbane River to give greater lead indication of this issue and work is currently underway to investigate changes in the Lockyer WQ Monitoring program (including instrumentation) to better inform on this risk. Further work will look at developing more complex understanding of identified sub-catchments to look for remedial options and alternate management strategies to deal with future events and scenarios.

## 3.5 Improvement Plan

The Wivenhoe Drinking Water Quality Management Improvement Plan (WDWQMIP- Appendix 5.17) was developed for the Wivenhoe system to detail the gaps needed to be satisfied for full implementation of the WDWQMP, or for continuous improvement of the system. The WDWQMIP is a working document and is kept in conjunction with the overarching plan, thus allowing for reviews and updates to be undertaken regularly (Refer Section 6). Table 4 provides a summary of the progress made against the WDWQMIP.

**Table 4: Update on progress towards indentified improvements in the Wivenhoe DWQM Improvement Plan.**

| Measures, actions, strategies or processes | Timeframe | Current Status |
|---|---|---|
| RMI-1a: Complete the Somerset, Wivenhoe and Mid-Brisbane Natural Asset Management Plans (NAMPs) | Complete December 2012 | The Somerset, Wivenhoe and Mid-Brisbane NAMPs have been completed |
| RMI-1b: Develop Procedures for catchments and storages to protect water quality as defined in the Somerset, Wivenhoe and Mid-Brisbane Natural Asset Management Plans | Complete July 2013 | Through linkages with the Catchment WQ Management Framework, the NAMPs identify risks in the catchment and develop plans to minimise their impact. A number of specific projects (identified in Section 3.3, Table 2) are already underway through this process as well as a number of procedures and plans relating to the management of our lands. |
| RMI-2: Formalise arrangement with council for Seqwater auditing of council on site sewage management system inspection and approval programs. | Complete June 2013 | The sanitary surveys include a process for assessing Council processes for managing on site sewage management systems. Refer to RMI-3 |
| RMI-3: Investigate options to increase formal referral powers for on site sewage management systems and/or develop a state planning policy for on site sewage management systems in drinking water catchments. | Complete June 2013 | The State government has announced a new planning policy approach aimed at developing a single state planning policy. The first step in this process is to identify state interests to be covered under this policy and Seqwater is negotiating with the Department of State Development, Infrastructure and Planning for the protection of drinking water catchments to be recognised as an interest. If successful, this will be implemented as part of the new State Planning Policy scheduled for February 2013 which will give Seqwater greater ability to influence activities in the catchments with potential to impact water quality. |
| RMI-4: Develop an overarching fire management system under the Natural Asset Management Plans which will include relevant state and council programs as well as a strategy for Seqwater land and leases. | Complete June 2013 | Requirements and planning for Fire management Plans are set through the NAMPs and the Catchment Land Management Strategy. Through this process, fire management plans are currently being developed for individual catchments and focus on Seqwater land. The plans are developed following the SEQ Burn Guidelines developed by the South East Queensland Fire and Biodiversity Consortium (SEQFBC), a network of land managers and stakeholders devoted to providing a coordinated response and best-practice recommendations for fire management, fire ecology and the conservation of biodiversity in the South East Queensland region through education, community engagement and applied research. Seqwater also participate in the regional Fire Management process as coordinated by the QPWS and the QFRS. The fire management plans for the Wivenhoe Catchment is currently in development with expected completion by June 2013. The Somerset fire management plan is scheduled for 2013-14. |

| Measures, actions, strategies or processes | Timeframe | Current Status |
|---|---|---|
| RMI-5: Further develop 3D-hydrodynamic and ecological, quantitative predictive model of Wivenhoe. | Ongoing project | Appendix PM10 of the WDWQMP (REF-00131) reported on the initial application and testing of a three-dimensional (3-D) hydrodynamic model of Lake Wivenhoe using the ELCOM modelling platform. The model has been successfully applied to investigate a range of PRW inflow scenarios and is still in an active development phase. Initial PRW simulation results showed that the model was able to simulate the mixing and dilution dynamics of PRW with the reservoir in an intuitively acceptable manner. Notwithstanding the obvious inability to validate the model to a PRW inflow (as there isn't any flow), the simulation results suggest that both the PRW inflow rate and initial lake storage level can have a significant influence on PRW concentrations at the main dam wall off-take point. Results also suggest that catchment inflows, Somerset Dam releases and mixing induced by the Splityard Creek hydro-power station have the potential to increase mixing and significantly dilute the PRW.<br><br>Continuous refinements to the hydrodynamic simulation will be made as part of ongoing research projects as new and updated sources of data become available and as resources permit. This will include the quantification of the time required for different concentrations of PRW to reach the Wivenhoe dam wall. Future work will also consider the simulation of nutrient and phytoplankton dynamics with the Lake before expanding to incorporate recent research into food web dynamics (zooplankton, fish and macrophyte interactions).<br><br>In 2012 additional experiments were undertaken in the Gold Creek Reservoir to collect data on the ecosystem response to PRW-like inflows to assist in refining the nutrient and phytoplankton models. Results from these experiments indicated that sediment biogeochemistry is likely to have a strong influence on the processing of nutrients in PRW-like inflows. Results from this experiment also suggest that sediment biogeochemical processes might also exert a controlling influence on vertical stratification within the reservoir under certain conditions which in turn will influence mixing and dilution of PRW inflows. The wider implications of these results for Seqwater's reservoirs are still under investigation. These results are also being used to refine the coupled hydrodynamic and biogeochemical model for Lake Wivenhoe as well.as other Seqwater reservoirs. |
| RMI-6: Update the operational protocol between Water Secure and Seqwater in order to take account of improvements identified in the summary of the WDQWMP preventive measures. | Complete December 2011 | Appendix PM16 – Corporate - Operating Protocol Seqwater WaterSecure (CON-00009) of the WDWQMP was amended to reflect the merger between Seqwater and WaterSecure. Additionally, a number of updates were made to the associated operating protocols under the market rules as described in the January 2012 Periodic Report. This operating protocol is now an internal procedure (PRO-01377) under the RWMP. |

| Measures, actions, strategies or processes | Timeframe | Current Status |
|---|---|---|
| RMI-7: Develop Site Based Management plans for Somerset, Wivenhoe, Lockyer and Mid-Brisbane with targets and restrictions for recreation in dams and Seqwater land | Complete June 2013 | The original timeframe of June 2011 for completing draft recreation management plans was substantially delayed due to impact of the January 2011 flood. Some of our key recreation sites are still undergoing repair, including the public viewing platform at Wivenhoe Dam. Seqwater took the view that it was prudent to wait for the outcome of the Queensland Floods Commission of Inquiry to ensure any findings or recommendations could be taken into account prior to developing the Site based management plans under the Recreational Strategy. The Commission of Inquiry has completed its task, and has handed down its report. As a result of the impending restructure of the water industry under government reform, Seqwater has decided to further delay the roll out of the recreation master plans with a view to align with the new organisation's recreational policy developed after January 1, 2013. The existing recreation rules and activities will remain in place until the recreation master planning is completed for each site. Once a clear direction is known, the WDWQIP will be updated to reflect this. |
| RMI-8: Convene general WDWQMP Staff and Stakeholder (other Water Grid entities) Awareness and Implementation workshops. | Round 1: end June 2012<br>Repeat once every three years | This process is currently under development following the implementation of the Catchment WQ Management Framework and the finalisation of the water industry reform under the new state government. Once a clear direction is known, the WDWQIP will be updated to reflect this. |
| RMI-9: Implement a monitoring program for temperature differential between PRW and Lake Wivenhoe at the point of augmentation | Complete prior to augmentation | Temperature monitoring is ongoing in Lake Wivenhoe, including via online instrumentation. The instrumentation for online monitoring of the PRW temperature at the Lake Wivenhoe point of supply is currently not fully operational as PRW is currently not being supplied for augmentation of drinking water supply. |
| RMI-10: Undertake further monitoring to address any data and information gaps that need to be filled to improve the evidence base of the risk assessment | Ongoing | Refer to Section 6 |
| RMI-11: Develop training requirements register | Complete June 2012 | The training register is complete. A training needs analysis was conducted in 2012 to better identify training requirements and opportunities. |
| RMI-12: Create fully revised and integrated WDWQMP and WCRW RWMP after 1st July 2011 once Water Secure and Seqwater merge | Complete December 2011 | The review of these plans following the merger was completed by the 30th June 2012 as conditioned by the WCRW RWMP approval conditions (Condition 7.3 regular reviews). This included a review of the Scheme Manager risk assessment for the RWMP which was completed in May 2012 and review of associated documentation and supporting programs. The integration of these plans was completed by the amendment of the WCRW RWMP submitted to OWSR for approval on the 25th September 2012. The revised RWMP contains the updated communication plan (PRO-01337) to link with the WDWQMP identified above. |
| RMI-13: Finalise the Seqwater Catchment Water Quality and Reporting Framework | Complete July 2011 | The Seqwater Catchment Water Quality Management Framework was completed in June 2011. |

| Measures, actions, strategies or processes | Timeframe | Current Status |
|---|---|---|
| RMI-14: Development of audit process for the WDWQMP | Complete June 2012 | Refer to Section 5 |
| RMI-15: Develop a review and revision process for the WDWQMP | Complete June 2012 | Refer to Section 6 |
| RMI-16: Implement the Seqwater Catchment Water Quality and Reporting Framework for Somerset, Wivenhoe, Mid-Brisbane and Lockyer Catchments | Complete July 2012 | The framework has been implemented in the Somerset Catchment and is in the process of being applied to the Wivenhoe and Mid-Brisbane River Catchments with ongoing data collation in preparation for risk assessments in January 2013. Refer to Section 6 for Further details. |
| RMI-17: Ensure all procedures referred to in the WDWQMP and site specific documents have been registered on Q-Pulse | Complete July 2011 | This was completed in late 2011 and was detailed in January 2012 periodic report |

# 4. Analysis of Water Quality

## 4.1 Water Quality Monitoring Program Summary

Source Water Quality is monitored in the Wivenhoe System as described in:

- PLN-00135 – Lakes Wivenhoe &Manchester and mid-Brisbane River Catchment and Storage Monitoring Plan (Appendix 6.4)
- PLN-00133 – Lockyer Creek Catchment and Storage Monitoring Plan (Appendix 6.3)
- PLN-00132 – Lake Somerset Catchment and Storage Monitoring Plan (Appendix 6.2)

A summary of the Water Quality Monitoring Program is provided in Table 5. Data will be presented and discussed below in each of these groupings relevant to each of the systems water treatment Plants

**Table 5: Summary of water quality monitoring programs for the Wivenhoe system**

| Catchment | # Sites | Frequency of routine monitoring |
|---|---|---|
| Somerset | 8 | Monthly<br>Online Instrument |
| Upper Brisbane River | 4 | Event Based |
| Upper Wivenhoe | 4 | Monthly<br>Online Instrument |
| Lower Wivenhoe | 5 | Monthly<br>Online Instrument |
| Lockyer Creek | 1 | Monthly<br>Event Based<br>Online Instrument |
| Upper Mid Brisbane | 2 | Monthly |
| lower Mid Brisbane | 3 | Monthly<br>Online Instrument |

Routine sampling is conducted under contract with by ALS Pty. Ltd who are industry trained and NATA accredited. In addition, Seqwater staff also conduct sampling where required through escalation or incidents and are qualified scientists and industry trained. Sampling and analysis are conducted according to industry best practice and standards. Further details can be found in the Catchment Water Quality Monitoring and Reporting Framework (PLN-00110, Appendix 6.1 of the WDWQMP)

## 4.2 Esk WTP Catchment

### Somerset Inputs

A monomictic (stratified system with one mixing event per year) regime was present during the 1 July 2011 to 30 June 2012 monitoring period for Somerset Dam's headwaters, showing the typical pattern of stratification in spring-summer coinciding with seasonally higher air temperatures and mixing during late autumn-winter (Figure 3).

A slight thermocline was present in the upper surface waters from July to September 2011. A strong thermocline developed in October. By December an anoxic layer (DO 0.25- 1.6 mg/L) had developed between 9 metres and the bottom, in association with a metalimnion (the thermocline) dispersed between 2-12 metres. A similar pattern of a strong thermocline and an anoxic layer from approximately 10 metres to the bottom persisted in January and February 2012. In March 2012 a strong temperature differential was still present; however, both the metalimnion and the anoxic layer were reduced. Significant releases downstream were seen in February and over March, with minor releases in January and June coinciding with rainfall events in the catchment (Figure 4). These inflows do not appear to have had a significant impact on stratification. By April 2012 the water column returned to a completely mixed state, and remained mixed until the end of the monitoring period.

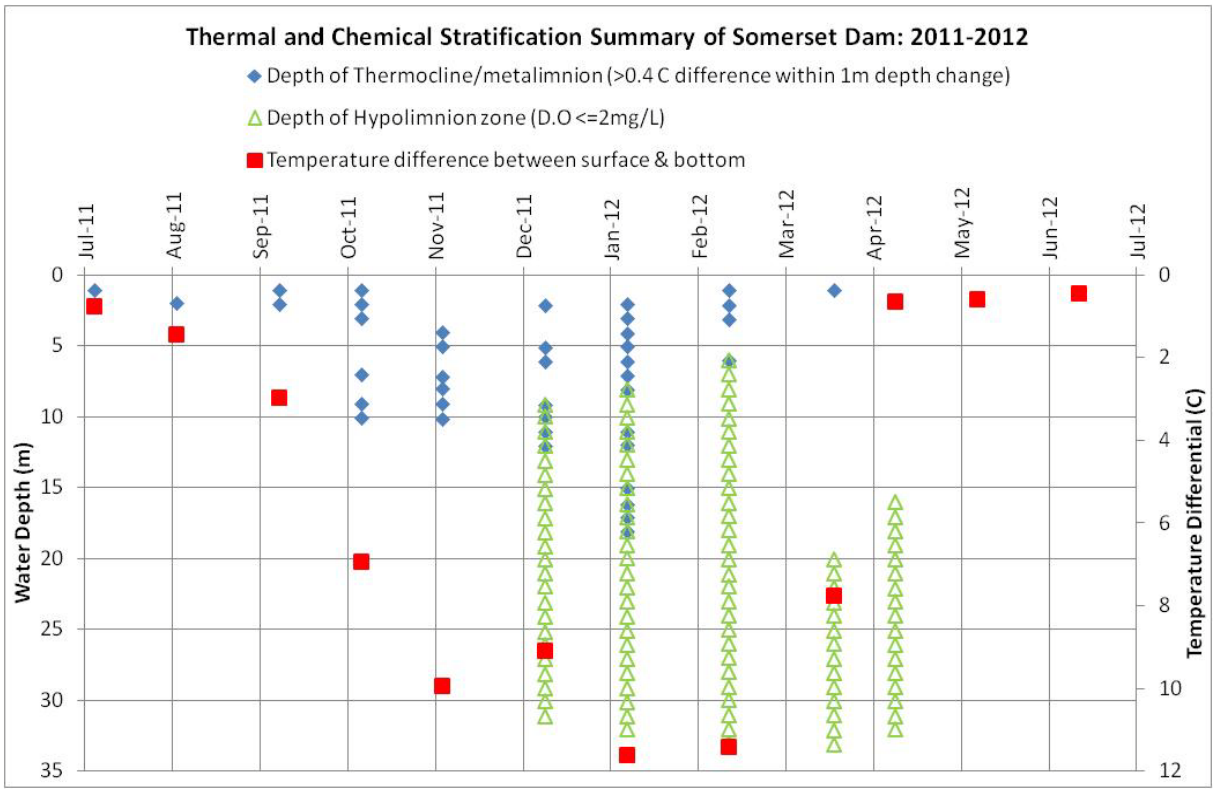


**Figure 3: Summary of thermal and chemical stratification at the Somerset headwater site for the period July 2011 to June 2012. Changes to the lower depth of the hypolimnion are due to changes in reservoir depth and not a change in the depth of the hypolimnion.**

The concentration of cyanobacteria in Somerset Dam followed a pattern that generally reflected the stratification and nutrient enrichment in the dam, with the cyanobacterial concentration beginning to increase in spring, peaking in summer and returning to low concentrations in autumn and winter. These variations coincided with seasonal peaks in air temperature and photoperiod. Cyanobacterial populations were dominated by *Cylindrospermopsis raciborskii* with low level toxin production evident over the peak of the bloom period (Table 6).

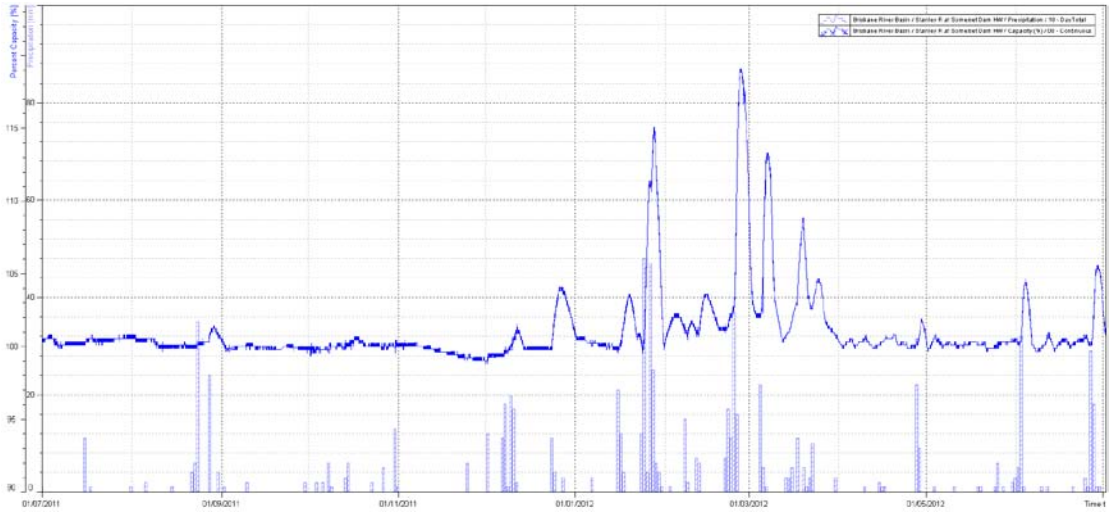

**Figure 4: Rainfall at the Somerset Dam Wall and storage level over the monitoring period**

There was no significant change in the water quality risk profile from Somerset Dam releases to the Esk Water Treatment plant (Table 6).

**Table 6: Summary Data for the Somerset Dam Wall July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Somerset Release | TN | mg/L | 13 | 0.26 | 0.38 | 0.66 | 0.54 |
| | TP | mg/L | 13 | 0.013 | 0.019 | 0.035 | 0.022 |
| | DO | mg/L | 12 | 3.99 | 8.865 | 10.03 | 8.215 |
| | E.coli | cfu/100mls | 13 | < 1 | < 1 | 18 | 2 |
| | Cylindrospermopsis raciborskii | cells/ml | 23 | ND | 660 | 76800 | 3624 |
| | Microcystis aeruginosa | cells/ml | 24 | ND | ND | 120 | 672 |
| | Anabaena circinalis | cells/ml | 24 | ND | ND | ND | 484 |
| | Cylindrospermopsin | ug/L | 3 | 0.4 | 1 | 1.6 | 0.35 |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | 13 | 1 | 3 | 6 | 3 |
| | Pesticides | ug/L | 2 | < ADWG limits | | | |
| | Total Metals | mg/L | 5 | < ADWG limits | | | |
| | Dissolved Iron | mg/L | 13 | 0.03 | 0.04 | 0.57 | 0.022 |
| | Dissolved Manganese | mg/L | 7 | 0.001 | 0.002 | 0.004 | < 0.001 |
| | Cryptosporidium | oocysts/10L | NT | | | | |
| | Giardia | cysts/10L | NT | | | | |
| | Specific Conductivity | uS/cm | 12 | 175 | 198 | 239 | 228 |
| | pH | | 12 | 7.22 | 8.095 | 8.94 | 7.92 |
| | MIB | ng/L | 12 | < 2 | < 2 | 14 | 7.1 |
| | Geosmin | ng/L | 12 | < 2 | < 2 | 4.6 | < 2 |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

## Upper Brisbane Inputs

There was no significant change in the water quality risk profile from the upper Brisbane River to the Esk Water Treatment plant (Table 7) through a number of rainfall events in this catchment. There was a slight increase in the total suspended solid concentration and decrease in nutrient concentration, however, this is hard to quantify without knowledge of the size and extent of the events sampled. Conductivity appears to have increased in the upper Brisbane, as evidenced in the upper Wivenhoe (Table 8) which is further discussed below.

**Table 7: Summary Data for the Upper Brisbane River event stations July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Upper Brisbane | TN | mg/L | 12 | 0.42 | 0.56 | 1.27 | 0.91 |
| | TP | mg/L | 12 | 0.04 | 0.0825 | 0.2 | 0.12 |
| | DO | mg/L | NT | | | | 11.45 |
| | E.coli | cfu/100mls | 8 | 70 | 2000 | 5200 | 1500 |
| | Cylindrospermopsis raciborskii | cells/ml | NT | | | | |
| | Microcystis aeruginosa | cells/ml | NT | | | | |
| | Anabaena circinalis | cells/ml | NT | | | | |
| | Cylindrospermopsin | ug/L | NT | | | | |
| | Microcystin | ug/L | NT | | | | |
| | Saxitoxins | ug/L | NT | | | | |
| | Total Suspended Solids | mg/L | 40 | 4 | 28.5 | 200 | 17 |
| | Pesticides | ug/L | NT | | | | |
| | Total Metals | mg/L | NT | | | | |
| | Dissolved Iron | mg/L | NT | | | | 0.786 |
| | Dissolved Manganese | mg/L | NT | | | | 0.086 |
| | Cryptosporidium | oocysts/10L | 2 | < 4 | < 4 | < 4 | ND |
| | Giardia | cysts/10L | 2 | 8 | | 670 | ND |
| | Specific Conductivity | uS/cm | NT | | | | 854.5 |
| | pH | | NT | | | | 7.63 |
| | MIB | ng/L | NT | | | | |
| | Geosmin | ng/L | NT | | | | |

## Upper Wivenhoe Inputs

A significant change in conductivity was seen over the reporting period in the upper Wivenhoe region (Table 8). This has correlated to increases in both TDS and hardness in the region.This change has been attributed to the Upper Brisbane River and changes since the flood. It is hypothesised this is due to the return of baseflow from recharged saline aquifers however this has yet to be confirmed. This was the subject of an investigation and model development (Cox et al., 2012), however, due to the paucity of data, the root cause could not be determined. It was recommended that further detailed monitoring be conducted to better understand this change sand this will be addressed in the upcoming review (refer to Section 6). All other data collected was comparable to long-term analysis.

**Table 8: Summary Data for the Upper Wivenhoe July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Upper Wivenhoe | TN | mg/L | 26 | 0.3 | 0.445 | 0.61 | 0.68 |
| | TP | mg/L | 25 | 0.019 | 0.033 | 0.075 | 0.055 |
| | DO | mg/L | 24 | 4.98 | 8.61 | 12.66 | 8.49 |
| | E.coli | cfu/100mls | 26 | < 1 | 3.5 | 28 | 3 |
| | Cylindrospermopsis raciborskii | cells/ml | 23 | ND | 140 | 17400 | 975 |
| | Microcystis aeruginosa | cells/ml | 22 | ND | | | 493 |
| | Anabaena circinalis | cells/ml | 23 | ND | ND | 7800 | 655 |
| | Cylindrospermopsin | ug/L | NT* | | | | < 0.2 |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | 23 | 4 | 8 | 16 | 6 |
| | Pesticides | ug/L | 4 | < ADWG limits | | | |
| | Total Metals | mg/L | 8 | Total Al > ADWG 2 occassion, rest < ADWG | | | |
| | Dissolved Iron | mg/L | 25 | 0.07 | 0.24 | 1.05 | 0.013 |
| | Dissolved Manganese | mg/L | 28 | < 0.001 | < 0.001 | 0.007 | 0.0085 |
| | Cryptosporidium | oocysts/10L | NT | | | | 0 |
| | Giardia | cysts/10L | NT | | | | 0 |
| | Specific Conductivity | uS/cm | 24 | 376 | 439 | 629 | 332 |
| | pH | | 24 | 6.91 | 8.21 | 8.85 | 8.04 |
| | MIB | ng/L | 12 | < 2 | < 2 | 6.2 | |
| | Geosmin | ng/L | 12 | < 2 | 3.05 | 37.5 | |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

## 4.3 Wivenhoe Dam Recreation WTP Catchment

### Purified Recycled Water Inputs

The PRW quality monitoring results from the Lake Wivenhoe Point of Supply (Point of Supply for augmentation of drinking water supply) show that the final quality of the water complies with the water quality standards for augmentation of drinking water supply as specified in Schedule 3b of the *Public Health Regulation 2005*. There were only four results (out of a total of nearly 15 800 monitoring results for about 530 different parameters) from monitoring at this Point of Supply during the 2011-12 financial year that were above a Standard in Schedule 3b. These were all for the disinfection by-product bromodichloromethane. A public health risk assessment was undertaken by Seqwater, which confirmed that these events would not have constituted a public health risk (even if PRW had been supplied for augmentation of drinking water supply).

These monitoring results confirm that the barriers of Western Corridor Recycled Water Scheme are effective at excluding contaminants and the PRW is safe and suitable for augmentation of SEQ

drinking water supply. Details of the PRW monitoring program including statistical analysis of results can be found in the *WCRW Recycled Water Management Plan Annual Report 2011-12*.

## Mid Wivenhoe Inputs

A significant algal population dominated by *Cylindrospermopsis raciborskii* with low level toxin production was evident over the monitoring period in the Mid Wivenhoe region (Table 9). The associated elevated primary productivity has driven a significant increase in median dissolved oxygen levels during the monitoring period however this is not expected to present a change in the risk profile in the lake. All other parameters were within long-term ranges.

**Table 9: Summary Data for the Mid Wivenhoe July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Mid Wivenhoe | TN | mg/L | 26 | 0.39 | 0.45 | 0.58 | 0.58 |
| | TP | mg/L | 26 | 0.01 | 0.023 | 0.038 | 0.029 |
| | DO | mg/L | 24 | 5.54 | 9.1 | 12.42 | 8.48 |
| | E.coli | cfu/100mls | 26 | 1 | 1 | 9 | 1 |
| | Cylindrospermopsis raciborskii | cells/ml | 30 | ND | 7300 | 51700 | 2696 |
| | Microcystis aeruginosa | cells/ml | 30 | ND | | | 440 |
| | Anabaena circinalis | cells/ml | 30 | ND | | | 2235 |
| | Cylindrospermopsin | ug/L | 9 | ND | 1.8 | 7.9 | 0.7 |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | 23 | 1 | 4 | 6 | 4 |
| | Pesticides | ug/L | 4 | < ADWG limits | | | |
| | Total Metals | mg/L | 8 | Total Ar > ADWG 2 occassion, rest < ADWG | | | |
| | Dissolved Iron | mg/L | 25 | 0.04 | 0.1 | 0.84 | 0.0095 |
| | Dissolved Manganese | mg/L | 25 | < 0.001 | < 0.001 | 0.002 | < 0.001 |
| | Cryptosporidium | oocysts/10L | NT | | | | |
| | Giardia | cysts/10L | NT | | | | |
| | Specific Conductivity | uS/cm | 24 | 70 | 324 | 379 | 349 |
| | pH | | 24 | 7.03 | 8.01 | 8.97 | 8.2 |
| | MIB | ng/L | NT | | | | 5 |
| | Geosmin | ng/L | NT | | | | < 2 |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

## Lower Wivenhoe Inputs

The Wivenhoe headwater site's monomictic pattern was present during the 1 July 2011 to 30 June 2012 monitoring period, showing the typical pattern of stratification in spring-summer coinciding with seasonally higher air temperatures and mixing during late autumn-winter (Figure 5).

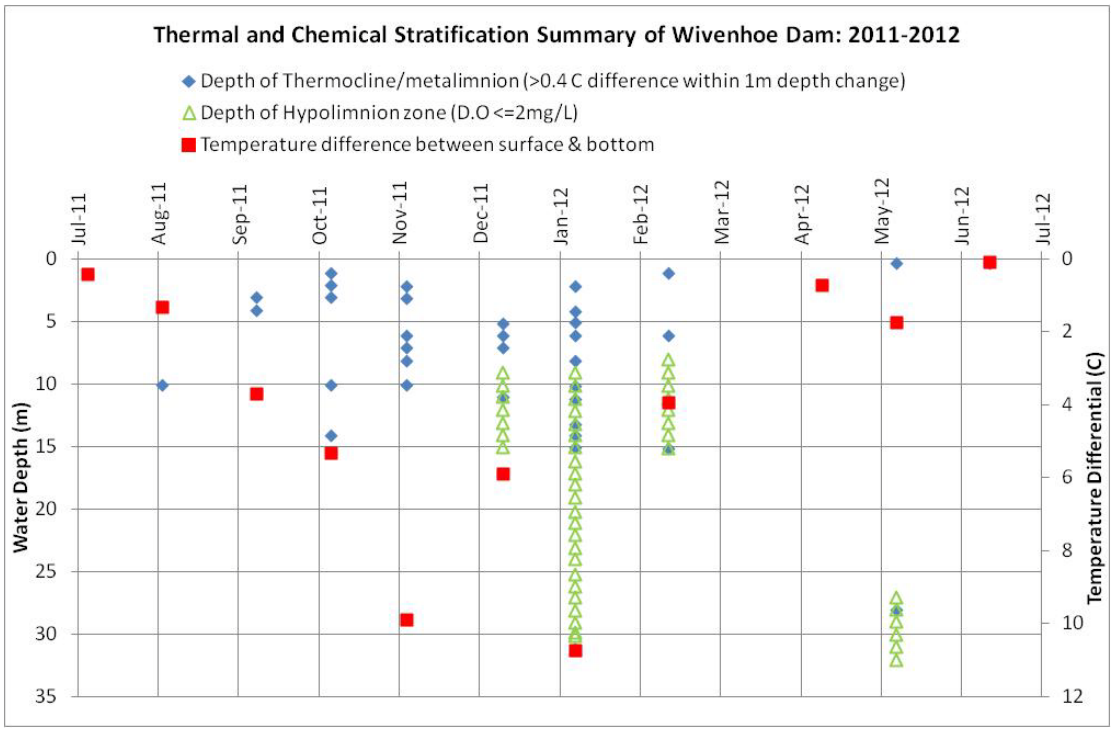


**Figure 5: Summary of thermal and chemical stratification at the Wivenhoe headwater site for the period July 2011 to June 2012, data was not able to be collected in March 2012 due to the dam releasing. Changes to the lower depth of the hypolimnion are due to changes in reservoir depth and not a change in the depth of the hypolimnion.**

Following mixed conditions in July, a slight thermocline was present in the upper surface waters in August and increased in depth in September 2011. A strong stratification layer developed in October; despite this thermocline DO was still consistent throughout the water column. By December, an anoxic layer (DO 1.5-0.38 mg/L) had developed between nine metres and the bottom, in association with the metalimnion dispersed between 5-11 metres. A similar pattern persisted in January and February 2012 with a strong thermocline and an anoxic layer from approximately 10 metres to the bottom. The data was not able to be collected at the headwater site in March 2012 due to releases from the dam. In April 2012 the water column was well mixed. In May the dam returned to a stratified state with an anoxic layer in the bottom five metres of the water column. This reduction in input and mixing is likely to have allowed the dam to re-stratify and develop an anoxic zone. The combined effect of rainfall and releases in February and March appear to have destabilised the stratification slightly however did not result in a mixing event (Figure 6). This combination of impact continued through the rest of the year as the temperature cooled towards a well mixed water column in June.

**Figure 6: Rainfall at the Wivenhoe Dam Wall and storage level over the monitoring period**

The concentration of cyanobacteria in Wivenhoe Dam followed a pattern that generally reflected the stratification and nutrient enrichment in the dam, with the cyanobacterial concentration beginning to increase in spring, peaking in summer and returning to low concentrations in autumn and winter. These variations coincided with seasonal peaks in air temperature and photoperiod. Cyanobacterial populations were dominated by *Cylindrospermopsis raciborskii* with low level toxin production evident over the peak of the bloom period (Table 10). There was no significant change in the water quality risk profile in the Lower Wivenhoe region (Table 10).

**Table 10: Summary Data for the Lower Wivenhoe July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Lower Wivenhoe | TN | mg/L | 12 | 0.36 | 0.445 | 0.76 | 0.52 |
| | TP | mg/L | 12 | 0.012 | 0.018 | 0.041 | 0.02 |
| | DO | mg/L | 11 | 4.35 | 8.96 | 11.56 | 8.73 |
| | E.coli | cfu/100mls | 12 | < 1 | < 1 | 7 | ND |
| | Cylindrospermopsis raciborskii | cells/ml | 11 | ND | 20 | 80000 | 2440 |
| | Microcystis aeruginosa | cells/ml | 11 | ND | | | 763 |
| | Anabaena circinalis | cells/ml | 11 | ND | | | 770 |
| | Cylindrospermopsin | ug/L | 1 | 1.4 | 1.4 | 1.4 | 0.4 |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | 12 | 1 | 3.5 | 6 | 3 |
| | Pesticides | ug/L | 2 | < ADWG limits | | | |
| | Total Metals | mg/L | 3 | Total Al, Ar, Pb > ADWG 1 occassion, rest < ADWG | | | |
| | Dissolved Iron | mg/L | 12 | 0.03 | 0.07 | 0.71 | 0.01 |
| | Dissolved Manganese | mg/L | 12 | < 0.001 | < 0.001 | 0.007 | ND |
| | Cryptosporidium | oocysts/10L | NT | | | | ND |
| | Giardia | cysts/10L | NT | | | | |
| | Specific Conductivity | uS/cm | 11 | 302 | 335 | 376 | 375 |
| | pH | | 11 | 7.39 | 8.37 | 9.00 | 8.27 |
| | MIB | ng/L | 11 | < 2 | 5.3 | 11.2 | ND |
| | Geosmin | ng/L | 11 | < 2 | < 2 | 7.1 | ND |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

## 4.4 Lowood WTP Catchment

### Lake Wivenhoe Releases

There was no significant change in the water quality risk profile for Lowood WTP from releases from Wivenhoe Dam (Table 11).

**Table 11: Summary Data for releases from Wivenhoe July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Wivenhoe Release | TN | mg/L | 12 | 0.35 | 0.4 | 0.46 | 0.52 |
| | TP | mg/L | 12 | 0.017 | 0.022 | 0.054 | 0.022 |
| | DO | mg/L | 10 | 4.87 | 8.26 | 10.00 | 8.52 |
| | E.coli | cfu/100mls | 12 | < 1 | 2.5 | 64 | 2.5 |
| | Cylindrospermopsis raciborskii | cells/ml | 12 | 80 | 3710 | 17000 | 1242 |
| | Microcystis aeruginosa | cells/ml | 12 | ND | | | 335 |
| | Anabaena circinalis | cells/ml | 12 | ND | | | 435 |
| | Cylindrospermopsin | ug/L | NT* | | | | 0.2 |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | 9 | 1 | 3 | 5 | 3 |
| | Pesticides | ug/L | 2 | < ADWG limits | | | |
| | Total Metals | mg/L | 2 | < ADWG limits | | | |
| | Dissolved Iron | mg/L | 9 | 0.05 | 0.18 | 0.69 | 0.005 |
| | Dissolved Manganese | mg/L | 9 | < 0.001 | 0.01 | 0.422 | 0.006 |
| | Cryptosporidium | oocysts/10L | NT | | | | |
| | Giardia | cysts/10L | NT | | | | |
| | Specific Conductivity | uS/cm | 10 | 302 | 334 | 378 | 379 |
| | pH | | 10 | 7.62 | 7.885 | 8.35 | 7.945 |
| | MIB | ng/L | 11 | < 2 | 4.2 | 10.7 | < 4 |
| | Geosmin | ng/L | 11 | < 2 | 2.2 | 4.3 | < 2 |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

## Lockyer Creek Inputs

A significant change in conductivity was seen over the reporting period in the Lower Lockyer (Table 12) which has been attributed to the return of baseflows from saline aquifers in the Lockyer Catchment (Refer Section 3.4). This has correlated to increases in both TDS and hardness in the region. The return of significant flows has also likely led to an increase in dissolved oxygen. All other data collected was comparable to long-term analysis.

**Table 12: Summary Data for the Lower Lockyer Creek July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Lockyer | TN | mg/L | 13 | 0.5 | 0.75 | 1.12 | 1.6 |
| | TP | mg/L | 13 | 0.015 | 0.065 | 0.291 | 0.68 |
| | DO | mg/L | 11 | 4.60 | 8.44 | 11.51 | 6.04 |
| | E.coli | cfu/100mls | 10 | 4 | 48 | 870 | 160 |
| | Cylindrospermopsis raciborskii | cells/ml | 9 | ND | ND | 30 | 140 |
| | Microcystis aeruginosa | cells/ml | 9 | ND | | | 3830 |
| | Anabaena circinalis | cells/ml | 9 | ND | | | 1078 |
| | Cylindrospermopsin | ug/L | NT* | | | | ND |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | NT | | | | 73 |
| | Pesticides | ug/L | NT | | | | |
| | Total Metals | mg/L | NT | | | | |
| | Dissolved Iron | mg/L | NT | | | | |
| | Dissolved Manganese | mg/L | 10 | 0.002 | 0.01 | 0.044 | 0.266 |
| | Cryptosporidium | oocysts/10L | NT | | | | |
| | Giardia | cysts/10L | NT | | | | |
| | Specific Conductivity | uS/cm | 11 | 601 | 917 | 1656 | 422 |
| | pH | | 11 | 6.86 | 8.02 | 8.50 | 7.649 |
| | MIB | ng/L | 10 | < 2 | 3.7 | 5.9 | < 4 |
| | Geosmin | ng/L | 10 | < 2 | 2.35 | 6.7 | 6.25 |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

## Upper Mid-Brisbane River

Conductivity increases in the Lockyer (refer above) has not had a significant impact on the baseline conductivity in the upper Mid-Brisbane however there has been a noticeable increase in conductivity through flow events from the Lockyer (Table 13). There is also evidence to suggest algal related impacts have increased with significant increases in algal numbers and taste and odour compounds in the upper Mid-Brisbane, likely driven by algal growth in the Lockyer below O'Reilly's Weir (monitoring point). This will be addressed in the upcoming review (refer to Section 6). All other data collected was comparable to long-term analysis.

**Table 13: Summary Data for the Upper Mid-Brisbane River July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Upper Mid-Brisbane | TN | mg/L | 14 | 0.32 | 0.445 | 0.66 | 0.55 |
| | TP | mg/L | 14 | 0.009 | 0.0195 | 0.074 | 0.042 |
| | DO | mg/L | 12 | 6.87 | 8.57 | 10.44 | 7.7 |
| | E.coli | cfu/100mls | 13 | 5 | 34 | 280 | 33 |
| | Cylindrospermopsis raciborskii | cells/ml | | ND | 40 | 9500 | 700 |
| | Microcystis aeruginosa | cells/ml | 13 | ND | | | 30 |
| | Anabaena circinalis | cells/ml | 13 | ND | | | ND |
| | Cylindrospermopsin | ug/L | NT* | | | | ND |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | 13 | 3 | 7 | 29 | 8 |
| | Pesticides | ug/L | 2 | Atrazine > ADWG 2 occassion, rest < ADWG | | | |
| | Total Metals | mg/L | 4 | Total Al > ADWG 2 occassion, rest < ADWG | | | |
| | Dissolved Iron | mg/L | 13 | 0.09 | 0.33 | 2.4 | 0.006 |
| | Dissolved Manganese | mg/L | 15 | 0.006 | 0.012 | 0.286 | 0.01 |
| | Cryptosporidium | oocysts/10L | NT | | | | |
| | Giardia | cysts/10L | NT | | | | |
| | Specific Conductivity | uS/cm | 12 | 318.75 | 388.50 | 531.00 | 402 |
| | pH | | 12 | 7.60 | 8.05 | 8.46 | 7.8675 |
| | MIB | ng/L | 9 | 2.6 | 5.7 | 10 | 4.2 |
| | Geosmin | ng/L | 7 | 2.1 | 4 | 7 | < 2 |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

## 4.5 Mt Crosby WTPs Catchment

### Lower Mid-Brisbane River

There was no significant change in the water quality risk profile for Mt Crosby WTPs from the lower Mid-Brisbane (Table 14) though conductivity issues upstream (refer above) will be considered during the scheduled review (Refer Section 6).

**Table 14: Summary Data for the Lower Mid-Brisbane River July 2011 – June 2012. Variable temporal and spatial information is presented for selected parameters.**

| System | parameter | unit | n | Min | Med | Max | Long-term median (RSK-00147 |
|---|---|---|---|---|---|---|---|
| Lower Mid-Brisbane | TN | mg/L | 26 | 0.33 | 0.455 | 1.3 | 0.51 |
| | TP | mg/L | 26 | 0.025 | 0.036 | 0.307 | 0.041 |
| | DO | mg/L | 24 | 3.37 | 9.23 | 12.21 | 8.11 |
| | E.coli | cfu/100mls | 25 | < 1 | 16 | 240 | 22 |
| | Cylindrospermopsis raciborskii | cells/ml | 26 | ND | ND | 3100 | 330 |
| | Microcystis aeruginosa | cells/ml | 26 | ND | | | 300 |
| | Anabaena circinalis | cells/ml | 26 | ND | | | 543 |
| | Cylindrospermopsin | ug/L | 1 | ND | | | 0.2 |
| | Microcystin | ug/L | NT* | | | | ND |
| | Saxitoxins | ug/L | NT* | | | | ND |
| | Total Suspended Solids | mg/L | 23 | 4 | 8 | 195 | 6 |
| | Pesticides | ug/L | 2 | Atrazine > ADWG 2 occassion, rest < ADWG | | | |
| | Total Metals | mg/L | 4 | Total Al > ADWG 4 occassion, rest < ADWG | | | |
| | Dissolved Iron | mg/L | 23 | 0.15 | 0.4 | 7.91 | 0.008 |
| | Dissolved Manganese | mg/L | 24 | 0.001 | 0.004 | 0.017 | 0.01 |
| | Cryptosporidium | oocysts/10L | 3 | ND | | | ND |
| | Giardia | cysts/10L | 3 | ND | | | ND |
| | Specific Conductivity | uS/cm | 24 | 317 | 415 | 770 | 386 |
| | pH | | 24 | 6.53 | 8.05 | 8.60 | 7.91 |
| | MIB | ng/L | 25 | < 2 | 3.9 | 24.8 | < 4 |
| | Geosmin | ng/L | 25 | < 2 | < 2 | 6.4 | 2.3 |

* Not Tested under requirements of Cyanobacterial Managment Plan (PLN-00109)

# 5. Audit of the WDWQMP

Pursuant to Section 99 (4) of the *Water Supply Safety and Reliability Act*, an audit of the WDWQMP is required every five years from the date of approval, which would require an audit to be completed prior to June 29, 2016. Seqwater are undertaking a review of the WDWQMP (refer Section 6) which precludes the requirements of any more frequent audits outside the Act. Following the finalisation of the government reforms from January 1, 2013 the audit process for Seqwater's DWQMPs and RWMPs will be developed to align with the requirements of the new business and the operating legislation.

# 6. Regular Review of the WDWQMP

Pursuant to Section 99 (3) of the *Water Supply Safety and Reliability Act* a review of the WDWQMP is required every four years from the date of approval, which would require a review to be completed prior to June 29, 2015. Seqwater are undertaking a review of the WDWQMP (refer Section 6) to align with the implementation of the Catchment Water Quality Management Framework and the government reforms that take effect in early 2013.

This review process will involve an assimilation and analysis of data against relevant guidelines and trends and include a review of specific projects and reports conducted in the region. This information will feed into a review of the risk assessments (inherent and unmitigated components as identified in Section 3.2. Following this process, the WDWQMP and its associated procedures will be updated and submitted to the Office of the Water Supply Regulator as required for approval.

The review will also include a revision of the associated monitoring plans to address any data and information gaps that need to be filled to improve the evidence base of the risk assessment and alternative technique/ advancements delivered from Seqwater's Research, Science and Technology program or the water industry will be incorporated.

# 7. References

Cox, M., Raiber, M., James, A., & Hawke, A. (2012). Groundwater/Surface Water Conceptual, Hydrological and Water Quality Models: Middle-Brisbane River and subcatchments (REF-00243): Institute for Future Environments, Queensland University of Technology, Brisbane.

WSAA. (2003). Best Practice Environmental Management Guidelines — Catchments for Recreational Water: Conducting and Assessing Sanitary Inspections. : Water Services Association of Australia.