



Water Quality Monitoring Program

2015 Annual Report

Acknowledgements:

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Executive Summary

Hornsby Shire Council established a water quality monitoring program in 1994 to assess, through time, the impact of land use on waterways within the Shire and to monitor the performance of Council's Catchments Remediation Rate (CRR) Program. The monitoring data is used for prioritising catchment remediation works, environmental assessments, catchment modelling and education programs. This data is available to the community and interested authorities upon request and presented within Annual Reports and on Council's website www.hornsby.nsw.gov.au/water.

During the 2014-15 reporting period water quality was routinely monitored at 65 sites across the Shire in both freshwater and estuarine locations to assess:

- Long term ecosystem health in estuarine and freshwater sites located below different landuse types (urban, industrial, rural, bushland).
- Activities directly influencing water quality (e.g. wastewater treatment plants).
- Effectiveness of disused landfill leachate collection and treatment.
- Effectiveness of stormwater harvesting and reuse programs which reduce stormwater impacts and improve water conservation.

Routine water quality monitoring for aquatic ecosystem health showed the following results (Table 1 and Table 2) between the 2013-14 and 2014-15 reporting periods:

- an improvement in the physical-chemical site health grades of two freshwater sites and one estuarine site
- a decline in the physical-chemical site health grades of two freshwater sites and two estuarine sites
- an improvement in the microbial site health grade of one freshwater site
- a decline in the microbial site health grades of fourteen freshwater sites and three estuarine sites.

It is important to note that 2014-15 reporting period received significantly more rain fall than the previous year (~1400mm compared to ~680mm in 2013-14), resulting in more pressure from catchment inputs.

The general trend for water quality in Hornsby Shire (Figure 1 and Figure 2), as evident from monitoring through time, is that better water quality results are recorded where catchments remain primarily

undisturbed (reference sites), this is usually in National Parks and Nature Reserves. Results generally decline downstream of rural and urban settlements, with most impacted water quality being recorded downstream of industrial areas. Water quality in estuarine areas is generally good due to constant tidal flushing. The upper sections of Marramarra and Berowra Creeks, where less tidal flushing occurs, show signs of impacts from the catchments.

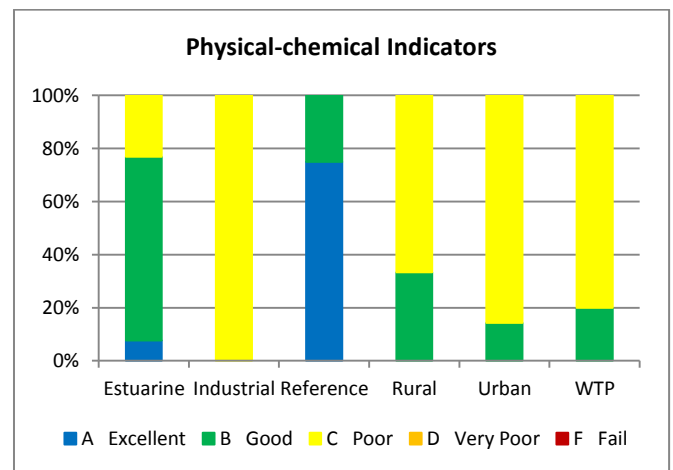


Figure 1 Percentage of site health grades for physical-chemical indicators within each catchment land use

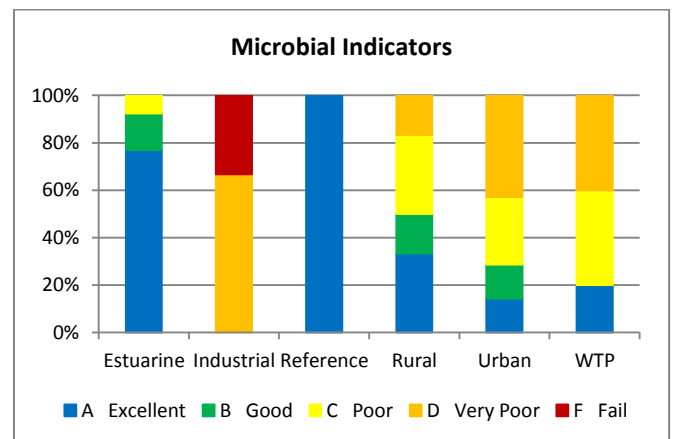


Figure 2 Percentage of site health grades for microbial indicators within each catchment land use

Stormwater harvesting and reuse systems have been operating well since the implementation of a preventative maintenance system in late 2013. Further investigation into the amount of potable water in the systems at Epping, North Epping and Greenway Ovals is recommended. Levels of bacteria are low (below trigger values) in all treated stormwater being applied to playing ovals through irrigation.

Site No.	Location	Category	2012/2013		2013/2014		2014/2015	
			Phys-Chem	Microbial	Phys-Chem	Microbial	Phys-Chem	Microbial
001	Berowra Ck	WTP	D	A+	C	A+	C	C ↓
002	Tunks Ck	Rural	B	A+	A	A+	B ↓	A+
004	Berowra Ck	Urban	C	A	C	A	C	C ↓
005	Berowra Ck	Urban	D	A	C	A	C	D ↓
006	Georges Ck	Urban	C	A	C	A	C	B ↓
008	Devlins Ck	Urban	D	D	C	B	C	D ↓
010	Larool Ck	Industrial	D	F	D	D	C ↑	D
012	Hornsby Ck	Industrial	D	F	C	F	C	F
013	Sams Ck	Industrial	D	D	C	A	C	D ↓
023	Waitara Ck	WTP	D	C	C	C	C	D ↓
036	Murray Anderson Ck	Reference	A	A+	A	A+	A	A+
037	Smugglers Ck	Reference	A	A+	A	A+	A	A+
039	Joe Crafts Ck	Urban	A	A+	B	A+	B	A
042	Colah Ck	Rural	C	A	C	A	C	C ↓
043	Calna Ck	WTP	C	A+	C	A+	C	A+
045	Berowra Ck	WTP	C	B	C	B	C	C ↓
046	Trib Terrys Ck	Urban	D	F	C	C	C	D ↓
049	Still Ck	Rural	C	A	B	A+	C ↓	B ↓
052	Calna Ck	WTP	B	D	B	A	B	D ↓
054	Laughtondale Ck	Reference	A	A+	A	A+	A	A
062	Kimmerikong Ck	Rural	D	B	C	A	C	C ↓
063	Colah Ck	Rural	C	A+	B	A	B	A
064	Trib. Colah Ck	Urban	D	B	C	B	C	C ↓
080	Glenorie Ck	Rural	D	F	D	F	C ↑	D ↑
114	Muogomarra Ck	Reference	B	A+	A	A+	A	A+
123	Peats Crater Ck	Reference	B	A	B	A+	B	A
147	Trib. Byles Ck	Reference	A	A+	A	A+	A	A
149	Duckpond Ridge Ck	Reference	B	A+	B	A+	B	A+
164	Djarra Crossing	Reference	A	A	A	A+	A	A

Table 1 Comparison of site health grades for freshwater aquatic ecosystem health sites between the last three reporting periods. Results for 2014-15 also indicate whether the site health grade has improved or decline since the 2013-14 reporting period

Site No.	Location	Phys-Chem	Microbial	Aquatic Biota	Waterway Health Grade
038	Sandbrook Inlet	B	A	C	B
048	Marramarra Ck	C	B	C	C
055	Brooklyn Baths	B	A	A	A
060	Berowra Ferry	B	B	C	B
061	Calabash Bay	B	A	D	B
100	Crosslands Reserve	C	C	A	B
103	Milsons Passage	B	A	A	A
108	Bradleys Beach, Dangar Island	B	A	A	A
150	Gunya Point	A	A	A	A
151	Bar Island	B	A	C	B
152	Courangra Point	B	A	B	B
153	Laughtondale	C	A	C	B
174	Mullet Ck	B	A	B	B

Table 2 Site Health Grades and subsequent Waterway Health Grades for estuarine sites during the 2014-15 reporting period

1. Hornsby Shire and Catchments

1.1 Hornsby Shire Region

The Hornsby Shire is approximately 25 kilometres north-west of Sydney covering an area of 510 square kilometres. Nearly two-thirds of Hornsby Shire is National Park and bushland. The Shire includes land from Eastwood in the south to Wisemans Ferry in the north and Brooklyn to the east (HSC 2013).

The traditional owners of the Shire were the Aboriginal people of the Darug and Guringai language groups. European settlement in the Shire

dates from 1794 when the first land grants were made along the Hawkesbury River, with land primarily used for farming (HSC 2013).

Hornsby Shire's main urban and rural developments are located in the southern half of the Shire on the plateau areas. At present approximately 10% of the Shire is zoned and used for urban development, 15% for rural purposes, 5% for open space and 70% is Environmental Protection or National Park (Figure 1.1).

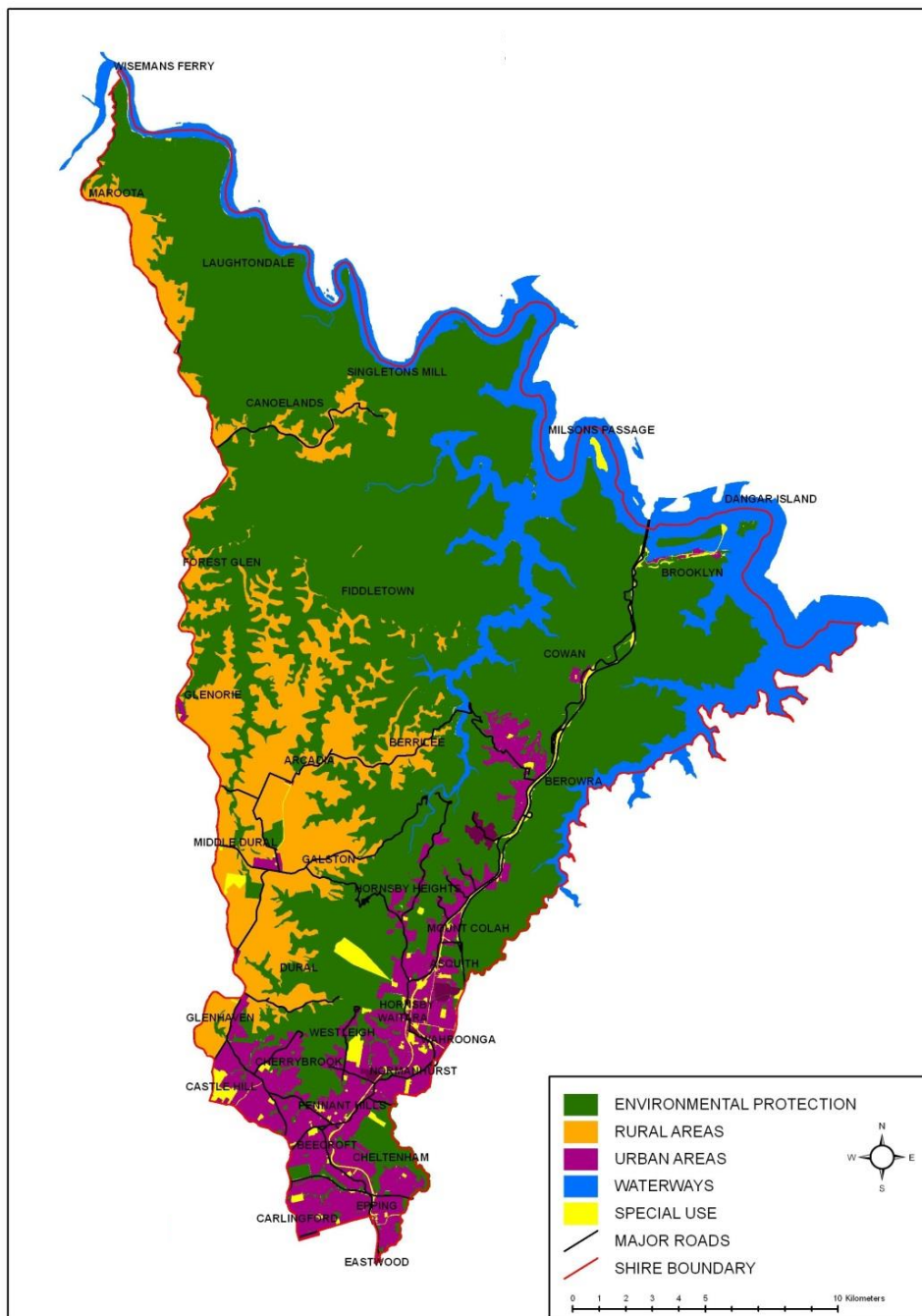


Figure 1.1 Hornsby Shire Council Zoning Map

1.2 Major Water Catchments

The four major water catchments within Hornsby Shire include Berowra Creek, Cowan Creek, the Hawkesbury River and Lane Cove River (Figure 1.2). The lower Hawkesbury River (estuary) connects with the ocean at Broken Bay and is the receiving water for Berowra Creek and Cowan Creek catchments. Water from the Lane Cove River catchment is received in Sydney Harbour.

1.2.1 Berowra Creek Catchment

The Berowra Creek catchment is bounded on the south by Castle Hill Road, to the west by Old Northern Road, to the north by Canoelands Ridge and to the east by the Pacific Highway. All of the Berowra Creek Catchment is within the Hornsby Shire Local Government Area.

The catchment contains significant bushland areas, including Marramarra National Park, Muogamarra Nature Reserve and Berowra Valley National Park. Land uses in this catchment include bushland, rural, developed and developing urban, light industrial and commercial. The main impacts on water quality in Berowra Creek arise from the discharge of tertiary treated sewage from the West Hornsby and Hornsby Heights Wastewater Treatment Plants (WTPs) into Waitara and Calna Creeks, and from stormwater run-off from the developed urban and commercial areas located in the south eastern parts of the Shire.

The rural and rural-residential areas in the southern end of the Shire flow to upper Berowra Creek, Tunks, Still and Calabash Creeks. Along the south-western edge similar areas flow to Colah and Fiddletown Creeks then to Marramarra Creek which flows to lower Berowra Creek, close to the confluence with the Hawkesbury River.

1.2.2 Cowan Creek Catchment

Within the Cowan Creek catchment there are four Local Government Areas. The western boundary of Cowan Creek catchment, defined by the Pacific Highway, lies within Hornsby Shire. Cockle Creek and Cowan Creek form part of the Shire boundary. Land uses in the southern part of this area include extensive light industrial areas, large commercial shopping centres and developed urban areas. Kuring-gai Chase National Park also covers a large part of the catchment.

1.2.3 Lane Cove River

Seven Local Government authorities have jurisdiction over the Lane Cove River catchment. Only the upper reaches of the Lane Cove River catchment are within Hornsby Shire; Devlins Creek, upper Lane Cover River and Terrys Creek. This catchment is dominated by developed urban land uses and some commercial areas as well as bushland areas including the upper parts of Lane Cove National Park. This is Hornsby Shire's only catchment area that flows to Sydney Harbour.

1.2.4 Hawkesbury River Catchment

The Hawkesbury River catchment within Hornsby Shire is divided into two areas which include the Wiseman's Ferry and Maroota region as well as the Brooklyn area. These areas flow directly to the Hawkesbury River. Land uses in these areas include small farming ventures, market gardening, residential development, marinas, boat ramps, aquaculture and fishing industries (commercial and recreational). A wastewater treatment plant that services Brooklyn, Dangar Island, Mooney Mooney and Cheero Point discharges tertiary treated effluent beneath Peats Ferry Bridge on the Old Pacific Highway, into an area of strong tidal current.

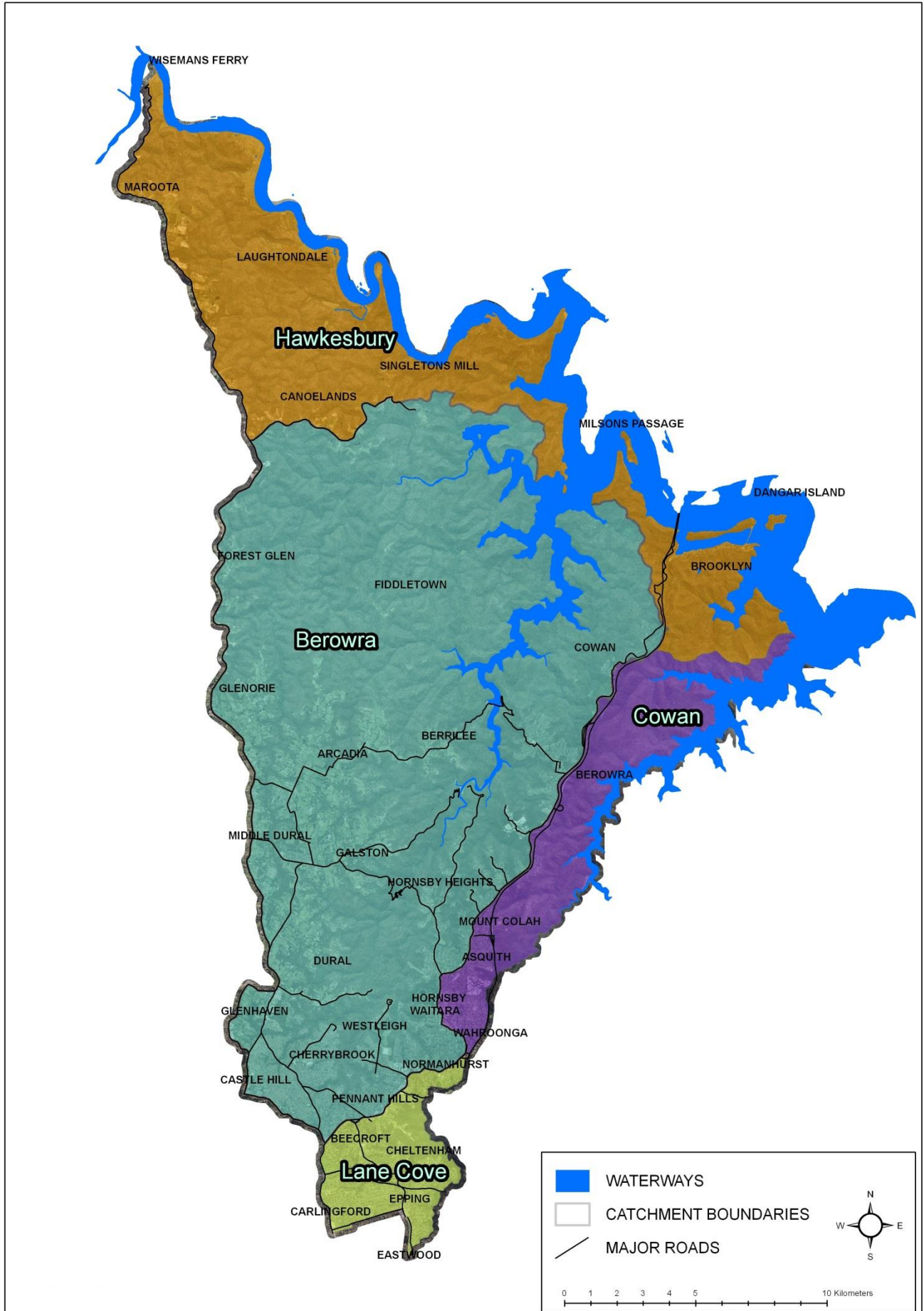


Figure 1.2 Hornsby Shire Council Major Catchments

2. Water Quality Monitoring Program

2.1 Water Quality Management

2.1.1 National Level

The National Water Quality Management Strategy (NWQMS) outlines a national approach to improving water quality in Australian and New Zealand waterways. It was originally endorsed by two Ministerial Councils; the former Agriculture and Resources Management Council of Australia and New Zealand (ARMCANZ) and the former Australian and New Zealand Environment and Conservation Council (ANZECC). Since 1992 the NWQMS has been developed by the Australian and New Zealand Governments in cooperation with state and territory governments. Ongoing development is currently overseen by the Standing Council on Environment and Water (SCEW) and the National Health and Medical Research Council (NHMRC). The NWQMS aims to protect the nation's water resources, by improving water quality while supporting the businesses, industry, environment and communities that depend on water for their continued development (Dept of Environment 2015).

Australia has a national framework for assessing water quality which is explained in the ANZECC 2000 Guidelines. These guidelines outline an agreed framework to assess water quality in terms of whether the water is suitable for a range of environmental values, including human uses. The Water Quality Objectives identify environmental values for NSW waters and the ANZECC 2000 Guidelines provide the technical guidance to assess the water quality needed to protect those values (NSW DECCW 2006).

2.1.2 Regional Level

NSW has a set of Water Quality Objectives that are the agreed environmental values and long-term goals for NSW surface waters (NSW DECCW 2006). They describe:

- Community values and uses for our rivers, creeks, estuaries and lakes (i.e. healthy aquatic life, water suitable for recreational activities like swimming and boating, and drinking water).
- A range of water quality indicators to assess whether the current condition of our waterways supports those values and uses.

NSW water quality objectives have been agreed for fresh, estuarine and marine waters. These objectives are consistent with the agreed national framework for assessing water quality set out in the ANZECC 2000 Guidelines (NSW DECCW 2006).

2.1.3 Local Level

The local environment within the Hornsby Shire has substantial and continual pressure to accommodate a rapidly growing population. Over the next 10 years it is forecast over 4270 new private dwellings will be built, and over 2380 new jobs created (HSC 2013). The importance of understanding the condition of our local environment is critical as a healthy environment supports our health and wellbeing and thus our quality of life (HSC 2012). Water quality is one of the prime indicators of the condition of our local environment. The continuing collection and interpretation of water quality through time is essential to understand both climate variability and the impact of development on the Shire's natural environment (HSC 2012).

Hornsby Council has a number of programs to protect and enhance the local waterways. These include:

- Catchment Remediation Rate Program
- Hawkesbury Estuary Program
- Sustainable Total Water Cycle Management
- Water Quality Monitoring Program.

This report will detail the results of Council's water quality monitoring program for the 2014-2015 period. Other Annual Reports prepared by the Natural Resources Branch can be accessed via the Hornsby Council website www.hornsby.nsw.gov.au.

2.2 History of the Program

Hornsby Shire Council's water quality monitoring program began soon after the Statement of Joint Intent (SoJI) was signed in 1994 (Appendix A). This was an agreement between the NSW Department of Planning, Environmental Protection Authority, Hawkesbury-Nepean Catchment Management Trust, Hornsby Shire Council and the Water Board established in response to environmental issues which included, the regular occurrence of algal blooms in the estuarine section of Berowra Creek, increasing pressures of urban development and

sewage discharge issues, tighter pollution regulations coming into force, the publication of Australian environmental water quality guidelines (ANZECC, 1992 (updated 2000)), and the recognition of the detrimental impacts of catchment activities on water quality.

The monitoring program was initially designed to assess, through time, the impact of land use on waterways and to monitor the performance of Council's Catchment Remediation Rate (CRR) Program. Sites have progressively been added and the program expanded to include:

- aquatic ecosystem health monitoring (fresh and estuarine waters),
- monitoring and assessment of CRR initiatives,
- recreational water quality monitoring,
- monitoring to detect harmful estuarine algal blooms,
- biological monitoring (macroinvertebrates and diatoms),
- monitoring of discrete events (e.g. Hornsby Quarry dewatering program).

2.3 Program Objectives

Objectives of the Water Quality Monitoring Program include:

- Trends through time - undertake long term monitoring of water catchments within Hornsby Shire to assess trends in water quality from both point and diffuse pollution sources, with an emphasis on understanding causes and effects of algal blooms in the Berowra Creek estuary.
- Environmental condition assessment - compare the observed water quality data with undisturbed catchments, and with Regional Environmental Health Values (REHVs) developed using local long term monitoring data in conjunction with nationally accepted guidelines for fresh and marine waters; specifically for the water values associated with the protection of

aquatic ecosystems, with recreational water uses, and for stormwater reuse projects. Further, to use biological monitoring at representative sites to complement the water quality program.

- Asset management - determine the effectiveness of Catchment Remediation assets in removing pollutants from the waterways.
- Water conservation - support water savings programs, including stormwater harvesting and reuse projects at sports ovals.
- Improve catchment knowledge - use water quality data to calibrate and support catchment/pollutant modelling and assist with environmental education programs.

2.4 Program Review

To ensure that Council's long term Water Quality Monitoring Program continues to deliver appropriate and reliable data to achieve program objectives a systematic review of all program components commenced in 2014.

At the time of writing this report a Review Summary document and Program Matrix was being developed to provide a detailed inventory of all current program components with recommendations for specific review actions. During 2015-16 a review team will work through the recommendations and actions to move towards an optimal program design. It is expected that implementation of the reviewed program will commence by July 2016.

The structure of the review has been based on a combination of approaches to developing water quality monitoring programs with key documents being the *Australian Guidelines for Water Quality Monitoring and Reporting* (ANZECC 2000), *Design of Networks for Monitoring Water Quality* (Sander et al 1983) and the *New South Wales Natural Resources Monitoring, Evaluation and Reporting Strategy 2010-2015* (NSW DECCW 2010).

3. Water Quality Sites

Representative sampling sites have been selected across the Shire to meet the objectives of the water quality monitoring program. A site is a geographic location where a hand held probe can be used to measure the physical conditions of a water body and/or where a sample of water can be collected for analysis of the water body's chemical, microbial and biological characteristics.

During 2014-15 water quality was routinely monitored at 65 sites (Figure 3.2) across the Shire to assess:

- Long term ecosystem health in estuarine and freshwater sites located below different landuse types (urban, industrial, rural, bushland).
- Activities directly influencing water quality (e.g. wastewater treatment plants).
- Effectiveness of disused landfill leachate collection and treatment
- Effectiveness of stormwater harvesting and treatment processes which reduce stormwater impacts and improve water conservation.

Water quality was assessed at a number of additional sites throughout the year in response to individual events. These samples were not part of the routine sampling schedule and will not be presented in this report.

Appendix G provides details of all water quality monitoring sites including inactive/historic sites, active/current sites and sites established for short term monitoring of discrete events.

3.1 Aquatic Ecosystem Health

Freshwater sites monitored for long term aquatic ecosystem health were selected with consideration given to the reliability of stream flow throughout the year, site accessibility and the ability to monitor stormwater flows. These sites are representative of different catchment landuses within the Shire (i.e. primarily undisturbed/reference condition, urban, rural and industrial). Table 3.1 provides summary information on site classification or primary land use and the location of sites monitored for aquatic ecosystem health. Detailed information on each site can be found in Appendix B.

3.1.1 Reference Sites

Reference sites represent the highest water quality against which water quality in other less pristine locations can be compared. Data from reference sites show natural variation of water parameters in creeks with minimal human impact, thus providing 'control' or 'reference' data. These creeks with primarily undisturbed catchments reflect the water quality that may have existed before Hornsby Shire was developed.

Ideally reference sites should have similar geography, geology, soils and vegetation to the creeks to which they are being compared. However, development within the Shire historically began in areas with good quality soils suitable for farming and on ridge tops with shale derived soils. Subsequent urban development concentrated around the ridge top areas. As a result there is now a paucity of unimpacted creeks draining such types of soils and geology.

Council monitors two long-term reference sites (036 and 037) that are within nearby National Parks and dominated by large areas of exposed sandstone and poorer soils. Six potential reference sites were introduced in 2011 (054, 114, 123, 147, 149, 164) to obtain additional data to assess how representative sites 036 and 037 are as reference sites (Wright, 2011). As part of the water quality monitoring program review these additional potential reference sites will be assessed and the most suitable sites retained as long term reference sites to meet the objectives of the water quality monitoring program.

For the purpose of this report, only the current long term reference sites (036 and 037) will be used as comparative reference sites in the data analysis. These are also the sites that were used in the development of Council's Regional Environmental Health Values (REHVs).

3.1.2 Industrial, Rural and Urban Sites

The major industrial areas in Hornsby Shire are located around Sefton Rd Thornleigh, Leighton Place Hornsby and Beaumont Road Mount Kuring-gai. These industrial areas flow to Larool Creek (site 010), Hornsby Creek (site 012) and Sams Creek (site 013) respectively (Table 3.1).

Rural areas are classified as those areas with a majority of their catchment being zoned rural or with townships which primarily rely on onsite sewage

management systems to dispose of their effluent. Current rural sites are 002, 042, 049, 062, 063, 064 and 080 (Table 3.1), generally located in the north and western parts of the Shire. The townships of Galston, Glenorie and Cowan have recently had sewer infrastructure installed by Sydney Water and it is expected that the impacts from onsite systems in these areas will lessen into the future as more properties become connected.

Urban catchments consist of residential and light commercial areas throughout the Shire. They are characterised by reticulated water and sewerage systems, a large percentage of impervious surfaces (e.g. roads, driveways, and roofs) and complex stormwater collection infrastructure, which often discharges directly into local streams. Current urban sites include 004, 005, 006, 008, 039 and 046 (Table 3.1). It is likely that a recommendation from the water quality monitoring program review will be to establish an additional category of landuse to distinguish between medium density and high density urban landuse to account for the substantial amount of multistoried residential developments currently being built.

3.1.3 Estuarine Sites

Monitoring of water quality at estuarine sites in the Hawkesbury River is undertaken to assess the environmental health of the estuary, which is the receiving water for the majority of the Shire as well as upstream catchments outside of the Hornsby Shire Local Government Area. Current estuarine

sites include 038, 048, 055, 060, 061, 100, 103, 108, 150, 151, 152, 153 and 174 (Table 3.1). These sites are distributed across the salinity gradient of the estuary from high salinity sea water (25-35ppt) near the mouth of the Hawkesbury River to brackish (10-25ppt) and mostly fresh water (<10ppt) further up the estuary and in tributaries. In addition to catchment inputs coming down the river, water quality in estuarine sites relies significantly on the amount of tidal flushing a site receives from the ocean.

Brooklyn Baths (site 055), Crosslands Reserve (site 100) and Bradleys Beach, Dangar Island (site 108) are popular swimming locations. In addition to environmental health, water quality data from these sites also provides information regarding public health and the suitability of the sites for recreational activities. Long term monitoring data has been used to develop an online application providing daily updates on the suitability of swimming at different locations in the Hawkesbury estuary www.hornsby.nsw.gov.au/waterquality.

Council also manages a number of water quality monitoring buoys (Figure 3.1) remotely deployed to monitor temperature, chlorophyll-a, salinity and turbidity levels within the estuary. Chlorophyll-a is used as an indicator for algal growth and Council responds if levels are persistently elevated (~30µg/L), as this may indicate a problematic micro-algal bloom. Further details of this monitoring program are available at www.hornsby.nsw.gov.au/waterquality and within the Estuary Management Annual Reports.



Figure 3.1 Remote water quality monitoring buoy at Courangra Point on the Hawkesbury River

Wastewater Treatment Plant Sites

Reticulated sewerage systems comprise of pipes, pumping stations, overflow points and treatment plants designed to transport, treat and dispose of sewage. Property owners are responsible for the maintenance of sewerage systems on private land as far as the connection to the sewer main, while Sydney Water Corporation (SWC) maintains the remaining infrastructure and treatment plants.

Within Hornsby Shire there are three wastewater treatment plants operated by SWC; Hornsby Heights, West Hornsby and Brooklyn. The two larger plants, Hornsby Heights and West Hornsby, provide tertiary treatment to sewage collected in the more densely settled urban suburbs and industrial areas in the southern half of the Shire. Treated effluent from these plants is discharged to Calna Creek and Waitara Creek respectively, both of which are tributaries of the Berowra Creek. A smaller plant is operating at Brooklyn and the treated effluent is discharged directly into the Hawkesbury River under the old Peats Road Ferry Bridge.

The treatment plants operate under an Environmental Protection Licence, issued by the NSW Environment Protection Authority. SWC is required to operate and maintain the sewer pipe collection system and the treatment plants to certain standards. The Licences specify monitoring requirements and pollution reduction programs. Monitoring data, plant operation and licencing information is publically available on the SWC website www.sydneywater.com.au.

Despite having these licence conditions and controls in place it is not uncommon for untreated or partially treated sewage to enter local creeks in sewered areas. There are a number of ways this can happen:

- During wet weather, stormwater may infiltrate sewer pipes from illegal connections or fractured pipes, greatly increasing flows in the sewer pipe network. This can cause an overload of the system's capacity resulting in the treatment plant releasing only partially treated sewage, or releasing overflows from designated discharge points adjacent to sewer mains or pumping stations throughout the network. For example, within the catchment of West Hornsby WTP,

there are approximately 30 designed overflow points near creeks.

- During dry weather, overflows of sewage can occur at designed relief points as a result of blockage in a pipe (e.g. by tree roots). Blockages reduce the capacity of the pipe to carry its design flow causing sewage to back up along the pipes and escape via designated overflow points.

Due to the significant impact of sewage management processes on creeks, Council monitors a number of water quality sites to assess the combined impacts of urban stormwater runoff and treated and untreated effluent on aquatic ecosystem health (HSC 2011). Current wastewater treatment plant sites are 001, 023, 043, 045 and 052 (Table 3.2).

Hornsby Heights WTP discharges approximately 6.7 mega litres of tertiary treated effluent per day (Sydney Water 2015) to Calna Creek in Walls Gully. Calna Creek enters Berowra Creek in the tidal reach about 1 kilometre downstream of Crosslands Reserve. The treatment plant discharge point into Calna Creek is about four kilometres upstream of its confluence with Berowra Creek.

West Hornsby WTP discharges approximately 11.9 mega litres per day (Sydney Water 2015) of tertiary treated effluent to Waitara Creek. The discharge point is about 700 metres upstream of the confluence of Waitara Creek with Berowra Creek, and approximately 12 kilometres upstream of the tidal reach of the Berowra Creek estuary at Crosslands Reserve.

Brooklyn WTP discharges approximately 0.4 mega litres per day (Sydney Water 2015) of tertiary treated effluent to the Hawkesbury River beneath the Peats Ferry road bridge. This WTP was commissioned in 2007 to service Brooklyn, Mooney Mooney, Dangar Island and Cheero Point residences. This newer system is a closed system and as such, does not incorporate the use of overflow points or partial treatment bypasses to deal with an increase in loads, thus minimising the impacts on local creeks.

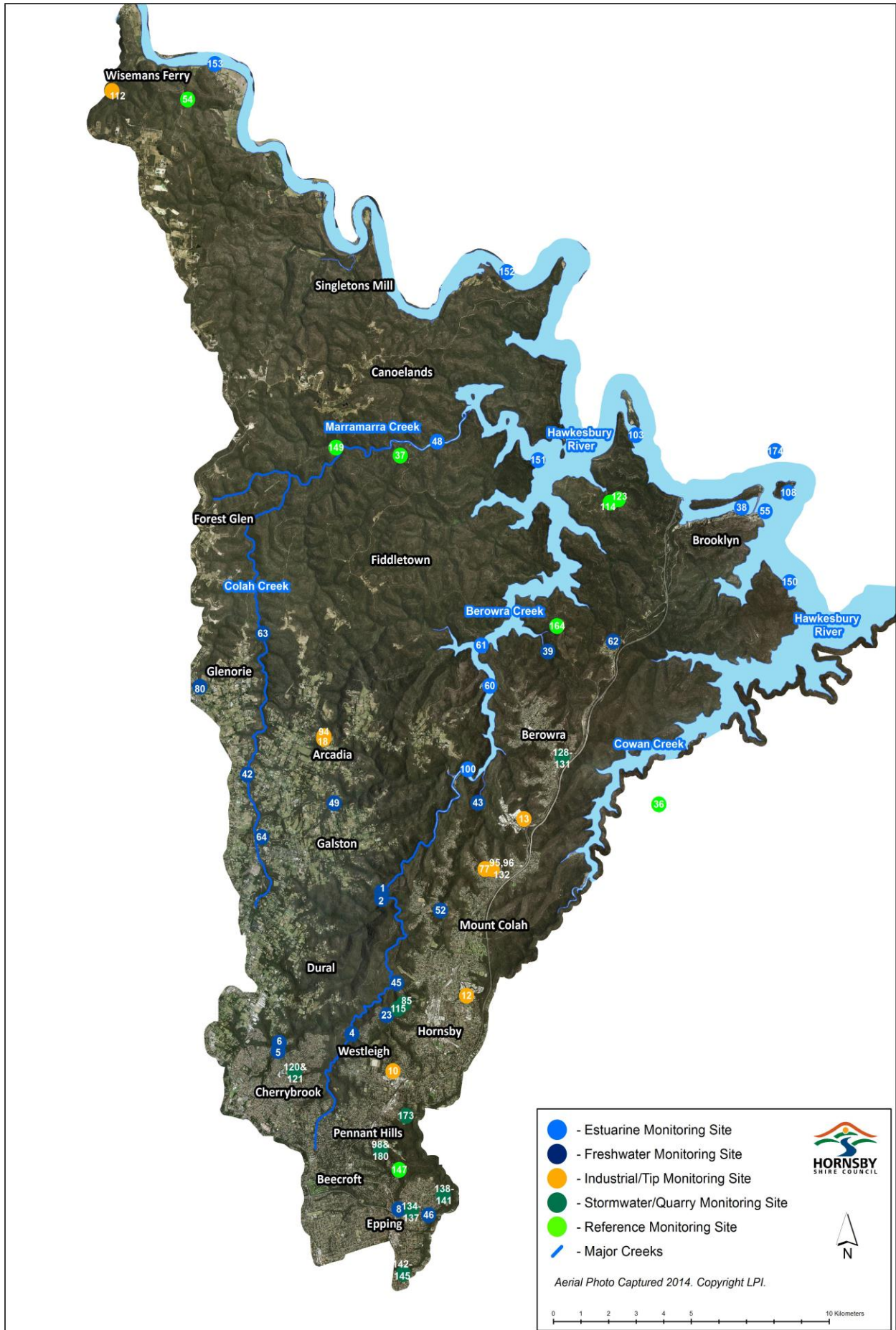


Figure 3.2 Active water quality monitoring sites for 2014-15

Site	Classification/Landuse	Creek	Location
001	Wastewater Treatment Plant	Berowra Creek	Downstream West Hornsby WTP
002	Rural	Tunks Creek	Galston Gorge
004	Urban	Berowra Creek	Benowie Walking Trail Westleigh
005	Urban	Pyes Creek	Kristine Pl Cherrybrook
006	Urban	Georges Creek	Fallon Rd Cherrybrook
008	Urban	Devlins Creek	Sutherland Rd Cheltenham
010	Industrial	Larool Creek	Larool Cres Thornleigh
012	Industrial	Hornsby Creek	Leighton Place Hornsby
013	Industrial	Sams Creek	Hamley Rd Mt Kuring-gai
023	Wastewater Treatment Plant	Waitara Creek	Upstream West Hornsby WTP
036	Reference	Murray Anderson Creek	Ku-ring-gai Chase National Park
037	Reference	Smugglers Creek	Marramarra National Park
038	Estuarine	Sandbrook Inlet	Brooklyn, Hawkesbury River
039	Urban	Joe Crafts Creek	Tributary of Berowra Creek
042	Rural	Colah Creek	Wylds Rd Glenorie
043	Wastewater Treatment Plant	Calna Creek	Downstream Hornsby Heights WTP
045	Wastewater Treatment Plant	Berowra Creek	Downstream West Hornsby WTP
046	Urban	Unnamed, tributary of Terrys Creek	Somerset St North Epping
048	Estuarine	Marramarra Creek	Marramarra National Park
049	Rural	Still Creek	Mansfield Rd Arcadia
052	Wastewater Treatment Plant	Calna Creek	Upstream Hornsby Heights WTP
054	Reference	Laughtondale Creek	Laughtondale Gully Rd Marramarra National Park
055	Estuarine	Hawkesbury River	Brooklyn Baths
060	Estuarine	Berowra Creek	Berowra Ferry Crossing
061	Estuarine	Berowra Creek	Calabash Point
062	Rural	Unnamed, tributary of Kimmeriking Creek	Alberta Ave Cowan
063	Rural	Colah Creek	Ben Bullen Firetrail Glenorie
064	Rural	Unnamed, tributary of Colah Creek	Sallaway Rd Galston
080	Rural	Glenorie Creek	Tekapo Ave Glenorie
100	Estuarine	Berowra Creek	Crosslands Reserve Hornsby Heights
103	Estuarine	Hawkesbury River	Milsons Passage
108	Estuarine	Hawkesbury River	Bradleys Beach, Dangar Island
114	Reference	Muogamarra Creek	Muogamarra Nature Reserve
123	Reference	Unnamed Creek in Peats Crater	Muogamarra Nature Reserve
147	Reference	Unnamed Creek, tributary Byles Creek	Day Rd Cheltenham
149	Reference	Unnamed Creek, Marramarra National Park	Duckpond Ridge Firetrail Marramarra National Park
150	Estuarine	Hawkesbury River	Gunyah Point
151	Estuarine	Hawkesbury River	Mouth Marramarra Ck
152	Estuarine	Hawkesbury River	Courangra point
153	Estuarine	Hawkesbury River	Laughtondale
164	Reference	Djarra Crossing	Muogamarra Nature Reserve
174	Estuarine	Mullet Creek	Mouth of Mullet Creek

Table 3.1 Freshwater and estuarine sites monitored for aquatic ecosystem health during 2014-15

3.2 Catchment Remediation Initiatives

3.2.1 Stormwater Harvesting and Reuse

In recent years, the need to conserve water and to reduce the impacts of urban stormwater on streams has led to an increase in the harvesting of stormwater for reuse. Stormwater harvesting involves collecting stormwater runoff from parks, paved areas and drains in a selected catchment. The collected water is then treated onsite to a standard that is fit for purpose (e.g. irrigation) and reused locally.

A number of stormwater harvesting and reuse schemes have been constructed in Hornsby Shire through the CRR Program, with the majority of them providing irrigation for sports ovals. The catchment areas for harvesting are selected after a thorough investigation to ensure minimal risk to the downstream creeks or to public health (HSC 2011).

Council currently manages eight (8) stormwater harvesting and reuse facilities located at Berowra Oval, Foxglove Oval, Greenway Park, Epping Oval, North Epping Oval, Somerville Oval, Thornleigh Oval and Council's Community Nursery (Table 3.2). Further information on Council's water conservation initiatives can be found at www.hornsby.nsw.gov.au/water.

3.2.2 Stormwater Quality Improvement

Council manages over 430 stormwater quality improvement devices (SQIDs) across the Shire. In 2014 a vegetated cell was installed in Larool Creek to address the issue of poor water quality identified through long term monitoring of the creek (Figure 3.3). The original site (010) is now a representative upstream site and an additional site (175) was established downstream to assess the effectiveness of the device. It is expected that more time and resources will become available for the assessment devices following the water quality monitoring program review. Further information on stormwater quality improvement devices and the CRR program is available at www.hornsby.nsw.gov.au/crr and in the CRR Annual Reports.

3.2.3 Disused Landfill Remediation

Council manages three (3) disused landfill sites at Arcadia, Mount Colah (Foxglove Oval) and Wisemans Ferry. These sites are all decommissioned and have been remediated in various ways. Leachate from Arcadia landfill is captured, treated and discharged to a local creek (Sites 018, 094). Leachate from Wisemans Ferry is captured; there is no discharge from this site (site 112). Leachate from Foxglove Oval, Mount Colah is captured, treated and reused for irrigating the playing field (Sites 077, 095, 096, 132).

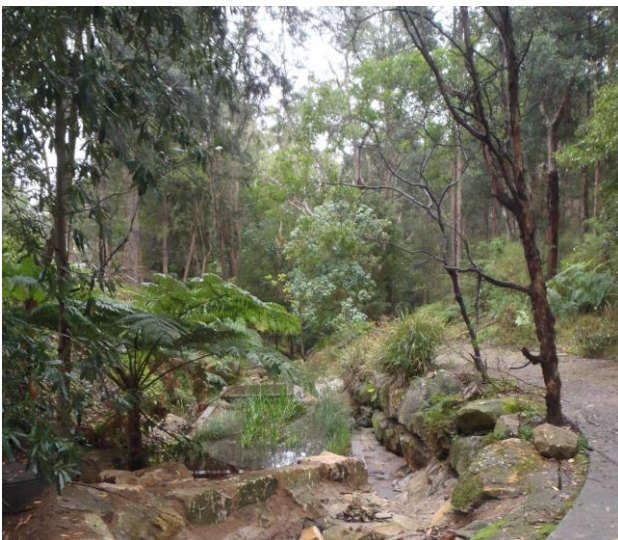


Figure 3.3 Vegetated stormwater quality treatment cell in Larool Creek and the upstream monitoring point

Site	Classification	Location	Description
010	Stormwater Quality Improvement	Larool Creek	Upstream device / Industrial
018	Landfill Remediation	Arcadia	Raw leachate
077	Landfill Remediation	Foxglove Oval	Downstream receiving water
094	Landfill Remediation	Arcadia	Treated leachate
095	Landfill Remediation	Foxglove Oval	Raw leachate
096/178	Landfill Remediation	Foxglove Oval	Partially treated leachate
098	Harvesting & reuse	Community Nursery	Treated Stormwater
112	Landfill Remediation	Wisemans Ferry	Raw leachate
120	Harvesting & reuse	Greenway Park	Raw stormwater
121	Harvesting & reuse	Greenway Park	Treated stormwater
128	Harvesting & reuse	Berowra Oval	Raw stormwater
131	Harvesting & reuse	Berowra Oval	Treated stormwater
132	Landfill Remediation	Foxglove Oval	Treated leachate
134	Harvesting & reuse	Epping Oval	Raw stormwater
137	Harvesting & reuse	Epping Oval	Treated stormwater
138	Harvesting & reuse	North Epping Oval	Raw stormwater
141	Harvesting & reuse	North Epping Oval	Treated stormwater
142	Harvesting & reuse	Somerville Oval	Raw stormwater
145	Harvesting & reuse	Somerville Oval	Treated stormwater
173	Harvesting and reuse	Dawson Ave, Thornleigh	Treated stormwater
175	Stormwater Quality Improvement	Larool Creek	Downstream device
180	Harvesting & reuse	Community Nursery	Raw Stormwater

Table 3.2 Sites monitored to determine the effectiveness of catchment remediation initiatives during 2014-15.

4. Sampling and Testing Procedures

4.1 Routine Monitoring

The water quality monitoring program involves systematic sampling to a predetermined, usually monthly, schedule over the year. Sampling is carried out during daylight hours (8am to 3pm) on weekdays, through all seasons and in both wet and dry periods. Industrial sites, which have historically been the most impacted, are monitored fortnightly. Optimal sampling frequencies of all sites will be assessed as part of the water quality monitoring program review.

4.1.1 Field Measurements

Physical water quality parameters are measured in-situ using a multi-sensor water quality probe (Yeokal™ 615 Sonde) include:

- Dissolved Oxygen (DO% sat and DO mg/L)
- Electrical Conductivity (EC ms/cm and EC μ s/cm)
- pH
- Salinity (ppt)
- Temperature ($^{\circ}$ C)
- Turbidity (NTU)

At each water testing site observations are recorded on weather conditions, rainfall, tide status, the occurrence of nuisance organisms, oily films, frothing and odours, stream flow, water clarity, water colour and any other notable site details. These observations and portable probe measurements are recorded in the field on a mobile device and downloaded each afternoon into Council's database.

4.1.2 Laboratory Analysis

Freshwater water samples are collected and sent for laboratory analysis of:

- Bacteria (Faecal coliforms (CFU/100mL) and Enterococci (CFU/100mL))

- Nutrients (total nitrogen, oxidised nitrogen, ammonium nitrogen and total phosphorus)
- Suspended Solids (mg/L)

In addition, all freshwater sites are sampled and analysed quarterly for:

- Alkalinity (Bicarbonate mg CaCO_3 /L)
- Major Cations and Anions
- Trace Metals

Some sites such as stormwater harvesting devices and sites receiving runoff from industrialised catchments may also be analysed for additional parameters including:

- Biochemical Oxygen Demand (CBOD₅)
- Sodium Absorption Ratio (SAR)
- Fluoride (mg/L)

Estuarine water samples are collected and sent for laboratory analysis of

- Chlorophyll-a (μ g/L)
- Bacteria (Faecal coliforms (CFU/100mL) and Enterococci (CFU/100mL))
- Nutrients (total nitrogen, oxidised nitrogen, ammonium nitrogen, total phosphorus and soluble reactive phosphorus SRP (mg/L))
- Suspended Solids (mg/L)

Appropriate sample bottles are prepared and provided by the contract laboratories (Table 4.1). At freshwater sites the sampling depth is 5 -10cm below the water surface, and at saltwater sites approximately 50cm below the surface. Immediately after collection all the water bottles are placed in an esky with ice bricks.

During the 2014-15 period chemical and microbial analyses were carried out by Sydney Water Monitoring Services in accordance with the parameters, detection limits and testing methods described in Table 4.2.

Analyte	Bottle	Preservative
Microbial (Faecal coliforms & Enterococci)	250ml PET	Thiosulphate
Suspended Solids	1L HDPE	No preservative
Chlorophyll-a	1.25L PET	No preservative
Trace metals,	250ml HDPE	No preservative
Nutrients (Tp, TN, NH ₃ -N, NO _x -N)	200ml PET	No preservative
Major cations & anions	200ml PET	No preservative
Bicarbonate/alkalinity	500ml PET	No preservative

Table 4.1 Bottle and preservative requirements for sampling parameters

Analyte	Detection Limit	Method Reference (APHA 2005)
General		
Suspended solids	<2mg/L	APHA 2540-D
BOD5	<2mg/L	APHA 5210-B
Bicarbonate/Alkalinity	<5mg CaCO ₃ /L	APHA 2320-B
Nutrients		
Oxidised Nitrogen NO _x -N	<0.01mg/L	APHA 4500-NO3 I FIA
Ammonia Nitrogen NH ₃ -N	<0.01mg/L	APHA 4500-NH3 H FIA
Total Nitrogen	<0.05mg/L	APHA 4500-P J FIA
Total Phosphorus	<0.002mg/L	APHA 4500-P J / NO3 FIA
Soluble Reactive Phosphorus	<0.002mg/L	PHA 4500-P
Micro-biological		
Faecal coliforms	<1 CFU/100ml	AS 4276-7
Enterococci	<1 CFU/100ml	AS 4276.9 (2007)
Chlorophyll –a	<1 µg/L	APHA 10200-H
Metals (freshwater only)		
Trace metals	various	various methods
Cations	various	various methods
Anions	various	various methods
Organic		
PAH	<0.5 µg/L	APHA 6440-B
Oil and grease	<3 mg/L	APHA 5520 various

Table 4.2 Laboratory parameters, reporting limits and test methods

4.1.3 Phytoplankton Identification

Identification of phytoplankton (>5µm) from estuarine sites involves sampling from surface waters using a 1m long plastic bailer tube and transferring the sample to a 500mL PET bottle containing Lugols preserving solution. In addition, a concentrated algal sample is collected using a 30 micron mesh net. The net is towed behind the boat for approximately 5

minutes at slow speed. The contents of the net are washed into a 200mL PET bottle containing Lugols solution (Figure 4.1). These samples are stored in a cool dark location then sealed in a plastic bag, wrapped in bubble wrap and sent by overnight express post to Microalgal Services laboratory in Victoria for algal identification and enumeration.



Figure 4.1 Collecting and preserving an integrated (profiling tube) and a concentrated (net tow) sample for phytoplankton analysis

4.2 Quality Assurance / Quality Control

4.2.1 Probe Calibration

To ensure accurate in-situ measurements, the Yeokal™ probe sensors are calibrated the morning of each sampling run using commercially available standard solutions and check tests (Table 4.3). Calibration is checked again in the afternoon following each sampling run. Correction factors are applied to probe data if sensor calibration drifted by more than accepted daily variation (Table 4.3).

At each sample site the date, time, site details, visual observations and probe readings are typed into a mobile device, and later downloaded into Council's database. In the field, the probe readings are stored in the probe memory, downloaded in the afternoon and stored as 'back-up' data.

4.2.2 Sample Handling

The contract laboratory supplies new bottles for sampling prepared with preservatives where required. The date and unique sample identification number is printed on adhesive labels prior to sampling. After the water samples are taken the sample bottles are immediately placed in eskies with ice and freezer blocks. After returning from the field the bottles are repacked on ice, a 'Chain of Custody' form is completed and attached to the esky. The samples are then couriered to the laboratory by 5pm the same day.

4.2.3 Duplicate and Field Blank Samples

A duplicate field sample is taken at one site each month. This effectively provides two samples of the same water which are labelled differently. The results from the laboratory analysis provide an indication of combined variability of water quality at a site and variability of the laboratory testing procedures.

Further, a field blank is prepared each month and sent to the laboratory for analysis. Field blanks are sample bottles filled with high purity deionised water before the sampling run, labelled, packaged and then sent to the laboratory with the other water samples for analysis of all parameters. The results indicate potential contamination from either the sample bottles or transportation and handling. Field blanks can also provide a check of a laboratories handling, analysis and detection limits.

4.2.4 Laboratory Procedures

The contract laboratory has a comprehensive quality control program which is a requirement to retain national accreditation (NATA certification). With each daily batch of samples for each test parameter the laboratory includes extra Quality Assurance / Quality Control (QA/QC) samples including replicate tests, lab blanks, spiked samples and lab check samples, which must all pass in-house QC standards before results are released. Final reports provided to Council include QA/QC test results.

Probe Tests	Low Value Calibration	High Value Calibration	Check Solution, Test immediately after calibration	Daily Calibration check before and after each days sampling	Accepted Daily Variation (low/high)
Temperature	Quarterly in range 3 to 7°C	Quarterly in range 40 to 45°C		One point check against standardised thermometer in water bath	0.2 / 0.2°C
EC	Daily 0µS/cm (DI water)	Daily 1413µS/cm (commercial)	Sydney Tap water (approx 200µS/cm)	Low and high point calibration check	1 / 15µS/cm
Salinity	Daily 0ppt (DI water)	Daily 35ppt (commercial)		Low and high point calibration check	0.01 / 0.5ppt
DO	Monthly 0% sat(zero DO sensor insert)	Daily 100% sat (air bubbled in tank of tap water)		Low and high point calibration check	0.5 / 5%
pH	Daily pH7 (commercial)	Daily pH10 (commercial)	Daily pH4 and pH7 dilute x10 (commercial)	Low and high point calibration check	0.1 / 0.1 pH units. Correct pH for temperature variation

Table 4.3 Probe calibration QA/QC procedures

5. Water Quality Guidelines

A water quality guideline is a numerical concentration limit or narrative statement recommended to support and maintain a designated water use. Guidelines are used as a general tool for assessing water quality and are the key to determining water quality objectives that protect and support the designated environmental values of our water resources, and against which performance can be measured.

Guidelines are derived with the intention of providing some confidence that there will be no significant impact on the environmental values if they are achieved. Exceedance of the guidelines indicates that there is potential for an impact to occur, but does not provide any certainty that an impact will/has occurred.

(ANZECC 2000)

5.1 Aquatic Ecosystem Protection

5.1.1 Australian Water Quality Guidelines

Previously, Council's water quality monitoring program employed National Guidelines (ANZECC 2000) for aquatic ecosystem protection for data analysis and reporting. In particular, Council used the default trigger values for aquatic ecosystem protection in south-east Australian lowland east flowing rivers and south-east Australian estuaries.

However, the Guidelines (ANZECC 2000) suggest that where possible, more appropriate guideline trigger values for selected indicators should be developed based on long term local or regional monitoring of reference sites. Reference sites represent the highest quality of water health against which the water quality at sites in less pristine locations can be compared.

Local long term reference sites have been used to develop Regional Environmental Health Values (REHVs Sect 5.1.2) for Hornsby Shire and these are now used for data analysis and reporting on aquatic ecosystem health.

In addition, faecal coliform and enterococci trigger values were derived from the national Guidelines for Managing Risk in Recreational Waters (NHMRC 2008). Trigger values for suspended solids and turbidity are not precisely defined in the Guidelines (ANZECC 2000) so the 'NSW State Authority' recommendations, listed in the guidelines, have been used.

5.1.2 Regional Environmental Health Values

Freshwater

As recommended in the Guidelines (ANZECC 2000) local trigger values, known as Regional Environmental Health Values (REHVs), have been developed for Hornsby Shire in preference to using the 'default' national values (Table 5.1).

Measurements of physical, chemical and biological indicators at suitable reference sites provide benchmarks for assessing biological diversity in waterways in the local regions. REHVs for freshwater sites were derived from water quality data collected at two local reference sites (036, 037) between 2002 and 2010. Procedures used to develop these REHVs are detailed in the Companion Technical Report (HSC 2012).

Estuarine Water

Due to the nature of development in Hornsby Shire the water quality monitoring program does not include an estuarine reference site. All estuarine areas in or near Hornsby Shire (Hawkesbury River, Berowra and Cowan Creeks) are in some way impacted by developed areas. Therefore, it was not possible to collect long term estuarine reference data. In the absence of available data for local estuarine reference sites the default values from ANZECC (2000) and NHMRC (2008) Guidelines have been used (Table 5.2).

REHVs FRESHWATER	Turbidity	Suspended Solids	Total Phosphorus	Total Nitrogen	Oxidised Nitrogen	Ammonium Nitrogen	pH	Electrical Conductivity	Dissolved Oxygen	Faecal Coliforms
Units	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	unit	mS/cm	%sat	CFU/100mL
Trigger Values	8	7	0.01	0.32	0.05	0.02	4.8 to 7	0.32	75 to 118	Median <150 and 80 th % <600

Table 5.1 REHVs for physical-chemical stressors and faecal bacteria for freshwater sites (derived from long term local reference data, ANZECC (2000) & NHMRC (2008))

REHVs ESTUARINE WATER	Turbidity	Suspended Solids	Total Phosphorus	Total Nitrogen	Oxidised Nitrogen	Ammonium Nitrogen	pH	Dissolved Oxygen	Faecal Coliforms	Enterococci	Chlorophyll-a
Units	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	unit	%sat	CFU/100mL	CFU/100mL	µg/L
Trigger Values	10	6	0.03	0.3	0.015	0.015	7 – 8.5	80 - 110	Median <150 and 80 th % <600	95 th % <40 (200,500)	4

Table 5.2 Trigger values for physical-chemical, faecal bacteria and aquatic biota indicators for estuarine sites (derived from ANZECC (2000) & NHMRC (2008))

5.2 Stormwater Harvesting and Reuse

A series of National Guideline documents on water reuse have been published under the National Water Quality Management Strategy. One of these guidelines, Stormwater Harvesting and Reuse (NRMMC et al 2009), describes processes to manage the risks of stormwater capture and reuse in terms of minimising health, environmental and operational risk.

To ensure stormwater harvested by Council is fit for purpose (i.e. irrigation of sports ovals and the community nursery) a set of trigger values have been derived based on the Stormwater Harvesting and Reuse Guideline (NRMMC et al 2009) together with the ANZECC Guideline (2000) for Irrigation Waters (Table 5.3).

Risk	Parameter	Trigger	Notes
Catchment Issues	Fluoride	0.1mg/L	Presence of fluoride may point to leaking fluoridated town water (e.g. fluoride level of 0.3mg/L implies approximately 30% town water).
Soil Structure	Salinity/Conductivity	2000 μ S/cm (for very sensitive plants)	Irrigation of sensitive plants. Salt tolerance depends on sand/clay content of soils, and on plant species being grown.
	Sodicity	Na 114mg/L	
	Sodium Absorption Ratio (SAR)	SAR 2 (at EC=200 μ S/cm) SAR 7 (at EC=2000 μ S/cm)	Acceptable SAR depends on value of conductivity. Waters with high SAR might induce degradation of soil structure by clay aggregate breakdown. Potential problems may overcome by corrective management (e.g. application of lime or gypsum)
	Chloride	Cl 175mg/L	
Infrastructure and equipment	Turbidity	10 NTU	Effectiveness of UV treatment decreases as turbidity increases
	Total suspended solids	20 year life 50	Potential blockages of irrigation pipes and jets
	Hardness (mg CaCO ₃ /L)	100 year life 20	
	Total Iron (mg/L)	350	
	Total Phosphorus (mg/L)	10	
	0.8	0.2	
		0.05	
Public Health	Bacterial (median values)	Faecal coliforms 10 CFU/100mL E.Coli 10 CFU/100mL	Test initially fortnightly, then reduce to monthly if median <10. But increase back to fortnightly after any result >100.

Table 5.3 Trigger values for stormwater harvesting, treatment and reuse for open space irrigation.

5.3 Estuarine Phytoplankton / Microalgal Bloom Hazards

Phytoplankton are small (often microscopic) aquatic plants that are free floating and able to reproduce rapidly in favourable conditions (ANZECC 2000). Blooms often occur when essential nutrients (nitrate, phosphate, and silicate) are available in response to natural processes (oceanic upwelling or runoff) or human activities (fertiliser use or effluent discharge). Some blooms are beneficial to an ecosystem while others can be harmful, so it is important to know what species make up the bloom and what conditions caused it (Suthers & Rissik 2009).

Phytoplankton blooms have different effects depending on the species present. Blooms can cause harmless water discolouration, be non-toxic but harmful to marine organisms or they may contain toxins that are harmful to fish, marine mammal and humans (Suthers & Rissik 2009). Some species of marine phytoplankton produce natural toxins which, when filtered by shellfish are concentrated to levels which may be harmful to humans if consumed (NSW Food Authority, 2014).

The NSW Food Authority sets out recommended Phytoplankton Action Levels (PALs) based on the concentrations of specific algal species that affect shellfish aquaculture (Appendix D). Whenever monitoring indicates these species are present and trigger values are exceeded, the Regional Algal Coordinating Committee (RACC) is notified. This may result in the closure of the estuary to fishing (by the Department of Primary Industries – Fishing and Aquaculture), or closure of shellfish harvesting (by the NSW Food Authority) and/or the placement of public warning notices by Council.

Council has developed preliminary guidelines for monitoring algal blooms based on Table 5.4 from Coad et al (2012). Recommended management actions are based on mean daily chlorophyll-a concentrations. The findings are compared with the PALs of the NSW Food Authority (2014) and the appropriate actions taken.

Threshold	CHLa Daily Mean Concentration (ug/L)	Example Bloom Management Response	Ecosystem Protection Risk	Management Mode			Management Mode Key	
				Summer	Autumn/ Spring	Winter		
Extreme	64+	Estuary closure recommended	High >8ug/L					Alert mode Bloom= Seasonal Mean exceeded ≥ 3 consecutive days Perturbation= Seasonal Mean exceeded < 3 consecutive days
Very High	32 to 64	Secondary contact cautioned						
High	16 to 32	Primary contact cautioned						
Medium	8 to 16	Community alert						
Moderate	4 to 8	Agency alert	Moderate >4ug/L and < 8ug/L (HRC, 1998)	8ug/L 	6ug/L 		Action mode Increasing CHLa < Seasonal mean	
Low	0 to 4	Estuary open	Low <4ug/L (ANZECC, 2000)			4ug/L 	Surveillance Mode Decreasing or stable CHLa < Seasonal mean	

Table 5.4 Management response to real-time chlorophyll-a monitoring probes from Coad et al (2012)

6. Presentation of Monitoring Data

6.1 Box and Whisker Plots

Water quality data is presented using 'box and whisker' plots to compare water quality at test sites with the local reference sites. Figure 6.1 shows how to interpret the graphs used in this report. The graph presents the median, maximum, minimum, 20th percentile and 80th percentile data for each parameter at a site. This gives a visual presentation of the magnitude, scatter and most usual range of a water quality parameter.

A red dotted line on a plot represents the associated REHV for either fresh or estuarine water. A single dotted line indicates a maximum trigger value (e.g. turbidity or total phosphorus), below which compliant

values will occur. Results exceeding the REHV indicate the potential for an impact to occur, which may trigger further investigation.

Two red dotted lines indicate an upper and lower limit to the REHV (e.g. pH or dissolved oxygen). Data that comply with the REHV will fall between these lines. Values outside (either above or below) the REHV range indicate the potential for an impact to occur, which may trigger further investigation.

A number of statistical terms are used within the results section of this report to provide water quality summaries and trends (Table 6.1).

Term	Meaning
Parameter	A water quality variable or component which is subjected to analysis (e.g. temperature, phosphorus etc.).
Valid N	The number of water samples taken or tests conducted at the site during the reporting period for each parameter.
Mean	The numerical average of the values for the parameter for the samples taken or tested during the reporting period. The 'mean' value can be biased by extreme values.
Median	The 'middle' value of the parameter at a site for all the samples taken or tested during the reporting period. When all the values are sorted into increasing magnitude from lowest to highest (rank order), the median is the middle number if there are uneven number of values, or it is the average of the two central numbers when there is an even number of values.
Minimum	The lowest value of the parameter at a site for all the samples taken or tested during the reporting period.
Maximum	The highest value of the parameter at the site for all samples taken or tested during the reporting period.
Range	The numerical difference between the minimum and maximum value for the parameter is the range of values for that parameter during the reporting period
20 th Percentile	The statistically calculated value of the parameter above which 80% of all test results occur. Values below the 20 th percentile might be considered significantly lower than the average.
80 th Percentile	The statistically calculated value of the parameter below which 80% of all test results occur. Values above the 80 th percentile might be considered significantly higher than the average.
Standard Deviation	The statistical standard deviation of the values for a parameter for the samples taken or tested during the reporting period. If the standard deviation is high relative to the mean (e.g. turbidity, faecal coliforms) it means the parameter is variable throughout the year. If the standard deviation is low relative to the mean (e.g. pH) it means there is low variability of parameter results over the year.

Table 6.1 Terminology for water quality data presentation

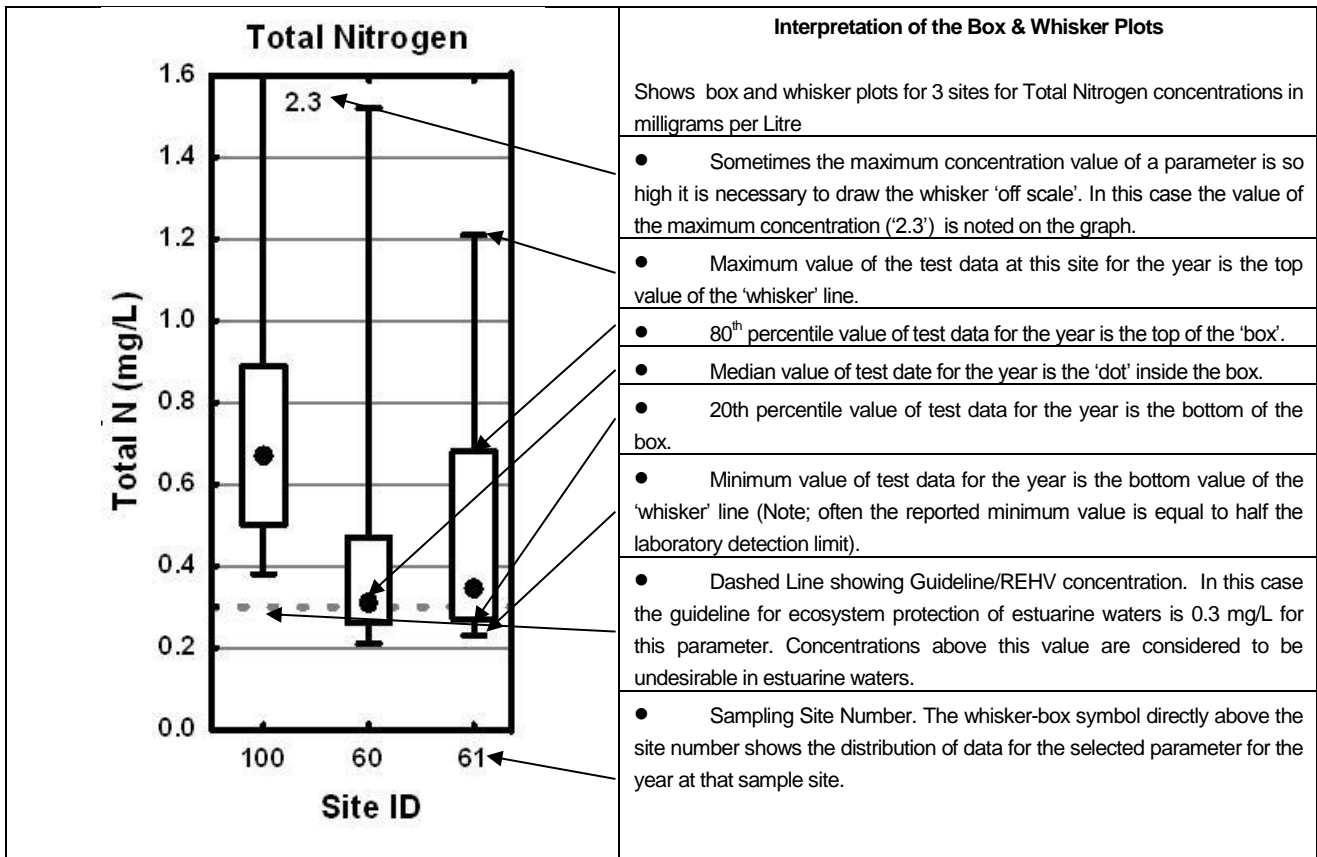


Figure 6.1 Interpretation of water quality data using box and whisker plots

6.2 Waterway Health Grading

In 2012 Council developed a waterway health grading system to report on the health of creeks and estuaries in the Shire. This involves determining an indicator health grade, site health grade and subsequent summary health grade for each water quality monitoring site. Development of the water health grading system is detailed in the *Companion Technical Report* (HSC 2012).

To determine a summary health grade three categories of indicators are used;

- physical-chemical stressors
- microbial indicators
- aquatic biota indicators.

For freshwater sites this report presents indicator and sites health grades for physical-chemical stressors and microbial indicators only, aquatic biota data was not collected during this reporting period.

For estuarine sites this report presents indicator and site health grades for all categories and an overall Waterway Health Grade for each site.

6.2.1 Indicator Health Grade

Phys-Chem Indicators

Indicator health grades for phys-chem parameters are determined by using box and whisker plots to compare water quality data for each parameter against REHVs for fresh or estuarine water (Figure 6.2). Indicator Health Grades are displayed along the top of each box plot.

In the case of pH and dissolved oxygen, which have upper and lower REHVs, it is more precise to determine the percentage of data that is within the REHV limits by preparing histograms that calculate the percentage of results that fall within the associated limits (Figure 6.3).

Microbial Indicators

Indicator health grades for microbial parameters are determined using box and whisker plots with REHVs based on the median and 80th percentile. Results of the box plot are compared against the health grade categories (Figure 6.4) and an indicator health grade

assigned. In estuarine sites there is also an REHV for enterococci using the 95th percentile. It should be noted that it is statistically preferred to have more than 20 data points for this analysis, annual results have only 12 (N=12). Use of this REHV is more suitable for long term data analysis when data from multiple years can be combined, thus enterococci results will not be reported in this annual report.

Aquatic Biota Indicators

Indicator health grades for aquatic biota in freshwater are based on macroinvertebrate sampling and analysis which has not been undertaken in this reporting period. Indicator health grades for aquatic biota in estuarine water is based on chlorophyll-a results and determined using box and whisker plots, as per the phys-chem indicator health grades (Figure 6.1).

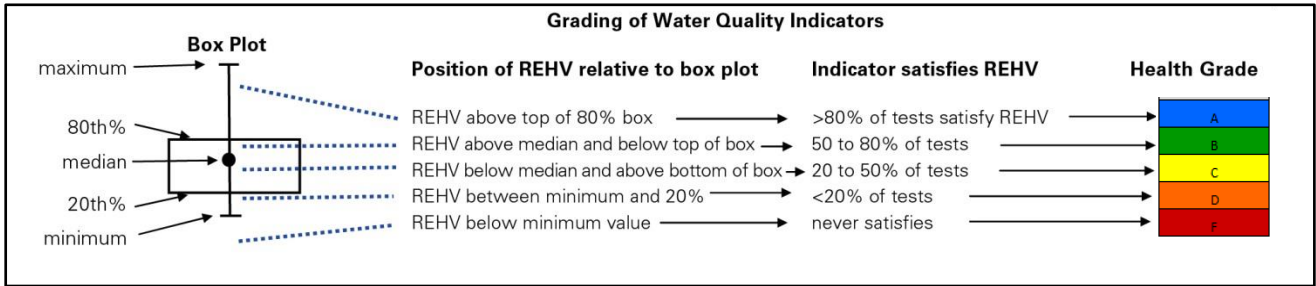


Figure 6.2 Method for indicator health grading for physical-chemical stressors using percentiles and REHVs on a box and whisker plot

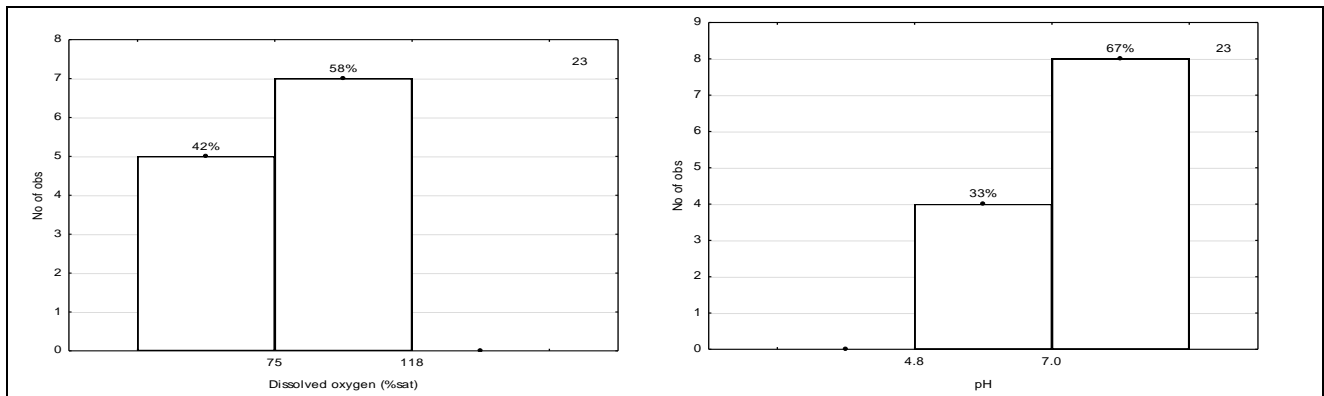
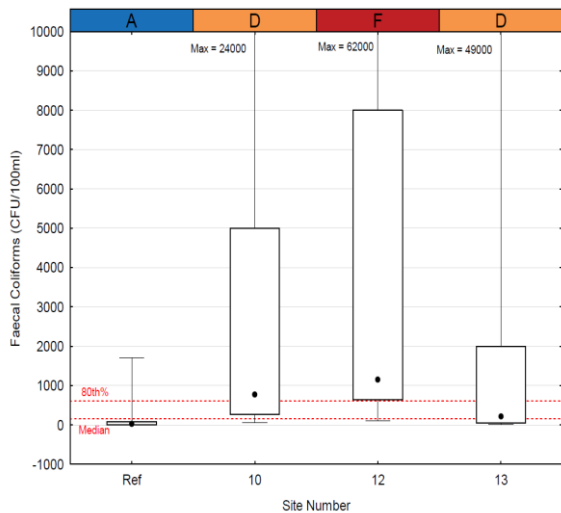


Figure 6.3 Method for indicator health grading for physical-chemical stressors using percentiles and REHVs on a histogram



Median	80 th Percentile	Faecal Coliform Health Grade
≤ 150	≤ 150	A+
≤ 150	≤ 600	A
≤ 150	>600 and ≤ 1000	B
>150	≤ 600	B
≤ 150	>1000	C
>150 and ≤ 600	>600 and ≤ 1000	C
>150 and ≤ 600	>1000	D
>600	≤ 1000	D
>600 and ≤ 1000	>1000	F
>1000	-	F

Figure 6.4 Method for indicator health grading for microbial stressors using percentiles and REHVs on a box and whisker plot

6.2.2 Site Health Grade

Phys-Chem Indicators

A site health grade for physical and chemical parameters is a combined ranking of the indicator health grades at each water quality site. It is calculated using the averaging process as follows (Figure 6.5):

- Step 1. Each individual indicator grade is given an indicator score
- Step 2. Scores for all physical-chemical parameters are then averaged
- Step 3. The average score is compared to average score categories
- Step 4. Assign corresponding site grade

The site health grades for physical-chemical stressors are A to F (Table 6.2): Grade A is the top score, which indicates clean water and a healthy ecosystem; Grades B, C and D indicate increasingly degraded

water bodies; Grade F represents a ‘Fail’ implying that water quality is always poor and the ecosystem is severely impaired.

Microbial Indicators

Site Health Grades for microbial indicators in freshwater sites are the same as the Indicator Health Grades as there is only parameter (i.e. faecal coliforms). Site Health Grades for microbial indicators in estuarine sites are determined using the averaging process in Figure 6.4 for faecal coliforms and enterococci

Aquatic biota Indicators

Site Health Grades for aquatic biota indicators in estuarine sites are the same as the Indicator Health Grades as there is only parameter (i.e. chlorophyll-a).

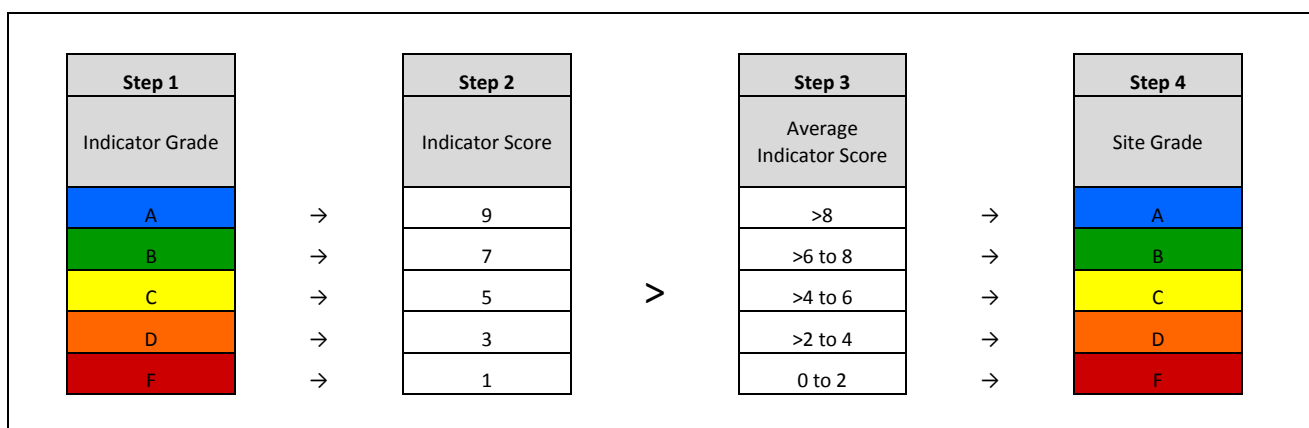


Figure 6.5 How indicator grades are scored and averaged to produce a site grade for physical-chemical stressors

Health Grade and Colour	Percentage of time physical-chemical stressors satisfy REHVs*	Health Description	Cleanliness categories	Probable impact on the natural aquatic biota
A	Over 80%	Excellent	Clean	Healthy
B	50% to 80%	Good	Slightly degraded	Mild impairment
C	20% to 50%	Poor	Moderately degraded	Moderate impairment
D	Below 20%	Very Poor	Severely degraded	Serious impairment
F	Never passes	Fail	Always Bad	Severe impairment

Table 6.2 Grading system used to categorise water quality for physical-chemical stressors

6.2.3 Summary Waterway Health Grade

The site health grade for physical and chemical stressors can be combined with a health grading for microbial and aquatic biota indicators for each individual monitoring site to determine a summary waterway health grade (Figure 6.6). It is proposed that this analysis is undertaken every 5 years to monitor the improvement, or otherwise, of water quality within Hornsby Shire. This will accommodate aquatic biota sampling regimes for freshwater sites and also provide a more statistically robust result for microbial indicators (i.e. N ≥ 20).

For the purpose of this report Summary Waterway Health Grades have been determined for estuarine sites. Freshwater sites have Site Health Grades only determined for phys-chem and microbial indicators.

Further information on Summary Waterway Health Grades and the determination process can be found in the *Water Quality Report Card and Companion Technical Report* (HSC 2012) respectively.

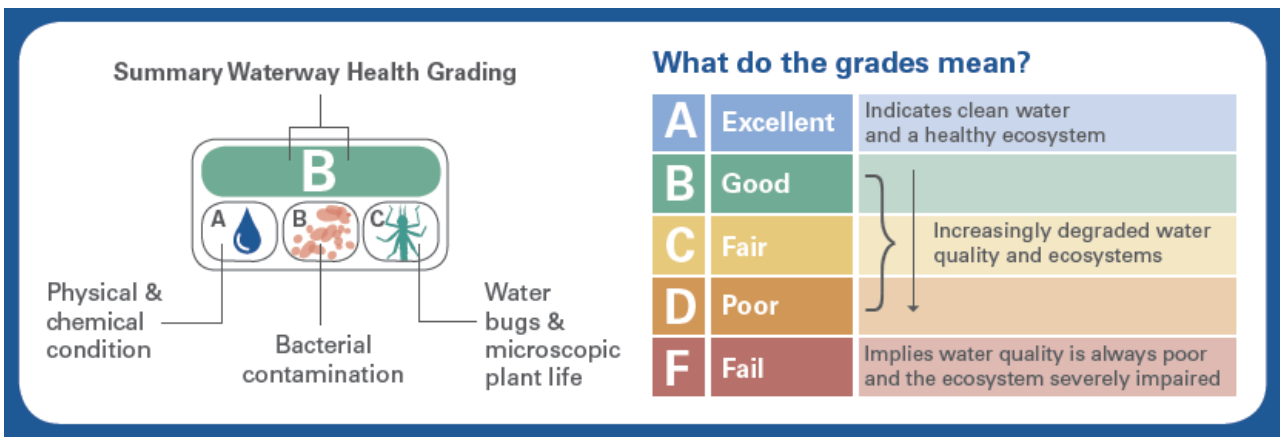


Figure 6.6 Physical-chemical, microbial and aquatic biota indicators used to determine a summary waterway health gradings

7. Water Quality Monitoring Results

7.1 Influence of Rainfall on Water Quality

Rainfall events have a major influence on water quality as rainfall runoff pathways are a key driver of contaminant mobilisation, transport and interception. At a local level, catchment development significantly increases the frequency and quantity of the smaller more frequent storm discharges as impervious areas (e.g. roofs, roads, pavements) transport stormwater directly to pipe and channel drainage systems. In urban catchments these more frequent events generate the most significant contaminant loads with 70-90% of contaminants exported by storm events of 1 year average recurrence interval (ARI) and smaller (Wong 2006).

Rainfall can influence water quality by increasing turbidity and suspended solids in stormwater, washing rubbish and contaminants into streams and creeks and increasing the likelihood of overflows from sewerage systems into waterways in developed areas. The magnitude of contamination at a sampling site is related to the quantity and the intensity of rainfall and to how recently a rainfall event occurred prior to sampling.

Council's water quality monitoring program involves systematic sampling to a set monthly schedule which over the year will include all seasons and usually, representative dry and wet periods. A 'wet weather' sampling event is defined as one in which a total of over 10mm of rain fell during the day prior to sampling (Figure 7.2). It is recognised that stream flow rates at some sites are more affected by small rain events (e.g. sites downstream of industrial and urban areas with a high percentage of imperviousness), while sites further downstream (e.g. estuarine sites or sites with heavily vegetated catchments) are less affected except after heavy rainfall or extended wet periods.

Figure 7.2 shows the daily rainfall and cumulative rainfall for the 2014-2015 year obtained from the Bureau of Meteorology (BoM), averaged over 13 gauging stations throughout Hornsby Shire (Appendix E). These values have been calculated using the best available data however at the time of writing, some 2015 data had not been quality assured by BoM. Information on Councils sampling schedule, from July 2014 to June 2015, is given along the bottom of the graph. During this reporting period there were a total of 84 sampling days (indicated by green dots) which included eight (8) 'wet weather' sampling days (indicated by red dots).

Also identified on Figure 7.2 are the rainfall events which caused 'bypass events' at either West Hornsby or Hornsby Heights WTPs resulting in the release of only partially treated sewage into creeks. Sydney Water is licensed for these events under the NSW EPA. Data on wet and dry weather partial treatment bypass events has been provided by Sydney Water.

The total annual rainfall in Hornsby Shire during 2014/15 was approximately 1400mm, which is significantly higher than 2013/14 (~680mm). There were more sampling days classified as 'wet weather' (8 in 14/15 compared to 4 in 13/14) and the rainfall pattern was also different. There was an increase in high rainfall events during this reporting period with a significant storm event in April 2015. A number of smaller events were spread throughout the 12 months with most rainfall occurring during August, December and January. It should be noted that sampling sites can be influenced by rainfall for an extended period following a rainfall event, thus sampling days not classified as a 'wet weather' event (10mm received in the previous 24 hours) may still be highly influenced by the last rainfall.



Figure 7.1 Comparison of dry weather and wet weather flows in Tunks Creek (Site 002)

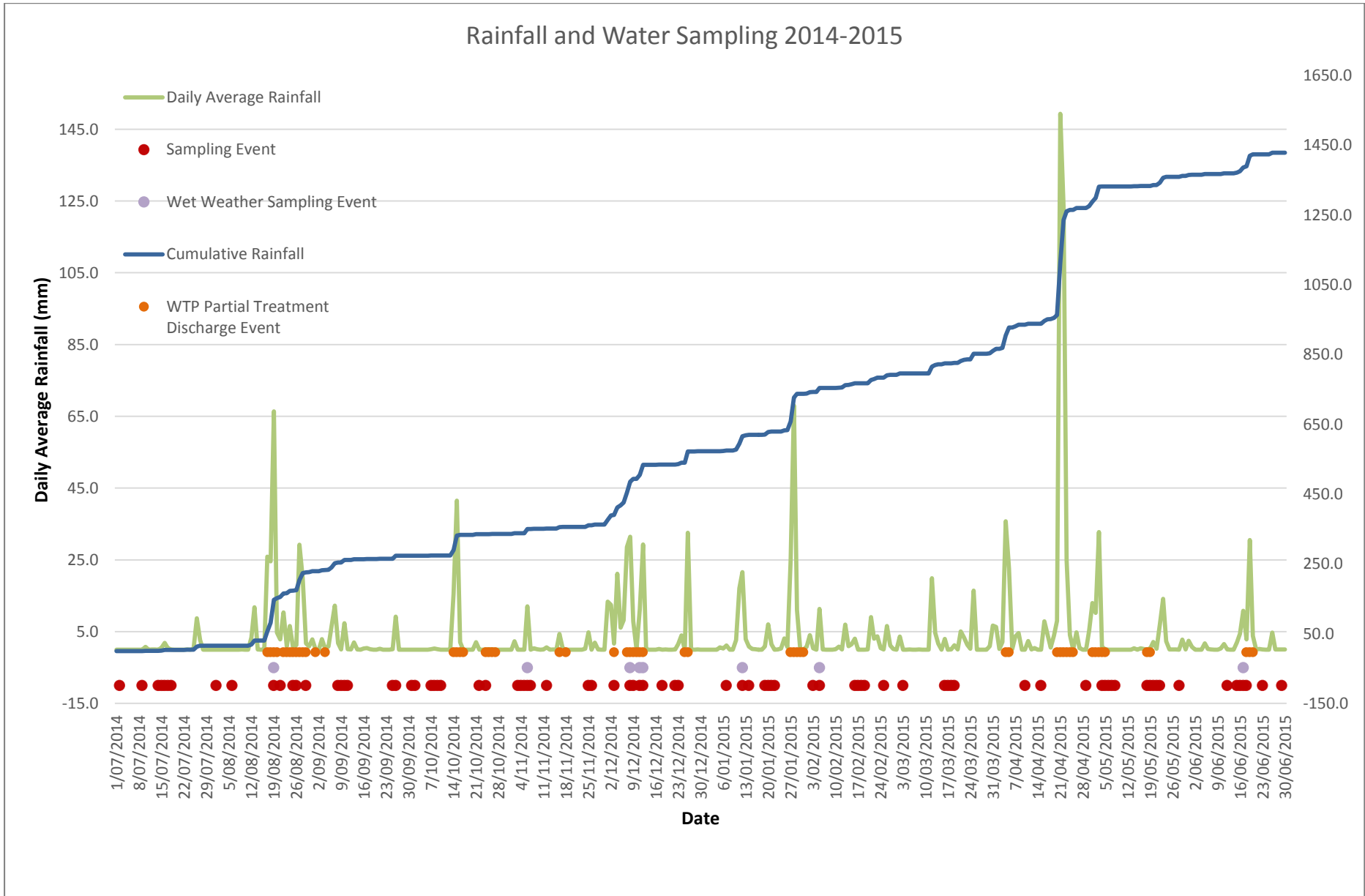


Figure 7.2 Water quality monitoring dates and wet weather monitoring events overlaid on daily rainfall

7.2 Aquatic Ecosystem Health

7.2.1 QA/QC Results

Blank Samples

Eleven (11) blank suites of samples (N=75) were prepared and sent for analysis during this reporting period. For selected parameters the results were below detection limits on 95% of occasions (Table 7.1). Results on or above detection limits may be due to contamination during the sampling and handling process or through laboratory practices.

Duplicate Samples

Nine (9) duplicate samples were collected and sent for analysis during this reporting period. Each duplicate comprised a suite of samples "A" and a duplicate suite of samples "B". For selected parameters the correlation coefficient shows no significant differences between the results for sample A and sample B for any parameter (Table 7.2).

Suspended Solids (mg/L)	Ammonium-Nitrogen (mg/L)	Oxidised-Nitrogen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Chlorophyll-a (ug/L)	Faecal Cols (CFU/100ml)	Enterococci (CFU/100ml)
<2	<0.01	<0.01	<0.05	<0.002	<0.2	<1	<1
<2	<0.01	<0.01	<0.05	<0.002	<0.2	<1	<1
<2	<0.01	<0.01	<0.05	<0.002	*	<1	*
<2	<0.01	<0.01	<0.05	<0.002	*	<1	*
<2	<0.01	<0.01	<0.05	<0.002	<0.2	<1	<1
<2	<0.01	<0.01	<0.05	<0.002	*	<1	*
<2	<0.01	<0.01	<0.05	0.002	*	<1	*
<2	<0.01	<0.01	<0.05	0.002	<0.2	<1	<1
<2	<0.01	<0.01	<0.05	<0.002	*	<1	<1
<2	<0.01	<0.01	<0.05	<0.002	<0.2	<1	<1
<2	<0.01	<0.01	<0.05	0.002	0.2	<1	<1
<2	<0.01	<0.01	<0.05	<0.002	*	<1	<1
*	Not sampled						
	Laboratory detection limit						
	Result not below detection limit						

Table 7.1 Laboratory results for selected parameters of blank samples (N=75)

P<0.05	Suspended Solids (mg/L)	Ammonium-Nitrogen (mg/L)	Oxidised Nitrogen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Faecal Coliforms (CFU/100ml)	Enterococci (CFU/100ml)
Correlation Coefficient	0.943739	0.999999	0.999996	0.999972	0.989785	0.962998	0.984189

Table 7.2 Correlation coefficients for selected parameters of duplicate samples (N=11, p<0.05)

7.2.2 Reference Sites

Eight sites were monitored for reference conditions during the 2014-15 period. Graphical comparisons of water quality parameters between reference sites and against REHVs are presented in Figure 7.3. Indicator Health Grades are presented along the top of the box plots with subsequent Site Health Grades for phys-chem and microbial indicators in Table 7.3. A comparison of the phys-chem and microbial Site Health Grades for the last three reporting years is also presented in Table 7.3. Summary statistics for these sites are presented in Appendix F.

Reference sites represent the highest water quality against which the water quality in other locations (less pristine sites) can be compared with. Data from reference sites show natural variation of water parameters in creeks with minimal human impact, thus providing 'control' or 'reference' data. These creeks reflect the water quality that may have existed before Hornsby Shire was developed. Only the two long term reference sites (036 and 037) are used for comparison against sites representative of other land use types in the following sections.

Receiving waters of primarily undisturbed catchments in Hornsby Shire are generally characterised by low pH, electrical conductivity, faecal coliforms, suspended solids and nutrients and high dissolved oxygen levels. The pH values at reference sites are more acidic (i.e. lower pH) than the pH range found in other sites. These pH levels are not unusual for unbuffered waters in wholly sandstone catchments. Creeks in many developed sandstone catchment areas are considerably higher (more alkaline) than the natural background, which may be attributed to the widespread use of alkaline concretes and detergents. This may have permanently changed the naturally acidic nature of most streams in urban areas in Sydney (HSC 2011).

Site 023 within Peats Crater, Muogamarra Nature Reserve, shows some major differences when compared with other reference sites. pH, turbidity, total phosphorus, total nitrogen and oxidised-nitrogen results are consistently higher relative to other reference sites, reflecting the known igneous geology influence of the catchment. It is unlikely that site 123 will continue to be monitored for reference conditions following the water quality monitoring program review.

Site dot-points below summarise which indicators exceeded the REHV trigger values on the majority of sampling occasions. This highlights the parameters of most concern and provides an indication of the

types of catchment activities that may be impacting the waterway.

Site 036 – Murray Anderson Creek

- Site Health Grade of A for phys-chem indicators.
- Site Health Grade of A+ for microbial indicators.
- All results complied with the REHVs 100% of the time.

Site 037 – Smugglers Creek

- Site Health Grade of A for phys-chem indicators.
- Site Health Grade of A+ for microbial indicators.
- All results complied with the REHVs >80% of the time.
- Results exceeding the REHVs <20% of the time turbidity, total phosphorus, total nitrogen and faecal coliforms.

Site 054 – Loughtondale Creek

- Site Health Grade of A for phys-chem indicators.
- Site Health Grade of A for microbial indicators.
- Results that complied with the REHVs 100% of the time oxidised-nitrogen.
- Results exceeding the REHVs <20% of the time suspended solids, dissolved oxygen and ammonium-nitrogen.
- Results exceeding the REHVs 20-50% of the time electrical conductivity, turbidity, total phosphorus, total nitrogen and faecal coliforms.
- Results exceeding the REHVs 50-80% of the time pH.

Site 114 – Muogamarra Creek

Note: this site was inaccessible due to inclement weather conditions on a number of occasions during this reporting period and in March 2015 the creek was dry. These results are based on only four (N=4) sampling events.

- Site Health Grade of A for phys-chem indicators.
- Site Health Grade of A+ for microbial indicators.
- Results complying with the REHVs 100% of the time electrical conductivity, turbidity, suspended solids, total phosphorus, total nitrogen, oxidised nitrogen and faecal coliforms.
- Results exceeding the REHVs 20-50% of the time dissolved oxygen, pH and ammonium-nitrogen.

Site 123 – Peats Crater Creek

Note: this site was inaccessible on a number of occasions due to inclement weather conditions during this reporting period. These results are based on only five (N=5) sampling events.

- Site Health Grade of B for phys-chem indicators.
- Site Health Grade of A for microbial indicators.
- Results complying with the REHVs 100% of the time turbidity and suspended solids.
- Results exceeding the REHVs <20% of the time ammonium-nitrogen.
- Results exceeding the REHVs 20-50% of the time total nitrogen and oxidised-nitrogen and faecal coliforms.
- Results exceeding the REHVs 50-80% of the time dissolved oxygen.

- Results exceeding the REHVs >80% of the time electrical conductivity and pH.
- Results exceeding the REHVs 100% of the time total phosphorus.

Site 147 – Unnamed Creek, Cheltenham

- Site Health Grade of A for phys-chem indicators.
- Site Health Grade of A for microbial indicators.
- Results complying with the REHVs 100% of the time suspended solids, dissolved oxygen, ammonium-nitrogen and oxidised-nitrogen.
- Results exceeding the REHVs <20% of the time electrical conductivity, turbidity, pH, total phosphorus, total nitrogen.
- Results exceeding the REHVs 20-50% of the time faecal coliforms.

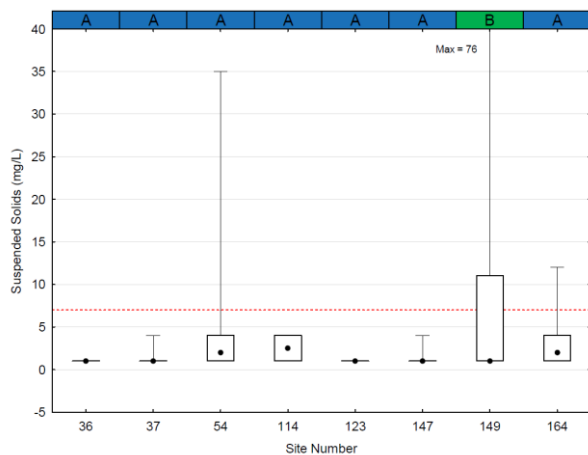
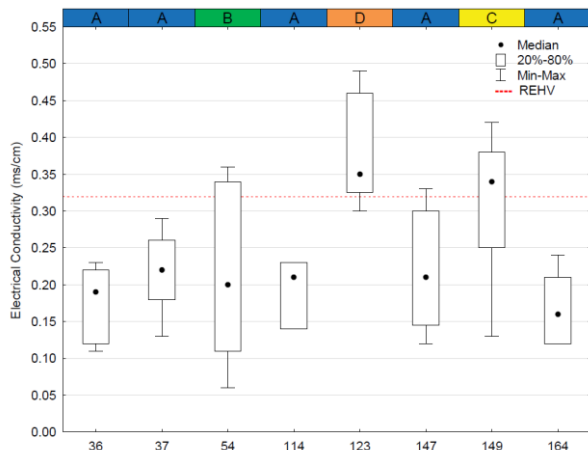
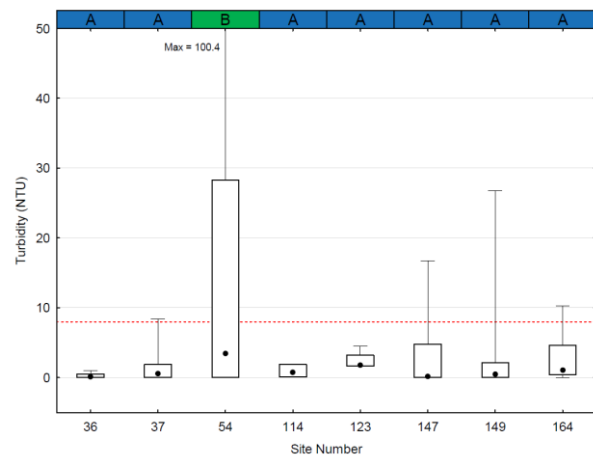
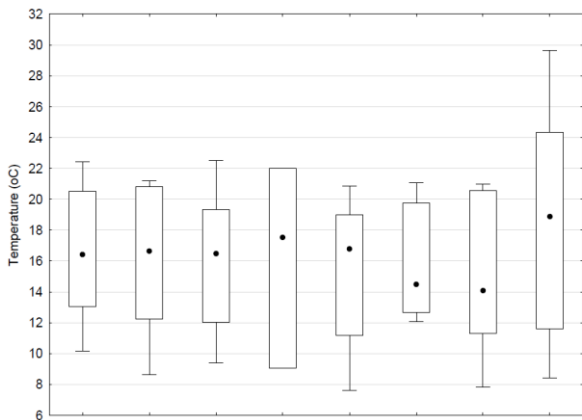
Site 149 – Duckpond Ridge Creek

- Site Health Grade of B for phys-chem indicators.
- Site Health Grade of A+ for microbial indicators.
- Results complying with the REHVs 100% of the time dissolved oxygen and oxidised-nitrogen.

- Results exceeding the REHVs <20% of the time turbidity, total nitrogen, ammonium-nitrogen and faecal coliforms.
- Results exceeding the REHVs 20-50% of the time suspended solids, total phosphorus.
- Results exceeding the REHVs 50-80% of the time electrical conductivity.
- Results exceeding the REHVs 100% of the time pH.

Site 164 – Djarra Crossing

- Site Health Grade of A for phys-chem indicators.
- Site Health Grade of A for microbial indicators.
- Results complying with the REHVs 100% of the time electrical conductivity, total nitrogen, ammonium-nitrogen and oxidised-nitrogen.
- Results exceeding the REHVs <20% of the time turbidity, suspended solids, dissolved oxygen, total phosphorus.
- Results exceeding the REHVs 20-50% of the time faecal coliforms.
- Results exceeding the REHVs 50-80% of the time pH.



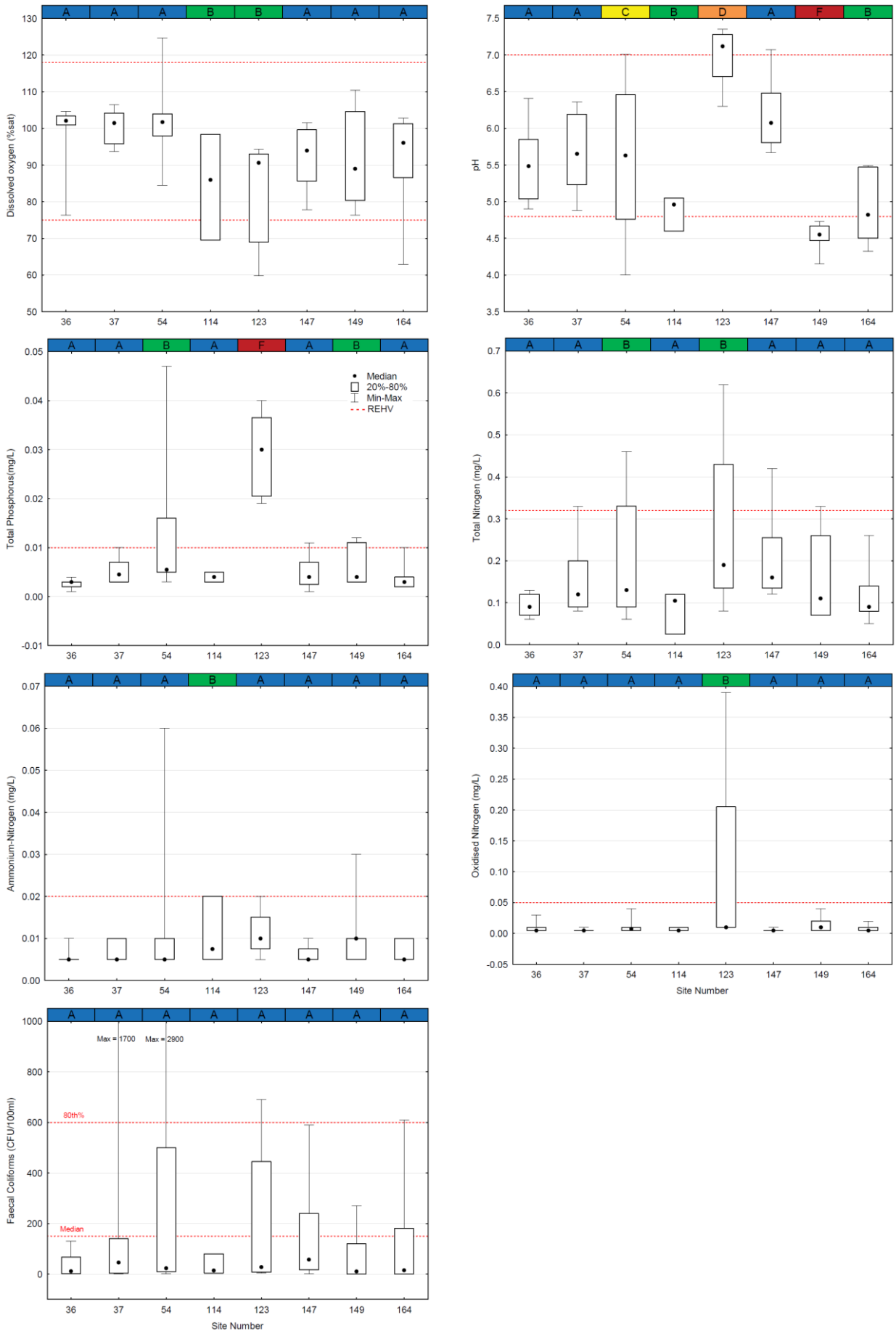


Figure 7.3 Water quality in creeks in primarily undisturbed locations: annual distribution of parameters compared with REHVs for freshwater aquatic ecosystem health

SITE HEALTH GRADES THROUGH TIME - REFERENCE SITES						
SITE NO.	2012/2013		2013/2014		2014/2015	
	Phys-Chem	Microbial	Phys-Chem	Microbial	Phys-Chem	Microbial
036	A	A+	A	A+	A	A+
037	A	A+	A	A+	A	A+
054	A	A+	A	A+	A	A
114	B	A+	A	A+	A	A+
123	B	A	B	A+	B	A
147	A	A+	A	A+	A	A
149	B	A+	B	A+	B	A+
164	A	A	A	A+	A	A

Table 7.3 Comparison of Site Health Grades for phys-chem and microbial indicators at Reference sites for the 2012-13 to 2014-15 reporting periods

7.2.3 Industrial Sites

Three sites representative of industrial landuse within the catchment were monitored during the 2014-15 period. Graphical comparisons of water quality parameters against two long term reference sites (Ref) and the REHVs are presented in Figure 7.4. Indicator Health Grades are presented along top of the box plots with subsequent Site Health Grades for phys-chem and microbial indicators in Table 7.4. A comparison of the phys-chem and microbial Site Health Grades for the last three reporting years is also presented in Table 7.4. Summary statistics for these sites are presented in Appendix F.

Receiving waters of industrial catchments in Hornsby Shire are generally characterised by high concentrations of nutrients (TP, TN, NO_x-N, NH₃-N) and elevated levels of pH and faecal coliforms. pH values well above reference levels may reflect widespread use of alkaline products (e.g. concrete and surfactants) within developed areas. Elevated nutrient levels in industrial catchments may be due to discharge of human waste, industrial and household chemicals, industrial processes and stormwater inputs. Common sources of faecal contaminants in developed catchments are sewer overflows and animal faeces where roofs and other depositional areas are directly connected to the drainage system (Wong 2006).

Site dot-points below summarise which indicators exceeded the REHV trigger values on the majority of sampling occasions. This highlights the parameters

of most concern and provides an indication of the types of catchment activities that may be impacting the waterway.

Site 010 – Larool Creek

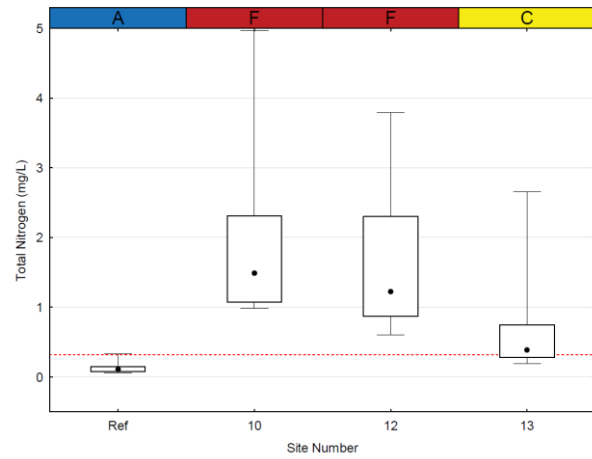
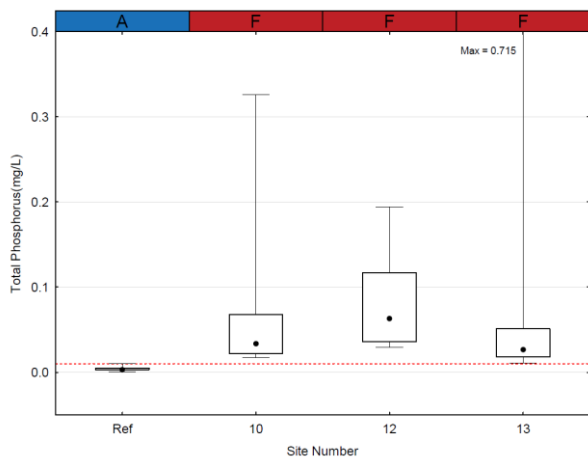
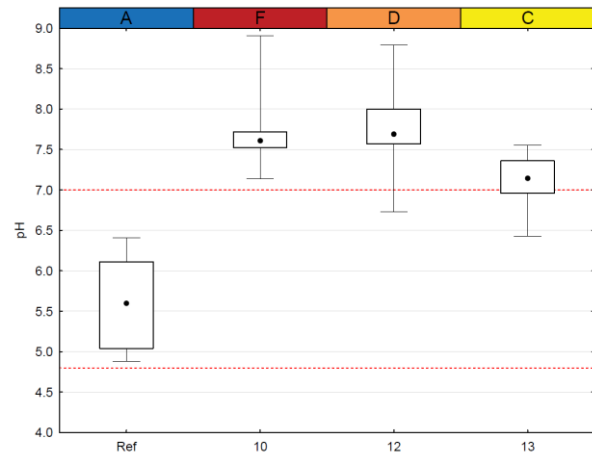
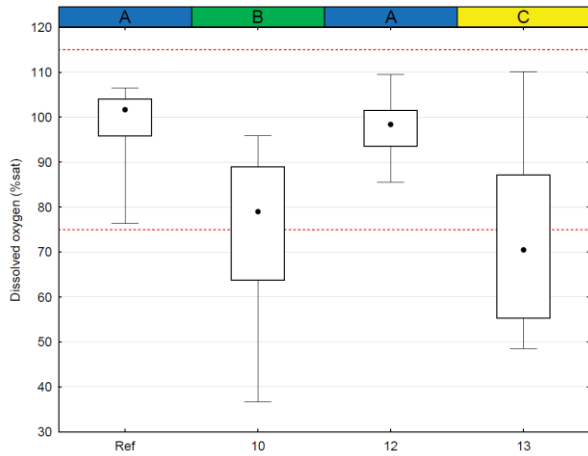
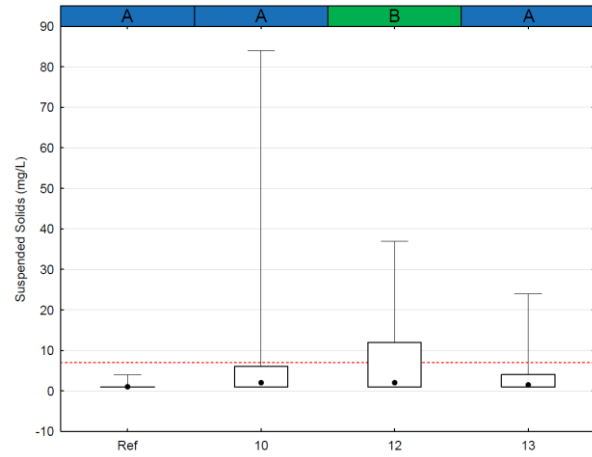
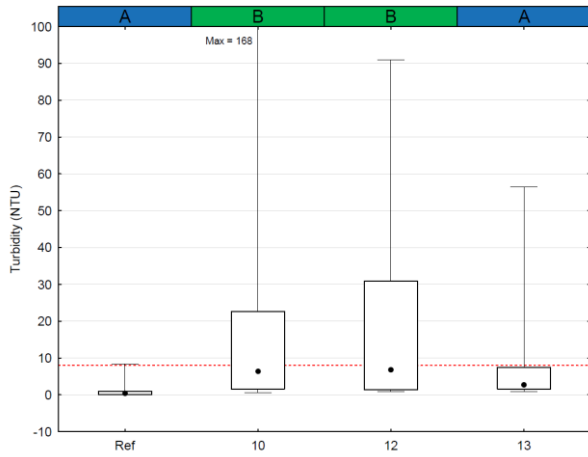
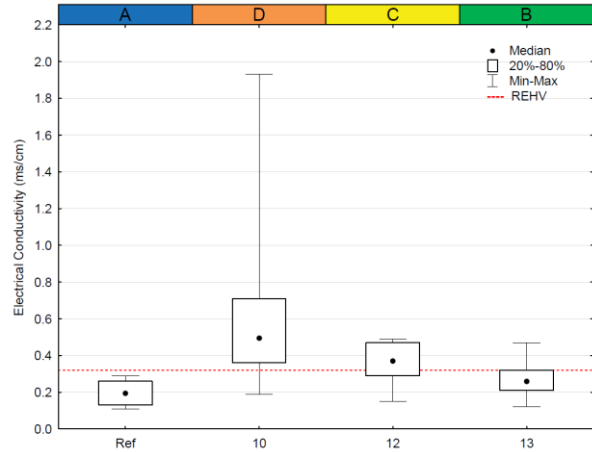
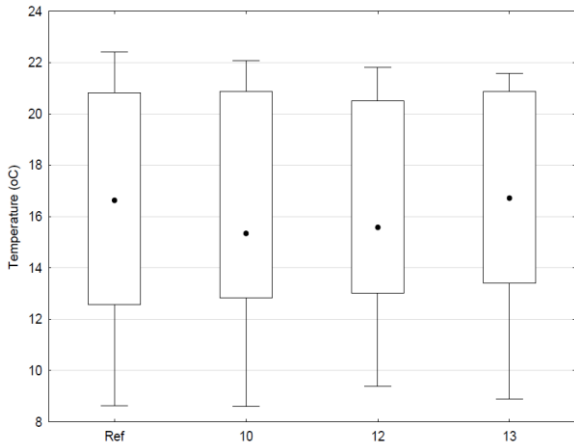
- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of D for microbial indicators.
- Results exceeding the REHVs 100% of the time pH, total phosphorus, total nitrogen and oxidised nitrogen.
- Results exceeding the REHVs >80% of the time electrical conductivity, ammonium nitrogen and faecal coliforms.
- No results exceeded the REHVs 50-80% of the time.

Site 012 – Hornsby Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of F for microbial indicators.
- Results exceeding the REHVs 100% of the time total phosphorus, total nitrogen oxidised nitrogen and faecal coliforms.
- Results exceeding the REHVs >80% of the time pH and ammonium nitrogen.
- Results exceeding the REHVs 50-80% of the time electrical conductivity.

Site 013 – Sams Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of D for microbial indicators.
- Results exceeding the REHVs 100% of the time total phosphorus.
- Results exceeding the REHVs >80% of the time oxidised nitrogen and faecal coliforms.
- Results exceeding the REHVs 50-80% of the time dissolved oxygen, pH, total nitrogen and ammonium nitrogen.



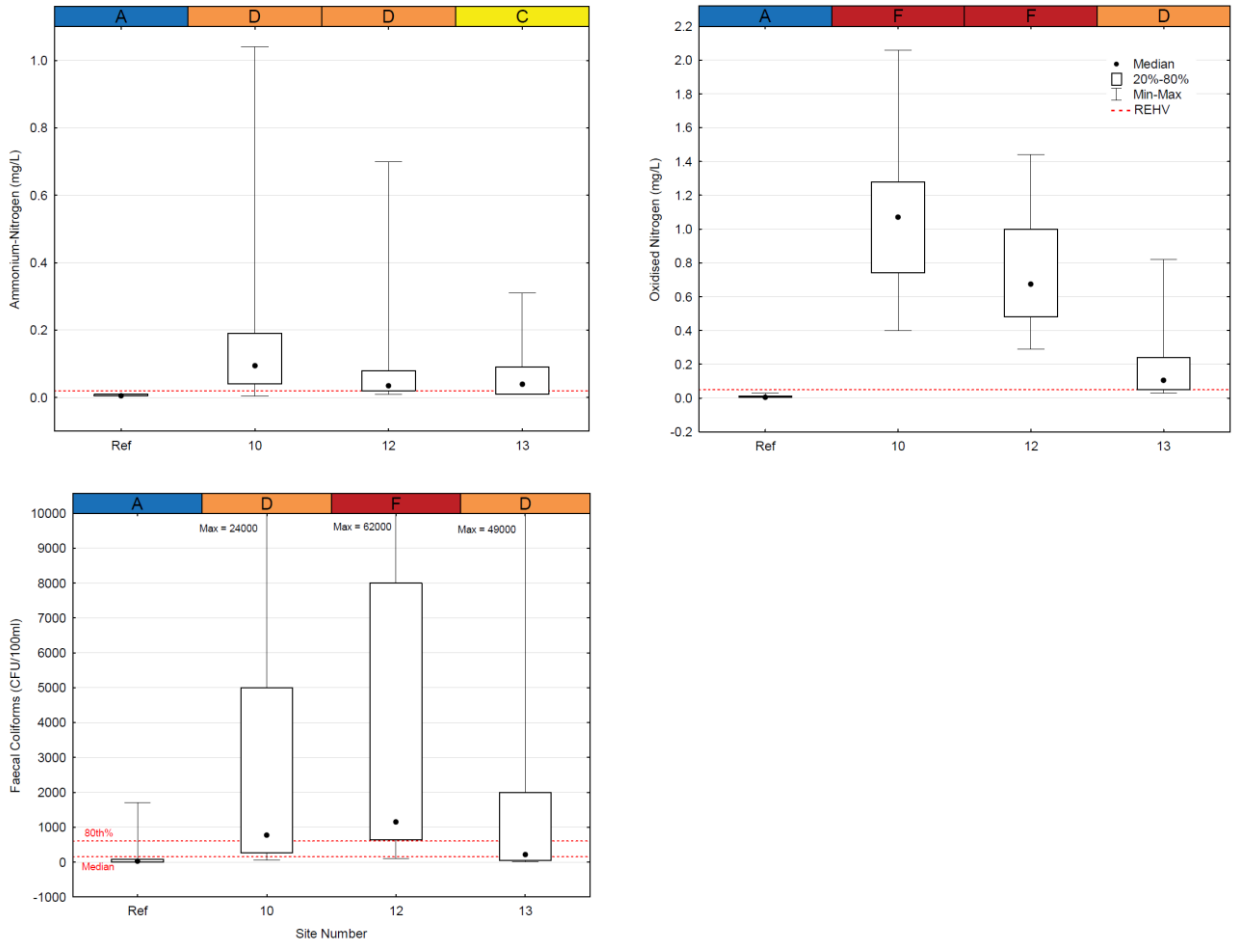


Figure 7.4 Water quality in creeks receiving runoff from industrial areas: annual distribution of parameters compared with reference creeks and REHVs for freshwater aquatic ecosystem health

SITE HEALTH GRADES THROUGH TIME - INDUSTRIAL SITES						
SITE NO.	2012/2013		2013/2014		2014/2015	
	Phys-Chem	Microbial	Phys-Chem	Microbial	Phys-Chem	Microbial
010	D	F	D	D	C	D
012	D	F	C	F	C	F
013	D	D	C	A	C	D

Table 7.4 Comparison of Site Health Grades for phys-chem and microbial indicators at industrial sites for the 2012-13 to 2014-15 reporting periods

7.2.4 Rural Sites

Seven (7) sites representative of rural land use within the catchment were monitored during the 2014-15 period. Graphical comparisons of water quality parameters against two long term reference sites (Ref) and the REHVs are presented in Figure 7.5.

Indicator Health Grades are displayed along the top of the box plots with subsequent Site Health Grades for phys-chem and microbial indicators in Table 7.5. A comparison of the phys-chem and microbial Site Health Grades for the last three reporting years is also presented in Table 7.5. Summary statistics for these sites are presented in Appendix F.

Receiving waters downstream of rural catchments in Hornsby Shire are generally characterised by elevated electrical conductivity, faecal coliforms and nutrients (TP, TN, NH₃-N, NO_x-N). Elevated levels of nutrients and bacteria are most likely due to the use of on-site wastewater management systems (OSWMS) in areas not yet connected to sewer. Council routinely inspects the OSWMSs in rural areas, however the shallow, sandstone geology is not well suited to absorption trenches or aerated wastewater treatment systems (AWTS) and significant seepage of untreated effluent would occur. Fertilisers, domestic use of detergents, incorrect disposal of grey water and illegal septic tank discharges could also contribute to the high nutrient loads. Site 002 continues to maintain good water quality despite receiving runoff from rural catchments. This may be attributed to the site being located quite a distance downstream of the rural settlements with significant intact bushland in between which allows natural in-stream processes to absorb and assimilate pollutants that are present in sites in closer proximity to rural settlements.

Site dot-points below summarise which indicators exceeded the REHV trigger values on the majority of sampling occasions. This highlights the parameters of most concern and provides an indication of the types of catchment activities that may be impacting the waterway.

Site 002 – Tunks Creek

- Site Health Grade of B for phys-chem indicators.
- Site Health Grade of A+ for microbial indicators.
- No results exceeded the REHVs 100% of the time.
- No results exceeded the REHVs >80% of the time.
- Results exceeding the REHVs 50-80% of the time pH and total phosphorus.

Site 042 – Colah Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of C for microbial indicators.

- Results exceeding the REHVs 100% of the time total phosphorus.
- Results exceeding the REHVs >80% of the time total nitrogen.
- Results exceeding the REHVs 50-80% of the time electrical conductivity, pH, ammonium-nitrogen, oxidised-nitrogen and faecal coliforms.

Site 049 – Still Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of B for microbial indicators.
- No results exceeded the REHVs 100% of the time.
- Results exceeding the REHVs >80% of the time electrical conductivity, total phosphorus, total nitrogen and oxidised-nitrogen.
- Results exceeding the REHVs 50-80% of the time pH.

Site 062 – Unnamed Creek, Cowan

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of C for microbial indicators.
- Results exceeding the REHVs 100% of the time pH.
- Results exceeding the REHVs >80% of the time electrical conductivity, total phosphorus, total nitrogen.
- Results exceeding the REHVs 50-80% of the time ammonium-nitrogen, oxidised-nitrogen and faecal coliforms.

Site 063 – Colah Creek

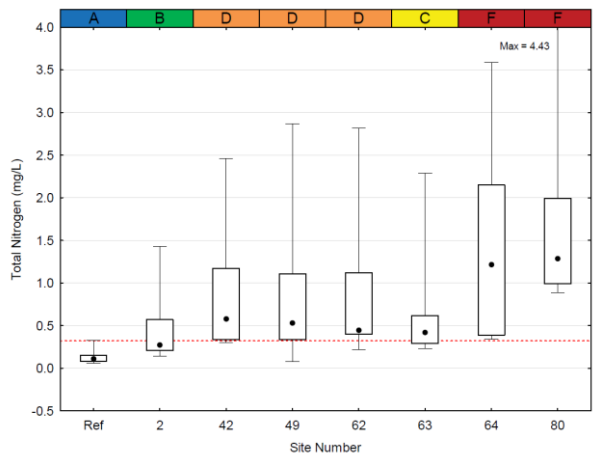
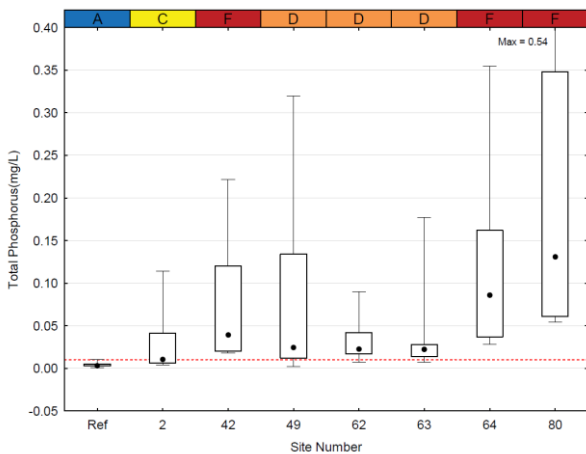
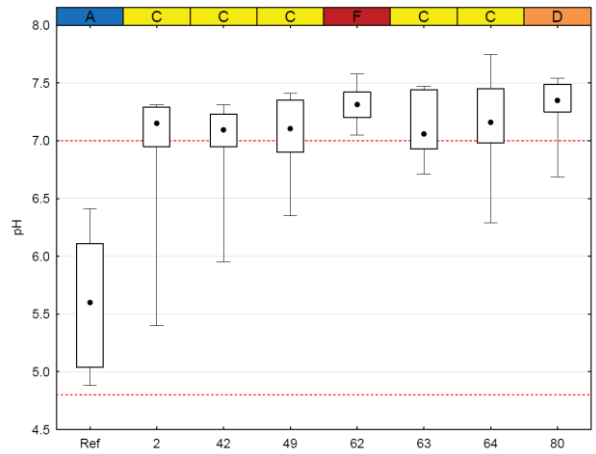
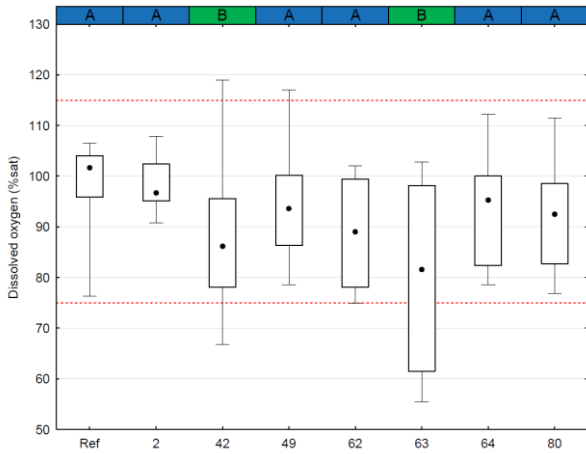
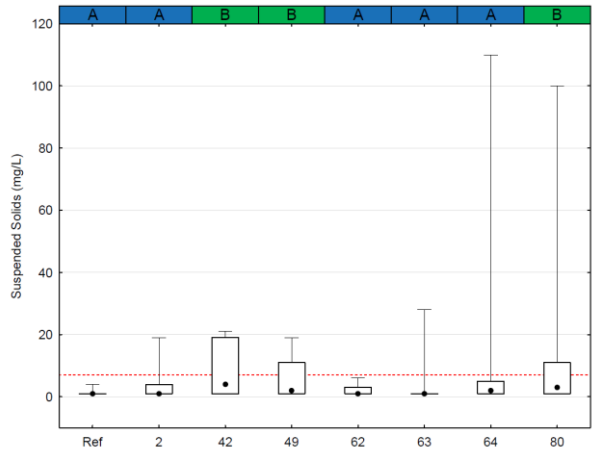
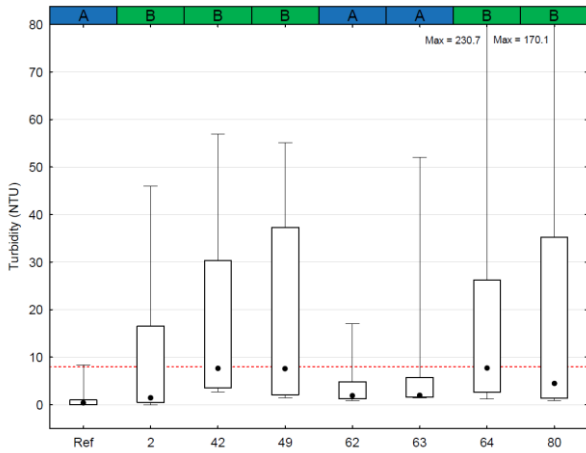
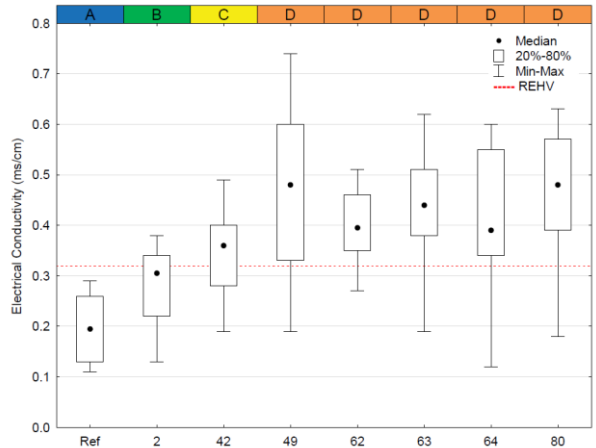
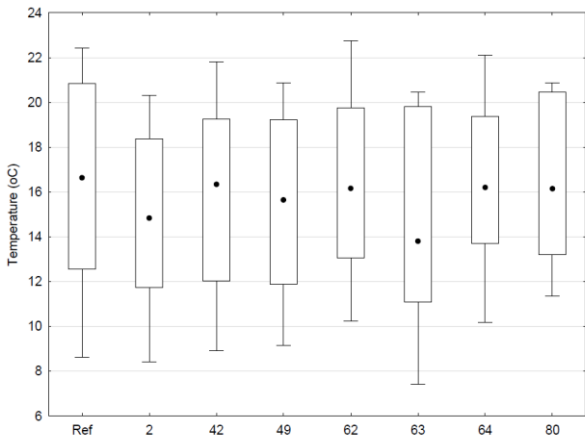
- Site Health Grade of B for phys-chem indicators.
- Site Health Grade of A for microbial indicators.
- No results exceeded the REHVs 100% of the time.
- Results exceeding the REHVs >80% of the time electrical conductivity, total phosphorus.
- Results exceeding the REHVs 50-80% of the time pH, total nitrogen.

Site 064 – Unnamed Creek, Galston Village

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of C for microbial indicators.
- Results exceeding the REHVs 100% of the time total phosphorus, total nitrogen.
- Results exceeding the REHVs >80% of the time electrical conductivity, ammonium-nitrogen and oxidised-nitrogen.
- Results exceeding the REHVs 50-80% of the time pH and faecal coliforms.

Site 080 – Glenorie Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of D for microbial indicators.
- Results exceeding the REHVs 100% of the time total phosphorus, total nitrogen, ammonium-nitrogen and oxidised-nitrogen.
- Results exceeding the REHVs >80% of the time electrical conductivity, pH and faecal coliforms.
- No results exceeded the REHVs 50-80% of the time.



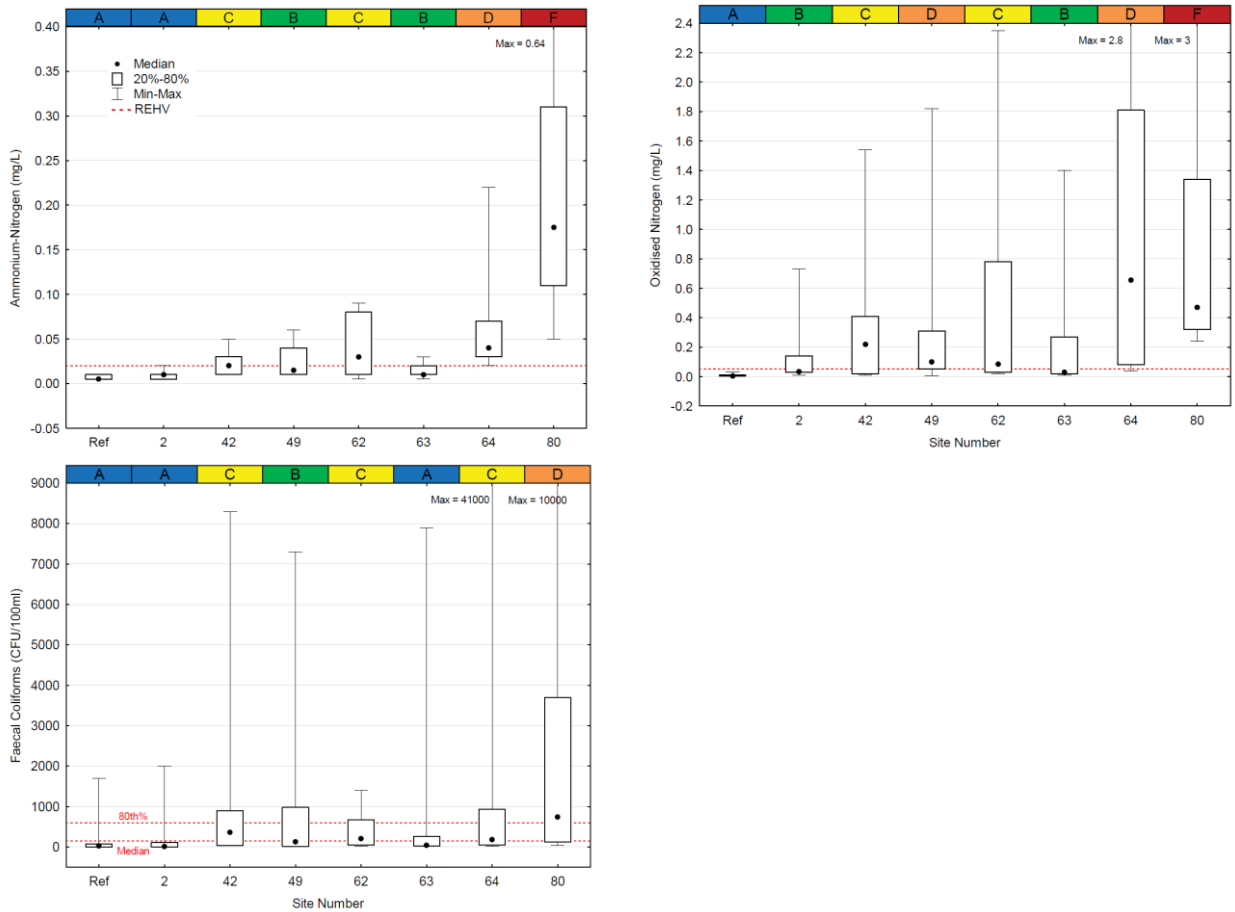


Figure 7.5 Water quality in creeks receiving runoff from rural areas: annual distribution of parameters compared with reference creeks and REHVs for freshwater aquatic ecosystem health

SITE HEALTH GRADES THROUGH TIME - RURAL SITES						
SITE NO.	2012/2013		2013/2014		2014/2015	
	Phys-Chem	Microbial	Phys-Chem	Microbial	Phys-Chem	Microbial
002	B	A+	A	A+	B	A+
042	C	A	C	A	C	C
049	C	A	B	A+	C	B
062	D	B	C	A	C	C
063	C	A+	B	A	B	A
064	D	B	C	B	C	C
080	D	F	D	F	C	D

Table 7.5 Comparison of Site Health Grades for phys-chem and microbial indicators at Rural sites for the 2012-13 to 2014-15 reporting periods

7.2.5 Urban Sites

Six (6) sites representative of urban land use within the catchment were monitored during the 2014-15 period. Graphical comparisons of water quality parameters against two long term reference sites (Ref) and the REHVs are presented in Figure 7.6. Indicator Health Grades are displayed along the top of the box plots and subsequent Site Health Grades for phys-chem and microbial indicators in Table 7.6. A comparison of the phys-chem and microbial Site Health Grades for the last three reporting years is also presented in Table 7.6. Summary statistics for these sites are presented in Appendix F.

Receiving waters of urban catchments in Hornsby Shire are generally characterised by elevated electrical conductivity and pH values and high levels of nutrients (TP, TN, NO_x-N). pH values well above natural background (reference) levels may reflect widespread use of alkaline products (e.g. concrete and surfactants) within developed urban areas. Elevated levels of bacteria in urban areas may be attributed faecal contamination entering streams via stormwater runoff and/or sewage overflows during wet weather events. Nutrients in urban catchments could be sourced from overuse of garden fertilisers and manures, eroding soils, road runoff and sewage overflows. Site 039 maintains particularly good water quality results for a site downstream of an urban catchment. This may be attributed to the site being located quite a distance downstream of the urban settlements with significant intact bushland which allows in-stream processes to absorb and assimilate pollutants that are present at sites in close proximity to urban settlements.

Site dot-points below summarise which indicators exceeded the REHV trigger values on the majority of sampling occasions. This highlights the parameters of most concern and provides an indication of the types of catchment activities that may be impacting the waterway.

Site 004 – Berowra Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of C for microbial indicators.
- Results exceeding the REHVs 100% of the time pH and oxidised-nitrogen.
- Results exceeding the REHVs >80% of the time total phosphorus and total nitrogen.

- Results exceeding the REHVs 50-80% of the time electrical conductivity and faecal coliforms.

Site 005 – Pyes Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of D for microbial indicators.
- Results exceeding the REHVs 100% of the time pH, total phosphorus, total nitrogen and oxidised-nitrogen.
- Results exceeding the REHVs >80% of the time electrical conductivity and faecal coliforms.
- Results exceeding the REHVs 50-80% of the time ammonium-nitrogen.

Site 006 – Georges Creek

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of B for microbial indicators.
- Results exceeding the REHVs 100% of the time electrical conductivity, pH and total phosphorus.
- No results exceeded the REHVs >80% of the time.
- Results exceeding the REHVs 50-80% of the time total nitrogen and oxidised-nitrogen.

Site 008 – Devlins Creek

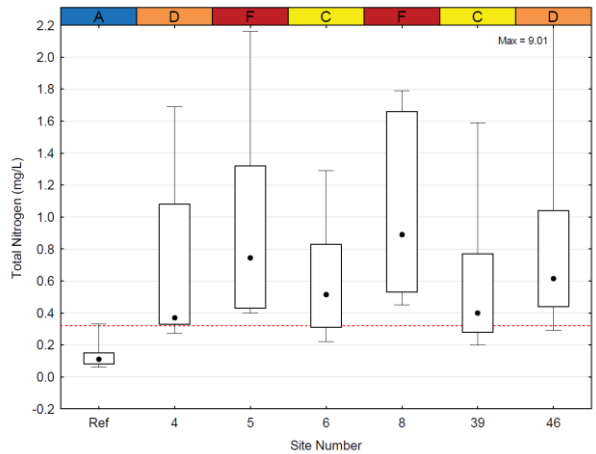
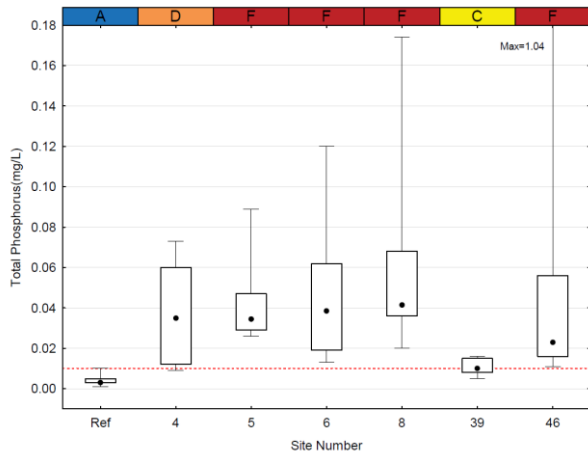
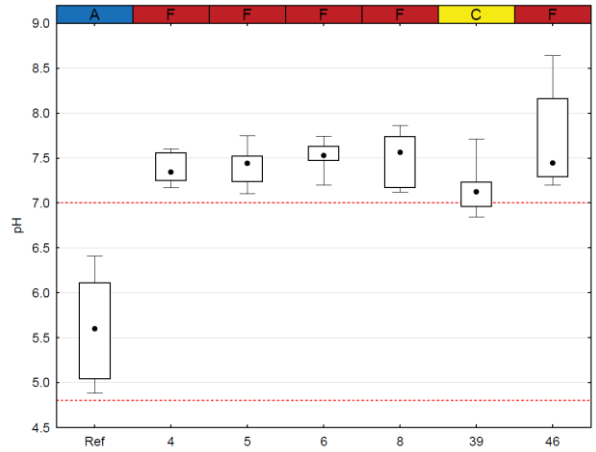
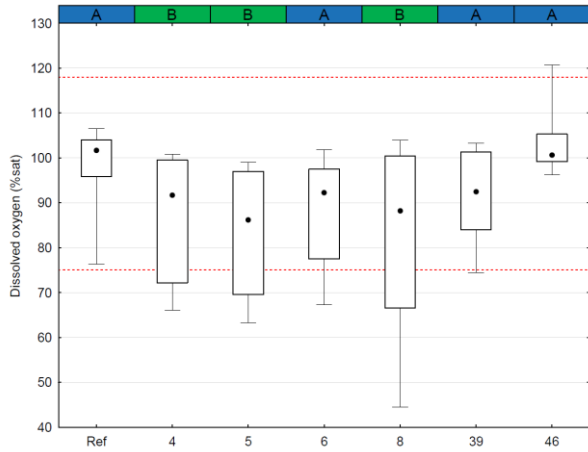
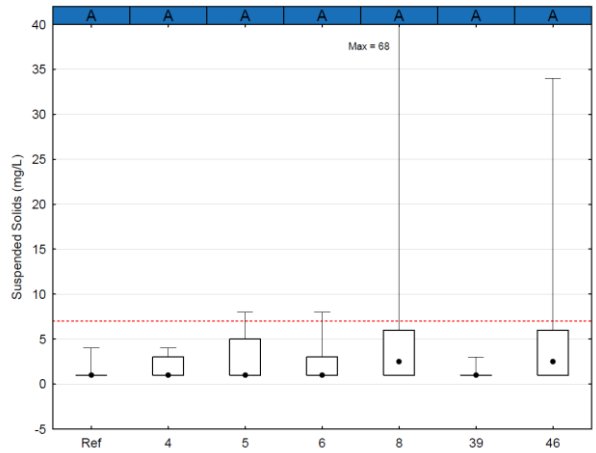
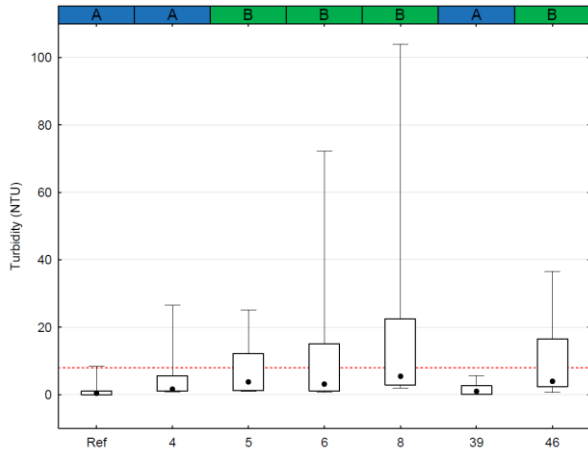
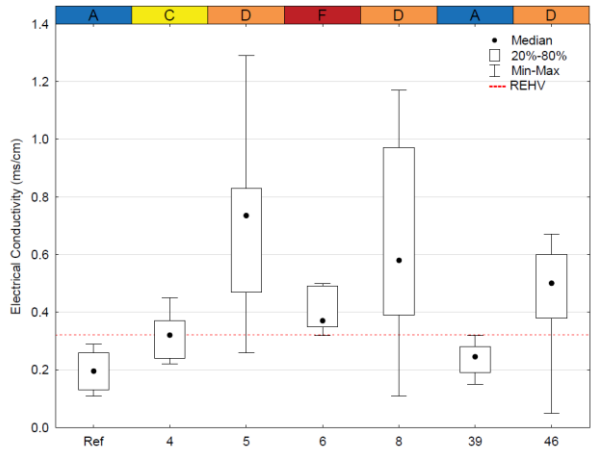
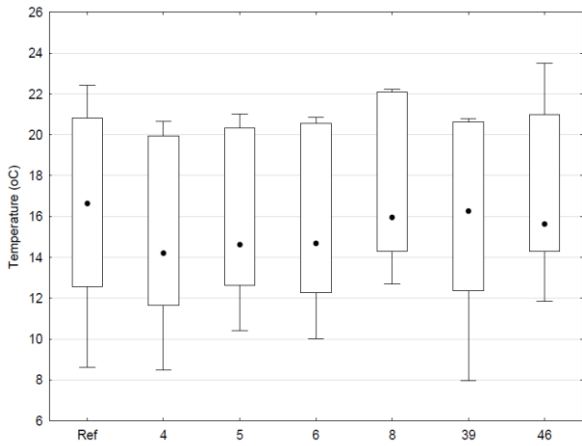
- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of D for microbial indicators.
- Results exceeding the REHVs 100% of the time pH, total phosphorus, total nitrogen and oxidised-nitrogen.
- Results exceeding the REHVs >80% of the time electrical conductivity, ammonium-nitrogen and faecal coliforms.
- No results exceeded the REHVs 50-80% of the time.

Site 039 – Joe Crafts Creek

- Site Health Grade of B for phys-chem indicators.
- Site Health Grade of A for microbial indicators.
- No results exceeded the REHVs 100% of the time.
- Results exceeding the REHVs >80% of the time oxidised-nitrogen.
- Results exceeding the REHVs 50-80% of the time pH, total phosphorus and total nitrogen.

Site 046 – Unnamed Creek, Epping

- Site Health Grade of C for phys-chem indicators.
- Site Health Grade of D for microbial indicators.
- Results exceeding the REHVs 100% of the time pH, total phosphorus, oxidised-nitrogen.
- Results exceeding the REHVs >80% of the time electrical conductivity, total nitrogen, ammonium-nitrogen and faecal coliforms.
- No results exceeded the REHVs 50-80% of the time.



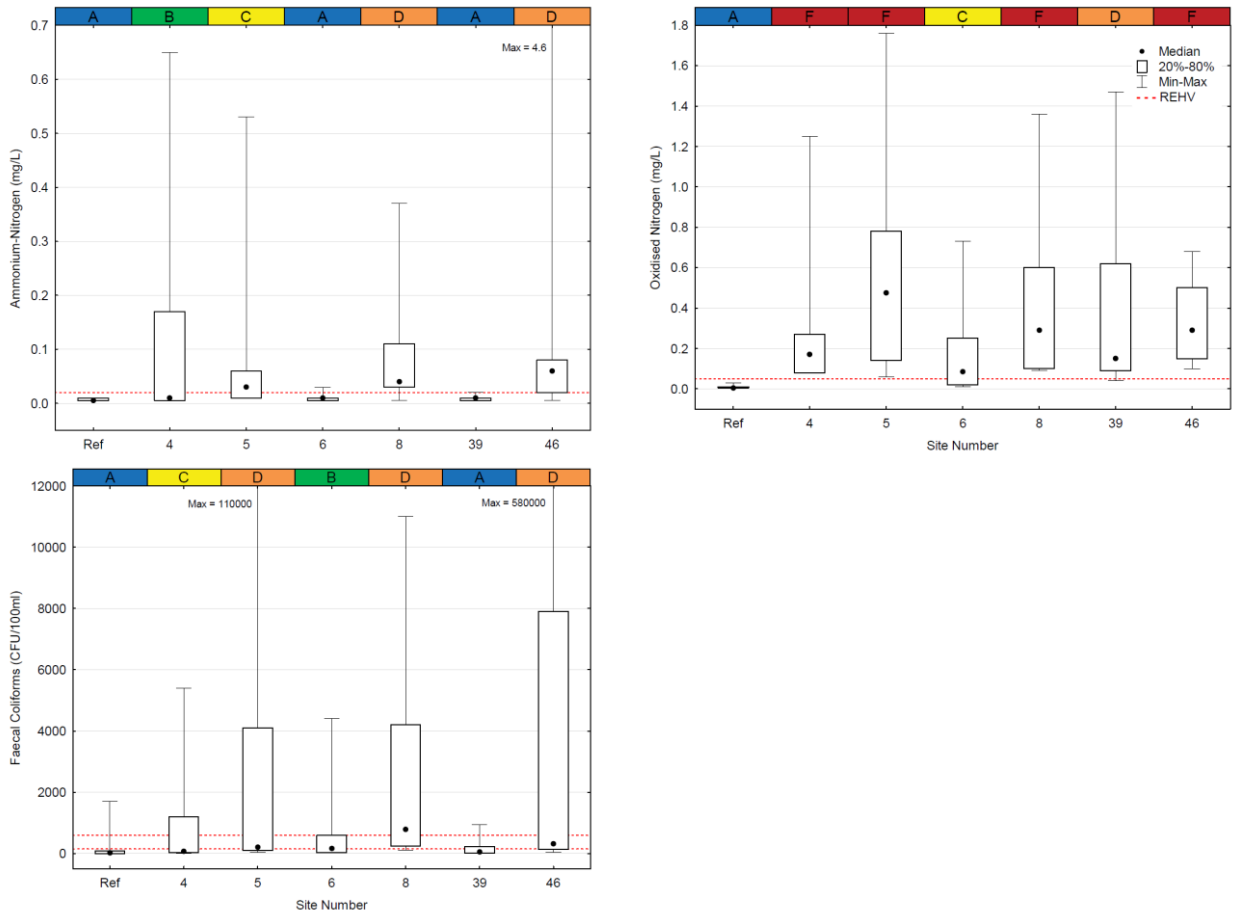


Figure 7.6 Water quality in creeks receiving runoff from urban areas: annual distribution of parameters compared with reference creeks and REHVs for freshwater aquatic ecosystem health

SITE HEALTH GRADES THROUGH TIME - URBAN SITES						
SITE NO.	2012/2013		2013/2014		2014/2015	
	Phys-Chem	Microbial	Phys-Chem	Microbial	Phys-Chem	Microbial
004	C	A	C	A	C	C
005	D	A	C	A	C	D
006	C	A	C	A	C	B
008	D	D	C	B	C	D
039	A	A+	B	A+	B	A
046	D	F	C	C	C	D

Table 7.6 Comparison of Site Health Grades for phys-chem and microbial indicators at Urban sites for the 2012-13 to 2014-15 reporting periods

7.2.6 Estuarine Sites

Thirteen estuarine sites were monitored in the lower Hawkesbury River and its tributaries during the 2014-15 period. Graphical comparisons of water quality parameters against the REHVs are presented in Figure 7.7. Indicator Health Grades are displayed along the top of the box plots. Subsequent Site Health Grades and an overall Waterway Health Grade is presented in Table 7.7. Summary statistics for these sites are presented in Appendix F.

Water quality in estuarine waters within Hornsby Shire is generally characterised by low levels of faecal contamination, high suspended solids and elevated nutrient concentrations higher in the tributaries. The elevated nutrient levels higher in the tributaries reflect the influence of urban and rural catchments on receiving waters. Further downstream these impacts are mitigated through a stronger influence of tidal flushing. Nutrient sources include wastewater treatment discharge from urban systems and fertiliser use in the rural catchments. High suspended solids and turbidity levels are indicative of a tide dominant estuary with fine sediment that is easily resuspended. Sites 038, 048 and 151 are located in relatively shallow locations that have a bed load of predominantly fine sediments.

Elevated chlorophyll-a levels at site 061 reflect the high algal productivity in this location. It is thought that the deep hole (~15m) at this locations reduces the flushing capacity compared to the rest of Berowra Creek which provides favourable conditions for algal bloom propagation. Council undertakes continuous remote monitoring of Chlorophyll-a levels within the estuary, details of this monitoring are available in the Hawkesbury Estuary Program Annual Report and online www.hornsby.nsw.gov.au/waterquality.

Site dot-points below summarise which indicators exceeded the REHV trigger values on the majority of sampling occasions. This highlights the parameters of most concern and provides an indication of the types of catchment activities that may be impacting the waterway.

Site 038 – Sandbrook Inlet

- Overall Waterway Health Grade B
- Results exceeding the trigger values 100% of the time suspended solids.
- No results exceeded the trigger values >80% of the time.
- Results exceeding the trigger values 50-80% of the time turbidity, oxidised-nitrogen and chlorophyll-a.

Site 048 – Marramarra Creek

- Overall Waterway Health Grade C

- No results exceeded the trigger values 100% of the time.
- Results exceeding the trigger values >80% of the time suspended solids, turbidity, total nitrogen and ammonium-nitrogen.
- Results exceeding the trigger values 50-80% of the time total phosphorus, oxidised-nitrogen and chlorophyll-a.

Site 055 – Brooklyn Baths

- Overall Waterway Health Grade A.
- Results exceeding the trigger values 100% of the time suspended solids.
- Results exceeding the trigger values >80% of the time ammonium-nitrogen.
- Results exceeding the trigger values 50-80% of the time turbidity.

Site 060 – Berowra Waters

- Overall Waterway Health Grade B.
- Results exceeding the trigger values 100% of the time total nitrogen.
- Results exceeding the trigger values >80% of the time oxidised-nitrogen.
- Results exceeding the trigger values 50-80% of the time dissolved oxygen, suspended solids, ammonium-nitrogen and chlorophyll-a.

Site 061 – Calabash Bay

- Overall Waterway Health Grade B.
- No results exceeded the trigger values 100% of the time.
- Results exceeding the trigger values >80% of the time total nitrogen and chlorophyll-a.
- Results exceeding the trigger values 50-80% of the time total phosphorus.

Site 100 – Crosslands Reserve

- Overall Waterway Health Grade B.
- Results exceeding the trigger values 100% of the time total nitrogen, ammonium-nitrogen and oxidised-nitrogen.
- No results exceeded the trigger values >80% of the time.
- Results exceeding the trigger values 50-80% of the time dissolved oxygen, total phosphorus.

Site 103 – Milsons Passage

- Overall Waterway Health Grade A.
- Results exceeding the trigger values 100% of the time suspended solids.
- Results exceeding the trigger values >80% of the time oxidised-nitrogen.
- Results exceeding the trigger values 50-80% of the time turbidity and ammonium-nitrogen.

Site 108 – Bradleys Beach, Dangar Island

- Overall Waterway Health Grade A.
- No results exceeded the trigger values 100% of the time.
- Results exceeding the trigger values >80% of the time suspended solids.
- Results exceeding the trigger values 50-80% of the time ammonium-nitrogen and oxidised-nitrogen.

Site 150 – Gonyah Point

- Overall Waterway Health Grade A.
- No results exceeded the trigger values 100% of the time.
- No results exceeded the trigger values >80% of the time.
- Results exceeding the trigger values 50-80% of the time suspended solids.

Site 151 – Bar Island

- Overall Waterway Health Grade B.
- No results exceeded the trigger values 100% of the time.
- Results exceeding the trigger values >80% of the time suspended solids and oxidised-nitrogen.
- Results exceeding the trigger values 50-80% of the time turbidity, total nitrogen and chlorophyll-a.

Site 152 – Courangra Point

- Overall Waterway Health Grade B.
- Results exceeding the trigger values 100% of the time oxidised-nitrogen
- Results exceeding the trigger values >80% of the time total nitrogen.

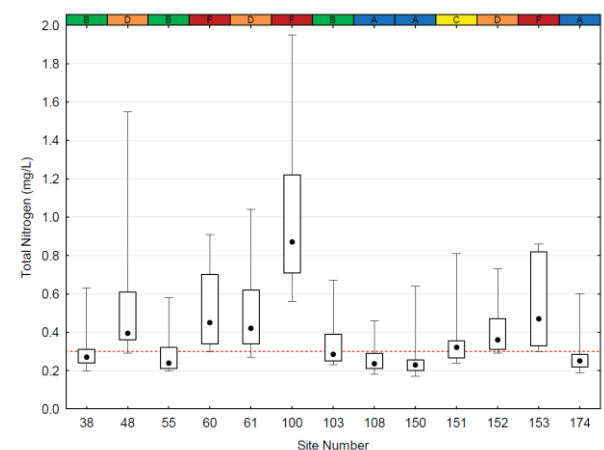
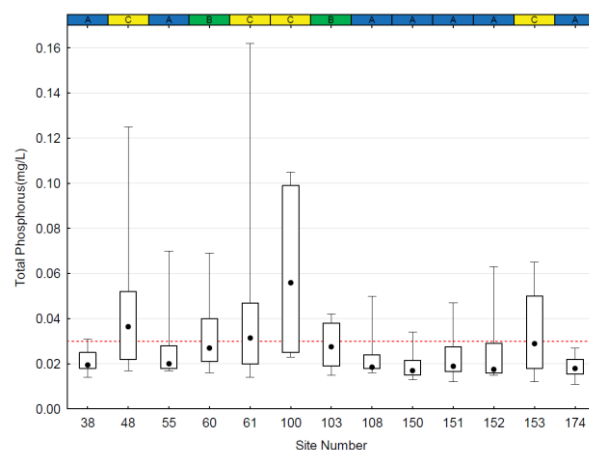
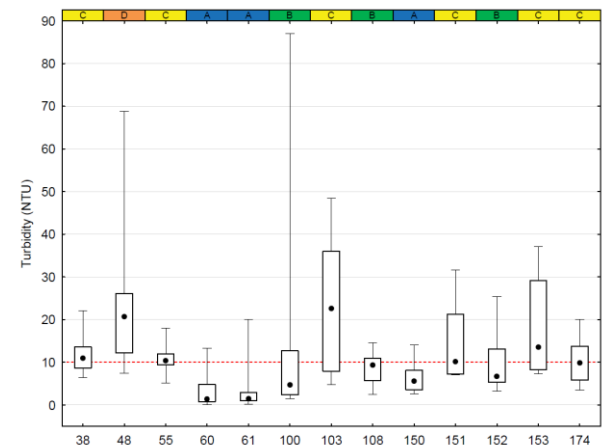
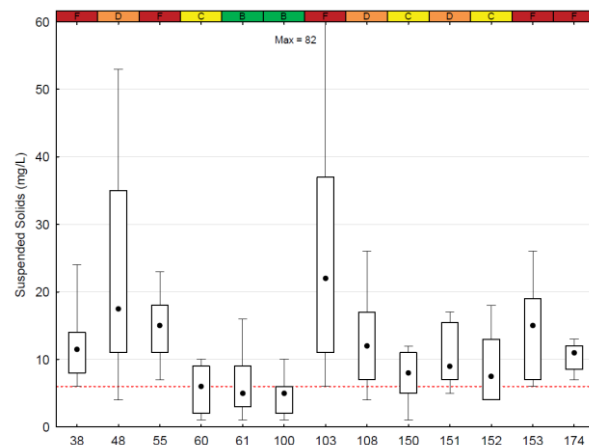
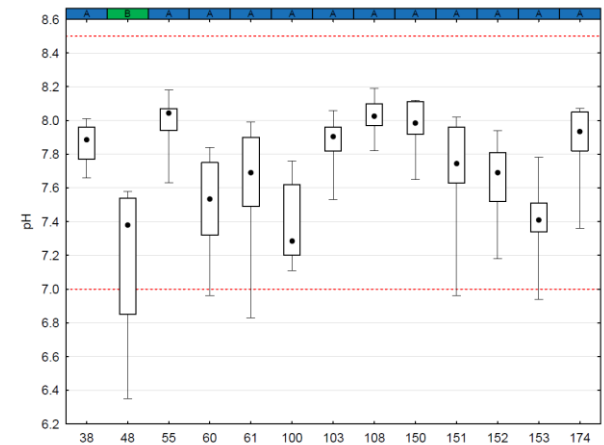
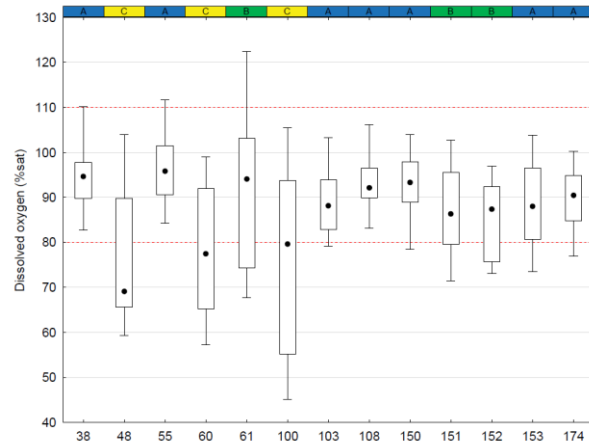
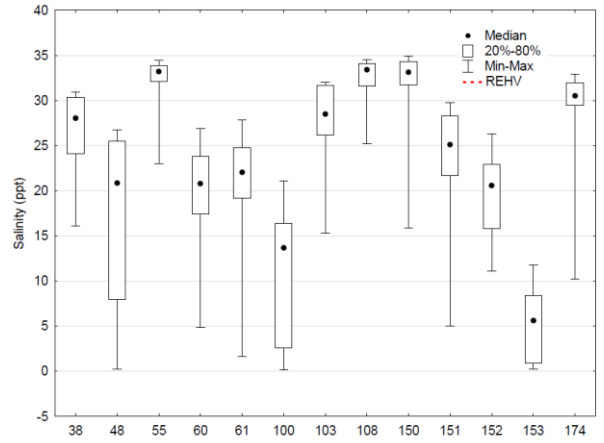
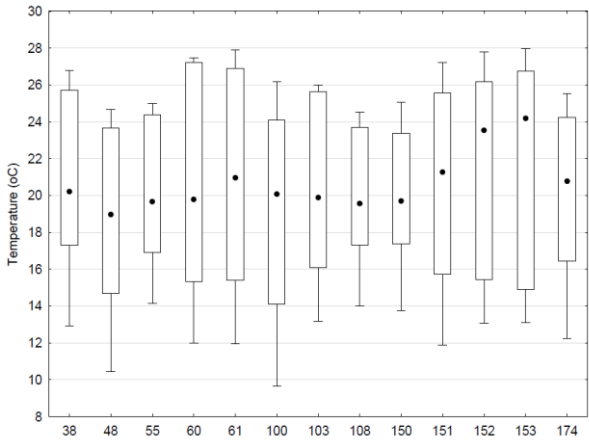
- Results exceeding the trigger values 50-80% of the time suspended solids and chlorophyll-a.

Site 153 – Loughtondale

- Overall Waterway Health Grade B.
- Results exceeding the trigger values 100% of the time suspended solids, total nitrogen.
- Results exceeding the trigger values >80% of the time oxidised-nitrogen.
- Results exceeding the trigger values 50-80% of the time turbidity, total phosphorus and chlorophyll-a.

Site 174 – Mullet Creek

- Overall Waterway Health Grade B.
- Results exceeding the trigger values 100% of the time suspended solids.
- No results exceeded the trigger values >80% of the time.
- Results exceeding the trigger values 50-80% of the time turbidity and oxidised-nitrogen.



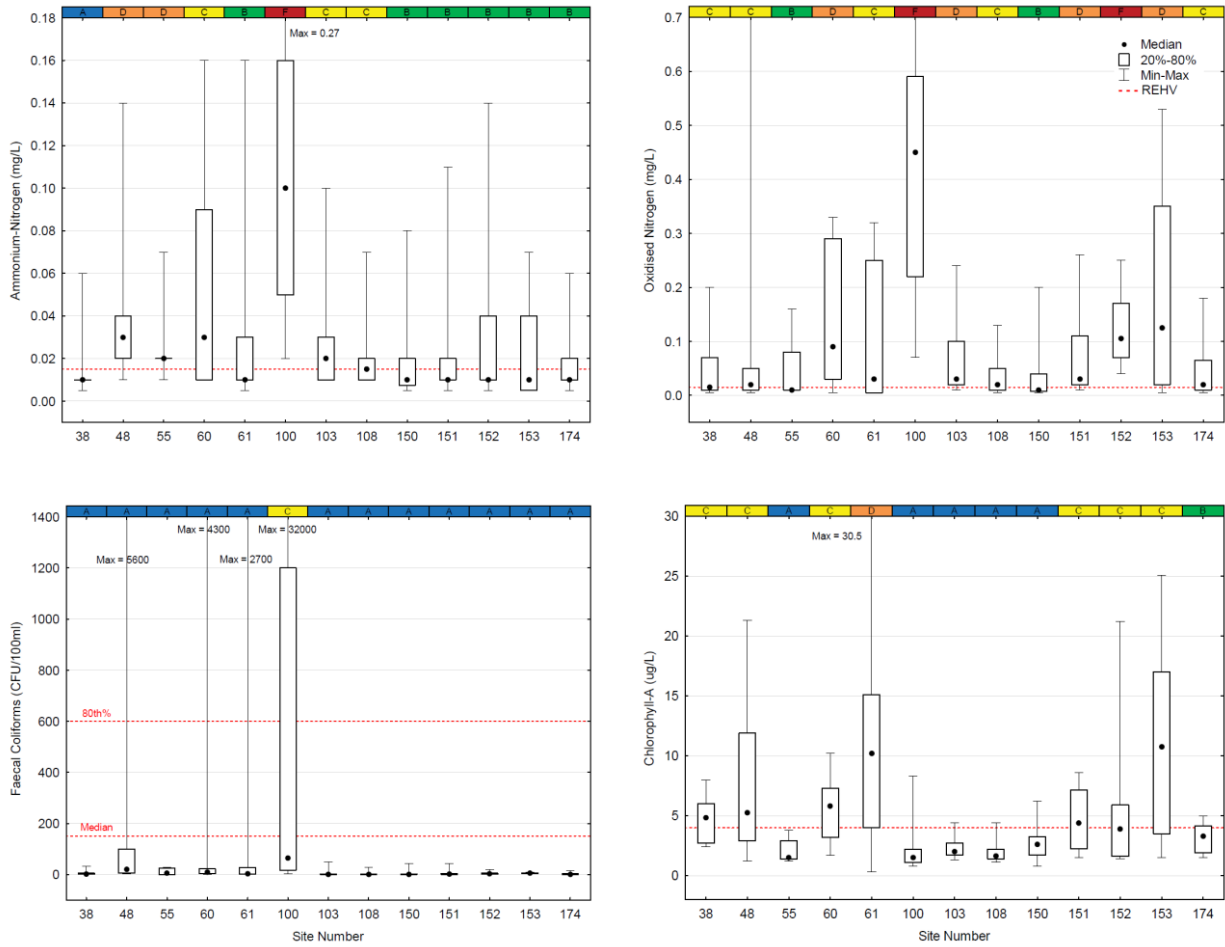


Figure 7.7 Water quality in estuarine areas: annual distribution of parameters compared with REHVs for estuarine aquatic ecosystem health

Site No.	Phys-Chem	Bacteria	Chlorophyll-a	Waterway Health Grade
038	B	A	C	B
048	C	B	C	C
055	B	A	A	A
060	B	B	C	B
061	B	A	D	B
100	C	C	A	B
103	B	A	A	A
108	B	A	A	A
150	A	A	A	A
151	B	A	C	B
152	B	A	B	B
153	C	A	C	B
174	B	A	B	B

Table 7.7 Waterway Health Grades for estuarine sites for the 2014-15 reporting period

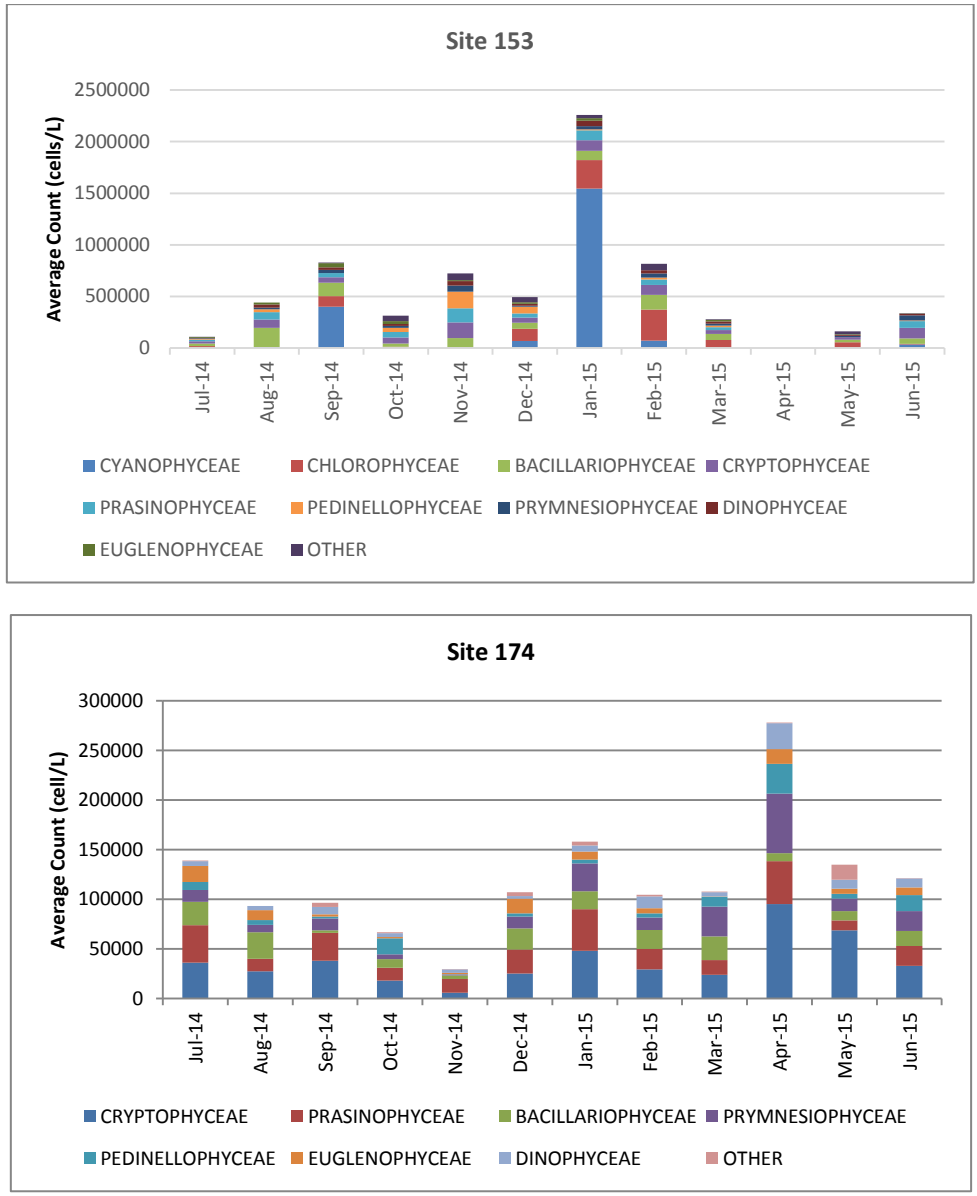


Figure 7.8 Distribution of microalgal classes present at each site for at least 10 months of the reporting year

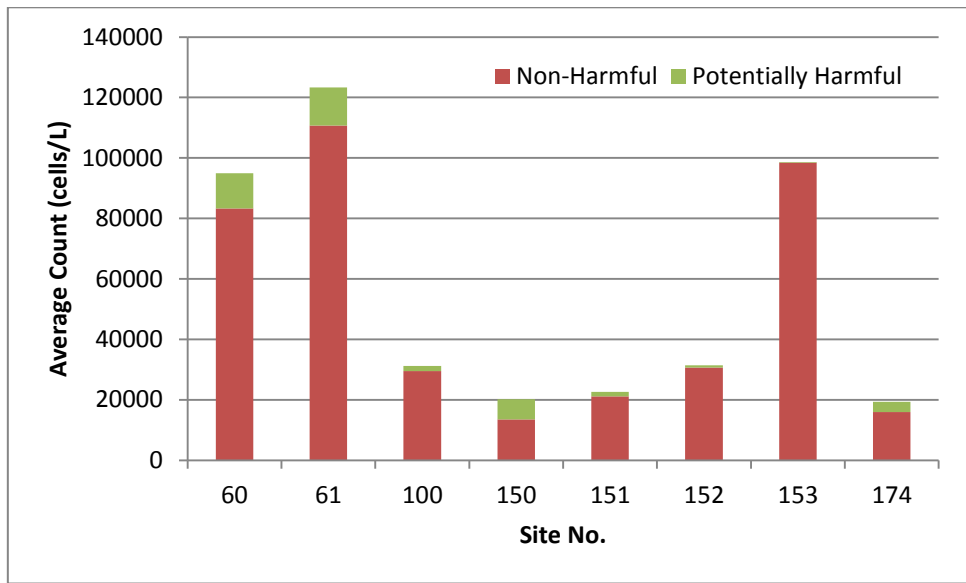


Figure 7.9 Comparison of potentially harmful versus non-harmful algae species per site during the 2013-14 period

Genus		Species	Trigger Level (cell/L)	Jul 14	Aug 14	Sep 14	Oct 14	Nov 14	Dec 14	Jan 15	Feb 15	Mar 15	Apr 15	May 15	Jun 15	Total number of months present	
A Amnesic / Paralytic / Diarrhetic / Shellfish Poisoning	<i>Alexandrium</i>	<i>catenella</i>	200			E	E	P	P		P					5	
		<i>minutum</i>	200						E		P						2
		<i>tamarense</i>	200							P							1
	<i>Dinophysis</i>	<i>acuminata</i>	1000	P	P	P	E	P	P	P			P			P	9
		<i>caudata</i>	500	P	P		P	P	E	P	E	E	P	P	P	P	11
	<i>Phalochroma/Dinophysis</i> <i>Pseudo-nitzschia</i>	<i>tripos</i>	500									P	P				2
		<i>rotundata</i>	500							E	P	P	P				4
		<i>delicatissima group</i>	500000	P	P	P	P	P	P	P	P	P	P	P	P	P	12
		<i>fraudulenta</i>	50000	P	P		P						P				5
		<i>multistriata</i>	50000	P	P	P	P	P		E	P	P	P			P	10
		<i>pungens/multiseris</i>	50000	P	P	P	P	P		E	E	P	P	P	P	P	12
		<i>subpacifica</i>	50000	P													
<i>turgidula</i>		50000										P				1	
	<i>turgidula/dolorosa</i>	50000										P			P	2	
B Toxicity Unclear	<i>Alexandrium</i>	<i>ostenfeldii</i>		P	P				P		P					4	
		<i>pseudogonyaulax</i>		P	P	P	P		P	P	P				P	8	
	<i>Chattonella</i>	<i>sp.</i>		P					P		P			P		4	
	<i>Heterosigma</i>	<i>akashiwo</i>		P	P		P	P	P	P	P	P				8	
	<i>Pseudochattonella</i>	<i>sp.</i>							P							1	
	<i>Pseudo-nitzschia</i>	<i>subpacifica</i>				P											1
<i>subpacifica/heimii</i>						P				P		P			P	4	
C Potential Toxin Producer	<i>Cochlodinium</i>	<i>sp.</i>							P	P	P	P			P	5	
	<i>Dictyocha</i>	<i>octonaria</i>		P	P	P	P	P	P	P	P	P			P	10	
		<i>speculum</i>										P					1
	<i>Karenia</i>	<i>mikimoloi</i>										P					1
		<i>mikimotoi</i>							P	P		P					3
	<i>papilionacea</i>								P							1	
	<i>sp.</i>					P			P	P	P	P			P	6	
	<i>Karlodinium</i>	<i>sp.</i>							P							1	
	<i>Lepidodinium</i>	<i>chlorophorum</i>									P					1	
	<i>Lingulodinium</i>	<i>polyedrum</i>				P	P	P	P	P	P	P				6	
	<i>Mesoporus</i>	<i>perforatus</i>													P	1	
	<i>Prorocentrum</i>	<i>minimum/cordatum</i>		P	P	P	P	P	P	P	P	P		P	P	11	
<i>Protoceratium</i>	<i>reticulatum</i>								P	P		P			3		
<i>Takayama</i>	<i>pulchella</i>								P						1		
D Toxicity Unlikely	<i>Alexandrium</i>	<i>fraterculus</i>		P		P			P		P					4	
		<i>insuetum</i>						P	P							2	
	<i>margalefi</i>		P	P	P	P			P	P	P			P	8		
	<i>Prorocentrum</i>	<i>dentatum</i>						P								1	
Total number of potentially harmful algae species present per month				15	12	11	15	13	31	16	23	18	3	7	12		
P	Species is present with cell counts below trigger levels (Group A only)																
E	Species is present with cell counts exceeding trigger levels (Group A only)																
	Species not present/recorded in that month																

Table 7.8 Occurrence of harmful algal species compared to the NSW Food Authority Phytoplankton Alert Levels (PALs)

7.2.8 Wastewater Treatment Plant Sites

Sites upstream and downstream of local wastewater treatment plants are monitored to investigate the influence of treated and partially treated effluent discharge on local creeks. Sites downstream of wastewater treatment plants in Hornsby Shire are generally characterised by high levels of nutrients and increased electrical conductivity. The high electrical conductivity results are due to dissolved salts used during the sewage treatment process being discharged to the creek. There is often an increase in water temperature downstream of the treatment plants as a result of wastewater being retained in shallow maturation ponds and heated by exposure to sunlight prior to being discharged. Suspended solids and turbidity levels can decrease downstream of discharge points, primarily due to the dilution factor of the clear treated effluent mixing with more turbid creek water flowing from disturbed catchments.

West Hornsby Wastewater Treatment Plant

One site upstream and two sites downstream (near and far) of the West Hornsby WTP were monitored during the 2014-15 period. Graphical comparisons of water quality parameters against two long term reference sites (Ref) and the REHVs are presented in Figure 7.10. Indicator health grades are displayed along the top of the box plots and subsequent site health grades for physical-chemical and microbial properties in Table 7.9. A comparison of the physical-chemical and microbial Site Health Grades for the last three reporting years is also presented in Table 7.9. Summary statistics for these sites are presented in Appendix F.

Site dot-points below summarise which indicators exceeded the REHV trigger values on the majority of

sampling occasions. This highlights the parameters of most concern and provides an indication of the types of catchment activities that may be impacting the waterway.

Site 023 – Waitara Creek (upstream WHWTP)

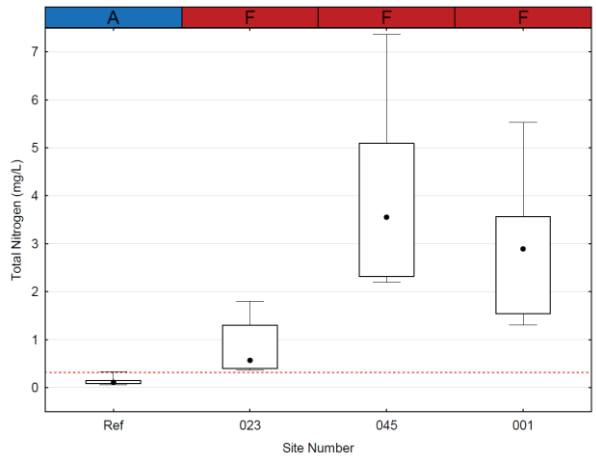
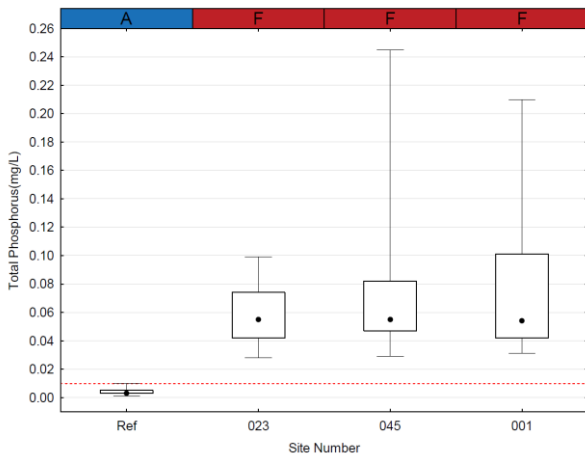
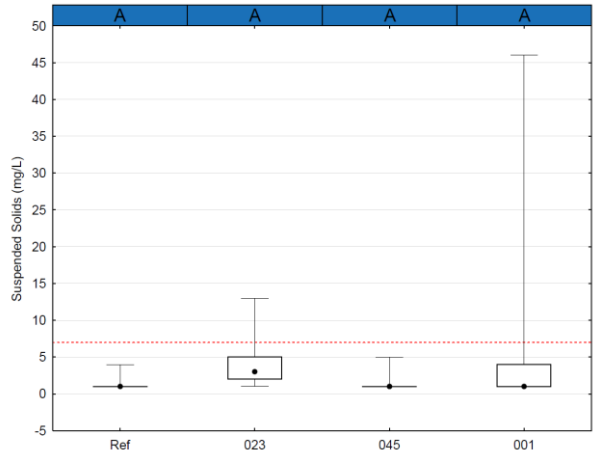
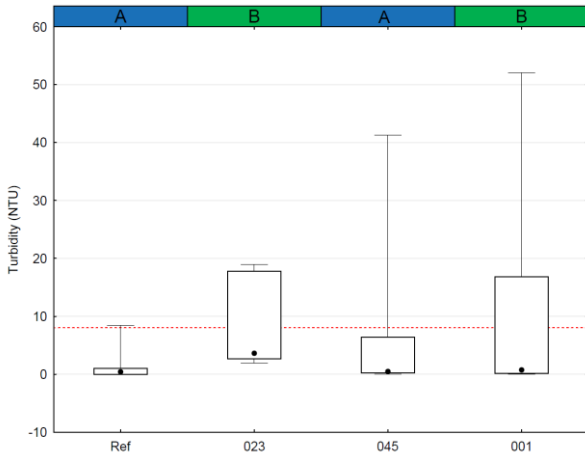
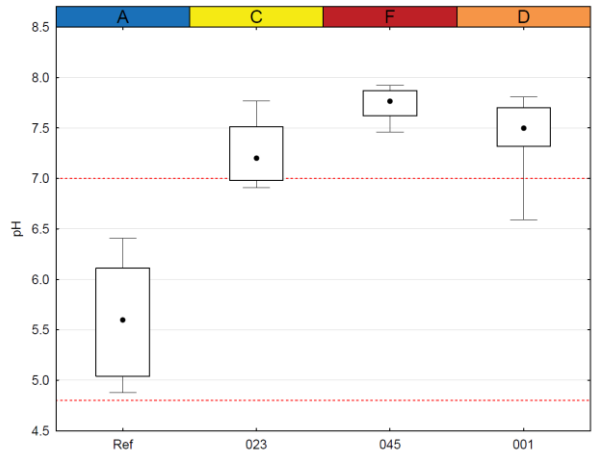
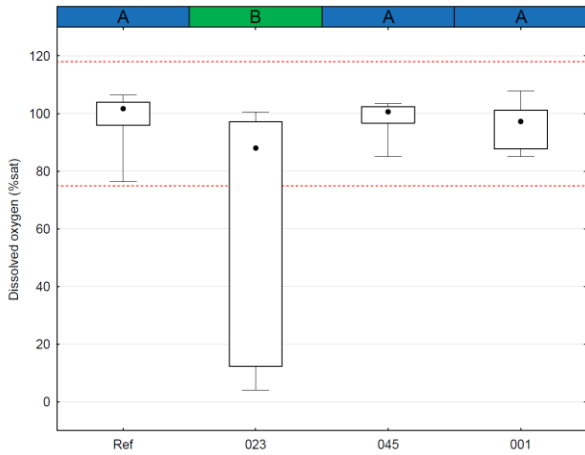
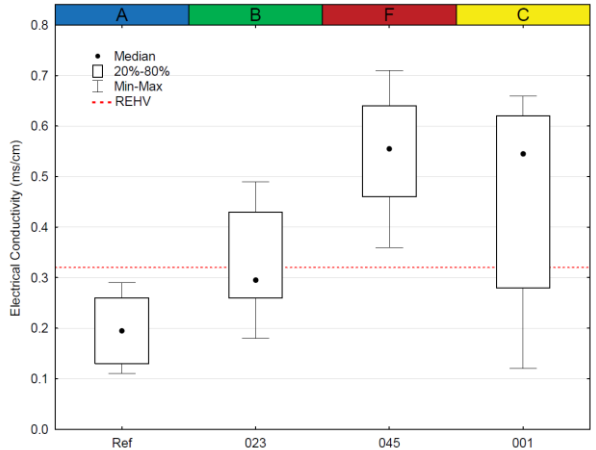
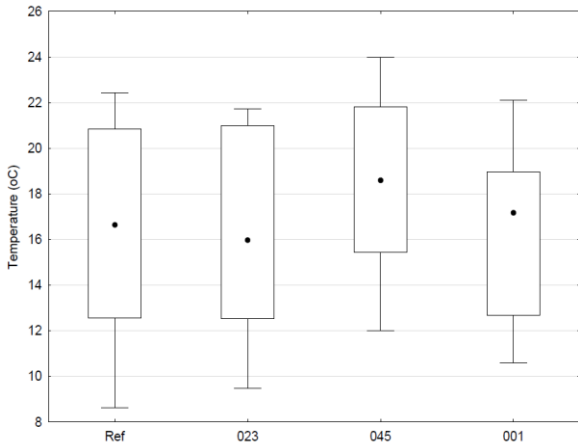
- Site Health Grade of C for phys-chem parameters. No change from 2013-14.
- Site Health Grade of D for microbial parameters.
- Results exceeding the REHVs 100% of the time total phosphorus and total nitrogen.
- Results exceeding the REHVs >80% of the time faecal coliforms.
- Results exceeding the REHVs 50-80% of the time pH and oxidised nitrogen.

Site 045 – Berowra Creek (near downstream WHWTP)

- Site Health Grade of C for phys-chem parameters. No change from 2013-14.
- Site Health Grade of C for microbial parameters.
- Results exceeding the REHVs 100% of the time electrical conductivity, pH, total phosphorus, total nitrogen and oxidised nitrogen.
- No results exceeded the REHVs >80% of the time.
- Results exceeding the REHVs 50-80% of the time faecal coliforms.

Site 001 – Berowra Creek (further downstream WHWTP)

- Site Health Grade of C for phys-chem parameters. No change from 2013-14.
- Site Health Grade of D for microbial parameters.
- Results exceeding the REHVs 100% of the time total phosphorus, total nitrogen and oxidised nitrogen.
- Results exceeding the REHVs >80% of the time pH.
- Results exceeding the REHVs 50-80% of the time electrical conductivity and faecal coliforms.



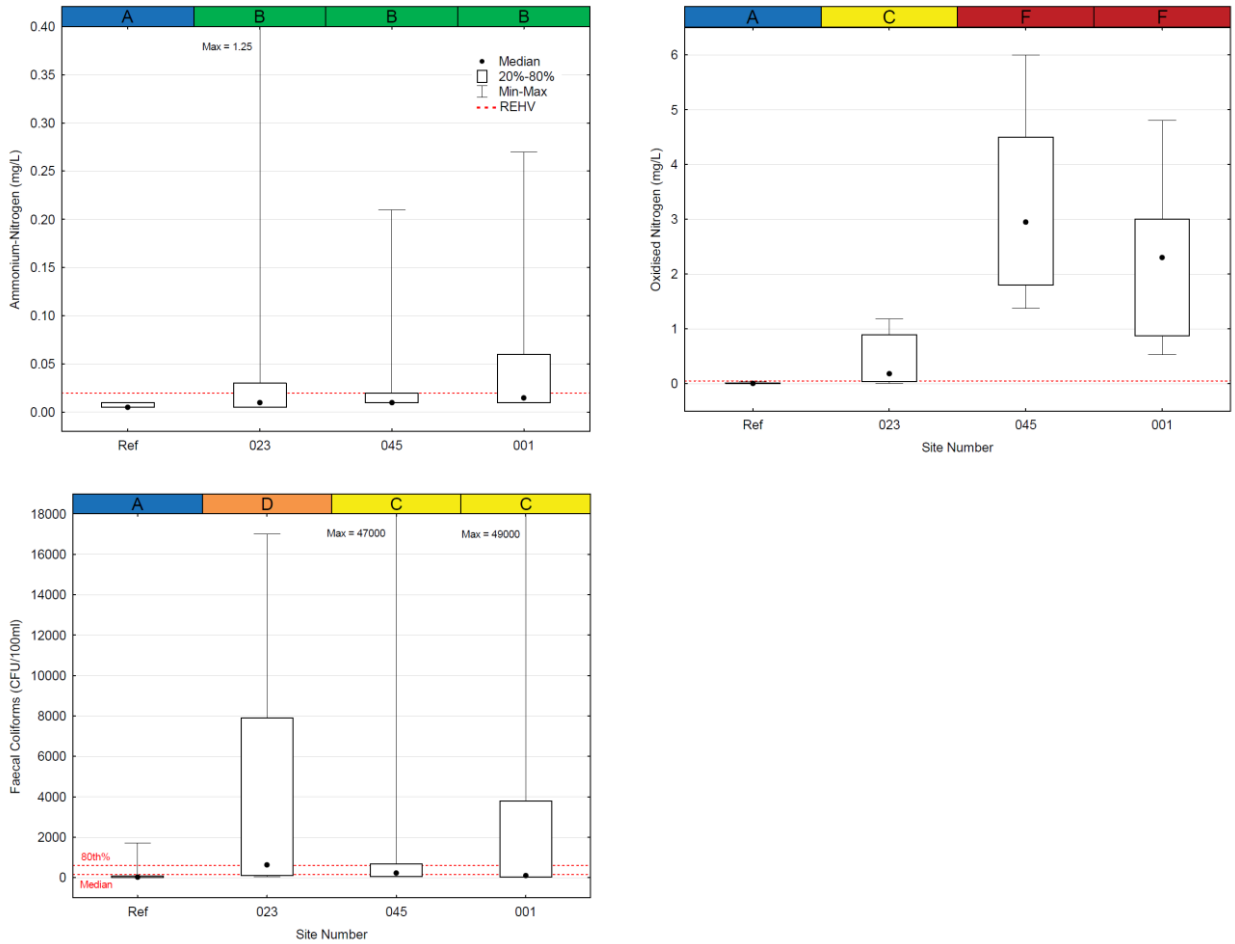


Figure 7.10 Water quality at creeks associated with West Hornsby wastewater treatment plant discharge: annual distribution of selected parameters compared to reference sites and REHVs for freshwater aquatic ecosystem health

SITE HEALTH GRADES THROUGH TIME - WHWTP SITES						
SITE NO.	2012/2013		2013/2014		2014/2015	
	Phys-Chem	Microbial	Phys-Chem	Microbial	Phys-Chem	Microbial
023	D	C	C	C	C	D
045	C	B	C	B	C	C
001	D	A+	C	A+	C	C

Table 7.9 Comparison of Site Health Grades for phys-chem and microbial indicators at West Hornsby WTP sites for the 2012-13 to 2014-15 reporting periods

Hornsby Heights Wastewater Treatment Plant

One site upstream and one site downstream of the Hornsby Heights WTP were monitored during the 2014-15 period. Graphical comparisons of water quality parameters against two long term reference sites (Ref) and the REHVs are presented in Figure 7.11. Indicator health grades are displayed along the top of the box plots and subsequent site health grades for physical-chemical and microbial properties are presented in Table 7.10. A comparison of the physical-chemical and microbial Site Health Grades for the last three reporting years is also presented in Table 7.10. Summary statistics are presented in Appendix F.

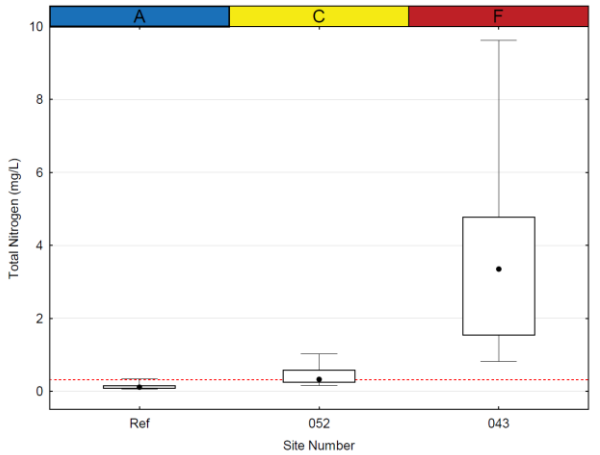
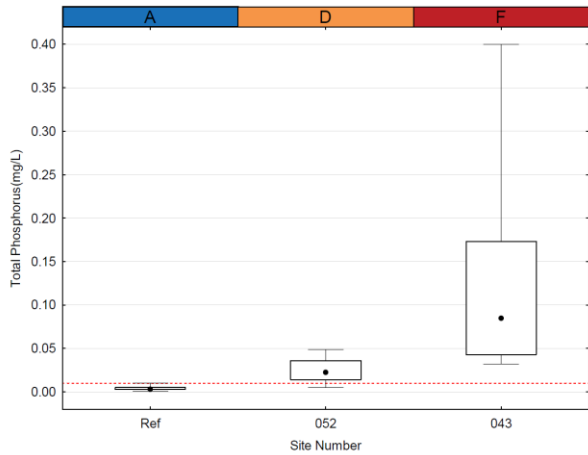
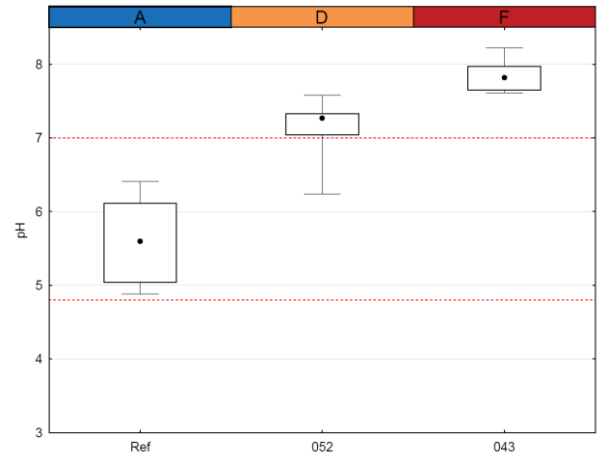
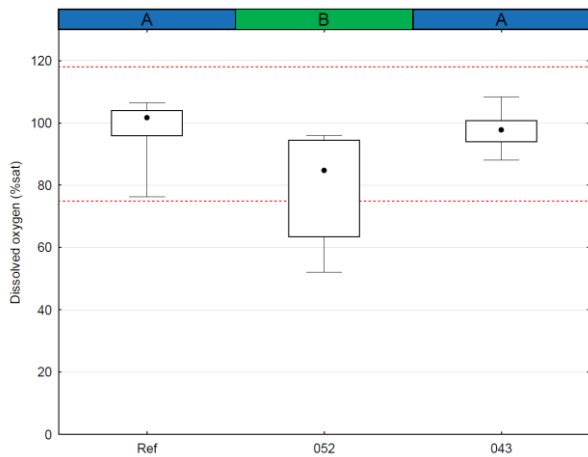
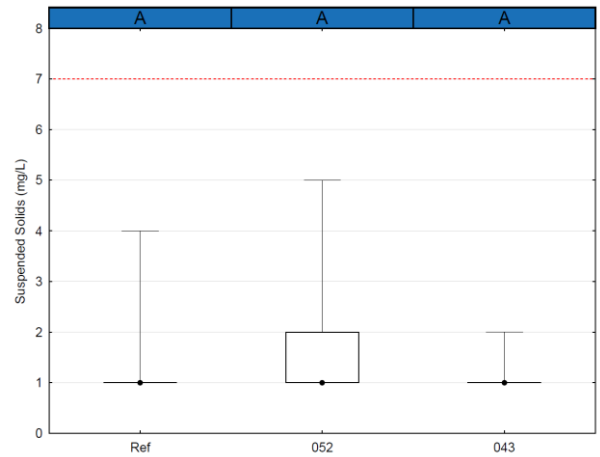
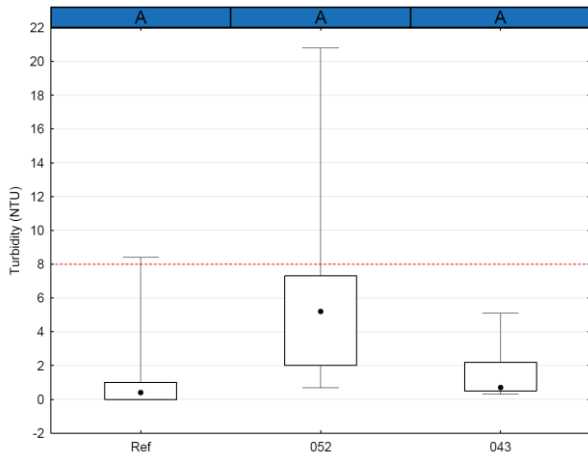
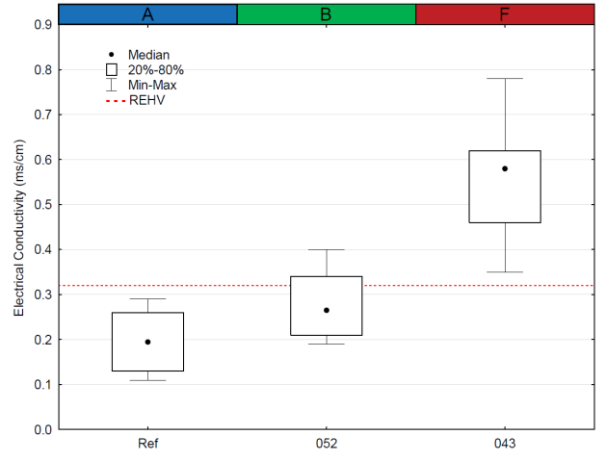
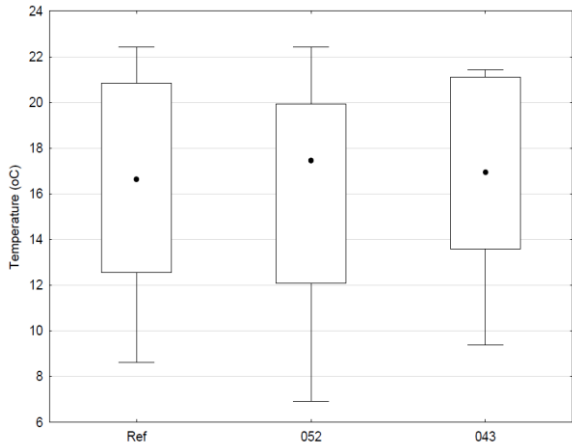
Site dot-points below summarise which indicators exceeded the REHV trigger values on the majority of sampling occasions. This highlights the parameters of most concern and provides an indication of the types of catchment activities that may be impacting the waterway.

Site 052 – Calna Creek (upstream HHWTP)

- Site Health Grade of B for phys-chem parameters.
- Site Health Grade of D for microbial parameters.
- No results exceeded the REHVs 100% of the time.
- Results exceeding the REHVs >80% of the time pH, total phosphorus and faecal coliforms.
- Results exceeding the REHVs 50-80% of the time total nitrogen and oxidised nitrogen.

Site 043 – Calna Creek (downstream HHWTP)

- Site Health Grade of C for phys-chem parameters.
- Site Health Grade of A+ for microbial parameters.
- Results exceeding the REHVs 100% of the time electrical conductivity, pH, total phosphorus, total nitrogen and oxidised nitrogen.
- No results exceeded the REHVs >80% of the time.
- No results exceeded the REHVs 50-80% of the time.



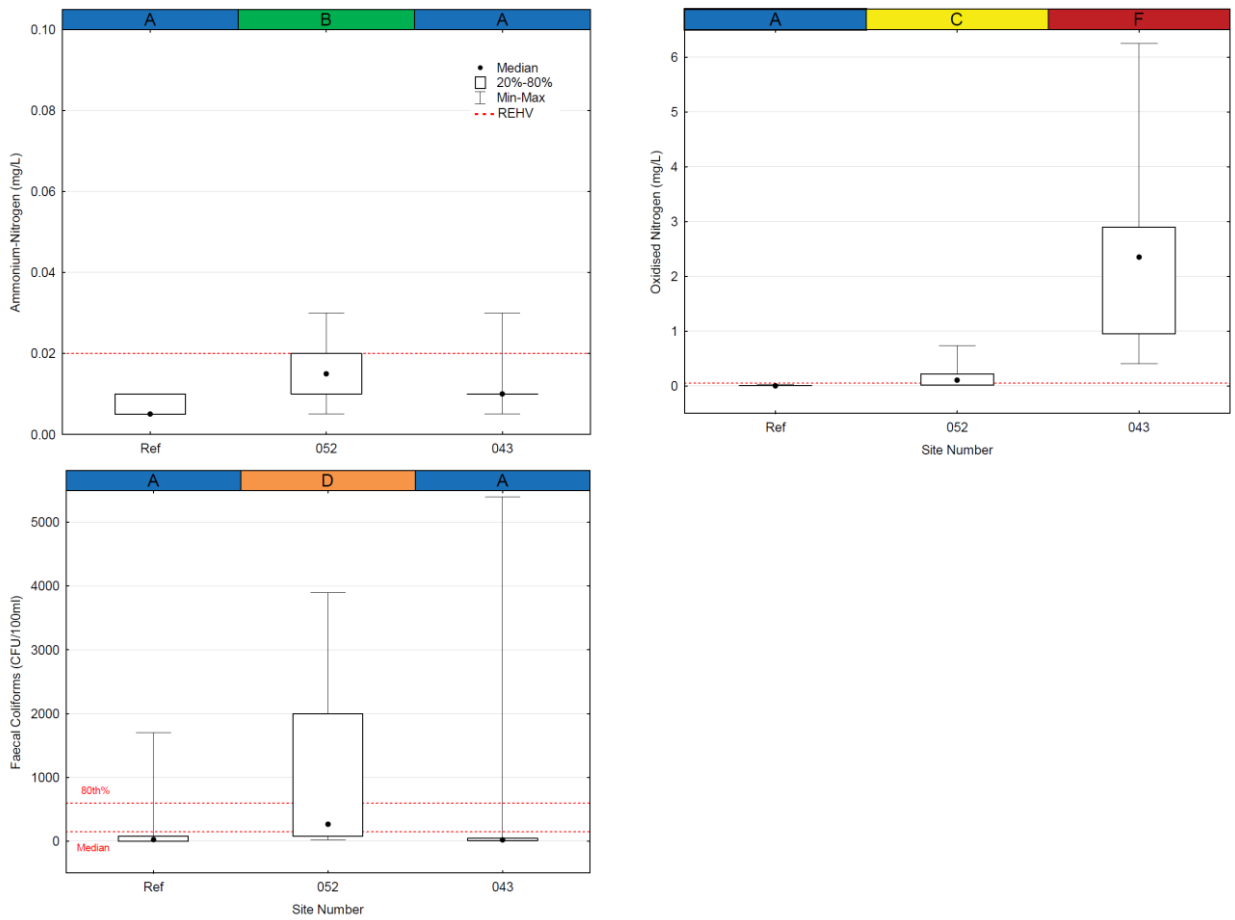


Figure 7.11 Water quality at creeks associated with West Hornsby wastewater treatment plant discharge: annual distribution of selected parameters compared to reference sites and REHVs for freshwater aquatic ecosystem health

SITE HEALTH GRADES THROUGH TIME – HHWTP SITES						
SITE NO.	2012/2013		2013/2014		2014/2015	
	Phys-Chem	Microbial	Phys-Chem	Microbial	Phys-Chem	Microbial
052	B	D	B	A	B	D
043	C	A+	C	A+	C	A+

Table 7.10 Comparison of Site Health Grades for phys-chem and microbial indicators at Hornsby Heights WTP sites for the 2012-13 to 2014-15 reporting periods

7.3 Catchment Remediation Initiatives

7.3.1 Stormwater Harvesting and Reuse

The performance of stormwater harvesting facilities is dependent on regular maintenance to prevent equipment deterioration and failures and to ensure systems are operating satisfactorily. There has been an improvement in operation efficiencies following the introduction of a preventative maintenance program in 2013. Results for this reporting period indicate that high turbidity levels at Somerville Oval may be hindering the treatment process and should be investigated further. During dry periods or when a treatment process is not operating effectively the

facilities are set to 'top up' with potable water. This process is monitored by recording fluoride levels in the treated water (Table 7.11). A fluoride result of 0.1mg/L indicated approximately 10% potable water in the sample. Fluoride results from this reporting period indicate the amount of potable water in the systems at North Epping Oval, Epping Oval and Greenway Park are still of concern.

Graphical comparisons of selected water quality parameters against trigger values for stormwater harvesting and reuse are presented in Figure 7.12. Summary statistics for these sites are presented in Appendix F.

Test Parameter	Trigger Value	Valid N	Nth Epping 141	Epping 137	Somerville 145	Greenway 121	Berowra 131
Fluoride (mg/L)	>0.1	12	0.47	0.48	0.20	0.85	0.19
Electrical Conductivity (µS/cm)	>2000	12	352.92	230.77	254.08	210.31	303.85
Chloride (mg/L)	>175	5	37.00	23.67	31.00	26.50	38.50
Turbidity (NTU)	>10	12	0.47	1.27	41.93	1.98	0.42
Suspended Solids (mg/L)	>50	5	1.00	1.50	5.00	1.33	1.00
Bicarbonate Alkalinity (mg/CaCO ₃ /L)	>350	2	91.00	83.00	48.80	31.20	50.70
Iron (mg/L)	>10	2	0.03	0.06	1.10	0.005	0.04
Total Phosphorus(mg/L)	>0.8	5	0.07	0.13	0.01	0.03	0.02
Faecal Coliforms (CFU/100ml)	>10	12	1.00*	0.50*	6.00*	0.50*	3.00*
<i>*Mean values given, except for Faecal Coliforms where median value is listed</i>							
	Acceptable						
	Potential Issue						
	Problematic, investigate further						

Table 7.11 Water quality of the treated water component of stormwater harvesting and reuse systems

Berowra Oval – Site 128 (raw) and 131 (treated)

- Reduction in faecal coliform count from raw to treated samples
- Very low levels of potable water evident
- System working well

Greenway Park – Site 120 (raw) and 121 (treated)

- Low faecal coliform counts in both raw and treated samples
- Very high levels of potable water evident in treated tanks
- System requires some investigation

Epping Oval – Site 134 (raw) and 137 (treated)

- Low faecal coliform counts in both raw and treated samples
- Approximately 50% potable water evident in treated tanks
- System may require some further investigation

Nth Epping Oval – Site 138 (raw) and 141 (treated)

- Significant reduction in faecal coliform count from raw to treated samples

- Approximately 50% potable water evident in treated tanks
- System may require further investigation regarding potable water use but disinfection working well

Somerville Oval – Site 142 (raw) and 145 (treated)

- Some reduction in faecal coliform count from raw to treated samples
- Very low levels of potable water evident
- High turbidity in both raw and treated samples which may be inhibiting the disinfection process
- System may require some further investigation into the turbidity levels.

Community Nursery – Site 180 (raw) and 098 (treated)

- Due to a contamination incident this site has not been routinely monitored during this reporting period. The system became operational in early 2015 however there is not enough data for analysis at this time.

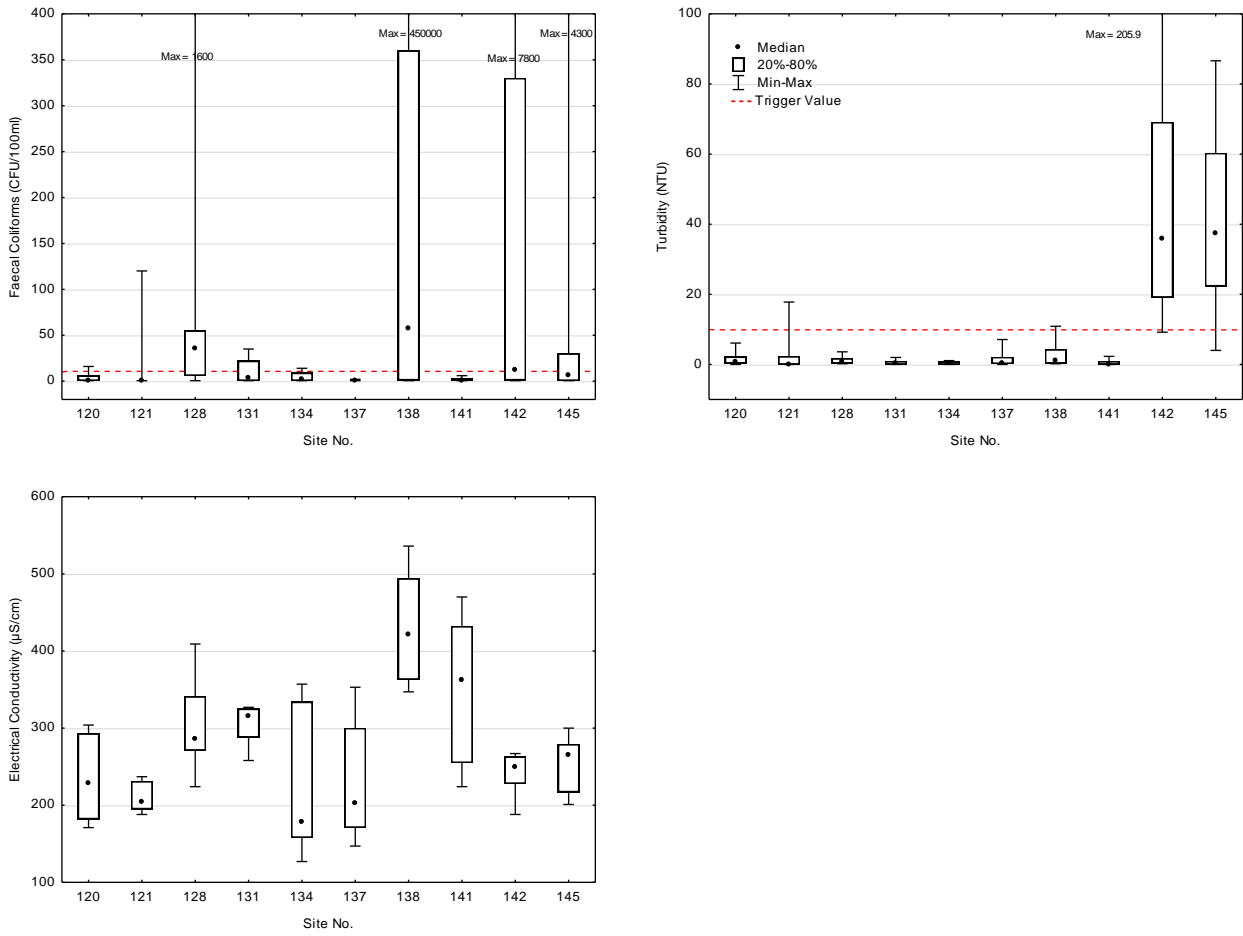


Figure 7.12 Water quality in stormwater harvesting and reuse systems: annual distribution of selected parameters comparing raw and treated stormwater

7.3.2 Landfill Sites

Seven (7) sites were monitored at three disused landfill locations during the 2014-2015 period; Wisemans Ferry, Arcadia Oval and Foxglove Oval. Arcadia Oval and Wisemans Ferry are monitored quarterly and Foxglove Oval is monitored monthly. Data from monitoring at Wisemans Ferry is incorporated into the Infrastructure and Recreation Division's report to the NSW EPA and not reported here.

Arcadia Oval

Two (2) sites were monitored at Arcadia Oval to assess the effectiveness of the leachate capture and treatment system in place. As these sites are

sampled quarterly (i.e. N=4) is more suitable to present the limited data in a table, not a box plot. Table 7.12 presents data from site 018 which is raw leachate and Table 7.13 presents data from site 094 which is treated leachate.

- Turbidity and suspended solids are reduced to below trigger values leachate treatment.
- Faecal coliforms are reduced to below trigger values following leachate treatment.
- Total nitrogen and ammonium-nitrogen are slightly reduced in treated leachate.
- Oxidised-nitrogen increased in treated leachate.

Summary statistics for site 018 - raw leachate at Arcadia Oval								
Site 018	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	18.398	18.665	14.200	22.060	14.200	22.060	3.238
Electrical Conductivity (µS/cm)	4	1123.750	1112.000	906.000	1365.000	906.000	1365.000	231.187
pH	4	6.750	6.770	6.650	6.810	6.650	6.810	0.071
Turbidity (NTU)	4	22.525	17.450	4.500	50.700	4.500	50.700	20.666
Dissolved oxygen (%sat)	4	19.725	12.550	2.100	51.700	2.100	51.700	23.310
Suspended Solids (mg/L)	4	21.250	20.500	4.000	40.000	4.000	40.000	17.462
Ammonium-Nitrogen (mg/L)	4	10.350	10.275	7.550	13.300	7.550	13.300	3.125
Oxidised Nitrogen (mg/L)	4	1.990	2.005	0.700	3.250	0.700	3.250	1.048
Total Nitrogen (mg/L)	4	13.568	14.000	8.470	17.800	8.470	17.800	4.313
Total Phosphorus(mg/L)	4	0.023	0.018	0.013	0.044	0.013	0.044	0.014
Faecal Coliforms (CFU/100ml)	4	55.250	13.000	5.000	190.000	5.000	190.000	90.005

Table 7.12 Summary statistics for raw leachate at Arcadia Oval for the 2014-15 reporting period

Summary statistics for site 094 - raw leachate at Arcadia Oval								
Site 094	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	17.470	17.625	13.010	21.620	13.010	21.620	3.527
Electrical Conductivity (µS/cm)	4	1123.750	1099.000	1053.000	1244.000	1053.000	1244.000	85.718
pH	4	7.663	7.655	7.630	7.710	7.630	7.710	0.036
Turbidity (NTU)	4	2.475	0.150	0.100	9.500	0.100	9.500	4.684
Dissolved oxygen (%sat)	4	41.600	41.400	15.000	68.600	15.000	68.600	29.429
Suspended Solids (mg/L)	4	2.250	1.000	1.000	6.000	1.000	6.000	2.500
Ammonium-Nitrogen (mg/L)	4	8.180	8.185	4.550	11.800	4.550	11.800	3.556
Oxidised Nitrogen (mg/L)	4	5.170	5.890	2.300	6.600	2.300	6.600	1.957
Total Nitrogen (mg/L)	4	14.075	14.350	10.700	16.900	10.700	16.900	2.554
Total Phosphorus(mg/L)	4	0.013	0.012	0.010	0.020	0.010	0.020	0.005
Faecal Coliforms (CFU/100ml)	4	2.125	1.000	0.500	6.000	0.500	6.000	2.594

Table 7.13 Summary statistics for treated leachate at Arcadia Oval for the 2014-15 reporting period

Foxglove Oval

Four sites were monitored at Foxglove Oval to assess the effectiveness of the leachate capture, treatment and reuse system. Site 077 is an urban creek downstream of Foxglove Oval. Site 095 is raw captured leachate, site 096 is leachate that has been treated by a bioreactor for nutrients and site 132 is the treated tank that is used for oval irrigation.

Graphical comparisons of water quality parameters against stormwater harvesting and irrigation guideline trigger values and the REHVs are presented in Figure 7.13.

- Fluoride results show that the treated leachate is not being used for irrigation as the treated tank (132) results indicate 100% potable water on all sampling occasions.

- Electrical conductivity and turbidity results show that the bioreactor is treating the leachate to a level below stormwater harvesting and reuse trigger values.
- Total nitrogen and ammonium-nitrogen are both significantly reduced through treatment in the bioreactor.
- Levels of nitrogen in Gleeson Creek are well above REHVs indicating some impacts from the landfill are still occurring.
- High faecal coliform results in Gleeson Creek (077) and in the treated leachate pit (096) indicate there may a source of faecal contaminants in the catchment which could require further investigation.

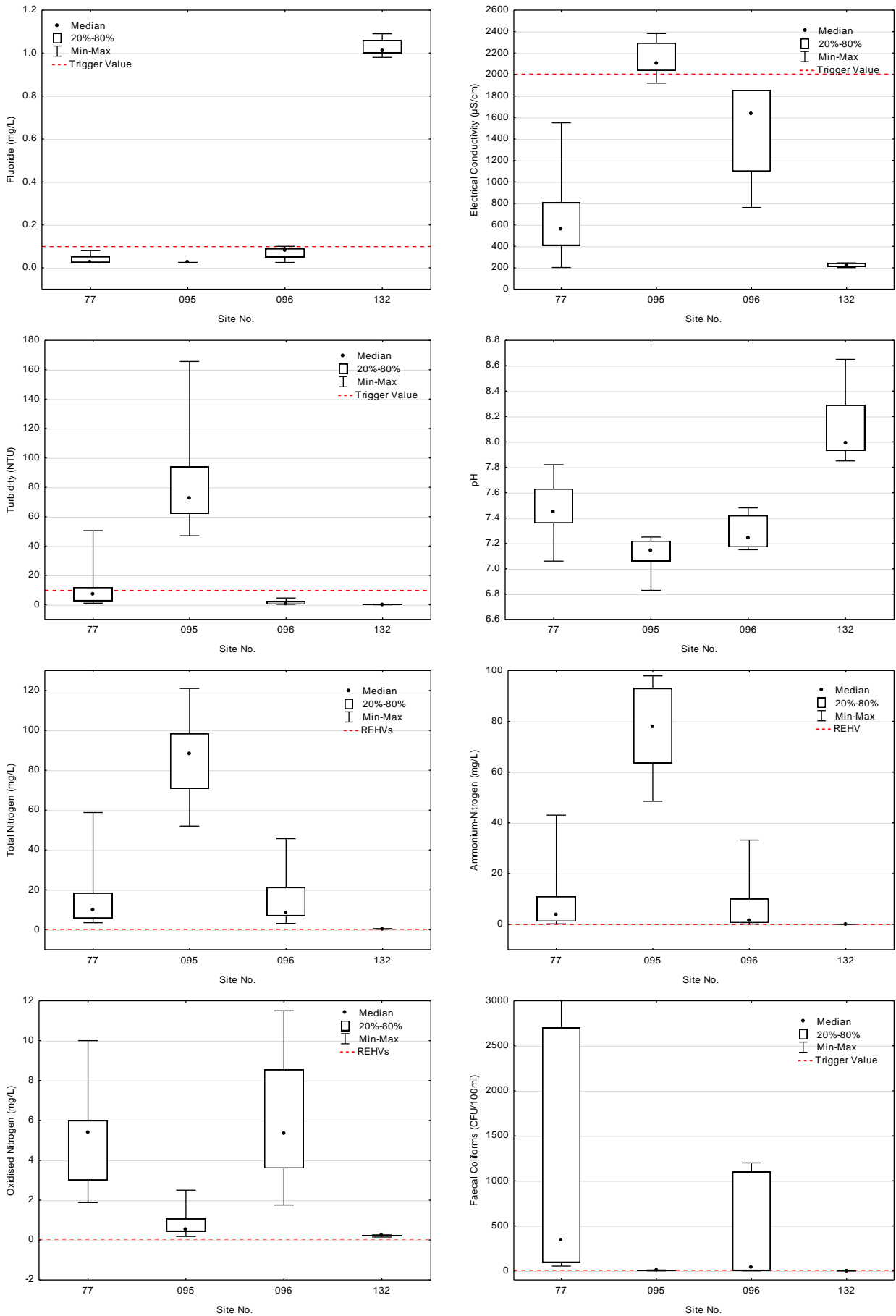


Figure 7.13 Quality of leachate from Foxglove Oval disused landfill site: annual distribution of selected parameters compared with REHVs for freshwater aquatic ecosystem health

8. Summary

Chemical, physical and biological water quality results for 2014-2015 show that catchment land-use and rainfall play a major role in the aquatic ecosystem health of the Shire's waterways. Rainfall contributed to the transport and deposition of land base pollutants such as sediment, nutrients and gross pollutants (litter) in streams, creeks and rivers. This is especially significant in areas with piped stormwater infrastructure where run-off moves rapidly and directly to the receiving waters.

Water quality results for the 2014-2015 reporting period have been assessed against REHVs developed specifically for Hornsby Shire (HSC 2012). Due to higher annual rainfall and a number of significant rainfall events many sites show a decline compared to results from last year. REHVs are being exceeded at most sites across the Shire, indicating the potential for impacts to aquatic ecosystem health.

Stormwater and sewage from overflows or failing infrastructure continue to be a problem in industrial and urban catchments where large areas of impervious surfaces and piped stormwater systems move catchment based pollutants quickly and directly to the receiving creeks. Onsite wastewater

management systems continue to place stress on waterways in rural settlements, particularly the townships of Galston and Glenorie. Rural catchment activities such as the intensive use of fertilisers and reduced vegetation are impacting on receiving waters further downstream. Despite significant upgrades to the West Hornsby and Hornsby Heights STPs in early 2000, both Berowra Creek and Calna Creek are impacted by treated effluent being discharged into these systems. Water quality results for estuarine areas are generally good however the upper sections of Marramarra and Berowra Creeks show signs of impacts from the upper catchments.

Ongoing maintenance and monitoring of stormwater harvesting and reuse facilities will reduce the use of potable water for irrigating playing ovals and prevent the flow of contaminated stormwater to urban creeks having positive outcomes for both aquatic ecosystem health and water conservation.

It is expected that a number of changes will be made to the current water quality monitoring program and reporting following the extensive program review that commenced in 2014. The revised program should be implemented by July 2016.

9. Acronyms

ANZECC	Australian and New Zealand Environmental and Conservation Council
ARI	Average Recurrence Interval
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
BOD	Biochemical Oxygen Demand
BOM	Bureau of Meteorology
CFU	Colony Forming Units
CRR	Catchment Remediation Rate
DO	Dissolved Oxygen
EC	Electrical Conductivity
NH ₃ -N	Ammonia-Nitrogen
NHMRC	National Health and Medical Research Council
NO _x	Oxidised Nitrogen
NWQMS	National Water Quality Management Strategy
PAL	Phytoplankton Action Levels
QA/QC	Quality Assurance / Quality Control
RACC	Regional Algal Coordinating Committee
REHV	Regional Environmental Health Value
SCEW	Standing Council on Environment and Water
SoJI	Statement of Joint Intent
SWC	Sydney Water Corporation
TN	Total Nitrogen
TP	Total Phosphorus
WTP	Wastewater Treatment Plant

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11. Appendices

Appendix A – Extract from Original Statement of Joint Intent

STATEMENT OF JOINT INTENT

It is hereby agreed that

Department of Planning
Environment Protection Authority
Hawkesbury-Nepean Catchment Management Trust
Hornsby Council
Water Board

will henceforth work together to achieve, within the framework of the current Urban Development Program, the ecologically sustainable development of the Berowra Creek catchment and the recovery of the environmental health of the Creek.

To this end it is agreed that the initial goal for Berowra Creek at Fishponds Waterhole and downstream shall be consistent with the pursuit of recreational activities such as swimming, canoeing and boating. Furthermore, it is agreed that fishing with confidence and safety and the protection of the shellfish industry are longer term goals. The values to be protected are defined by the Australian Water Quality Guidelines for Fresh and Marine Waters and are characterised as Primary Contact Recreation and Protection of Modified Aquatic Ecosystems for Fish, Crustacea and Shellfish.

It is also agreed that a Water Quality Management Strategy and a Plan of Management to achieve this initial goal will be jointly prepared and progressively implemented. All parties to this agreement will co-operate to ensure that a draft Water Quality Management Strategy for Berowra Creek is prepared and placed on exhibition by end of September 1994.

It is acknowledged that Berowra Creek contains excessive levels of nitrogen and high levels of phosphorus. Accordingly appropriate nutrient reduction measures will be implemented forthwith.

To this end the Water Board will install by end July 1994 measures at West Hornsby Sewage Treatment Plant to endeavour to achieve an arithmetic mean of 20 to 25mg/L Total Nitrogen concentration in the discharged effluent. Also the Water Board will make immediate operational changes to reduce phosphorus and faecal coliform concentrations in discharged effluent from West Hornsby Sewage Treatment Plant and Hornsby Heights Sewage Treatment Plant. Furthermore the Water Board will prepare and exhibit by end September 1994 an options study for Hornsby Heights Sewage Treatment Plant and West Hornsby Sewage Treatment Plant. The options study will propose technically feasible measures for further nitrogen reduction. The options of 15mg/L, 10 mg/L and 5mg/L Total Nitrogen (90 percentile) in discharged effluent and pumping effluent out of the catchment are to be specifically considered. The Water Board will prepare and publicly exhibit by end June 1995 an EIS for each of those options which the Technical Working Party established by the Minister for Planning considers feasible and warranting such examination. The Board undertakes that the option approved by the Minister for Planning will be put in operation expeditiously.

Hornsby Council undertakes that it will impose and enforce controls on construction sites so as to significantly reduce the sediment and other pollutants reaching the Creek from these sources. To this end Hornsby Council will prepare and exhibit by end September 1994 a draft Erosion and Sediment Control Code. Hornsby Council will prepare and exhibit by end September 1994 a

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revised Stormwater Management Code, a revised Stormwater Design Manual and an Issues Report on the remediation of the existing stormwater system. As part of implementing the Water Quality Management Strategy, Hornsby Council will also expeditiously prepare an options study, environmental assessment and an implementation strategy for reducing storm water nutrient ingress to Berowra Creek. Hornsby Council will utilise the principle of water sensitive urban design in its consideration of future developments.

The Hawkesbury-Nepean Catchment Management Trust will prepare and exhibit by end September 1994 a draft public education strategy.

The Water Board, Environment Protection Authority and Hornsby Council shall forthwith commence a catchment survey to identify and quantify sources of pollution so that appropriate remediation and enforcement action can be taken.

The Water Board, Environment Protection Authority and Hornsby Council shall forthwith establish a co-operative monitoring program for the waterways of Berowra Creek so that the effectiveness of changes can be measured and assessed.

The Department of Planning undertakes that it will not introduce any planning measures that are incompatible with the ecological sustainability of Berowra Creek.

Gabrielle Kibble

G Kibble
Director of Planning

N Shepherd

N Shepherd
Director-General
Environment Protection Authority

R Crawford

R Crawford
Chairman
Hawkesbury-Nepean Catchment Management Trust

*Endorsed,
Robert Webster*

C Meany

C Meany
Mayor
Hornsby Council

P Broad

P Broad
Managing Director
Water Board

27/4/94.

Appendix B - Detailed site descriptions of freshwater and estuarine sites monitored for aquatic ecosystem health

Reference Creeks

Site 36 Murray Anderson Creek. Site 36 is located in Murray Anderson Creek, which is a of Smiths Creek within the Cowan Creek catchment. Access is via boat from Cowan Creek with a short walk to the site. The catchment above this site is approximately 250 hectares in size, all within Ku-ring-gai Chase National Park. This site has been sampled since 1995.

Site 37 Smugglers Creek. Site 37 is located in Smugglers Creek, which is a tributary of Marramarra Creek within the Berowra Creek catchment. Access is via boat up Marramarra Creek and then on foot approximately 500m upstream. The catchment above this site is approximately 533 hectares in size, all within Marramarra National Park. This site has been sampled since 1995.

Site 54 Laughtondale Creek. Site 54 is located in Laughtondale Creek on the northern boundary of Marramarra National Park. Access is via Laughtondale Gully Rd. The catchment is approximately 312 hectares which has about 10% cleared land under horticulture. There is a gravel road running beside the creek for much of its length. During wet weather the creek can contain fresh coarse sediment washed off from the road. The creek flows through a narrow gully with a series of shallow pools of sandstone bedrock. The site was used as a reference site between 1996 and 2002, sampling of this site commenced again in 2011.

Site 114 Muogamarra Creek. Site 114 is located within Muogamarra Creek within Muogamarra Nature Reserve. The catchment is approximately 305 hectares of undisturbed bushland valley with sandstone geology. Access is by 4WD down Peats Trail from the Pacific Highway then by foot on a bush track for about 1 kilometre. The site is in a shady, freshwater section of the creek approximately, 100m upstream of the saltwater marsh of Peats Bight. The creek has crystal clear base flow, but surface water may cease in drought conditions, leaving stagnant pools.

Site 123 Peats Crater. Site 123 is located in an unnamed creek draining Peats Crater, here referred to as 'Peats Crater Creek', in Muogamarra Nature Reserve. Although its catchment size (at approximately 90 hectares) is not large, this site was chosen because of its predominantly basalt geology. The catchment includes exposure of igneous rock in a diatrema. The central part of the valley (crater) was cleared for farming in the late 1800's, but since the area was declared a Nature Reserve it has been undergoing natural revegetation. Access is by 4WD down Peats Trail from the Pacific Highway then by foot on a bush track for about 200m. Near the sample site the creek flows through a densely shaded gully and does not have a permanent base flow, drying out occasionally during drought conditions.

Site 147 Unnamed Creek. Site 147 is located in an unnamed creek, here referred to as 'Pennant Hills Oval Creek', which flows into Byles Creek from a small bushland catchment of about 33 hectares adjacent to the Pennant Hills Oval complex. This small creek flows after rainy periods but periodically dries out. It is in sandstone geology and the sample site has wide shallow pools on bare sandstone bedrock. It is believed to be the only remaining subcatchment of Lane Cove River that has not been subjected to degradation by urban development. Access to this site is along a walking track about 200m from the end of Day Rd, Cheltenham.

Site 149 Unnamed Creek. Site 149 is located in an unnamed creek in Canoelands, here referred to as 'Duckpond Ridge Creek', which flows through predominantly undisturbed bushland in sandstone geology within Marramarra National Park. The catchment is approximately 760 hectares and is bound by Duckpond Ridge, the Old Northern Road and Canoelands Ridge. Some relatively small areas (about 10%) of the catchment in its headwaters along Old Northern Road and Canoelands Road have been cleared for sand extraction and horticulture. The creek at the sample site is in a deep rocky gully, heavily shaded and with sandstone boulders covered in brown diatom growth. Access to the site is by 4WD to the north-eastern end of Duckpond Ridge fire trail and then a short walk through bushland.

Site 164 Djarra Crossing. Site 164 is located in the north arm of Joe Crafts Creek in Muogamarra Nature Reserve. The catchment is 90 hectares in undisturbed bushland in sandstone geology. Access is by 4WD from Glendale Road, Cowan and down the western fire trail to the creek crossing. The creek at the sample site is predominantly bare sandstone bedrock open to midday sunlight. Water flow may cease during drought conditions, although this has not occurred since monitoring started in May 2011.

Industrial Sites

Site 10 Larool Creek, Thornleigh. The headwaters of Larool Creek originate within the Thornleigh industrial area and flow in a northerly direction until it intersects Waitara Creek west of Hornsby. Site 10 on Larool Creek is about 100m downstream of Sefton Road. The catchment above this site is small, approximately 38 hectares, of which 34% is zoned residential, 51% is zoned commercial/business/industrial, 13% is open space and 2% is special uses. As indicated by the long term water quality monitoring results, this creek has received a consistent level of pollution which has resulted in poor water quality for many years. This creek consistently remains one of the most polluted within Hornsby Shire. This site has been sampled since October 1994.

Site 12 Hornsby Creek, Hornsby. Site 12 is located in Hornsby Creek, upstream of the road bridge at Leighton Place and flows into Ku-ring-gai Chase National Park. The catchment above this site is approximately 305 hectares in size and 60% of the landuse is residential comprising high, medium and low density residential zonings. Commercial/Industrial/Business makes up 17%, 10% is Special use A (roads, rail etc), 10% is Special use B (community purposes) and 2% is open space. This highly urbanised catchment contains large areas of impervious surfaces which can contribute to higher flow volumes during rain and rapidly transport pollutants to the creek. This site has been sampled since October 1994.

Site 13 Sams Creek, Mount Kuring-gai. This site is located in the headwaters of Sams Creek within Berowra Valley National Park, at the end of Hamley Road, Mt Kuring-gai. Industry dominates the landuse upstream of this site. The area was connected to sewer in 2008 and premises are being progressively connected. As of 2011 (the last inspections undertaken) more than half of the premises were connected, however some premises may still be relying on the pump out of effluent. Any new development in the area is required to connect to the sewer. The catchment above this site is approximately 18 hectares with 86% zoned industrial and 14% zoned open space. Downstream of this sample site the creek flows in a north westerly direction for 3km before it joins Berowra Creek. This site has been sampled since October 1994.

Rural Sites

Site 2 Tunks Creek, Galston Gorge. Site 2 is located at the bottom of the Tunks Creek catchment, 100 metres upstream of the confluence with Berowra Creek. The site is approximately 5 km downstream of rural and urban sources. The catchment area is approximately 1690 hectares with 65% being zoned rural and approximately 30% consisting of open space and environmental protection zones. Sampling commenced at this site in October 1994.

Site 42 Colah Creek, Glenorie. Site 42 is located in Colah Creek, upstream of the Wylds Road Bridge, Glenorie. The catchment above this site is approximately 990 hectares, 83% zoned as rural with the remaining areas being a mix of residential, main roads, commercial and open space. Sampling commenced at this site in October 1994.

Site 49 Still Creek, Arcadia. Site 49 is located in the upper reaches of Still Creek draining a catchment of approximately 440 hectares, 80% of which is zoned rural and 17% is open space. Sampling commenced at this site in October 1994.

Site 62 Cowan. This site is located in the headwaters of Kimmerikong Creek and receives run-off from the Cowan township. The monitoring site is located upstream of the former quarry. Sampling commenced at this site in July 2002. The catchment area is estimated to be approximately 11 hectares.

Site 63 Colah Creek, Glenorie. Site 63 is located in Colah Creek, prior to it flowing into Marramarra National Park. Sampling commenced at this site in July 2002. The site has an estimated catchment area of 2290 Ha.

Site 64 Tributary of Colah Creek, Galston. Site 64 is located off Salloway Road, Galston. The monitoring location is on a tributary of Colah Creek, which receives run-off from the Galston township. Sampling commenced at this site in July 2002. The catchment area is estimated to be 145 Ha.

Site 80 Glenorie Creek, Glenorie. Site 80 is located in Glenorie Creek at the corner of Tekopa Ave and Tecoma Drive Glenorie. Sampling commenced at this site in August 1999 to assess the impact of the Glenorie township and residential area, with onsite wastewater treatment systems, on water quality. This site is also impacted by market gardens and animal/hobby farms. The catchment area is approximately 100 Ha.

Urban Sites

Site 4 Berowra Creek, Westleigh. Site 4 is located in the Berowra Valley National Park and is accessed by the Benowie walking track below Westleigh. The estimated catchment area is 1230 hectares. Monitoring started here in October 1994. The site is surrounded by predominantly bushland areas which buffer the influences of surrounding development by filtering stormwater pollution. This site is upstream of the two sewage treatment plants which discharge into Berowra Creek, but is influenced by stormwater from roads and residential developments of Westleigh, Pennant Hills, parts of Thornleigh and Cherrybrook.

Site 5 Pyes Creek, Cherrybrook. Site 5 is located in Pyes Creek at Cherrybrook and drains a catchment of approximately 380 hectares of which 79% is zoned residential. The site is located in a section of creek that has extensive patches of exposed bedrock. Monitoring started here in October 1994.

Site 6 Georges Creek, Cherrybrook. Site 6 is located within Georges Creek. The upstream area of the catchment is 440 hectares in size with 56% zoned rural, 20% zoned residential and approximately 24% being zoned open space and environmental protection. The site is located adjacent to a gabion wall constructed to retain a sewage pumping station. Monitoring started here in October 1994.

Site 8 Devlins Creek, Cheltenham. Site 8 is located in Devlins Creek, adjacent to Sutherland Road at Cheltenham and is about 200m downstream of the crossing of the M2 Motorway. The catchment above this site is approximately 823 hectares with about 8% falling in the Parramatta City Council area. Almost 77% of this catchment is zoned residential with the remaining 23% consisting of special uses (9%), commercial/industrial and business (1%) and open space (13%). Monitoring started here in October 1994.

Site 39 Joe Crafts Creek, Berowra. Site 39 on Joe Crafts Creek is located in the freshwater section of the creek about 100m above the tidal influence of Berowra Creek. Joe Crafts Creek at the sampling site is characterised by a rocky substrate with large boulders throughout the creek. The estimated catchment area is 688 ha. Sampling commenced at this site in October 1994. The site receives runoff predominantly from a large area of bushland and from parts of the Berowra urban area. The site differs from other urban area monitoring sites as it is further (4km) downstream from the associated urban development. The site provides a good indication of water quality for the Joe Crafts Creek catchment as a whole as the site is close to its confluence with Berowra Creek.

Site 46 Unnamed tributary of Terrys Creek, Epping. Site 46 is located in a tributary of Terrys Creek at Epping in the Lane Cover River catchment. Part of the creek is piped under the M2 Motorway. The catchment above this site is approximately 82 hectares, 87% of which is zoned residential. Monitoring started here in October 1994. During the construction and expansion of the M2 motorway it was necessary to relocate this site approximately 200m downstream of the original location (Site 46A).

Estuarine Sites

Site 38 Sandbrook Inlet. This site is located in the navigation channel towards the upstream end of Sandbrook Inlet, Brooklyn. This area is heavily influenced by marine industry and is characterised by shallow foreshores with a navigation channel down the middle of the inlet and swing moorings on either side. The Inlet is bound by marina operations and residential development along the southern shore and Long Island Nature Reserve to the north. Sandbrook Inlet is not open to the Hawkesbury River at the eastern end. The Brooklyn area commenced connection to the Brooklyn STP in 2006/07.

Site 48 Marramarra Creek. This site is located within Marramarra National Park in the estuarine tidal reaches of Marramarra Creek (adjacent to the old orange orchard). The creek receives runoff from a large area of undisturbed bushland as well as rural developments at Galston, Glenorie, Fiddletown, Arcadia, Forrest Glen and Canoelands. The site has been monitored since October 1994.

Site 60 Berowra Creek. This site is located in the middle of Berowra Creek at Berowra Waters, downstream of the Berowra Ferry crossing. The site is characterised by the ferry crossing, marina operations, swing moorings and residential development along the foreshore. The site has been monitored since 1997.

Site 61 Berowra Creek. This site is located in Berowra Creek at Calabash Point. The site has a depth of approximately 15m which is unusually deep compared to the rest of Berowra Creek. This site has been monitored

since 1997. In 2002 a remote water quality monitoring probe was deployed to monitor temperature, salinity and chlorophyll-a, acting as an early warning device for algal bloom detection. Detailed information on the Council's remote water quality monitoring buoys can be found in the Hawkesbury Estuary Program Annual Reports.

Site 100 Berowra Creek. This site is located at the northern beach of Crosslands Reserve, in the upper reaches of Berowra Creek.

Site 103. This site is located at the eastern end of Milsons Passage. This site is influenced by the river side settlement of Milsons Passage and sampled by boat.

Site 108. This site is located off Bradleys Beach, Dangar Island, Hawkesbury River. The site is primarily marine and highly influenced by tidal movement. This is a popular recreational area.

Sites 150 – 153 Hawkesbury River. Council has deployed a number of remote water quality monitoring buoys along the salinity gradient of the Hawkesbury River estuary, from the freshwater of Wisemans Ferry to the marine waters off Gonyah Point. Water quality data collected at these sites includes temperature, salinity and chlorophyll-a levels and is available at www.hornsby.nsw.gov.au/estuary.

Site 174. This site is located in the mouth of Mullet Creek on the Hawkesbury River. The site is primarily marine and highly influenced by tidal movement. This location is an oyster growing area.

Appendix C - Detailed site descriptions of sites monitored to assess the performance of catchment remediation initiatives

Site 43 Calna Creek. Site 43 is located in the freshwater section of Calna Creek 4km downstream of the HHSTP outfall, and approximately 1km upstream of the confluence with the Berowra Creek estuary. The estimated catchment area is 1060 Ha. This section of creek is shaded by vegetation and the substrate consists of large sandstone boulders. Sampling at this site gives a good indication of the quality of water entering Berowra Creek from the Calna Creek catchment. Dry weather flows in Calna Creek are dominated by STP discharge which contains high levels of oxidised nitrogen. Monitoring started here in October 1994.

Site 52 Calna Creek. This site is located in Calna Creek about 300m above the STP outfall. The water quality at site 52 provides a direct indication of the influence of the urban catchment on water quality compared to the STP. The catchment area above this site is approximately 280 hectares with 59% zoned residential. Monitoring started here in November 1995.

Site 1 Berowra Creek. Site 1 is located on Berowra Creek at Galston Gorge and is included in the section, with other sites associated with the WHSTP, because of the significant influence of the WHSTP on water quality this far downstream in Berowra Creek. The catchment area above this site is approximately 5550 hectares with 30% zoned rural, 33% residential and 19% national parks and reserves. Other landuses in the catchment include open space, industrial/commercial/business, special uses and environmental protection. Monitoring started here in November 1994.

Site 23 Waitara Creek. Site 23 is located approximately 100 metres upstream of the WHSTP outfall and is situated in the pool above a fire trail crossing. This site drains the Waitara Creek catchment which contains residential, commercial, small areas of open space as well as Larool Creek which drains the Thornleigh industrial area. The total catchment area above this sampling site is 650 hectares. Of this catchment area 58% is zoned residential, 19% is zoned special uses, 18% is zoned open space and 5% is zoned commercial. Monitoring started here in October 1994.

Site 45 Fishponds, Berowra Creek. This site is located in the Berowra Valley Regional Park and is influenced by the catchments of upper Berowra Creek and Waitara Creek, of the Pyes/Georges Creek catchments, as well as West Hornsby STP which discharges into Waitara Creek. The volume of treated waters discharged by the STP accounts for a significant fraction of the base flow at Fishponds. The high concentrations of nitrogen species at Fishponds and downstream can mainly be attributed to the WHSTP. Notwithstanding the current effect of the STP on nitrogen concentrations downstream of the discharge point, it should be noted that the concentration values at Fishponds are now about 10-20% of those routinely recorded before the STP upgrade works about 2003. Nevertheless further nutrient removal is required to achieve Guideline values for nitrogen.

The catchment area above this site is approximately 3370 hectares of which 12% is zoned rural, 46% is zoned residential, 3% is zoned industrial/commercial/business, 10% is special uses, 9% is open space, 3% is environmental protection and 17% is national parks and reserves. Monitoring started here in October 1994.

Berowra Oval, Berowra (Sites 128, 131). Berowra Oval is a 2 hectare park that includes a 1.3 hectare sports oval as well as vegetated surrounds comprised of trees and recreational areas. This scheme harvests runoff from the 17.5 hectare mostly developed areas surrounding Berowra Oval. The catchment primarily consists of an established residential area, including some open space area. This project has been operational since 2009 (Storm Consulting 2012(a)).

Community Nursery, Pennant Hills (Sites 98, 180). The nursery grounds constitute the 0.7 hectare water supply catchment for the Earthwise Cottage scheme. The nursery grounds comprise of unsealed gravel surfaces with slope at roughly 6% towards the western boundary. Surface runoff drains to the western boundary, where it is collected by vegetated bio-swales and conveyed to an off take pit located at a low point within the site. The project has been operational since January 2004 (Storm Consulting 2012(g)).

Epping Oval, Epping (Sites 134, 137). Epping Oval is a 4 hectare park with a 1.3 hectare sports oval and athletics track, car park, as well as vegetated surrounds comprising of trees and recreational areas. This scheme harvests stormwater from a 4 hectare suburban catchment for the purpose of irrigating the oval, athletics track and

playground gardens. The catchment is dominated by open space parklands, fringed by residential areas and two sealed roads. The project has been operational since 2011 (Storm Consulting 2012(b)).

Greenway Park, Cherrybrook (Sites 120, 121). This scheme captures stormwater from an 8 hectare catchment which is treated and used for irrigation of two playing fields. The catchment is dominated by open space parklands, and includes some residential and commercial areas, which do not pose any major risks to water quality. The project has been operational since 2009 (Storm Consulting 2012(d)).

North Epping Oval, North Epping (Sites 138, 141). North Epping is a 3.4 hectare park that includes a 1.3 hectare sports oval, two enclosed tennis/netball courts, car park, as well as vegetated surrounds comprised of a mix of both trees and grasses. This scheme harvests stormwater from a 4 hectare suburban catchment for irrigating the sports oval. The catchment is dominated by open space, residential areas and two sealed roads (Storm Consulting 2012(e)).

Somerville Oval, Epping (Sites 142, 145). Somerville oval is a 3 hectare park that includes a 1.3 hectare sports oval, amenities buildings, playground and car park as well as surrounds comprised of trees and recreational areas. This scheme harvests stormwater from a 25 hectare suburban catchment for irrigating the oval. The catchment is dominated by open space parklands, fringed by residential areas and intersected by a railway line (Storm Consulting 2012(f)).

Arcadia Landfill (Sites 18, 94). The Arcadia landfill near Arcadia Park was remediated in 1997/1998 by clay capping. Water management included separation of stormwater seepages. The captured leachate is collected in underground tanks and treated using a trailer-mounted bioreactor. Water is tested at two sites to assess the effectiveness of seepage collection and the bioreactor performance.

Foxglove Oval, Mt Colah (Sites 77, 95, 96, 132). Foxglove oval was initially operated as a landfill site which closed in 1980. The landfill site was compacted, capped and converted into an oval in 1985. In the 1990's Council installed a water quality treatment process to reduce the impacts of the leachate leaving the site. With the leachate being treated to a quality suitable for irrigation, a harvesting system was commissioned and completed in 2010.

Wisemans Ferry Landfill (Sites 56, 112). This landfill site ceased operation in 2002. The tip has been clay capped with ongoing revegetation and water management activities. Two sites are monitored quarterly: the leachate collection dam (Site 56) and Riser 'C' (Site 112). Water quality monitoring is a requirement of the Environmental Protection Licence issued for this site. Council's Work Division currently manages the disused landfill site and associated licence, reporting to State Government as required.

Appendix D – NSW Food Authority Phytoplankton Action levels

The following table summarises the phytoplankton levels (in cells/litre) which are used to trigger sampling of shellfish flesh. The levels relate to discrete or composite samples. These levels are a combination of levels used internationally and in various states in Australia. They should be revised as further monitoring and research is undertaken and supports a change.

Phytoplankton species	Toxin	Trigger flesh sampling [#] (cells per litre)	Alert level – Close harvest area pending flesh testing results	Issue public health warning (cells per litre)
<i>Alexandrium minutum</i> [#]	PSP	200	500	5000
<i>Alexandrium ostenfeldii</i> [#]	PSP	200	500	5000
<i>Alexandrium catenella</i> [#]	PSP	200	500	5000
<i>Alexandrium tamarense</i> [#]	PSP	200	500	5000
<i>Alexandrium spp.</i> [#]	PSP (?)			
<i>Gymnodinium catenatum</i>	PSP	1000 mussels 2000 other shellfish	5000	5000
<i>Pseudonitzschia (P.multiseriis & P.australis)</i> *	ASP	50,000	500,000	N/A
<i>Pseudonitzschia delicatissima</i> group – historically non-toxic in Australia	ASP (?)	500,000		N/A
<i>Karenia cf. brevis</i>	NSP	1000		5000
<i>Dinophysis acuminata</i>	DSP	1000		N/A
<i>Dinophysis acuta</i>	DSP	500		N/A
<i>Dinophysis caudata</i>	DSP	500		N/A
<i>Dinophysis fortii</i>	DSP	500		N/A
<i>Dinophysis hastate</i>	DSP	500		N/A
<i>Dinophysis mitra</i>	DSP	500		N/A
<i>Dinophysis rotundata</i>	DSP	500		N/A
<i>Dinophysis tripos</i>	DSP	500		N/A
Total <i>Dinophysis spp.</i>	DSP	500		N/A
<i>Prorocentrum lima</i>	DSP	500		N/A

Note: For *Pseudonitzschia spp.* risk remains high for a minimum of two weeks post bloom crash. The cell levels within each toxin group are cumulative, eg 600 cells/l of both *D. acuta* and *D. fortii* would mean a total count of 1200 cells/l, exceeding the critical level to initiate flesh testing.

[#] *Alexandrium* species may be difficult to identify when numbers are low. If any doubt exists, they should be treated as potentially toxic.

* Species within the *Pseudo-nitzschia* groups are difficult to identify. The toxic species of most concern in each group are listed for those laboratories that have capacity to identify these algae to species level. Otherwise all algae within these groups should be considered potentially toxic.

Appendix E – Bureau of Meteorology rainfall stations

Station No.	Location
67089	West Pennant Hills (Cumberland State Forest)
66124	Parramatta North (Masons Drive)
66119	Mt Kuring-Gai (Ledora Farm)
67065	Hornsby (Swimming Pool)
67014	Maroota (Old Telegraph Rd)
67086	Dural (Old Northern Road)
67062	Cherrybrook (Casuarina Drive)
67052	Berowra (Goodwyn Road)
67010	Glenorie (Old Northern Road)
66047	Pennant Hills (Yarra Road)
61119	Wisemans Ferry (Old PO)
66211	Wahroonga (Ada Avenue)

Appendix F – Individual Site Summary Statistics

Summary Statistics for Site 001 for July 2014 to June 2015								
Site 001	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	16.443	17.170	10.600	22.100	12.660	18.970	3.830
Electrical Conductivity (ms/cm)	12	0.465	0.545	0.120	0.660	0.280	0.620	0.180
Electrical Conductivity (µS/cm)	12	468.417	544.000	166.000	652.000	276.000	611.000	177.800
Turbidity (NTU)	12	10.617	0.750	0.000	52.100	0.100	16.800	19.690
Dissolved oxygen (mg/L)	12	9.345	9.450	7.290	11.520	7.990	10.580	1.430
Dissolved oxygen (%sat)	12	95.025	97.250	85.020	107.900	87.684	101.200	7.770
pH	12	7.443	7.500	6.590	7.810	7.320	7.700	0.320
Salinity (ppt)	12	0.231	0.270	0.060	0.330	0.140	0.310	0.090
Suspended Solids (mg/L)	12	7.333	1.000	1.000	46.000	1.000	4.000	14.570
Ammonium-Nitrogen (mg/L)	12	0.055	0.015	0.010	0.270	0.010	0.060	0.090
Oxidised Nitrogen (mg/L)	12	2.235	2.300	0.530	4.800	0.870	3.000	1.340
Total Nitrogen (mg/L)	12	2.905	2.895	1.300	5.530	1.540	3.560	1.350
Total Phosphorus(mg/L)	12	0.080	0.054	0.031	0.210	0.042	0.101	0.060
Faecal Coliforms (CFU/100ml)	12	7824.50	109.00	6.00	49000.00	30.00	3800.00	17270.82
Enterococci (CFU/100ml)	5	1232.20	200.00	22.00	5600.00	35.50	2945.00	2444.15
Bicarbonate Alkalinity (mg/CaCO3/L)	4	49.500	54.850	29.700	58.600	29.700	58.600	13.480
Chloride (mg/L)	4	61.250	64.000	32.000	85.000	32.000	85.000	24.680
Fluoride (mg/L)	4	0.288	0.245	0.080	0.580	0.080	0.580	0.210
Sodium (mg/L)	4	44.500	44.750	20.200	68.300	20.200	68.300	22.340
Sulphate as SO42-(mg/L)	4	43.000	42.500	13.000	74.000	13.000	74.000	27.580
Potassium (mg/L)	4	6.668	4.320	3.130	14.900	3.130	14.900	5.570
Magnesium (mg/L)	4	6.080	6.325	3.140	8.530	3.140	8.530	2.300
Calcium (mg/L)	4	23.450	21.650	11.000	39.500	11.000	39.500	12.750
Aluminium (ug/L)	4	665.500	175.000	32.000	2280.000	32.000	2280.000	1078.450
Arsenic (ug/L)	4	0.875	0.500	0.500	2.000	0.500	2.000	0.750
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.250	0.750	0.500	3.000	0.500	3.000	1.190
Copper (ug/L)	4	5.500	5.500	3.000	8.000	3.000	8.000	2.080
Lead (ug/L)	4	1.375	0.500	0.500	4.000	0.500	4.000	1.750
Manganese (ug/L)	4	14.000	8.000	5.000	35.000	5.000	35.000	14.070
Molybdenum (ug/L)	4	1.000	0.750	0.500	2.000	0.500	2.000	0.710
Nickel (ug/L)	4	1.625	1.500	0.500	3.000	0.500	3.000	1.110
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	13.500	12.500	7.000	22.000	7.000	22.000	6.240
Boron (ug/L)	4	32.500	27.000	25.000	51.000	25.000	51.000	12.400
Iron (ug/L)	4	779.500	427.000	204.000	2060.000	204.000	2060.000	863.250
Mercury (ug/L)	4	0.005	0.005	0.005	0.010	0.005	0.005	0.000

Summary Statistics for Site 002 for July 2014 to June 2015								
Site 002	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	14.934	14.830	8.420	20.300	11.720	18.380	3.854
Electrical Conductivity (ms/cm)	12	0.281	0.305	0.130	0.380	0.220	0.340	0.077
Electrical Conductivity (µS/cm)	12	283.000	301.000	160.000	387.000	176.000	362.000	81.038
Turbidity (NTU)	12	8.525	1.450	0.000	46.000	0.500	16.500	14.885
Dissolved oxygen (mg/L)	12	9.995	9.960	8.020	12.290	9.470	10.560	1.212
Dissolved oxygen (%sat)	12	98.540	96.700	90.800	107.800	95.100	102.400	5.092
pH	12	6.962	7.150	5.400	7.310	6.950	7.290	0.547
Salinity (ppt)	12	0.140	0.155	0.060	0.190	0.110	0.170	0.041
Suspended Solids (mg/L)	12	3.333	1.000	1.000	19.000	1.000	4.000	5.365
Ammonium-Nitrogen (mg/L)	12	0.009	0.010	0.005	0.020	0.005	0.010	0.004
Oxidised Nitrogen (mg/L)	12	0.122	0.035	0.010	0.730	0.030	0.140	0.203
Total Nitrogen (mg/L)	12	0.423	0.275	0.140	1.430	0.210	0.570	0.366
Total Phosphorus(mg/L)	12	0.024	0.011	0.004	0.114	0.006	0.041	0.032
Faecal Coliforms (CFU/100ml)	12	283.292	10.500	0.500	2000.000	2.000	110.000	638.957
Enterococci (CFU/100ml)	5	21.400	22.000	3.000	40.000	8.500	34.000	13.993
E Coli (CFU/100mL)	2	6.000	6.000	6.000	6.000	6.000	6.000	0.000
Bicarbonate Alkalinity (mg/CaCO3/L)	4	17.750	16.350	13.500	24.800	13.500	24.800	4.902
Chloride (mg/L)	4	60.250	62.500	35.000	81.000	35.000	81.000	19.687
Sulphate as SO42-(mg/L)	4	12.975	12.500	6.900	20.000	6.900	20.000	5.392
Fluoride (mg/L)	4	0.050	0.050	0.050	0.050	0.050	0.050	0.000
Sodium (mg/L)	4	33.550	31.900	20.100	50.300	20.100	50.300	12.836
Potassium (mg/L)	4	3.335	3.030	2.500	4.780	2.500	4.780	1.042

Magnesium (mg/L)	4	5.915	5.490	3.240	9.440	3.240	9.440	2.631
Calcium (mg/L)	4	7.600	7.145	5.710	10.400	5.710	10.400	1.992
Aluminium (ug/L)	4	603.750	260.000	35.000	1860.000	35.000	1860.000	847.382
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.125	0.500	0.500	3.000	0.500	3.000	1.250
Copper (ug/L)	4	1.375	1.000	0.500	3.000	0.500	3.000	1.109
Lead (ug/L)	4	0.875	0.500	0.500	2.000	0.500	2.000	0.750
Manganese (ug/L)	4	8.500	7.000	5.000	15.000	5.000	15.000	4.509
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	0.875	0.500	0.500	2.000	0.500	2.000	0.750
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	4.375	5.000	2.500	5.000	2.500	5.000	1.250
Boron (ug/L)	4	20.750	20.000	19.000	24.000	19.000	24.000	2.217
Iron (ug/L)	4	656.000	418.500	247.000	1540.000	247.000	1540.000	597.038
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 004 for July 2014 to June 2015								
Site 004	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	14.802	14.205	8.490	20.650	11.650	19.950	3.902
Electrical Conductivity (ms/cm)	12	0.317	0.320	0.220	0.450	0.240	0.370	0.077
Electrical Conductivity (µS/cm)	12	323.583	315.000	225.000	425.000	267.000	399.000	68.704
Turbidity (NTU)	12	4.542	1.600	0.800	26.600	1.000	5.600	7.272
Dissolved oxygen (mg/L)	12	8.981	9.515	5.930	11.280	7.040	10.960	1.941
Dissolved oxygen (%sat)	12	86.604	91.725	66.100	100.800	72.200	99.500	13.827
pH	12	7.380	7.345	7.170	7.600	7.250	7.560	0.158
Salinity (ppt)	12	0.158	0.160	0.110	0.220	0.120	0.190	0.040
Suspended Solids (mg/L)	13	1.538	1.000	1.000	4.000	1.000	3.000	1.050
Ammonium-Nitrogen (mg/L)	13	0.088	0.010	0.005	0.650	0.005	0.170	0.181
Oxidised Nitrogen (mg/L)	13	0.302	0.170	0.080	1.250	0.080	0.270	0.369
Total Nitrogen (mg/L)	13	0.630	0.370	0.270	1.690	0.330	1.080	0.471
Total Phosphorus(mg/L)	13	0.036	0.035	0.009	0.073	0.012	0.060	0.021
Faecal Coliforms (CFU/100ml)	13	848.23	71.00	11.00	5400.00	26.00	1200.00	1691.37
Enterococci (CFU/100ml)	6	55.83	43.50	32.00	90.00	38.00	88.00	26.14
E Coli (CFU/100mL)	2	48.00	48.00	40.00	56.00	40.00	56.00	11.31
Bicarbonate Alkalinity (mg/CaCO3/L)	5	39.440	38.100	30.800	50.800	34.150	45.400	7.238
Chloride (mg/L)	5	49.400	45.000	36.000	79.000	36.000	65.000	17.729
Sulphate as SO42-(mg/L)	5	12.260	13.000	6.600	18.000	6.650	17.500	5.452
Fluoride (mg/L)	5	0.178	0.200	0.090	0.270	0.105	0.240	0.073
Sodium (mg/L)	5	30.660	27.000	25.300	41.600	26.050	37.100	6.717
Potassium (mg/L)	5	2.880	3.260	1.800	3.720	1.970	3.600	0.855
Magnesium (mg/L)	5	5.610	5.410	4.270	7.680	4.545	6.775	1.305
Calcium (mg/L)	5	16.960	16.600	13.300	21.200	14.850	19.250	2.825
Aluminium (ug/L)	5	520.000	66.000	34.000	2100.000	47.500	1219.500	891.930
Arsenic (ug/L)	5	0.800	0.500	0.500	2.000	0.500	1.250	0.671
Cadmium (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	5	1.200	1.000	0.500	2.000	0.500	2.000	0.758
Copper (ug/L)	5	2.800	3.000	1.000	4.000	1.500	4.000	1.304
Lead (ug/L)	5	0.800	0.500	0.500	2.000	0.500	1.250	0.671
Manganese (ug/L)	5	14.800	15.000	12.000	17.000	13.000	16.500	1.924
Molybdenum (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	5	0.900	0.500	0.500	2.000	0.500	1.500	0.652
Silver (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Selenium (ug/L)	5	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Uranium (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	5	17.000	17.000	8.000	26.000	11.500	22.500	6.519
Boron (ug/L)	5	41.600	38.000	27.000	57.000	28.000	57.000	14.656
Iron (ug/L)	5	1298.200	1470.000	517.000	1920.000	615.500	1895.000	650.897
Mercury (ug/L)	5	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 005 for July 2014 to June 2015								
Site 005	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	15.480	14.620	10.410	21.000	12.640	20.300	3.470
Electrical Conductivity (ms/cm)	12	0.690	0.740	0.260	1.300	0.470	0.800	0.290
Electrical Conductivity (µS/cm)	12	720.170	727.500	253.000	1313.000	501.000	945.000	291.080
Turbidity (NTU)	12	7.530	3.750	1.000	25.200	1.200	12.200	7.980

Dissolved oxygen (mg/L)	12	8.490	8.910	5.680	11.000	7.000	9.600	1.700
Dissolved oxygen (%sat)	12	83.620	86.200	63.300	99.000	69.600	97.000	12.580
pH	12	7.420	7.440	7.100	7.800	7.240	7.500	0.170
Salinity (ppt)	12	0.350	0.370	0.130	0.700	0.230	0.400	0.150
Suspended Solids (mg/L)	12	2.580	1.000	1.000	8.000	1.000	5.000	2.500
Ammonium-Nitrogen (mg/L)	12	0.080	0.030	0.010	0.500	0.010	0.100	0.150
Oxidised Nitrogen (mg/L)	12	0.550	0.480	0.060	1.800	0.140	0.800	0.490
Total Nitrogen (mg/L)	12	0.950	0.750	0.400	2.200	0.430	1.300	0.580
Total Phosphorus(mg/L)	12	0.040	0.030	0.026	0.100	0.029	0.000	0.020
Faecal Coliforms (CFU/100ml)	12	10051.75	205.00	33.00	110000.00	98.00	4100.00	31518.95
Enterococci (CFU/100ml)	5	2512.60	210.00	42.00	12000.00	51.50	6125.00	5304.39
E Coli (CFU/100mL)	2	55215.00	55215.00	430.00	110000.00	430.00	110000.00	77477.69
Bicarbonate Alkalinity (mg/CaCO3/L)	4	57.130	59.800	40.600	68.300	40.600	68.300	12.440
Chloride (mg/L)	4	86.750	94.500	38.000	120.000	38.000	120.000	34.940
Sulphate as SO42-(mg/L)	4	118.250	113.000	17.000	230.000	17.000	230.000	107.480
Fluoride (mg/L)	4	0.200	0.210	0.090	0.300	0.090	0.300	0.100
Sodium (mg/L)	4	87.230	92.550	27.800	136.000	27.800	136.000	55.010
Potassium (mg/L)	4	8.220	8.380	2.830	13.300	2.830	13.300	5.300
Magnesium (mg/L)	4	7.510	7.610	3.810	11.000	3.810	11.000	2.940
Calcium (mg/L)	4	34.680	30.150	17.300	61.100	17.300	61.100	18.950
Aluminium (ug/L)	4	552.250	434.000	31.000	1310.000	31.000	1310.000	540.160
Arsenic (ug/L)	4	0.630	0.500	0.500	1.000	0.500	1.000	0.250
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.630	1.000	0.500	4.000	0.500	4.000	1.600
Copper (ug/L)	4	4.500	4.500	3.000	6.000	3.000	6.000	1.290
Lead (ug/L)	4	1.130	0.500	0.500	3.000	0.500	3.000	1.250
Manganese (ug/L)	4	30.500	30.500	18.000	43.000	18.000	43.000	13.870
Molybdenum (ug/L)	4	2.380	2.000	0.500	5.000	0.500	5.000	1.890
Nickel (ug/L)	4	1.750	1.500	1.000	3.000	1.000	3.000	0.960
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	17.000	16.500	15.000	20.000	15.000	20.000	2.160
Boron (ug/L)	4	41.500	37.000	24.000	68.000	24.000	68.000	19.810
Iron (ug/L)	4	1054.250	927.500	692.000	1670.000	692.000	1670.000	425.280
Mercury (ug/L)	4	0.010	0.010	0.005	0.000	0.005	0.000	0.000

Summary Statistics for Site 006 for July 2014 to June 2015								
Site 006	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	15.395	14.685	10.020	20.870	12.270	20.560	3.698
Electrical Conductivity (ms/cm)	12	0.392	0.370	0.320	0.500	0.350	0.490	0.064
Electrical Conductivity (µS/cm)	12	392.833	374.500	300.000	469.000	352.000	460.000	56.248
Turbidity (NTU)	12	10.775	3.100	0.600	72.200	1.100	15.100	20.413
Dissolved oxygen (mg/L)	12	9.082	9.360	6.010	11.510	7.480	10.630	1.801
Dissolved oxygen (%sat)	12	88.868	92.250	67.300	101.800	77.500	97.500	11.944
pH	12	7.515	7.530	7.200	7.740	7.470	7.630	0.147
Salinity (ppt)	12	0.192	0.190	0.130	0.250	0.170	0.240	0.036
Suspended Solids (mg/L)	12	2.250	1.000	1.000	8.000	1.000	3.000	2.094
Ammonium-Nitrogen (mg/L)	12	0.012	0.010	0.005	0.030	0.005	0.010	0.009
Oxidised Nitrogen (mg/L)	12	0.196	0.085	0.010	0.730	0.020	0.250	0.250
Total Nitrogen (mg/L)	12	0.593	0.515	0.220	1.290	0.310	0.830	0.358
Total Phosphorus(mg/L)	12	0.043	0.039	0.013	0.120	0.019	0.062	0.031
Faecal Coliforms (CFU/100ml)	12	572.08	165.00	15.00	4400.00	29.00	590.00	1225.45
Enterococci (CFU/100ml)	5	345.20	330.00	68.00	890.00	83.00	615.00	329.78
E Coli (CFU/100mL)	2	250.00	250.00	150.00	350.00	150.00	350.00	141.42
Bicarbonate Alkalinity (mg/CaCO3/L)	4	49.475	49.400	40.000	59.100	40.000	59.100	8.918
Chloride (mg/L)	4	66.750	64.000	49.000	90.000	49.000	90.000	17.212
Sulphate as SO42-(mg/L)	4	19.400	23.000	5.600	26.000	5.600	26.000	9.344
Fluoride (mg/L)	4	0.103	0.100	0.090	0.120	0.090	0.120	0.013
Sodium (mg/L)	4	40.975	40.600	34.000	48.700	34.000	48.700	6.214
Potassium (mg/L)	4	4.790	4.750	4.340	5.320	4.340	5.320	0.503
Magnesium (mg/L)	4	7.455	7.690	5.450	8.990	5.450	8.990	1.493
Calcium (mg/L)	4	20.775	20.950	17.600	23.600	17.600	23.600	3.169
Aluminium (ug/L)	4	1724.250	262.000	43.000	6330.000	43.000	6330.000	3074.708
Arsenic (ug/L)	4	0.875	0.500	0.500	2.000	0.500	2.000	0.750
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.750	1.750	0.500	3.000	0.500	3.000	1.443
Copper (ug/L)	4	2.750	3.000	1.000	4.000	1.000	4.000	1.258
Lead (ug/L)	4	1.375	0.500	0.500	4.000	0.500	4.000	1.750

Manganese (ug/L)	4	17.750	19.000	8.000	25.000	8.000	25.000	7.089
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	1.500	1.250	0.500	3.000	0.500	3.000	1.225
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	13.125	14.500	2.500	21.000	2.500	21.000	8.230
Boron (ug/L)	4	44.250	37.500	29.000	73.000	29.000	73.000	20.089
Iron (ug/L)	4	1371.500	1011.000	824.000	2640.000	824.000	2640.000	851.190
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 008 for July 2014 to June 2015								
Site 008	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	16.918	15.960	12.710	22.230	14.300	22.110	3.525
Electrical Conductivity (ms/cm)	12	0.639	0.580	0.110	1.170	0.390	0.970	0.319
Electrical Conductivity (µS/cm)	12	657.750	605.000	191.000	1173.000	415.000	962.000	294.633
Turbidity (NTU)	12	23.183	5.450	1.900	104.000	2.900	22.500	37.875
Dissolved oxygen (mg/L)	12	8.223	8.905	3.870	10.950	6.250	10.180	2.257
Dissolved oxygen (%sat)	12	82.958	88.200	44.500	104.000	66.600	100.400	19.016
pH	12	7.528	7.565	7.120	7.860	7.170	7.740	0.266
Salinity (ppt)	12	0.320	0.285	0.050	0.590	0.190	0.490	0.162
Suspended Solids (mg/L)	12	11.750	2.500	1.000	68.000	1.000	6.000	22.446
Ammonium-Nitrogen (mg/L)	12	0.080	0.040	0.005	0.370	0.030	0.110	0.103
Oxidised Nitrogen (mg/L)	12	0.475	0.290	0.090	1.360	0.100	0.600	0.450
Total Nitrogen (mg/L)	12	0.964	0.890	0.450	1.790	0.530	1.660	0.504
Total Phosphorus(mg/L)	12	0.061	0.042	0.020	0.170	0.036	0.070	0.046
Faecal Coliforms (CFU/100ml)	12	2573.33	785.00	110.00	11000.00	240.00	4200.00	3522.87
Enterococci (CFU/100ml)	5	2071.60	95.00	40.00	10000.00	51.50	5080.00	4432.34
E Coli (CFU/100mL)	2	5555.00	5555.00	110.00	11000.00	110.00	11000.00	7700.39
Bicarbonate Alkalinity (mg/CaCO3/L)	4	43.700	45.700	32.900	50.500	32.900	50.500	8.099
Chloride (mg/L)	4	67.750	72.000	34.000	93.000	34.000	93.000	24.581
Sulphate as SO42-(mg/L)	4	22.250	21.500	16.000	30.000	16.000	30.000	5.909
Fluoride (mg/L)	4	0.143	0.130	0.110	0.200	0.110	0.200	0.039
Sodium (mg/L)	4	44.225	46.050	21.200	63.600	21.200	63.600	17.664
Potassium (mg/L)	4	3.668	3.730	2.560	4.650	2.560	4.650	0.945
Magnesium (mg/L)	4	6.090	6.325	2.770	8.940	2.770	8.940	2.534
Calcium (mg/L)	4	19.600	20.050	13.700	24.600	13.700	24.600	4.634
Aluminium (ug/L)	4	1553.000	1041.500	259.000	3870.000	259.000	3870.000	1684.662
Arsenic (ug/L)	4	1.000	0.750	0.500	2.000	0.500	2.000	0.707
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.750	0.750	0.500	5.000	0.500	5.000	2.179
Copper (ug/L)	4	12.750	5.500	4.000	36.000	4.000	36.000	15.521
Lead (ug/L)	4	4.000	2.000	1.000	11.000	1.000	11.000	4.761
Manganese (ug/L)	4	34.000	28.500	14.000	65.000	14.000	65.000	22.405
Molybdenum (ug/L)	4	0.875	0.500	0.500	2.000	0.500	2.000	0.750
Nickel (ug/L)	4	1.500	1.000	1.000	3.000	1.000	3.000	1.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	47.250	25.000	23.000	116.000	23.000	116.000	45.850
Boron (ug/L)	4	39.500	40.000	22.000	56.000	22.000	56.000	13.988
Iron (ug/L)	4	1527.000	1165.000	718.000	3060.000	718.000	3060.000	1049.303
Mercury (ug/L)	4	0.009	0.005	0.005	0.020	0.005	0.020	0.008

Summary Statistics for Site 010 for July 2014 to June 2015								
Site 010	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	24	16.450	15.340	8.600	22.090	12.830	20.870	3.645
Electrical Conductivity (ms/cm)	24	0.597	0.495	0.190	1.930	0.360	0.710	0.384
Electrical Conductivity (µS/cm)	24	608.125	490.500	231.000	1965.000	374.000	724.000	392.494
Turbidity (NTU)	24	16.100	6.400	0.500	168.000	1.600	22.600	33.788
Dissolved oxygen (mg/L)	24	7.533	7.655	3.870	10.420	5.910	9.100	1.673
Dissolved oxygen (%sat)	24	76.188	79.000	36.700	95.900	63.700	89.000	14.359
pH	24	7.660	7.610	7.140	8.910	7.520	7.720	0.349
Salinity (ppt)	24	0.300	0.240	0.090	1.000	0.180	0.360	0.204
Suspended Solids (mg/L)	24	9.667	2.000	1.000	84.000	1.000	6.000	22.463
Ammonium-Nitrogen (mg/L)	24	0.169	0.095	0.005	1.040	0.040	0.190	0.231
Oxidised Nitrogen (mg/L)	24	1.049	1.070	0.400	2.060	0.740	1.280	0.386
Total Nitrogen (mg/L)	24	1.765	1.490	0.980	4.970	1.070	2.310	0.902

Total Phosphorus(mg/L)	24	0.054	0.034	0.017	0.330	0.022	0.068	0.063
Faecal Coliforms (CFU/100ml)	24	3434.96	775.00	59.00	24000.00	260.00	5000.00	5938.07
Enterococci (CFU/100ml)	9	434.00	450.00	38.00	1100.00	78.00	760.00	347.89
E Coli (CFU/100ml)	3	336.67	240.00	120.00	650.00	120.00	650.00	277.91
Bicarbonate Alkalinity (mg/CaCO3/L)	4	67.175	62.600	52.800	90.700	52.800	90.700	16.570
Chloride (mg/L)	4	55.000	52.000	34.000	82.000	34.000	82.000	19.900
Sulphate as SO42-(mg/L)	4	23.500	19.000	18.000	38.000	18.000	38.000	9.678
Fluoride (mg/L)	22	0.568	0.585	0.120	0.920	0.490	0.700	0.209
Sodium (mg/L)	4	36.625	33.450	24.500	55.100	24.500	55.100	13.226
Potassium (mg/L)	4	4.125	3.500	2.960	6.540	2.960	6.540	1.651
Magnesium (mg/L)	4	7.750	7.685	4.430	11.200	4.430	11.200	2.788
Calcium (mg/L)	4	28.300	27.550	21.500	36.600	21.500	36.600	7.088
Aluminium (ug/L)	4	751.250	682.500	60.000	1580.000	60.000	1580.000	793.330
Arsenic (ug/L)	4	0.625	0.500	0.500	1.000	0.500	1.000	0.250
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	2.250	2.000	1.000	4.000	1.000	4.000	1.258
Copper (ug/L)	4	7.000	7.000	4.000	10.000	4.000	10.000	2.582
Lead (ug/L)	4	1.750	1.250	0.500	4.000	0.500	4.000	1.658
Manganese (ug/L)	4	44.000	42.000	16.000	76.000	16.000	76.000	24.940
Molybdenum (ug/L)	4	1.500	1.500	1.000	2.000	1.000	2.000	0.577
Nickel (ug/L)	4	1.625	2.000	0.500	2.000	0.500	2.000	0.750
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	49.250	48.000	23.000	78.000	23.000	78.000	22.559
Boron (ug/L)	4	41.250	40.500	28.000	56.000	28.000	56.000	14.315
Iron (ug/L)	4	1128.000	1034.000	474.000	1970.000	474.000	1970.000	631.660
Mercury (ug/L)	4	0.005	0.005	0.005	0.010	0.005	0.005	0.000

Summary Statistics for Site 012 for July 2014 to June 2015								
Site 012	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	24	16.317	15.575	9.380	21.830	13.010	20.510	3.550
Electrical Conductivity (ms/cm)	24	0.362	0.370	0.150	0.490	0.290	0.470	0.100
Electrical Conductivity (µS/cm)	24	363.458	381.000	115.000	472.000	297.000	439.000	82.170
Turbidity (NTU)	24	16.958	6.800	0.800	91.000	1.400	30.900	22.020
Dissolved oxygen (mg/L)	24	9.667	9.940	7.560	11.800	8.480	10.610	1.090
Dissolved oxygen (%sat)	24	97.669	98.400	85.500	109.500	93.500	101.450	4.990
pH	24	7.701	7.690	6.730	8.790	7.570	8.000	0.400
Salinity (ppt)	24	0.178	0.180	0.070	0.250	0.150	0.230	0.050
Suspended Solids (mg/L)	24	8.167	2.000	1.000	37.000	1.000	12.000	10.810
Ammonium-Nitrogen (mg/L)	24	0.079	0.035	0.010	0.700	0.020	0.080	0.140
Oxidised Nitrogen (mg/L)	24	0.722	0.675	0.290	1.440	0.480	1.000	0.270
Total Nitrogen (mg/L)	24	1.458	1.225	0.600	3.790	0.870	2.300	0.860
Total Phosphorus(mg/L)	24	0.077	0.063	0.029	0.190	0.036	0.120	0.050
Faecal Coliforms (CFU/100ml)	24	7843.33	1350.00	310.00	62000.00	680.00	10000.00	14879.99
Enterococci (CFU/100ml)	9	340.67	250.00	66.00	690.00	150.00	640.00	224.58
E Coli (CFU/100ml)	3	1966.67	1500.00	1100.00	3300.00	1100.00	3300.00	1171.89
Bicarbonate Alkalinity (mg/CaCO3/L)	4	50.500	53.500	31.200	63.800	31.200	63.800	13.880
Chloride (mg/L)	4	32.925	36.000	9.700	50.000	9.700	50.000	17.320
Sulphate as SO42-(mg/L)	4	17.575	17.500	9.300	26.000	9.300	26.000	6.930
Fluoride (mg/L)	22	0.354	0.345	0.080	0.600	0.260	0.490	0.140
Sodium (mg/L)	4	22.685	23.600	8.540	35.000	8.540	35.000	11.030
Potassium (mg/L)	4	2.943	2.725	2.140	4.180	2.140	4.180	0.950
Magnesium (mg/L)	4	4.920	5.400	2.100	6.780	2.100	6.780	2.280
Calcium (mg/L)	4	21.275	22.900	13.000	26.300	13.000	26.300	5.890
Aluminium (ug/L)	4	856.000	835.500	83.000	1670.000	83.000	1670.000	685.970
Arsenic (ug/L)	4	0.750	0.750	0.500	1.000	0.500	1.000	0.290
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	4.500	4.000	2.000	8.000	2.000	8.000	2.650
Copper (ug/L)	4	7.500	7.500	4.000	11.000	4.000	11.000	2.890
Lead (ug/L)	4	2.125	1.500	0.500	5.000	0.500	5.000	2.020
Manganese (ug/L)	4	13.250	12.000	10.000	19.000	10.000	19.000	3.950
Molybdenum (ug/L)	4	1.375	1.000	0.500	3.000	0.500	3.000	1.110
Nickel (ug/L)	4	1.375	1.000	0.500	3.000	0.500	3.000	1.110
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	60.750	60.000	43.000	80.000	43.000	80.000	16.820
Boron (ug/L)	4	45.750	38.000	21.000	86.000	21.000	86.000	28.430

Iron (ug/L)	4	867.000	883.000	702.000	1000.000	702.000	1000.000	136.730
Mercury (ug/L)	4	0.006	0.005	0.005	0.010	0.005	0.010	0.000

Summary Statistics for Site 013 for July 2014 to June 2015								
Site 013	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	24	16.598	16.715	8.900	21.580	13.400	20.870	3.750
Electrical Conductivity (ms/cm)	24	0.274	0.260	0.120	0.470	0.210	0.320	0.080
Electrical Conductivity (µS/cm)	24	273.000	270.500	98.000	463.000	225.000	312.000	72.190
Turbidity (NTU)	24	9.999	2.750	0.800	56.400	1.600	7.500	16.770
Dissolved oxygen (mg/L)	24	7.013	6.885	4.560	11.020	5.310	8.240	1.670
Dissolved oxygen (%sat)	24	71.556	70.500	48.500	110.100	55.300	87.200	15.610
pH	24	7.144	7.145	6.430	7.550	6.960	7.360	0.250
Salinity (ppt)	24	0.135	0.130	0.060	0.240	0.100	0.160	0.040
Suspended Solids (mg/L)	24	4.375	1.500	1.000	24.000	1.000	4.000	6.700
Ammonium-Nitrogen (mg/L)	24	0.064	0.040	0.010	0.310	0.010	0.090	0.070
Oxidised Nitrogen (mg/L)	24	0.173	0.105	0.030	0.820	0.050	0.240	0.190
Total Nitrogen (mg/L)	24	0.555	0.385	0.190	2.660	0.280	0.750	0.520
Total Phosphorus(mg/L)	24	0.063	0.027	0.011	0.720	0.018	0.051	0.140
Faecal Coliforms (CFU/100ml)	24	3515.17	215.00	10.00	49000.00	44.00	2000.00	10451.79
Enterococci (CFU/100ml)	9	676.56	250.00	59.00	3800.00	120.00	600.00	1185.69
E Coli (CFU/100mL)	3	109.67	68.00	61.00	200.00	61.00	200.00	78.31
Bicarbonate Alkalinity (mg/CaCO3/L)	4	50.450	52.300	32.400	64.800	32.400	64.800	13.700
Chloride (mg/L)	4	27.775	32.000	9.100	38.000	9.100	38.000	13.000
Sulphate as SO42-(mg/L)	4	14.900	16.500	6.600	20.000	6.600	20.000	6.440
Fluoride (mg/L)	22	0.108	0.095	0.060	0.180	0.080	0.130	0.030
Sodium (mg/L)	4	16.635	17.800	7.140	23.800	7.140	23.800	7.300
Potassium (mg/L)	4	2.080	2.170	1.310	2.670	1.310	2.670	0.580
Magnesium (mg/L)	4	4.335	4.420	2.060	6.440	2.060	6.440	1.810
Calcium (mg/L)	4	19.450	20.600	11.600	25.000	11.600	25.000	6.020
Aluminium (ug/L)	4	500.500	243.500	35.000	1480.000	35.000	1480.000	671.990
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.125	0.500	0.500	3.000	0.500	3.000	1.250
Copper (ug/L)	4	5.000	3.500	1.000	12.000	1.000	12.000	4.970
Lead (ug/L)	4	1.875	0.500	0.500	6.000	0.500	6.000	2.750
Manganese (ug/L)	4	38.250	38.500	27.000	49.000	27.000	49.000	10.440
Molybdenum (ug/L)	4	1.125	1.000	0.500	2.000	0.500	2.000	0.630
Nickel (ug/L)	4	1.000	0.750	0.500	2.000	0.500	2.000	0.710
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	61.750	41.500	24.000	140.000	24.000	140.000	52.850
Boron (ug/L)	4	30.500	28.000	14.000	52.000	14.000	52.000	15.800
Iron (ug/L)	4	1221.750	1169.500	718.000	1830.000	718.000	1830.000	504.950
Mercury (ug/L)	4	0.006	0.005	0.005	0.010	0.005	0.010	0.000

Summary Statistics for Site 018 for July 2014 to June 2015								
Site 018	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	18.398	18.665	14.2000	22.060	14.2000	22.060	3.2382
Electrical Conductivity (ms/cm)	4	1.108	1.120	0.8600	1.330	0.8600	1.330	0.2472
Electrical Conductivity (µS/cm)	4	1123.750	1112.000	906.0000	1365.000	906.0000	1365.000	231.1873
Turbidity (NTU)	4	22.525	17.450	4.5000	50.700	4.5000	50.700	20.6660
Dissolved oxygen (mg/L)	4	1.963	1.170	0.2100	5.300	0.2100	5.300	2.3942
Dissolved oxygen (%sat)	4	19.725	12.550	2.1000	51.700	2.1000	51.700	23.3099
pH	4	6.750	6.770	6.6500	6.810	6.6500	6.810	0.0712
Salinity (ppt)	4	0.558	0.555	0.4400	0.680	0.4400	0.680	0.1201
Suspended Solids (mg/L)	4	21.250	20.500	4.0000	40.000	4.0000	40.000	17.4619
Ammonium-Nitrogen (mg/L)	4	10.350	10.275	7.5500	13.300	7.5500	13.300	3.1254
Oxidised Nitrogen (mg/L)	4	1.990	2.005	0.7000	3.250	0.7000	3.250	1.0479
Total Nitrogen (mg/L)	4	13.568	14.000	8.4700	17.800	8.4700	17.800	4.3125
Total Phosphorus(mg/L)	4	0.023	0.018	0.0130	0.044	0.0130	0.044	0.0141
Faecal Coliforms (CFU/100ml)	4	55.250	13.000	5.0000	190.000	5.0000	190.000	90.0051
Enterococci (CFU/100ml)	1	310.000	310.000	310.0000	310.000	310.0000	310.000	

Summary Statistics for Site 023 for July 2014 to June 2015								
Site 023	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.

Chromium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Copper (ug/L)	4	0.875	1.000	0.500	1.000	0.500	1.000	0.250
Lead (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Manganese (ug/L)	4	42.000	46.500	24.000	51.000	24.000	51.000	12.517
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	0.625	0.500	0.500	1.000	0.500	1.000	0.250
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	6.375	5.000	2.500	13.000	2.500	13.000	4.571
Boron (ug/L)	4	22.000	24.500	14.000	25.000	14.000	25.000	5.354
Iron (ug/L)	4	290.750	247.500	143.000	525.000	143.000	525.000	169.270
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 037 for July 2014 to June 2015								
Site 037	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	15.923	16.635	8.620	21.190	12.220	20.830	4.100
Electrical Conductivity (ms/cm)	12	0.221	0.220	0.130	0.290	0.180	0.260	0.050
Electrical Conductivity (µS/cm)	12	206.750	218.500	117.000	291.000	175.000	230.000	51.119
Turbidity (NTU)	12	1.583	0.600	0.000	8.400	0.000	1.900	2.499
Dissolved oxygen (mg/L)	12	10.253	10.130	8.480	12.610	8.960	11.280	1.298
Dissolved oxygen (%sat)	12	100.762	101.450	93.700	106.500	95.840	104.200	3.900
pH	12	5.643	5.653	4.880	6.360	5.230	6.190	0.528
Salinity (ppt)	12	0.109	0.110	0.030	0.170	0.090	0.130	0.036
Suspended Solids (mg/L)	12	1.500	1.000	1.000	4.000	1.000	1.000	1.168
Ammonium-Nitrogen (mg/L)	12	0.007	0.005	0.005	0.010	0.005	0.010	0.003
Oxidised Nitrogen (mg/L)	12	0.006	0.005	0.005	0.010	0.005	0.005	0.002
Total Nitrogen (mg/L)	12	0.148	0.120	0.080	0.330	0.090	0.200	0.072
Total Phosphorus(mg/L)	12	0.005	0.005	0.003	0.010	0.003	0.007	0.003
Faecal Coliforms (CFU/100ml)	12	212.58	46.00	0.50	1700.00	4.00	140.00	484.59
Enterococci (CFU/100ml)	5	25.60	27.00	10.00	44.00	12.00	38.50	13.90
E Coli (CFU/100ml)	2	35.00	35.00	6.00	64.00	6.00	64.00	41.01
Bicarbonate Alkalinity (mg/CaCO3/L)	4	2.075	1.700	1.000	3.900	1.000	3.900	1.384
Chloride (mg/L)	4	55.500	55.500	49.000	62.000	49.000	62.000	6.028
Sulphate as SO42-(mg/L)	4	5.025	4.850	3.800	6.600	3.800	6.600	1.179
Fluoride (mg/L)	4	0.025	0.025	0.025	0.025	0.025	0.025	0.000
Sodium (mg/L)	4	28.500	28.600	24.200	32.600	24.200	32.600	4.465
Potassium (mg/L)	4	1.168	1.120	0.920	1.510	0.920	1.510	0.283
Magnesium (mg/L)	4	4.723	4.800	3.910	5.380	3.910	5.380	0.608
Calcium (mg/L)	4	1.005	0.950	0.770	1.350	0.770	1.350	0.282
Aluminium (ug/L)	4	127.500	142.500	47.000	178.000	47.000	178.000	56.394
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Copper (ug/L)	4	0.875	1.000	0.500	1.000	0.500	1.000	0.250
Lead (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Manganese (ug/L)	4	54.250	47.000	42.000	81.000	42.000	81.000	18.062
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	1.125	1.000	0.500	2.000	0.500	2.000	0.629
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	4.375	5.000	2.500	5.000	2.500	5.000	1.250
Boron (ug/L)	4	19.500	20.500	13.000	24.000	13.000	24.000	4.655
Iron (ug/L)	4	629.000	368.500	189.000	1590.000	189.000	1590.000	646.388
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 038 for July 2014 to June 2015								
Site 038	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	11	0.868	0.900	0.500	1.100	0.700	1.100	0.198
Temperature (oC)	12	20.811	20.215	12.910	26.790	17.320	25.690	4.602
Turbidity (NTU)	12	11.625	10.950	6.400	22.100	8.700	13.600	4.232
Dissolved oxygen (mg/L)	12	7.541	7.180	5.720	11.280	6.550	8.470	1.475
Dissolved oxygen (%sat)	12	95.313	94.650	82.800	110.160	89.700	97.700	7.628
pH	12	7.871	7.885	7.660	8.010	7.770	7.960	0.103
Salinity (ppt)	12	26.948	28.045	16.100	30.960	24.110	30.330	4.191
Suspended Solids (mg/L)	12	11.833	11.500	6.000	24.000	8.000	14.000	4.726
Ammonium-Nitrogen (mg/L)	12	0.014	0.010	0.005	0.060	0.010	0.010	0.015

Oxidised Nitrogen (mg/L)	12	0.043	0.015	0.005	0.200	0.010	0.070	0.058
Total Nitrogen (mg/L)	12	0.306	0.270	0.200	0.630	0.240	0.310	0.115
Total Phosphorus(mg/L)	12	0.021	0.020	0.014	0.031	0.018	0.025	0.005
Soluble Reactive Phosphorus (mg/L)	0							
Chlorophyll-a (ug/L)	12	4.625	4.850	2.400	8.000	2.700	6.000	1.767
Faecal Coliforms (CFU/100ml)	12	5.58	2.00	0.50	33.00	1.00	5.00	9.51
Enterococci (CFU/100ml)	12	4.25	2.00	0.50	22.00	1.00	6.00	6.09

Summary Statistics for Site 039 for July 2014 to June 2015								
Site 039	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	15.723	16.270	7.960	20.800	12.370	20.630	4.085
Electrical Conductivity (ms/cm)	12	0.240	0.245	0.150	0.320	0.190	0.280	0.050
Electrical Conductivity (µS/cm)	12	228.000	225.000	130.000	301.000	176.000	275.000	52.352
Turbidity (NTU)	12	1.608	1.000	0.000	5.700	0.100	2.600	1.920
Dissolved oxygen (mg/L)	12	9.443	9.390	6.690	12.010	7.510	10.960	1.834
Dissolved oxygen (%sat)	12	91.888	92.480	74.500	103.300	84.000	101.300	9.792
pH	12	7.141	7.125	6.840	7.710	6.960	7.230	0.219
Salinity (ppt)	12	0.119	0.120	0.070	0.160	0.100	0.140	0.026
Suspended Solids (mg/L)	12	1.250	1.000	1.000	3.000	1.000	1.000	0.622
Ammonium-Nitrogen (mg/L)	12	0.009	0.010	0.005	0.020	0.005	0.010	0.004
Oxidised Nitrogen (mg/L)	12	0.348	0.150	0.040	1.470	0.090	0.620	0.419
Total Nitrogen (mg/L)	12	0.553	0.400	0.200	1.590	0.280	0.770	0.384
Total Phosphorus(mg/L)	12	0.011	0.010	0.005	0.016	0.008	0.015	0.004
Faecal Coliforms (CFU/100ml)	12	159.21	52.00	0.50	940.00	6.00	230.00	263.31
Enterococci (CFU/100ml)	5	93.00	37.00	21.00	320.00	25.00	189.00	127.64
E Coli (CFU/100mL)	2	152.00	152.00	44.00	260.00	44.00	260.00	152.74
Bicarbonate Alkalinity (mg/CaCO3/L)	4	24.025	24.350	17.400	30.000	17.400	30.000	5.185
Chloride (mg/L)	4	38.500	40.000	22.000	52.000	22.000	52.000	12.477
Sulphate as SO42-(mg/L)	4	11.875	12.000	8.500	15.000	8.500	15.000	3.614
Fluoride (mg/L)	4	0.039	0.025	0.025	0.080	0.025	0.080	0.028
Sodium (mg/L)	4	23.925	23.200	15.900	33.400	15.900	33.400	7.284
Potassium (mg/L)	4	1.805	1.640	1.400	2.540	1.400	2.540	0.511
Magnesium (mg/L)	4	4.275	4.155	2.530	6.260	2.530	6.260	1.543
Calcium (mg/L)	4	9.460	8.915	6.410	13.600	6.410	13.600	3.018
Aluminium (ug/L)	4	243.750	161.000	38.000	615.000	38.000	615.000	255.803
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Copper (ug/L)	4	2.000	1.500	1.000	4.000	1.000	4.000	1.414
Lead (ug/L)	4	0.625	0.500	0.500	1.000	0.500	1.000	0.250
Manganese (ug/L)	4	9.250	6.500	5.000	19.000	5.000	19.000	6.551
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	5.625	5.000	2.500	10.000	2.500	10.000	3.146
Boron (ug/L)	4	27.000	27.000	22.000	32.000	22.000	32.000	5.228
Iron (ug/L)	4	418.500	407.000	280.000	580.000	280.000	580.000	158.941
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 042 for July 2014 to June 2015								
Site 042	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	15.730	16.340	8.910	21.810	12.020	19.250	4.061
Electrical Conductivity (ms/cm)	12	0.352	0.360	0.190	0.490	0.280	0.400	0.083
Electrical Conductivity (µS/cm)	12	351.667	364.000	235.000	455.000	268.000	402.000	69.243
Turbidity (NTU)	12	15.733	7.650	2.700	56.900	3.500	30.300	18.571
Dissolved oxygen (mg/L)	12	8.813	8.690	5.860	12.740	7.680	10.080	1.920
Dissolved oxygen (%sat)	12	87.849	86.150	66.800	119.000	78.100	95.600	13.651
pH	12	6.997	7.095	5.950	7.310	6.950	7.230	0.363
Salinity (ppt)	12	0.177	0.180	0.100	0.240	0.150	0.200	0.038
Suspended Solids (mg/L)	13	6.923	4.000	1.000	21.000	1.000	19.000	7.889
Ammonium-Nitrogen (mg/L)	13	0.024	0.020	0.010	0.050	0.010	0.030	0.012
Oxidised Nitrogen (mg/L)	13	0.288	0.220	0.010	1.540	0.020	0.410	0.416
Total Nitrogen (mg/L)	13	0.755	0.580	0.300	2.460	0.340	1.170	0.596
Total Phosphorus(mg/L)	13	0.060	0.039	0.018	0.222	0.020	0.120	0.060
Faecal Coliforms (CFU/100ml)	13	1195.231	360.000	26.000	8300.000	42.000	900.000	2385.945
Enterococci (CFU/100ml)	6	283.333	280.000	80.000	510.000	220.000	330.000	142.922

E Coli (CFU/100mL)	3	706.667	800.000	420.000	900.000	420.000	900.000	253.246
Bicarbonate Alkalinity (mg/CaCO ₃ /L)	4	38.550	38.000	32.100	46.100	32.100	46.100	5.897
Chloride (mg/L)	4	62.250	66.500	43.000	73.000	43.000	73.000	13.696
Sulphate as SO ₄ ²⁻ (mg/L)	4	18.525	21.000	7.100	25.000	7.100	25.000	7.889
Fluoride (mg/L)	4	0.088	0.090	0.070	0.100	0.070	0.100	0.013
Sodium (mg/L)	4	38.700	39.750	28.800	46.500	28.800	46.500	7.850
Potassium (mg/L)	4	5.860	5.715	5.160	6.850	5.160	6.850	0.794
Magnesium (mg/L)	4	7.520	7.665	6.050	8.700	6.050	8.700	1.226
Calcium (mg/L)	4	15.100	14.850	13.400	17.300	13.400	17.300	1.730
Aluminium (ug/L)	4	1103.000	636.000	120.000	3020.000	120.000	3020.000	1308.677
Arsenic (ug/L)	4	0.513	0.500	0.050	1.000	0.050	1.000	0.388
Cadmium (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Chromium (ug/L)	4	1.388	1.250	0.050	3.000	0.050	3.000	1.360
Copper (ug/L)	4	2.500	1.500	1.000	6.000	1.000	6.000	2.380
Lead (ug/L)	4	1.013	0.500	0.050	3.000	0.050	3.000	1.342
Manganese (ug/L)	4	35.750	37.500	25.000	43.000	25.000	43.000	8.461
Molybdenum (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Nickel (ug/L)	4	1.013	1.000	0.050	2.000	0.050	2.000	0.796
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	11.000	11.000	5.000	17.000	5.000	17.000	6.928
Boron (ug/L)	4	39.250	34.500	33.000	55.000	33.000	55.000	10.532
Iron (ug/L)	4	1740.000	1460.000	1240.000	2800.000	1240.000	2800.000	714.283
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 043 for July 2014 to June 2015								
Site 043	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	11	16.557	16.940	9.370	21.440	13.580	21.110	3.996
Electrical Conductivity (ms/cm)	11	0.557	0.580	0.350	0.780	0.460	0.620	0.117
Electrical Conductivity (µS/cm)	11	562.455	580.000	351.000	740.000	476.000	654.000	113.454
Turbidity (NTU)	11	1.673	0.700	0.300	5.100	0.500	2.200	1.782
Dissolved oxygen (mg/L)	11	9.570	9.580	7.430	11.440	8.290	10.850	1.304
Dissolved oxygen (%sat)	11	97.592	97.800	88.110	108.400	94.000	100.800	5.295
pH	11	7.825	7.820	7.610	8.220	7.650	7.970	0.183
Salinity (ppt)	11	0.282	0.290	0.180	0.390	0.230	0.310	0.058
Suspended Solids (mg/L)	11	1.182	1.000	1.000	2.000	1.000	1.000	0.405
Ammonium-Nitrogen (mg/L)	11	0.012	0.010	0.005	0.030	0.010	0.010	0.007
Oxidised Nitrogen (mg/L)	11	2.406	2.350	0.410	6.250	0.950	2.900	1.682
Total Nitrogen (mg/L)	11	3.672	3.350	0.820	9.630	1.540	4.780	2.561
Total Phosphorus(mg/L)	11	0.126	0.085	0.032	0.400	0.043	0.173	0.113
Faecal Coliforms (CFU/100ml)	11	516.18	22.00	3.00	5400.00	11.00	43.00	1619.97
Enterococci (CFU/100ml)	5	35.40	31.00	19.00	64.00	22.50	50.50	17.30
Bicarbonate Alkalinity (mg/CaCO ₃ /L)	4	67.000	62.500	54.100	88.900	54.100	88.900	15.476
Chloride (mg/L)	4	68.500	69.000	58.000	78.000	58.000	78.000	9.147
Fluoride (mg/L)	4	0.365	0.305	0.270	0.580	0.270	0.580	0.147
Sodium (mg/L)	4	59.050	59.700	44.700	72.100	44.700	72.100	12.547
Sulphate as SO ₄ ²⁻ (mg/L)	4	52.000	53.500	38.000	63.000	38.000	63.000	10.551
Potassium (mg/L)	4	10.018	7.775	5.720	18.800	5.720	18.800	6.032
Magnesium (mg/L)	4	6.235	6.510	5.100	6.820	5.100	6.820	0.793
Calcium (mg/L)	4	30.100	28.400	26.100	37.500	26.100	37.500	5.197
Aluminium (ug/L)	4	133.500	145.500	59.000	184.000	59.000	184.000	61.104
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Copper (ug/L)	4	2.250	2.000	1.000	4.000	1.000	4.000	1.258
Lead (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Manganese (ug/L)	4	6.000	5.500	4.000	9.000	4.000	9.000	2.160
Molybdenum (ug/L)	4	0.750	0.750	0.500	1.000	0.500	1.000	0.289
Nickel (ug/L)	4	1.750	2.000	1.000	2.000	1.000	2.000	0.500
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	9.375	8.000	2.500	19.000	2.500	19.000	7.341
Boron (ug/L)	4	35.000	37.000	22.000	44.000	22.000	44.000	9.274
Iron (ug/L)	4	212.750	185.500	134.000	346.000	134.000	346.000	96.067
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 045 for July 2014 to June 2015

Site 045	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	18.290	18.595	12.000	24.000	15.440	21.820	3.900
Electrical Conductivity (ms/cm)	12	0.548	0.555	0.360	0.710	0.460	0.640	0.110
Electrical Conductivity (µS/cm)	12	565.917	575.000	358.000	688.000	504.000	670.000	103.560
Turbidity (NTU)	12	5.358	0.500	0.000	41.300	0.200	6.400	11.700
Dissolved oxygen (mg/L)	12	9.456	9.455	7.270	11.070	8.560	10.880	1.130
Dissolved oxygen (%sat)	12	99.004	100.550	85.100	103.400	96.700	102.300	4.920
pH	12	7.733	7.765	7.460	7.920	7.620	7.870	0.140
Salinity (ppt)	12	0.278	0.280	0.180	0.370	0.230	0.320	0.060
Suspended Solids (mg/L)	12	1.333	1.000	1.000	5.000	1.000	1.000	1.150
Ammonium-Nitrogen (mg/L)	12	0.031	0.010	0.010	0.210	0.010	0.020	0.060
Oxidised Nitrogen (mg/L)	12	3.160	2.950	1.370	6.000	1.800	4.500	1.430
Total Nitrogen (mg/L)	12	3.862	3.555	2.200	7.360	2.320	5.090	1.560
Total Phosphorus(mg/L)	12	0.074	0.055	0.029	0.250	0.047	0.082	0.060
Chlorophyll-a (ug/L)	12	0.667	0.550	0.300	1.400	0.500	0.900	0.310
Faecal Coliforms (CFU/100ml)	12	4448.92	225.00	44.00	47000.00	51.00	690.00	13445.20
Enterococci (CFU/100ml)	10	65.70	51.00	20.00	210.00	29.50	84.00	56.28
Bicarbonate Alkalinity (mg/CaCO3/L)	3	51.467	57.400	38.600	58.400	38.600	58.400	11.150
Chloride (mg/L)	3	76.667	77.000	65.000	88.000	65.000	88.000	11.500
Fluoride (mg/L)	3	0.367	0.240	0.180	0.680	0.180	0.680	0.270
Sodium (mg/L)	3	59.167	54.200	45.900	77.400	45.900	77.400	16.330
Sulphate as SO42-(mg/L)	3	53.333	46.000	22.000	92.000	22.000	92.000	35.570
Potassium (mg/L)	3	9.240	5.050	4.270	18.400	4.270	18.400	7.940
Magnesium (mg/L)	3	6.960	7.320	4.970	8.590	4.970	8.590	1.840
Calcium (mg/L)	3	31.633	30.400	18.700	45.800	18.700	45.800	13.590
Aluminium (ug/L)	3	1357.667	526.000	57.000	3490.000	57.000	3490.000	1861.480
Arsenic (ug/L)	3	1.000	0.500	0.500	2.000	0.500	2.000	0.870
Cadmium (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	3	1.167	1.000	0.500	2.000	0.500	2.000	0.760
Copper (ug/L)	3	6.333	5.000	5.000	9.000	5.000	9.000	2.310
Lead (ug/L)	3	1.000	0.500	0.500	2.000	0.500	2.000	0.870
Manganese (ug/L)	3	107.333	18.000	7.000	297.000	7.000	297.000	164.350
Molybdenum (ug/L)	3	1.167	1.000	0.500	2.000	0.500	2.000	0.760
Nickel (ug/L)	3	2.333	2.000	2.000	3.000	2.000	3.000	0.580
Selenium (ug/L)	3	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	3	15.333	18.000	7.000	21.000	7.000	21.000	7.370
Boron (ug/L)	3	51.333	40.000	34.000	80.000	34.000	80.000	25.010
Iron (ug/L)	3	848.333	724.000	191.000	1630.000	191.000	1630.000	727.510
Mercury (ug/L)	3	0.005	0.005	0.005	0.010	0.005	0.005	0.000

Summary Statistics for Site 046 for July 2014 to June 2015								
Site 046	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	16.680	15.635	11.850	23.500	14.280	20.990	3.600
Electrical Conductivity (ms/cm)	12	0.470	0.500	0.050	0.700	0.380	0.600	0.200
Electrical Conductivity (µS/cm)	12	479.920	525.500	102.000	625.000	397.000	610.000	153.000
Turbidity (NTU)	12	9.880	3.950	0.700	36.500	2.400	16.500	12.600
Dissolved oxygen (mg/L)	12	10.160	10.145	8.490	12.000	9.320	10.830	1.000
Dissolved oxygen (%sat)	12	103.170	100.650	96.200	120.700	99.200	105.300	6.300
pH	12	7.640	7.445	7.200	8.600	7.290	8.160	0.500
Salinity (ppt)	12	0.240	0.260	0.020	0.300	0.170	0.300	0.100
Suspended Solids (mg/L)	12	5.830	2.500	1.000	34.000	1.000	6.000	9.600
Ammonium-Nitrogen (mg/L)	12	0.450	0.060	0.005	4.600	0.020	0.080	1.300
Oxidised Nitrogen (mg/L)	12	0.340	0.290	0.100	0.700	0.150	0.500	0.200
Total Nitrogen (mg/L)	12	1.320	0.615	0.290	9.000	0.440	1.040	2.400
Total Phosphorus(mg/L)	12	0.120	0.023	0.011	1.000	0.016	0.056	0.300
Faecal Coliforms (CFU/100ml)	12	51239.92	315.00	42.00	580000.00	140.00	7900.00	166660.80
Enterococci (CFU/100ml)	5	1503.40	110.00	24.00	7100.00	43.50	3660.00	3129.50
E Coli (CFU/100mL)	2	3971.00	3971.00	42.00	7900.00	42.00	7900.00	5556.40
Bicarbonate Alkalinity (mg/CaCO3/L)	4	45.850	51.000	24.800	56.600	24.800	56.600	14.600
Chloride (mg/L)	4	53.500	62.500	13.000	76.000	13.000	76.000	29.600
Sulphate as SO42-(mg/L)	4	25.000	28.000	6.000	38.000	6.000	38.000	13.500
Fluoride (mg/L)	4	0.080	0.080	0.060	0.100	0.060	0.100	0.000
Sodium (mg/L)	4	38.550	40.300	10.300	63.300	10.300	63.300	22.400
Potassium (mg/L)	4	3.740	2.960	2.060	7.000	2.060	6.980	2.200
Magnesium (mg/L)	4	5.510	5.980	1.320	8.800	1.320	8.760	3.400
Calcium (mg/L)	4	24.460	27.400	8.450	34.600	8.450	34.600	11.300

Aluminium (ug/L)	4	657.000	583.000	62.000	1400.000	62.000	1400.000	635.200
Arsenic (ug/L)	4	0.630	0.500	0.500	1.000	0.500	1.000	0.300
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.250	0.750	0.500	3.000	0.500	3.000	1.200
Copper (ug/L)	4	4.750	5.000	1.000	8.000	1.000	8.000	2.900
Lead (ug/L)	4	2.000	1.750	0.500	4.000	0.500	4.000	1.800
Manganese (ug/L)	4	53.250	52.500	22.000	86.000	22.000	86.000	35.000
Molybdenum (ug/L)	4	0.880	0.500	0.500	2.000	0.500	2.000	0.800
Nickel (ug/L)	4	1.130	1.000	0.500	2.000	0.500	2.000	0.600
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	29.250	30.000	27.000	30.000	27.000	30.000	1.500
Boron (ug/L)	4	40.000	40.500	17.000	62.000	17.000	62.000	18.900
Iron (ug/L)	4	1960.000	1285.000	1150.000	4120.000	1150.000	4120.000	1441.900
Mercury (ug/L)	4	0.010	0.005	0.005	0.000	0.005	0.005	0.000

Summary Statistics for Site 048 for July 2014 to June 2015								
Site 048	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	10	0.640	0.650	0.200	1.100	0.400	0.850	0.272
Temperature (oC)	12	18.733	18.965	10.440	24.670	14.670	23.650	4.909
Turbidity (NTU)	12	25.083	20.700	7.500	68.800	12.200	26.100	19.022
Dissolved oxygen (mg/L)	12	6.782	6.355	4.360	11.060	4.800	8.590	2.162
Dissolved oxygen (%sat)	12	76.518	69.100	59.300	103.900	65.600	89.800	14.738
pH	12	7.208	7.380	6.350	7.580	6.850	7.540	0.408
Salinity (ppt)	12	17.320	20.855	0.200	26.740	7.930	25.460	9.623
Suspended Solids (mg/L)	12	22.083	17.500	4.000	53.000	11.000	35.000	14.519
Ammonium-Nitrogen (mg/L)	12	0.037	0.030	0.010	0.140	0.020	0.040	0.034
Oxidised Nitrogen (mg/L)	12	0.098	0.020	0.005	0.840	0.010	0.050	0.236
Total Nitrogen (mg/L)	12	0.523	0.395	0.290	1.550	0.360	0.610	0.341
Total Phosphorus(mg/L)	12	0.043	0.037	0.017	0.125	0.022	0.052	0.030
Soluble Reactive Phosphorus (mg/L)	0							
Chlorophyll-a (ug/L)	12	7.008	5.250	1.200	21.300	2.900	11.900	5.802
Faecal Coliforms (CFU/100ml)	12	507.17	20.00	3.00	5600.00	6.00	100.00	1605.36
Enterococci (CFU/100ml)	12	191.25	12.00	2.00	2000.00	7.00	59.00	571.13

Summary Statistics for Site 049 for July 2014 to June 2015								
Site 049	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	15.458	15.645	9.140	20.860	11.880	19.210	3.813
Electrical Conductivity (ms/cm)	12	0.473	0.480	0.190	0.740	0.330	0.600	0.164
Electrical Conductivity (µS/cm)	12	476.000	445.000	260.000	797.000	306.000	617.000	165.706
Turbidity (NTU)	12	16.017	7.600	1.400	55.100	2.100	37.300	18.682
Dissolved oxygen (mg/L)	12	9.444	9.195	7.000	12.520	8.250	10.760	1.574
Dissolved oxygen (%sat)	12	94.026	93.600	78.500	117.000	86.300	100.200	9.847
pH	12	7.065	7.105	6.350	7.410	6.900	7.350	0.300
Salinity (ppt)	12	0.233	0.220	0.100	0.370	0.160	0.300	0.082
Suspended Solids (mg/L)	12	5.083	2.000	1.000	19.000	1.000	11.000	5.823
Ammonium-Nitrogen (mg/L)	12	0.023	0.015	0.010	0.060	0.010	0.040	0.018
Oxidised Nitrogen (mg/L)	12	0.269	0.100	0.005	1.820	0.050	0.310	0.499
Total Nitrogen (mg/L)	12	0.747	0.530	0.080	2.870	0.340	1.110	0.740
Total Phosphorus(mg/L)	12	0.065	0.025	0.002	0.320	0.012	0.134	0.092
Faecal Coliforms (CFU/100ml)	12	1223.417	133.500	7.000	7300.000	16.000	980.000	2425.306
Enterococci (CFU/100ml)	5	363.400	130.000	7.000	1200.000	23.500	820.000	497.959
E Coli (CFU/100ml)	2	600.000	600.000	220.000	980.000	220.000	980.000	537.401
Bicarbonate Alkalinity (mg/CaCO3/L)	4	25.450	30.850	1.000	39.100	1.000	39.100	17.097
Chloride (mg/L)	4	82.500	88.000	59.000	95.000	59.000	95.000	16.340
Sulphate as SO42-(mg/L)	4	15.000	15.500	5.000	24.000	5.000	24.000	7.874
Fluoride (mg/L)	4	0.061	0.070	0.025	0.080	0.025	0.080	0.025
Sodium (mg/L)	4	46.575	48.450	37.200	52.200	37.200	52.200	6.633
Potassium (mg/L)	4	5.270	5.980	2.180	6.940	2.180	6.940	2.117
Magnesium (mg/L)	4	8.473	8.690	6.860	9.650	6.860	9.650	1.168
Calcium (mg/L)	4	9.568	11.650	2.270	12.700	2.270	12.700	4.965
Aluminium (ug/L)	4	927.500	534.000	262.000	2380.000	262.000	2380.000	994.520
Arsenic (ug/L)	4	0.513	0.500	0.050	1.000	0.050	1.000	0.388
Cadmium (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Chromium (ug/L)	4	1.138	0.750	0.050	3.000	0.050	3.000	1.301
Copper (ug/L)	4	2.500	1.500	1.000	6.000	1.000	6.000	2.380
Lead (ug/L)	4	0.763	0.500	0.050	2.000	0.050	2.000	0.852

Manganese (ug/L)	4	139.750	70.000	37.000	382.000	37.000	382.000	162.594
Molybdenum (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Nickel (ug/L)	4	2.500	2.000	1.000	5.000	1.000	5.000	1.915
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	11.625	14.000	2.500	16.000	2.500	16.000	6.156
Boron (ug/L)	4	27.750	27.000	23.000	34.000	23.000	34.000	4.646
Iron (ug/L)	4	1688.000	1545.000	582.000	3080.000	582.000	3080.000	1033.481
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 052 for July 2014 to June 2015								
Site 052	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	15.693	17.460	6.900	22.430	12.090	19.920	4.693
Electrical Conductivity (ms/cm)	12	0.278	0.265	0.190	0.400	0.210	0.340	0.072
Electrical Conductivity (µS/cm)	12	271.083	268.500	187.000	351.000	212.000	329.000	55.092
Turbidity (NTU)	12	6.075	5.200	0.700	20.800	2.000	7.300	5.578
Dissolved oxygen (mg/L)	12	8.083	8.885	5.010	10.230	5.820	10.080	1.997
Dissolved oxygen (%sat)	12	80.244	84.750	52.000	95.900	63.500	94.500	15.000
pH	12	7.162	7.270	6.240	7.580	7.040	7.330	0.338
Salinity (ppt)	12	0.140	0.130	0.090	0.200	0.100	0.180	0.040
Suspended Solids (mg/L)	14	1.571	1.000	1.000	5.000	1.000	2.000	1.284
Ammonium-Nitrogen (mg/L)	14	0.016	0.015	0.005	0.030	0.010	0.020	0.008
Oxidised Nitrogen (mg/L)	14	0.151	0.110	0.010	0.740	0.020	0.220	0.190
Total Nitrogen (mg/L)	14	0.421	0.325	0.150	1.020	0.240	0.570	0.236
Total Phosphorus(mg/L)	14	0.025	0.023	0.005	0.049	0.014	0.036	0.013
Faecal Coliforms (CFU/100ml)	14	847.43	265.00	18.00	3900.00	77.00	2000.00	1297.11
Enterococci (CFU/100ml)	6	211.33	245.00	31.00	380.00	47.00	320.00	144.57
Bicarbonate Alkalinity (mg/CaCO3/L)	4	43.525	43.750	36.700	49.900	36.700	49.900	5.908
Chloride (mg/L)	4	40.000	43.500	25.000	48.000	25.000	48.000	10.614
Fluoride (mg/L)	4	0.075	0.075	0.070	0.080	0.070	0.080	0.006
Sodium (mg/L)	4	23.800	23.850	17.500	30.000	17.500	30.000	5.258
Sulphate as SO42-(mg/L)	4	13.950	15.500	4.800	20.000	4.800	20.000	7.430
Potassium (mg/L)	4	1.840	2.050	1.130	2.130	1.130	2.130	0.475
Magnesium (mg/L)	4	5.560	5.400	4.150	7.290	4.150	7.290	1.376
Calcium (mg/L)	4	14.900	14.250	13.400	17.700	13.400	17.700	1.944
Aluminium (ug/L)	4	296.250	280.500	43.000	581.000	43.000	581.000	263.772
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Copper (ug/L)	4	2.500	1.500	1.000	6.000	1.000	6.000	2.380
Lead (ug/L)	4	1.000	0.750	0.500	2.000	0.500	2.000	0.707
Manganese (ug/L)	4	31.500	25.500	13.000	62.000	13.000	62.000	21.486
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	0.875	1.000	0.500	1.000	0.500	1.000	0.250
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	10.500	10.000	5.000	17.000	5.000	17.000	5.916
Boron (ug/L)	4	29.750	33.000	16.000	37.000	16.000	37.000	9.674
Iron (ug/L)	4	1134.500	1048.000	612.000	1830.000	612.000	1830.000	512.711
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 054 for July 2014 to June 2015								
Site 054	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	16.060	16.480	9.410	22.510	12.030	19.310	4.225
Electrical Conductivity (ms/cm)	12	0.213	0.200	0.060	0.360	0.110	0.340	0.105
Electrical Conductivity (µS/cm)	12	206.250	186.500	90.000	335.000	110.000	321.000	95.445
Turbidity (NTU)	12	17.467	3.450	0.000	100.400	0.000	28.300	28.717
Dissolved oxygen (mg/L)	12	10.091	10.145	7.260	13.250	9.380	11.260	1.691
Dissolved oxygen (%sat)	12	101.425	101.750	84.500	124.700	97.900	104.000	9.790
pH	12	5.557	5.630	4.000	7.010	4.760	6.460	0.983
Salinity (ppt)	12	0.105	0.095	0.030	0.180	0.050	0.170	0.053
Suspended Solids (mg/L)	12	4.917	2.000	1.000	35.000	1.000	4.000	9.539
Ammonium-Nitrogen (mg/L)	12	0.011	0.005	0.005	0.060	0.005	0.010	0.016
Oxidised Nitrogen (mg/L)	12	0.012	0.008	0.005	0.040	0.005	0.010	0.011
Total Nitrogen (mg/L)	12	0.192	0.130	0.060	0.460	0.090	0.330	0.136
Total Phosphorus(mg/L)	12	0.013	0.006	0.003	0.047	0.005	0.016	0.014

Faecal Coliforms (CFU/100ml)	12	558.63	23.00	0.50	2900.00	9.00	500.00	1103.98
Enterococci (CFU/100ml)	5	182.60	40.00	9.00	800.00	13.50	423.00	345.47
E Coli (CFU/100mL)	2	265.00	265.00	30.00	500.00	30.00	500.00	332.34
Bicarbonate Alkalinity (mg/CaCO ₃ /L)	4	3.975	3.850	2.700	5.500	2.700	5.500	1.159
Chloride (mg/L)	4	39.250	40.500	24.000	52.000	24.000	52.000	12.366
Sulphate as SO ₄ ²⁻ (-mg/L)	4	4.700	4.650	4.200	5.300	4.200	5.300	0.469
Fluoride (mg/L)	4	0.025	0.025	0.025	0.025	0.025	0.025	0.000
Sodium (mg/L)	4	20.400	19.800	13.500	28.500	13.500	28.500	6.694
Potassium (mg/L)	4	1.725	1.755	1.300	2.090	1.300	2.090	0.390
Magnesium (mg/L)	4	3.188	3.025	1.840	4.860	1.840	4.860	1.347
Calcium (mg/L)	4	1.395	1.360	0.910	1.950	0.910	1.950	0.513
Aluminium (ug/L)	4	950.250	876.000	639.000	1410.000	639.000	1410.000	366.290
Arsenic (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Cadmium (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Chromium (ug/L)	4	1.263	1.500	0.050	2.000	0.050	2.000	0.936
Copper (ug/L)	4	1.250	1.000	1.000	2.000	1.000	2.000	0.500
Lead (ug/L)	4	0.638	0.750	0.050	1.000	0.050	1.000	0.457
Manganese (ug/L)	4	39.500	31.500	19.000	76.000	19.000	76.000	25.775
Molybdenum (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Nickel (ug/L)	4	2.250	2.000	1.000	4.000	1.000	4.000	1.258
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	10.750	11.000	5.000	16.000	5.000	16.000	4.500
Boron (ug/L)	4	16.250	15.000	14.000	21.000	14.000	21.000	3.304
Iron (ug/L)	4	702.250	713.500	362.000	1020.000	362.000	1020.000	339.368
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 055 for July 2014 to June 2015								
Site 055	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Secchi Depth (m)	11	1.045	1.000	0.700	1.900	0.800	1.100	0.314
Temperature (oC)	12	20.161	19.670	14.150	25.000	16.910	24.380	3.649
Turbidity (NTU)	12	10.842	10.400	5.200	18.000	9.400	11.900	3.341
Dissolved oxygen (mg/L)	12	7.476	7.010	6.150	10.970	6.780	8.180	1.289
Dissolved oxygen (%sat)	12	96.817	95.800	84.200	111.600	90.600	101.500	7.641
pH	12	7.992	8.045	7.630	8.180	7.940	8.070	0.158
Salinity (ppt)	12	32.338	33.200	23.020	34.470	32.120	33.880	3.077
Suspended Solids (mg/L)	13	14.846	15.000	7.000	23.000	11.000	18.000	4.240
Ammonium-Nitrogen (mg/L)	13	0.026	0.020	0.010	0.070	0.020	0.020	0.020
Oxidised Nitrogen (mg/L)	13	0.045	0.010	0.010	0.160	0.010	0.080	0.056
Total Nitrogen (mg/L)	13	0.295	0.240	0.200	0.580	0.210	0.320	0.122
Total Phosphorus(mg/L)	13	0.025	0.020	0.017	0.070	0.018	0.028	0.014
Soluble Reactive Phosphorus (mg/L)	1	0.011	0.011	0.011	0.011	0.011	0.011	
Chlorophyll-a (ug/L)	13	1.954	1.500	1.200	3.800	1.400	2.900	0.911
Faecal Coliforms (CFU/100ml)	13	11.12	6.00	0.50	29.00	0.50	25.00	11.52
Enterococci (CFU/100ml)	13	4.46	2.00	0.50	15.00	1.00	9.00	4.87

Summary Statistics for Site 060 for July 2014 to June 2015								
Site 060	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Secchi Depth (m)	13	2.119	2.100	1.000	3.800	1.500	2.600	0.774
Temperature (oC)	12	20.518	19.790	12.000	27.450	15.310	27.230	5.352
Turbidity (NTU)	12	2.983	1.450	0.000	13.300	0.800	4.800	3.834
Dissolved oxygen (mg/L)	12	6.526	6.235	3.960	9.980	4.990	8.240	1.829
Dissolved oxygen (%sat)	12	77.843	77.500	57.200	99.000	65.200	91.920	12.821
pH	12	7.514	7.535	6.960	7.840	7.320	7.750	0.247
Salinity (ppt)	12	19.899	20.795	4.840	26.870	17.410	23.780	5.646
Suspended Solids (mg/L)	13	5.615	6.000	1.000	10.000	2.000	9.000	3.097
Ammonium-Nitrogen (mg/L)	13	0.046	0.030	0.010	0.160	0.010	0.090	0.048
Oxidised Nitrogen (mg/L)	13	0.143	0.090	0.005	0.330	0.030	0.290	0.125
Total Nitrogen (mg/L)	13	0.513	0.450	0.300	0.910	0.340	0.700	0.194
Total Phosphorus(mg/L)	13	0.032	0.027	0.016	0.069	0.021	0.040	0.015
Soluble Reactive Phosphorus (mg/L)	5	0.016	0.017	0.011	0.019	0.012	0.019	0.003
Chlorophyll-a (ug/L)	13	5.385	5.800	1.700	10.200	3.200	7.300	2.490
Faecal Coliforms (CFU/100ml)	13	414.92	9.00	1.00	4300.00	4.00	22.00	1199.06
Enterococci (CFU/100ml)	13	48.38	2.00	0.50	500.00	0.50	7.00	138.36

Summary Statistics for Site 061 for July 2014 to June 2015								
Site 061	Valid N	Mean	Median	Minimum	Maximum	Percentile	Percentile	Std.Dev.

					20	80		
Secchi Depth (m)	26	2.002	2.000	0.550	3.500	1.500	2.300	0.749
Temperature (oC)	27	20.923	20.960	11.970	27.900	15.410	26.890	5.348
Turbidity (NTU)	27	2.911	1.500	0.200	20.100	1.000	2.900	4.219
Dissolved oxygen (mg/L)	27	7.410	7.060	4.820	10.840	6.040	8.950	1.519
Dissolved oxygen (%sat)	27	92.200	94.100	67.700	122.400	74.300	103.100	15.422
pH	27	7.659	7.690	6.830	7.990	7.490	7.900	0.287
Salinity (ppt)	27	21.104	22.020	1.610	27.830	19.200	24.770	5.860
Suspended Solids (mg/L)	28	5.821	5.000	1.000	16.000	3.000	9.000	3.570
Ammonium-Nitrogen (mg/L)	28	0.027	0.010	0.005	0.160	0.010	0.030	0.040
Oxidised Nitrogen (mg/L)	28	0.091	0.030	0.005	0.320	0.005	0.250	0.113
Total Nitrogen (mg/L)	28	0.479	0.420	0.270	1.040	0.340	0.620	0.185
Total Phosphorus(mg/L)	28	0.038	0.032	0.014	0.162	0.020	0.047	0.029
Soluble Reactive Phosphorus (mg/L)	10	0.015	0.015	0.008	0.020	0.011	0.018	0.004
Chlorophyll-a (ug/L)	27	10.378	10.200	0.300	30.500	4.000	15.100	7.862
Faecal Coliforms (CFU/100ml)	28	130.04	2.50	0.50	2700.00	1.00	28.00	514.88
Enterococci (CFU/100ml)	28	25.05	1.00	0.50	540.00	0.50	5.00	101.85

Summary Statistics for Site 062 for July 2014 to June 2015								
Site 062	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	16.341	16.165	10.220	22.760	13.060	19.750	3.766
Electrical Conductivity (ms/cm)	12	0.403	0.395	0.270	0.510	0.350	0.460	0.067
Electrical Conductivity (µS/cm)	12	394.167	407.000	261.000	476.000	363.000	436.000	58.041
Turbidity (NTU)	12	3.817	1.900	0.900	17.100	1.300	4.800	4.524
Dissolved oxygen (mg/L)	12	8.738	9.230	6.650	10.300	7.230	9.820	1.223
Dissolved oxygen (%sat)	12	88.914	89.000	74.900	102.000	78.100	99.400	9.358
pH	12	7.326	7.315	7.050	7.580	7.200	7.420	0.153
Salinity (ppt)	12	0.199	0.195	0.130	0.260	0.170	0.230	0.036
Suspended Solids (mg/L)	12	1.917	1.000	1.000	6.000	1.000	3.000	1.621
Ammonium-Nitrogen (mg/L)	12	0.039	0.030	0.005	0.090	0.010	0.080	0.031
Oxidised Nitrogen (mg/L)	12	0.525	0.085	0.020	2.350	0.030	0.780	0.834
Total Nitrogen (mg/L)	12	0.893	0.445	0.220	2.820	0.400	1.120	0.893
Total Phosphorus(mg/L)	12	0.030	0.023	0.007	0.090	0.017	0.042	0.022
Faecal Coliforms (CFU/100ml)	12	402.667	210.000	21.000	1400.000	53.000	670.000	461.008
Enterococci (CFU/100ml)	5	78.200	72.000	36.000	140.000	45.500	114.000	39.601
E Coli (CFU/100mL)	3	196.667	170.000	120.000	300.000	120.000	300.000	92.916
Bicarbonate Alkalinity (mg/CaCO3/L)	4	67.075	66.800	58.400	76.300	58.400	76.300	7.391
Chloride (mg/L)	4	52.000	57.500	32.000	61.000	32.000	61.000	13.441
Sulphate as SO42-(mg/L)	4	18.950	19.750	4.300	32.000	4.300	32.000	14.099
Fluoride (mg/L)	4	0.040	0.038	0.025	0.060	0.025	0.060	0.018
Sodium (mg/L)	4	39.175	42.050	25.700	46.900	25.700	46.900	9.270
Potassium (mg/L)	4	3.870	3.695	3.150	4.940	3.150	4.940	0.859
Magnesium (mg/L)	4	7.168	6.900	5.800	9.070	5.800	9.070	1.413
Calcium (mg/L)	4	19.525	19.500	16.000	23.100	16.000	23.100	3.288
Aluminium (ug/L)	4	207.500	213.000	58.000	346.000	58.000	346.000	121.360
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	0.625	0.500	0.500	1.000	0.500	1.000	0.250
Copper (ug/L)	4	1.750	1.500	1.000	3.000	1.000	3.000	0.957
Lead (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Manganese (ug/L)	4	30.000	28.000	14.000	50.000	14.000	50.000	15.427
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	0.625	0.500	0.500	1.000	0.500	1.000	0.250
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	7.375	5.000	2.500	17.000	2.500	17.000	6.524
Boron (ug/L)	4	44.250	45.000	36.000	51.000	36.000	51.000	6.994
Iron (ug/L)	4	754.250	763.500	390.000	1100.000	390.000	1100.000	372.629
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 063 for July 2014 to June 2015								
Site 063	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	9	14.337	13.800	7.420	20.470	11.090	19.810	4.252
Electrical Conductivity (ms/cm)	9	0.438	0.440	0.190	0.620	0.380	0.510	0.116
Electrical Conductivity (µS/cm)	9	450.222	434.000	231.000	713.000	383.000	505.000	126.608
Turbidity (NTU)	9	7.900	2.000	1.500	52.000	1.600	5.700	16.588
Dissolved oxygen (mg/L)	9	8.614	7.870	4.980	11.650	6.200	11.090	2.411

Dissolved oxygen (%sat)	9	82.875	81.600	55.400	102.800	61.500	98.100	16.996
pH	9	7.114	7.060	6.710	7.470	6.930	7.440	0.247
Salinity (ppt)	9	0.224	0.230	0.100	0.310	0.190	0.260	0.057
Suspended Solids (mg/L)	9	4.000	1.000	1.000	28.000	1.000	1.000	9.000
Ammonium-Nitrogen (mg/L)	9	0.014	0.010	0.005	0.030	0.010	0.020	0.008
Oxidised Nitrogen (mg/L)	9	0.221	0.030	0.010	1.400	0.020	0.270	0.451
Total Nitrogen (mg/L)	9	0.601	0.420	0.230	2.290	0.290	0.620	0.644
Total Phosphorus(mg/L)	9	0.037	0.022	0.007	0.177	0.014	0.028	0.053
Faecal Coliforms (CFU/100ml)	9	949.667	41.000	15.000	7900.000	27.000	260.000	2607.710
Enterococci (CFU/100ml)	3	109.667	95.000	84.000	150.000	84.000	150.000	35.360
E Coli (CFU/100mL)	1	180.000	180.000	180.000	180.000	180.000	180.000	
Bicarbonate Alkalinity (mg/CaCO3/L)	3	30.600	31.200	26.400	34.200	26.400	34.200	3.934
Chloride (mg/L)	3	94.667	93.000	81.000	110.000	81.000	110.000	14.572
Sulphate as SO42-(mg/L)	3	18.333	19.000	10.000	26.000	10.000	26.000	8.021
Fluoride (mg/L)	3	0.080	0.080	0.070	0.090	0.070	0.090	0.010
Sodium (mg/L)	3	51.100	47.900	44.400	61.000	44.400	61.000	8.750
Potassium (mg/L)	3	5.497	5.390	4.660	6.440	4.660	6.440	0.895
Magnesium (mg/L)	3	9.513	8.820	8.420	11.300	8.420	11.300	1.560
Calcium (mg/L)	3	14.067	13.600	12.800	15.800	12.800	15.800	1.553
Aluminium (ug/L)	3	249.000	328.000	61.000	358.000	61.000	358.000	163.502
Arsenic (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Cadmium (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Chromium (ug/L)	3	0.517	0.500	0.050	1.000	0.050	1.000	0.475
Copper (ug/L)	3	1.000	1.000	1.000	1.000	1.000	1.000	0.000
Lead (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Manganese (ug/L)	3	18.000	21.000	11.000	22.000	11.000	22.000	6.083
Molybdenum (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Nickel (ug/L)	3	0.517	0.500	0.050	1.000	0.050	1.000	0.475
Selenium (ug/L)	3	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	3	7.500	5.000	2.500	15.000	2.500	15.000	6.614
Boron (ug/L)	3	33.000	32.000	29.000	38.000	29.000	38.000	4.583
Iron (ug/L)	3	1017.667	1020.000	993.000	1040.000	993.000	1040.000	23.587
Mercury (ug/L)	3	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 064 for July 2014 to June 2015								
Site 064	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	16.380	16.200	10.160	22.110	13.710	19.360	3.700
Electrical Conductivity (ms/cm)	12	0.410	0.390	0.120	0.600	0.340	0.550	0.130
Electrical Conductivity (µS/cm)	12	407.580	414.500	111.000	585.000	345.000	537.000	127.080
Turbidity (NTU)	12	28.850	7.700	1.200	230.700	2.600	26.200	64.410
Dissolved oxygen (mg/L)	12	9.210	9.290	6.880	11.600	7.300	10.370	1.490
Dissolved oxygen (%sat)	12	93.450	95.300	78.600	112.200	82.316	100.000	9.720
pH	12	7.170	7.160	6.290	7.750	6.980	7.450	0.370
Salinity (ppt)	12	0.200	0.190	0.060	0.300	0.170	0.270	0.060
Suspended Solids (mg/L)	12	11.580	2.000	1.000	110.000	1.000	5.000	31.060
Ammonium-Nitrogen (mg/L)	12	0.060	0.040	0.020	0.220	0.030	0.070	0.060
Oxidised Nitrogen (mg/L)	12	0.920	0.660	0.040	2.800	0.080	1.810	0.950
Total Nitrogen (mg/L)	12	1.400	1.220	0.340	3.590	0.390	2.150	1.120
Total Phosphorus(mg/L)	12	0.110	0.090	0.028	0.360	0.037	0.160	0.090
Faecal Coliforms (CFU/100ml)	12	3793.50	185.00	23.00	41000.00	55.00	930.00	11731.94
Enterococci (CFU/100ml)	5	11419.00	260.00	75.00	56000.00	162.50	28255.00	24922.02
E Coli (CFU/100mL)	2	20710.00	20710.00	420.00	41000.00	420.00	41000.00	28694.39
Bicarbonate Alkalinity (mg/CaCO3/L)	4	54.000	54.600	49.800	57.000	49.800	57.000	3.040
Chloride (mg/L)	4	76.750	70.000	57.000	110.000	57.000	110.000	23.510
Sulphate as SO42-(mg/L)	4	22.250	24.500	11.000	29.000	11.000	29.000	7.890
Fluoride (mg/L)	4	0.090	0.080	0.070	0.130	0.070	0.130	0.030
Sodium (mg/L)	4	50.880	45.800	38.800	73.100	38.800	73.100	15.220
Potassium (mg/L)	4	5.080	5.080	4.140	6.000	4.140	6.000	0.960
Magnesium (mg/L)	4	7.860	7.280	6.600	10.300	6.600	10.300	1.660
Calcium (mg/L)	4	21.400	20.400	19.200	25.600	19.200	25.600	2.870
Aluminium (ug/L)	4	1174.250	901.000	55.000	2840.000	55.000	2840.000	1180.460
Arsenic (ug/L)	4	0.760	0.500	0.050	2.000	0.050	2.000	0.850
Cadmium (ug/L)	4	0.390	0.500	0.050	0.500	0.050	0.500	0.230
Chromium (ug/L)	4	1.500	1.000	1.000	3.000	1.000	3.000	1.000
Copper (ug/L)	4	4.250	3.500	1.000	9.000	1.000	9.000	3.400
Lead (ug/L)	4	1.010	0.500	0.050	3.000	0.050	3.000	1.340
Manganese (ug/L)	4	26.250	28.000	17.000	32.000	17.000	32.000	6.900

Molybdenum (ug/L)	4	0.390	0.500	0.050	0.500	0.050	0.500	0.230
Nickel (ug/L)	4	1.250	1.000	1.000	2.000	1.000	2.000	0.500
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	21.000	23.000	5.000	33.000	5.000	33.000	12.110
Boron (ug/L)	4	41.250	40.500	34.000	50.000	34.000	50.000	6.600
Iron (ug/L)	4	1650.000	1440.000	1220.000	2500.000	1220.000	2500.000	584.350
Mercury (ug/L)	4	0.010	0.010	0.005	0.010	0.005	0.010	0.000

Summary Statistics for Site 077 for July 2014 to June 2015								
Site 077	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	16.231	17.540	8.180	22.520	12.740	20.010	4.460
Electrical Conductivity (ms/cm)	12	0.658	0.565	0.220	1.460	0.390	0.800	0.360
Electrical Conductivity (µS/cm)	12	660.833	562.500	203.000	1551.000	408.000	808.000	380.960
Turbidity (NTU)	12	11.825	7.000	1.100	50.500	2.600	11.900	14.460
Dissolved oxygen (mg/L)	12	6.078	5.675	3.950	9.620	4.310	7.900	1.940
Dissolved oxygen (%sat)	12	61.616	57.200	38.100	91.000	45.600	82.900	18.590
pH	12	7.471	7.445	7.060	7.820	7.360	7.630	0.230
Salinity (ppt)	12	0.333	0.280	0.110	0.750	0.190	0.430	0.190
Suspended Solids (mg/L)	13	4.077	1.000	1.000	17.000	1.000	6.000	5.510
Ammonium-Nitrogen (mg/L)	13	9.420	3.750	0.180	43.000	1.150	11.000	12.490
Oxidised Nitrogen (mg/L)	13	5.045	5.400	1.880	10.000	3.000	6.000	2.130
Total Nitrogen (mg/L)	13	15.646	9.770	3.560	58.800	5.790	18.500	15.620
Total Phosphorus(mg/L)	13	0.039	0.024	0.012	0.120	0.014	0.065	0.040
Faecal Coliforms (CFU/100ml)	13	8253.538	340.000	54.000	80000.000	94.000	2700.000	22225.500
Enterococci (CFU/100ml)	6	484.000	180.000	34.000	1800.000	40.000	670.000	688.060
E Coli (CFU/100ml)	3	103.33	96.00	94.00	120.00	94.00	120.00	14.47
Bicarbonate Alkalinity (mg/CaCO3/L)	5	98.56	100.00	33.20	147.00	49.90	146.50	49.73
Chloride (mg/L)	5	68.000	84.000	30.000	94.000	34.000	94.000	31.430
Sulphate as SO42-(mg/L)	5	22.620	27.000	6.100	32.000	13.550	29.500	10.020
Fluoride (mg/L)	5	0.036	0.025	0.025	0.080	0.025	0.053	0.020
Sodium (mg/L)	5	39.500	42.500	18.600	58.400	19.850	57.650	19.000
Potassium (mg/L)	5	9.798	7.530	6.390	14.200	6.680	14.050	3.900
Magnesium (mg/L)	5	8.046	8.160	3.140	12.100	4.135	11.900	3.950
Calcium (mg/L)	5	30.460	32.800	13.600	40.300	20.200	39.550	10.830
Aluminium (ug/L)	5	334.400	239.000	130.000	827.000	183.000	533.500	279.340
Arsenic (ug/L)	5	0.800	0.500	0.500	2.000	0.500	1.250	0.670
Cadmium (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	5	0.800	0.500	0.500	2.000	0.500	1.250	0.670
Copper (ug/L)	5	5.200	2.000	1.000	16.000	1.500	10.500	6.220
Lead (ug/L)	5	1.200	0.500	0.500	4.000	0.500	2.250	1.570
Manganese (ug/L)	5	30.000	35.000	12.000	36.000	22.000	35.500	10.170
Molybdenum (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	5	1.500	2.000	0.500	2.000	0.750	2.000	0.710
Selenium (ug/L)	5	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	5	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	5	18.000	11.000	6.000	39.000	6.000	33.500	14.820
Boron (ug/L)	5	73.800	62.000	48.000	100.000	53.500	100.000	24.480
Iron (ug/L)	5	909.000	844.000	475.000	1800.000	514.000	1336.500	527.850
Mercury (ug/L)	5	0.01	0.01	0.01	0.01	0.01	0.01	0.00

Summary Statistics for Site 080 for July 2014 to June 2015								
Site 080	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	13	16.462	16.150	11.340	20.870	13.200	20.460	3.436
Electrical Conductivity (ms/cm)	13	0.468	0.480	0.180	0.630	0.390	0.570	0.128
Electrical Conductivity (µS/cm)	13	467.077	509.000	137.000	609.000	374.000	571.000	128.758
Turbidity (NTU)	13	27.454	4.500	0.900	170.100	1.400	35.200	47.879
Dissolved oxygen (mg/L)	13	9.023	9.150	7.450	11.500	7.850	10.190	1.273
Dissolved oxygen (%sat)	13	92.074	92.500	76.800	111.500	82.700	98.500	9.070
pH	13	7.322	7.350	6.690	7.540	7.250	7.490	0.236
Salinity (ppt)	13	0.232	0.240	0.090	0.320	0.190	0.280	0.063
Suspended Solids (mg/L)	14	10.857	3.000	1.000	100.000	1.000	11.000	25.973
Ammonium-Nitrogen (mg/L)	14	0.210	0.175	0.050	0.640	0.110	0.310	0.153
Oxidised Nitrogen (mg/L)	14	0.851	0.470	0.240	3.000	0.320	1.340	0.817
Total Nitrogen (mg/L)	14	1.689	1.285	0.890	4.430	0.990	1.990	1.054

Total Phosphorus(mg/L)	14	0.198	0.131	0.054	0.540	0.061	0.350	0.155
Faecal Coliforms (CFU/100ml)	14	2001.71	745.00	44.00	10000.00	120.00	3700.00	2694.91
Enterococci (CFU/100ml)	5	7496.00	1900.00	750.00	24000.00	790.00	17000.00	9998.89
E Coli (CFU/100ml)	2	5255.00	5255.00	510.00	10000.00	510.00	10000.00	6710.44
Bicarbonate Alkalinity (mg/CaCO3/L)	4	62.900	62.050	50.500	77.000	50.500	77.000	10.872
Chloride (mg/L)	4	74.250	71.000	60.000	95.000	60.000	95.000	14.863
Sulphate as SO42-(mg/L)	4	32.500	30.500	22.000	47.000	22.000	47.000	10.472
Fluoride (mg/L)	4	0.113	0.110	0.100	0.130	0.100	0.130	0.013
Sodium (mg/L)	4	43.125	39.000	35.800	58.700	35.800	58.700	10.504
Potassium (mg/L)	4	11.178	11.000	8.610	14.100	8.610	14.100	2.274
Magnesium (mg/L)	4	10.348	9.455	8.480	14.000	8.480	14.000	2.484
Calcium (mg/L)	4	21.500	20.200	20.100	25.500	20.100	25.500	2.668
Aluminium (ug/L)	4	843.000	524.000	44.000	2280.000	44.000	2280.000	985.538
Arsenic (ug/L)	4	0.763	0.500	0.050	2.000	0.050	2.000	0.852
Cadmium (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Chromium (ug/L)	4	1.138	1.250	0.050	2.000	0.050	2.000	1.013
Copper (ug/L)	4	2.750	3.000	1.000	4.000	1.000	4.000	1.500
Lead (ug/L)	4	1.013	0.500	0.050	3.000	0.050	3.000	1.342
Manganese (ug/L)	4	40.000	42.500	16.000	59.000	16.000	59.000	19.408
Molybdenum (ug/L)	4	0.388	0.500	0.050	0.500	0.050	0.500	0.225
Nickel (ug/L)	4	0.888	0.750	0.050	2.000	0.050	2.000	0.837
Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	10.250	10.000	5.000	16.000	5.000	16.000	5.123
Boron (ug/L)	4	39.500	35.000	33.000	55.000	33.000	55.000	10.408
Iron (ug/L)	4	1410.250	1375.000	881.000	2010.000	881.000	2010.000	484.266
Mercury (ug/L)	4	0.005	0.005	0.005	0.010	0.005	0.010	0.000

Summary Statistics for Site 094 for July 2014 to June 2015								
Site 094	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	17.470	17.625	13.0100	21.620	13.0100	21.620	3.5267
Electrical Conductivity (ms/cm)	4	1.125	1.120	1.0200	1.240	1.0200	1.240	0.0915
Electrical Conductivity (µS/cm)	4	1123.750	1099.000	1053.0000	1244.000	1053.0000	1244.000	85.7181
Turbidity (NTU)	4	2.475	0.150	0.1000	9.500	0.1000	9.500	4.6836
Dissolved oxygen (mg/L)	4	4.103	3.955	1.2800	7.220	1.2800	7.220	3.0794
Dissolved oxygen (%sat)	4	41.600	41.400	15.0000	68.600	15.0000	68.600	29.4294
pH	4	7.663	7.655	7.6300	7.710	7.6300	7.710	0.0359
Salinity (ppt)	4	0.575	0.570	0.5200	0.640	0.5200	0.640	0.0500
Suspended Solids (mg/L)	4	2.250	1.000	1.0000	6.000	1.0000	6.000	2.5000
Ammonium-Nitrogen (mg/L)	4	8.180	8.185	4.5500	11.800	4.5500	11.800	3.5565
Oxidised Nitrogen (mg/L)	4	5.170	5.890	2.3000	6.600	2.3000	6.600	1.9568
Total Nitrogen (mg/L)	4	14.075	14.350	10.7000	16.900	10.7000	16.900	2.5539
Total Phosphorus(mg/L)	4	0.013	0.012	0.0100	0.020	0.0100	0.020	0.0046
Faecal Coliforms (CFU/100ml)	4	2.125	1.000	0.5000	6.000	0.5000	6.000	2.5941
Enterococci (CFU/100ml)	1	29.000	29.000	29.0000	29.000	29.0000	29.000	
Bicarbonate Alkalinity (mg/CaCO3/L)	1	316.000	316.000	316.0000	316.000	316.0000	316.000	
Chloride (mg/L)	1	51.000	51.000	51.0000	51.000	51.0000	51.000	
Sulphate as SO42-(mg/L)	1	137.000	137.000	137.0000	137.000	137.0000	137.000	
Fluoride (mg/L)	1	0.025	0.025	0.0250	0.025	0.0250	0.025	
Sodium (mg/L)	1	45.300	45.300	45.3000	45.300	45.3000	45.300	
Magnesium (mg/L)	1	22.600	22.600	22.6000	22.600	22.6000	22.600	
Potassium (mg/L)	1	17.000	17.000	17.0000	17.000	17.0000	17.000	
Calcium (mg/L)	1	122.000	122.000	122.0000	122.000	122.0000	122.000	
Aluminium (ug/L)	1	61.000	61.000	61.0000	61.000	61.0000	61.000	
Arsenic (ug/L)	1	0.050	0.050	0.0500	0.050	0.0500	0.050	
Cadmium (ug/L)	1	0.050	0.050	0.0500	0.050	0.0500	0.050	
Chromium (ug/L)	1	0.050	0.050	0.0500	0.050	0.0500	0.050	
Copper (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Lead (ug/L)	1	0.050	0.050	0.0500	0.050	0.0500	0.050	
Manganese (ug/L)	1	193.000	193.000	193.0000	193.000	193.0000	193.000	
Molybdenum (ug/L)	1	0.050	0.050	0.0500	0.050	0.0500	0.050	
Nickel (ug/L)	1	7.000	7.000	7.0000	7.000	7.0000	7.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	69.000	69.000	69.0000	69.000	69.0000	69.000	
Boron (ug/L)	1	267.000	267.000	267.0000	267.000	267.0000	267.000	

Iron (ug/L)	1	185.000	185.000	185.0000	185.000	185.0000	185.000
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005

Summary Statistics for Site 095 for July 2014 to June 2015								
Site 095	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	7	18.909	19.970	13.710	23.450	15.640	21.590	3.464
Electrical Conductivity (ms/cm)	7	2.117	2.080	1.920	2.400	1.970	2.250	0.173
Electrical Conductivity (µS/cm)	7	2150.429	2108.000	1920.000	2382.000	2037.000	2294.000	167.817
Turbidity (NTU)	7	84.629	72.800	47.000	165.600	61.900	94.000	38.720
Dissolved oxygen (mg/L)	7	5.157	5.300	3.180	6.140	4.860	5.970	0.995
Dissolved oxygen (%sat)	7	55.557	55.500	32.200	68.600	51.300	66.500	12.359
pH	7	7.119	7.140	6.830	7.250	7.060	7.220	0.143
Salinity (ppt)	7	1.079	1.070	0.890	1.240	1.020	1.160	0.114
Suspended Solids (mg/L)	5	9.200	7.000	7.000	15.000	7.000	12.500	3.493
Ammonium-Nitrogen (mg/L)	7	77.929	78.000	48.500	97.900	63.500	93.000	17.295
Oxidised Nitrogen (mg/L)	7	0.813	0.510	0.180	2.500	0.430	1.070	0.791
Total Nitrogen (mg/L)	7	86.357	88.400	52.000	121.000	70.800	98.400	21.878
Total Phosphorus(mg/L)	7	0.021	0.019	0.013	0.035	0.015	0.025	0.007
Faecal Coliforms (CFU/100ml)	7	4.857	5.000	0.500	11.000	0.500	8.000	4.049
Enterococci (CFU/100ml)	5	25.800	30.000	3.000	51.000	4.500	45.000	20.850
E Coli (CFU/100mL)	4	5.38	5.00	0.50	11.00	0.50	11.00	4.96
Chloride (mg/L)	5	241.00	242.00	210.00	270.00	215.00	266.50	26.12
Sulphate as SO42-(mg/L)	2	21.300	21.300	3.600	39.000	3.600	39.000	25.032
Fluoride (mg/L)	7	0.025	0.025	0.025	0.025	0.025	0.025	0.000
Sodium (mg/L)	5	144.800	146.000	121.000	165.000	128.500	160.500	17.167
Potassium (mg/L)	2	63.250	63.250	53.800	72.700	53.800	72.700	13.364
Magnesium (mg/L)	5	29.860	30.900	26.300	31.800	27.650	31.550	2.255
Calcium (mg/L)	5	99.640	99.300	88.900	111.000	92.450	107.000	8.201
Iron (ug/L)	1	3.150	3.150	3.150	3.150	3.150	3.150	

Summary Statistics for Site 096 for July 2014 to June 2015								
Site 096	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	7	17.596	19.350	11.010	21.460	14.100	20.610	3.820
Electrical Conductivity (ms/cm)	7	1.431	1.590	0.770	1.870	1.090	1.770	0.403
Electrical Conductivity (µS/cm)	7	1450.143	1631.000	762.000	1854.000	1099.000	1854.000	412.035
Turbidity (NTU)	7	1.557	0.800	0.300	4.600	0.300	2.300	1.579
Dissolved oxygen (mg/L)	7	2.579	2.300	2.050	3.390	2.170	3.360	0.562
Dissolved oxygen (%sat)	7	26.914	24.700	22.400	37.300	22.800	30.800	5.347
pH	7	7.281	7.240	7.150	7.480	7.170	7.420	0.127
Salinity (ppt)	7	0.731	0.810	0.390	0.960	0.550	0.910	0.210
Suspended Solids (mg/L)	5	1.200	1.000	1.000	2.000	1.000	1.500	0.447
Ammonium-Nitrogen (mg/L)	7	7.319	1.360	0.130	33.200	0.570	10.100	11.942
Oxidised Nitrogen (mg/L)	7	6.116	5.350	1.760	11.500	3.600	8.550	3.211
Total Nitrogen (mg/L)	7	15.804	8.280	3.190	45.700	6.970	21.300	14.714
Total Phosphorus(mg/L)	7	0.051	0.046	0.035	0.076	0.038	0.066	0.016
Faecal Coliforms (CFU/100ml)	7	345.929	40.000	0.500	1200.000	4.000	1100.000	550.292
Enterococci (CFU/100ml)	5	1433.600	320.000	58.000	6000.000	89.000	3335.000	2563.836
E Coli (CFU/100mL)	4	285.13	20.00	0.50	1100.00	0.50	1100.00	543.49
Chloride (mg/L)	5	224.40	263.00	86.00	313.00	128.00	301.50	94.55
Sulphate as SO42-(mg/L)	2	10.400	10.400	3.800	17.000	3.800	17.000	9.334
Fluoride (mg/L)	7	0.071	0.080	0.025	0.100	0.050	0.090	0.027
Sodium (mg/L)	5	140.400	176.000	58.000	181.000	84.000	179.000	54.702
Potassium (mg/L)	2	50.050	50.050	27.900	72.200	27.900	72.200	31.325
Magnesium (mg/L)	5	29.140	32.400	18.400	33.800	23.000	33.650	6.501
Calcium (mg/L)	5	81.200	88.200	51.900	96.700	64.950	93.950	17.734
Iron (ug/L)	1	0.290	0.290	0.290	0.290	0.290	0.290	

Summary Statistics for Site 098 for July 2014 to June 2015								
Site 098	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	19.563	19.880	15.4000	23.090	15.4000	23.090	3.7018
Electrical Conductivity (ms/cm)	4	0.225	0.210	0.1800	0.300	0.1800	0.300	0.0526
Electrical Conductivity (µS/cm)	4	207.000	217.000	168.0000	226.000	168.0000	226.000	27.1416
Turbidity (NTU)	4	0.625	0.550	0.0000	1.400	0.0000	1.400	0.6449
Dissolved oxygen (mg/L)	4	6.005	6.000	3.9700	8.050	3.9700	8.050	1.6860
Dissolved oxygen (%sat)	4	64.575	66.100	45.6000	80.500	45.6000	80.500	14.3565

pH	4	7.523	7.545	7.1100	7.890	7.1100	7.890	0.3239
Salinity (ppt)	4	0.113	0.105	0.0900	0.150	0.0900	0.150	0.0263
Suspended Solids (mg/L)	4	1.000	1.000	1.0000	1.000	1.0000	1.000	0.0000
Ammonium-Nitrogen (mg/L)	4	0.013	0.008	0.0050	0.030	0.0050	0.030	0.0119
Oxidised Nitrogen (mg/L)	4	0.460	0.495	0.3100	0.540	0.3100	0.540	0.1030
Total Nitrogen (mg/L)	4	0.780	0.805	0.6800	0.830	0.6800	0.830	0.0707
Total Phosphorus(mg/L)	4	0.083	0.074	0.0680	0.116	0.0680	0.116	0.0224
Faecal Coliforms (CFU/100ml)	4	19.250	16.000	3.0000	42.000	3.0000	42.000	18.2825
Enterococci (CFU/100ml)	3	8.333	6.000	1.0000	18.000	1.0000	18.000	8.7369
Fluoride (mg/L)	4	0.580	0.630	0.4100	0.650	0.4100	0.650	0.1137

Summary Statistics for Site 100 for July 2014 to June 2015								
Site 100	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	0							
Temperature (oC)	12	18.939	20.070	9.660	26.160	14.090	24.080	5.459
Turbidity (NTU)	12	12.867	4.700	1.400	87.000	2.400	12.700	23.875
Dissolved oxygen (mg/L)	12	6.769	7.010	3.550	9.750	3.820	9.250	2.488
Dissolved oxygen (%sat)	12	76.122	79.650	45.100	105.400	55.160	93.700	21.168
pH	12	7.370	7.285	7.110	7.760	7.200	7.620	0.229
Salinity (ppt)	12	11.632	13.675	0.170	21.080	2.550	16.350	6.848
Suspended Solids (mg/L)	13	4.615	5.000	1.000	10.000	2.000	6.000	2.434
Ammonium-Nitrogen (mg/L)	13	0.108	0.100	0.020	0.270	0.050	0.160	0.070
Oxidised Nitrogen (mg/L)	13	0.532	0.450	0.070	1.560	0.220	0.590	0.400
Total Nitrogen (mg/L)	13	1.019	0.870	0.560	1.950	0.710	1.220	0.423
Total Phosphorus(mg/L)	13	0.060	0.056	0.023	0.110	0.025	0.099	0.032
Soluble Reactive Phosphorus (mg/L)	3	0.028	0.032	0.017	0.040	0.017	0.036	0.010
Chlorophyll-a (ug/L)	13	2.131	1.500	0.800	8.300	1.100	2.200	2.021
Faecal Coliforms (CFU/100ml)	13	2903.69	65.00	3.00	32000.00	17.00	1200.00	8812.38
Enterococci (CFU/100ml)	13	446.69	18.00	5.00	5000.00	6.00	300.00	1373.02

Summary Statistics for Site 103 for July 2014 to June 2015								
Site 103	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	12	0.879	0.700	0.400	2.150	0.500	1.200	0.512
Temperature (oC)	12	20.073	19.885	13.180	26.010	16.070	25.620	4.489
Turbidity (NTU)	12	22.358	22.650	4.800	48.400	7.900	36.000	14.228
Dissolved oxygen (mg/L)	12	7.091	6.820	5.630	9.760	6.000	8.290	1.271
Dissolved oxygen (%sat)	12	88.937	88.150	79.100	103.200	82.900	93.840	6.820
pH	12	7.870	7.905	7.530	8.060	7.820	7.960	0.154
Salinity (ppt)	12	27.687	28.495	15.300	31.990	26.160	31.650	4.645
Suspended Solids (mg/L)	12	27.000	22.000	6.000	82.000	11.000	37.000	20.494
Ammonium-Nitrogen (mg/L)	12	0.027	0.020	0.010	0.100	0.010	0.030	0.026
Oxidised Nitrogen (mg/L)	12	0.061	0.030	0.010	0.240	0.020	0.100	0.068
Total Nitrogen (mg/L)	12	0.340	0.285	0.230	0.670	0.250	0.390	0.129
Total Phosphorus(mg/L)	12	0.027	0.028	0.015	0.042	0.019	0.038	0.009
Soluble Reactive Phosphorus (mg/L)	0							
Chlorophyll-a (ug/L)	12	2.258	2.000	1.300	4.400	1.700	2.700	0.901
Faecal Coliforms (CFU/100ml)	12	5.21	1.00	0.50	49.00	0.50	1.00	13.88
Enterococci (CFU/100ml)	12	4.13	2.00	0.50	26.00	0.50	4.00	7.09

Summary Statistics for Site 108 for July 2014 to June 2015								
Site 108	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	10	1.195	1.200	0.800	1.500	1.050	1.350	0.209
Temperature (oC)	12	19.738	19.565	14.000	24.520	17.320	23.690	3.384
Turbidity (NTU)	12	8.958	9.350	2.500	14.600	5.700	11.000	3.557
Dissolved oxygen (mg/L)	12	7.244	6.835	6.250	10.430	6.500	8.070	1.178
Dissolved oxygen (%sat)	12	93.122	92.100	83.200	106.160	89.900	96.500	6.207
pH	12	8.028	8.025	7.820	8.190	7.970	8.100	0.095
Salinity (ppt)	12	32.676	33.410	25.220	34.550	31.570	34.080	2.549
Suspended Solids (mg/L)	12	13.250	12.000	4.000	26.000	7.000	17.000	6.552
Ammonium-Nitrogen (mg/L)	12	0.020	0.015	0.010	0.070	0.010	0.020	0.017
Oxidised Nitrogen (mg/L)	12	0.035	0.020	0.005	0.130	0.010	0.050	0.037
Total Nitrogen (mg/L)	12	0.257	0.235	0.180	0.460	0.210	0.290	0.077
Total Phosphorus(mg/L)	12	0.022	0.019	0.016	0.050	0.018	0.024	0.009
Soluble Reactive Phosphorus (mg/L)	0							
Chlorophyll-a (ug/L)	12	1.967	1.650	1.100	4.400	1.400	2.200	0.905
Faecal Coliforms (CFU/100ml)	12	3.33	0.75	0.50	28.00	0.50	2.00	7.81

Enterococci (CFU/100ml)	12	2.92	0.75	0.50	21.00	0.50	3.00	5.81
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Summary Statistics for Site 112 for July 2014 to June 2015								
Site 112	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	19.518	19.610	15.5300	23.320	15.5300	23.320	3.1902
Electrical Conductivity (ms/cm)	4	2.290	2.255	1.9800	2.670	1.9800	2.670	0.3575
Electrical Conductivity (µS/cm)	4	2312.500	2287.000	1999.0000	2677.000	1999.0000	2677.000	362.8099
Turbidity (NTU)	4	1.250	1.000	0.0000	3.000	0.0000	3.000	1.3820
Dissolved oxygen (mg/L)	4	3.700	2.935	0.2400	8.690	0.2400	8.690	3.8446
Dissolved oxygen (%sat)	4	38.375	31.600	2.8000	87.500	2.8000	87.500	38.6655
pH	4	6.993	6.860	6.5900	7.660	6.5900	7.660	0.4654
Salinity (ppt)	4	1.198	1.180	1.0300	1.400	1.0300	1.400	0.1857
Suspended Solids (mg/L)	4	2.500	1.500	1.0000	6.000	1.0000	6.000	2.3805
Ammonium-Nitrogen (mg/L)	4	0.679	0.005	0.0050	2.700	0.0050	2.700	1.3475
Oxidised Nitrogen (mg/L)	4	3.848	2.445	0.4000	10.100	0.4000	10.100	4.5664
Total Nitrogen (mg/L)	4	5.843	4.120	1.8300	13.300	1.8300	13.300	5.3872
Total Phosphorus(mg/L)	4	0.035	0.034	0.0240	0.046	0.0240	0.046	0.0107
Faecal Coliforms (CFU/100ml)	4	3.625	2.500	0.5000	9.000	0.5000	9.000	3.7277
Enterococci (CFU/100ml)	1	2300.000	2300.000	2300.0000	2300.000	2300.0000	2300.000	

Summary Statistics for Site 114 for July 2014 to June 2015								
Site 114	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	16.528	17.530	9.060	21.990	9.060	21.990	5.417
Electrical Conductivity (ms/cm)	4	0.198	0.210	0.140	0.230	0.140	0.230	0.040
Electrical Conductivity (µS/cm)	4	196.250	196.000	189.000	204.000	189.000	204.000	6.185
Turbidity (NTU)	4	0.875	0.750	0.100	1.900	0.100	1.900	0.802
Dissolved oxygen (mg/L)	4	8.388	8.960	6.080	9.550	6.080	9.550	1.568
Dissolved oxygen (%sat)	4	84.950	85.950	69.500	98.400	69.500	98.400	13.214
pH	4	4.893	4.960	4.600	5.050	4.600	5.050	0.202
Salinity (ppt)	4	0.098	0.105	0.070	0.110	0.070	0.110	0.019
Suspended Solids (mg/L)	4	2.500	2.500	1.000	4.000	1.000	4.000	1.291
Ammonium-Nitrogen (mg/L)	4	0.010	0.008	0.005	0.020	0.005	0.020	0.007
Oxidised Nitrogen (mg/L)	4	0.006	0.005	0.005	0.010	0.005	0.010	0.003
Total Nitrogen (mg/L)	4	0.089	0.105	0.025	0.120	0.025	0.120	0.045
Total Phosphorus(mg/L)	4	0.004	0.004	0.003	0.005	0.003	0.005	0.001
Faecal Coliforms (CFU/100ml)	4	28.00	14.00	4.00	80.00	4.00	80.00	35.59

Summary Statistics for Site 120 for July 2014 to June 2015								
Site 120	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	12	20.047	20.210	12.3300	26.260	15.0400	24.890	4.6917
Electrical Conductivity (ms/cm)	12	0.236	0.240	0.1300	0.330	0.1900	0.280	0.0607
Electrical Conductivity (µS/cm)	12	237.333	229.000	171.0000	304.000	182.0000	293.000	52.5501
Turbidity (NTU)	12	1.542	0.600	0.0000	6.100	0.3000	2.200	2.0088
Dissolved oxygen (mg/L)	12	4.428	4.380	1.8200	6.790	3.8700	5.530	1.3186
Dissolved oxygen (%sat)	12	48.392	49.900	21.4000	65.300	40.3000	59.700	13.4280
pH	12	7.035	7.010	6.6700	7.450	6.8800	7.180	0.2098
Salinity (ppt)	12	0.117	0.120	0.0700	0.160	0.0900	0.140	0.0296
Suspended Solids (mg/L)	5	1.000	1.000	1.0000	1.000	1.0000	1.000	0.0000
Ammonium-Nitrogen (mg/L)	5	0.016	0.010	0.0050	0.050	0.0050	0.030	0.0192
Oxidised Nitrogen (mg/L)	5	0.622	0.650	0.2400	0.930	0.3950	0.835	0.2553
Total Nitrogen (mg/L)	5	1.236	1.140	0.9600	1.600	1.0450	1.475	0.2460
Total Phosphorus(mg/L)	5	0.113	0.117	0.0600	0.158	0.0725	0.153	0.0412
Faecal Coliforms (CFU/100ml)	12	3.542	0.500	0.5000	16.000	0.5000	6.000	4.8451
Enterococci (CFU/100ml)	4	1.875	0.500	0.5000	6.000	0.5000	6.000	2.7500
Bicarbonate Alkalinity (mg/CaCO3/L)	1	66.000	66.000	66.0000	66.000	66.0000	66.000	
Chloride (mg/L)	5	18.600	19.000	12.0000	26.000	12.0000	25.000	6.5422
Sulphate as SO42-(mg/L)	3	24.000	25.000	18.0000	29.000	18.0000	29.000	5.5678
Fluoride (mg/L)	12	0.121	0.120	0.0900	0.150	0.1200	0.130	0.0183
Sodium (mg/L)	5	12.760	13.000	7.5900	18.100	8.1000	17.300	4.6506
Magnesium (mg/L)	5	4.968	4.780	2.9900	7.450	3.0200	7.010	2.0220
Potassium (mg/L)	3	6.607	6.510	6.1900	7.120	6.1900	7.120	0.4725
Calcium (mg/L)	5	26.080	26.900	19.5000	31.000	22.6500	29.100	4.1686
Aluminium (ug/L)	1	124.000	124.000	124.0000	124.000	124.0000	124.000	
Arsenic (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	

Copper (ug/L)	1	227.000	227.000	227.0000	227.000	227.0000	227.000	
Lead (ug/L)	1	5.000	5.000	5.0000	5.000	5.0000	5.000	
Manganese (ug/L)	1	17.000	17.000	17.0000	17.000	17.0000	17.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	13.000	13.000	13.0000	13.000	13.0000	13.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	948.000	948.000	948.0000	948.000	948.0000	948.000	
Boron (ug/L)	1	15.000	15.000	15.0000	15.000	15.0000	15.000	
Iron (ug/L)	2	168.815	168.815	0.6300	337.000	0.6300	337.000	237.8495
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005	

Summary Statistics for Site 121 for July 2014 to June 2015								
Site 121	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	13	17.729	18.030	13.3600	21.530	14.5100	21.220	3.0003
Electrical Conductivity (ms/cm)	13	0.212	0.200	0.1400	0.290	0.1800	0.250	0.0407
Electrical Conductivity (µS/cm)	13	210.308	204.000	188.0000	237.000	195.0000	231.000	17.4661
Turbidity (NTU)	13	1.985	0.000	0.0000	17.800	0.0000	2.300	4.9327
Dissolved oxygen (mg/L)	13	9.309	9.410	7.7700	11.010	8.4000	10.190	1.0040
Dissolved oxygen (%sat)	13	97.554	100.100	79.8000	110.500	89.5000	107.600	9.9153
pH	13	7.972	8.050	7.1000	8.550	7.3900	8.460	0.4625
Salinity (ppt)	13	0.104	0.100	0.0700	0.140	0.0900	0.120	0.0190
Suspended Solids (mg/L)	6	1.333	1.000	1.0000	3.000	1.0000	1.000	0.8165
Ammonium-Nitrogen (mg/L)	6	0.213	0.270	0.0100	0.340	0.0500	0.340	0.1481
Oxidised Nitrogen (mg/L)	6	0.260	0.215	0.1600	0.450	0.1800	0.340	0.1123
Total Nitrogen (mg/L)	6	0.895	0.745	0.6500	1.320	0.6900	1.220	0.2945
Total Phosphorus(mg/L)	6	0.032	0.003	0.0020	0.101	0.0020	0.083	0.0466
Faecal Coliforms (CFU/100ml)	13	9.885	0.500	0.5000	120.000	0.5000	0.500	33.0928
Enterococci (CFU/100ml)	5	9.700	0.500	0.5000	37.000	0.5000	23.500	15.8059
Bicarbonate Alkalinity (mg/CaCO3/L)	1	31.200	31.200	31.2000	31.200	31.2000	31.200	
Chloride (mg/L)	6	26.500	29.500	20.0000	30.000	20.0000	30.000	5.0498
Sulphate as SO42-(mg/L)	3	11.967	10.000	8.9000	17.000	8.9000	17.000	4.3936
Fluoride (mg/L)	13	0.851	1.000	0.2500	1.130	0.5100	1.080	0.3236
Sodium (mg/L)	6	15.333	15.450	13.2000	17.000	13.9000	17.000	1.6729
Magnesium (mg/L)	6	5.255	5.180	4.5900	6.310	4.8700	5.400	0.5926
Potassium (mg/L)	3	3.703	2.520	2.0100	6.580	2.0100	6.580	2.5043
Calcium (mg/L)	6	17.167	15.400	13.6000	24.700	13.8000	20.100	4.3962
Aluminium (ug/L)	1	29.000	29.000	29.0000	29.000	29.0000	29.000	
Arsenic (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Copper (ug/L)	1	10.000	10.000	10.0000	10.000	10.0000	10.000	
Lead (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Manganese (ug/L)	1	3.000	3.000	3.0000	3.000	3.0000	3.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	5.000	5.000	5.0000	5.000	5.0000	5.000	
Boron (ug/L)	1	27.000	27.000	27.0000	27.000	27.0000	27.000	
Iron (ug/L)	2	5.155	5.155	0.3100	10.000	0.3100	10.000	6.8519
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005	

Summary Statistics for Site 123 for July 2014 to June 2015								
Site 123	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	5	15.424	16.780	7.610	20.860	11.190	18.980	4.891
Electrical Conductivity (ms/cm)	5	0.384	0.350	0.300	0.490	0.325	0.460	0.075
Electrical Conductivity (µS/cm)	5	386.200	365.000	324.000	512.000	333.500	449.500	74.180
Turbidity (NTU)	5	2.300	1.800	1.600	4.500	1.650	3.200	1.235
Dissolved oxygen (mg/L)	5	8.448	8.730	5.340	11.310	6.660	10.095	2.141
Dissolved oxygen (%sat)	5	82.920	90.600	59.800	94.400	69.000	93.000	14.343
pH	5	7.018	7.120	6.300	7.350	6.705	7.280	0.413
Salinity (ppt)	5	0.190	0.170	0.150	0.250	0.160	0.230	0.040
Suspended Solids (mg/L)	5	1.000	1.000	1.000	1.000	1.000	1.000	0.000
Ammonium-Nitrogen (mg/L)	5	0.011	0.010	0.005	0.020	0.008	0.015	0.006

Oxidised Nitrogen (mg/L)	5	0.088	0.010	0.010	0.390	0.010	0.205	0.169
Total Nitrogen (mg/L)	5	0.264	0.190	0.080	0.620	0.135	0.430	0.207
Total Phosphorus(mg/L)	5	0.029	0.030	0.019	0.040	0.021	0.037	0.009
Faecal Coliforms (CFU/100ml)	5	186.60	28.00	4.00	690.00	7.50	445.00	292.80
Enterococci (CFU/100ml)	1	83.00	83.00	83.00	83.00	83.00	83.00	
E Coli (CFU/100mL)	1	690.00	690.00	690.00	690.00	690.00	690.00	

Summary Statistics for Site 128 for July 2014 to June 2015								
Site 128	Valid N	Mean	Median	Minimum	Maximum	Percentile	Percentile	Std.Dev.
						20	80	
Temperature (oC)	13	18.337	18.520	13.0100	22.630	13.9700	22.230	3.5601
Electrical Conductivity (ms/cm)	13	0.307	0.310	0.1900	0.410	0.2500	0.360	0.0621
Electrical Conductivity (µS/cm)	13	301.615	286.000	224.0000	409.000	271.0000	341.000	48.8408
Turbidity (NTU)	13	1.100	0.600	0.2000	3.600	0.3000	1.700	1.0893
Dissolved oxygen (mg/L)	13	7.637	7.870	5.2800	9.590	6.2400	9.190	1.4944
Dissolved oxygen (%sat)	13	80.300	82.000	59.2000	99.200	69.1000	90.600	11.9826
pH	13	7.743	7.420	6.8000	10.020	7.0400	8.570	0.9081
Salinity (ppt)	13	0.152	0.160	0.0900	0.200	0.1200	0.180	0.0311
Suspended Solids (mg/L)	6	1.000	1.000	1.0000	1.000	1.0000	1.000	0.0000
Ammonium-Nitrogen (mg/L)	6	0.008	0.008	0.0050	0.010	0.0050	0.010	0.0027
Oxidised Nitrogen (mg/L)	6	0.612	0.505	0.2700	1.000	0.4700	0.920	0.2856
Total Nitrogen (mg/L)	6	0.817	0.675	0.6300	1.320	0.6400	0.960	0.2757
Total Phosphorus(mg/L)	6	0.031	0.023	0.0100	0.066	0.0140	0.050	0.0227
Faecal Coliforms (CFU/100ml)	13	149.577	35.000	0.5000	1600.000	6.0000	55.000	436.4823
Enterococci (CFU/100ml)	5	17.600	3.000	1.0000	60.000	1.5000	41.000	25.2448
Bicarbonate Alkalinity (mg/CaCO3/L)	1	41.200	41.200	41.2000	41.200	41.2000	41.200	
Chloride (mg/L)	6	38.333	36.500	31.0000	50.000	34.0000	42.000	6.9474
Sulphate as SO42-(mg/L)	3	30.667	32.000	24.0000	36.000	24.0000	36.000	6.1101
Fluoride (mg/L)	13	0.147	0.140	0.0600	0.320	0.0900	0.180	0.0687
Sodium (mg/L)	6	25.450	24.850	21.9000	31.200	23.0000	26.900	3.4098
Magnesium (mg/L)	6	6.193	5.850	5.2500	7.940	5.5300	6.740	0.9988
Potassium (mg/L)	3	2.797	3.180	1.7100	3.500	1.7100	3.500	0.9546
Calcium (mg/L)	6	27.250	20.800	17.6000	49.800	18.2000	36.300	13.0318
Aluminium (ug/L)	1	43.000	43.000	43.0000	43.000	43.0000	43.000	
Arsenic (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Copper (ug/L)	1	9.000	9.000	9.0000	9.000	9.0000	9.000	
Lead (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Manganese (ug/L)	1	1.000	1.000	1.0000	1.000	1.0000	1.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	12.000	12.000	12.0000	12.000	12.0000	12.000	
Boron (ug/L)	1	29.000	29.000	29.0000	29.000	29.0000	29.000	
Iron (ug/L)	2	12.610	12.610	0.2200	25.000	0.2200	25.000	17.5221
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005	

Summary Statistics for Site 131 for July 2014 to June 2015								
Site 131	Valid N	Mean	Median	Minimum	Maximum	Percentile	Percentile	Std.Dev.
						20	80	
Temperature (oC)	13	19.355	18.900	14.1600	23.960	15.3200	22.460	3.3376
Electrical Conductivity (ms/cm)	13	0.308	0.310	0.2300	0.360	0.2800	0.330	0.0383
Electrical Conductivity (µS/cm)	13	303.846	315.000	258.0000	327.000	288.0000	325.000	24.5352
Turbidity (NTU)	13	0.423	0.200	0.0000	2.000	0.0000	0.900	0.5904
Dissolved oxygen (mg/L)	13	8.308	8.210	7.3400	10.400	7.4700	8.920	0.9491
Dissolved oxygen (%sat)	13	89.669	88.100	82.3000	101.100	85.1000	93.100	5.1956
pH	13	8.156	8.110	7.4000	8.980	7.5500	8.880	0.6077
Salinity (ppt)	13	0.149	0.150	0.0900	0.180	0.1400	0.170	0.0257
Suspended Solids (mg/L)	6	1.000	1.000	1.0000	1.000	1.0000	1.000	0.0000
Ammonium-Nitrogen (mg/L)	6	0.007	0.005	0.0050	0.010	0.0050	0.010	0.0026
Oxidised Nitrogen (mg/L)	6	0.485	0.420	0.2200	1.010	0.2700	0.570	0.2862
Total Nitrogen (mg/L)	6	0.632	0.605	0.3000	1.130	0.4200	0.730	0.2892
Total Phosphorus(mg/L)	6	0.017	0.017	0.0130	0.021	0.0150	0.021	0.0034
Faecal Coliforms (CFU/100ml)	13	9.423	3.000	0.5000	35.000	0.5000	22.000	11.3850
Enterococci (CFU/100ml)	5	14.300	11.000	0.5000	28.000	3.2500	27.000	12.1943
Bicarbonate Alkalinity (mg/CaCO3/L)	1	50.700	50.700	50.7000	50.700	50.7000	50.700	

Chloride (mg/L)	6	38.500	39.000	33.0000	43.000	37.0000	40.000	3.3317
Sulphate as SO42-(mg/L)	3	25.333	23.000	23.0000	30.000	23.0000	30.000	4.0415
Fluoride (mg/L)	13	0.190	0.160	0.0600	0.480	0.0900	0.200	0.1241
Sodium (mg/L)	6	25.567	25.300	23.7000	29.400	23.8000	25.900	2.0849
Magnesium (mg/L)	6	6.160	6.015	5.3300	7.530	5.5100	6.560	0.7993
Potassium (mg/L)	3	2.350	2.190	2.1600	2.700	2.1600	2.700	0.3035
Calcium (mg/L)	6	24.383	22.800	20.1000	31.800	20.2000	28.600	4.8738
Aluminium (ug/L)	1	146.000	146.000	146.0000	146.000	146.0000	146.000	
Arsenic (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Copper (ug/L)	1	11.000	11.000	11.0000	11.000	11.0000	11.000	
Lead (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Manganese (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	5.000	5.000	5.0000	5.000	5.0000	5.000	
Boron (ug/L)	1	21.000	21.000	21.0000	21.000	21.0000	21.000	
Iron (ug/L)	2	38.505	38.505	0.0100	77.000	0.0100	77.000	54.4402
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005	

Summary Statistics for Site 132 for July 2014 to June 2015								
Site 132	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	7	19.369	21.260	13.790	23.000	15.830	21.800	3.468
Electrical Conductivity (ms/cm)	7	0.246	0.260	0.190	0.310	0.190	0.280	0.045
Electrical Conductivity (uS/cm)	7	225.857	228.000	202.000	246.000	210.000	243.000	17.382
Turbidity (NTU)	7	0.057	0.000	0.000	0.300	0.000	0.100	0.113
Dissolved oxygen (mg/L)	7	8.870	8.860	7.650	9.820	8.480	9.260	0.686
Dissolved oxygen (%sat)	7	95.729	96.600	88.600	99.900	93.000	99.800	4.142
pH	7	8.104	7.990	7.850	8.650	7.930	8.290	0.277
Salinity (ppt)	7	0.121	0.130	0.090	0.150	0.090	0.140	0.023
Suspended Solids (mg/L)	5	2.400	1.000	1.000	8.000	1.000	4.500	3.131
Ammonium-Nitrogen (mg/L)	7	0.028	0.010	0.005	0.090	0.010	0.050	0.031
Oxidised Nitrogen (mg/L)	7	0.210	0.220	0.150	0.260	0.190	0.240	0.037
Total Nitrogen (mg/L)	7	0.430	0.410	0.310	0.590	0.400	0.450	0.084
Total Phosphorus(mg/L)	7	0.003	0.002	0.002	0.004	0.002	0.004	0.001
Faecal Coliforms (CFU/100ml)	7	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Enterococci (CFU/100ml)	5	8.600	0.500	0.500	41.000	0.500	20.750	18.112
E Coli (CFU/100mL)	4	0.50	0.50	0.50	0.50	0.50	0.50	0.00
Chloride (mg/L)	5	35.00	35.00	34.00	36.00	34.50	35.50	0.71
Sulphate as SO42-(mg/L)	2	9.550	9.550	9.100	10.000	9.100	10.000	0.636
Fluoride (mg/L)	7	1.023	1.010	0.980	1.090	1.000	1.060	0.039
Sodium (mg/L)	5	19.340	19.800	18.400	19.900	18.600	19.850	0.691
Potassium (mg/L)	2	2.640	2.640	2.430	2.850	2.430	2.850	0.297
Magnesium (mg/L)	5	5.478	5.370	5.040	6.210	5.100	5.910	0.463
Calcium (mg/L)	5	15.820	16.400	13.600	18.700	13.800	17.550	2.074
Iron (ug/L)	1	0.020	0.020	0.020	0.020	0.020	0.020	

Summary Statistics for Site 134 for July 2014 to June 2015								
Site 134	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	13	19.707	19.010	14.2300	26.720	15.3700	24.140	4.5299
Electrical Conductivity (ms/cm)	13	0.237	0.210	0.1300	0.360	0.1600	0.340	0.0850
Electrical Conductivity (uS/cm)	13	238.462	178.000	127.0000	357.000	158.0000	334.000	92.4262
Turbidity (NTU)	13	0.346	0.300	0.0000	1.100	0.0000	0.800	0.3688
Dissolved oxygen (mg/L)	13	5.159	4.530	1.1300	8.940	2.8700	8.210	2.7351
Dissolved oxygen (%sat)	13	54.123	48.800	13.4000	87.100	35.6000	82.300	25.2905
pH	13	7.402	7.600	6.8200	8.060	6.8800	7.770	0.4242
Salinity (ppt)	13	0.115	0.100	0.0600	0.180	0.0800	0.170	0.0431
Suspended Solids (mg/L)	5	1.000	1.000	1.0000	1.000	1.0000	1.000	0.0000
Ammonium-Nitrogen (mg/L)	5	0.027	0.010	0.0050	0.100	0.0075	0.055	0.0409
Oxidised Nitrogen (mg/L)	5	0.438	0.410	0.3600	0.550	0.3750	0.515	0.0766
Total Nitrogen (mg/L)	5	0.866	0.740	0.6500	1.370	0.6800	1.115	0.2919
Total Phosphorus(mg/L)	5	0.200	0.210	0.1690	0.237	0.1695	0.225	0.0295
Faecal Coliforms (CFU/100ml)	12	4.792	2.000	0.5000	14.000	0.5000	9.000	5.2978

Enterococci (CFU/100ml)	4	18.500	10.000	2.0000	52.000	2.0000	52.000	23.0145
Bicarbonate Alkalinity (mg/CaCO3/L)	1	96.300	96.300	96.3000	96.300	96.3000	96.300	
Chloride (mg/L)	5	20.000	15.000	13.0000	29.000	14.0000	28.500	7.8102
Sulphate as SO42-(mg/L)	3	17.000	21.000	8.0000	22.000	8.0000	22.000	7.8102
Fluoride (mg/L)	12	0.109	0.115	0.0250	0.190	0.0500	0.170	0.0643
Sodium (mg/L)	5	11.986	8.460	7.7700	18.000	7.8850	17.850	5.3599
Magnesium (mg/L)	5	2.824	2.540	1.8900	4.160	1.9400	3.850	0.9932
Potassium (mg/L)	3	7.477	8.980	3.7300	9.720	3.7300	9.720	3.2657
Calcium (mg/L)	5	26.840	20.000	16.9000	40.500	17.7500	39.350	11.5014
Aluminium (ug/L)	1	88.000	88.000	88.0000	88.000	88.0000	88.000	
Arsenic (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Copper (ug/L)	1	9.000	9.000	9.0000	9.000	9.0000	9.000	
Lead (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Manganese (ug/L)	1	1.000	1.000	1.0000	1.000	1.0000	1.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	24.000	24.000	24.0000	24.000	24.0000	24.000	
Boron (ug/L)	1	37.000	37.000	37.0000	37.000	37.0000	37.000	
Iron (ug/L)	2	77.050	77.050	0.1000	154.000	0.1000	154.000	108.8237
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005	

Summary Statistics for Site 137 for July 2014 to June 2015								
Site 137	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	13	17.427	19.030	12.1300	22.100	13.0800	20.390	3.5510
Electrical Conductivity (ms/cm)	13	0.246	0.250	0.1500	0.390	0.1900	0.270	0.0685
Electrical Conductivity (µS/cm)	13	230.769	202.000	147.0000	353.000	171.0000	300.000	68.0002
Turbidity (NTU)	13	1.269	0.300	0.0000	7.100	0.2000	2.100	2.0035
Dissolved oxygen (mg/L)	13	8.858	9.590	5.7500	10.610	6.6500	10.340	1.7051
Dissolved oxygen (%sat)	13	91.846	95.700	67.6000	115.500	76.1000	104.000	14.8567
pH	13	8.230	8.470	7.0000	9.290	7.4600	8.800	0.7180
Salinity (ppt)	13	0.121	0.120	0.0700	0.190	0.0900	0.130	0.0345
Suspended Solids (mg/L)	6	1.500	1.000	1.0000	4.000	1.0000	1.000	1.2247
Ammonium-Nitrogen (mg/L)	6	0.128	0.070	0.0050	0.310	0.0050	0.310	0.1486
Oxidised Nitrogen (mg/L)	6	0.345	0.355	0.2200	0.480	0.2300	0.430	0.1067
Total Nitrogen (mg/L)	6	0.802	0.720	0.6900	1.230	0.7100	0.740	0.2106
Total Phosphorus(mg/L)	6	0.100	0.128	0.0030	0.182	0.0040	0.155	0.0773
Faecal Coliforms (CFU/100ml)	13	0.654	0.500	0.5000	2.000	0.5000	0.500	0.4274
Enterococci (CFU/100ml)	5	4.900	0.500	0.5000	19.000	0.5000	11.500	8.0265
Bicarbonate Alkalinity (mg/CaCO3/L)	1	83.000	83.000	83.0000	83.000	83.0000	83.000	
Chloride (mg/L)	6	23.667	23.000	16.0000	32.000	17.0000	31.000	7.7374
Sulphate as SO42-(mg/L)	3	12.567	11.000	8.7000	18.000	8.7000	18.000	4.8439
Fluoride (mg/L)	13	0.485	0.490	0.0600	1.060	0.0600	0.950	0.4126
Sodium (mg/L)	6	12.860	12.600	9.0600	17.100	9.3000	16.500	3.6921
Magnesium (mg/L)	6	3.778	3.870	1.6500	6.380	1.8700	5.030	1.8181
Potassium (mg/L)	3	4.530	3.810	2.4000	7.380	2.4000	7.380	2.5669
Calcium (mg/L)	6	22.833	21.800	13.6000	38.900	16.5000	24.400	8.9005
Aluminium (ug/L)	1	69.000	69.000	69.0000	69.000	69.0000	69.000	
Arsenic (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Copper (ug/L)	1	29.000	29.000	29.0000	29.000	29.0000	29.000	
Lead (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Manganese (ug/L)	1	8.000	8.000	8.0000	8.000	8.0000	8.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	49.000	49.000	49.0000	49.000	49.0000	49.000	
Boron (ug/L)	1	26.000	26.000	26.0000	26.000	26.0000	26.000	
Iron (ug/L)	2	56.545	56.545	0.0900	113.000	0.0900	113.000	79.8394
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005	

Summary Statistics for Site 138 for July 2014 to June 2015								
Site 138	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	18.710	18.005	14.0600	23.800	15.6600	22.720	3.5000
Electrical Conductivity (ms/cm)	12	0.420	0.420	0.3100	0.500	0.3500	0.500	0.1000
Electrical Conductivity (µS/cm)	12	430.000	420.500	347.0000	536.000	363.0000	494.000	63.3000
Turbidity (NTU)	12	2.880	1.150	0.2000	10.900	0.3000	4.300	3.5000
Dissolved oxygen (mg/L)	12	3.730	4.335	0.1600	6.700	1.1600	5.640	2.2000
Dissolved oxygen (%sat)	12	38.970	45.950	2.0000	65.400	13.2000	56.800	22.5000
pH	12	7.390	7.380	6.8200	8.300	7.1400	7.500	0.3000
Salinity (ppt)	12	0.210	0.205	0.1500	0.300	0.1700	0.250	0.0000
Suspended Solids (mg/L)	5	2.800	1.000	1.0000	6.000	1.0000	5.500	2.5000
Ammonium-Nitrogen (mg/L)	5	0.050	0.020	0.0100	0.200	0.0150	0.110	0.1000
Oxidised Nitrogen (mg/L)	5	0.360	0.360	0.0100	0.800	0.1300	0.595	0.3000
Total Nitrogen (mg/L)	5	1.390	1.350	0.8900	2.000	1.0900	1.710	0.4000
Total Phosphorus(mg/L)	5	0.220	0.146	0.0750	0.500	0.0840	0.391	0.2000
Faecal Coliforms (CFU/100ml)	12	#####	57.500	0.5000	#####	1.0000	360.000	#####
Enterococci (CFU/100ml)	4	8.750	5.500	1.0000	23.000	1.0000	23.000	9.9000
Bicarbonate Alkalinity (mg/CaCO3/L)	1	78.000	78.000	78.0000	78.000	78.0000	78.000	
Chloride (mg/L)	5	43.600	41.000	37.0000	53.000	38.5000	50.000	6.4000
Sulphate as SO42-(mg/L)	3	33.000	28.000	26.0000	45.000	26.0000	45.000	10.4000
Fluoride (mg/L)	12	0.270	0.160	0.1100	1.400	0.1500	0.210	0.3000
Sodium (mg/L)	5	28.380	30.300	23.5000	30.900	25.1000	30.700	3.2000
Magnesium (mg/L)	5	7.160	7.500	4.7200	9.200	5.6450	8.515	1.7000
Potassium (mg/L)	3	9.380	9.760	7.2900	11.100	7.2900	11.100	1.9000
Calcium (mg/L)	5	46.380	49.700	38.4000	53.900	39.1000	52.000	6.9000
Aluminium (ug/L)	1	244.000	244.000	244.0000	244.000	244.0000	244.000	
Arsenic (ug/L)	1	1.000	1.000	1.0000	1.000	1.0000	1.000	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Copper (ug/L)	1	9.000	9.000	9.0000	9.000	9.0000	9.000	
Lead (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Manganese (ug/L)	1	12.000	12.000	12.0000	12.000	12.0000	12.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	28.000	28.000	28.0000	28.000	28.0000	28.000	
Boron (ug/L)	1	55.000	55.000	55.0000	55.000	55.0000	55.000	
Iron (ug/L)	2	162.640	162.640	0.2800	325.000	0.2800	325.000	229.6000
Mercury (ug/L)	1	0.010	0.005	0.0050	0.000	0.0050	0.005	

Summary Statistics for Site 141 for July 2014 to June 2015								
Site 141	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	19.015	18.230	14.5600	23.810	15.5600	22.820	3.3854
Electrical Conductivity (ms/cm)	12	0.355	0.352	0.2300	0.500	0.2600	0.470	0.0965
Electrical Conductivity (µS/cm)	12	352.917	362.500	224.0000	470.000	255.0000	432.000	86.7551
Turbidity (NTU)	12	0.467	0.000	0.0000	2.300	0.0000	0.900	0.7500
Dissolved oxygen (mg/L)	12	7.325	7.555	5.7000	8.910	6.2100	8.390	1.1112
Dissolved oxygen (%sat)	12	79.325	78.200	60.3000	101.800	64.6000	97.200	15.2258
pH	12	7.713	7.725	7.3500	8.400	7.4600	7.890	0.2848
Salinity (ppt)	12	0.174	0.170	0.1100	0.250	0.1300	0.230	0.0494
Suspended Solids (mg/L)	5	1.000	1.000	1.0000	1.000	1.0000	1.000	0.0000
Ammonium-Nitrogen (mg/L)	5	0.075	0.010	0.0050	0.190	0.0075	0.175	0.0919
Oxidised Nitrogen (mg/L)	5	0.584	0.380	0.3000	1.420	0.3050	0.965	0.4748
Total Nitrogen (mg/L)	5	1.140	1.020	0.7400	1.810	0.7550	1.585	0.4496
Total Phosphorus(mg/L)	5	0.075	0.081	0.0260	0.138	0.0270	0.119	0.0481
Faecal Coliforms (CFU/100ml)	12	2.042	1.000	0.5000	6.000	0.5000	3.000	2.0721
Enterococci (CFU/100ml)	4	3.625	0.500	0.5000	13.000	0.5000	13.000	6.2500
Bicarbonate Alkalinity (mg/CaCO3/L)	1	91.000	91.000	91.0000	91.000	91.0000	91.000	
Chloride (mg/L)	5	37.000	33.000	32.0000	50.000	32.0000	44.000	7.6812
Sulphate as SO42-(mg/L)	3	26.333	24.000	12.0000	43.000	12.0000	43.000	15.6312
Fluoride (mg/L)	12	0.468	0.305	0.1500	1.000	0.1800	0.880	0.3429
Sodium (mg/L)	5	22.640	23.600	17.8000	27.600	18.0000	26.800	4.4708
Magnesium (mg/L)	5	6.612	6.370	5.3400	8.260	5.6500	7.695	1.1276
Potassium (mg/L)	3	6.427	6.780	3.1200	9.380	3.1200	9.380	3.1449
Calcium (mg/L)	5	37.000	43.100	18.4000	53.500	19.8500	51.100	16.1152

Aluminium (ug/L)	1	45.000	45.000	45.0000	45.000	45.0000	45.000	
Arsenic (ug/L)	1	1.000	1.000	1.0000	1.000	1.0000	1.000	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	1.000	1.000	1.0000	1.000	1.0000	1.000	
Copper (ug/L)	1	14.000	14.000	14.0000	14.000	14.0000	14.000	
Lead (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Manganese (ug/L)	1	20.000	20.000	20.0000	20.000	20.0000	20.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	16.000	16.000	16.0000	16.000	16.0000	16.000	
Boron (ug/L)	1	47.000	47.000	47.0000	47.000	47.0000	47.000	
Iron (ug/L)	2	30.585	30.585	0.1700	61.000	0.1700	61.000	43.0133
Mercury (ug/L)	1	0.005	0.005	0.0050	0.005	0.0050	0.005	

Summary Statistics for Site 142 for July 2014 to June 2015								
Site 142	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	18.751	18.505	15.6800	23.220	15.9800	21.060	2.5140
Electrical Conductivity (ms/cm)	12	0.237	0.250	0.1400	0.290	0.1900	0.270	0.0470
Electrical Conductivity (µS/cm)	12	240.500	250.000	188.0000	267.000	228.0000	263.000	26.3590
Turbidity (NTU)	12	50.275	35.750	9.2000	205.900	19.1000	69.100	53.5090
Dissolved oxygen (mg/L)	12	4.414	4.815	0.1700	7.610	2.6000	6.460	2.2290
Dissolved oxygen (%sat)	12	46.650	51.450	1.9000	77.000	29.8000	65.000	22.3900
pH	12	7.056	7.085	6.6700	7.440	6.9000	7.230	0.2370
Salinity (ppt)	12	0.117	0.125	0.0800	0.140	0.0900	0.130	0.0210
Suspended Solids (mg/L)	5	15.600	4.000	1.0000	66.000	1.0000	36.000	28.2540
Ammonium-Nitrogen (mg/L)	5	0.035	0.005	0.0050	0.130	0.0050	0.080	0.0540
Oxidised Nitrogen (mg/L)	5	0.550	0.550	0.3000	0.830	0.3150	0.785	0.2370
Total Nitrogen (mg/L)	5	0.908	0.890	0.5000	1.270	0.6550	1.170	0.2890
Total Phosphorus(mg/L)	5	0.104	0.088	0.0420	0.240	0.0470	0.169	0.0800
Faecal Coliforms (CFU/100ml)	12	724.792	12.000	0.5000	7800.000	1.0000	330.000	2233.4010
Enterococci (CFU/100ml)	4	93.500	16.000	12.0000	330.000	12.0000	330.000	157.6970
Bicarbonate Alkalinity (mg/CaCO3/L)	1	34.200	34.200	34.2000	34.200	34.2000	34.200	
Chloride (mg/L)	5	33.000	33.000	32.0000	34.000	32.5000	33.500	0.7070
Sulphate as SO42-(mg/L)	3	19.667	20.000	18.0000	21.000	18.0000	21.000	1.5280
Fluoride (mg/L)	12	0.135	0.130	0.1200	0.150	0.1200	0.150	0.0120
Sodium (mg/L)	5	28.160	27.900	25.7000	31.000	26.0500	30.400	2.2350
Magnesium (mg/L)	5	4.674	4.680	4.1600	5.070	4.2800	5.065	0.4020
Potassium (mg/L)	3	3.587	3.550	3.3000	3.910	3.3000	3.910	0.3070
Calcium (mg/L)	5	15.620	15.000	12.8000	20.200	13.8000	17.750	2.7430
Aluminium (ug/L)	1	9640.000	9640.000	9640.0000	9640.000	9640.0000	9640.000	
Arsenic (ug/L)	1	5.000	5.000	5.0000	5.000	5.0000	5.000	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	4.000	4.000	4.0000	4.000	4.0000	4.000	
Copper (ug/L)	1	29.000	29.000	29.0000	29.000	29.0000	29.000	
Lead (ug/L)	1	12.000	12.000	12.0000	12.000	12.0000	12.000	
Manganese (ug/L)	1	68.000	68.000	68.0000	68.000	68.0000	68.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	4.000	4.000	4.0000	4.000	4.0000	4.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	103.000	103.000	103.0000	103.000	103.0000	103.000	
Boron (ug/L)	1	49.000	49.000	49.0000	49.000	49.0000	49.000	
Iron (ug/L)	2	2705.555	2705.555	1.1100	5410.000	1.1100	5410.000	3824.6630
Mercury (ug/L)	1	0.040	0.040	0.0400	0.040	0.0400	0.040	

Summary Statistics for Site 145 for July 2014 to June 2015								
Site 145	Valid N	Mean	Median	Minimum	Maximum	Percentile		Std.Dev.
						20	80	
Temperature (oC)	12	18.953	18.650	15.5600	22.780	16.3400	21.530	2.5800
Electrical Conductivity (ms/cm)	12	0.265	0.260	0.1900	0.340	0.2400	0.290	0.0410
Electrical Conductivity (µS/cm)	12	254.083	264.500	201.0000	300.000	217.0000	279.000	32.2950
Turbidity (NTU)	12	41.933	37.550	4.0000	86.600	22.3000	60.300	25.6150
Dissolved oxygen (mg/L)	12	5.698	5.505	2.3500	8.520	4.3800	7.780	1.8430
Dissolved oxygen (%sat)	12	60.767	61.900	25.7000	86.100	48.2000	81.000	17.5740

pH	12	7.211	7.280	6.7800	7.590	6.9700	7.390	0.2530
Salinity (ppt)	12	0.131	0.130	0.0900	0.170	0.1200	0.150	0.0220
Suspended Solids (mg/L)	5	5.000	1.000	1.0000	20.000	1.0000	11.000	8.3960
Ammonium-Nitrogen (mg/L)	5	0.050	0.020	0.0050	0.200	0.0050	0.110	0.0840
Oxidised Nitrogen (mg/L)	5	0.808	0.880	0.3400	1.030	0.5750	1.005	0.2750
Total Nitrogen (mg/L)	5	1.104	1.220	0.7700	1.240	0.9200	1.230	0.1990
Total Phosphorus(mg/L)	5	0.097	0.110	0.0320	0.124	0.0680	0.120	0.0370
Faecal Coliforms (CFU/100ml)	12	382.792	6.000	0.5000	4300.000	0.5000	30.000	1235.3020
Enterococci (CFU/100ml)	4	15.000	14.000	2.0000	30.000	2.0000	30.000	11.9440
Bicarbonate Alkalinity (mg/CaCO3/L)	1	48.800	48.800	48.8000	48.800	48.8000	48.800	
Chloride (mg/L)	5	31.000	31.000	29.0000	33.000	29.5000	32.500	1.5810
Sulphate as SO42-(mg/L)	3	19.667	20.000	15.0000	24.000	15.0000	24.000	4.5090
Fluoride (mg/L)	12	0.201	0.155	0.1300	0.680	0.1400	0.180	0.1520
Sodium (mg/L)	5	24.140	23.600	21.8000	27.600	22.2000	26.350	2.2930
Magnesium (mg/L)	5	4.414	4.320	4.0100	5.310	4.0250	4.850	0.5280
Potassium (mg/L)	3	3.443	3.100	2.7600	4.470	2.7600	4.470	0.9050
Calcium (mg/L)	5	20.080	20.900	11.9000	29.600	14.0000	25.750	6.6590
Aluminium (ug/L)	1	4180.000	4180.000	4180.0000	4180.000	4180.0000	4180.000	
Arsenic (ug/L)	1	3.000	3.000	3.0000	3.000	3.0000	3.000	
Cadmium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Chromium (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Copper (ug/L)	1	18.000	18.000	18.0000	18.000	18.0000	18.000	
Lead (ug/L)	1	5.000	5.000	5.0000	5.000	5.0000	5.000	
Manganese (ug/L)	1	38.000	38.000	38.0000	38.000	38.0000	38.000	
Molybdenum (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Nickel (ug/L)	1	2.000	2.000	2.0000	2.000	2.0000	2.000	
Selenium (ug/L)	1	1.500	1.500	1.5000	1.500	1.5000	1.500	
Silver (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Uranium (ug/L)	1	0.500	0.500	0.5000	0.500	0.5000	0.500	
Zinc (ug/L)	1	86.000	86.000	86.0000	86.000	86.0000	86.000	
Boron (ug/L)	1	44.000	44.000	44.0000	44.000	44.0000	44.000	
Iron (ug/L)	2	1090.680	1090.680	1.3600	2180.000	1.3600	2180.000	1540.5310
Mercury (ug/L)	1	0.020	0.020	0.0200	0.020	0.0200	0.020	

Summary Statistics for Site 147 for July 2014 to June 2015								
Site 147	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	10	15.777	14.485	12.060	21.070	12.645	19.735	3.317
Electrical Conductivity (ms/cm)	10	0.220	0.210	0.120	0.330	0.145	0.300	0.076
Electrical Conductivity (µS/cm)	10	206.500	200.500	114.000	295.000	142.500	275.000	62.996
Turbidity (NTU)	10	2.860	0.200	0.000	16.700	0.000	4.800	5.298
Dissolved oxygen (mg/L)	10	9.318	9.595	7.110	10.920	8.145	10.485	1.291
Dissolved oxygen (%sat)	10	92.228	93.990	77.900	101.500	85.650	99.650	7.775
pH	10	6.152	6.075	5.670	7.070	5.805	6.480	0.445
Salinity (ppt)	10	0.108	0.105	0.060	0.160	0.070	0.145	0.037
Suspended Solids (mg/L)	10	1.300	1.000	1.000	4.000	1.000	1.000	0.949
Ammonium-Nitrogen (mg/L)	10	0.006	0.005	0.005	0.010	0.005	0.008	0.002
Oxidised Nitrogen (mg/L)	10	0.006	0.005	0.005	0.010	0.005	0.005	0.002
Total Nitrogen (mg/L)	10	0.199	0.160	0.120	0.420	0.135	0.255	0.094
Total Phosphorus(mg/L)	10	0.005	0.004	0.001	0.011	0.003	0.007	0.003
Faecal Coliforms (CFU/100ml)	10	146.25	58.00	0.50	590.00	17.50	240.00	183.19
Enterococci (CFU/100ml)	5	30.80	28.00	2.00	71.00	5.00	58.00	28.17
E Coli (CFU/100mL)	2	126.00	126.00	52.00	200.00	52.00	200.00	104.65
Bicarbonate Alkalinity (mg/CaCO3/L)	4	5.025	4.500	2.800	8.300	2.800	8.300	2.465
Chloride (mg/L)	4	50.500	52.000	27.000	71.000	27.000	71.000	18.699
Sulphate as SO42-(mg/L)	4	7.275	8.450	2.400	9.800	2.400	9.800	3.490
Fluoride (mg/L)	4	0.025	0.025	0.025	0.025	0.025	0.025	0.000
Sodium (mg/L)	4	26.500	25.400	17.800	37.400	17.800	37.400	8.128
Potassium (mg/L)	4	1.445	1.325	1.090	2.040	1.090	2.040	0.412
Magnesium (mg/L)	4	5.365	5.430	2.900	7.700	2.900	7.700	1.969
Calcium (mg/L)	4	2.678	2.610	1.890	3.600	1.890	3.600	0.718
Aluminium (ug/L)	4	1008.250	334.500	204.000	3160.000	204.000	3160.000	1437.176
Arsenic (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	4	1.250	1.250	0.500	2.000	0.500	2.000	0.866
Copper (ug/L)	4	0.875	1.000	0.500	1.000	0.500	1.000	0.250
Lead (ug/L)	4	1.000	0.750	0.500	2.000	0.500	2.000	0.707
Manganese (ug/L)	4	25.750	10.000	4.000	79.000	4.000	79.000	35.697
Molybdenum (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	4	1.000	0.750	0.500	2.000	0.500	2.000	0.707

Selenium (ug/L)	4	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	4	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	4	8.250	6.000	5.000	16.000	5.000	16.000	5.252
Boron (ug/L)	4	32.750	28.500	16.000	58.000	16.000	58.000	17.951
Iron (ug/L)	4	677.750	689.000	83.000	1250.000	83.000	1250.000	524.777
Mercury (ug/L)	4	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 149 for July 2014 to June 2015								
Site 149	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	9	14.544	14.090	7.830	20.980	11.290	20.560	4.525
Electrical Conductivity (ms/cm)	9	0.317	0.340	0.130	0.420	0.250	0.380	0.089
Electrical Conductivity (µS/cm)	9	321.667	326.000	198.000	448.000	254.000	384.000	77.519
Turbidity (NTU)	9	3.711	0.500	0.000	26.800	0.000	2.100	8.698
Dissolved oxygen (mg/L)	9	9.436	9.160	6.810	12.100	7.250	11.460	2.019
Dissolved oxygen (%sat)	9	91.626	89.000	76.400	110.400	80.400	104.600	11.432
pH	9	4.533	4.550	4.150	4.730	4.470	4.670	0.167
Salinity (ppt)	9	0.158	0.170	0.060	0.210	0.130	0.190	0.046
Suspended Solids (mg/L)	9	10.778	1.000	1.000	76.000	1.000	11.000	24.672
Ammonium-Nitrogen (mg/L)	9	0.011	0.010	0.005	0.030	0.005	0.010	0.007
Oxidised Nitrogen (mg/L)	9	0.012	0.010	0.005	0.040	0.005	0.020	0.012
Total Nitrogen (mg/L)	9	0.143	0.110	0.070	0.330	0.070	0.260	0.094
Total Phosphorus(mg/L)	9	0.006	0.004	0.003	0.012	0.003	0.011	0.004
Faecal Coliforms (CFU/100ml)	9	50.17	11.00	0.50	270.00	1.00	120.00	90.54
Enterococci (CFU/100ml)	3	28.33	24.00	8.00	53.00	8.00	53.00	22.81
E Coli (CFU/100mL)	1	10.00	10.00	10.00	10.00	10.00	10.00	
Bicarbonate Alkalinity (mg/CaCO3/L)	3	12.067	1.000	1.000	34.200	1.000	34.200	19.168
Chloride (mg/L)	3	98.667	79.000	67.000	150.000	67.000	150.000	44.859
Sulphate as SO42-(mg/L)	3	8.033	7.200	7.100	9.800	7.100	9.800	1.531
Fluoride (mg/L)	3	0.047	0.025	0.025	0.090	0.025	0.090	0.038
Sodium (mg/L)	3	53.933	38.500	33.600	89.700	33.600	89.700	31.072
Potassium (mg/L)	3	3.473	1.490	1.480	7.450	1.480	7.450	3.444
Magnesium (mg/L)	3	9.363	6.070	5.520	16.500	5.520	16.500	6.187
Calcium (mg/L)	3	6.183	1.680	1.270	15.600	1.270	15.600	8.158
Aluminium (ug/L)	3	241.000	314.000	51.000	358.000	51.000	358.000	166.009
Arsenic (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Cadmium (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Chromium (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Copper (ug/L)	3	0.833	1.000	0.500	1.000	0.500	1.000	0.289
Lead (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Manganese (ug/L)	3	160.333	160.000	66.000	255.000	66.000	255.000	94.500
Molybdenum (ug/L)	3	0.350	0.500	0.050	0.500	0.050	0.500	0.260
Nickel (ug/L)	3	2.667	3.000	1.000	4.000	1.000	4.000	1.528
Selenium (ug/L)	3	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	3	13.000	17.000	5.000	17.000	5.000	17.000	6.928
Boron (ug/L)	3	25.333	18.000	16.000	42.000	16.000	42.000	14.468
Iron (ug/L)	3	481.333	349.000	267.000	828.000	267.000	828.000	303.009
Mercury (ug/L)	3	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 150 for July 2014 to June 2015								
Site 150	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	14	1.321	1.300	0.600	1.900	1.000	1.600	0.351
Temperature (oC)	14	19.947	19.700	13.750	25.050	17.360	23.380	3.567
Turbidity (NTU)	14	6.250	5.600	2.600	14.100	3.600	8.100	3.372
Dissolved oxygen (mg/L)	14	7.024	6.755	6.200	8.200	6.530	7.960	0.648
Dissolved oxygen (%sat)	14	93.357	93.300	78.500	103.900	88.900	97.900	5.937
pH	14	7.967	7.985	7.650	8.120	7.920	8.110	0.142
Salinity (ppt)	14	32.126	33.140	15.860	34.910	31.740	34.300	4.789
Suspended Solids (mg/L)	15	7.400	8.000	1.000	12.000	5.000	11.000	3.355
Ammonium-Nitrogen (mg/L)	15	0.016	0.010	0.005	0.080	0.008	0.020	0.018
Oxidised Nitrogen (mg/L)	15	0.031	0.010	0.005	0.200	0.008	0.040	0.050
Total Nitrogen (mg/L)	15	0.250	0.230	0.170	0.640	0.200	0.255	0.111
Total Phosphorus(mg/L)	15	0.019	0.017	0.013	0.034	0.015	0.022	0.005
Soluble Reactive Phosphorus (mg/L)	5	0.009	0.009	0.006	0.013	0.006	0.012	0.003
Chlorophyll-a (ug/L)	15	2.627	2.600	0.800	6.200	1.700	3.250	1.281
Faecal Coliforms (CFU/100ml)	15	5.07	0.50	0.50	42.00	0.50	1.50	11.85

Enterococci (CFU/100ml)	15	1.27	0.50	0.50	8.00	0.50	1.50	1.94
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Summary Statistics for Site 151 for July 2014 to June 2015								
Site 151	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	14	0.775	0.750	0.300	1.250	0.400	1.100	0.303
Temperature (oC)	14	20.481	21.270	11.870	27.220	15.720	25.570	5.026
Turbidity (NTU)	14	13.307	10.150	7.000	31.700	7.200	21.300	7.583
Dissolved oxygen (mg/L)	14	6.784	6.580	5.130	8.860	6.000	8.190	1.087
Dissolved oxygen (%sat)	14	85.907	86.350	71.400	102.700	79.600	95.500	8.894
pH	14	7.740	7.745	6.960	8.020	7.630	7.960	0.264
Salinity (ppt)	14	24.126	25.105	5.000	29.740	21.650	28.290	6.118
Suspended Solids (mg/L)	15	10.667	9.000	5.000	17.000	7.000	15.500	4.100
Ammonium-Nitrogen (mg/L)	15	0.023	0.010	0.005	0.110	0.010	0.020	0.029
Oxidised Nitrogen (mg/L)	15	0.065	0.030	0.010	0.260	0.020	0.110	0.069
Total Nitrogen (mg/L)	15	0.356	0.320	0.240	0.810	0.265	0.355	0.152
Total Phosphorus(mg/L)	15	0.022	0.019	0.012	0.047	0.017	0.028	0.009
Soluble Reactive Phosphorus (mg/L)	5	0.009	0.009	0.006	0.012	0.007	0.011	0.002
Chlorophyll-a (ug/L)	15	4.620	4.400	1.500	8.600	2.250	7.150	2.358
Faecal Coliforms (CFU/100ml)	15	4.60	2.00	0.50	43.00	0.50	3.50	10.74
Enterococci (CFU/100ml)	15	6.90	2.00	0.50	59.00	0.50	5.50	15.01

Summary Statistics for Site 152 for July 2014 to June 2015								
Site 152	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	13	0.962	0.700	0.500	1.800	0.500	1.600	0.512
Temperature (oC)	13	21.200	23.530	13.080	27.777	15.420	26.180	5.227
Turbidity (NTU)	13	9.092	6.700	3.200	25.400	5.300	13.100	6.003
Dissolved oxygen (mg/L)	13	6.857	6.670	5.560	8.960	5.900	7.710	1.112
Dissolved oxygen (%sat)	13	85.531	87.400	73.100	96.900	75.700	92.400	7.835
pH	13	7.654	7.690	7.180	7.940	7.520	7.810	0.208
Salinity (ppt)	13	19.598	20.570	11.090	26.300	15.790	22.940	4.309
Suspended Solids (mg/L)	14	8.500	7.500	4.000	18.000	4.000	13.000	4.220
Ammonium-Nitrogen (mg/L)	14	0.025	0.010	0.005	0.140	0.010	0.040	0.035
Oxidised Nitrogen (mg/L)	14	0.121	0.105	0.040	0.250	0.070	0.170	0.065
Total Nitrogen (mg/L)	14	0.404	0.360	0.290	0.730	0.310	0.470	0.120
Total Phosphorus(mg/L)	14	0.023	0.018	0.015	0.063	0.016	0.029	0.013
Soluble Reactive Phosphorus (mg/L)	4	0.010	0.010	0.006	0.012	0.006	0.012	0.003
Chlorophyll-a (ug/L)	14	5.071	3.900	1.400	21.200	1.600	5.900	5.142
Faecal Coliforms (CFU/100ml)	14	4.68	2.50	0.50	19.00	1.00	6.00	5.34
Enterococci (CFU/100ml)	14	5.79	2.50	0.50	38.00	1.00	8.00	9.70

Summary Statistics for Site 153 for July 2014 to June 2015								
Site 153	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	13	0.646	0.600	0.200	1.200	0.300	1.000	0.320
Temperature (oC)	13	21.608	24.180	13.110	27.980	14.900	26.740	5.543
Turbidity (NTU)	13	18.569	13.600	7.300	37.100	8.300	29.100	10.338
Dissolved oxygen (mg/L)	13	7.586	7.210	6.460	10.330	6.740	7.910	1.157
Dissolved oxygen (%sat)	13	88.215	88.000	73.500	103.800	80.700	96.500	8.115
pH	13	7.426	7.410	6.940	7.780	7.340	7.510	0.206
Salinity (ppt)	13	5.870	5.620	0.190	11.760	0.890	8.380	3.736
Suspended Solids (mg/L)	14	14.071	15.000	6.000	26.000	7.000	19.000	6.207
Ammonium-Nitrogen (mg/L)	14	0.021	0.010	0.005	0.070	0.005	0.040	0.022
Oxidised Nitrogen (mg/L)	14	0.195	0.125	0.005	0.530	0.020	0.350	0.183
Total Nitrogen (mg/L)	14	0.531	0.470	0.300	0.860	0.330	0.820	0.204
Total Phosphorus(mg/L)	14	0.032	0.029	0.012	0.065	0.018	0.050	0.016
Soluble Reactive Phosphorus (mg/L)	4	0.009	0.007	0.003	0.018	0.003	0.018	0.007
Chlorophyll-a (ug/L)	14	10.607	10.750	1.500	25.100	3.500	17.000	6.628
Faecal Coliforms (CFU/100ml)	14	5.21	5.50	2.00	9.00	3.00	7.00	2.08
Enterococci (CFU/100ml)	14	7.29	4.00	0.50	38.00	0.50	12.00	10.05

Summary Statistics for Site 164 for July 2014 to June 2015								
Site 164	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	9	17.779	18.870	8.420	29.660	11.600	24.340	6.609
Electrical Conductivity (ms/cm)	9	0.171	0.160	0.120	0.240	0.120	0.210	0.047
Electrical Conductivity (µS/cm)	9	161.667	168.000	114.000	196.000	125.000	178.000	25.822
Turbidity (NTU)	9	2.644	1.100	0.000	10.300	0.400	4.600	3.307

Dissolved oxygen (mg/L)	9	8.080	9.180	0.750	11.890	5.240	11.200	3.492
Dissolved oxygen (%sat)	9	92.348	96.100	62.900	102.800	86.630	101.300	12.075
pH	9	4.862	4.820	4.320	5.490	4.500	5.470	0.408
Salinity (ppt)	9	0.084	0.080	0.060	0.120	0.060	0.110	0.024
Suspended Solids (mg/L)	9	2.889	2.000	1.000	12.000	1.000	4.000	3.551
Ammonium-Nitrogen (mg/L)	9	0.007	0.005	0.005	0.010	0.005	0.010	0.003
Oxidised Nitrogen (mg/L)	9	0.008	0.005	0.005	0.020	0.005	0.010	0.005
Total Nitrogen (mg/L)	9	0.113	0.090	0.050	0.260	0.080	0.140	0.060
Total Phosphorus(mg/L)	9	0.004	0.003	0.002	0.010	0.002	0.004	0.003
Faecal Coliforms (CFU/100ml)	9	101.17	15.00	0.50	610.00	1.00	180.00	199.45
Enterococci (CFU/100ml)	4	29.75	22.00	1.00	74.00	1.00	74.00	31.12
E Coli (CFU/100mL)	2	16.00	16.00	6.00	26.00	6.00	26.00	14.14
Bicarbonate Alkalinity (mg/CaCO3/L)	2	1.500	1.500	1.000	2.000	1.000	2.000	0.707
Chloride (mg/L)	2	37.000	37.000	32.000	42.000	32.000	42.000	7.071
Sulphate as SO42-(mg/L)	2	4.950	4.950	4.500	5.400	4.500	5.400	0.636
Fluoride (mg/L)	2	0.025	0.025	0.025	0.025	0.025	0.025	0.000
Sodium (mg/L)	2	19.600	19.600	18.200	21.000	18.200	21.000	1.980
Potassium (mg/L)	2	0.950	0.950	0.860	1.040	0.860	1.040	0.127
Magnesium (mg/L)	2	3.020	3.020	2.750	3.290	2.750	3.290	0.382
Calcium (mg/L)	2	0.370	0.370	0.270	0.470	0.270	0.470	0.141
Aluminium (ug/L)	2	286.500	286.500	228.000	345.000	228.000	345.000	82.732
Arsenic (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Cadmium (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Copper (ug/L)	2	0.750	0.750	0.500	1.000	0.500	1.000	0.354
Lead (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Manganese (ug/L)	2	18.500	18.500	14.000	23.000	14.000	23.000	6.364
Molybdenum (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Nickel (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Selenium (ug/L)	2	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	2	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	2	3.750	3.750	2.500	5.000	2.500	5.000	1.768
Boron (ug/L)	2	34.500	34.500	14.000	55.000	14.000	55.000	28.991
Iron (ug/L)	2	341.000	341.000	188.000	494.000	188.000	494.000	216.375
Mercury (ug/L)	2	0.005	0.005	0.005	0.005	0.005	0.005	0.000

Summary Statistics for Site 173 for July 2014 to June 2015								
Site 173	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	11	17.334	16.640	13.3500	22.050	14.4500	20.620	2.9430
Electrical Conductivity (ms/cm)	11	0.107	0.110	0.0000	0.160	0.1100	0.150	0.0480
Electrical Conductivity (µS/cm)	11	97.364	99.000	33.0000	144.000	79.0000	114.000	31.5410
Turbidity (NTU)	11	17.236	13.300	2.5000	67.800	10.3000	16.700	17.3560
Dissolved oxygen (mg/L)	11	6.908	7.130	2.3300	10.350	3.9600	9.540	2.7850
Dissolved oxygen (%sat)	11	70.727	76.100	26.0000	100.800	45.3000	98.900	26.2510
pH	11	6.826	6.750	6.5400	7.360	6.7000	6.900	0.2360
Salinity (ppt)	11	0.055	0.060	0.0000	0.080	0.0500	0.070	0.0250
Suspended Solids (mg/L)	10	3.900	2.000	1.0000	18.000	1.0000	5.000	5.2160
Ammonium-Nitrogen (mg/L)	11	0.007	0.005	0.0050	0.020	0.0050	0.010	0.0050
Oxidised Nitrogen (mg/L)	11	0.735	0.690	0.2500	1.590	0.3100	0.870	0.4330
Total Nitrogen (mg/L)	11	0.921	0.880	0.3600	1.800	0.5200	1.410	0.4640
Total Phosphorus(mg/L)	11	0.034	0.029	0.0200	0.070	0.0220	0.047	0.0160
Faecal Coliforms (CFU/100ml)	12	2333.750	78.500	2.0000	26000.000	18.0000	640.000	7456.7560
Enterococci (CFU/100ml)	3	107.667	99.000	54.0000	170.000	54.0000	170.000	58.4840
Chloride (mg/L)	2	15.000	15.000	12.0000	18.000	12.0000	18.000	4.2430
Fluoride (mg/L)	12	0.025	0.025	0.0250	0.030	0.0250	0.025	0.0000
Sodium (mg/L)	2	11.000	11.000	9.2000	12.800	9.2000	12.800	2.5460
Magnesium (mg/L)	2	1.375	1.375	1.2800	1.470	1.2800	1.470	0.1340
Calcium (mg/L)	2	8.835	8.835	8.0100	9.660	8.0100	9.660	1.1670

Summary Statistics for Site 174 for July 2014 to June 2015								
Site 174	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Secchi Depth (m)	14	0.957	0.925	0.550	1.900	0.700	1.100	0.327
Temperature (oC)	14	20.135	20.775	12.240	25.520	16.450	24.230	4.400
Turbidity (NTU)	14	10.393	9.900	3.500	20.000	5.800	13.800	4.904
Dissolved oxygen (mg/L)	14	6.908	6.755	5.720	8.630	6.260	7.750	0.841
Dissolved oxygen (%sat)	14	89.893	90.450	77.000	100.200	84.800	94.800	6.362

pH	14	7.868	7.935	7.360	8.070	7.820	8.050	0.222
Salinity (ppt)	14	29.359	30.500	10.230	32.930	29.420	31.940	5.636
Suspended Solids (mg/L)	15	10.600	11.000	7.000	13.000	8.500	12.000	2.063
Ammonium-Nitrogen (mg/L)	15	0.016	0.010	0.005	0.060	0.010	0.020	0.015
Oxidised Nitrogen (mg/L)	15	0.041	0.020	0.005	0.180	0.010	0.065	0.048
Total Nitrogen (mg/L)	15	0.277	0.250	0.190	0.600	0.220	0.285	0.104
Total Phosphorus(mg/L)	15	0.018	0.018	0.011	0.027	0.016	0.022	0.004
Soluble Reactive Phosphorus (mg/L)	5	0.008	0.007	0.006	0.012	0.007	0.011	0.002
Chlorophyll-a (ug/L)	15	3.173	3.300	1.500	5.000	1.900	4.150	1.132
Faecal Coliforms (CFU/100ml)	15	3.07	1.00	0.50	16.00	0.50	3.50	4.97
Enterococci (CFU/100ml)	15	14.67	1.00	0.50	200.00	0.50	3.00	51.28

Summary Statistics for Site 175 for July 2014 to June 2015								
Site 175	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	15	18.454	18.530	13.940	22.780	14.720	21.505	3.133
Electrical Conductivity (ms/cm)	15	0.494	0.420	0.260	0.870	0.365	0.625	0.187
Electrical Conductivity (µS/cm)	15	504.133	433.000	237.000	858.000	382.000	657.000	180.752
Turbidity (NTU)	15	6.373	3.100	0.500	43.900	1.150	5.800	10.988
Dissolved oxygen (mg/L)	15	8.836	8.850	7.830	10.430	8.145	9.415	0.707
Dissolved oxygen (%sat)	15	93.993	94.000	80.700	101.000	90.700	98.650	5.160
pH	15	7.705	7.730	7.380	8.050	7.595	7.800	0.154
Salinity (ppt)	15	0.248	0.210	0.130	0.440	0.185	0.310	0.095
Suspended Solids (mg/L)	15	2.733	2.000	1.000	10.000	1.000	3.500	2.576
Ammonium-Nitrogen (mg/L)	15	0.095	0.080	0.005	0.340	0.030	0.130	0.085
Oxidised Nitrogen (mg/L)	15	1.013	0.980	0.270	2.100	0.545	1.375	0.485
Total Nitrogen (mg/L)	15	1.585	1.520	0.550	4.230	1.000	1.885	0.858
Total Phosphorus(mg/L)	15	0.038	0.030	0.014	0.100	0.020	0.064	0.025
Faecal Coliforms (CFU/100ml)	15	2837.93	650.00	99.00	23000.00	345.00	3200.00	5797.39
Enterococci (CFU/100ml)	9	343.56	290.00	35.00	960.00	37.00	680.00	300.36
E Coli (CFU/100mL)	3	292.00	280.00	66.00	530.00	66.00	530.00	232.23
Bicarbonate Alkalinity (mg/CaCO3/L)	3	62.000	67.400	50.400	68.200	50.400	68.200	10.054
Chloride (mg/L)	3	45.000	52.000	30.000	53.000	30.000	53.000	13.000
Sulphate as SO42-(mg/L)	3	17.333	17.000	16.000	19.000	16.000	19.000	1.528
Fluoride (mg/L)	15	0.586	0.620	0.110	0.850	0.495	0.705	0.190
Sodium (mg/L)	3	28.567	29.500	21.800	34.400	21.800	34.400	6.352
Potassium (mg/L)	3	3.960	3.060	2.780	6.040	2.780	6.040	1.807
Magnesium (mg/L)	3	6.290	7.100	4.020	7.750	4.020	7.750	1.993
Calcium (mg/L)	3	26.067	23.400	20.300	34.500	20.300	34.500	7.466
Aluminium (ug/L)	3	670.333	90.000	51.000	1870.000	51.000	1870.000	1039.125
Arsenic (ug/L)	3	0.667	0.500	0.500	1.000	0.500	1.000	0.289
Cadmium (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Chromium (ug/L)	3	2.333	2.000	2.000	3.000	2.000	3.000	0.577
Copper (ug/L)	3	5.667	4.000	4.000	9.000	4.000	9.000	2.887
Lead (ug/L)	3	1.667	0.500	0.500	4.000	0.500	4.000	2.021
Manganese (ug/L)	3	27.000	30.000	10.000	41.000	10.000	41.000	15.716
Molybdenum (ug/L)	3	1.333	1.000	1.000	2.000	1.000	2.000	0.577
Nickel (ug/L)	3	1.500	2.000	0.500	2.000	0.500	2.000	0.866
Selenium (ug/L)	3	1.500	1.500	1.500	1.500	1.500	1.500	0.000
Silver (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Uranium (ug/L)	3	0.500	0.500	0.500	0.500	0.500	0.500	0.000
Zinc (ug/L)	3	54.333	50.000	38.000	75.000	38.000	75.000	18.877
Boron (ug/L)	3	34.667	28.000	25.000	51.000	25.000	51.000	14.224
Iron (ug/L)	3	900.000	999.000	371.000	1330.000	371.000	1330.000	487.105
Mercury (ug/L)	3	0.005	0.005	0.005	0.010	0.005	0.005	0.000

Summary Statistics for Site 180 for July 2014 to June 2015								
Site 180	Valid N	Mean	Median	Minimum	Maximum	Percentile 20	Percentile 80	Std.Dev.
Temperature (oC)	4	19.770	19.945	16.0000	23.190	16.0000	23.190	3.5419
Electrical Conductivity (ms/cm)	4	0.208	0.210	0.1800	0.230	0.1800	0.230	0.0222
Electrical Conductivity (µS/cm)	4	182.500	183.000	155.0000	209.000	155.0000	209.000	24.8395
Turbidity (NTU)	4	12.525	2.550	1.6000	43.400	1.6000	43.400	20.5915
Dissolved oxygen (mg/L)	4	4.800	4.845	3.8100	5.700	3.8100	5.700	0.7781
Dissolved oxygen (%sat)	4	52.575	49.800	43.9000	66.800	43.9000	66.800	9.8858
pH	4	7.278	7.140	6.9500	7.880	6.9500	7.880	0.4116
Salinity (ppt)	4	0.103	0.105	0.0900	0.110	0.0900	0.110	0.0096
Suspended Solids (mg/L)	4	3.500	1.000	1.0000	11.000	1.0000	11.000	5.0000
Ammonium-Nitrogen (mg/L)	4	0.043	0.050	0.0200	0.050	0.0200	0.050	0.0150
Oxidised Nitrogen (mg/L)	4	0.298	0.295	0.1300	0.470	0.1300	0.470	0.1394

Total Nitrogen (mg/L)	4	0.748	0.705	0.6800	0.900	0.6800	0.900	0.1031
Total Phosphorus(mg/L)	4	0.167	0.101	0.0660	0.400	0.0660	0.400	0.1571
Faecal Coliforms (CFU/100ml)	4	75.750	46.500	10.0000	200.000	10.0000	200.000	87.7435
Enterococci (CFU/100ml)	3	161.000	77.000	16.0000	390.000	16.0000	390.000	200.6514
Chloride (mg/L)	1	12.000	12.000	12.0000	12.000	12.0000	12.000	
Sulphate as SO42-(mg/L)	1	4.500	4.500	4.5000	4.500	4.5000	4.500	
Fluoride (mg/L)	4	0.415	0.410	0.1400	0.700	0.1400	0.700	0.2288
Sodium (mg/L)	1	8.350	8.350	8.3500	8.350	8.3500	8.350	
Magnesium (mg/L)	1	4.600	4.600	4.6000	4.600	4.6000	4.600	
Potassium (mg/L)	1	5.270	5.270	5.2700	5.270	5.2700	5.270	
Calcium (mg/L)	1	14.600	14.600	14.6000	14.600	14.6000	14.600	

APPENDIX XX

SITE	STATUS	SITE LOCATION	RECEIVING WATERS	CATCHMENT	SITE ACCESS	PROJECT	ACCESS	FREQUENCY	SITE TYPE	Latitude	Longitude
001	ACTIVE	Berowra Ck, Galston Gorge	Berowra Creek > Hawkesbury River	Berowra Creek	200m downstream (north) of Galston Rd bridge and confluence with Tunks Ck	Routine Monitoring	Car	Monthly	Freshwater	S 33 39.8022'	E 51 04.7695'
002	ACTIVE	Tunks Ck, Galston Gorge	Tunks Creek > Berowra Ck > Hawkesbury River	Berowra Creek	100m above confluence with Berowra Ck Under Galston Rd bridge	Routine Monitoring	Car	Monthly	Freshwater	S 33 39.9326'	E 51 04.7695'
003	NON-ACTIVE	Bujwa Ck, below Cowan	Bujwa Creek	Berowra	Project QUACK (south branch "reference" creek)	Berowra CMC	Car	No	Freshwater		
004	ACTIVE	Berowra Ck, Westleigh	Berowra Ck > Hawkesbury River	Berowra Creek	About 800m south along Benowie Track from junction with firetrail below Barwood Close	Routine Monitoring	Car	Monthly	Freshwater	S 33 42.4804'	E 51 04.0078'
005	ACTIVE	Pyes Ck, Cherrybrook	Pyes Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Below end Kristine Place	Routine Monitoring	Car	Monthly	Freshwater	S 33 42.7778'	E 51 02.2656'
006	ACTIVE	Georges Ck, Dural	Georges Ck > Pyes Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Below end of Jenner Rd or down Sydney Water access track off Fallon Drive	Routine Monitoring	Car	Monthly	Freshwater	S 33 42.6679'	E 51 02.3359'
007	NON-ACTIVE	Devlins Ck, Beecroft	Devlins Creek	Lane Cove	End Mahers Rd, Beecroft behind golf course	routine Monitoring	Car	Yes	Freshwater		
008	ACTIVE	Devlins Ck, Cheltenham	Devlins Ck > Lane Cove River	Lane Cove River	End Sutherland Rd, Cheltenham	Routine Monitoring	Car	Monthly	Freshwater	S 33 45.7905'	E 51 05.0410'
009	NON-ACTIVE	Bujwa Ck, Cowan	Bujwa Creek	Berowra	Project QUACK (north branch)	Berowra CMC	Car	No	Freshwater		
010	ACTIVE	Larool Ck, Thornleigh	Larool Ck > Waitara Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Behind park next to Larool Child Care Centre, below Thornleigh Industrial Area	Routine Monitoring	Car	Fortnightly	Freshwater	S 33 43.1953'	E 51 04.9609'
011	NON-ACTIVE	Canoeland Ck	Canoelands Creek	Berowra	Project QUACK	Berowra CMC	Car	No	Freshwater		
012	ACTIVE	Hornsby Ck, Hornsby	Hornsby Ck > Cockle Ck > Cowan Ck	Cowan Creek	20m upstream of Leighton Place crossing of Creek	Routine Monitoring	Car	Fortnightly	Freshwater	S 33 41.8002'	E 51 06.7148'
013	ACTIVE	Sams Ck, Mt Ku-ring-gai	Sams Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Walk down fire trail from bottom of Hamley Rd. 10m below trash rack	Routine Monitoring	Car	Fortnightly	Freshwater	S 33 38.4819'	E 51 08.1386'
014	NON-ACTIVE	Water tank, Greenway Park, Shephards Drive Cherrybrook	Berowra Creek	Berowra	Stormwater tank at Greenway Pk off Shephards Dv, Cherrybrook - tank removed ~2009	Stormwater Harvesting	Car	No	Stormwater		
015	NON-ACTIVE	Water tank Pennant Hills Tennis Courts	Berowra Creek	Berowra	Stormwater tank in Pennant Hills Park behind tennis courts	Stormwater Harvesting	Car	No	Stormwater		
016	NON-ACTIVE	Water tank in Sommerville Park, Epping	Terrys Creek	Lane Cove	Stormwater tank near Sommerville Oval - tank removed 2010	Stormwater Harvesting	Car	No	Stormwater		
017	NON-ACTIVE	Colah Ck, Sallaway Rd crossing	Colah Creek	Berowra	Project QUACK	routine Monitoring	Car	No	Freshwater		
018	ACTIVE	Arcadia Tip	Calabash Ck > Calabash Bay > Berowra Ck > Hawkesbury River	Berowra Creek	Arcadia tip leachate (main pond now) concrete sump. Access down track in locked compound). Lift concrete lid to dip sample	Tip leachate monitoring	Car	Quarterly	Leachate	S 33 36.8559'	E 51 03.4785'
019	NON-ACTIVE	Hornsby Heights STP outfall (into Calna Ck) Walls Gully	Calna Creek	Berowra	End Pikes Rd in SW land	routine Monitoring	Car	Yes	Freshwater		
020	NON-ACTIVE	Calna Ck, Walls Gully, Hornsby Heights	Calna Creek	Berowra	Near Pikes Rd 100m upstream of SW STP	routine Monitoring	Car	Yes	Freshwater		
021	NON-ACTIVE	Calna Ck, Walls Gully, Hornsby Heights (downstream of STP)	Calna Creek	Berowra	100m downstream of STP	routine Monitoring	Car	Yes	Freshwater		
022	NON-ACTIVE	Waitara Ck, West Hornsby STP outfall	Waitara Creek	Berowra	Outfall from West Hornsby STP into Waitara Ck. Access of Valley Rd down concrete channel	routine Monitoring	Car	Yes	Freshwater		
023	ACTIVE	Waitara Ck, Hornsby	Waitara Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Upstream side of concrete causeway of firetrail just south of Ginger Meggs Park	Routine Monitoring	Car	Monthly	Freshwater	S 33 42.1420'	E 51 04.8320'
024	NON-ACTIVE	Waitara Ck, downstream of West Hornsby STP	Waitara Creek	Berowra	Just upstream of confluence with Old Mans Ck	routine Monitoring	Car	Yes	Freshwater		
025	NON-ACTIVE	Samuel Oxley Park West Pennant Hills- downstream of CDS	Berowra Creek	Berowra	Down stream of SQID	CRR Device	Car	No	Freshwater		
026	NON-ACTIVE	Samuel Oxley Park- West Pennant Hills- upstream of CDS Device	Berowra Creek	Berowra	Upstream of SQID	CRR Device	Car	No	Freshwater		
027	NON-ACTIVE	Clarinda St wetland- Downstream	Berowra Creek	Berowra	Wetland overflow at weir of lower pond	CRR Device	Car	No	Stormwater		
028	NON-ACTIVE	Clarinda St Wetland- upstream	Berowra Creek	Berowra	Inlet of wetland below trash rack	CRR Device	Car	No	Stormwater		
029	NON-ACTIVE	Fiddletown Ck	Fiddletown Creek	Berowra	Project QUACK	Berowra CMC	Car	No	Freshwater		
030	NON-ACTIVE	HSC Nursery- downstream-raw water	Berowra Creek	Berowra		CRR Device	Car	No	Freshwater		
031	NON-ACTIVE	HSC Nursery- upstream-wetland	Berowra Creek	Berowra		CRR Device	Car	No	Freshwater		
032	NON-ACTIVE	Council Depot- Sefton Road- upstream	Berowra Creek	Berowra		CRR Device	Car	No	Freshwater		
033	NON-ACTIVE	Council Depot- Sefton Road- downstream	Berowra Creek	Berowra		CRR Device	Car	No	Freshwater		

034	NON-ACTIVE	Glenorie Ck	Glenorie Creek	Berowra	Project QUACK	Berowra CMC	Car	No	Freshwater		
035	NON-ACTIVE	Tunks Ck, Dural	Tunks Creek	Berowra	Off Odette Rd, Dural, Project QUACK	Berowra CMC	Car	No	Freshwater		
036	ACTIVE	Murray Anderson Ck, Kuring-Gai Chase NP	Murray Anderson Ck > Smiths Ck > Cowan Ck	Cowan Creek	Off Smiths Ck, in Ku-ring-gai National Park. Access by boat at high tide.	Reference Site	Boat	Monthly	Freshwater	S 33 38.2441'	E 51 11.3222'
037	ACTIVE	Smugglers Ck, Marramarra NP	Smugglers Creek > Marramarra Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Access by boat up Marramarra Ck, then bushwalk about 500m up Smugglers Creek	Reference Site	Boat	Monthly	Freshwater	S 33 31.5986'	E 51 05.3847'
038	ACTIVE	Sandbrook Inlet, Brooklyn	Sandbrook Inlet > Hawkesbury River	Hawkesbury River	Centre of inlet between rock outcrop (on Long Island) and green boatshed Brooklyn	Routine Monitoring	Boat	Yes	Monthly	S 33 32.6845'	E 51 13.0664'
039	ACTIVE	Joe Crafts Ck, Muogamarra NR	Joe Crafts Ck > Joe Crafts Bay > Berowra Ck > Hawkesbury River	Berowra Creek	Walk upstream from boating limit above confluence with Berowra Creek. Sample in freshwater above tidal limit	Routine Monitoring	Boat	Monthly	Freshwater	S 33 35.3388'	E 51 08.7617'
040	NON-ACTIVE	Waitara Ck, Hornsby	Waitara Creek	Berowra	Project QUACK	Berowra CMC	Car	No	Freshwater		
041	NON-ACTIVE	Sams Ck, just above tidal limit	Sams Creek	Berowra	Walk upstream from boating limit above confluence with Berowra Estuary	routine Monitoring	Boat	Yes	Freshwater		
042	ACTIVE	Colah Ck, Glenorie	Colah Ck > Marramarra Ck > Berowra Ck > Hawkesbury River	Berowra Creek	50m upstream from Wylds Rd bridge	Routine Monitoring	Car	Monthly	Freshwater	S 33 37.5278'	E 51 01.6601'
043	ACTIVE	Calna Ck, Lyrebird Gully	Calna Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Walk from Crosslands to confluence of Berowra Ck and Calna Ck, then upstream about 1km. Sample freshwater above tidal limit.	Routine Monitoring	Car	Monthly	Freshwater	S 33 38.1264'	E 51 07.0703'
044	NON-ACTIVE	Hornsby Quarry Dam	Waitara Creek	Berowra	Quarry water sampled from boat	Hornsby Quarry monitoring	Car	No	Freshwater		
045	ACTIVE	Fishponds, Berowra Ck, Hornsby	Berowra Ck > Hawkesbury River	Berowra Creek	Along firetrail and walk track from Rosemead Rd, Hornsby	Routine Monitoring	Car	Monthly	Freshwater	S 33 41.5322'	E 51 05.0664'
046	ACTIVE	Trib Terrys Ck, North Epping	Terrys Ck > Lane Cove River	Lane Cove River	50 from end of Somerset St, above waterfall	Routine Monitoring	Car	Monthly	Freshwater	S 33 45.9135'	E 51 05.7304'
047	NON-ACTIVE	Fagan Park Dam	Still Creek	Berowra		One off test	Car	No	Freshwater		
048	ACTIVE	Marramarra Ck, Marramarra NP	Marramarra Creek > Berowra Ck > Hawkesbury River	Berowra Creek	From boat in tidal section upstream from Bar Island. Access at high tide.	Routine Monitoring	Boat	Monthly	Estuarine	S 33 31.3413'	E 51 06.2226'
049	ACTIVE	Still Ck, Galston	Still Creek > Berowra Ck > Hawkesbury River	Berowra Creek	Near end Mansfield Rd, Glenorie, just above waterfall	Routine Monitoring	Car	Monthly	Freshwater	S 33 38.1210'	E 51 03.6894'
050	NON-ACTIVE	Berowra Ck, upstream of Boundary Rd wetland	Berowra Creek	Berowra	100m upstream of wetland off	routine Monitoring	Car	Yes	Freshwater		
051	NON-ACTIVE	PENNANT HILLS HIGH CK - LAURENCE STREET Downstream	Berowra Creek	Berowra	Tedbury Ck?	routine Monitoring	Car	Yes	Freshwater		
052	ACTIVE	Calna Ck, Walls Gully, Hornsby Heights	Calna Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Drive from Pike Rd Hornsby Heights down into Sydney Water land. Sample about 300m upstream of STP discharge	Routine Monitoring	Car	Monthly	Freshwater	S 33 40.2500'	E 51 06.1464'
053	NON-ACTIVE	Wisemans Ferry- Recreational Monitoring Site (DIPNR Site No. 21210009)	Hawkesbury river	Hawkesbury River	(no sample data)	Recreational monitoring	Car	No	Estuarine		
054	ACTIVE	Laughtondale Gully Ck	Laughtondale Gully Ck > Hawkesbury River	Hawkesbury River	Laughtondale Gully Rd, pool opposite big rock overhang	Reference Site	Car	Monthly	Freshwater	S 33 24.8417'	E 51 00.5468'
055	ACTIVE	Brooklyn Baths, Brooklyn	Hawkesbury River	Hawkesbury River	Brooklyn Baths- Recreational Monitoring Site (DIPNR Site No. 21210007). Outside of baths.	Recreational monitoring	Car or Boat	Monthly	Estuarine	S 33 32.7758'	E 51 13.9023'
056	NON-ACTIVE	Wisemans Ferry Tip leachate pond (se also site 112)		Hawkesbury River	Pond below old tip embankment, Old Wisemans Ferry Rd (Access gate key A21 or 969D)	Tip leachate monitoring	Car	Yes	Tip Leachate		
057	NON-ACTIVE	100M UPSTREAM OF PENNANT HILLS HIGH SCHOOL WETLAND	Berowra Creek	Berowra	Tedbury Ck?	routine Monitoring	Car	Yes	Freshwater		
058	NON-ACTIVE	Lyrebird Gully - downstream	Lyrebird Creek	Berowra	Project QUACK. Downstream	Berowra CMC	Car	No	Freshwater		
059	NON-ACTIVE	Lyrebird Gully - upstream	Lyrebird Gully	Berowra	Project QUACK, upstream	Berowra CMC	Car	No	Freshwater		
060	ACTIVE	Berowra Ck, Berowra Waters	Berowra Creek > Hawkesbury River	Hawkesbury River	From boat centre stream 50m downstream of ferry	Routine Monitoring	Boat	Monthly	Estuarine	S 33 35.9321'	E 51 07.4277'
061	ACTIVE	Berowra Ck, Calabash Point	Berowra Ck > Hawkesbury River	Hawkesbury River	From boat near chlorophyll monitor buoy	Routine Monitoring	Boat	Monthly + probe changes	Estuarine	S 33 35.2104'	E 51 07.2050'

062	ACTIVE	Kimmeriong Ck, Cowan	Kimmerikong Ck > Kimmerikong Bay > Berowra Ck > Hawkesbury River	Berowra Creek	About 300m from Alberta Ave along bushtrack	Routine Monitoring	Car	Monthly	Freshwater	S 33 35.1772'	E 51 10.2910'
063	ACTIVE	Colah Creek, Ben Bullen Road	Colah Creek > Marramorra Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Drive/walk down firetrail then track for about 400m	Routine Monitoring	Car	Monthly	Freshwater	S 33 34.9067'	E 51 02.0957'
064	ACTIVE	Trib Colah Ck, Galston	Trib > Colah Creek > Marramorra Ck > Berowra Ck > Hawkesbury River	Berowra Creek	small stream at causeway of firetrail off Sallaway Rd	Routine Monitoring	Car	Monthly	Freshwater	S 33 38.7304'	E 51 01.9843'
065	NON-ACTIVE	Bujwa Bay	Berowra Estuary	Hawkesbury River		Routine Monitoring	Boat	No	Estuarine		
066	NON-ACTIVE	Berowra Ck, Boundary Rd, Pennant Hills	Berowra Creek	Berowra	Below Boundary Rd	Routine Monitoring	Car	Yes	Freshwater		
067	NON-ACTIVE	BEROWRA CREEK AT KIMMERKONG BAY (FC ONLY)	Berowra Estuary	Hawkesbury River		Routine Monitoring	Boat	Yes	Estuarine		
068	NON-ACTIVE	BEROWRA CREEK AT COBA BAY (FC ONLY)	Berowra Estuary	Hawkesbury River		Routine Monitoring	Boat	Yes	Estuarine		
069	NON-ACTIVE	BEROWRA CREEK AT PEATS BITE (FC ONLY)	Berowra Estuary	Hawkesbury River		Routine Monitoring	Boat	Yes	Estuarine		
070	NON-ACTIVE	MOONEY MOONEY CK AT WORKERS CLUB WHARF (MIDSTREAM)	Lower Hawkesbury Estuary	Hawkesbury River		Routine Monitoring	Boat	Yes	Estuarine		
071	NON-ACTIVE	MOONEY MOONEY CREEK AT SNAKE ISLAND	Lower Hawkesbury Estuary	Hawkesbury River		Routine Monitoring	Boat	Yes	Estuarine		
072	NON-ACTIVE	MULLET CREEK IN BETWEEN FIRST TWO OYSTER LEASES	Lower Hawkesbury Estuary	Hawkesbury River		Routine Monitoring	Boat	Yes	Estuarine		
073	NON-ACTIVE	Kalang Rd, Asquith - upstream of SQID	Calna Creek	Berowra	Upstream of sed. Basin at Kalang Rd, Asquith	Routine Monitoring	Car	Yes	Freshwater		
074	NON-ACTIVE	Kalang Rd, Asquith - SQID downstream of both sed basins	Calna Creek	Berowra	Downstream of sed. Basin at Kalang Rd, Asquith	Routine Monitoring	Car	Yes	Freshwater		
075	NON-ACTIVE	Berowra Ck, below Boundary Rd wetland	Berowra Creek	Berowra	Directly below wetland at green outlet pipe	Routine Monitoring	Car	Yes	Freshwater		
076	NON-ACTIVE	PORTO BAY	Lower Hawkesbury Estuary	Hawkesbury River		Routine Monitoring	Boat	Yes	Estuarine		
077	ACTIVE	Gleeson Ck, Mt Colah	Gleeson Creek > Calna Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Upstream of fire trail causeway off Oxley Dr, Mt Colah (east end)	Routine Monitoring	Car	Monthly	Freshwater	S 33 39.4155'	E 51 07.2089'
078	NON-ACTIVE	Fox Glove Oval. Southern stormwater drain	Gleeson Creek	Berowra	Stormwater drain (in pool down two levels)	Tip leachate monitoring	Car	No	Freshwater		
079	NON-ACTIVE	Fox Glove Oval. Northern stormwater drain	Gleeson Creek	Berowra	Stormwater line (upstream of sewer line)	Tip leachate monitoring	Car	No	Freshwater		
080	ACTIVE	Glenorie Ck, Glenorie	Glenorie Ck > Colah Creek > Marramorra Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Upstream of GPT at Tepoka Dr, Glenorie	Routine Monitoring	Car	Monthly	Freshwater	S 33 35.8789'	E 51 00.5957'
081	NON-ACTIVE	PLYMPTON ROAD WETLAND, BEECROFT		Lane Cove		Routine Monitoring	Car	No	Freshwater		
082	NON-ACTIVE	END OF GULLY RD, BEROWRA AT FIRST POND	Joe Crafts Creek	Berowra		Routine Monitoring	Car	No	Freshwater		
083	NON-ACTIVE	BEROWRA CREEK, DIRECTLY UPSTREAM OF WALLAMEDA WETLAND, UNDER SMALL BRIDGE	Berowra	Berowra		Routine Monitoring	Car	Yes	Freshwater		
084	NON-ACTIVE	LOCATED DOWNSTREAM OF PLYMPTON ROAD WETLAND		Lane Cove		Routine Monitoring	Car	Yes	Freshwater		
085	ACTIVE	Hornsby Quarry, Hornsby	Old Mans Ck > Waitara Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Pumping station just prior to discharge	Hornsby Quarry monitoring	Car	Monthly	Freshwater		
086	NON-ACTIVE	NEVERFAIL BAY	Berowra Estuary	Hawkesbury River		routine Monitoring	Car	No	Estuarine		
087	NON-ACTIVE	Milsons Passage	Lower Hawkesbury Estuary	Hawkesbury River		routine Monitoring	Car	No	Estuarine		
088	ACTIVE	SPLIT SAMPLE				QA/QC		Monthly	QA/QC		
089	NON-ACTIVE	Hornsby Quarry upstream of Dam	Waitara Creek	Berowra		Hornsby Quarry monitoring	Car				
090	NON-ACTIVE	Crosslands Reserve- Recreational Monitoring Site (DIPNR Site No. 21210040)(1st ramp)	Berowra Estuary	Hawkesbury River	wade out from 1st ramp (opposite SDA wharf)	Recreational monitoring	Car	No	Estuarine		
091	NON-ACTIVE	Bobbin Head- Recreational Monitoring Site (DIPNR Site No. 21210006)	Cowan Estuary	Hawkesbury River		Recreational monitoring	Car	No	Estuarine		
092	NON-ACTIVE	Hornsby Swimming Pool RO treated water			purple tap centre of Hornsby Park	Water Reuse	Car	No	Freshwater		

093	ACTIVE	BLANK SAMPLE				QA/QC		Monthly	QA/QC		
094	ACTIVE	Arcadia Tip	Calabash Ck > Calabash Bay > Berowra Ck > Hawkesbury River	Berowra Creek	Treated water. Dip sample using tube sampler from plastic tank in locked compound	Tip leachate monitoring	Car	Quarterly	Leachate	S 33 36.8554'	E 51 03.4746'
095	ACTIVE	Foxglove oval- tip leachate upstream of CRR treatment device	Gleeson Creek	Berowra	sample from tap on large green tank (or concrete sump below tip embankment using tube sampler	Tip leachate monitoring	Car	No	Tip Leachate		
096	ACTIVE	Foxglove oval- CRR treatment device outlet tank-sampled at end of reedbed	Gleeson Creek	Berowra	downstream end of reedbed polishing dam. Sample from flexible pipe in concrete sump	Tip leachate monitoring	Car	Yes	Tip Leachate		
097	NON-ACTIVE	Berowra Creek at the Woolwash	Berowra Estuary	Berowra		algal bloom	Boat	Yes	Estuarine		
098	ACTIVE	HSC Nursery- Treated Water - purple sample tap near propagation shed	Devlins Creek	Lane Cove	Sampled at purple tap near propagation shed	CRR Device	Car	No	Stormwater		
098	NON-ACTIVE	HSC Nursery- pump shed - from pump (which pumps up to nursery)									
098	NON-ACTIVE	HSC Nursery- from port on top of grodan tank									
098	NON-ACTIVE	HSC Nursery- from port on top of left concrete storage water tank									
098	NON-ACTIVE	HSC Nursery- from port on top of right concrete storage water tank									
099	NON-ACTIVE	HSC Nursery- outlet end of open sediment tank									
099	NON-ACTIVE	HSC Nursery- stormwater collection sump in Parks Depot									
099	NON-ACTIVE	Crosslands Reserve- Recreational Monitoring Site (2nd boat ramp)	Berowra Estuary	Hawkesbury River	Wade out from 2nd ramp	Recreational monitoring	Car	No	Estuarine		
100	ACTIVE	Berowra Creek, Crosslands Reserve	Berowra Creek > Hawkesbury River	Berowra Creek	Drive to end of track (through gate - key required). Sample off the small beach at the northern end of the reserve	Recreational monitoring	Car	Monthly	Estuarine	S 33 37.5292'	E 51 06.8417'
101	NON-ACTIVE	Epping pool reverse osmosis unit	Devlins Creek	Lane Cove	Large corrugated water tank, from outlet tap	Water Reuse	Car	No	Freshwater		
102	NON-ACTIVE	Pennant Hills Park Tennis Courts. Downstream of UV treatment		Lane Cove		Stormwater Harvesting	Car	No	Stormwater		
103	ACTIVE	Milsons Passage, Hawkesbury River	Hawkesbury river	Hawkesbury River	Mouth of Milsons Passage (Eastern end)	Brooklyn STP outfall monitoring	Boat	Monthly	Estuarine	S 33 31.2900'	E 51 10.8183'
104	NON-ACTIVE	Hawkesbury R (STP monitoring) off Peat Island		Hawkesbury River	Middle of Hawkesbury River Channel off Peat Island	Brooklyn STP outfall monitoring	Boat	Yes	Estuarine		
105	NON-ACTIVE	Hawkesbury R (STP monitoring) under F3 bridge		Hawkesbury River	Hawkesbury River Bridge. 2nd pylon from the southern side	Brooklyn STP outfall monitoring	Boat	Yes	Estuarine		
106	NON-ACTIVE	Hawkesbury R (STP monitoring) entrance to Sandbrook Inlet		Hawkesbury River	Sandbrook inlet channel (middle). End of Fenwicks Marina	Brooklyn STP outfall monitoring	Boat	Yes	Estuarine		
107	NON-ACTIVE	Hawkesbury R (STP monitoring) off Long Island		Hawkesbury River	Middle of Hawkesbury River Channel North of Long Island	Brooklyn STP outfall monitoring	Boat	Yes	Estuarine		
108	ACTIVE	Bradleys Beach, Hawkesbury River	Hawkesbury River	Hawkesbury River	Off Bradley's Beach , Dangar Island	Brooklyn STP outfall monitoring	Boat	Monthly	Estuarine	S 33 32.4614'	E 51 14.5175'
109	NON-ACTIVE	Cherrybrook Lakes inlet	Berowra Creek	Berowra	pool at outlet of stormwater pipe under Kenburn Rd	CRR Device	Car	Yes	Stormwater		
110	Non-ACTIVE	Cherrybrook Lakes outlet	Berowra Creek	Berowra	outlet stream under footbridge	CRR Device	Car	Yes	Stormwater		
111	Non-ACTIVE	Berowra Ck at Rocky Fall Rapids (freshwater just upstream of tidal influence) - routine and rec monitoring	Berowra Creek	Berowra Estuary	Walk upstream from Crosslands Reserve about 4 km. Sample freshwater flow around rocks just above tidal influence	Routine Monitoring	Car/walk	No	Freshwater		
112	ACTIVE	Wisemans Ferry Tip	Mill Ck > Hawkesbury River	Hawkesbury River	open padlocked riser, sample using tube bailer	Tip leachate monitoring	Car	Quarterly	Leachate	S 33 24.6230'	E 50 58.7910'
113	NON-ACTIVE	Dog Pound Ck	Larool Creek	Berowra	walking track x-ing about 200m u/s of Larool Ck junction	Diatreme geology seepage	car/walk	no	Freshwater		
114	ACTIVE	Muogamarra Ck	Muogamarra Ck > Berowra Ck > Hawkesbury River	Berowra Creek	walking track at xing about 500m up creek from estuary, or drive Peats Crater fire trail	Possible Reference Site	Car or Boat	Monthly	Freshwater	S 33 32.5605'	E 51 10.2871'
115	ACTIVE	Old Mans Ck, Hornsby	Old Mans Ck > Waitara Ck > Berowra Ck > Hawkesbury River	Berowra Creek	firetrail crossing (on way to Fishponds)	Hornsby Quarry monitoring	Car	Monthly	Freshwater		
116	NON-ACTIVE	Coba Ck - freshwater - 50m above tidal influence	Berowra Estuary at Coba Bay	Berowra	100m u/s of end of Kulpas Track - severe bushbash	Possible reference site	walk	No	Freshwater		
117	NON-ACTIVE	BYLES CK - 50m u/s of Devlins Ck	Devlins Ck	Lane Cove	walk from end Day/Malton Rd		walk	No	Freshwater		

118	NON-ACTIVE	Still Ck, 50m above tidal influence	Berowra Ck	Berowra	Drive through Crosslands Convention Centre, walk about 300m up creek, 50m above tidal limit	Reference Site	Car/walk	No	Freshwater		
119	NON-ACTIVE	The Gully Rd stormwater pipe outlet near Community Centre	Joe Crafts Creek	Berowra	Measure water flow from pipe into trash rack area	Stormwater Harvesting	car	No	Stormwater		
120	ACTIVE	Cherrybrook Greenway Park, raw stormwater		Berowra	U/G tank outlet (sampling tap) in pump room, just before UV treatment	Stormwater Harvesting	car	Yes	Stormwater		
121	ACTIVE	Cherrybrook Greenway Park, UV treated stormwater		Berowra	Tank outlet (sampling tap) in pump room. After Jan 2011 sample using 12v pump directly into concrete tank	Stormwater Harvesting	car	Yes	Stormwater		
122	NON-ACTIVE	Calabash Ck below Arcadia Tip - about 200m downslope	Berowra Creek	Berowra	Walk down track from water treatment plant then bushbash to below first creek junction	Tip Leachate Monitoring	car	No	Freshwater		
123	ACTIVE	Peats Crater Creek	Peats Crater Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Walk from estuary about 800m, sample from rocky gully, or drive Peats Crater fire trail	Routine Monitoring	Car or Boat	Monthly	Freshwater	S 33 32.5258'	E 51 10.5000'
124	NON-ACTIVE	Margaret St Bioretention Basin - Inlet Pipe		Berowra Ck		CRR Device	car		Stormwater		
125	NON-ACTIVE	Margaret St Bioretention Basin - Outlet Pipe		Berowra Ck		CRR Device	car		Stormwater		
126	Non-active	Lyne Rd Bioretention Basin - inlet pipe		Lane Cove		CRR Device	car		Stormwater		
127	Non-active	Lyne Rd Bioretention Basin - outlet pipe		Lane Cove		CRR Device	car		Stormwater		
128	ACTIVE	Gully Rd, Berowra		Berowra Ck	U/G tank near Gully Rd trash rack; from overflow or 12v pump	Stormwater harvesting	Car	Monthly	Stormwater	S 33 37.3403'	E 51 09.0546'
129	ACTIVE	Berowra Oval Stormwater Harvesting - raw water- from tap at UV inlet		Berowra Ck	Sample from pipe inside control room - tap at UV inlet	Stormwater harvesting	Car		Stormwater	S 33 37.4033'	E 51 08.9394'
130	ACTIVE	Berowra Oval Stormwater Harvesting - treated water - from tap at UV outlet		Berowra Ck	Sample from pipe inside control room - tap at UV outlet	Stormwater harvesting	Car		Stormwater	S 33 37.4033'	E 51 08.9394'
131	ACTIVE	Berowra Oval, Berowra		Berowra Ck	Sample with bailer tube or 12V pump from inspection lid. Since Jan 2011 sample from tap on tank inside control room	Stormwater harvesting	Car	Monthly	Stormwater	S 33 37.4033'	E 51 08.9394'
132	ACTIVE	Foxglove Oval Stormwater harvesting - treated water from tap on green concrete tank		Berowra Ck	Sample direct from large green tank behind kiosk. Need vandal-proof tap key to sample	Stormwater harvesting	car		Stormwater		
133	Non-Active	Berowra Creek, Calabash Bay, southern shoreline near houses	Berowra Creek	Berowra Ck		Macro-Algal problem					
134	ACTIVE	Epping Oval Stormwater harvesting - raw water- large underground tank		Lane Cove R	Sample from U/G tank using 12v pump	Stormwater harvesting			Stormwater		
135	ACTIVE	Epping Oval Stormwater harvesting - raw water immediately before treatment		Lane Cove R	From tap before UV lamps in cntrol room	Stormwater harvesting			Stormwater		
136	ACTIVE	Epping Oval Stormwater harvesting - treated water immediately after UV		Lane Cove R	From tap after UV lamps in control room	Stormwater harvesting			Stormwater		
137	ACTIVE	Epping Oval Stormwater harvesting - treated water - aboveground tank from tap		Lane Cove R	Sample from tap on above ground tank near control room	Stormwater harvesting			Stormwater		
138	ACTIVE	North Epping Stormwater harvesting - raw water - small underground tank		Lane Cove R	Sample from U/G tank using 12v pump	Stormwater harvesting			Stormwater		
139	ACTIVE	North Epping Stormwater harvesting - raw water immediately before treatment		Lane Cove R		Stormwater harvesting			Stormwater		
140	ACTIVE	North Epping Stormwater harvesting - treated water immediately after UV		Lane Cove R		Stormwater harvesting			Stormwater		
141	ACTIVE	North Epping Stormwater harvesting - treated water - large underground tank		Lane Cove R	Sample from U/G tank using 12v pump	Stormwater harvesting			Stormwater		
142	ACTIVE	Somerville Oval Stormwater harvesting - raw water - underground tank		Lane Cove R	Sample from U/G tank using 12v pump	Stormwater harvesting			Stormwater		
143	ACTIVE	Somerville Oval Stormwater harvesting - raw water - immediately before treatment		Lane Cove R		Stormwater harvesting			Stormwater		
144	ACTIVE	Somerville Oval Stormwater harvesting - treated water immediately after UV		Lane Cove R		Stormwater harvesting			Stormwater		
145	ACTIVE	Somerville Oval Stormwater harvesting - treated water large underground tank		Lane Cove R	Sample from U/G tank using 12v pump	Stormwater harvesting			Stormwater		

146	NON-ACTIVE	Yatala Ck, Jerusalem Bay - 50m above tidal influence	Cowan Creek	Cowan Ck	boat up Jerusalem Bay at high tide as far as possible, then walk about 100m to freshwater ck just above camp site	Reference Site			Freshwater		
147	ACTIVE	Unnamed Ck, Trib Byles Ck, Cheltenham	Trib > Byles Ck > Devlins Ck > Lane Cove River	Lane Cove River	walk from Day/Malton Rd Cheltenham, cross Byles Ck, walk 20m to small side ck	Reference Site	Car	Monthly	Freshwater	S 33 45.0571'	E 51 05.0585'
148	NON-ACTIVE	Hornsby Park - stormwater outlet behind public toilets	Berowra	Berowra Ck		Stormwater					
149	ACTIVE	Marramarra Ck, Duckpond Ridge, Marramarra NP	Marramarra Ck > Berowra Ck	Berowra Creek	drive down to end of DuckPond Ridge firetrail, bushbash ~50m to creek, sample upstream of deep pool filled with strapweed	Reference Site	Car	Monthly	Freshwater	S 33 31.4042'	E 51 03.8339'
150	ACTIVE	Gunyah Point, Hawkesbury River	Hawkesbury River	Hawkesbury River	next to Council's moored probe water monitoring	algal bloom, salinity	Boat	Every 3 weeks through warm months - Every 4 weeks through cool months	Estuarine	S 33 34.1093'	E 51 14.4472'
151	ACTIVE	West Bar Island, Marramarra Creek	Hawkesbury River	Hawkesbury River	next to Council's moored probe water monitoring	algal bloom, salinity	Boat	Every 3 weeks through warm months - Every 4 weeks through cool months	Estuarine	S 33 31.7456'	E 51 08.6210'
152	ACTIVE	Courangra Point, Hawkesbury River	Hawkesbury River	Hawkesbury River	next to Council's moored probe water monitoring	algal bloom, salinity	Boat	Every 3 weeks through warm months - Every 4 weeks through cool months	Estuarine	S 33 28.3520'	E 51 08.0019'
153	ACTIVE	Laughtondale, Hawkesbury River	Hawkesbury River	Hawkesbury River	next to Council's moored probe water monitoring	algal bloom, salinity	Boat	Every 3 weeks through warm months - Every 4 weeks through cool months	Estuarine	S 33 24.1518'	E 51 01.0429'
154	NON-ACTIVE	Calabash Ck - freshwater - 50m above tidal influence	Berowra Ck	Berowra		Reference Site	Boat		Freshwater		
155	NON-ACTIVE	Banks Ck - freshwater- 50m above tidal influence	Berowra Ck	Berowra		Reference Site	Boat		Freshwater		
156	NON-ACTIVE	Dennys Ck - freshwater- 50m above tidal influence	Berowra Ck	Berowra	boat up Donnybrook Bay into Denny Ck at high tide, motor as far as possible, walk ~50m to freshwater	Reference Site	Boat		Freshwater		
157	NON-ACTIVE	"Deep Bay" Ck - freshwater- 50m above tidal influence	Berowra Ck	Berowra	Boat up Deep Bay, walk/climb up creek line about 50-80m and sample in pools	Reference Site	Boat		Freshwater		
158	Non-ACTIVE	Marramarra Ck (fresh) about 200m upstream of tidal limit	Berowra Ck	Berowra	Boat up Marramarra ck on high tide up to tidal limit. Walk 200m to large pool		Boat		Freshwater		
159	NON-ACTIVE	Marramarra Ck about 200m u/s of junction with Duckpond Ridge Ck	Berowra Ck	Berowra	Drive to bottom end of DuckPond Ridge firetrail. Bushbash to Marramarra Ck (~500m) sample at bottom end of big pool		Car		Freshwater		
160	NON-ACTIVE	Unnamed Ck flowing from saddle near Joes Mountain towards Fishponds	Berowra Ck	Berowra	Drive on firetrail from Rosemead Rd towards Fishponds. Walk towards Fishponds along GN Walk, and sample ck at small wooden bridge	Reference Site	Car/Walk		Freshwater		
161	NON-ACTIVE	Canoelands Ck just above tidal limit	Berowra Ck	Berowra	Boat up side creek from Marramarra Ck (just d/s from Smugglers ck), walk about 50m upstream to freshwater	Reference Site	Boat		Freshwater		
162	NON-ACTIVE	McCarrs Ck near McCarrs Ck Road Bridge	Pittwater		Drive and walk up firetrail about 100m	Reference Site	Car		Freshwater		
163	NON-ACTIVE	Unnamed Ck - draining from Barkala Cres Westleigh at GNWalk crossing	Berowra Ck	Berowra	Drive down firetrail from Barwood Close, walk towards Site 4 along GNW		Car/walk		Freshwater		
164	ACTIVE	Unnamed Ck, Djara Crossing	Djara Crossing > Joe Crafts Bay > Berowra Ck	Berowra Creek	Drive down firetrail from Glendale Rd to Djara Crossing	Reference Site	Car	Monthly	Freshwater	S 33 34.8686'	E 51 08.9941'
165	NON-ACTIVE	Duneba/Apanie Bioretention Basin - inlet pipe	Berowra Ck	Berowra	Large stainless steel pipe flowing under Duneba Drive into bioretention basin	CRR Device	Car		Stormwater		
166	Active	Duneba/Apanie Bioretention Basin - overflow of rock wall at weir			Water flowing from large stainless steel pipe - entering into the upper sediment basin above the rock wall and bioretention basin	CRR Device					
167	Active	Duneba/Apanie Bioretention Basin - outlet pipe	Berowra Ck	Berowra	Concrete pipe with sandbed underflow outlet from bioretention basin	CRR Device	Car		Stormwater		
168		Stewart St Nornsby Bioretention basin- outlet pipe	Berowra Ck	Berowra	Concrete pipe outlet- sandbed underdrain outlet from bioretention basin	CRR Device	Car		Stormwater		

169		Blackbutt St Pennant hills Bioretention Basin - outlet pipe	Lane Cove River	Lane Cove	Concrete pipe outlet- sandbed underdrain outlet from bioretention basin	CRR Device	Car		Stormwater		
170		Braidwood Rd North Epping- Upper bioretention Basin - outlet pipe	Lane Cove River	Lane Cove	Concrete pipe outlet- sandbed underdrain outlet from upper bioretention basin (flowing into lower bioretention basin)	CRR Device	Car		Stormwater		
171		Braidwood Rd North Epping- Lower bioretention Basin - outlet pipe	Lane Cove River	Lane Cove	Concrete pipe outlet- sandbed underdrain outlet from lower bioretention basin	CRR Device	Car		Stormwater		
172	ACTIVE	Dawson Ave Thornleigh stormwater harvesting and bioretention basin - inlet pipe			concrete pipe inlet - raw water	CRR Device	Car		Stormwater		
173	ACTIVE	Dawson Ave Thornleigh stormwater harvesting and bioretention basin - outlet pipe			concrete pipe outlet - treated water	CRR Device	Car		Stormwater		
174	ACTIVE	MHL Probe - Mullet Creek	Hawkesbury River	Hawkesbury River	next to Council's moored probe water monitoring	algal bloom, salinity	boat	no	estuarine		
175	ACTIVE	Larool Ck, Thornleigh	Larool Ck > Waitara Ck > Berowra Ck > Hawkesbury River	Berowra Creek	Instream approx 10m downstream of the device	CRR device	Car	Fortnightly	Freshwater	S 33 43.1821'	E 51 04.9531'
176	ACTIVE	Pecan Bioretention Basin			weir at overflow of sediment dam and inlet to sandbed	CRR device					
177	ACTIVE	Pecan Bioretention Basin			combined flow of underdrains from sandbed sampled above weir at outlet of collection sump	CRR device					
178	ACTIVE	Foxglove Oval Treated Tank (in the lock up section separate from the wetland area)									
179	ACTIVE	Stormwater from Council Chambers site			Drainage pit in Jersey Lane outside of council basement carpark	Green Walls Investigation	Walk	Event based	Stormwater		
180	ACTIVE	Raw water at nursery stormwater harvesting system - previously 98.4			HSC Nursery- from port on top of right concrete storage water tank						
181	ACTIVE	Trib Terrys Ck, Epping	Terrys Ck > Lane Cove River	Lane Cove River	Site moved d/s due to M2 widening works. 150m from end of Somerset St, below waterfall	Routine Monitoring	Car	Monthly	Freshwater	S 33 45.9458'	E 51 05.7851'
110f	ACTIVE	Cherrybrook Lakes - lower Lake off viewing platform	Berowra Creek	Berowra	under viewing platform, probe at 0.5 and 1.4m - DO monitoring	CRR Device	Car	Yes	Stormwater		
45A	NON-ACTIVE	Berowra Ck at Fishponds (lower end at wooden footbridge))	Berowra Creek	Berowra	Along firetrail and walk track from Rosemead Rd, Hornsby	Hornsby Quarry monitoring	Car	Yes	Freshwater		
46A	ACTIVE	Trib Terrys Ck, Epping	Terrys Ck > Lane Cove River	Lane Cove River	Site moved d/s due to M2 widening works. 150m from end of Somerset St, below waterfall	Routine Monitoring	Car	Monthly	Freshwater	S 33 45.9458'	E 51 05.7851'
96A	ACTIVE	Foxglove oval- CRR treatment device -sampled at outlet of Bioreactor	Gleeson Creek	Berowra	downstream end (outlet) of round ribbed bioreactor	Tip leachate monitoring	Car	Yes	Tip Leachate		
96A2	ACTIVE	Foxglove oval- CRR treatment device -sampled at outlet of Bioreactor			downstream end (outlet) of rectangular bioreactor						

