City of Ryde

Water Quality Monitoring Report

Spring 2018- Autumn 2019

This report was produced by Sydney Water Monitoring Services™
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Spring 2018 & Autumn 2019

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Cover image: Terrys Creek @ Core site, Marsfield

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Executive Summary

This report presents the findings of water quality monitoring carried out in Spring 2018 and Autumn 2019. The survey area included the Archers, Buffalo, Porters, Shrimptons and Terrys Creek catchments.

Overall water quality was consistent with historical data with high concentrations of total nitrogen, ammonia and total phosphorus across all sites. This coupled with low dissolved oxygen continues the categorisation of the creeks as highly disturbed ecosystems.

In previous years, there had been numerous values that were new lows or highs, particularly for faecal coliforms. This only happened once in the 2018/19 monitoring period, with CR5PC having the highest faecal coliform result on record in autumn 2019. Overall, however, the faecal coliform exceedances were quite low compared to historical data.

Macroinvertebrate results varied between the seasons and sites for both SIGNAL SF and Taxa Richness. All five sites experienced SIGNAL SF values that are consistent with historical data. This is a good sign that the sensitivity of the macroinvertebrates has not declined in Spring 2018. However, Autumn 2019 had values far below historical average range for Terrys and Buffalo creeks, whereby Buffalo Creek had the lowest recorded result against historical data for the second consecutive year.

Taxa Richness was inconsistent for most sites, with no clear seasonal trend. For Spring 2019, Shrimptons, Buffalo and Porters creeks experienced richness lower than historical average range. In addition, Buffalo Creek's Autumn 2019 results were seasonally different but also historically significant, well below average range. This may be linked to extended dry periods leading to reduced flow and habitat for macroinvertebrates.

The 2018/19 monitoring period was the second year that rapid riparian assessments were conducted. Some creeks had similar results between 2017/18 and 2018/19. Archers Creek went from *Fair* in 2017/18 to *Fair* in spring 2018 to *Poor* in autumn 2019. Terrys and Buffalo Creeks remained in the *Fair* category for 2018/19. Buffalo Creek moved from *Fair* to *Good* in 2018/19. Porters Creek remained the best performer, with Spring 2018 in the *Excellent* category and Autumn 2019 in the *Good* category.

Glossary

Item	Meaning
Abundance	The total number of individual specimens; in a sample, community, ecosystem etc.
Algae	Comparatively simple chlorophyll-bearing plants, most of which are aquatic and microscopic in size.
Alkalinity	The ability of a solution to neutralise acid (or buffer).
Ammonia	A colourless gas. In the aquatic environment, it exists in the relatively harmless form ammonium (NH4) and the toxic form ammonia (NH3).
Analyte	The physical and chemical parameters (indicators) to be measured.
Anthropogenic	Impacts on an environment that are produced or caused by humans
ANZECC	ANZECC is a forum for member governments to develop coordinated policies about national and international environment and conservation issues.
Catchment	The area that is drained by a river, lake or other water body.
Community	Assemblage of organisms characterised by a distinctive combination of species occupying a common environment and interacting with one another.
Concentration	The quantifiable amount of a chemical divided by the total volume of a mixture.
Conductivity	The measure of salt content in soil or water; it refers to the ability of the substance to transfer an electrical charge.
Dissolved Oxygen	The measurement of the concentration of oxygen that is dissolved in a water body.
Diversity (Biological)	The measure of the number and/or degree of available organisms in an environment.
Eutrophication	Enrichment of a water body with nutrients that results in increased aquatic plant growth and low oxygen levels.
Faecal Coliforms	Bacteria which inhabit the intestines of humans and other vertebrates and are present in faeces. Used as a primary indicator of sewage pollution in the environment.
Guideline (water quality)	Concentration limit or narrative statement recommended to support and maintain a designated water use.
Habitat	The place where a population lives and its surroundings, both living and non-living.
Indicator	A parameter (chemical, biological or geological) that can be used to provide a measure of the quality of water or the condition of an ecosystem.

Item	Meaning
Macroinvertebrate (Aquatic)	Animals without backbones that when mature are greater than 1 millimetre; live in the water column, on the water surface or on the bottom of a waterway.
Nitrogen (Aquatic)	An element that is essential for plant and animal growth, it occurs in three forms Nitrate, Nitrite and ammonium.
Nutrients	Compounds required for growth by plants and other organisms. Major plant nutrients are phosphorus and nitrogen.
pH	A measure of the degree of acidity or alkalinity; expressed on a logarithmic scale of 1 to 14 (1 is most acid, 7 neutral and 14 most alkaline).
Phosphorus	Is an element that is essential for plant and animal growth, excess concentrations can lead to eutrophication.
Physico-Chemical (Aquatic)	The measure and relationship between the physical and chemical identities of a water body.
Sensitive organism	An organism that's survival is highly susceptible to shifts in environmental conditions.
Sewage	The waste water from homes, offices, shops, factories and other premises discharged to the sewer. Is usually 99% water.
SIGNAL SF	SIGNAL (Stream Invertebrate Grade Number Average Level) is a biotic index using aquatic macroinvertebrates to assess stream health.
Stormwater	Rainwater that runs off the land, frequently carrying various forms of pollution such as litter and detritus, animal droppings and dissolved chemicals. This untreated water is carried in stormwater channels and discharged directly into water bodies.
Stormwater system	The system of pipes, canals and other channels used to carry stormwater to bodies of water, such as rivers or oceans. The system does not usually involve any significant form of treatment.
Tolerant organism	Is an organism that can survive in highly variable environmental conditions.
Turbidity	A measure of the amount of suspended solids (usually fine clay or silt particles) in water and thus the degree of scattering or absorption of light in the water.

Acronyms and abbreviations

Acronyms/ Abbreviation	Meaning
ANZECC	Australian and New Zealand Environment and Conservation Council
CFU	Colony Forming Unit
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
SIGNAL SF	Stream Invertebrate Grade Number Average Level – Sydney Family
µg/L	Micrograms per litre
µS/cm	Micro-siemens per centimetre (unit of conductivity)

Background

Water quality monitoring is carried out by the City of Ryde to inform environmental management and development decisions. The aims of this report are:

- assess physical and chemical water properties of five major creeks (Shrimptons, Archers, Terrys, Buffalo and Porters creeks) within the City of Ryde local government area during dry and wet weather conditions
- assess diversity and abundance of macroinvertebrate communities at five creeks within the study area
- analyse environmental and ecosystem health data which will assist in monitoring the impact of future developments, creek restoration, stormwater management, bushland rehabilitation and general anthropogenic activities and incidents within the catchment
- provide on-going information to assist the direction of future water quality monitoring plans
- provide an easy to interpret report for the community
- report any relevant environmental initiatives carried out by City of Ryde

Biological and chemical monitoring enables the City of Ryde to:

- build on baseline data that enables the temporal evaluation and analysis of the health of the catchments of the strategy
- identify and track new and existing impacts affecting the catchments
- provide direction and monitor potential infrastructural works within the LGA, i.e. in-stream or riparian rehabilitation and stormwater treatment projects
- build on the known taxa list for each catchment and to aid in the identification of key indicator taxa

The format and style of this annual report differs to previous years. The aim was to broaden the audience range and improve accessibility. It is a simplified version of the technical reports produced from 2004-2019. The technical details for the methods used, quality procedures, accreditation and journal references are the same as previous years and can be found in previous reports. The data tables, additional graphs, and method details for newly added Rapid Riparian Assessment and wet weather sampling have been reported in a separate document.

Study Area

The City of Ryde local government area is 40.651 km² and is located 12 km north west of central Sydney. It is dominated by residential housing and is comprised of 16 suburbs and 14 separate stormwater catchments. It includes several important commercial and industrial sectors.

Limited areas of natural bushland border urban infrastructure, including several significant natural bush corridors and areas of open space that support recreation and sporting activities. There are small sections of Lane Cove National Park present on the eastern and northern borders of Shrimptons, Porters and Buffalo creeks. All five creeks drain into the greater Parramatta River catchment. Archers Creek enters Parramatta River directly and the remaining creeks through the Lane Cove River catchment.

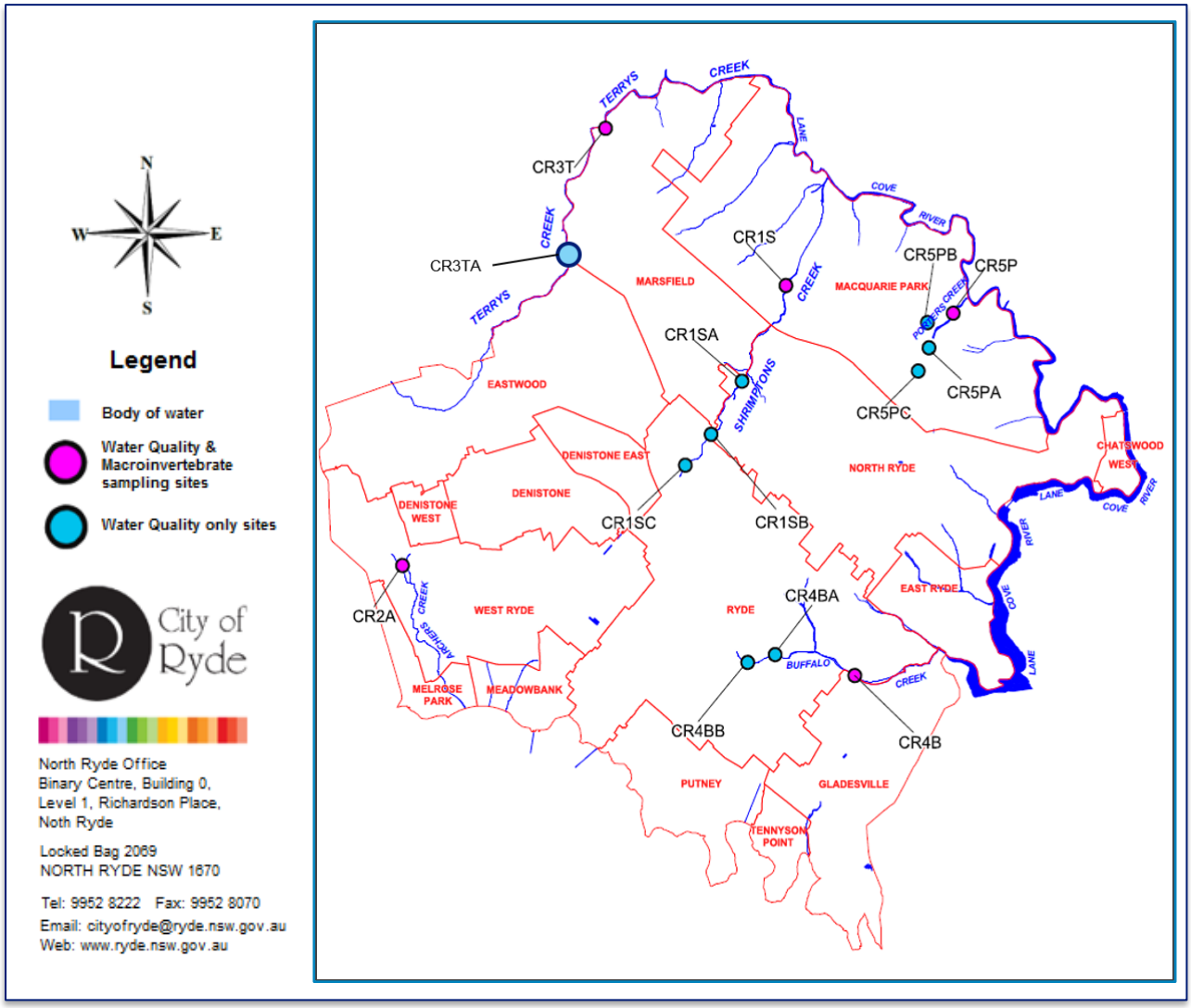

Figure 1 City of Ryde Water Quality Management Program Sites Map of sites for chemical and ecological monitoring across five creeks.

Sites

For each of the catchments there is a core site where macroinvertebrates, instream and riparian features, and water quality are assessed and additional water quality only sites (Table 1). Refer to the method description section for method information.

Table 1 Survey sites for monitoring chemical and ecological attributes.

** indicates a new site added to the program in spring 2017*

Site	Location	Water Quality (wet & dry weather)	Macroinvertebrates	Rapid Riparian Assessment
CR1S	Shrimptons Creek at Wilga Park	✓	✓	✓
CR1SA	Shrimptons Creek at Kent Rd	✓		
CR1SB	Shrimptons Creek at Bridge St	✓		
CR1SC	Shrimptons Creek at Quarry Rd	✓		
CR2A	Archers Creek at Maze Park	✓	✓	✓
CR3T	Terrys Creek at Somerset Park	✓	✓	✓
*CR3TA	Terrys at Foresters Park	✓		
CR4B	Buffalo Creek	✓	✓	✓
CR4BA	Buffalo Creek d/s Burrows Park	✓		
CR4BB	Buffalo Creek u/s Burrows Park	✓		
CR5P	Porters Creek d/s of depot	✓	✓	✓
CR5PA	Porters Creek main branch	✓		
CR5PB	Porters Creek spur branch	✓		
CR5PC	Porters Creek at Wicks Rd	✓		

Method descriptions

Macroinvertebrates

Aquatic macroinvertebrates are small (>1mm), spineless animals that naturally occur in water bodies. Macroinvertebrates are useful as bioindicators because some are more sensitive to pollution than others. As a result, a water pollution problem may be indicated if a stream is found to have a macroinvertebrate community dominated by pollution-tolerant animals and missing the more pollution-sensitive animals.

Figure 2 Collecting macroinvertebrates from Buffalo Creek (Autumn 2019)

They are collected from the core sites following a standard method detailed in previous reports. This involves using a fine mesh net to upwell the water and dislodge the animals. They are picked from the debris and preserved for lab based identification and enumeration.

SIGNAL SF

SIGNAL SF stands for *Stream Invertebrate Grade Number Average Level- Sydney Family.* It is a biotic index for freshwater macroinvertebrates examined at the family level to assess stream health.

This index assigns *sensitivity scores* from 1 being tolerant to poor stream health and 10 being very sensitive to poor stream health for each individual family.

Figure 3 Preserved macroinvertebrates

Taxa Richness

This is the total number of different types of animals collected. Generally, in healthier ecosystems, there will be higher diversity, which is higher taxa diversity.

Figure 4 Collecting freshwater macroinvertebrates from a stream, this water bug is a backswimmer (Notonectidae)

Water Quality

Physical, chemical and biological conditions of the five main catchments in the City of Ryde local government area were assessed following the same methods as previous years. This provides information that can create a snapshot of what was happening in the creek at that point in time.

Figure 6 Collecting water samples for analysis

Water quality samples were collected at the same time as the macroinvertebrates to ensure the data was accurate for comparison. These are the *dry weather* sampling events and occur when <10mm of rainfall has fallen in the catchments.

Water quality samples are collected at all 15 sites. Several analyses are conducted in the field and additional water is collected for lab analysis. The lab analysis is performed at the Sydney Water Laboratory located in West Ryde.

The results are then compared back to the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines. The ANZECC (2000) water quality guidelines outline a framework for assessing water quality in terms of whether the water is suitable for a range of environmental and community values. Exceedances of the ANZECC guidelines may indicate environmental disturbance. As the most recent review (ANZECC 2018) has not included revised water quality guidelines, the ANZECC (2000) guidelines have been used.

Figure 5 In-field water quality testing

Historical data is used during result analysis to compare the current results over what would be expected. As there is no historical data for wet weather, the results were compared to the dry weather sampling historical data.

The analytes assessed are:

Physico-chemical

Temperature, dissolved oxygen, pH, turbidity, conductivity

Alkalinity & hardness

Total magnesium, total calcium, hardness, alkalinity

Biological & nutrients

Faecal coliforms, ammonia, total nitrogen, total kjeldhal nitrogen, oxidised nitrogen, total phosphorus

Figure 7 A high flow area of Terrys Creek

Rapid Riparian Assessment

Rapid Riparian Assessments were added to the monitoring program in Spring 2017 to cover the areas of data, such as stream features, that aren't covered in macroinvertebrate and water quality sampling.

The riparian zone is the area where a body of water or stream, meets the land. The Rapid Riparian Assessment provides information on and assessment of the features of the stream and the vegetation community surrounding the stream.

Figure 8 Shrimptons Creek core site, high level of riparian vegetation

Ku-ring-gai and Willoughby councils use these types of assessment. The methods used were originally developed by Ku-ring-gai Council and researchers from Macquarie University.

The main categories assessed are:

- Site features
- Channel features
- Depositional features
- Erosional features
- Riparian vegetation
- Vegetation structure

Each variable within these categories are scored and form a score that will fall into an overall riparian health category.

Table 2 Rapid Riparian Assessment Categories

Category	Score range	Colour code
Excellent	≥60	
Good	27 to 59.99	
Fair	-6 to 26.99	
Poor	-39 to -6.99	
Very Poor	-72 to -39.99	

Rainfall

Rainfall plays a key role in the water quality of streams. The stream flow can be greatly altered during a high rainfall event, which can cause bank erosion, increased turbidity, nutrients and other pollution.

This can directly impact the macroinvertebrate community through loss of habitat and decreased water quality. The water quality results may also exceed the recommended guidelines because of increased stormwater input.

Seasonal rainfall, particularly extended low levels of rain can benefit both macroinvertebrates and water quality. Flowing water will flush out the stream and provide the conditions to avoid algae build up and oxygen depletion.

The rainfall data used is from the Sydney Water rain gauge located at West Ryde.

Rainfall & Sampling

Daily, monthly and cumulative rainfall for the sampling period is summarised in Figure 9. Rainfall was generally low and sporadic throughout the year, which is consistent with drought conditions experienced across eastern Australia in 2018-19.

The highest monthly rainfall was in March 2019 (217.5 mm). The next largest events were in October 2018 (211.5 mm) and November 2018 (124 mm). Cumulative rainfall reached 926.5mm for the year.

Macroinvertebrate, water quality and riparian spring 2018 sampling occurred on November 21st several weeks after the second heaviest rainfall event of the year. Autumn 2019 sampling was also several weeks after the largest rainfall event, on March 23rd.

Periods of heavy rainfall will impact hydrology, chemistry and physical properties of streams. This is also the case for the biota living in the stream. Some macroinvertebrates can be washed downstream and may be covered by sediment from increased turbidity.

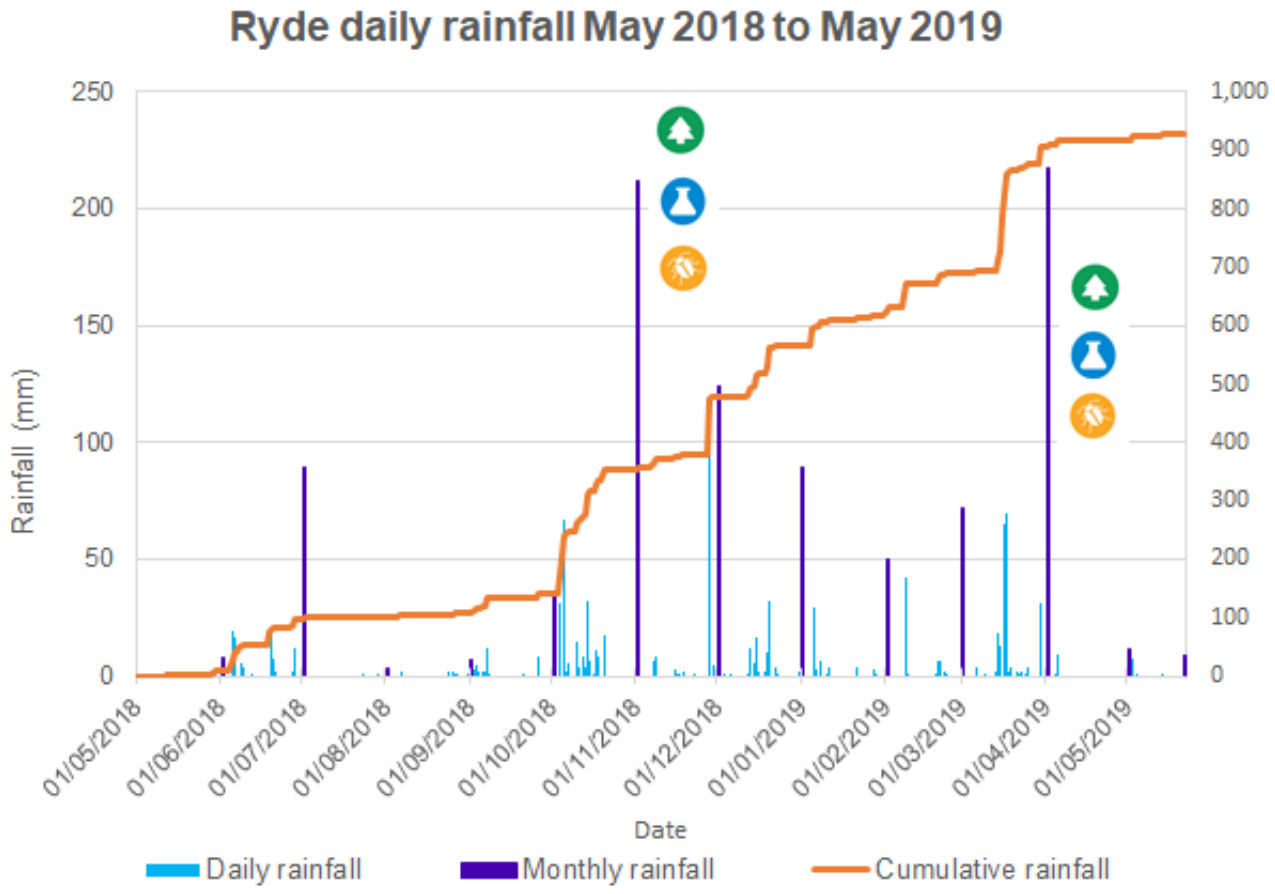

Figure 9 Rainfall and sampling events for Spring 2017 and Autumn 2018. Note cumulative rainfall scale is on the right.

Shrimptons Creek

Site Profiles

Within the Shrimptons Creek catchment there are three water quality sites and one core site (macroinvertebrates, water quality and riparian).

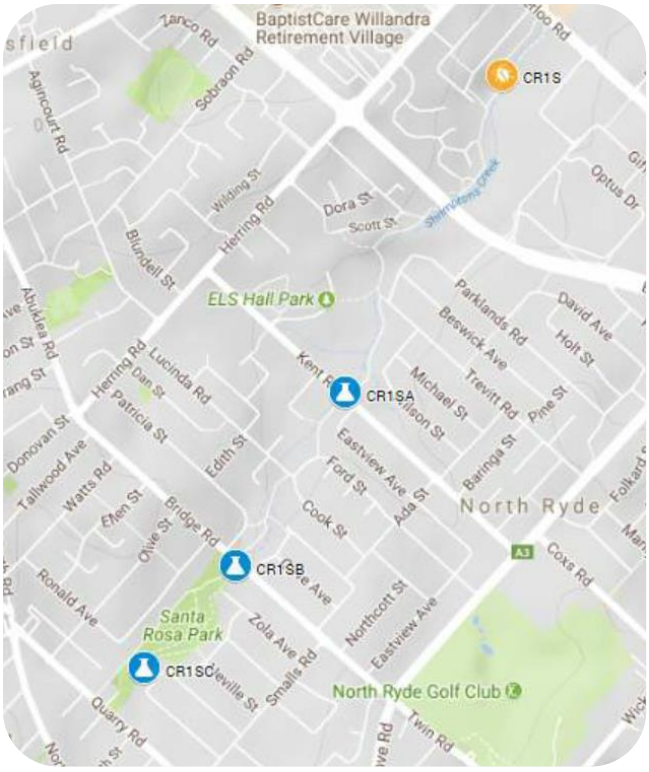

Figure 10 Shrimpton Creek Catchment Area

Within the last 18 months there have been numerous works by City of Ryde in the catchment to aid in water quality improvement. This includes:

- establishing 173 metres of riparian and corridor planting within Shrimptons Creek
- the Council and Sydney Water rectifying major pollution incidences from surrounding commercial properties and grease trap overflows from Macquarie Shopping Centre into Shrimptons Creek
- creation of three instream riffle structures to enhance water quality directly within Shrimptons Creek at Wilga Park. Debris islands were removed and general trash removal also conducted
- ongoing gross pollutant trap cleaning quarterly at the core site

CR1S Shrimptons Creek (core site)

The Shrimptons Creek core site is located within Wilga Park in the suburb of Macquarie Park. The surrounding land use is a mix of residential, commercial and light industrial.

The creek flows through a thin riparian corridor, which is a mix of native and exotic species. The creek bed is predominately bedrock and sand/silt.

During autumn 2019, there was a large degree of development on both banks of the creek. This includes the Wilga Park upgrade.

Figure 11 Council works on Wilga Park, uphill of Shrimptons Creek core site

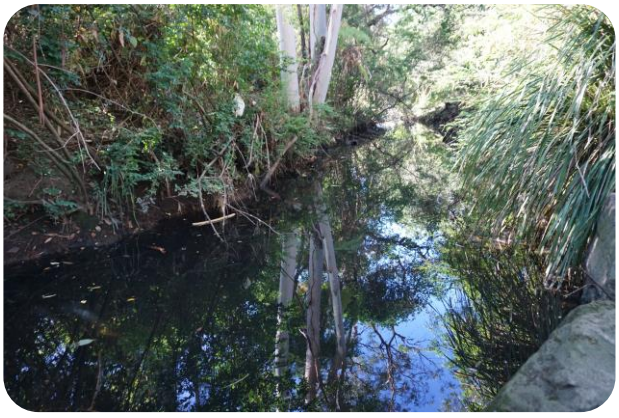

Figure 12 Shrimptons Creek core site facing downstream

CR1SA Shrimptons Creek @ Kent Road

The Kent Road site is situated amongst a residential area and is lined by a thin section of riparian vegetation that completely shades the creek and comprises a mix of native and exotic species.

There is a grose polluntant trap located within the site which was cleaned out regularly in the last 12 months. In Spring 2017 & Autumn 2018 there was moderate to high rubbish observed at the site. In Autumn 2018 a slight odour and low flow were observed during sampling.

Figure 13 Shrimptons Creek @ Kent Road facing downstream

CR1SB Shrimptons Creek @ Bridge Street

This site is located at the downstream section of Burrows Park, just before it flows under Bridge St and is surrounded by residential areas. The revegetation of the riparian area is now established adding to bank stabilisation, physical buffer and filtration. Low flow, low rubbish and high density of aquatic plants were observed in Autumn 2018.

Figure 14 Shrimptons Creek @ Bridge Street facing downstream

CR1SC Shrimptons Creek at Quarry Road

The Quarry Road site is located at the upstream section of Burrows Park, at the point where Shrimptons Creek emerges from the underground stormwater system. This site has sandstone blocks around the drain for bank stabilisation.

Odour, oil and scum was observed on the water surface in Spring 2017, Autumn 2018 and historically.

Figure 15 Shrimptons Creek @ Quarry Road facing downstream

Results & Interpretation

Macroinvertebrates

SIGNAL SF

There were no real seasonal differences between Spring 2018 and Autumn 2019 for SIGNAL SF values. Both seasons are within historic averages and macroinvertebrates present have not changed significantly.

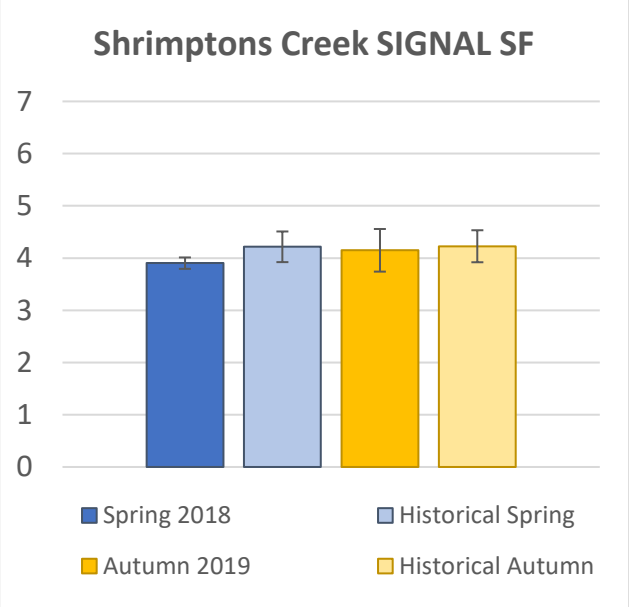

Figure 16 SIGNAL SF results for Shrimptons Creek

Taxa Richness

Spring 2018 and Autumn 2019 had seasonal differences for Taxa Richness. Spring 2018 fell below historical data for Shrimptons Creek. In contrast, Autumn 2019 was within historical range.

Autumn 2019 reflected similar results to the previous corresponding season, with consecutive years below Taxa Richness historical data. This may indicate an ongoing trend or merely seasonality/ongoing impacts of drought experienced by Shrimptons Creek.

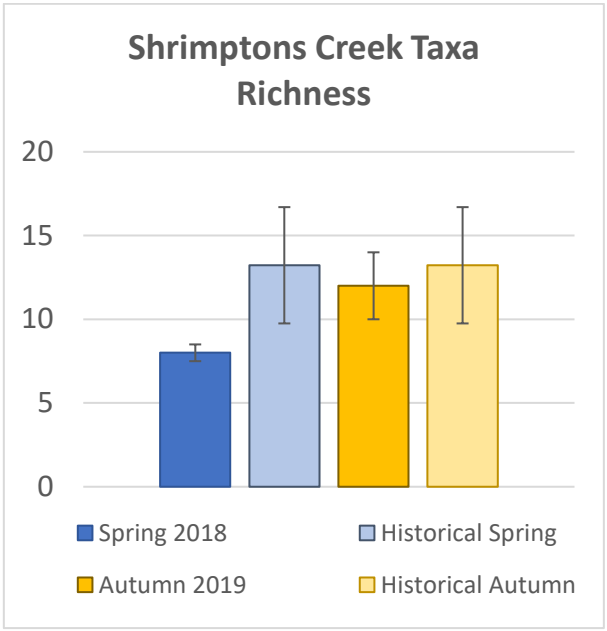

Figure 17 Taxa Richness results for Shrimptons Creek

Macroinvertebrates summary

SIGNAL SF Spring 2018 & Autumn 2019 where consistent with historical data

Taxa Richness Spring 2018 is within historical range & Autumn 2019 have continued with the previous seasons' trend and is lower than historical data

Water Quality

- Temperature, conductivity, pH and turbidity were all within the recommended range and were consistent with historical data.
- Shrimptons Creek @ Bridge St (CR1SB) had good dissolved oxygen results for both seasons, they were above the historical median. All remaining sites for the Shrimptons Creek catchment were outside of the recommended guidelines for

both seasons. Shrimptons Creek core site (CR1S) had the lowest dissolved oxygen result in Spring 2018 (24.2%) out of all the 2018/2019 data collected. It was not the lowest result on record and is consistent with the low values seen throughout the years

- Water hardness was within the moderate range for both seasons for CR1S and CR1SA. CR1SB had variable results, with medium water hardness in spring and hard water in autumn. The opposite was true for CR1SC, with hard water in spring and moderate in autumn.
- Magnesium, calcium and alkalinity results were all consistent with historical data. CR1SA had lower than historical median results for all analytes listed above, while CR1SC had higher results. CR1S and CR1SB had lower results in spring and higher results in autumn.
- Biological water quality results were within the historical range for both spring and autumn for all sites.
- There were three faecal coliform exceedances, in spring and autumn for CR1SB (1,300 and 1,900) and in spring for CR1SC (1,900). These exceedances were not the highest recorded results. The highest for CR1SB was in Autumn 2010 (9,200) and the highest for CR1SC was in Autumn 2018 (200,000).
- From all historical faecal coliform results, there is an exceedance rate of 20%. This year was slightly higher at 25% exceedance.
- Total nitrogen and phosphorus results exceeded he recommended guidelines at all sites for both seasons. This is consistent with the historical median for all sites.

Water quality summary

Overall water quality was consistent with previous years

Three faecal coliform exceedances occurred but were lower than historical exceedances.

Rapid Riparian Assessment

The riparian zone for the Shrimptons Creek core site has was impacted by nearby works for both seasons. The land use on the left bank of the creek was bare in both, due to development. In autumn 2019, the Wilga Park upgrade was underway, changing the right bank land use to bare/construction.

Higher rubbish was recorded in autumn 2019 compared to spring 2018. These factors contributed to the lower score seen in autumn 2019.

Rapid Riparian Assessment score

- Spring 2018 (35.6 – Good)
- Autumn 2019 (-3.3 - Poor)

Archers Creek

Site Profile

Archers Creek has only one site, CR2A Archers Creek core site.

Figure 18 Archers Creek Catchment Area

CR2A Archers Creek (core site)

This site is located in Maze Park, West Ryde and is upstream of the Victoria Rd crossing. The upstream surrounding land use is residential and a golf course is present downstream. The bank was relined in the past with sandstone blocks. The creek bed is mostly bedrock with banks of sediment (sand, silt and organic matter). The vegetation within and around the creek is a mix of native and introduced species.

Figure 20 Archers Creek Core Site facing downstream

Results & Interpretation

Macroinvertebrates

SIGNAL SF

The SIGNAL SF values for Spring 2018 and Autumn 2019 were both higher than historical averages, however Spring 2018 was outside historical range.

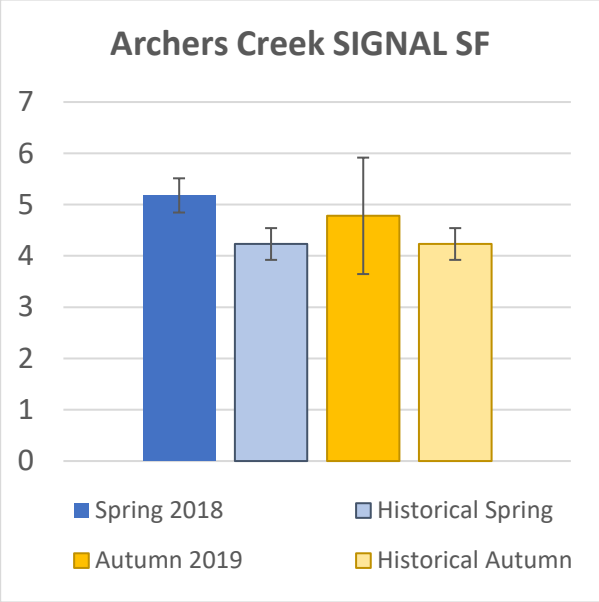

Figure 19 Archers Creek SIGNAL SF results

Taxa Richness

Spring 2018 and Autumn 2019 Taxa Richness results were within historical range. Archers Creek was the most consistent across all sites.

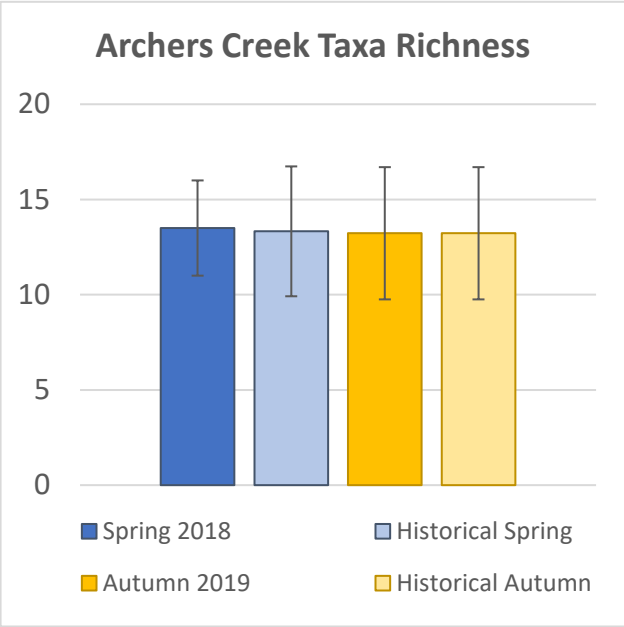

Figure 21 Archers Creek Taxa Richness results

Water Quality

- Temperature was above average in both seasons compared to historical median. They were, however, within the historical range of temperatures.
- Spring 2018 had lower than average results for magnesium, calcium, hardness and alkalinity.
- Results for all sites were within the range of historical data and close to the historical median. Total hardness remained in the moderate category for both seasons. There was a decrease in total calcium and magnesium in spring and an increase in autumn.
- There were no faecal coliform exceedances in either season for Archers Creek. This is a better result compared to historical data, where there were faecal coliform exceedances in 32.1% of the total results. Total nitrogen exceeded in autumn and total phosphorus exceeded in both seasons. This is consistent with historical data for Archers Creek.

Water quality summary

Overall water quality was consistent with previous years

No faecal coliform exceedances for both seasons.

Rapid Riparian Assessment

Archers Creek core site had seasonally variable results, with Spring 2018 in the *Good* category and Autumn 2019 in the *fair* category.

The main differences in the results between seasons, was weed infestation and litter. These properties combined can change a score up to 23 points.

In the 2017/18 period both seasons were in the fair category.

Rapid Riparian Assessment score

- Spring 2018 (40 – Good)
- Autumn 2019 (-3.3 - Fair)

Terrys Creek

Site Profiles

In June 2018, City of Ryde completed a creek restoration and flood mitigation project at the Abuklea Road tributary that leads to Terrys Creek. This project aimed to protect the creek from any further slumping or scour of the tributary edges and alleviate pressure in high rainfall events. The project also included removal of weedy vegetation and replacement with native plants.

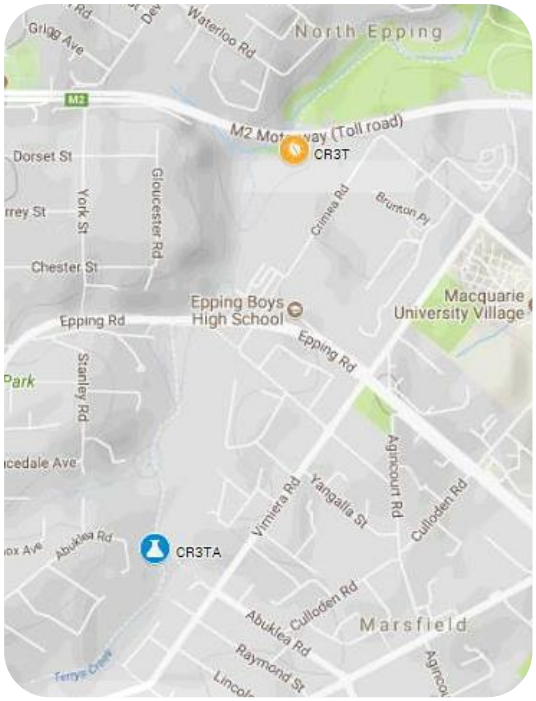

Figure 22 Terrys Creek Catchment Area

CRT3 Terrys Creek (core site)

This site is located within Somerset Park under the M2 overpass in the suburb of Epping. The surrounding land use is residential, and the creek flows through a bushland corridor. The surrounding riparian area and bank edge is a mix of native and exotic plant species. The creek bed is predominately bedrock, gravel and sand.

There were no observations that differed from standard conditions for this site in 2017/18.

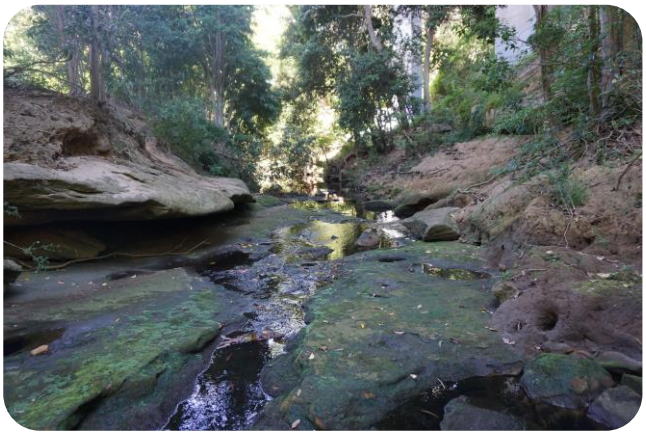

Figure 24 Terrys Creek Core Site facing downstream

CRT3A Terrys Creek @ Foresters Park

This site is located downstream of Terrys Creek Waterfall, which is an area surrounded by bushland. Dense vegetation covers both banks and consists of a mixture of native and introduced species. The bank is comprised of sediment (mostly sand and silt) and river rocks, which create areas of broken water.

It was first sampled in Spring 2017 and an echidna was observed upstream of the site.

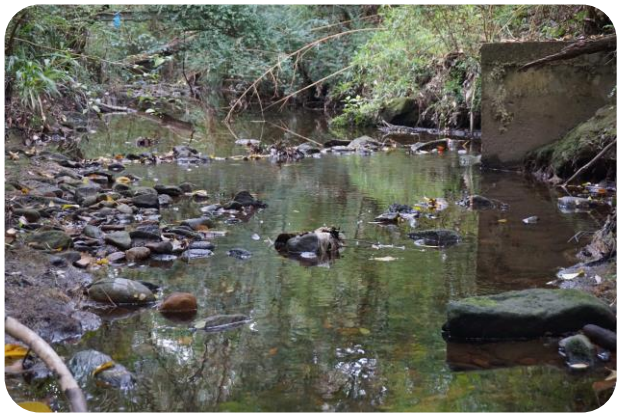

Figure 23 Terrys Creek @ Foresters Park facing upstream

Results & Interpretation

Macroinvertebrates

SIGNAL SF

The SIGNAL SF score for Spring 2018 was similar with historical averages. Autumn 2019 was below and outside of historical range.

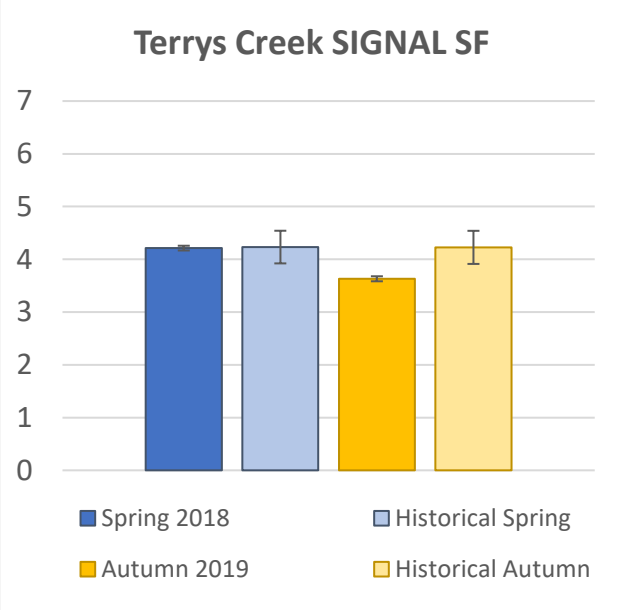

Figure 25 Terrys Creek SIGNAL SF results

Taxa Richness

Spring 2018 and Autumn 2019 had little seasonal difference in Taxa Richness. Spring 2018 had the highest Taxa Richness result across all sites and was within historic average range. Autumn 2019 was within historic standard deviation range.

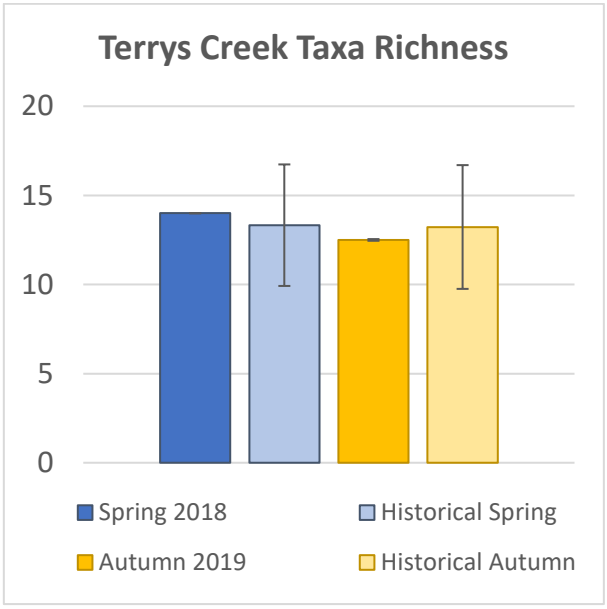

Figure 26 Terrys Creek Taxa Richness results

Macroinvertebrates summary

SIGNAL SF Spring 2018 was the same as historical average, Autumn 2019 was lower than historical range

Taxa Richness Both Spring 2018 and Autumn 2019 were within historical average range. Spring 2018 had the highest Taxa Richness of any site

Water Quality

- Terrys Creek core site (CR3T) dissolved oxygen varied greatly between seasons, spring 62% and autumn 93.2%. This was not the case for the water quality only site (CR3TA) with results of 74.2% and 88.3%
- Temperature, conductivity, pH and turbidity were all within the recommended range and were consistent with historical data for both Terrys Creek sites.

- Total magnesium, calcium and hardness were consistently lower than average for Terrys Creek core site, whereas the water quality only site (CR3TA) had mostly higher than average results. Water hardness was in the moderate category for CR3T and hard for CR3TA.
- There were no faecal coliform results above the recommended guidelines for both seasons, for both sites within Terrys Creek. Ammonia was the same as the historical median for both seasons for Terrys Creek core site, whereas the water quality only site (CR3TA) had lower results for both seasons.
- Total nitrogen, oxidised nitrogen and total phosphorus were all above the recommended guidelines, which is consistent with the historical medians

Water quality summary

Overall water quality was consistent with previous years

No faecal coliform exceedances for all sites and seasons.

No historic highs or lows for overall results.

Rapid Riparian Assessment

Terrys Creek core site had consistent results between Spring 2019 and Autumn 2019. Both were in the *fair* category. There were no major changes between seasons, with land use remaining the same.

The results from the 2017/18 period were also in the fair category.

Rapid Riparian Assessment score

- Spring 2018 (25.9 – Fair)
- Autumn 2019 (8.3 - Fair)

Buffalo Creek

Site Profiles

Buffalo Creek catchment has one core site and two water quality sites. In creek trash removal was carried out at Laurel Park wihtin the Buffalo Creek Catchment by City of Ryde.

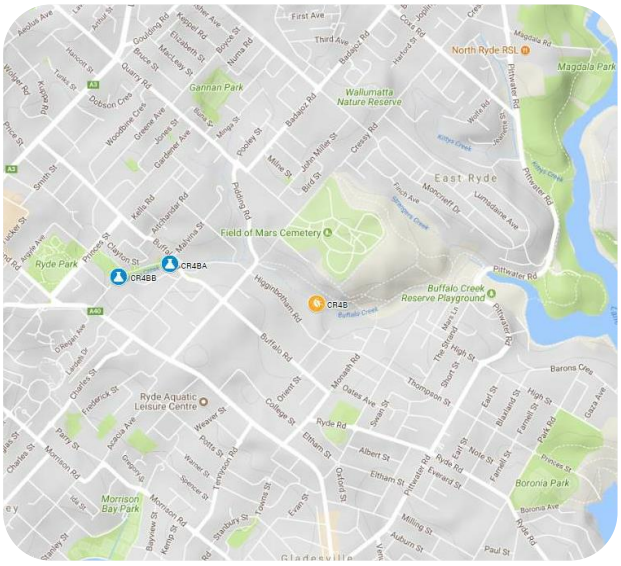

Figure 27 Buffalo Creek Catchment Area

CR4B Buffalo Creek (core site)

The Buffalo Creek core sampling site is in a bush corridor in the suburb of Gladesville and is accessed through private property. The surrounding land use is a mix of residential, light industry/commercial and reserves. The surrounding vegetation is a mix of native and exotic species, with exotic species dominating. The southern bank is mostly residential lawns.

The creek bed has a mix of sand, silt and gravel. There is usually some macrophyte growth, *Egeria* and *Potamogeton*, and little algal growth has been observed. Sedimentation has occurred periodically, along with a significant amount of organic debris and domestic rubbish

Figure 28 Buffalo Creek Core Site facing upstream

CR4BA Buffalo Creek Downstream of Burrows Park

The downstream Burrows Park site is accessed off Buffalo Rd and is positioned just before the creek flows under the road. The surrounding land use is residential and Burrows Park consists mostly of a bush corridor. There are usually obvious signs of bird activity around this site, including extensive bird droppings.

Figure 29 Buffalo Creek Downstream of Burrows Park facing upstream

CR4BB Buffalo Creek Upstream of Burrows Park

The upstream Burrows Park site is about 300 metres upstream of Buffalo Rd, and lies in the middle of a bush corridor. The site is surrounded by vegetation that completely shades the creek. The creek is shallow at this point and has little flow. The site is positioned just downstream from a stormwater tributary/pipe. There has been little observable physical change at this site throughout the survey periods.

Figure 30 Buffalo Creek Upstream of Burrows Park facing upstream

Results & interpretation

Macroinvertebrates

SIGNAL SF

Spring 2018 had a greater SIGNAL SF score than and Autumn 2019. Despite differences between the seasons, both were within historic average range.

Buffalo Creek showed the greatest difference across all sites, which is common due to seasonal variability of macroinvertebrates.

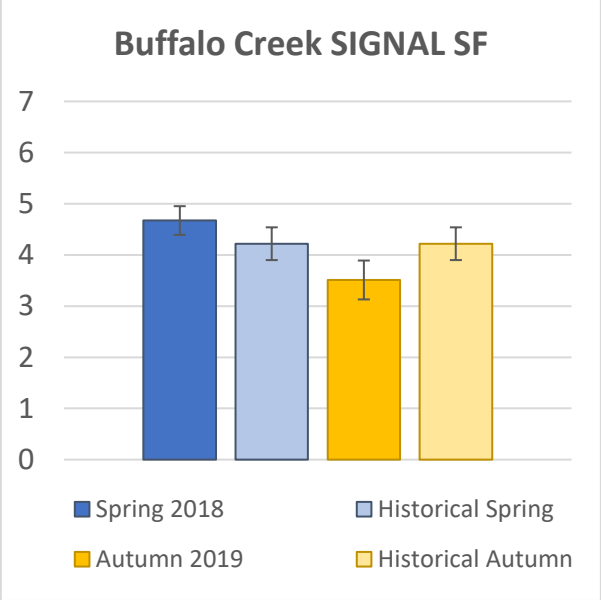

Figure 31 Buffalo Creek SIGNAL SF results

Taxa Richness

Spring 2018 and Autumn 2019 Taxa Richness was significantly lower than historical data. Autumn 2019 had the lowest overall Taxa Richness recorded for Buffalo Creek, and across all other sites. Autumn 2019 had low rainfall leading up to the sampling event, which may have contributed to poor Taxa Richness.

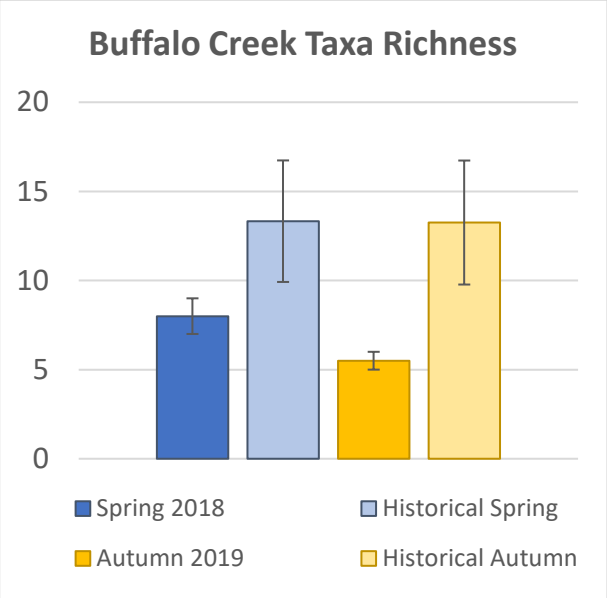

Figure 32 Buffalo Creek Taxa Richness results

Macroinvertebrates summary

SIGNAL SF Both seasons within historic range. Autumn 2019 had a historical low

Taxa Richness Both seasons were less than historical range, and Autumn 2019 had a historical low

Water Quality

- The three Buffalo Creek sites were within the recommended guidelines for pH, turbidity and conductivity for both seasons
- The dissolved oxygen results varied between sites. It was consistently higher than historical median for the core site (CR4B) for both seasons, whereas Buffalo Creek upstream @ Burrows Park (CR4BA) had a low result for Spring 2018 (51.2%) and higher result for Autumn 2019 (86.8%). The opposite was true for Buffalo Creek downstream @ Burrows Park (CR4BB) which had results of 86.5% and 82.7% for spring and autumn respectively.
- There was an overall increase in total magnesium, total calcium and hardness for both seasons for all Buffalo Creek sites. Alkalinity had mainly decreased for all sites and season, except for CR4BA autumn, with a result of 80. This was still within the historical data range.
- The core site had results in the moderate range for water hardness, while both water quality only sites for both seasons were in the hard water range.
- Total nitrogen, oxidised nitrogen and total phosphorus results were all above the recommended guideline for both seasons and all sites. This is consistent with the historical data range. They were, however, higher than the historical medians except for CR4BA in Spring 2018.
- There were two faecal coliform guideline exceedances, one in Autumn 2019 at CR4BA and the other in Spring 2018 at CR4BB. They were close the guideline and were well within the historical range of data. Ammonia was lower than the historical median for both CR4B and CR4BB.

Water quality summary

Overall water quality was consistent with previous years

All results were within the historical range for all three sites.

Rapid Riparian Assessment

Buffalo Creek core site had the second best overall scores of all the sites in the 2018/19 period. Both were in the *Good* category, with Autumn 2019 lower than Spring 2018. The main difference in the scores were due to weed infestation and litter

Rapid Riparian Assessment score

- Spring 2018 (42.5 – Good)
- Autumn 2019 (30.6 - Good)

Porters Creek

Site Profiles

There is one core site and three water quality only sites within the Porters Creek Catchment.

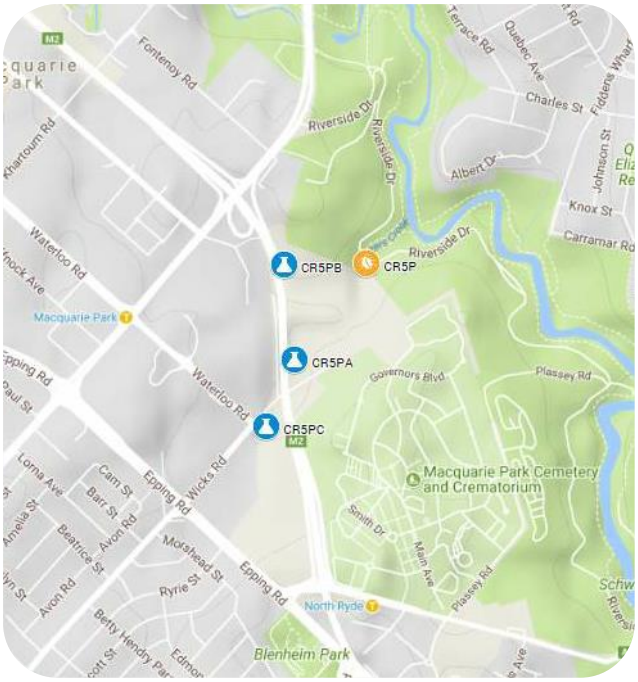

Figure 33 Porters Creek Catchment Area

CR5P Porters Creek (core site)

This site is located on the eastern boundary of the SUEZ Ryde Resource Recovery Centre, where Porters Creek emerges after flowing mostly underground in its upper section. Water quality samples were collected within the Centre close to where Porters Creek drains from an underground system. Macroinvertebrates were collected within the boundaries of the Lane Cove National Park just downstream of the depot and the bridge for the main park access road.

The surrounding riparian area is dominated by native plants with a small amount of exotic species. The creek bed is mostly bedrock with some cobble, boulder and sand. No macrophyte growth has been observed at the site however there has been varying levels of algal growth present.

Figure 34 Porters Creek Core Site facing downstream

CR5PA Porters Creek @ Main Branch

This site is located on the western boundary of the centre and consists of an open concrete channel. Samples are collected from the retention basin at the end of the channel. Extensive algal growth and scum was observed on the surface in both Spring 2017 and Autumn 2018. This is consistent with historical observations. Access prevented sampling in the past. This was resolved in Spring 2017.

Figure 35 Porters Creek @ Main Branch facing downstream

CR5PB Porters Creek @ Spur Branch

This site is in the north-western corner of the centre in an underground drainage pit where several underground stormwater lines meet before joining and draining to the main Porters Creek line. The exact location has changed over the years due to access issues. Algae was present in Spring 2017 and less algae in Autumn 2018.

Figure 36 Porters Creek @ Spur Branch

CR5PC Porters Creek @ Wicks Road

This site is the first point that Porters Creek drains from the underground stormwater system. The site is surrounded by commercial and industrial land uses. The banks have been re-lined with sandstone and surrounding area vegetated with native plants.

Figure 37 Porters Creek @ Wicks Road facing downstream

Results & Interpretation

Macroinvertebrates

SIGNAL SF

Both Spring 2018 and Autumn 2019 had similar results in line with historic average range.

Like Terrys Creek, Porters Creek had very consistent SIGNAL SF results between seasons and compared to the historical average.

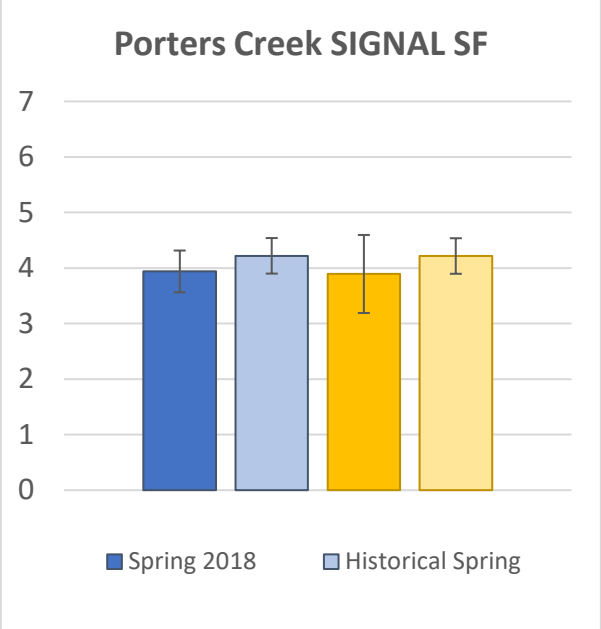

Figure 38 Porters Creek SIGNAL SF results

Taxa Richness

Spring 2018 was significantly less than historic averages and outside of historic range. Autumn 2019 was also below historical average, however was within range.

The changes seen at this site may be due to low rainfall and reduced flow from drought conditions.

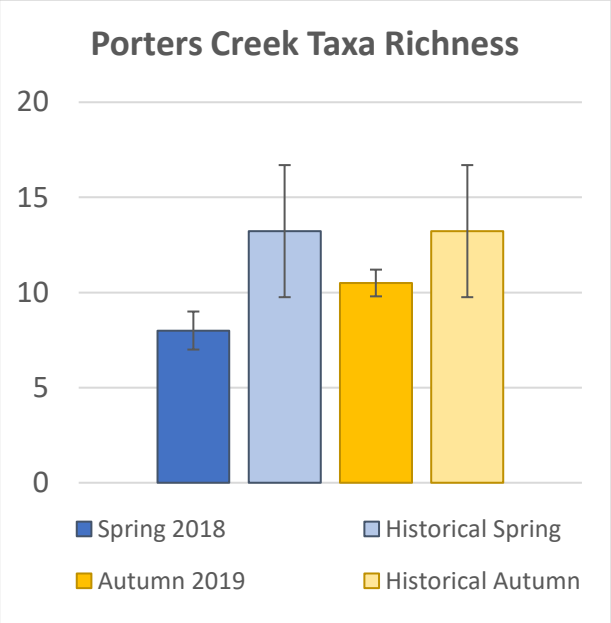

Figure 39 Porters Creek Taxa Richness results

Macroinvertebrates summary

SIGNAL SF Spring 2018 & Autumn 2019 was within historic range.

Taxa Richness Spring 2018 and Autumn 2019 were both beneath historical average.

Water Quality

- For all Porters Creek sites, the pH, turbidity, and conductivity were all within the recommended guidelines.
- Dissolved oxygen was outside of the recommended guidelines for Porters Creek core site (CR5P), Porters Creek @ Main Branch (CR5PA) and Porters Creek @ Spur Branch (CR5PB).
- There was a general trend of lower than historical median results for total magnesium, total calcium, hardness and alkalinity for Spring 2018 for CR5P, CR5PA and CR5PB compared to Spring 2019.
- For the CR5P, the water hardness results fell into the hard category for Spring 2018 and hard for Autumn 2019. CR5PA had water hardness results that changed by an order of magnitude between spring 2018 (35) and autumn 2019 (350). This means the water moved from soft to very hard. The remaining sites, CR5PB and CR5PC, had water hardness in the moderate hardness category.
- There were two faecal coliform results that exceeded the recommended guidelines for both seasons across all sites, CR5P (2,000) and CR5PC (32,000). The result for CR5PC was the highest result recorded since monitoring for this program began.
- One site, CR5PB, had total phosphorus results for Spring 2018 and Autumn 2019 that did not exceed the recommended guideline. They were the only results that were within the guidelines out of all five catchments across both time periods.
- Total nitrogen exceeded the recommended guideline at all Porters Creek sites for both seasons.

Water quality summary

Overall water quality was consistent with previous years.

CR5PB had the best total phosphorus results of the 2018/19 period.

CR5PC had a highest on record faecal coliform result in Autumn 2019.

Rapid Riparian Assessment

Porters Creek had the highest rapid riparian assessment results of the 2018/19 period, with Spring 2018 in the *excellent* category and Autumn 2019 in the *good* category.

There was low variability at the Porters Creek core site between seasons, with land use, vegetation community structure, and in-flow characteristics remaining the same.

this is the second year of rapid riparian assessment data and Porters Creek has remained the top scorer of the five creeks assessed.

Rapid Riparian Assessment summary

- Spring 2018 (60 – Excellent)
- Autumn 2019 (52 - Good)

Conclusions

Macroinvertebrates

The results for both SIGNAL SF and Taxa Richness varied greatly amongst and between sites in both Spring 2018 and Autumn 2019.

SIGNAL SF scores were within the historical average standard deviation in Spring for Shrimptons, Archers, Terrys, Buffalo and Porters creeks. However, Autumn results for Terrys and Buffalo creeks were below average. Buffalo Creek had the lowest average score in the monitoring program.

Overall Spring results indicate that the sensitivity of animals has not decreased for all five sites.

Taxa Richness was inconsistent for most sites, with no clear seasonal trend. Shrimptons, Buffalo and Porters creeks were lower than historical averages for Spring. In addition, Buffalo Creek had the lowest ever recorded result for Taxa Richness during Autumn 2019.

Previously, there has been a historical trend of seasonal variability with macroinvertebrate results. This is based on the environmental and biological factors that can sometimes result in higher diversity and abundance in Spring than Autumn.

Drought conditions may be influencing expected seasonal trends. During Spring 2018 and Autumn 2019 sampling, it was observed that the flow was much lower, continuing the trend of the previous year (Spring 2017 and Autumn 2018). A reduction in flow can lead to reduced habitat for macroinvertebrates and areas of stagnant water. This may explain the all-time low Taxa Richness score from Autumn 2019.

Water Quality

The water quality result for Spring 2018 and Autumn 2019 are reflective of the historical data collected. There were limited faecal coliform exceedances but most sites had typically high total phosphorus, total nitrogen and ammonia results.

Water quality is highly dependent on natural and anthropogenic factors. They all can impact on the water quality of streams.

During rainfall events, there will be changes in hydrology, organic matter, and pollutant levels. This can occur in pristine areas, where dead leaves, sediment and other debris can be washed into a stream. This can result in increased turbidity, which can impact on the diversity and abundance of aquatic animals including fish and macroinvertebrates.

In urban areas, there are more pollution sources and impervious surfaces, which can magnify the effects on water quality. Where there are areas of high impervious surfaces, such as roads, footpaths and buildings, it increases the volume and speed of the rainwater. These impervious surfaces are often a source of pollutants, such as oils, metals and nutrients, which are then deposited in streams.

The riparian zone is a buffer between the creek and the surrounding land, but it's effectiveness is reduced when water sources such as stormwater and sewer overflows are present.

Although the streams monitored in this program are highly altered, they each still retain ecological and conservation values. A realistic objective would be to maintain present

water quality to retain a functional, albeit modified, ecosystem that would support the management goals assigned to it.

Rapid Riparian Assessment

This was the second year of rapid riparian assessments for the five City of Ryde creek catchments.

Shrimptons Creek had changes in land use due to the Wilga Park upgrade and development on the left bank of the creek. In the 2017/18 period, it was in the *fair* category for both seasons. While there were changes, it remained in the *fair* category for Spring 2018, then moved to the *poor* category for Autumn 2019.

Archers Creek was also in the *fair* category for the 2017/18 period, improved to *good* in Spring 2018 and returned to *fair* in Autumn 2019.

Terrys Creek was also historically *fair* in 2017/18 and remained *fair* for both season in the 2018/19 period.

Buffalo Creek moved from *fair* in 2017/18 to *good* for Spring 2018 and Autumn 2019.

Porters Creek was the best performer for both the 2017/18 and the 2018/19 period with scores in the *excellent* and then *good* categories. It's position in the Lane Cove National Park means that the land use is not likely to change and there is a denser vegetation community composition compared to other sites.

The areas of the assessment that have the highest impact on the overall scores for the five catchments are:

- Land use
- Litter present
- Stream confinement and meanders
- Vegetation community composition
- Weed infestation

Some of these variables are likely to not change, specifically land use, sewerlines, and stream confinement and meanders. These are high scoring categories that would be difficult

Recommendations

- Continue monitoring macroinvertebrate, water quality and riparian condition at current sites
- Continue Gross Pollutant Trap maintenance and rubbish removal as currently conducted to help maintain and improve Rapid Riparian Assessment results
- Consider collecting pre-and post-work water quality data on any Council projects that aim to improve water quality