City of Ryde

Water Quality Monitoring Report

Spring 2022 & Autumn 2023

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Cover image: Archers Creek (Core Site, CR2) upstream at Maze Park Spring 2022

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Executive summary

This report comprises the Spring 2022 and Autumn 2023 water quality results for the Shrimptons, Archers, Buffalo, Terrys, and Porters Creek catchments. Field collection, in-stream measurements, field observations and laboratory analysis were used to compile data for the following parameters: (i) Macroinvertebrate community indices, (ii) Physico-chemical water quality and (iii) Rapid Riparian Assessment.

Freshwater Macroinvertebrate analysis was conducted at the five core sampling sites. For each site SIGNAL SF scores were calculated. Scores for all catchments were within a close range (3.5 – 4.8) and were consistent with historical averages. The highest average signal score during the Spring 2022 sampling season was 4.8 and was observed at Shrimptons Creek (CR1S). The lowest SIGNAL score observed during this season was 3.5 at Buffalo Creek, although this was still comparable with the historical average for this site (4.1). During Autumn 2023, Archers Creek site had the highest observed SIGNAL score (4.4) while Buffalo Creek also had the lowest score for this season (4.2).

Macroinvertebrate Taxa Richness scores were also calculated for each of the five core sites. Higher Macroinvertebrate taxa diversity can be indicative of higher water quality. For the Spring 2022 period Shrimptons Creek had the highest average taxa richness with a score of 12.5. The lowest richness score was observed at Terrys Creek with a value of 6. In contrast, Terrys Creek had the highest Richness result during the Autumn 2023 period (11.5), while Buffalo Creek reported the lowest value at 8.5. Richness scores for both Terrys and Porters catchments approximately doubled in score from Spring 2022 to Autumn 2023.

Chemical water quality analysis was also performed at each of the 14 sites. Data was collected using in-field sampling as well as laboratory analysis. These results were then compared to thresholds outlined in the 2000 ANZECC guidelines for water quality. In-field sampling results for parameters such as pH, conductivity and dissolved oxygen were consistent with the results of previous seasons. During Spring, 8 of the 14 sites had faecal coliform results within guideline limits (<1000CFU /100mL). In the Autumn season, this improved where 11 sample sites had coliform results within guidelines. Nutrient results for most sites were higher than threshold levels. Exceedances for analytes including Total nitrogen, Total phosphorus and Ammonia were observed during both sampling seasons. Further heavy metals analysis was conducted at the four Porters Creek catchment sites for both seasons. Most sites had results within guideline limits. However, during Spring 2022, Copper levels were higher than guideline limits while Zinc results were exceeded limits for both seasons.

Rapid Riparian Assessment (RRA) was conducted for each of the five core sites during the Spring sampling period only. Results were consistent with the previous season with most sites maintaining the same score. However, Terrys Creek and Buffalo Creek sites saw an improvement in RRA scores with both sites increasing from a “Fair” score (Spring 2020) to a “Good” score (Spring 2022).

1 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 is a simplified version of the 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.

2 Study Area

The City of Ryde is located 12 km North-West of central Sydney with a local government area of 40.651 km². It consists primarily of 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.

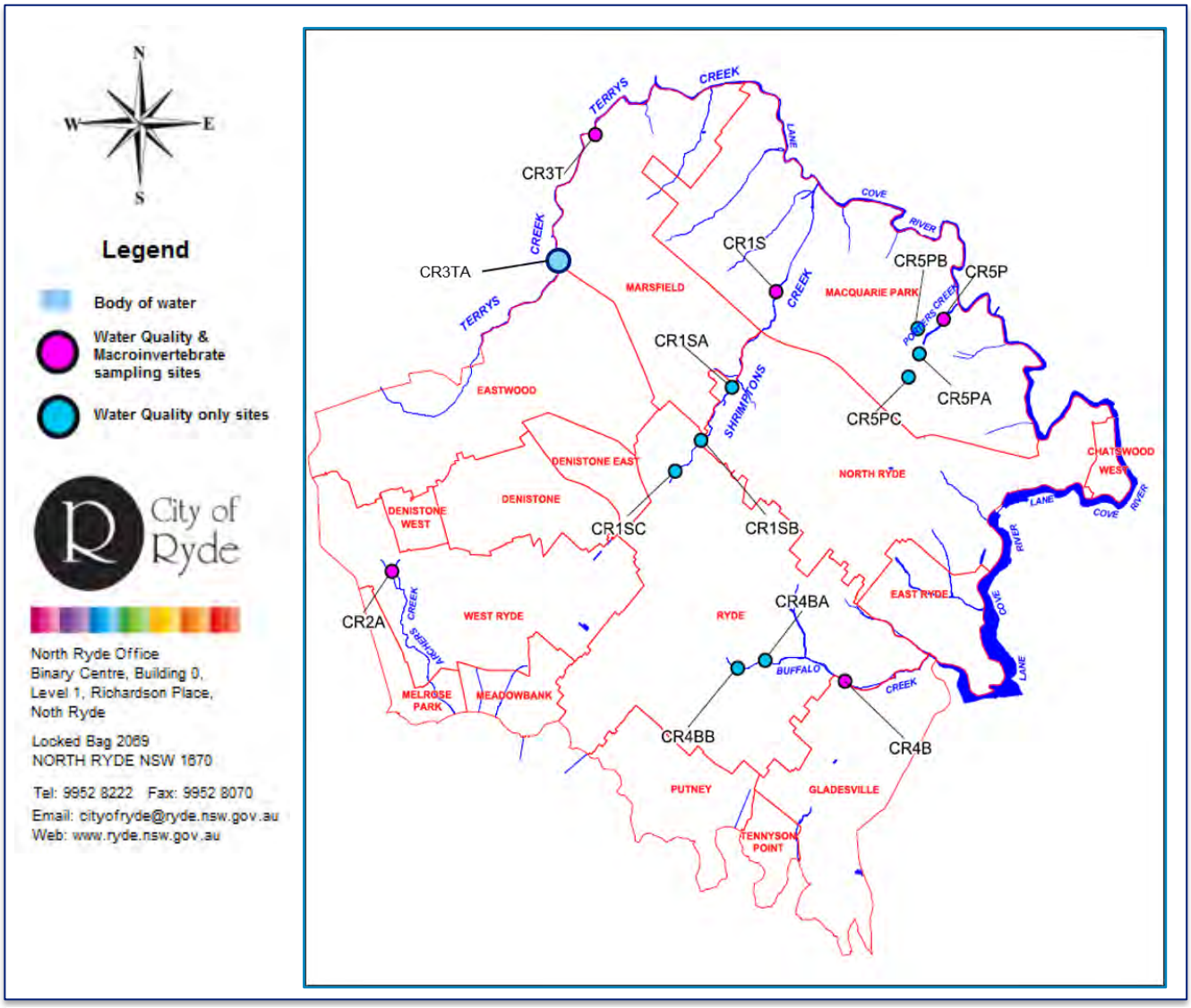

Figure 1 City of Ryde Water Quality Management Program Sites Map of sites for chemical and ecological monitoring across five creeks.

3 Sites

For each of the catchments there is a core site where macroinvertebrates, instream and water quality are assessed and additional water quality only sites.

Table 1 Survey sites for monitoring chemical and ecological attributes

Site	Location	Water Quality (wet & dry weather)	Macroinvertebrates
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	✓	

**Indicates a new site added to the program in Spring 2017*

4 Method descriptions

4.1 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.

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.

Figure 2 Collecting macroinvertebrates from Buffalo Creek (Autumn 2019)

4.1(i) 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

4.1(ii) 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 2 Macroinvertebrate collection; this water bug is a backswimmer (*Notonectidae*)

4.2 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 5 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.

Water quality samples are collected at all 14 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.

Water quality results are then compared to the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines.

These 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.

Historical data is used during result analysis to compare the current results over what would be expected. The analytes measured during this project are summarised in Table 2.

Figure 6 In-field water quality testing

Table 2 Water quality testing parameters

Parameter Measured	Examples
Physicochemical	Temperature, Dissolved Oxygen, pH, Turbidity, Conductivity, Alkalinity
Nutrients	Ammonia, Total Nitrogen, Total Kjeldahl Nitrogen, Oxidised Nitrogen, Total Phosphorus
Metals	Total Magnesium, Total Calcium, Total Hardness
Biological	Faecal Coliforms

4.3 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 7 Shrimptons Creek core site, displaying a 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 3 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	

5 Rainfall and Sampling

Figure 7 below summarises the monthly and cumulative rainfall data for the period June 2022 to June 2023. July 2022 had the highest observed monthly rainfall with a total volume of 357 mm. In contrast, June 2022 had the lowest total monthly rainfall when a total of only 6mm fell. Spring sampling was conducted on the 1st November 2022. In the days preceding sampling rainfall volume was low ranging between 0-1mm. The total rainfall volume for the month of November was also relatively low at 43mm. Autumn sampling was carried out on 11th April 2023. Daily rainfall preceding this sampling event ranged from 1 – 6mm. The month of April had a total rainfall volume of 128mm.

Rainfall can significantly influence both biological and chemical indicators of waterway health. High flow events can disturb established macroinvertebrate habitat contributing to a decline in the abundance and diversity of taxa. Prolonged periods of heavy rainfall can dilute concentrations of soluble compounds in water. Conversely, it can also lead to the influx of contaminants from adjacent environments such as park spaces and roadways.

Regular rainfall also plays a crucial role in maintaining waterway flows. Periods of drought with low rainfall can negatively impact waterways by reducing water volume leading to stagnant conditions. This can lead to the development of an anoxic environment and the proliferation of algal blooms.

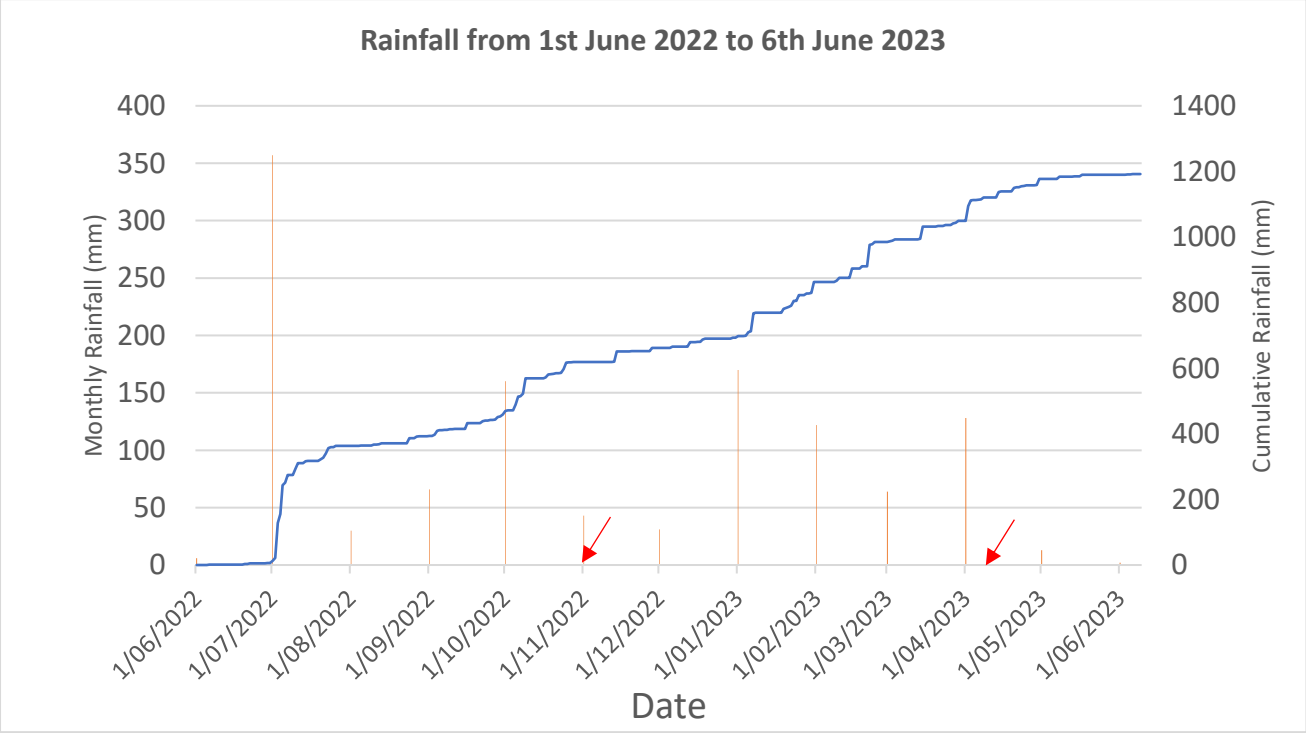

Figure 8 Rainfall data across Spring 2022 and Autumn 2023 sampling events. Note cumulative rainfall scale is on the right.

↙ - Signifies date of sampling (01/11/2022 and 11/04/2023)

6 Shrimptons Creek

6.1 Sites CR1S, CR1SA, CR1SB, CR1SC

The Shrimptons Creek catchment contains three water quality sites and one core site (macroinvertebrate, water quality and riparian assessment).

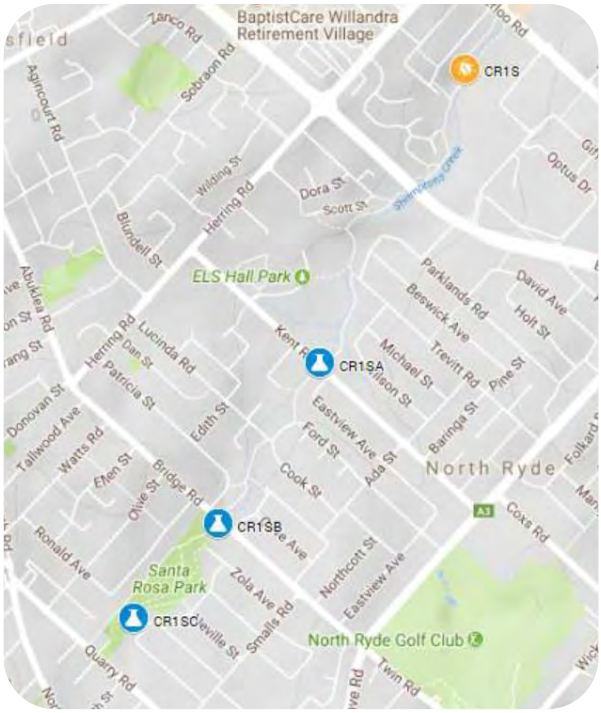

Figure 9 Shrimptons Creek Catchment Area

CR1S Shrimptons Creek Wilga Park (core site)

The Shrimptons Creek core site is located within Wilga Park in the suburb of Macquarie Park. Land use in this area is primarily 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.

Figure 10 Shrimptons Creek (core site) Spring 2022

CR1SA Shrimptons Creek at Kent Road

The Kent Road site is situated at ELS Hall Park 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.

Figure 11 Shrimptons Creek at Kent Rd facing downstream

CR1SB Shrimptons Creek at Bridge Road

This site is located at the downstream section of Santa Rosa 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.

Figure 12 Shrimptons Creek at Bridge Road facing downstream facing downstream

CR1SC Shrimptons Creek at Quarry Road

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

Figure 13 Shrimptons Creek at Quarry Rd facing downstream

6.2 Results and Interpretation

Macroinvertebrates

SIGNAL SF

Shrimptons Creek SIGNAL score was the highest result (4.8, Figure 14) for Spring 2022 and exceeded the historical average for this season. The SIGNAL score for Autumn 2023 was comparable to the previous season, and consistent with the historical average.

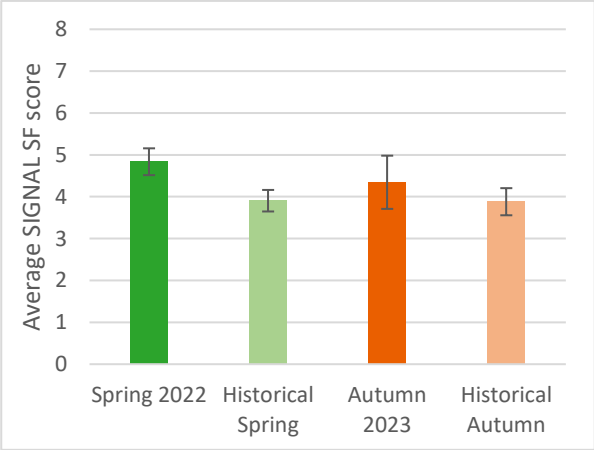

Figure 14 Shrimptons Creek SIGNAL scores

Taxa Richness

Shrimptons Creek catchment had the highest Richness result for the Spring season (12.5, Figure 15) when compared to all other sites.

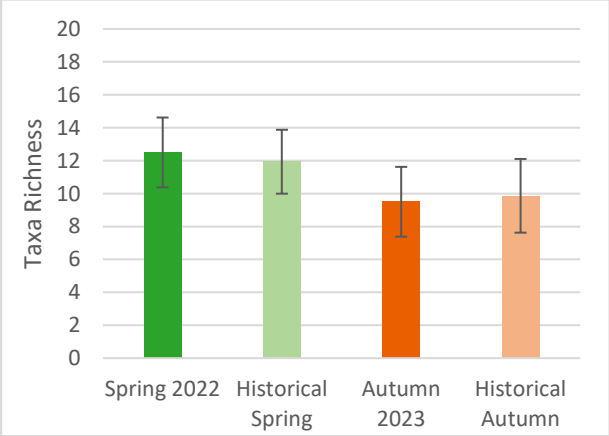

Figure 15 Shrimptons Creek Taxa Richness scores

However, during the Autumn season richness during the Autumn season richness results at this site declined (9.5), although values were still within range of the historical average.

Macroinvertebrates summary

SIGNAL SF and Taxa Richness results were comparable to historical averages for both seasons. Shrimptons Creek had the highest observed values for both parameters during Spring 2022

Water Quality

A range of In-field measurements were taken at each site in the Shrimptons catchment, including dissolved oxygen, turbidity, and conductivity. Santa Rosa Park upstream (CR1SC) had highest dissolved oxygen saturation during Spring (104.4%). This site also had the highest result during Autumn (93.7%). The lowest dissolved oxygen result was during Autumn at core site, Wilga Park (CR1S, 56.3%). Turbidity results were relatively low, with the highest reading observed during Autumn at ELS Hall Park (CR1SA, 12.8 NTU). Conductivity results were consistent and within ANZECC guideline limits.

Faecal coliform testing was conducted at each of the four Shrimptons Creek catchment sites. In general, coliform results were higher during the Autumn season when compared to Spring levels. For example, Shrimptons Creek core site at Wilga Park had a Spring 2022 coliform result of 270 CFU/100mL compared to 910 CFU/100mL in Autumn 2023. All coliform results for the Shrimptons Catchment were

within threshold, aside from the Spring result at the Santa Rosa Park upstream site (CR1SC). This site had a reading of 2800 CFU/100mL (>1000 CFU/100mL ANZECC guideline).

Nutrient results were consistent between Spring and Autumn sampling for the Shrimptons Creek sites. In general, these results were higher than the limits of the ANZECC guidelines. For Shrimptons Creek core site at Wilga Park (CR1S), Total Nitrogen values were 770ug/L in Spring and 740ug/L during Autumn. At each site in the Shrimptons Catchment all values were outside of ANZECC guidelines (350 ug/L). Half the sites also exceeded guidelines for Total Phosphorus results (25ug/L). The downstream (CR1SB), and upstream (CR1SC) sites at Santa Rosa Park were within threshold for the Autumn season this parameter. Results were (22ug/L and (17ug/L), respectively.

Water quality summary

In-field measurements were consistent with historical data. Most faecal coliform results were generally lower than the guideline values. Autumn coliform results were generally higher than Spring. Conversely, most nutrient results were outside of AZNECC guidelines for both seasons.

Archers Creek

7.1 Site CR2A (core site)

This site is located in Maze Park, West Ryde and is upstream of the Victoria Rd crossing (Figure 17). 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, Figure 18). The vegetation within and around the creek is a mix of native and introduced species.

Figure 17 Archers Creek Catchment Area

Figure 16 Archers Creek Core site (CR2A), Spring 2022

7.2 Results and Interpretation

Macroinvertebrates

SIGNAL SF

Archers Creek SIGNAL results for the Spring 2022 season were observed to be lower than the historical Spring average (Figure 19). However, the average SIGNAL SF score increased during Autumn 2023 and was the highest result for this season when compared to the other catchments.

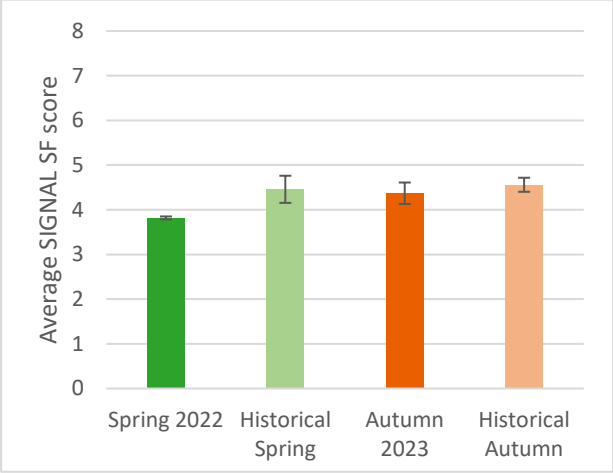

Figure 18 Archers Creek SIGNAL scores

Taxa richness

For both seasons, results for this site were lower than historical averages. During this period of sampling, Archers catchment had the second highest observed Taxa Richness result for both seasons.

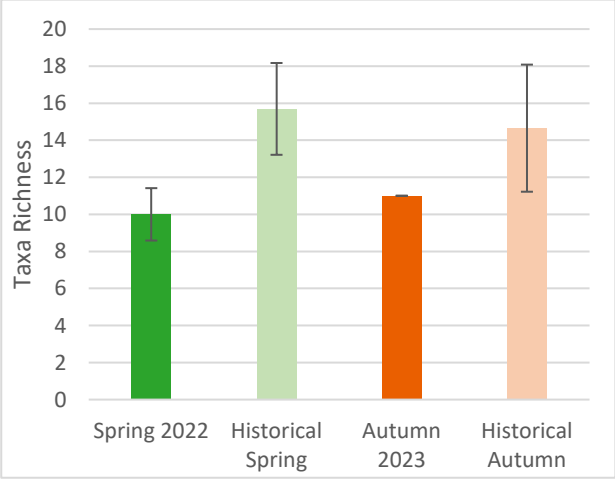

Figure 19 Archers Creek Taxa Richness scores

Macroinvertebrates summary

Archers Creek had the highest SIGNAL SF score for the Autumn 2023 season. This catchment also had the second highest Taxa Richness result for both sampling seasons.

Water Quality

Most in-field measurements for parameters such as conductivity, turbidity and pH values were consistent between seasons. Although, dissolved oxygen result for this site was higher in Spring (90.2%) compared to the result during Autumn (76.1%).

Faecal coliform results were consistent between seasons; 580CFU/100mL (Spring 2022) and 630CFU/100mL (Autumn 2023), and below the ANZECC guideline threshold.

Nutrient results for Archers Creek were also consistent between seasons and were often higher than ANZECC threshold values. Total Nitrogen results for both Spring (1260ug/L) and 1150ug/L Autumn were higher than the ANZECC guideline of 350ug/L. Total Phosphorus results were also elevated slightly above the guideline limit of 25ug/L (42ug/L in Spring and 33ug/L in Autumn). The Ammonia result in Spring (10ug/L) was lower than the ANZECC threshold (20ug/L) although, this level was slightly elevated in to 30ug/L during the following Autumn season. Alkalinity results were slightly higher in Autumn 90mg CaCO3/L when compared to Spring 73mg CaCO3/L.

Water quality summary

In-field measurements for this catchment were consistent between seasons and compared to historical averages. Most Nutrient results were elevated about ANZECC guideline thresholds.

8 Terrys Creek

8.1 Sites CR3T, CR3TA

CR3T Terrys Creek (core site)

This site is located within Somerset Park under the M2 overpass in the suburb of Epping (Figure 21). 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.

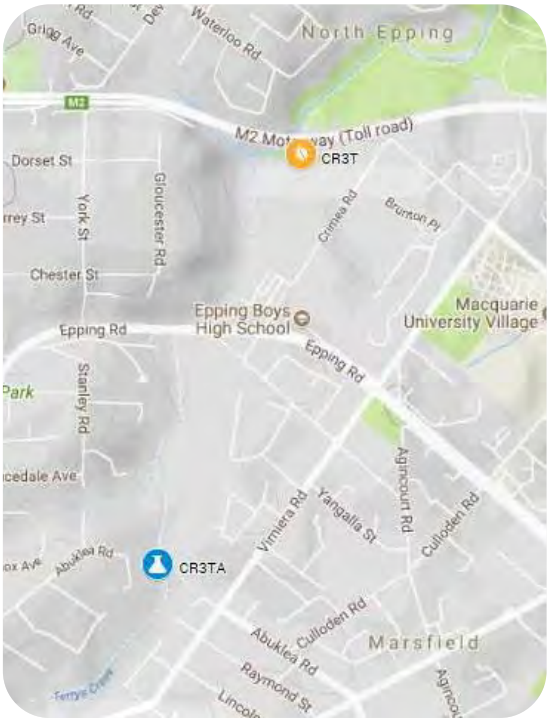

Figure 20 Terrys Creek Catchment Area

CR3TA Terrys Creek @ Forrester 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.

Figure 21 Terrys Creek core site at Forrester Park (CR3T), Spring 2022

8.2 Results and Interpretation

Macroinvertebrates

SIGNAL SF

Terrys Creek average SIGNAL SF scores were consistent between the two sampling seasons and were within range of the historical average

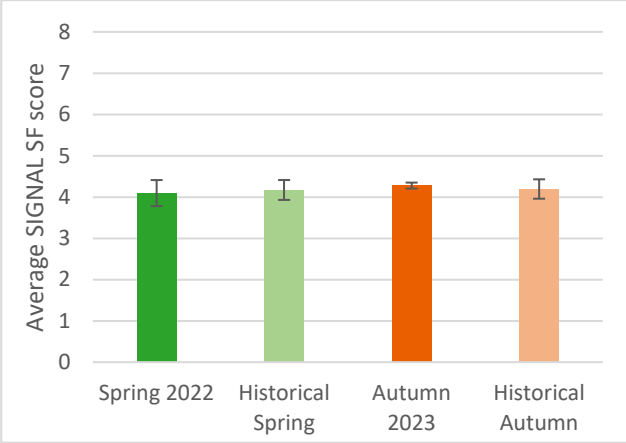

Figure 22 Terrys Creek SIGNAL scores

Taxa richness

Terrys Creek had the lowest observed Richness result during Spring 2022 (6). In contrast, during the Autumn 2023 season, this catchment had the highest Richness result (11.5).

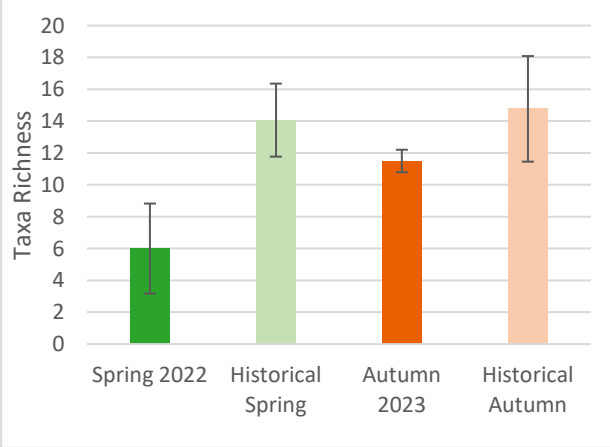

Figure 23 Terrys Creek Taxa Richness scores

Macroinvertebrates summary

SIGNAL SF scores for Terrys Creek were consistent between seasons. Conversely, Taxa Richness results had high variability between Spring and Autumn seasons.

Water Quality

Site CR3T had dissolved oxygen (DO%) results consistent between Spring and Autumn seasons. In contrast, site CR3TA had a higher DO% reading in Autumn 2023 (89%) when compared to the previous Spring (60.3%). Conductivity was higher for core site in Spring (599 µS/cm) than the following Autumn (358 µS/cm).

Terrys Creek core site (CR3T) had relatively low faecal coliform results for both Spring and Autumn seasons; 60- and 100CFU/100mL respectively. In contrast, site CR3TA had elevated coliform results exceeding ANZECC guidelines during both Spring (2500CFU/100mL) and Autumn (2100CFU/100mL) periods (values >1000CFU /100mL).

Spring Total Nitrogen results for site CR3T were almost double those observed in Autumn (600 ug/L and 340 ug/L). A similar trend was observed in CR3TA which also had a higher Spring result (910 ug/L) compared to Autumn (790 ug/L).

Water quality summary

In-field measurements were consistent between seasons. Core site CR3T had low faecal coliform concentration results in contrast to site CR3TA where both seasons recorded coliform concentrations above ANZECC guidelines.

9 Buffalo Creek

9.1 Sites CR4B, CR4BA, CR4BB

Buffalo Creek catchment has one core site in the Field of Mars Reserve. The two remaining sites are water quality only and are located upstream in Burrows Park.

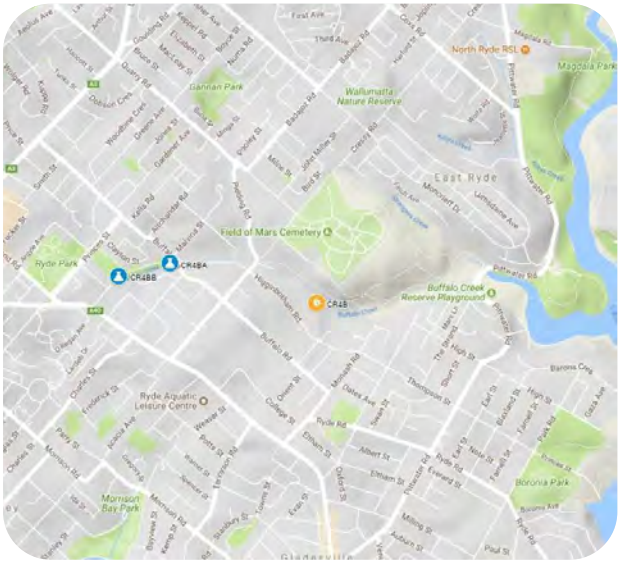

Figure 24 Buffalo Creek Catchment Area

CR4B Buffalo Creek (core site)

The Buffalo Creek core sampling site is located along the Southern border of the Field of Mars Reserve 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 25 Buffalo Creek core site (CR4B), Spring 2022

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 26 Buffalo Creek Downstream of Burrows Park

CR4BB Buffalo Creek Upstream of Burrows Park

The upstream Burrows Park site is about 300 metres upstream of Buffalo Road 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.

Figure 27 Buffalo Creek Upstream of Burrows Park

9.2 Results and Interpretation

Macroinvertebrates

SIGNAL SF

Buffalo Creek catchment had the lowest average SIGNAL score result for both Spring 2022 and Autumn 2023 with scores of 3.5 and 4.2 respectively. These results were consistent with values historically observed for this catchment.

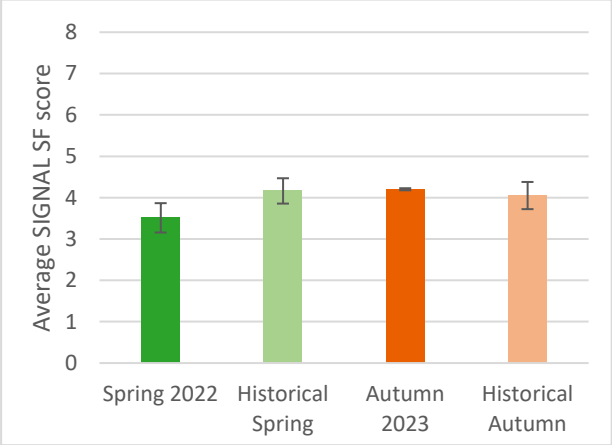

Figure 28 Buffalo Creek SIGNAL scores

Taxa richness

Buffalo Creek catchment recorded the same average Richness value for both Spring 2022 and Autumn 2023 seasons (8.5). These results were within range of the historical average Richness results for both seasons.

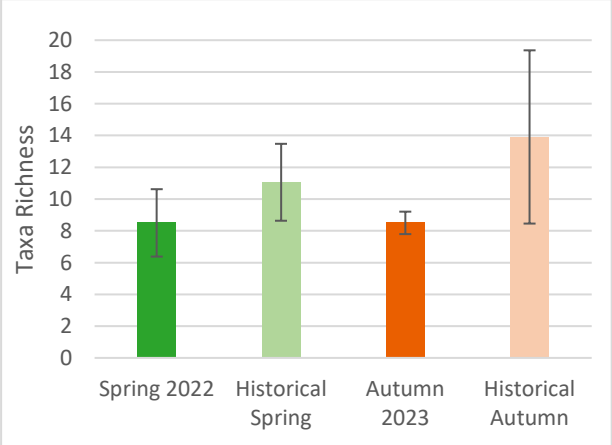

Figure 29 Buffalo Creek Taxa Richness scores

Macroinvertebrates summary

Buffalo Creek catchment had the lowest observed SIGNAL score for both sampling periods. Taxa Richness results were consistent between seasons, and within historical ranges for this site.

Water Quality (CR4B, CR4BA, CR4BB)

Buffalo Creek core site at the Field of Mars Reserve (CR4B) had the highest observed dissolved oxygen result for both Spring and Autumn seasons (95.5% and 89.1% respectively). This site also had the highest turbidity reading during Spring (13.70 NTU). Site CR4BA (Burrows Park downstream) had the lowest dissolved oxygen results for both Spring and Autumn (73.4% and 79% respectively). Conductivity results were consistent between sites and seasons and were all within ANZECC guideline limits (125-2500 µS/cm).

Buffalo Creek core site Faecal Coliform results were comparable between both sampling seasons and within ANZECC guidelines. Burrows Park downstream site (CR4BA) had a coliform result above threshold during both Spring (1500CFU/100mL) and Autumn (2900 CFU/100mL) seasons. Site CR4BB (Burrows Park upstream) also had a Spring result above ANZECC guidelines (2800 CFU/100mL) but had a result within threshold in the following Autumn (710 CFU/100mL). Site CR4B (Field of Mars

Reserve) had coliform results below ANZECC guidelines for both seasons (Autumn; 350 ug/L and Spring; 480 ug/L).

Total Nitrogen and Total Phosphorus results were above ANZECC guideline values for both seasons at all sites aside from the Total Phosphorus result at core site CR4B (Field of Mars Reserve) during Autumn (21 ug/L) which was lower than the guideline value of 25 ug/L. Most low-level Ammonia results for this catchment were below the guideline limit for both sampling seasons.

Water quality summary

In-field measurements and faecal coliform results were consistent across sampling seasons. Most nutrient results were above ANZECC guideline limits.

10 Porters Creek

10.1 Sites CR5P, CR5PA, CR5PB, CR5PC

There is one core site and three water quality only sites within the Porters Creek Catchment. From 1969 to 1986 the Council's Porters Creek site operated as a landfill site. It now operates as a construction waste recycling facility.

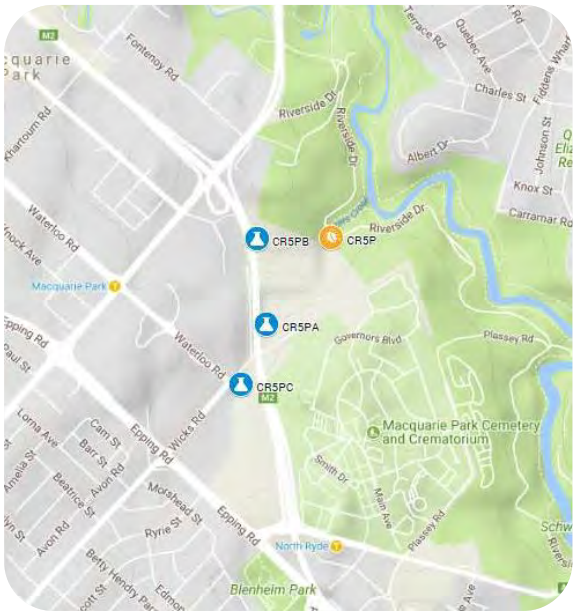

Figure 30 Porters Creek Catchment Area

CR5P Porters Creek (core site)

This site is located in the Lane Cove National Park, North of the Council's Environmental Construction Materials Recycling Facility. It is at this point that Porters Creek emerges after flowing mostly underground in its upper section. Water quality and macroinvertebrate sampling was conducted near the Porters Creek Bridge.

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 31 Porters Creek Core Site (CR5P), Spring 2022

CR5PA Porters Creek at Main Branch

This site is located on the western boundary of the construction waste recycling facility and consists of an open concrete channel. Samples are collected from the retention basin at the end of the channel.

Figure 32 Porters Creek at Main Branch facing downstream

CR5PB Porters Creek at 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.

Figure 33 Porters Creek at Spur Branch

CR5PC Porters Creek at Wicks Road

This site is the first point that Porters Creek daylights 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 34 Porters Creek at Wicks Road

10.2 Results and Interpretation

Macroinvertebrates

SIGNAL SF

Porters Creek site average SIGNAL scores were consistent between Spring and Autumn seasons as well as comparable to historical average (Figure 40).

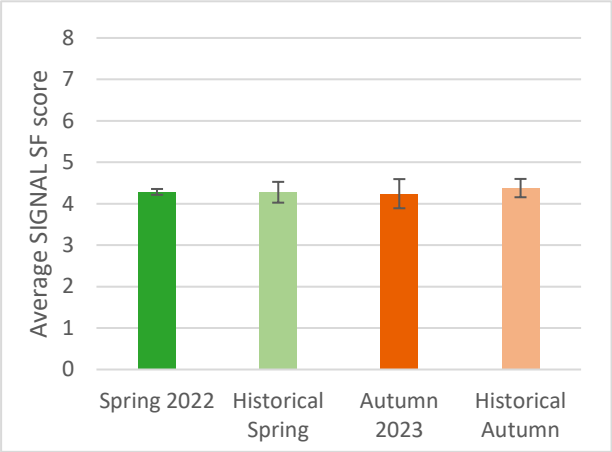

Figure 35 Porters Creek SIGNAL scores

Taxa Richness

In a pattern similar to Terrys Creek Catchment, Porters Creek had a relatively low Richness score in Spring 2022 (6.5), that almost doubled during the following Autumn sampling period (11). Furthermore, Spring values were below the historical threshold but returned to within range during Autumn.

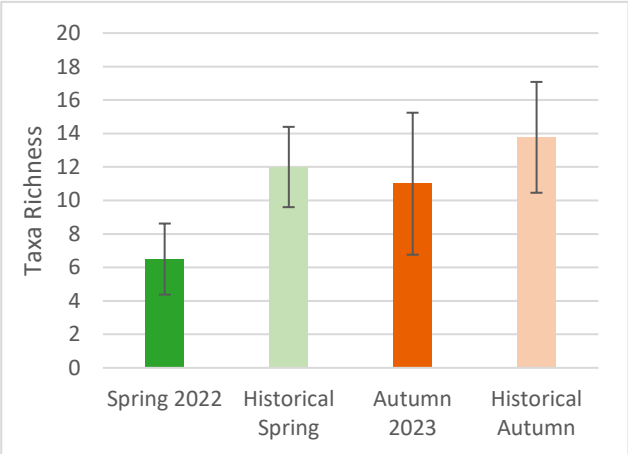

Figure 36 Porters Creek Taxa Richness scores

Macroinvertebrates summary

SIGNAL scores for Porters Creek were consistent between sampling seasons. Taxa Richness was relatively low in Spring 2022, in contrast to Autumn 2023 where a higher score was observed.

Water Quality

Observed in-field measurements showed variability in dissolved oxygen results between seasons. Site CR5PA (main branch) had the highest dissolved oxygen result during Spring 2022 (127.2%). During Autumn, this result was much lower 70.6% and site CR5PC (Wicks Road) had the highest reading for this season (96.9%). Turbidity results were relatively low across both sites and seasons.

Faecal coliform results were observed to be consistently higher during the Spring season when compared to Autumn values. Results for the core site in the Lane Cove National Park (CR5P) were comparable between sampling seasons and within ANZECC guidelines (Spring; 400 CFU/100Ml, Autumn; ~320). Coliform concentrations at site CR5PB (spur branch) were outside of ANZECC guidelines during Spring 2022 (1500 CFU/100mL) but fell back into range during Autumn 2023 (290 CFU/100mL). Site CR5PC (Wicks Road) recorded coliform concentrations outside of ANZECC guidelines for both Spring 2022 (~8700 CFU/100mL) and Autumn 2023 (~3900 CFU/100mL) periods.

For each of the four Porters Creek sites nutrient values were almost all elevated above threshold limits for each parameter. Total Nitrogen and Total Phosphorus results were above ANZECC guidelines for both seasons. Only the Total Phosphorus Autumn result for site CR5PB (spur branch) was below the limit of 25 µg/L.

Core site CR5P had low-level Ammonia result of 560 µg/L during Spring 2022. During Autumn 2023, this result rose to 3360 µg/L. The Autumn result was therefore above the ANZECC 95% guideline limit of 900 µg/L.

Water quality summary

Faecal coliform results indicated a trend of higher results during the Spring period. Most sites exceeded thresholds for nutrient indices. Further heavy metals analysis observed elevated concentrations of copper and zinc at several sites.

Porters Creek heavy metals testing

For both Spring and Autumn sampling periods additional heavy metals testing was carried out at each of the four Porters Creek sites (CR5P, CR5PA, CR5PB, CR5PC). The results of these analyses are provided in Table 5 below. In general, the observed total metals results were below detection levels for the test analytes. During the Spring season, there were exceedances for a range of analytes.

Sites CR5P (Lane Cover National Park) and CR5PC (Wicks Road) had total copper values of 5µg/L which was higher than the recommended threshold value of 1.4 µg/L. Site CR5PB (spur branch) located upstream of the recycling facility also had an elevated copper result of 10 µg/L. During this season, total zinc results were also above the guideline limit (8 µg/L) for each of the four sites. This was also the case for the following season.

Table 4 Additional heavy metals analyses for Porters Creek sites *results reported as mg/L

Season	Test Analyte (mg/L) *								
AUTUMN 2023	Total Mercury	Total Arsenic	Total Cadmium	Total Chromium	Total Copper	Total Iron	Total Lead	Total Manganese	Total Zinc
CR5P	<0.0003	<0.02	<0.005	<0.005	<0.005	0.45	<0.01	0.019	0.02
CR5PA	<0.0003	<0.02	<0.005	<0.005	<0.005	0.97	<0.01	0.15	0.02
CR5PB	<0.0003	<0.02	<0.005	<0.005	<0.005	0.29	<0.01	0.026	0.01
CR5PC	<0.0003	<0.02	<0.005	<0.005	<0.005	0.44	<0.01	0.091	0.1
SPRING 2022									
CR5P	<0.0003	<0.02	<0.005	<0.005	0.005	0.99	<0.01	0.035	0.01
CR5PA	<0.0003	<0.02	<0.005	<0.005	<0.005	0.47	<0.01	0.019	0.01
CR5PB	<0.0003	<0.02	<0.005	<0.005	0.01	3.25	<0.01	0.292	0.04
CR5PC	<0.0003	<0.02	<0.005	<0.005	0.005	0.42	<0.01	0.03	0.02

*Values exceeding ANZECC guideline threshold (in µg/L) highlighted in red

11 Rapid Riparian Assessment

Rapid Riparian Assessments (RRA) are conducted annually during the Spring season at each of the five catchments process of this assessment involves the observation of stream features as well as the vegetation community surrounding the stream. Table 4 (right) provides a summary of the results from the two most recent Spring sampling seasons.

In general, results were consistent with the 2020). Shrimptons and Archers Creek sites both recorded a “Fair” health score during the Spring 2020 and Spring 2022 sampling seasons. Porters Creek site was also consistent with a “Good” health score for both seasons. Terrys Ck and Buffalo Creek saw an improvement in RRA scores with both sites moving from a “Fair” score (Spring 2020) to a “Good” score (Spring 2022).

Table 5 Rapid Riparian Scores for Spring 2020 and Spring 2022 seasons

	Season	
Site	Spring 2020	Spring 2022
Shrimptons Ck	13.1	26.3
Archers Ck	-1.1	13.0
Terrys Ck	20.8	56
Buffalo Ck	22.1	36.9
Porters Ck	53.6	49.7

Figure 37 Examples of Riparian environments at Porters Creek core site (CR5P) during Spring 2020 (left) and Spring 2022 (right)

12 Discussion / Conclusion

11.1 Macroinvertebrates

During Spring 2022, Shrimptons Creek had the highest SIGNAL score as well as the highest Taxa Richness result. Shrimptons core site is located within a thin Riparian corridor with established vegetation of both banks. Riparian vegetation supports the structure of Macroinvertebrate communities by providing refuge habitat. The lowest SIGNAL result for this season was at Buffalo Creek (3.5). This site is adjacent to residential zones and areas of commercial industry. The proximity of such areas to this site may contribute to the influx of run-off from private gardens and roadways contributing to a decline in overall water quality. The lowest taxa Richness for Spring was observed at Terrys Creek. The trends of these current sampling seasons were found to be consistent with historical data. During the Autumn 2023 season, Buffalo Creek also had the lowest SIGNAL (4.2) and Taxa Richness (8.5) scores further demonstrating the influence of adjacent urban areas on waterway health. The highest SIGNAL score for Autumn was at Archers Creek (4.4). This result may be due structural features including the addition of sandstone blocks to support the channel, as well as the presence of organic matter and dense riparian vegetation. The highest Taxa Richness score during Autumn 2023 was at Terrys Creek was a score of 11.5.

11.2 Water Quality

In-situ field measurements were found to be generally consistent with previous seasons. During the Spring period 8 of the 14 sampling sites had faecal coliform concentrations within threshold guidelines. In Autumn 2023 this improved to 11 sites within threshold. This may be attributed to an increase in rain events leading to a dilution in environmental contaminants. During both seasons, most nutrient results were above ANZECC guideline limits. These results follow the trends of previous seasons. High nutrient load can be influenced by a range of factors including run-off from urban environments and roadways. It can also be caused by an influx of detritus or degraded vegetation entering the waterway.

During this season additional heavy metals analyses were conducted at the four Porters Creek sites. Several sites were found to have exceedances for the heavy metals copper and zinc. However, the results for most of the metals analysed (mercury, arsenic, cadmium, and chromium) were below test detection levels. Elevated levels of both copper and zinc concentrations could be attributed to industrial and/or road run off due to increased rainfall in the period preceding sampling. Zinc is commonly found in galvanized metals and metal surfaces, including metal roofing, construction materials, plumbing and stormwater pipes, guardrails, chain-link fencing, vehicle tyres, motor oil, hydraulic fluids, fertilisers and pesticides. Copper is widely used in the manufacture of alloys with zinc, nickel and tin, in metal plating and in the production of copper wiring, piping, brake pads and pesticides. Two of the testing locations with exceedances for copper and zinc are upstream of Council's Environmental Construction Materials Recycling Facility. Indeed, heavy metals testing undertaken from 2013 through to 2017, observed exceedances in copper and zinc levels at almost all testing locations.

11.3 Rapid Riparian Assessment

Generally, Rapid Riparian scores during this sampling season were observed to be consistent with the results of the previous Spring. However, both Terrys and Buffalo Creek saw an improvement in RRA score. During Spring 2022, Terrys Creek saw a reduction in the presence of litter observed on site when compared to Spring 2020. There was also an increase in the density of over-hanging vegetation as well as a reduction in the impacts of erosion, for example, there was a lower presence of bank slumps and channel erosion. As with Terrys Creek, less litter was observed at the Buffalo Creek site. During this season there was also a greater density of riparian vegetation. This season also had less observed bank erosion and channel restriction when compared to the previous season.

13 Recommendations

- At each of the established sampling sites, continue to monitor:

i) Macroinvertebrate communities (SIGNAL SF and Taxa Richness indices)

ii) Chemical water quality parameters

iii) Riparian condition

iv) Additional heavy metals analysis at Porters Creek sites

- Continue Gross Pollutant Trap maintenance and rubbish removal
- Consider collecting pre-and post-work water quality data on any Council projects that aim to improve water quality
- Continued collection of Stream-watch data, sampled in parallel with Sydney Water sites and time periods

14 Appendix

City of Ryde Council provided Streamwatch water quality data for the period of Autumn 2023 from several sites within the catchment zones currently sampled by Sydney Water. It is to be noted that the Streamwatch water quality data was collected by trained Bushcare groups using standardised equipment and methodologies. Data from the Council is verified before being stored as a permanent public record that is available for non-commercial purposes.

Sydney Water and the Sydney Catchment Authority do not accept responsibility for the use of this information. Data is uncontrolled if printed or downloaded.

The plots below contain the two sets of data for the parameters dissolved oxygen (mg/L) and conductivity (µS/cm) for the Shrimptons and Buffalo Creek catchments. Comparisons cannot be drawn between the two sets of data as the water quality sampling was conducted at different locations within the catchment and on different sampling dates.

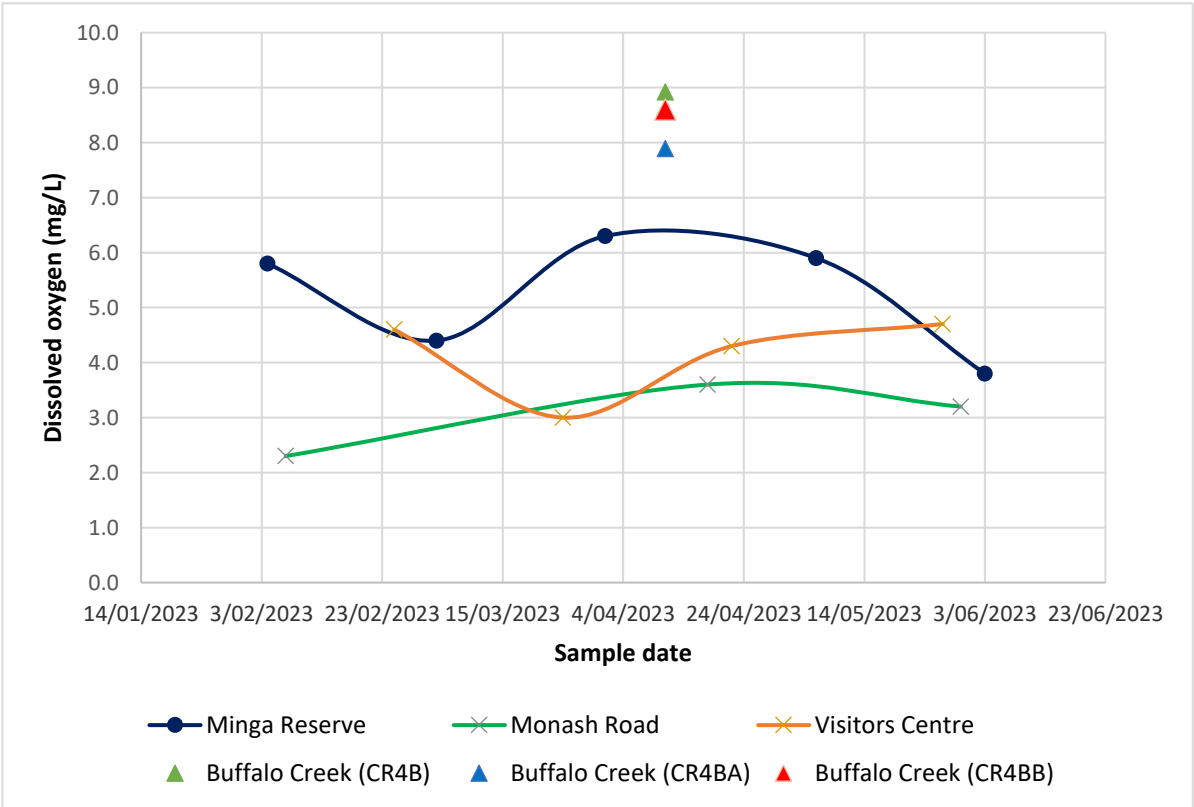

Figure (i) Dissolved oxygen (mg/L) results for Streamwatch (Minga Reserve, Monash Road, Visitors Centre) and Sydney Water (CR4B, CR4BA, CR4BB) sampling sites

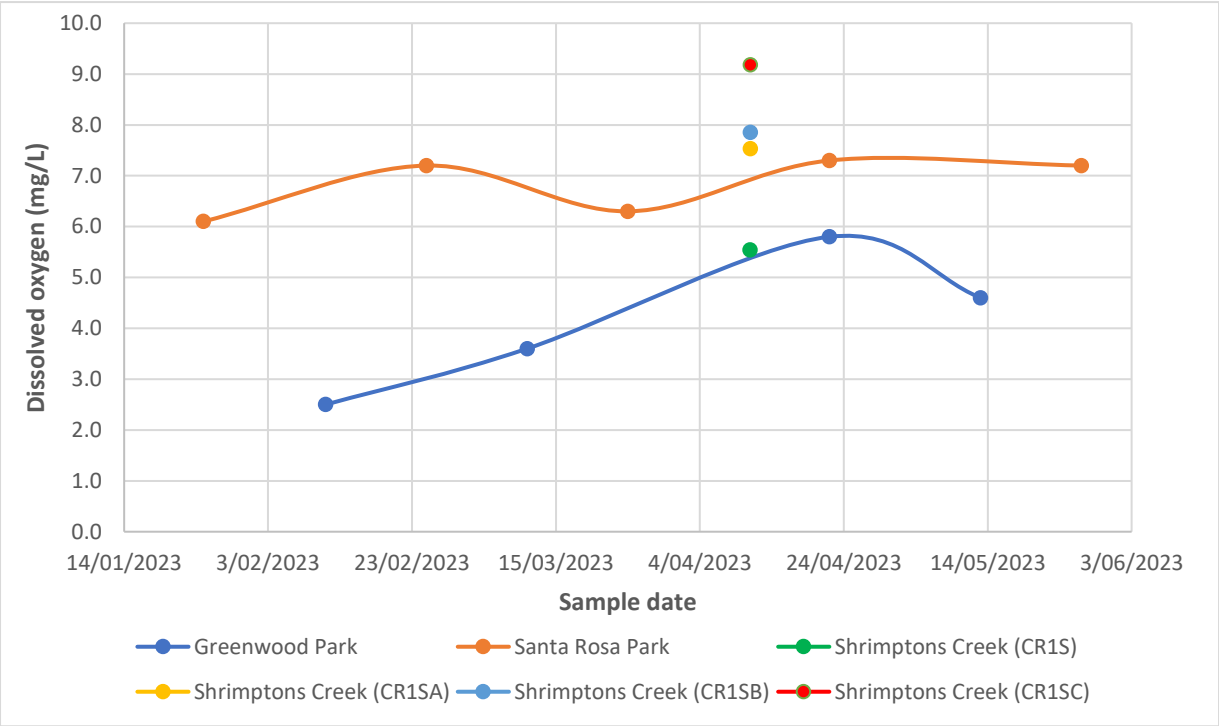

Figure (ii) Dissolved oxygen (mg/L) results for Streamwatch (Greenwood Park, Santa Rosa Park) and Sydney Water (CR1S, CR1SA, CR1SB, CR1SC) sampling sites

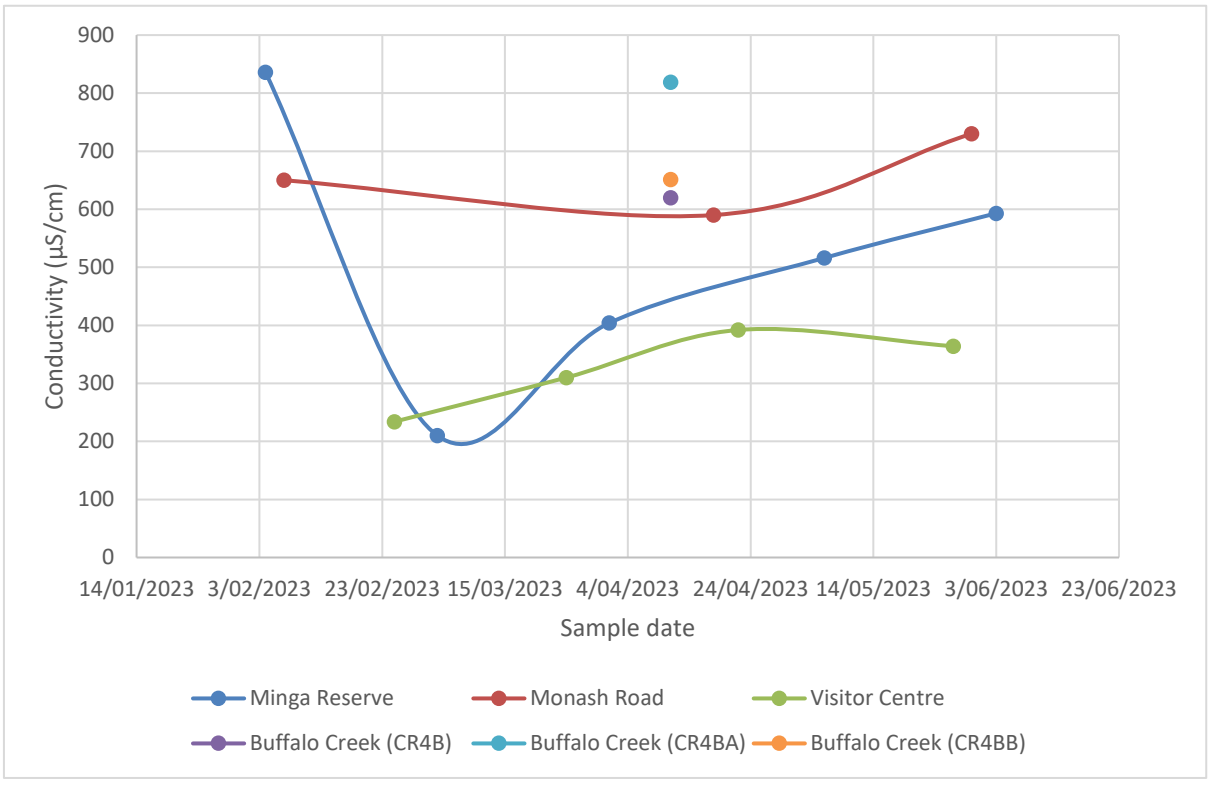

Figure (iii) Conductivity (µS/cm) results for Streamwatch (Minga Reserve, Monash Road, Visitors Centre) and Sydney Water (CR4B, CR4BA, CR4BB) sampling sites

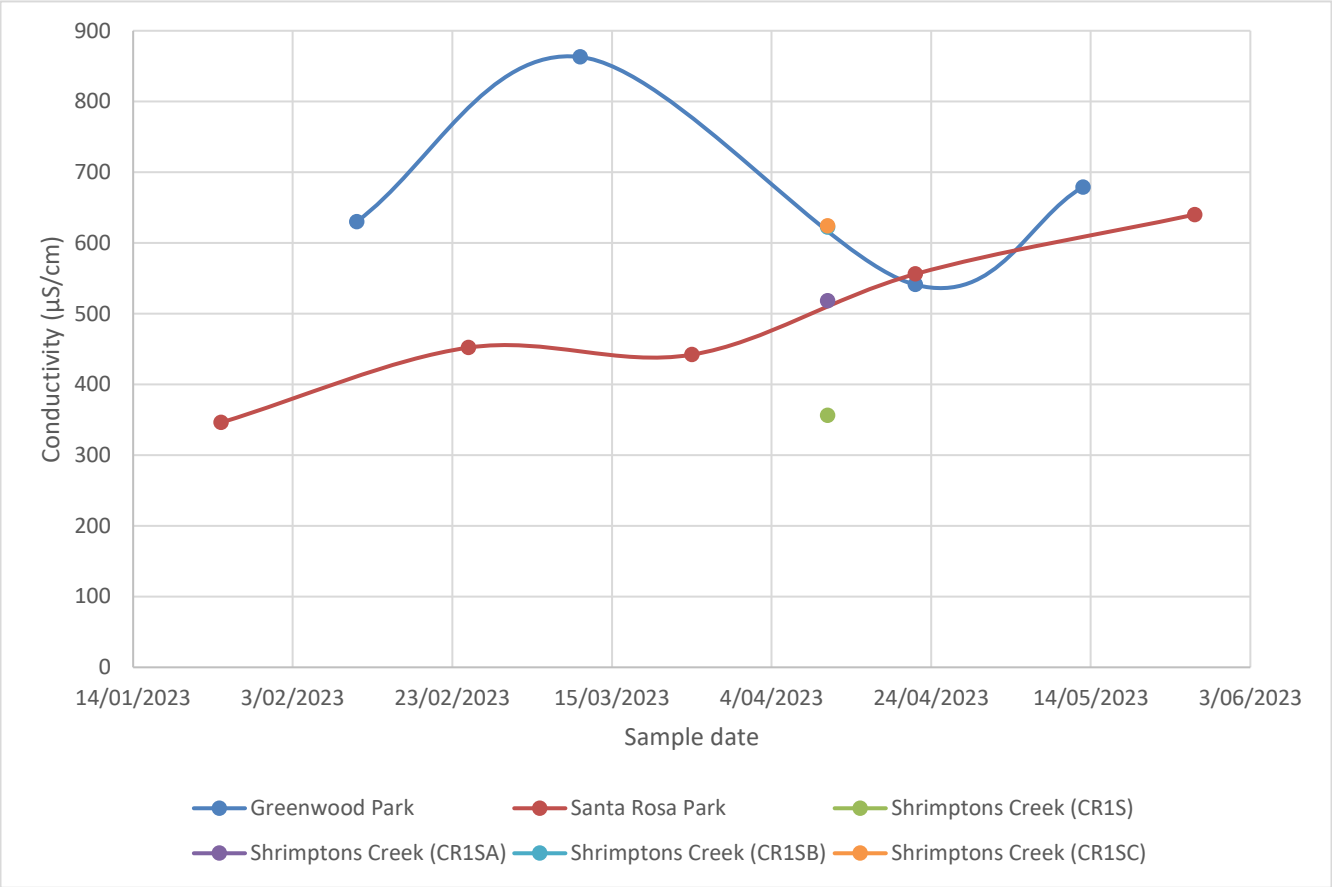

Figure (iv) Conductivity (µS/cm) results for Streamwatch (Greenwood Park, Santa Rosa Park) and Sydney Water (CR1S, CR1SA, CR1SB, CR1SC) sampling sites *Note: Result CR1SB (622 µS/cm) is plotted below to CR1SC (642 µS/cm)

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.
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.

Item	Meaning
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)