Water and Sediment Quality in the Bayswater Brook Catchment

2020 – 2021 monitoring report

Prepared for City of Bayswater

By Urbaqua

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EXECUTIVE SUMMARY

The Bayswater Brook (formerly Bayswater Main Drain) is a large drainage network with a catchment of 27,000 ha. It is the largest urban catchment in the Perth Metropolitan area and discharges into the Swan River. It is a permanently flowing drainage network that features both open drainage and piped drainage along its length.

The lower end of the drain was a natural watercourse linking numerous creeks and swamps throughout the catchment and flowing into the Swan River. In the 1920s the brook was modified for use as a drainage system to enable development of the area. The Bayswater Main drain intercepts groundwater to prevent flooding of low-lying areas and also receives stormwater from the large catchment area from numerous local government stormwater drains.

Regular water quality monitoring within the Bayswater Brook catchment began in 2006. The monitoring program has been altered since commencement on the basis of recommendations in the summary reports. This report provides a summary of the results of the 2020 and 2021 monitoring program as well as providing recommendations to support the long-term vision for the Bayswater Brook.

The Bayswater Brook monitoring program identified a number of water quality parameters that were recorded at concentrations that exceed ecosystem health criteria (ANZG 2018) toxicant trigger values for a 95% level of species protection, site specific Hardness Modified Trigger Value [HMTV], and default guideline values for south-west lowland rivers), as well as recreational guidelines (ANZG 2018).

Of particular concern during the 2020 and 2021 monitoring program are the widespread elevated levels of nitrogen (particularly in the form of total oxidised nitrogen and ammonia), as well as the elevated levels of soluble aluminum and zinc. Site BWMD16 was a site of specific ongoing concern, showing elevated levels of chromium and nickel in exceedance of the hardness modified trigger values, indicating the potential of a localised pollutant source nearby.

Nitrogen is noted as a key concern for the water quality within the Swan Canning Water Quality Improvement Plan (SRT 2009), which identifies the Bayswater Brook as a key sub-catchment for TN load reduction.

Recommendations

The recommendations are intended to support the long-term vision for the Bayswater Brook and are linked to the proposed management actions identified in Waterwise Bayswater (Urbaqua, 2020). A risk management approach is recommended to assist with source identification across all potential water quality parameters of concern in surface waters, and prioritisation of future management actions.

The results from the 2020-2021 monitoring program are largely consistent with the results from the 2018-2019 monitoring program and therefore the recommendations for water quality improvement actions carry over from the *Water and Sediment Quality in the Bayswater Brook Catchment 2018-2019* (Urbaqua, 2020) report.

The presence of a high density of septic tanks throughout the Bayswater Industrial area (Barron *et al.* 2010) provides a potential large source of nutrients to the lower section of the Bayswater

Brook. It is recommended that the City promote the replacement of septic tanks in the industrial area with reticulated sewage to significantly reduce ammonium nitrogen concentration in groundwater and the receiving drains.

Given the elevated concentrations of metals, and ongoing exceedance of assessment criteria at some monitoring locations, it is recommended that identification of the sources of metals be a high priority for water quality improvement within the catchment to reduce the risks to ecosystem health. Sub-catchment sites for the focus of small-medium enterprise audits by local government environmental health officers are identified.

Prioritisation and design of further water quality improvement projects within the greater catchment should consider the identification of areas of high groundwater contribution, the hydrological regime and key parameters of concern of the contributing sub-catchment, as well as site specific constraints to design and construction.

Summary results – Physiochemical

Executive Figure 1 shows the monitoring locations within the Bayswater Brook monitoring program where the median sample concentration for the 2020 and 2021 monitoring program was in exceedance of the respective default guideline levels.

pH

During the 2020 and 2021 monitoring period a number of sites recorded median pH levels that were outside of the ANZG (2018) default guidelines range. Lower pH levels were generally recorded in the northern section of the catchment which tended towards neutral closer to the Swan River outlet.

Electrical conductivity (EC)

All sites except for BWMD10 had a median EC in exceedance of the ANZG (2018) guidelines acceptable range. EC was generally higher towards the lower end of the catchment.

Dissolved oxygen (DO)

DO saturation was within the ANZG (2018) guideline range in the open drain sections at the lower end of the catchment. Further upstream there were a number of sites that had a median DO saturation below the ANZG (2018) guideline range.

Total suspended solids (TSS)

TSS concentrations were generally low across the catchment with most almost all sites recording median TSS concentrations below the DWER interim guideline level. There were four sites that had median TSS concentrations in exceedance of the interim guideline (BWMD03, BWMD06, BWMD09, and BWMD24). BWMD03 and BWMD06 are located within the vicinity of industrial areas within the catchment, while BWMD09 and BWMD24 are in more residential areas.

Summary results – Nutrients

Executive Figure 2 shows the monitoring locations within the Bayswater Brook monitoring program that had median nutrient concentrations in exceedance of the relevant default guidelines during the 2020 and 2021 monitoring program.

Total nitrogen (TN)

TN concentrations have been observed to be elevated at the Bayswater Brook catchment in the previous water and sediment quality reports (2014-2015, 2016-2017 & 2018-2019). During the 2018-2019 there were 7 sites that recorded a median TN concentration in exceedance of the ANZG (2018) guideline level. In the 2020-2021 monitoring period, there were 4 sites with a median in exceedance of the ANZG (2018) guideline level.

The sites in exceedance were generally located towards the southern end of the catchment, approaching the outlet to the Swan River. The median concentration at these sites was below the short-term reduction target level identified for the Bayswater Brook catchment in the *Swan Canning Water Quality Improvement Plan* (SRT 2009) but in exceedance of the long-term reduction target.

Total oxidised nitrogen (NO_x-N)

NO_x-N was generally elevated across the study area. During the 2020 and 2021 monitoring program there were a total of 20 sites with a median NO_x-N concentration in exceedance of the ANZG (2018) default guideline level, 13 of which were in exceedance at all sampling events.

Nitrogen as ammonia/ammonium (NH_x-N)

NH_x-N concentrations were elevated across the catchment but reduced from prior years. During the 2017-2018 monitoring program 21 sites recorded median NH_x-N concentrations in exceedance of the ANZG (2018) default guidelines level, 6 of which were in exceedance at all sampling events. During the 2020-2021 monitoring program, 7 sites recorded median NH_x-N concentrations in exceedance of the ANZG (2018) default guidelines level, none of which exceeded at every sampling event.

Total phosphorus (TP)

TP concentrations were generally within the ANZG (2018) guideline levels. Elevated concentrations were observed at a few sites throughout the monitoring program. A total of 5 sites recorded a median TP concentration in exceedance of the ANZG (2018) default guidelines level.

All sites recorded median concentrations of TP below both the short-term and long-term reduction target levels identified for the Bayswater Brook catchment in the *Swan Canning Water Improvement Plan* (SRT 2009), aside from BWMD24 which exceeded the long-term target.

Soluble reactive phosphorus (SRP)

SRP concentrations were generally within the guideline levels across the catchment. There were two sites that recorded medians in exceedance of the ANZG (2018) guideline level. This is an increase from no exceedances of median SRP in 2018-2019.

Summary results – Metals in water

Executive Figure 3 shows the monitoring locations within the Bayswater Brook catchment where 50% or more of the samples taken were in exceedances of their respective guidelines (Table 1, Table 3).

Aluminium (Al)

Soluble aluminium was elevated across the entire catchment, similar to the results of the previous surface water monitoring investigations. During the 2020 and 2021 monitoring program there 23 sites at which 50% or more of the samples taken were in exceedance of the ANZG (2018) toxicant trigger value for 95% level of species protection where the pH is above 6.5. There were 11 sites at which 50% or more of the samples were in exceedance of the ANZG (2018) recreational purposes guideline level.

Chromium (Cr)

Soluble chromium concentrations were generally low across the site. There were 3 sites that recorded an exceedance of the HMTV. BWMD16 exceeded the HMTV at all sampling events. All other sites did not exceed the HMTV on the majority of sampling occasions. This result has been observed at BWMD16 during the previous monitoring programs at the Bayswater Brook catchment.

Copper (Cu)

Two sites (BWMD24 and WELDSQUARE1) recorded exceedances of the HMTV at 50% or more of the samples taken in 2020-2021. No sites recorded exceedances of the HMTV at 50% or more of the samples taken in 2018-2019. Most of the exceedances recorded occurred in the month of July in both 2020 and 2021.

Lead (Pb)

Soluble lead concentrations during the 2020-2021 monitoring program were consistently below the HMTV at all sites. There was only 1 exceedance of the HMTV across the entire program (BWMD25, September 2020).

Nickel (Ni)

Soluble nickel concentrations during the 2020 and 2021 monitoring program were below the HMTV at all sites except two. BWMD16 was in exceedance of the HMTV at all sampling events across the monitoring period. BWMD02 recorded one exceedance in September 2021.

Zinc (Zn)

The soluble zinc concentration was elevated across the catchment. All sites were in exceedance of the HMTV at 50% or more of the samples taken during the 2020 and 2021 monitoring program. There was a total of 17 sites at which all samples taken were in exceedance of the HMTV; however, 2 of the sites were only sampled in July of each year.

Summary results – Metals in sediment

Sediment samples were taken from four sites (BWMD06, BWMD16, BWMD24 and BWMD26) that had been identified as having high metal concentrations in water during previous monitoring programs. Samples were taken during the September monitoring event of each year.

Aluminium (Al)

Aluminium in sediment did not exceed the adopted guideline during the 2020-2021 monitoring program.

Chromium (Cr)

Chromium in sediment did not exceed the ISQG low concentration of 80 mg/kg or the ISQG high concentration of 370 mg/kg in any sample during the 2020 and 2021 monitoring program.

Copper (Cu)

Copper in sediment did not exceed the ISQG low concentration of 65 mg/kg or the ISQG high concentration of 270 mg/kg in any sample during the 2020 and 2021 monitoring program. One exceedance was recorded in the 2018-2019 monitoring period.

Lead (Pb)

The concentration of lead in sediment was in exceedance of the ISQG low concentration value (50 mg/kg) at BWMD26 during September 2021 sampling event, but below the ISQG high concentration value (220 mg/kg). No other samples were in exceedance of the ISQG low or high concentration values during the 2020-2021 monitoring program.

Nickel (Ni)

The concentration of nickel in sediment was below the ISQG low concentration value of 21 mg/kg and the ISQG high concentration value of 52 mg/kg at all sites except BWMD16 during all sampling events. BWMD16 recorded one major exceedance of 390 mg/kg in September of 2021.

Zinc (Zn)

The concentration of zinc in sediment was notably elevated at BWMD26 at both the 2020 and 2021 sampling events. In 2020 the concentration reached 1,000 mg/kg and in 2021 the concentration reached 1,600 mg/kg; significantly higher than both the ISQG low concentration (200 mg/kg) and the ISQG high concentration (410 mg/kg). BWMD24 recorded one exceedance of the ISQG low concentration value in September of 2020 (210 mg/kg). All samples taken from the remaining sites were below the ISQG low and high concentrations.

Summary Results – Sites of concern

Based on all results, the following sites have been flagged as sites of concern. Parameters of note are listed alongside the sites. These are recommended to be closely monitored in future.

- BWMD02 (TN, NOx, SRP)
- BWMD06 (NH_x-N) (Al, Cu, Zn)
- BWMD09 (DO) (TP) (Al, Cr, Cu, Zn)
- BWMD15 (Al, Zn)
- BWMD16 (TN, NOx) (Al, Cr, Ni, Zn)
- BWMD24 (DO) (TP, SRP) (Cu, Zn)
- BWMD26 (TN, NOx, TP) (Zn)
- WELDSQUARE1 (Al, Cu, Zn)

Table 1 - Number of samples exceeding the water quality guidelines in 2020

		Water Quality Trigger Value			DWER Interim Guideline
Measurement	**Parameter**	**Lowland River**	**Freshwater 95% Protection**	**Recreational**	
Physical[1]	pH	47	NA	NA	NA
	Dissolved Oxygen	55	NA	55	NA
	Total Suspended Solids	NA	NA	NA	14
	Conductivity	85	NA	NA	NA
Nutrients[1]	Total Nitrogen	12	NA	NA	NA
	Total Oxidised Nitrogen	33	NA	71	NA
	Ammonia-Ammonium	56	NA	NA	NA
	Total Phosphorus	19	NA	NA	NA
	Soluble Reactive	7	NA	NA	NA
Soluble Metals[2]	Aluminium	NA	69	23	NA
	Chromium*	NA	5	NA	NA
	Copper*	NA	9	NA	NA
	Lead*	NA	2	NA	NA
	Nickel*	NA	3	NA	NA
	Zinc*	NA	69	NA	NA

Key

1	Number of water samples exceeding trigger value out of 85
2	Number of water samples exceeding trigger value out of 80
NA	Not applicable
*	Trigger value adjusted according to water hardness

Table 2 - Number of samples exceeding the sediment quality guidelines in 2020

		Sediment Quality Trigger Value (ANZG 2018)		Canadian Sediment Quality Guideline (Canadian Council of Ministers of the Environment 2002)
Measurement	**Parameter**	**DGV**	**GV-high**	
Metals[1]	Aluminium	NA	NA	0
	Chromium	0	0	NA
	Copper	0	0	NA
	Lead	0	0	NA
	Nickel	0	0	NA
	Zinc	2	1	NA

Key

1	Number of sediment samples exceeding trigger value out of 4
NA	Not applicable

Table 3 - Number of samples exceeding the water quality guidelines in 2021

		Water Quality Trigger Value			DWER Interim Guideline
Measurement	**Parameter**	**Lowland River**	**Freshwater 95% Protection**	**Recreational**	
Physical[1]	pH	27	NA	NA	NA
	Dissolved Oxygen	51	NA	51	NA
	Total Suspended Solids	NA	NA	NA	17
	Conductivity	89	NA	NA	NA
Nutrients[1]	Total Nitrogen	13	NA	NA	NA
	Total Oxidised Nitrogen	66	NA	NA	NA
	Ammonia-Ammonium	21	NA	59	NA
	Total Phosphorus	18	NA	NA	NA
	Soluble Reactive	4	NA	NA	NA
Soluble Metals[2]	Aluminium	NA	77	27	NA
	Chromium*	NA	4	NA	NA
	Copper*	NA	15	NA	NA
	Lead*	NA	1	NA	NA
	Nickel*	NA	4	NA	NA
	Zinc*	NA	77	NA	NA

Key

1	Number of water samples exceeding trigger value out of 89
2	Number of water samples exceeding trigger value out of 82
NA	Not applicable
*	Trigger value adjusted according to water hardness

Table 4 - Number of samples exceeding the sediment quality guidelines in 2021

		Sediment Quality Trigger Value (ANZG 2018)		Canadian Sediment Quality Guideline (Canadian Council of Ministers of the Environment 2002)
Measurement	**Parameter**	**DGV**	**GV-high**	
Metals[1]	Aluminium	NA	NA	0
	Chromium	0	0	NA
	Copper	0	0	NA
	Lead	1	0	NA
	Nickel	1	1	NA
	Zinc	1	1	NA

Key

1	Number of sediment samples exceeding trigger value out of 4
NA	Not applicable

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Figure A1 - Physico-chemical exceedances (2020-2021)

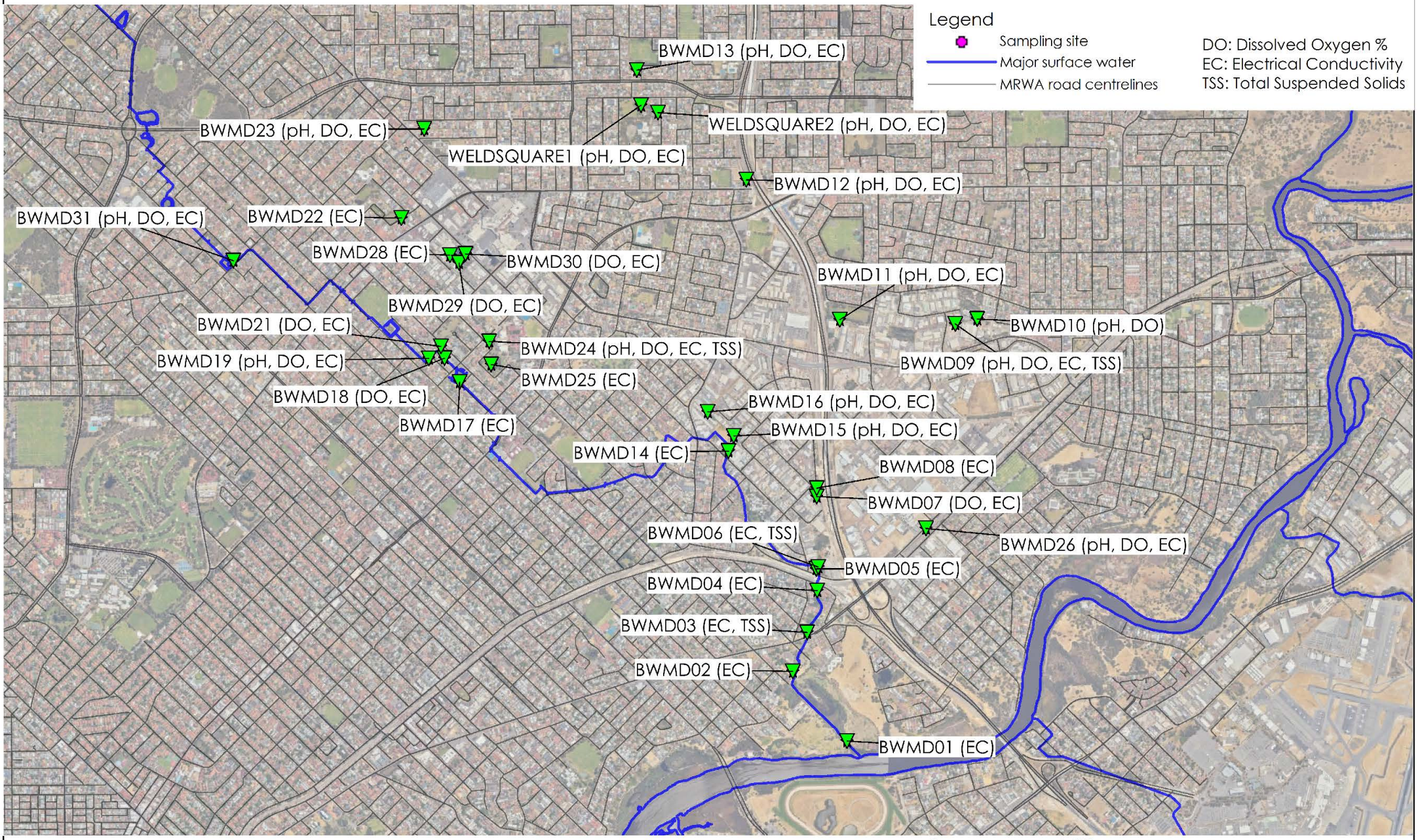

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Figure A2 - Nutrient exceedances (2020-2021)

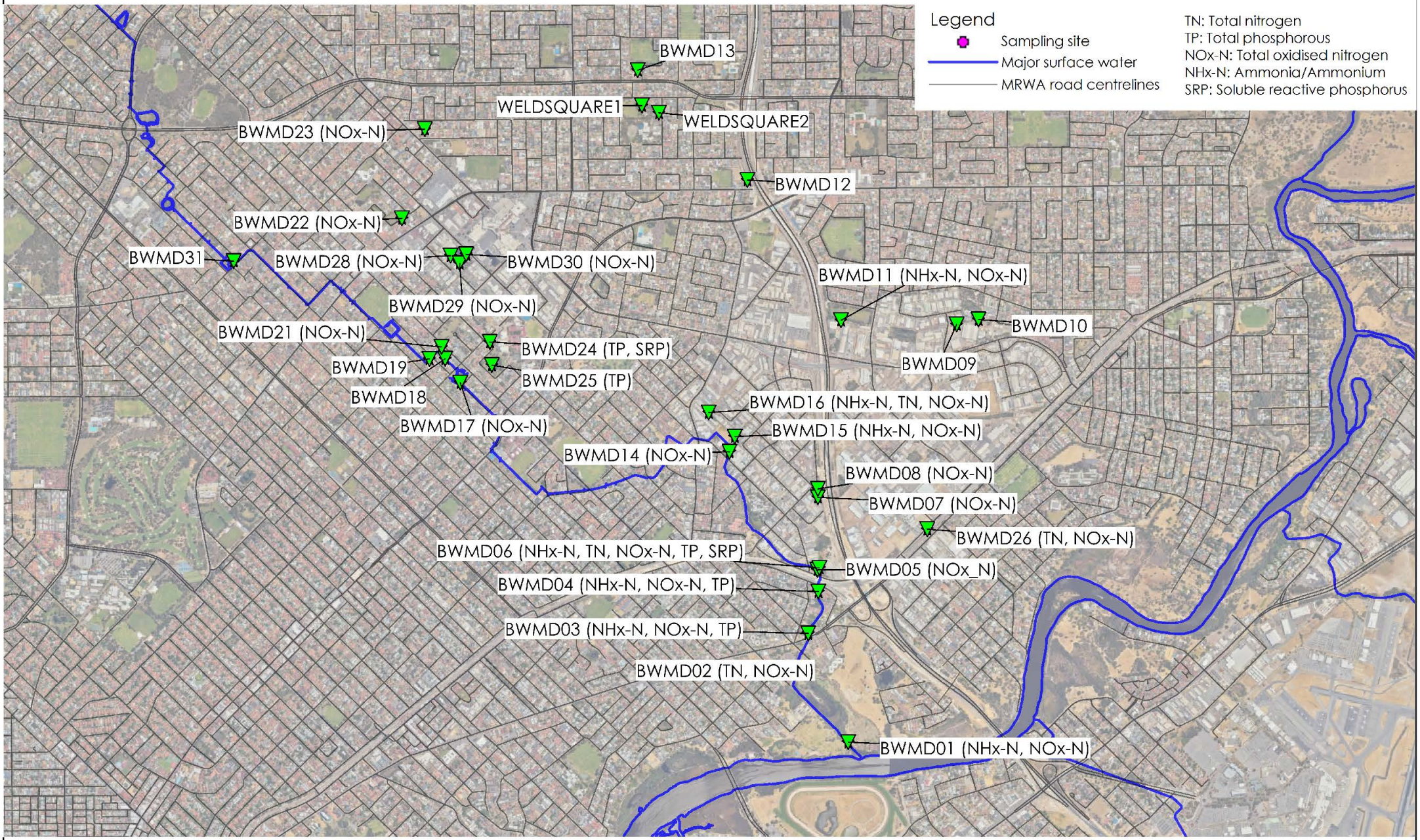

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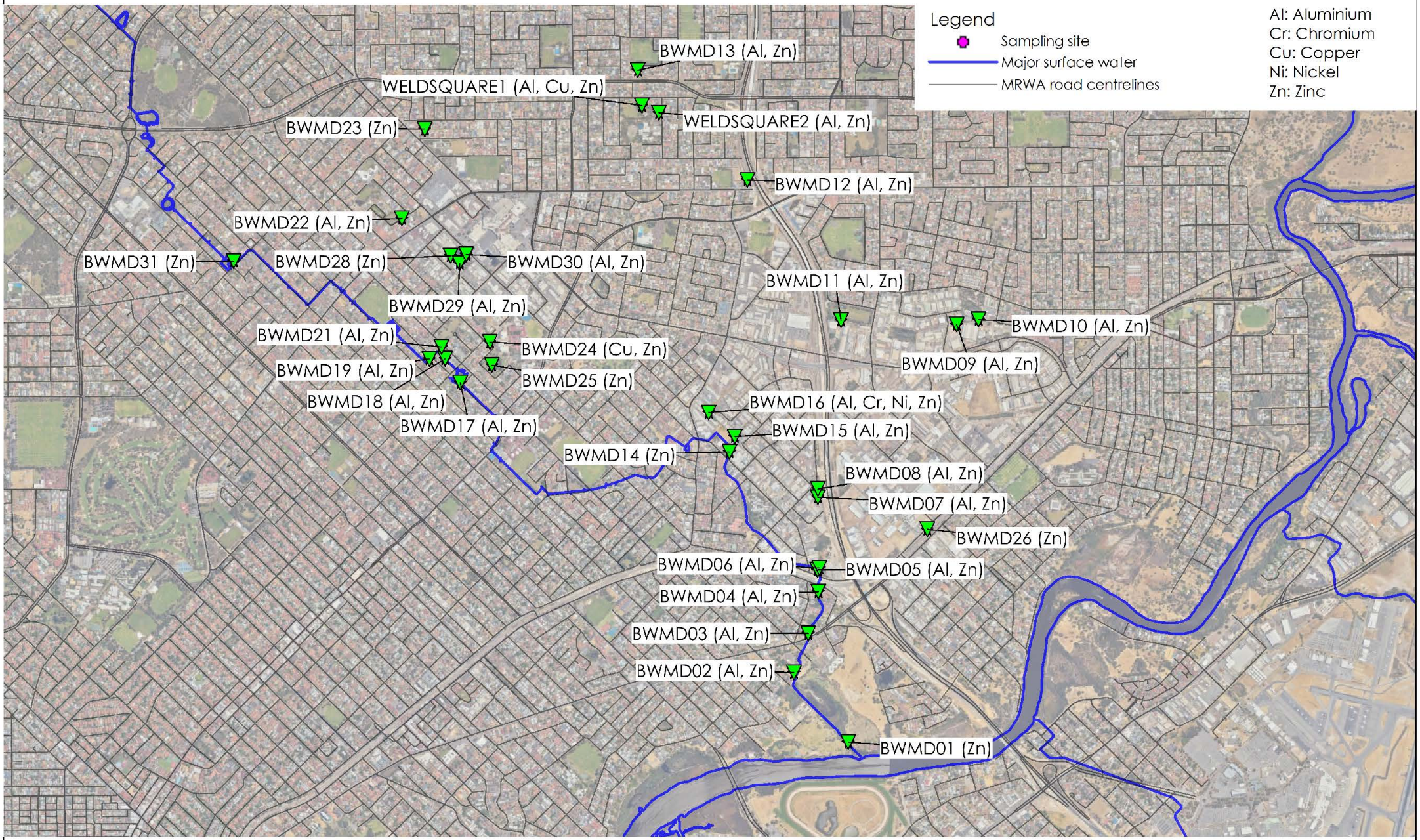
Figure A3 - Soluble metal exceedences (2020-2021)



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1 INTRODUCTION

1.1.1 Bayswater Brook

The Bayswater Brook (formerly Bayswater Main Drain) is a large drainage network with a catchment of 27,000 ha. It is the largest urban catchment in the Perth Metropolitan area and discharges into the Swan River. It is a permanently flowing drainage network that features both open drainage and piped drainage along its length.

Historically, the lower end of the drain was a natural watercourse linking minor waterways throughout the catchment before flowing into the Swan River. In the 1920s the brook was modified for use as a drainage system to enable development of the area. The Bayswater Brook intercepts groundwater to prevent flooding of low-lying areas and receives stormwater from surrounding local government stormwater drainage systems.

The dominant land use in the Bayswater Brook catchment is residential, with an additional large industrial area and several commercial zones, schools and sporting fields.

1.1.2 Water Quality Monitoring Program

Regular water quality monitoring within the Bayswater Brook catchment began in 2006. The monitoring program has been altered since commencement on the basis of recommendations from the summary reporting. An overview of the monitoring program includes;

- 2006: The Department of Water implemented a quarterly monitoring program at three sites within the Bayswater Brook
- 2007-2009: A once-off snapshot of water Bayswater Brook was conducted in July 2007, August 2008 and September 2009 to determine the location of pollution hotspot within the catchment that may be contributing to the contamination within the Bayswater Brook and Swan River.
- 2010: Sampling frequency increased to three times a year for greater temporal coverage and a more detailed profile of the catchment water quality.
- 2011: Changes made to the sample sites and suite of monitoring parameters.
- 2012-2015: Sediment sampling was included at four hot spot sites for the same suite of metals analysed in surface water sampling.
- 2016: 6 new sites were added to the program to increase the sampling profile within the catchment.
- 2017: The monitoring program was continued from 2016.
- 2018: The monitoring program was continued from 2017.
- 2019: The monitoring program was continued from 2018.
- 2020 & 2021: The monitoring program was continued unchanged from 2019.

1.2 Purpose of this report

The purpose of this report is to interpret the 2020-2021 water and sediment quality monitoring results from the Bayswater Brook catchment. An overview of historic trends in water quality is also provided to inform management actions that improve the ecological function of the drainage network.

2 METHODOLOGY

2.1 Sampling method

Surface water and sediment samples were collected in accordance with the *Sampling and Analysis Plan; Bayswater Brook Water and Sediment Quality Monitoring 2020* (Urbaqua 2020), *Sampling and Analysis Plan; Bayswater Brook Water and Sediment Quality Monitoring 2021* (Urbaqua 2021) (the SAPs), and in accordance with the Department of Water and Environmental Regulation (DWER) standards and protocols.

The following sections summarise the monitoring sites, monitoring frequency, monitoring parameters and quality control procedures for the entire program.

2.2 Site selection

There are 31 sites across the catchment area. These sites have been selected such that:

- They are located up and downstream of potential pollution sources;
- They are located up and downstream of rehabilitation projects;
- They will provide baseline data for a small branch of the main drain; and,
- They are generally representative of that section of the catchment.

Error! Reference source not found. provides a description and the coordinates of each site with locations illustrated in Figure 1.

Table 5: Bayswater Brook catchment sampling sites

WIN Site code	Drain section	Location	Easting	Northing
BWMD01	Memorial Road Bayswater	Open drain: Riverside gardens, downstream of bird sanctuary wetland, 10 m downstream of footbridge	398393.8	6466808.1
BWMD02	King William St Bayswater	Open drain: Before confluence of King William St branch drain with main drain	398011.0	6467301.6
BWMD03	Guildford Road Bayswater	Open drain: Downstream of confluence with Railway Pde branch drain	398111.1	6467578.2
BWMD04	Whatley Cr Bayswater	Open drain: Upstream of confluence with Railway Pde branch drain	398182.8	6467874.2
BWMD05	Railway Pde Bayswater	Open drain: Durham Rd branch drain, before confluence with main drain	398176.8	6468028.8
BWMD06	Tonkin Hwy (west) Bayswater	Open drain: Upstream of Durham Road branch drain	398191.1	6468042.0
BWMD07	Mooney St Bayswater	Wetland: Outlet from wetland to main drain, on south western edge of wetland (drive in)	398179.8	6468541.2
BWMD08	Bassendean Rd Bayswater	Open drain: Upstream of inlet into Mooney St wetland	398179.8	6468600.0

WIN Site code	Drain section	Location	Easting	Northing
BWMD09	Fairford St Bassendean	Open drain – living stream: Downstream of revegetation site, upstream of pipe under Fairford St	399162.7	6469764.2
BWMD10	Fairford St Bassendean	Open drain – living stream: Upstream of revegetation site, from Scaddan St	399317.7	6469799.3
BWMD11	Shalford St Bassendean	Open drain: Joan Rycroft reserve, from most downstream point (straight forward from park entrance)	398343.7	6469793.4
BWMD12	Tonkin Hwy (north) Embleton	Open drain: Downstream of confluence with drains from Elstead reserve (access at end of Walter Rd)	397680.4	6470785.8
BWMD13	Waltham Wy Morley	Downstream of basin adjacent to Waltham reserve, upstream of piping under Morley Drive	396904.4	6471563.6
BWMD14	Clavering Rd Bayswater	Open drain: Northern side of Clavering Rd, upstream of piped section under Clavering Rd	397555.2	6468862.6
BWMD15	James St Bayswater	Open drain: Before weir and confluence with northern branch of drain	397591.4	6468970.5
BWMD16	Christian St Bayswater	Open drain: Northern branch of drain, sample from King St	397407.6	6469140.5
BWMD17	Catherine St Morley	Wetland (Brown's Lake): Outlet from wetland into main drain on southern side of wetland	395649.7	6469351.8
BWMD18	Gummery St Morley	Open drain: Downstream of confluence of 2 branching drains	395542.9	6469521.0
BWMD19	Lawrence Rd Bedford	Open drain: At most downstream section of drain	395431.3	6469520.8
BWMD21	Coode St Morley	Open drain: At most downstream section of drain	395517.1	6469605.2
BWMD22	Jakobsens Way Dianella	Open drain: Adjacent to Jakobsens reserve, from footbridge	395236.4	6470514.1
BWMD23	Vera St Morley	Open drain: Most downstream point	395398.1	6471145.5
BWMD24	Drake Way Morley	Open drain: Upstream of inlet with Nora Hughes Lake, adjacent to intersection with Catherine St	395858.5	6469640.7
BWMD25	Drake Way Morley	Wetland: Outlet pipe from Nora Hughes wetland	395871.8	6469477.1
BWMD26	Railway Pde Bayswater	Open drain: Downstream of CSBP fertiliser site on Railway pde branch drain (Railway crossing)	398954.8	6468314.6
BWMD28	Russell St Morley	Wetland opposite Bunnings: Inlet in western corner	395581.4	6470251.2

WIN Site code	Drain section	Location	Easting	Northing
BWMD29	Russell St Morley	Wetland opposite Bunnings: Outlet in southern corner	395645.4	6470197.2
BWMD30	Russell St Morley	Wetland opposite Bunnings: Inlet in eastern corner	395691.3	6470259.7
BWMD31	Pola St Dianella	Open drain: Drain outlet from compensation basin at corner of Pola St and Surrey St	394046.4	6470212.5
WELDSQUARE1	Fitzgerald Rd Morley	Weld Square Living Stream: Inlet in northern corner	396934.5	6471313.6
WELDSQUARE2	Clarke Rd Morley	Weld Square Living Stream: outlet in eastern corner	397055.1	6471261.8

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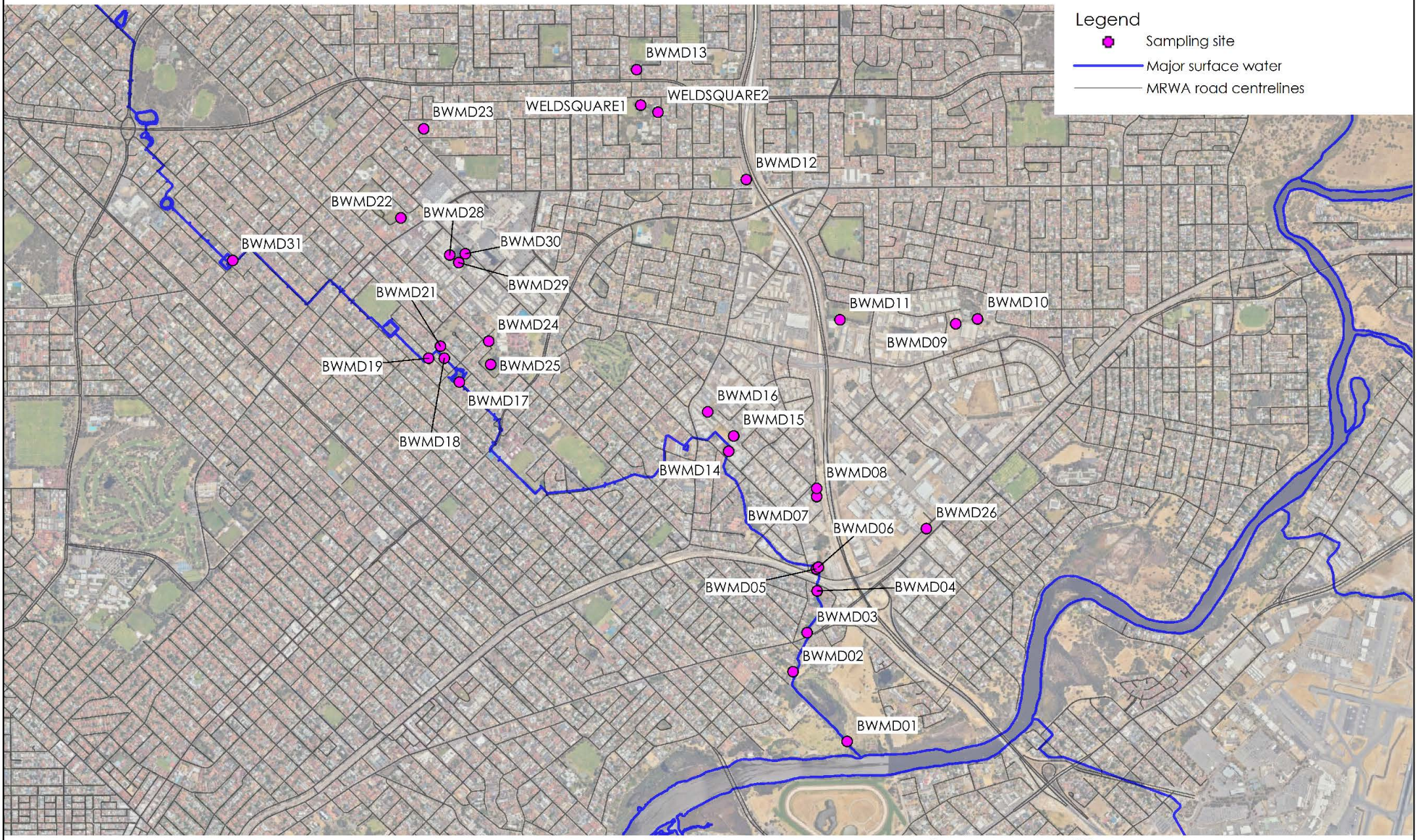
Figure 1 - Sampling locations



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2.3 Monitoring frequency

Surface water and sediment samples were collected monthly over a three-month period in both 2020 and 2021 in accordance with the SAPs. Sampling was conducted by appropriately trained City of Bayswater, Department of Water and Environmental Regulation (DWER) and Department of Biodiversity, Conservation and Attractions (DBCA) staff.

2.3.1 Monitoring Status – 2020-2021

For the monitoring year 2020, sampling was completed on the following dates:

- 1st and 2nd of July
- 5th and 6th of August
- 2nd and 3rd of September

For the monitoring year 2021, sampling was completed on the following dates:

- 21st and 22nd of July
- 18th and 19th of August
- 15th and 16th of September

2.3.2 Missed samples

Sampling was attempted from each of the 31 sample sites during the 2020 and 2021 monitoring programs. BWMD20 was removed as it was found to be consistently dry and BWMD27 was removed due to lack of access. BWMD30 was only sampled on one occasion and was found to be mostly dry on other occasions.

2.4 Water and sediment quality parameters

2.4.1 In situ water samples

Water samples were measured *in situ* for the following parameters:

- pH;
- Dissolved oxygen;
- Electrical conductivity; and,
- Temperature.

2.4.2 Water and sediment samples for laboratory analysis

Analyses of surface water and sediment samples were undertaken by the ChemCentre, which is accredited by the National Association of Testing Authorities (NATA) for the required analyses. Parameters and limits of reporting (LOR) for surface water and sediment samples are listed in

Table 6: Surface water and sediment sample parameters and limits of reporting (LOR)2.

Table 6: Surface water and sediment sample parameters and limits of reporting (LOR)

Water samples	Laboratory limit of reporting (LOR)
Parameter	**ChemCentre LOR**
Physico-chemical	
Total suspended solids	1.0
Total water hardness	1.0
Nutrients	
Total nitrogen	0.025
Total organic nitrogen	0.025
Total oxidised nitrogen	0.01
Nitrogen as ammonia/ammonium	0.01
Dissolved organic nitrogen	0.025
Total phosphorus	0.005
Soluble reactive phosphorus	0.005
Metals	
Aluminium – total and soluble	0.005
Chromium – total and soluble	0.0001
Copper - total and soluble	0.0001
Lead - total and soluble	0.0001
Nickel - total and soluble	0.0005
Zinc - total and soluble	0.005/0.001
Sediment samples	
Moisture	0.1
Aluminium	10
Chromium	0.05
Copper	0.1/0.5
Lead	0.5
Nickel	0.1
Zinc	5/0.25

2.5 Quality assurance and quality control measures

The City of Bayswater maintains a SAP for the Bayswater Brook monitoring program that is reviewed on an annual basis. Sampling procedures for surface water and sediment are in place and comply with Australian Standards. Details of the quality assurance and quality control measures are defined in the SAP, including:

- Field parameter sampling procedures (including replicates and field blank requirements).
- Sample collection and storage techniques.
- Sample labelling and chain of custody procedures; and
- Laboratory in-house quality assurance/quality control procedures.

Sampling was conducted by appropriately trained City of Bayswater and Department of Water and Environmental Regulation staff.

2.6 Guideline values and toxicant trigger values

The selection of assessment criteria for water and sediment quality results is determined by a number of factors including;

- The environmental value (EV) and level of protection of the water body and its receiving environment; and,
- The use of the water and water body.

While the Bayswater Brook catchment and drain are both highly modified ecosystems, the receiving environment is the Swan River which holds significant environmental value. From a water use perspective, the Bayswater Brook is not used for drinking or irrigation purposes, however it is open in many places and accessible to the public. The water quality results have therefore been compared to the recreational guidelines to account for risks to public health. The following criteria are used to assess the surface water quality:

- *Australian and New Zealand guidelines for freshwater and marine water quality* (ANZG 2018) where metals are compared to toxicant trigger values for a 95% level of species protection for freshwater ecosystems. The trigger value for aluminium is applied when the pH is greater than 6.5. Trigger values for cadmium, chromium, copper, lead, nickel and zinc in water require adjustment for hardness to reach a site-specific hardness modified trigger value (HMTV) as outlined in ANZG (2018).
- *Australian and New Zealand guidelines for freshwater and marine water quality* (ANZG 2018) for lowland rivers of south-western Australia, referred to as the default guideline values, which have been developed from regional datasets for ecosystems in the south-west of Western Australia.
- *Australian and New Zealand guidelines for recreational water quality and aesthetics* (ANZG 2018), referred to as the recreational purpose guidelines.
- *Swan Canning Water Quality Improvement Plan* (SRT 2009) for short and long-term nutrient targets.

The ANZG (2018) sediment assessment levels are referred to as the Interim Sediment Quality Guidelines (ISQGs). The guidelines have two concentrations, the ISQG-Low concentration (or trigger value) and the ISQG-High concentration, which represent a threshold concentration below which the frequency of adverse effects is expected to be low. The ISQG-High is intended as a trigger value above which adverse biological effects are expected to occur more frequently (DEC 2010).

3 RESULTS

This section summarises the results of the 2020-2021 Bayswater Brook monitoring program as well as the historical range and trends in water quality. Tables of the full results for water and sediment quality have been included in the Appendix.

3.1 Rainfall

Daily rainfall over the 2020-2021 monitoring period is shown in Figure 2 along with minimum and maximum daily temperatures recorded at the Bureau of Meteorology's Perth Metro station (station ref 9225). 2020-2021 sampling event dates are also indicated.

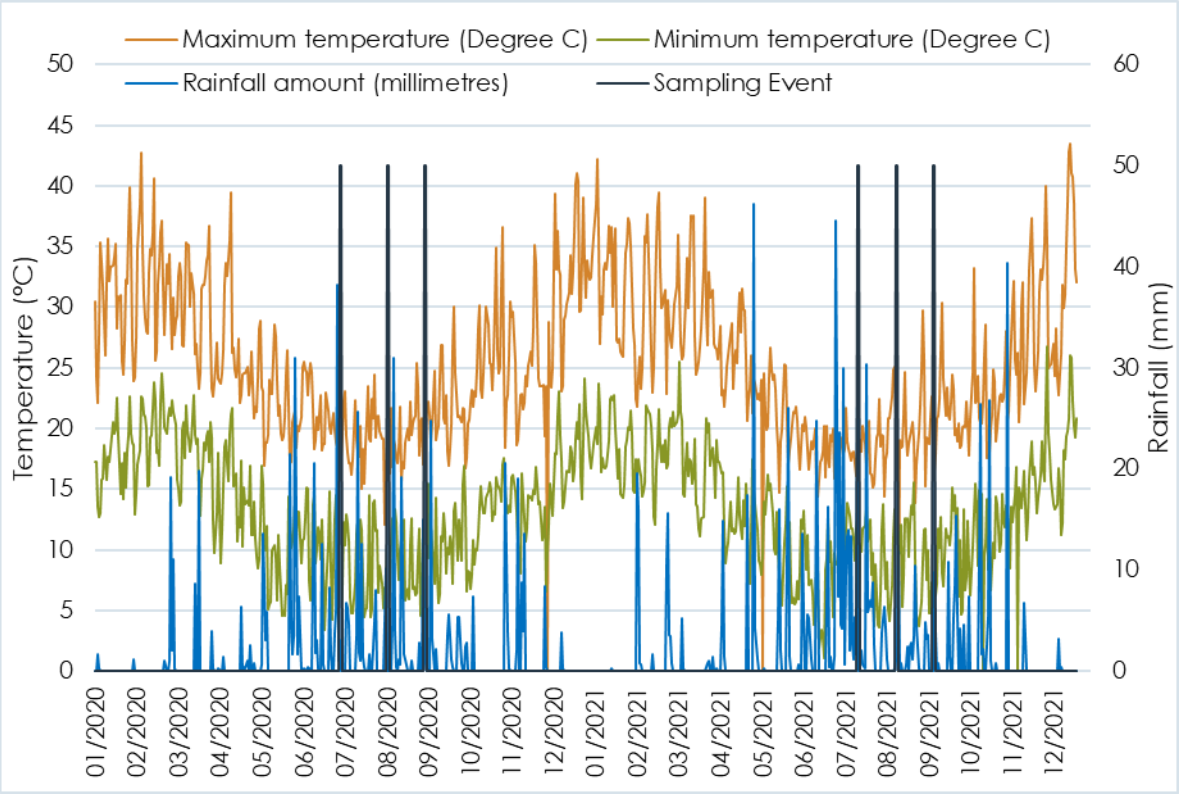


Figure 2: Daily rainfall and temperature recorded in the Perth Metropolitan area 2020-2021 (station ref. 9225) (BoM, 2022)

Table 7: Climate conditions preceding sample events

Sample date	Preceding conditions
2020 monitoring events	
1st and 2nd of July	49.0mm of rainfall were recorded in the four days prior to sampling. During sampling 3.0mm recorded on the 1st and no rainfall was recorded on the 2nd.
5th and 6th of August	15.0mm measured in the 4 days preceding the sampling. No rain was recorded during either event.
2nd and 3rd of September	17.8mm of rainfall were recorded in the four days prior to sampling. 5.8mm were recorded on the 2nd and 0.8mm were recorded on the 3rd.
2021 monitoring events	
21st and 22nd of July	10.8mm of rainfall were recorded in the four days prior to sampling. During sampling 29.6mm were recorded on the 21st and no rainfall was recorded on the 22nd.
18th and 19th of August	Unseasonably dry; 0.2 mm were recorded in the 4 days prior to sampling. During sampling 1.2mm were recorded on the 18th and 1.0mm were recorded on the 19th.
15th and 16th of September	Unseasonably dry; 3.6mm of rainfall was recorded in the 4 days preceding the sampling. No rainfall was recorded on the 15th and 9.8mm were recorded on the 16th.

3.2 Field record

Field observation forms include the detail of the flow conditions at the time of sampling and field observations of a site's condition. Copies of the field observation forms have been included in Appendix B.

3.3 Physico-chemical

All physico-chemical results from the 2020-2021 Bayswater Brook monitoring program have been included in Appendix A. The following sections describe the notable results. Discussion of results can be found in Section 5.1

3.3.1 pH

The ANZG (2018) default guideline range for pH for lowland rivers in south-western Australia is 6.5 – 8, while the ANZG (2018) recreational trigger value range is 6.5 – 8.5.

2020 Results

The pH recorded during 2020 ranged between a minimum of 5.31 at BWMD13 in August to 9.12 at BWMD25 in September (Figure 3). The general trend in pH across the sampling sites was neutral to slightly acidic with a mean of 6.48 and a median of 6.46. 46 of the 85 samples taken recorded a pH level less than 6.5 which makes 54% of the samples outside the ANZG (2018) guidelines acceptable range. One sample, BWMD225, lies above the guidelines with a peak pH of 9.12 in September. BWMD sites 9, 10, 11, 12, 13, 15, 16, 19, 23, 26 and 31, as well as both WELDSQUARE sites were outside of the acceptable range at all sampling events in 2020.

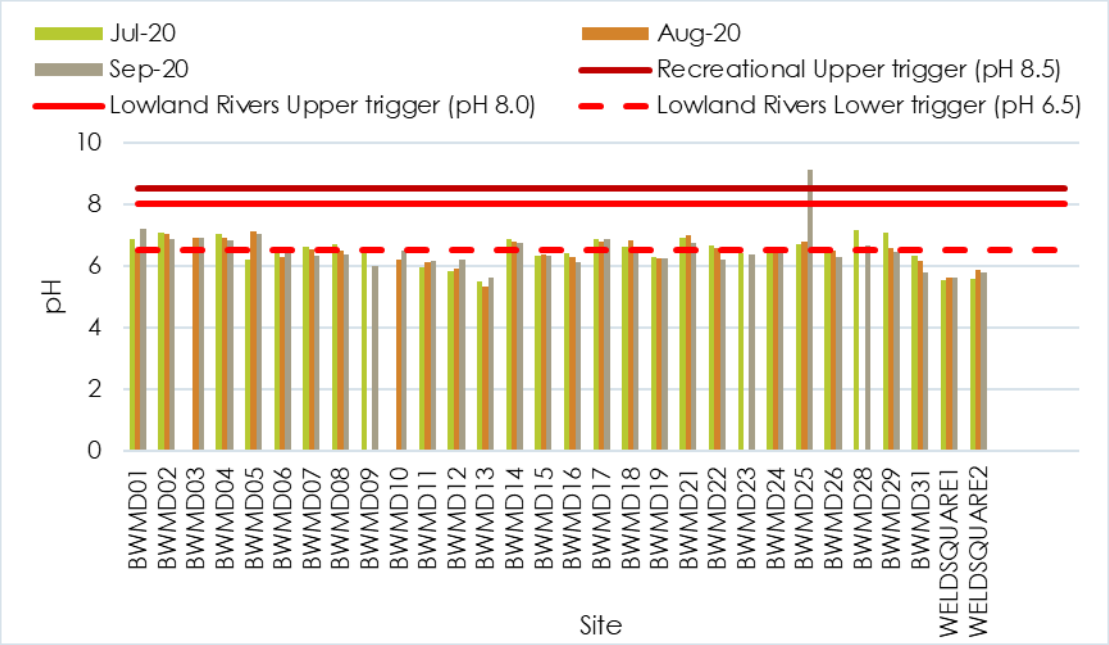


Figure 3: pH recorded at Bayswater Brook surface sampling sites 2020

2021 Results

The pH recorded during 2021 ranged between a minimum of 6.10 at BMWD10 in August to 7.47 at BWMD18 in September (Figure 4). The general trend in pH across the sampling sites was neutral to slightly acidic with a mean of 6.72 and a median of 6.66. 27 of the 89 samples (approximately 21%) were below the ANZG (2018) guidelines acceptable range. BWMD11 and WELDSQUARE02 were below ANZG (2018) guidelines during all 2021 sampling events.

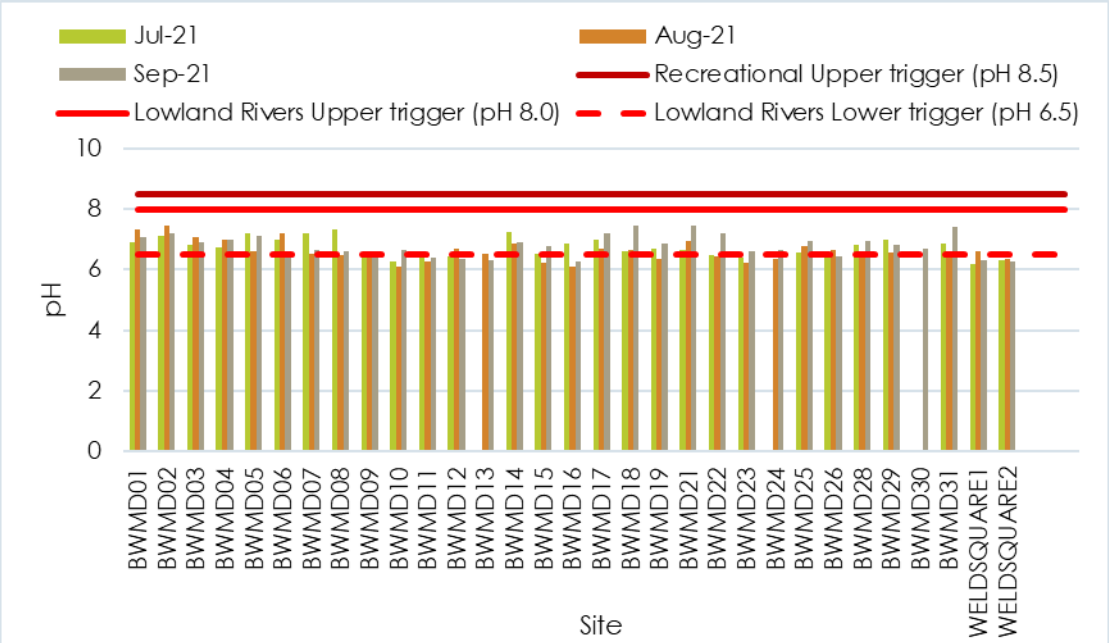


Figure 4: pH recorded at Bayswater Brook surface sampling sites 2021

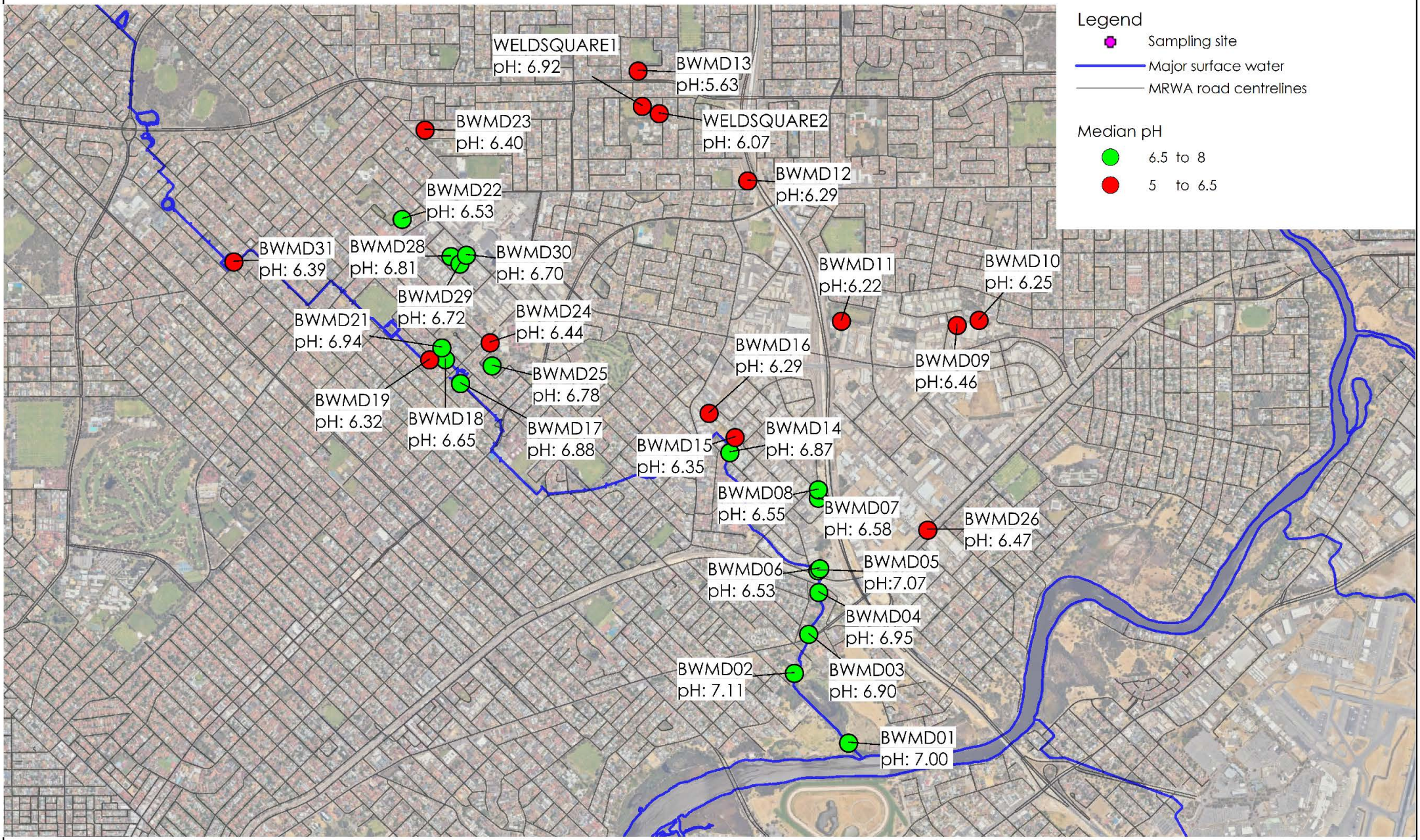
Table 8 shows a brief summary of the notable results from the in-situ pH sampling undertaken at the Bayswater Brook catchment over the 2020-2021 monitoring period.

Table 8: pH summary 2020-2021

pH results	Site
Median concentration of samples taken over 2020-2021 outside of ANZG (2018) acceptable range	BWMD09, BWMD10, BWMD11, BWMD12, BWMD13, BWMD15, BWMD16, BWMD19, BWMD23, BWMD24, BWMD26, BWMD31, WELDSQUARE1, WELDSQUARE2
Number of sites recording one or more exceedance of the default guideline range in 2020	21
Number of sites recording one or more exceedance of the default guideline range in 2021	16
Maximum pH	9.12 (BWMD13, August 2020)
Minimum pH	5.31 (BWMD25, September 2020)

City of Bayswater - Bayswater Brook water and sediment quality monitoring 2020-2021

Figure 5 - Median pH (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.3.2 *Electrical Conductivity (EC)*

The ANZG (2018) default guideline range for electrical conductivity (EC) in lowland rivers in south-west Australia is 0.12 mS/cm to 0.3 mS/cm.

2020 Results

During 2020, EC ranged from a minimum of 0.135 mS/cm at BWMD09 in July to a maximum of 0.938 mS/cm at BWMD26 in July (Figure 6). Aside from BWMD sites 09, 10, 24 and 25, all sites recorded an EC in exceedance of the ANZG (2018) guidelines acceptable range during all monitoring events.

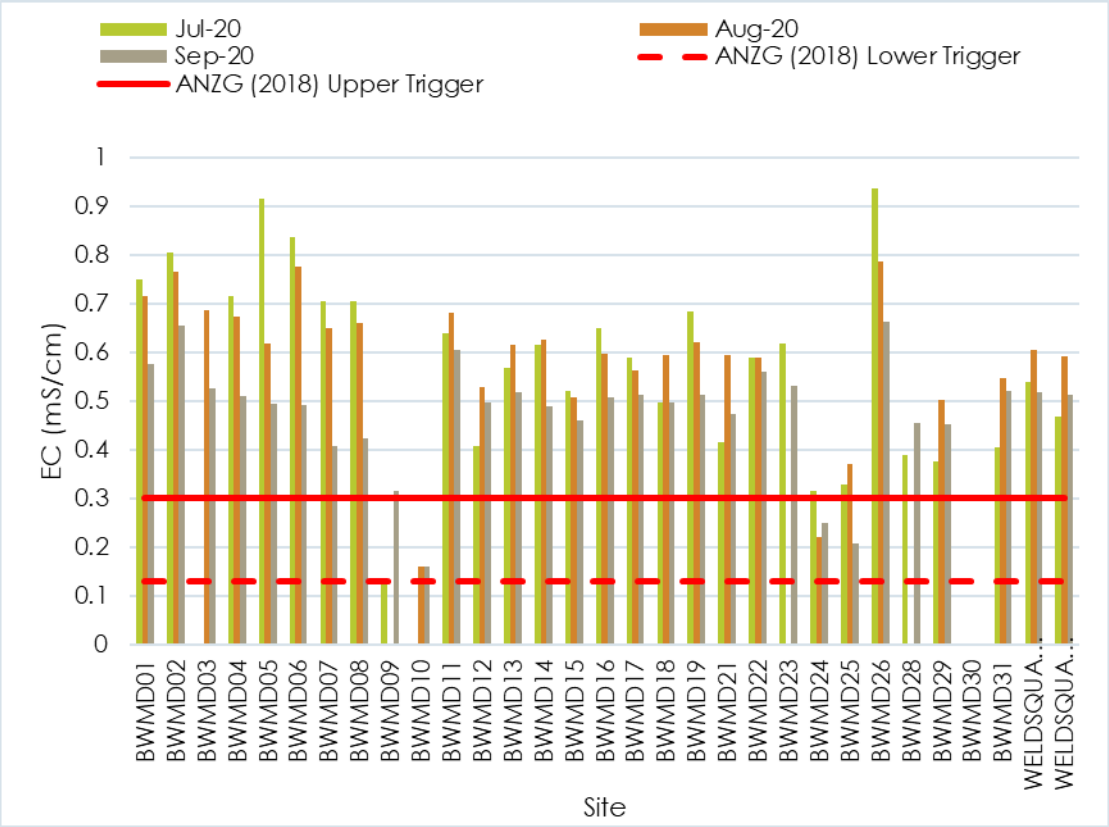


Figure 6: Electrical conductivity recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

During 2021, EC ranged from a minimum of 0.199 mS/cm at BWMD25 in July to 1.385 mS/cm at BWMD02 in July (Figure 7). Aside from sites 25 and 31, all sites recorded an EC in exceedance of the ANZG (2018) guidelines acceptable range during all monitoring events.

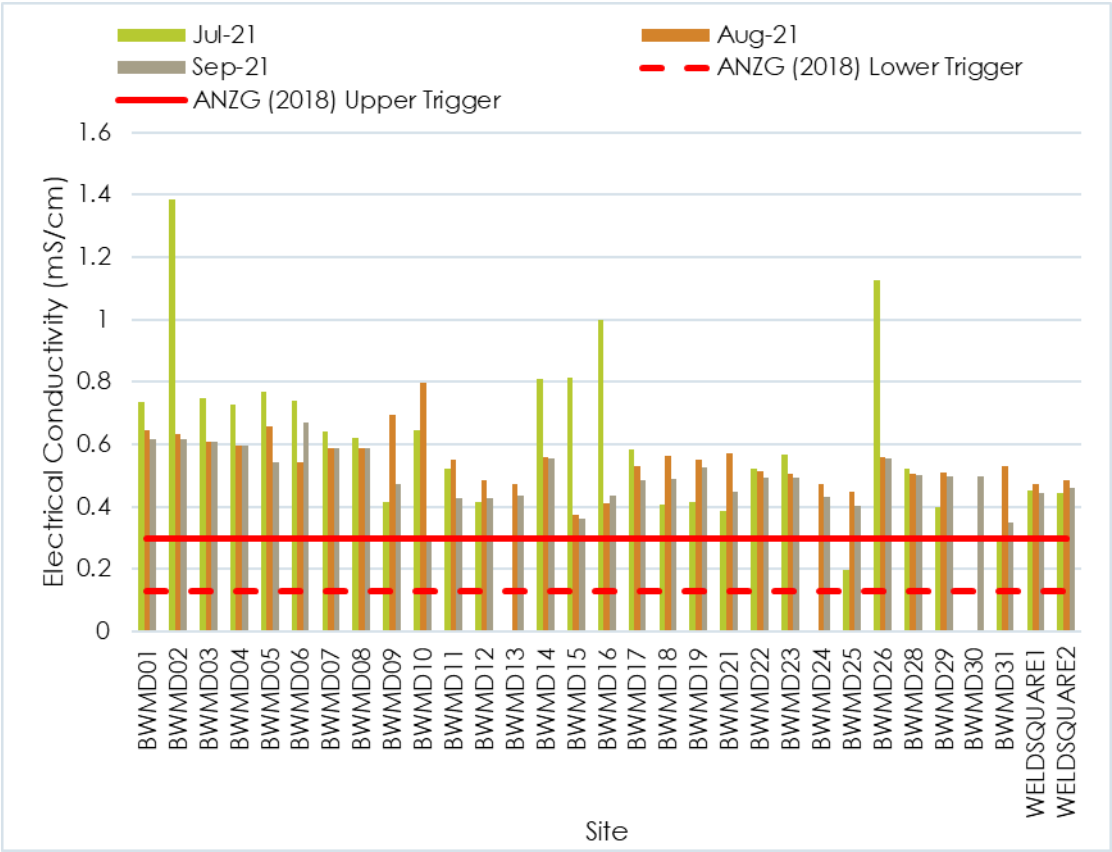


Figure 7: Electrical conductivity recorded at Bayswater Brook surface water sampling sites 2021

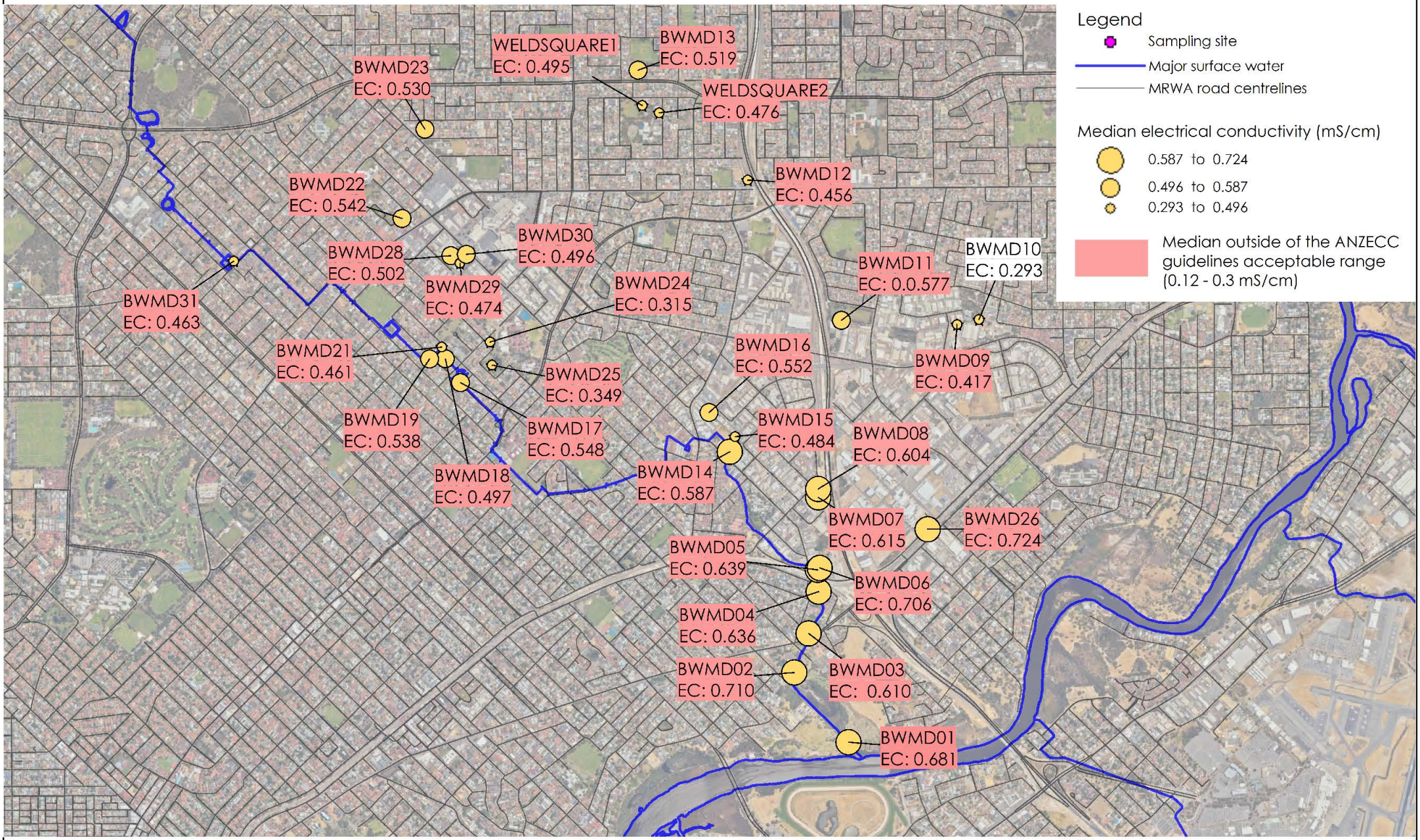
Table 9 shows a brief summary of the notable results from the in-situ EC sampling undertaken at the Bayswater Brook catchment over the 2020-2021 monitoring period.

Table 9: Electrical conductivity summary 2020-2021

Electrical conductivity results	Site
Median from samples taken during 2020-2021 outside of ANZG (2018) guidelines acceptable range	All except BWMD10
Number of sites recording one or more exceedance of the default guideline range in 2020	All except BWMD10
Number of sites recording one or more exceedance of the default guideline range in 2021	All
Maximum	1.385 mS/cm (BWMD02, July 2021)
Minimum	0.135 mS/cm (BWMD09, July 2020)

City of Bayswater - Bayswater Brook water and sediment quality monitoring 2020-2021

Figure 8 - Median Electrical Conductivity (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.3.3 *Dissolved oxygen saturation (DO)*

The ANZG (2018) default guideline range for dissolved oxygen saturation (DO%) for lowland rivers in south-west Western Australia is 80% to 120% saturation.

2020 Results

During 2020, DO saturations ranged from a minimum of 11.6% at BWMD10 in August to a maximum of 158.4% at BWMD25 in September. The majority of the sampling sites recorded DO saturations outside the ANZG (2018) guidelines acceptable range at the majority of the sampling events (Figure 9). All sites except BWMD 01, 02, 03, 04, 05, 08, 14, 15, 17 and 28 had a median saturation below the guideline range. BWMD25 was the only site with a saturation above the guideline range.

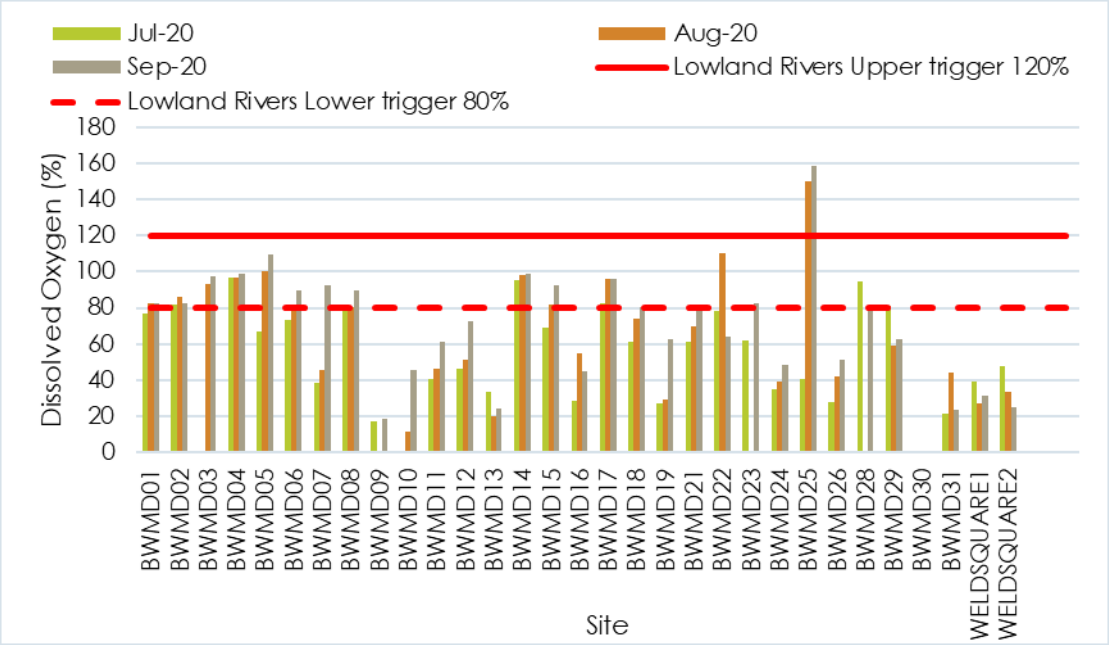


Figure 9: Dissolved oxygen saturation recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

During 2021, DO saturations ranged from a minimum of 17.8% at BWMD13 in August to a maximum of 109.9% at BWMD12 in September and BWMD17 in August. A majority of the sampling sites recorded DO saturations outside the ANZG (2018) guidelines acceptable range at a majority of the sampling events (Figure 10). All sites except BWMD 01, 02, 03, 04, 05, 06, 12, 14, 22 and 28 had a median saturation below the guideline range.

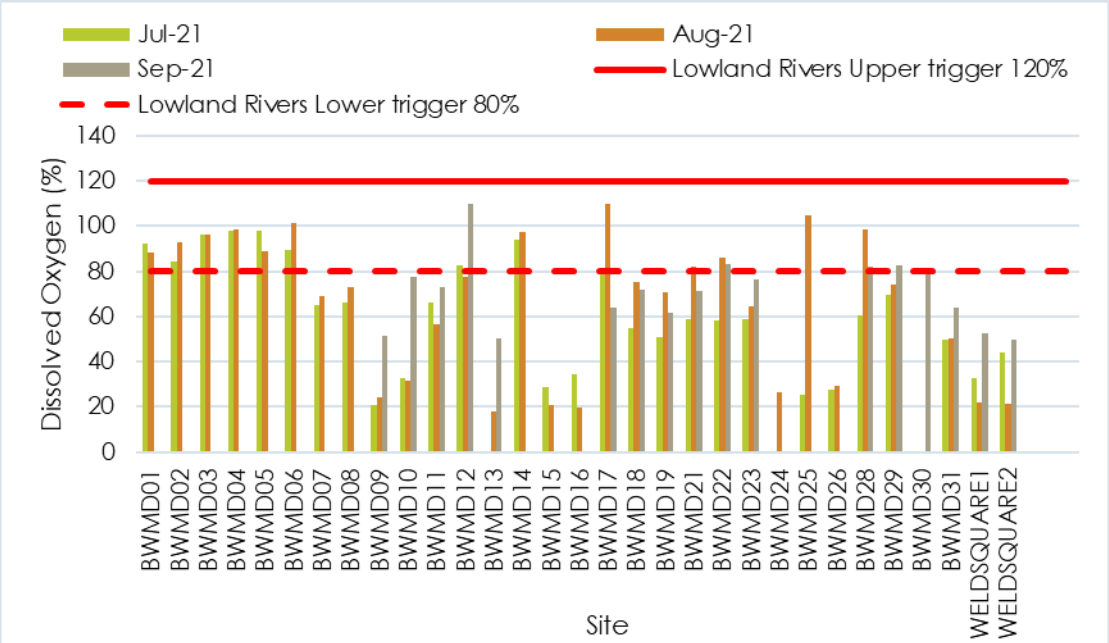


Figure 10: Dissolved oxygen saturation recorded at Bayswater Brook surface water sampling sites 2021

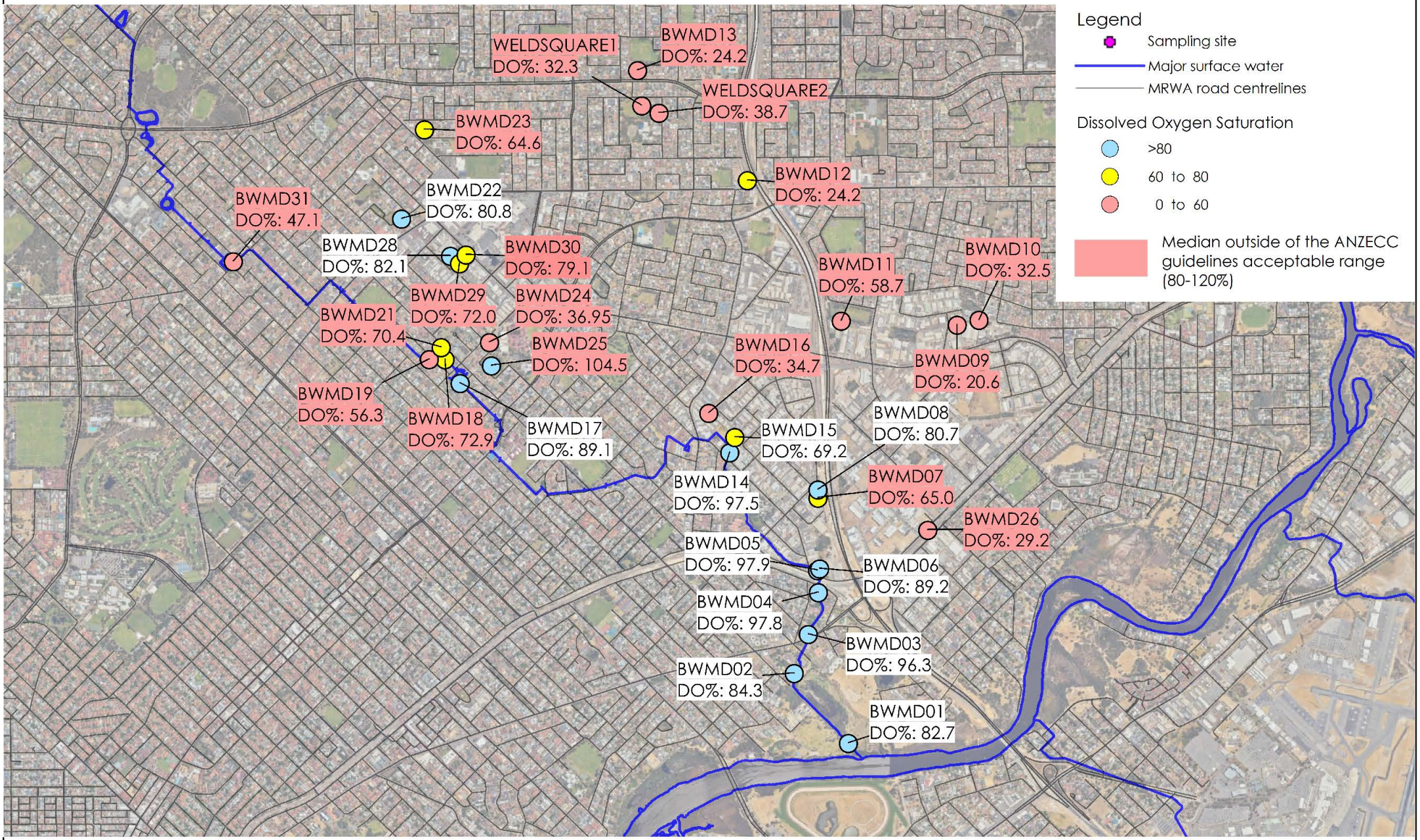
Table 10 provides a brief summary of the notable results from in-situ sampling of DO during the 2020-2021 monitoring program.

Table 10: Dissolved oxygen saturation results summary 2020-2021

Dissolved oxygen saturation results	Site
Sites with median dissolved oxygen saturation **within** the ANZG (2018) guidelines acceptable range from samples taken during 2020-2021	BMWD01, BMWD02, BMWD03, BMWD04, BMWD05, BMWD06, BMWD08, BMWD14, BMWD17, BMWD22, BMWD28
Number of sites recording one or more exceedance of the default guideline value in 2020	24
Number of sites recording one or more exceedance of the default guideline value in 2021	24
Maximum	158.4% (BWMD25, September 2020)
Minimum	11.6% (BWMD10, August 2020)

City of Bayswater - Bayswater Brook water and sediment quality monitoring 2020-2021

Figure 11 - Median Dissolved Oxygen Saturation (%) (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.3.4 Total Suspended Solids (TSS)

The Department of Water and Environmental Regulation (DWER) has an interim guideline for total suspended solids (TSS) of 6 mg/L.

2020 Results

TSS at the Bayswater Brook sampling sites were mostly below the DWER guideline level. However, a number of sites significantly exceeded the guideline level. BWDM sites 05, 06, 09, 13 and 24 along with WELDSQUARE1 all gave results above 10mg/L (Figure 12). Concentrations ranged from a minimum of <1 mg/L (the limit of reporting) at multiple sites and events, to a maximum of 28 mg/L at BWMD24 in August. BWDM sites 06, 09, 12, and 24 had median TSS concentrations in exceedance of the DWER guideline.

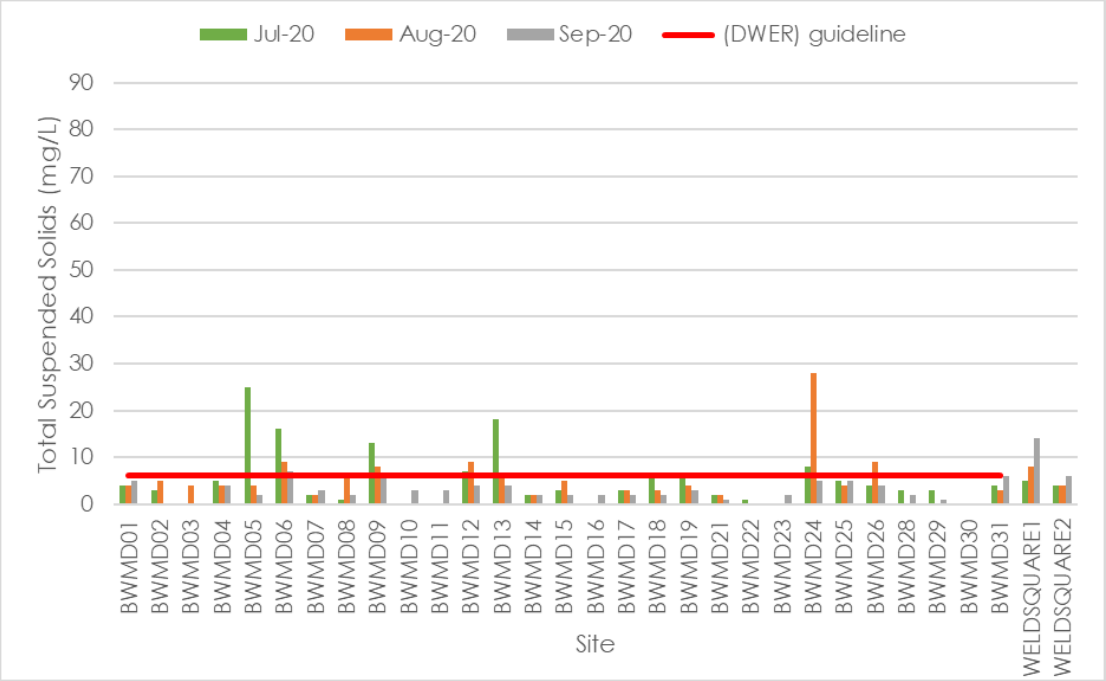

Figure 12: Total suspended solids concentration recorded at Bayswater Brook surface water sampling sites in 2020

2021 Results

Similar to 2020, TSS at the Bayswater Brook sampling sites were mostly below the DWER guideline level. However, a number of sites significantly exceeded the guideline level. BWDM sites 03, 04, 06, 09, 12, 24, 26 and 31 all gave results above 10mg/L (Figure 13). Concentrations ranged from a minimum of <1 mg/L (the limit of reporting) at multiple sites and events, to a maximum of 88 mg/L at BWMD06 in September. BWDM sites 03, 04, 06, 09, 24 and 26 had median TSS concentrations in exceedance of the DWER guideline.

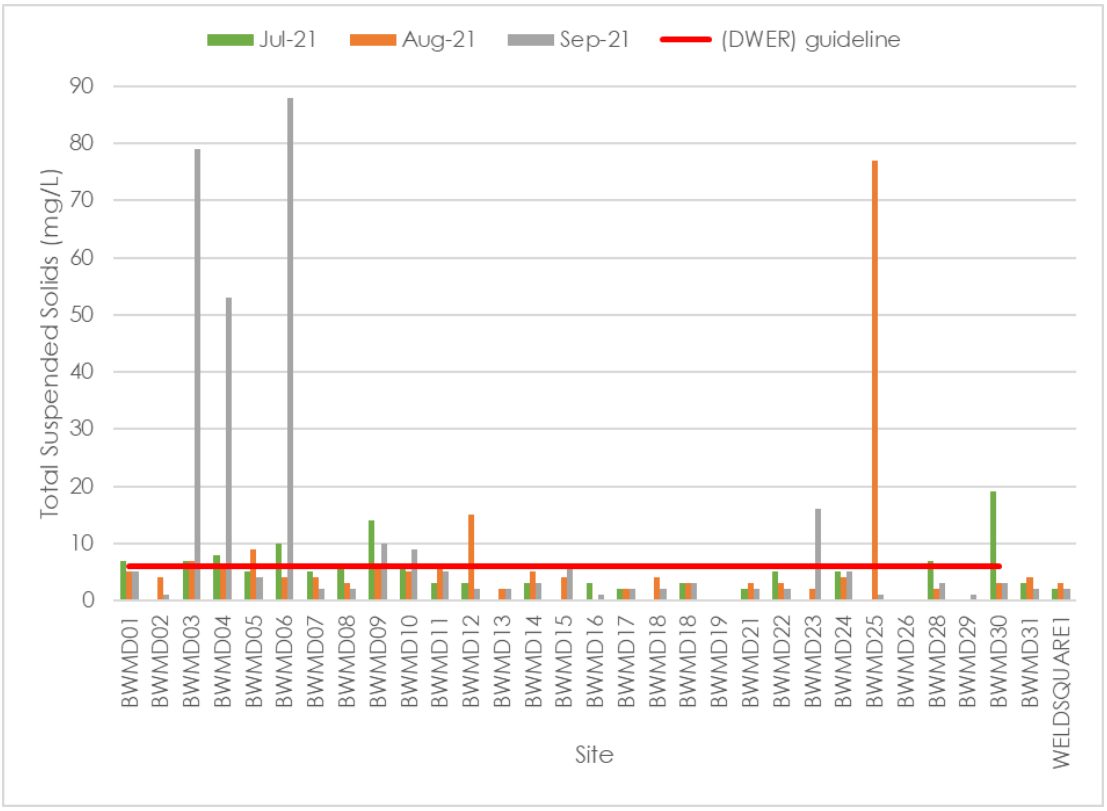

Figure 13: Total suspended solids concentration recorded at Bayswater Brook surface water sampling sites in 2021

Table 11 provides a summary of the notable results from laboratory TSS measurements during the 2020-2021 monitoring program.

Table 11: Total suspended solids results summary 2020-2021

Total suspended solids results	Site
Sites with median TSS concentrations in exceedance of the DWER interim guideline (6 mg/L) from samples taken during the 2020-2021 monitoring program.	BWMD03, BWMD06, BWMD09, BWMD24
Number of sites recording one or more exceedance of the default guideline value in 2020	8
Number of sites recording one or more exceedance of the default guideline value in 2021	12
Maximum	88 mg/L (BWMD06, September 2021)
Minimum	<1 mg/L July 2020: • BWMD11 August 2020: • BWMD22 September 2020: • BWMD02 • BWMD03 • BWMD22 July 2021: • BWMD02 • BWMD26

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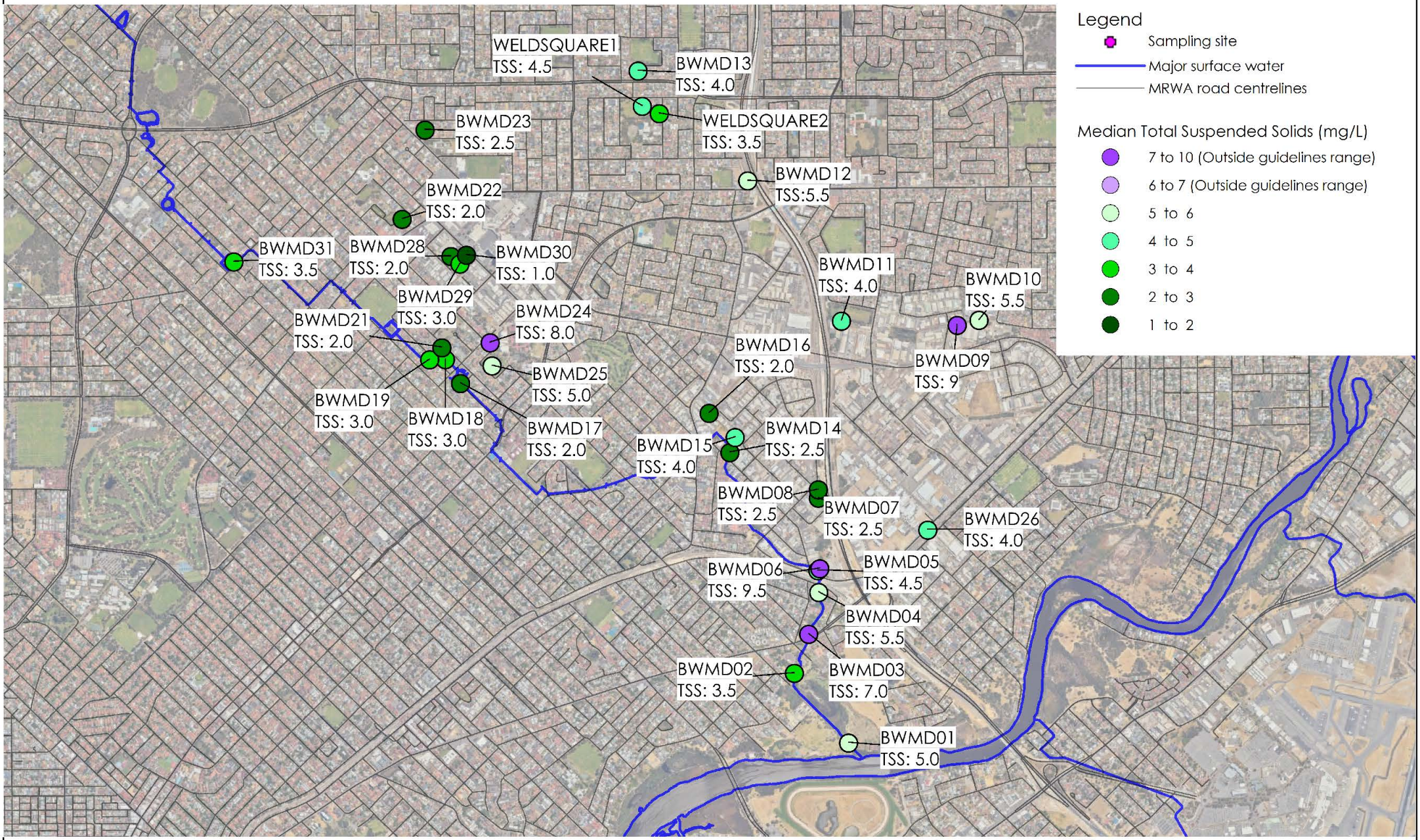
Figure 14 - Median Total Suspended Solids (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.4 Nutrients in Water

All nutrients in water results from the Bayswater Brook 2018-2019 monitoring program are included in Appendix A. Section 5.2 summarises the notable results.

3.4.1 Total Nitrogen (TN)

The ANZG (2018) default guideline value (DGV) for total nitrogen (TN) in lowland rivers in the south-west of Western Australia is 1.2 mg/L.

2020 Results

TN concentrations in 2020 ranged from a minimum of 0.4 mg/L at BWMD10 and BWMD24 in September to a maximum of 2.4 mg/L at BWMD16 in July (Figure 15). Sites BWMD02, BWMD06, BWMD16 and BWMD26 recorded median TN concentrations in 2020 above the ANZG guidelines level (1.2 mg/L).

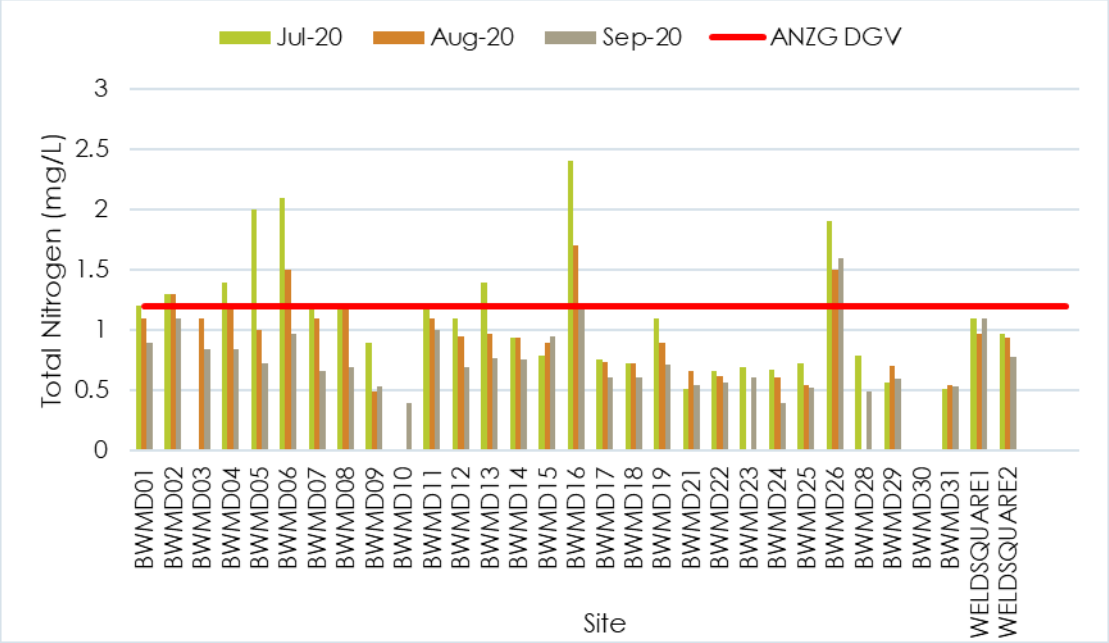


Figure 15: Total Nitrogen concentration recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

TN concentrations in 2021 ranged from a minimum of 0.45 mg/L at BWMD31 in September to a maximum of 2.6 mg/L at BWMD26 in July (Figure 16). Sites BWMD02, BWMD16 and BWMD24 recorded median TN concentrations above the ANZG guidelines level in 2021.

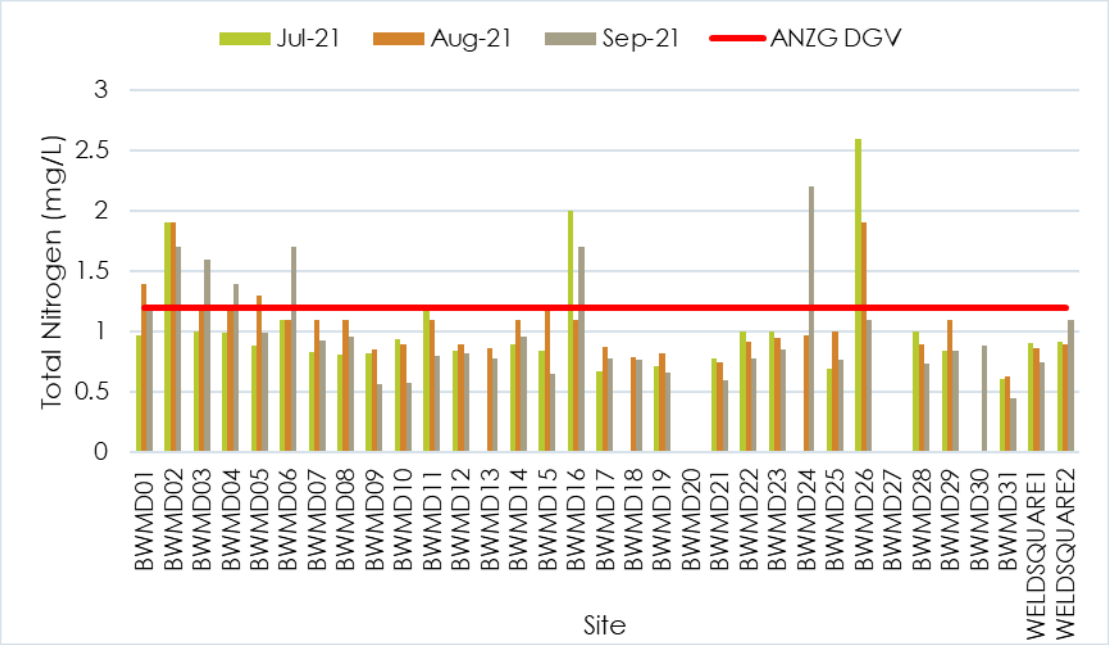


Figure 16: Total Nitrogen concentration recorded at Bayswater Brook surface water sampling sites 2021

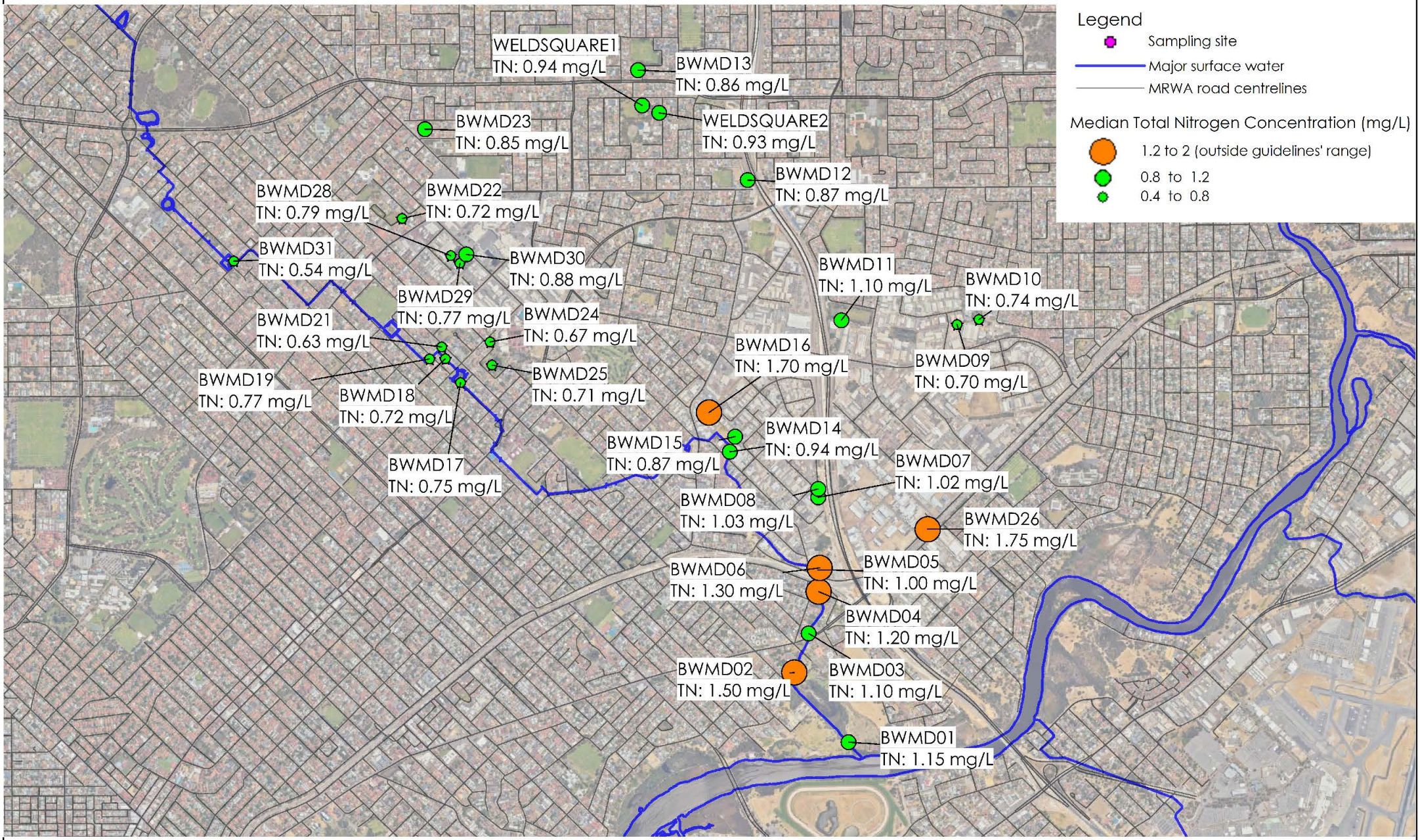
Table 12 provides a summary of the notable results from laboratory TN measurements during the 2020-2021 monitoring programs.

Table 12: Total nitrogen concentration results summary 2020-2021

Total nitrogen results	Site
Median TN concentration in exceedance of ANZG (2018) lowland rivers guideline (1.2 mg/L) from samples taken during 2020-2021	BWMD02, BWMD06, BWMD16, BWMD26
Number of sites recording one or more exceedance of the default guideline value in 2020	7
Number of sites recording one or more exceedance of the default guideline value in 2021	9
Maximum	2.6 mg/L (BWMD26, July 2021)
Minimum	0.40 mg/L (BWMD10 & BWMD24, September 2020)

City of Bayswater - Bayswater Brook water and sediment quality monitoring 2020-2021

Figure 17 - Median Total Nitrogen Concentration (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.4.2 *Total Oxidised Nitrogen (NOx)*

The ANZG (2018) default guideline value (DGV) for inorganic oxidised nitrogen (NO_x) for lowland rivers in south-west Western Australia is 0.15 mg/L.

2020 Results

NOx concentrations were elevated across a number of the sampling sites. Concentrations ranged from a minimum of 0.005 mg/L at several sites in August and BWMD25 in September to a maximum of 1.5 mg/L at BWMD16 in August. BWMD sites 01, 02, 03, 04, 05, 06, 07, 08, 11, 14, 16, and 26 were in exceedance of the ANZG (2018) guidelines level at all sampling sites in 2020. BWMD sites 01, 02, 03, 04, 05, 06, 07, 08, 11, 14, 15, 16 and 26 had median NOx concentrations in exceedance of the ANZG (2018) guideline level.

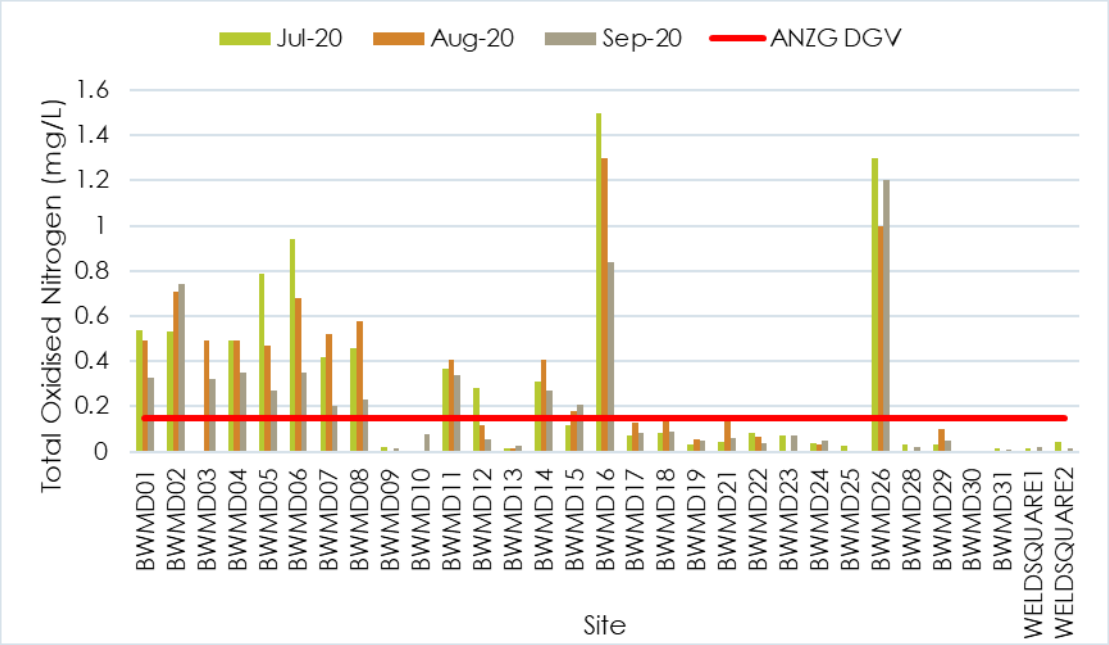

Figure 18: Total oxidised nitrogen concentration recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

NOx concentrations in 2021 followed a similar trend to 2020 with elevated concentrations across the study area. Concentrations ranged from a minimum of 0.011 mg/L at BWMD25 in September to a maximum of 2.3 mg/L at BWMD26 in July. BWMD sites 01, 02, 03, 04, 05, 06, 07, 08, 09, 11, 14, 16, 17, 18, 22, 23, 26, 28, 29 and 30 were in exceedance of the ANZG (2018) guideline level at all sampling events in 2021.

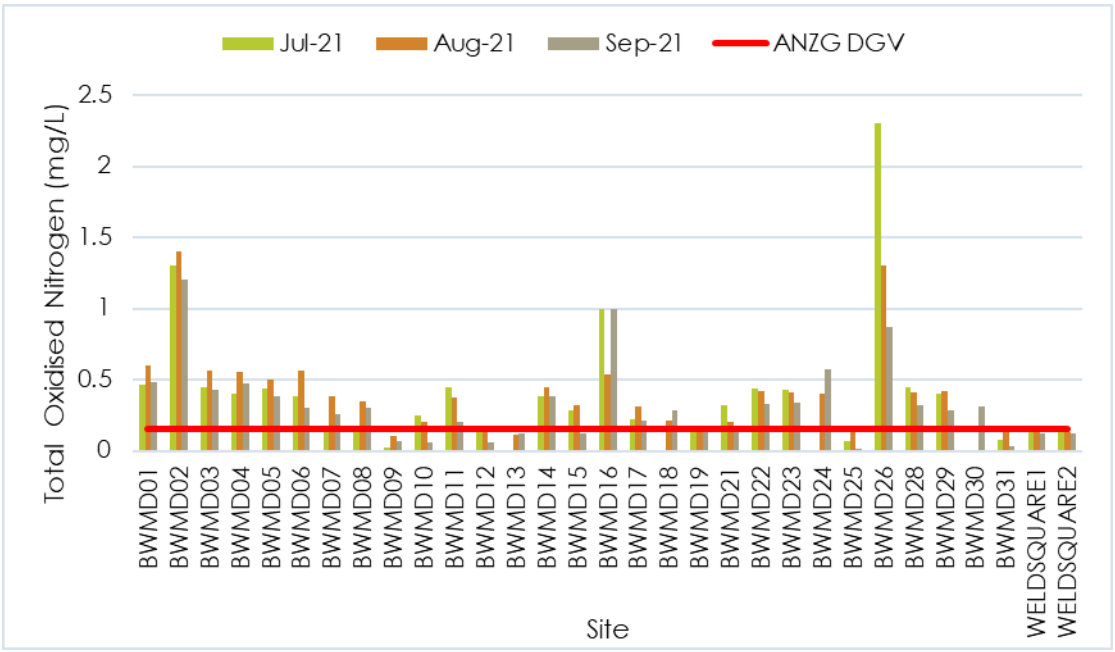

Figure 19: Total oxidised nitrogen concentration recorded at Bayswater Brook surface water sampling sites 2021

Table 13 provides a summary of the notable results from laboratory NO_x measurements taken during the 2020-2021 monitoring program.

Table 13: Total oxidised nitrogen concentration results summary 2020-2021

Total oxidised nitrogen results	Site
Median concentration in exceedance of the ANZG (2018) guideline level from samples taken during 2020-2021	BWMD01, BWMD02, BWMD03, BWMD04, BWMD05, BWMD06, BWMD07, BWMD08, BWMD11, BWMD14, BWMD15, BWMD16, BWMD17, BWMD21, BWMD22, BWMD23, BWMD26, BWMD28, BWMD29, BWMD30
Number of sites recording one or more exceedance of the default guideline value in 2020	16
Number of sites recording one or more exceedance of the default guideline value in 2021	27
Maximum	2.3 mg/L (BWMD26, July 2021)
Minimum	<0.01 mg/L (BWMD09, BWMD25, BWMD31, WELDSQUARE1, WELDSQUARE2, August 2020), (BWMD09, September 2020)

3.4.3 *Nitrogen as ammonia/ammonium (NH_x-N)*

The ANZG (2018) default guideline value (DGV) for nitrogen as ammonia/ammonium (NH_x-N) for lowland rivers in south-west Western Australia is 0.08 mg/L.

2020 Results

The concentration of NH_x-N ranged from a minimum of <0.01 mg/L (the limit of reporting) at several sites across all events to a maximum of 0.64 mg/L at BWMD05 and BWMD06 in July (Figure 20). Sites BWMD01, BWMD02, BWMD03, BWMD04, BWMD06, BWMD11, BWMD12, BWMD14, BWMD15, BWMD16, BWMD19 and BWMD26 recorded median concentrations in exceedance of the ANZG (2018) guideline level.

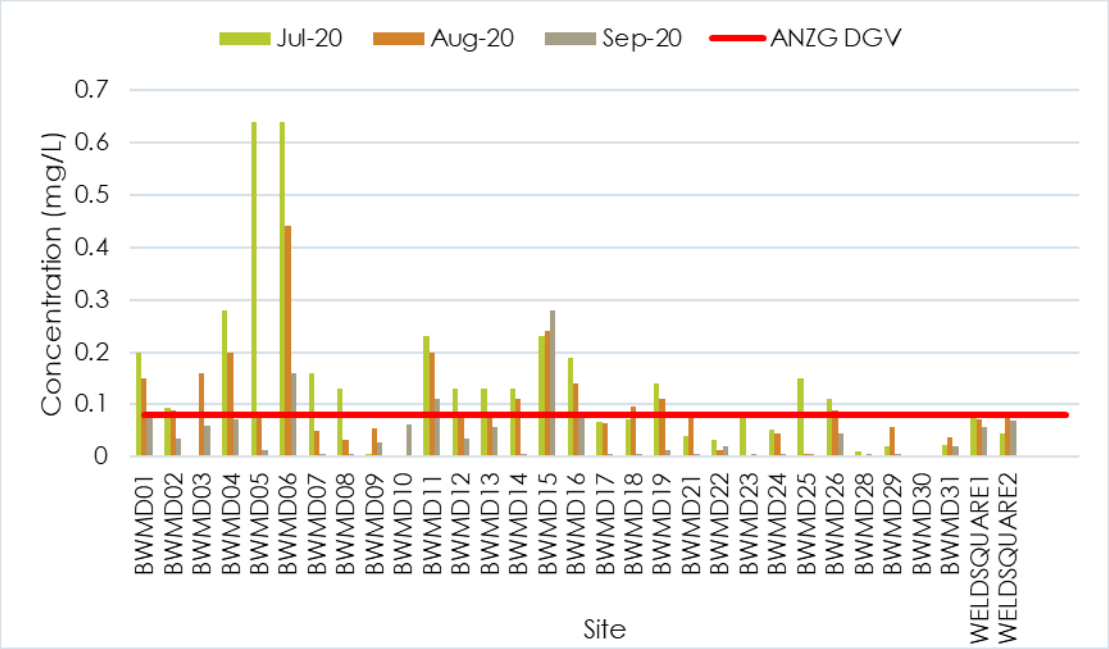

Figure 20: Ammonia/ammonium concentration recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

The concentration of NH_x-N ranged from a minimum of <0.01 mg/L (the limit of reporting) at several sites across all events to a maximum of 0.36 mg/L at BWMD06 in September (Figure 21). Sites BWMD01, BWMD03, BWMD04, BWMD06, BWMD16, and BWMD24 recorded median concentrations in exceedance of the ANZG (2018) guideline level.

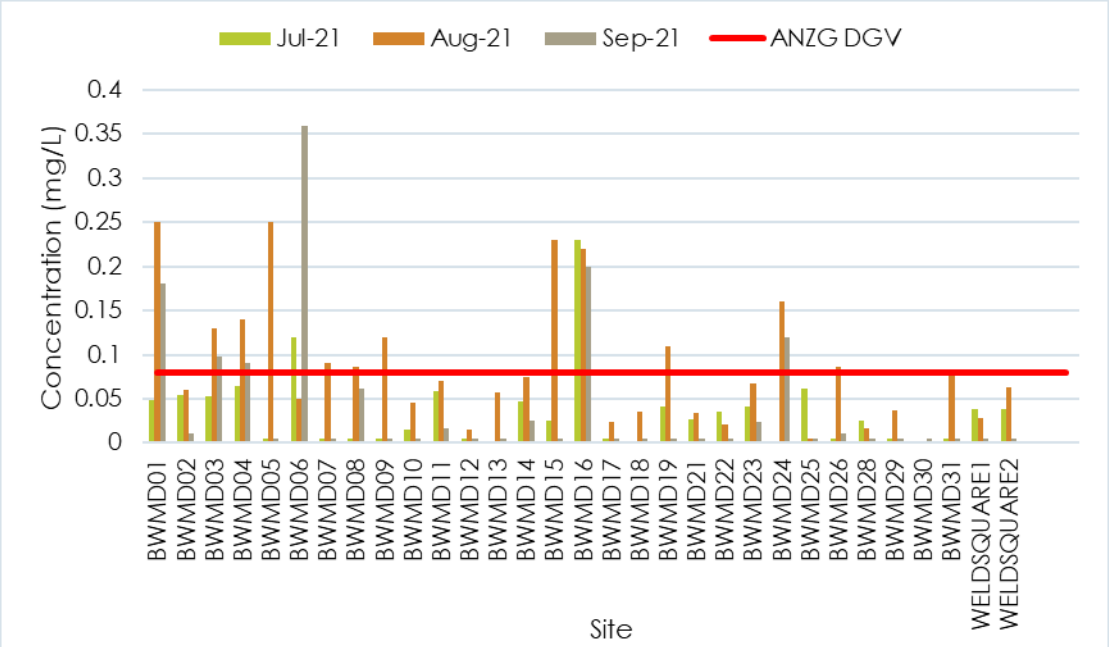

Figure 21: Ammonia/ammonium concentration recorded at Bayswater Brook surface water sampling sites 2021

Table 14 provides a summary of the notable results from laboratory NH_x-N measurements taken during the 2020-2021 monitoring program.

Table 14: Nitrogen as ammonia/ammonium results summary 2020-2021

Nitrogen as ammonia/ammonium results	Site
Median concentration in exceedance of the ANZG (2018) guideline level (samples taken during 2020-2021)	BWMD01, BWMD03, BWMD04, BWMD06, BWMD11, BWMD15, BWMD16
Number of sites recording one or more exceedance of the default guideline value in 2020	16
Number of sites recording one or more exceedance of the default guideline value in 2021	13
Maximum	0.64 mg/L (BWMD05, BWMD06, July 2020).
Minimum	<0.01 mg/L on 43 occasions at various sites over the monitoring period.

3.4.4 Total Phosphorus (TP)

The ANZG (2018) default guideline value (DGV) for total phosphorus (TP) in lowland rivers of south-west Western Australia is 0.065 mg/L.

2020 Results

During 2020, the concentration of total phosphorus ranged from a minimum of 0.01mg/L at BWMD22 in August to a maximum of 0.21 mg/L at BWMD24 in July (Figure 22). There were notable spikes in TP concentration in July with elevated results at BWMD05, BWMD06, BWMD09 and BWMD24. There were a number of sites that had median concentrations in exceedance of the ANZG (2018) guidelines level: BWMD06, BWMD09, BWMD24 and BWMD25. These results are consistent with what was observed in 2018-2019.

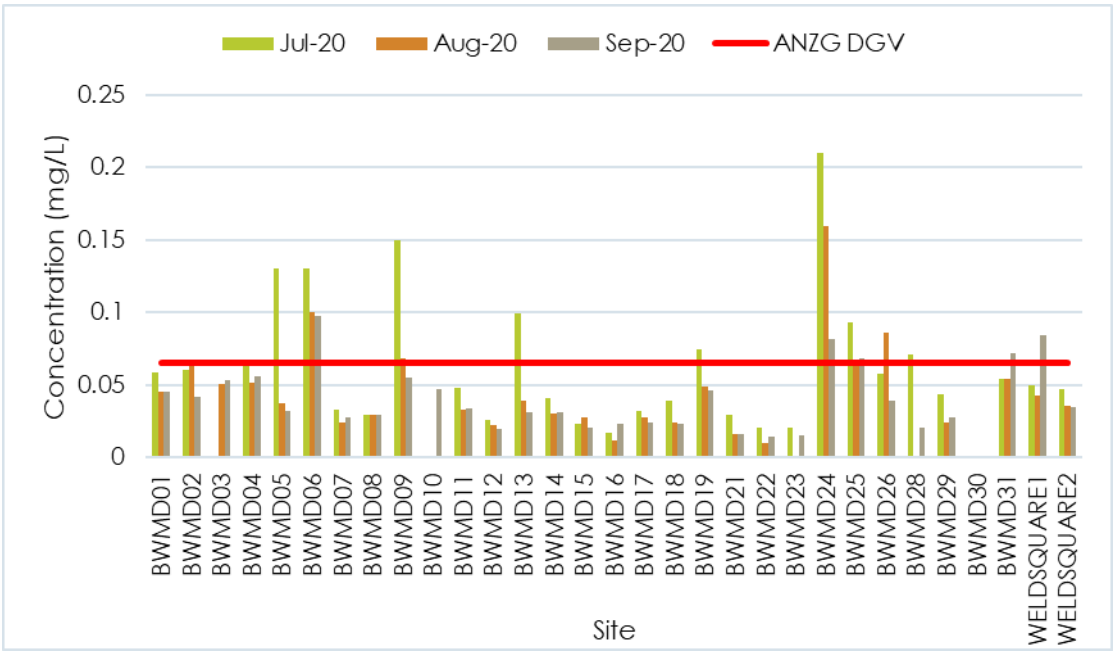

Figure 22: Total phosphorus concentration recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

During 2021, the concentration of total phosphorus ranged from a minimum of 0.007 mg/L at BWMD16 in August to a maximum of 1.8 mg/L in September at BWMD06 (Figure 23 and Figure 24). There were notable spikes in TP concentration at BWMD03, BWMD04 and BWMD06 in September. There were a number of sites that had median concentrations in exceedance of the ANZG (2018) guidelines level: BWMD02, BWMD03, BWMD04, BWMD06, BWMD24 and BWMD25. Aside from the September spikes, these results are consistent with what was observed in 2018-2019.

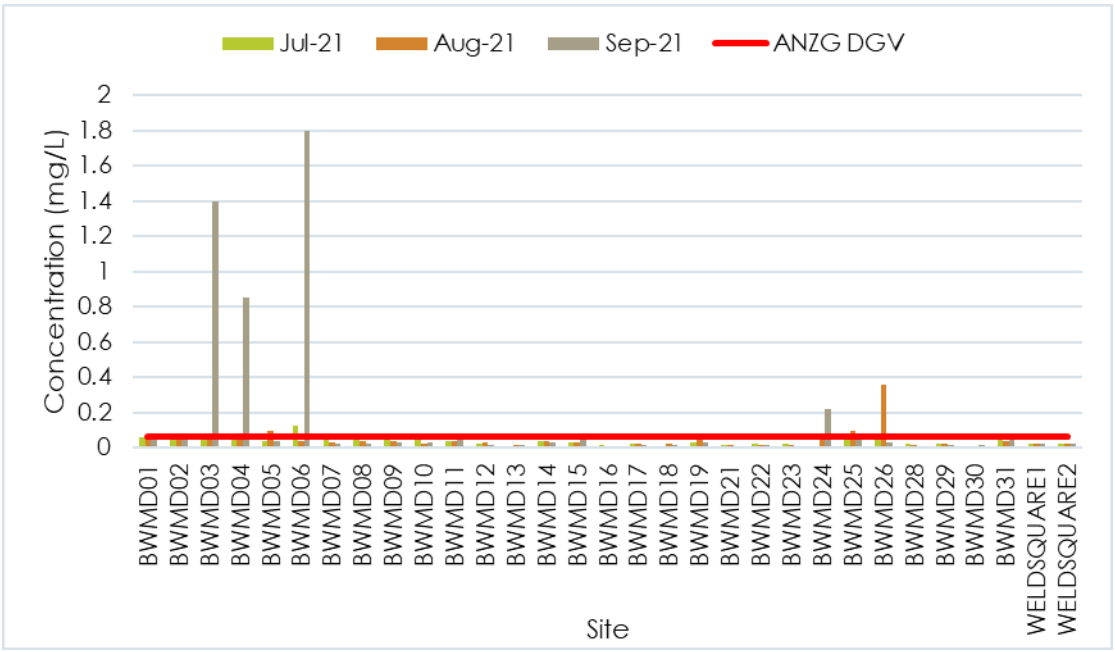

Figure 23: Total phosphorus concentration recorded at Bayswater Brook surface water sampling sites 2020

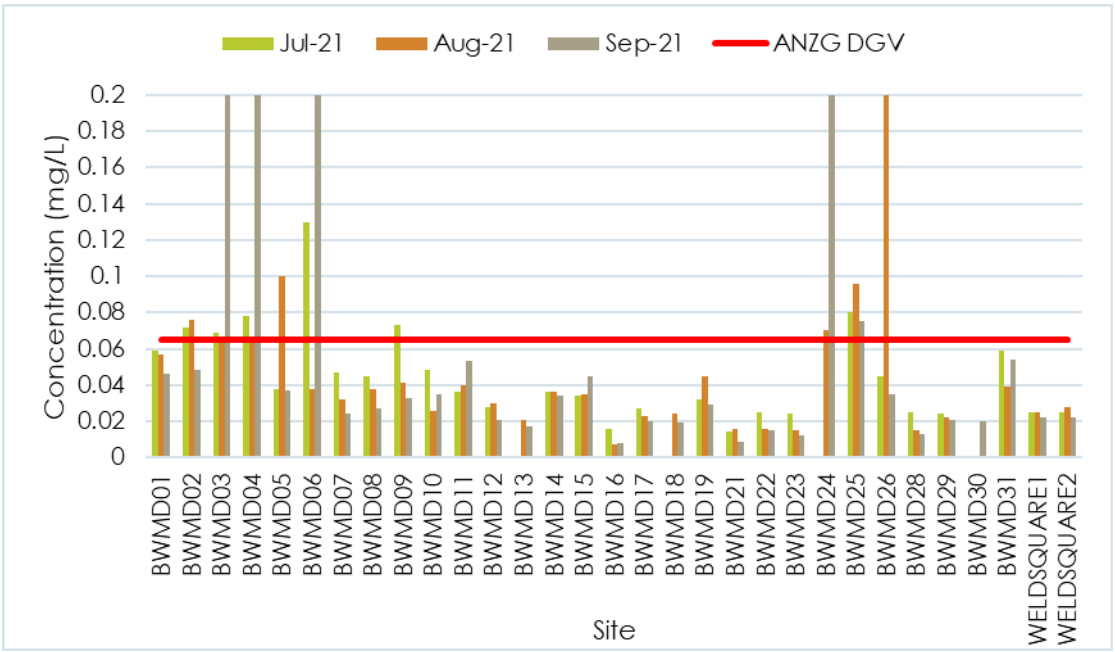

Figure 24: Total phosphorus concentration recorded at Bayswater Brook surface water sampling sites 2021 (enlarged – scale ends at 0.2)

Table 15 provides a summary of the laboratory TP measurements taken during the 2020 and 2021 monitoring program.

Table 15: Total phosphorus concentration results summary 2020-2021

Total phosphorus concentration results	Site
Median concentration in exceedance of ANZG (2018) guideline level (samples taken during 2020-2021)	BWMD03, BWMD04, BWMD06, BWMD24, BWMD25
Number of sites recording one or more exceedance of the default guideline value in 2020	12
Number of sites recording one or more exceedance of the default guideline value in 2021	9
Maximum	1.80 mg/L (BWMD06, September 2021)
Minimum	0.007 mg/L (BWMD16, August 2021)

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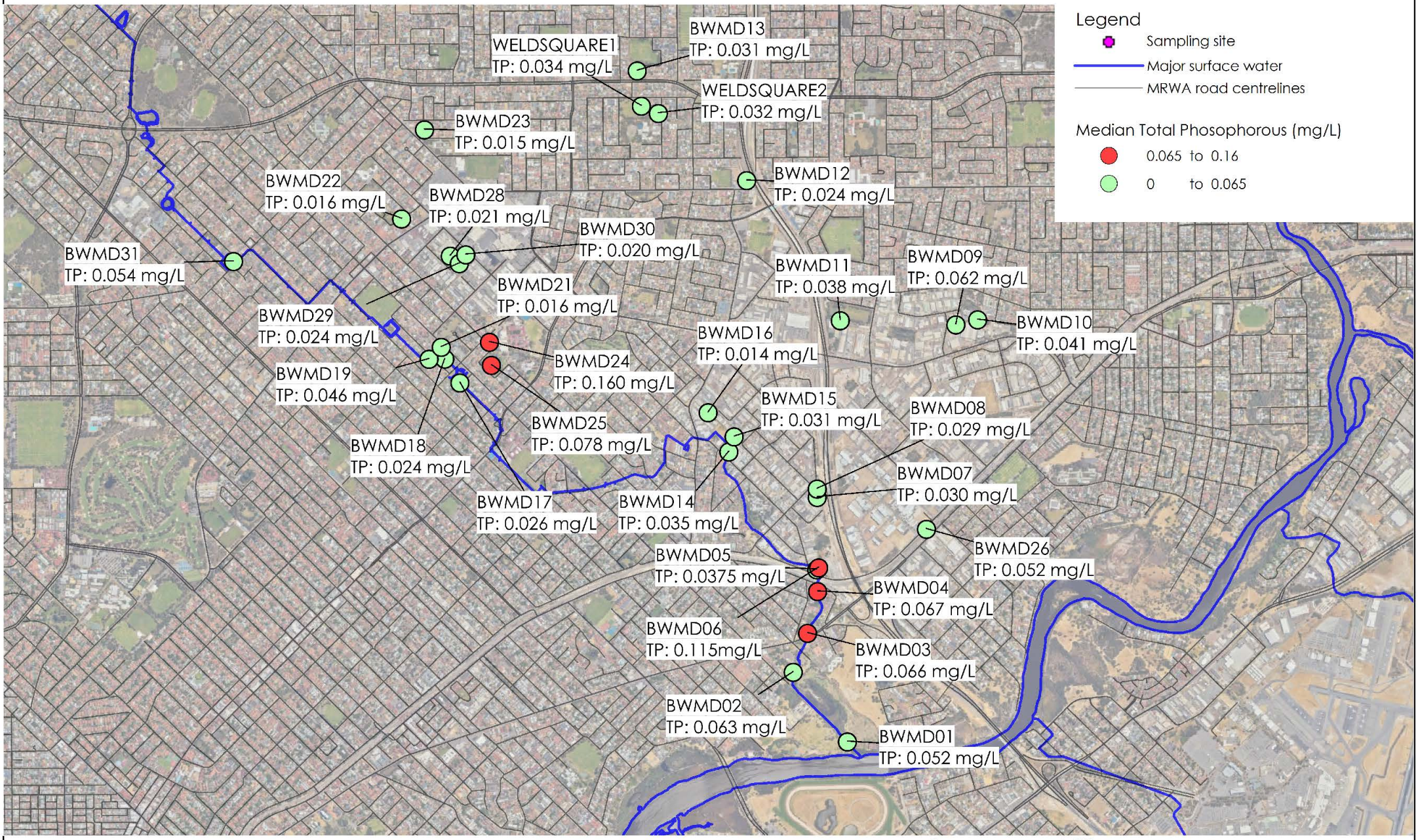
Figure 25 - Median Total Phosphorous Concentration (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.4.5 *Soluble Reactive Phosphorus (SRP)*

The ANZG (2018) default guideline value (DGV) for soluble reactive phosphorus (SRP) in lowland rivers of south-west Western Australia is 0.04 mg/L.

2020 Results

SRP concentrations during the 2020 monitoring program ranged from a minimum of 0.0025 mg/L (below the limit of reporting) at several locations and events to a maximum of 0.12 mg/L at BWMD24 in July. Only BWMD06 and BWMD24 recorded a median concentration in exceedance of the ANZG (2018) guidelines level, each with every event exceeding the guideline.

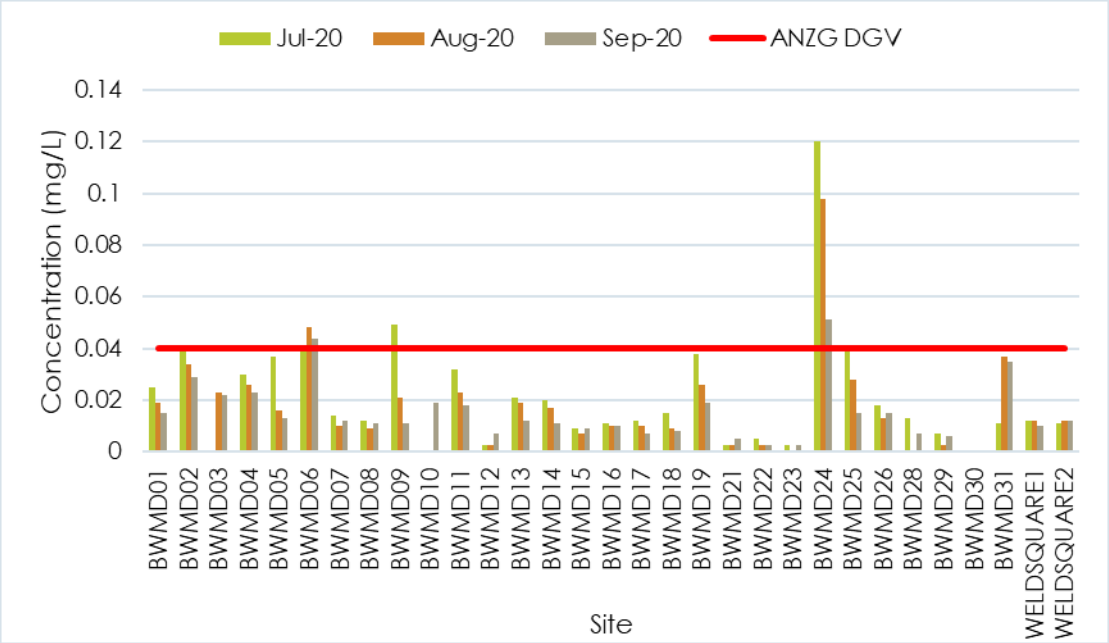

Figure 26: Soluble reactive phosphorus concentration recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

The SRP concentration during the 2021 monitoring program ranged from a minimum <0.005 mg/L (the limit of reporting) at several sites/events to a maximum of 0.049 mg/L at BWMD02 in July. Only BWMD02 recorded a median concentration above the ANZG (2018) guideline levels in 2021.

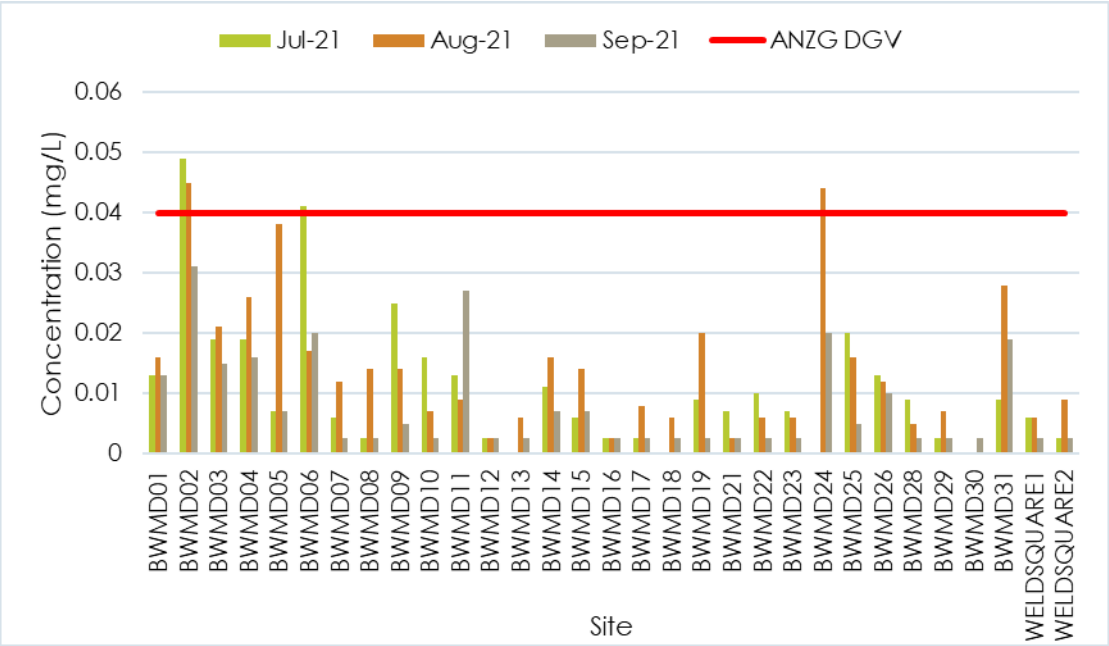

Figure 27: Soluble reactive phosphorus concentration recorded at Bayswater Brook surface water sampling sites 2021

Table 16 provides a summary of the laboratory SRP measurements taken during the 2018-2019 monitoring period.

Table 16: Soluble reactive phosphorus concentration results summary 2020-2021

Soluble reactive phosphorus concentration results	Site
Median concentration in exceedance of the ANZG (2018) guidelines level (samples taken during 2020-2021)	BWMD06, BWMD24
Number of sites recording one or more exceedance of the default guideline value in 2020	3
Number of sites recording one or more exceedance of the default guideline value in 2021	3
Maximum	0.12 mg/L (BWMD24, July 2020)
Minimum	<0.005 mg/L (on 36 occasions over the two years)

3.5 Metals in Water

Both total and soluble metals were monitored in the Bayswater Brook monitoring program in 2020 and 2021. Prior to the inclusion of soluble samples, only total metals were monitored from 2007 to 2010. Sampling for total metals has continued in conjunction with monitoring of soluble metals.

Soluble metals have been included in the monitoring program since 2011 and are a reasonable measure of the bioavailability of metal contaminants and the ecotoxicity risk to aquatic ecosystems. In this report soluble metals rather than total metals are used to determine exceedances of the ANZG (2018) toxicant trigger values and HMTVs as these are a good measure of the bioavailable fractions. Exceedances of toxicant trigger values and HMTVs by total metals is not considered as a large proportion may not be bioavailable.

pH affects the toxicity of aluminium and therefore the soluble aluminium concentrations are compared to the ANZG (2018) toxicant trigger value for a 95% level of species protection when the pH is greater than 6.5. For presentation purposes the samples with pH greater than 6.5 are shaded in the figures for soluble aluminium.

Water hardness affects the toxicity of other metals (chromium, copper, lead, nickel, and zinc). The ANZG (2018) toxicant trigger values for a 95% level of species protection for these metals are corrected for hardness to determine the HMTV with the algorithms for different metal species on an individual sample basis.

3.5.1 Aluminium (Al)

The ANZG (2018) toxicant trigger value for a 95% level of species protection for aluminium is 0.055 mg/L, which is applicable when pH is greater than 6.5. The ANZG (2018) recreational purposes guideline value is 0.2 mg/L. There is no HMTV for aluminium.

2020 Results

Soluble aluminium concentrations during the 2020 monitoring program ranged from a minimum of 0.03 mg/L at BWMD26 in July to a maximum of 0.75 mg/L at BWMD06 in August (Figure 28). All sites with a pH above 6.5 at the time of sampling exceeded the ANZG (2018) guideline for 95% species protection on all sampling events with the exception of BWMD02 in July. BWMD03, BWMD04, BWMD06, BWMD12, BWMD13, and both WELDSQUARE sites exceeded the ANZG (2018) recreational guidelines on all sampling occasions.

BWMD03, BWMD04, BWMD06, BWMD11, BWMD12, BWMD13, WELDSQUARE01 and WELDSQUARE02 had median concentrations in exceedance of the ANZG (2018) recreational guideline.

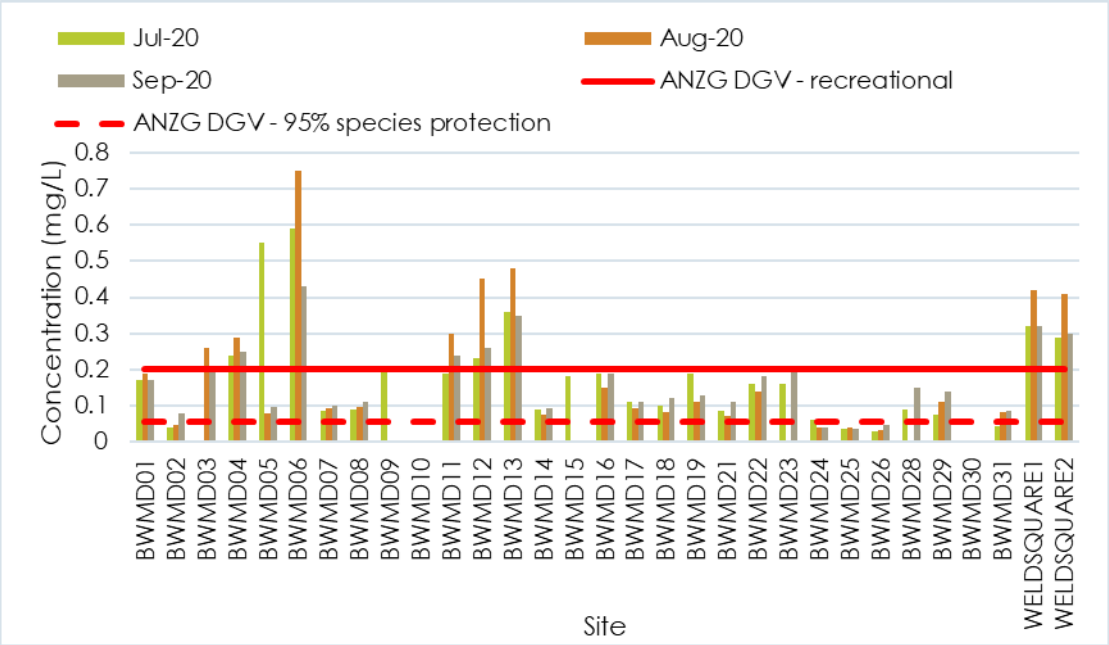

Figure 28: Soluble aluminium concentration recorded at Bayswater Brook surface water sampling sites 2020

2021 Results

The concentration of soluble aluminium during the 2021 monitoring program ranged from a minimum of 0.037 mg/L at BWMD26 in August to a maximum of 0.44 mg/L at BWMD05 in August. All sites with a pH above 6.5 exceeded the ANZG (2018) guidelines for 95% species protection with the exception of BWMD25 in September. BWMD09, BWMD10, BWMD12, BWMD13, BWMD15, BWMD20, BWMD27, WELDSQUARE01 and WELDSQUARE02 exceeded the ANZG (2018) recreational guidelines on all sampling events.

BWMD09, BWMD10, BWMD11, BWMD12, BWMD13, BWMD15, BWMD22, BWMD23, WELDSQUARE01 and WELDSQUARE02 had median concentrations in exceedance of the ANZG (2018) recreational guideline.

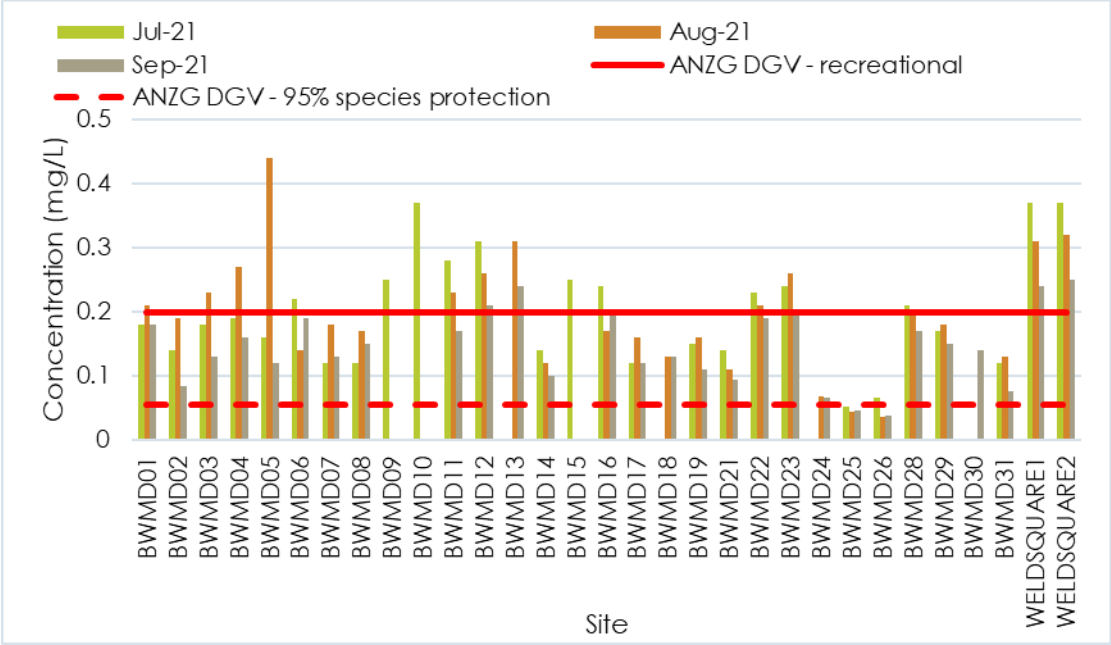

Figure 29: Soluble aluminium concentration recorded at Bayswater Brook surface water sampling sites 2021

Table 17 provides a summary of the notable results from laboratory aluminium measurements taken during the 2020-2021 monitoring program.

Table 17: Soluble aluminium concentration results summary 2020-2021

Soluble aluminium concentration results	Site
≥ 50% of samples taken during 2020-2021 exceeded the ANZG (2018) toxicant trigger for a 95% level of species protection (pH > 6.5)	BWMD02, BWMD03, BWMD04, BWMD05, BWMD06, BWMD07, BWMD08, BWMD11, BWMD12, BWMD16, BWMD17, BWMD18, BWMD19, BWMD21, BWMD22, BWMD29, BWMD30.
All samples in exceedance of the ANZG (2018) toxicant trigger for a 95% level of species protection (pH > 6.5)	None
All samples in exceedance of the ANZG (2018) recreational guideline level	BWMD12, BWMD13, WELDSQUARE01 and WELDSQUARE02
Maximum	0.75 mg/L (BWMD06, August 2020)
Minimum	0.03 mg/L (BWMD26, July 2020)

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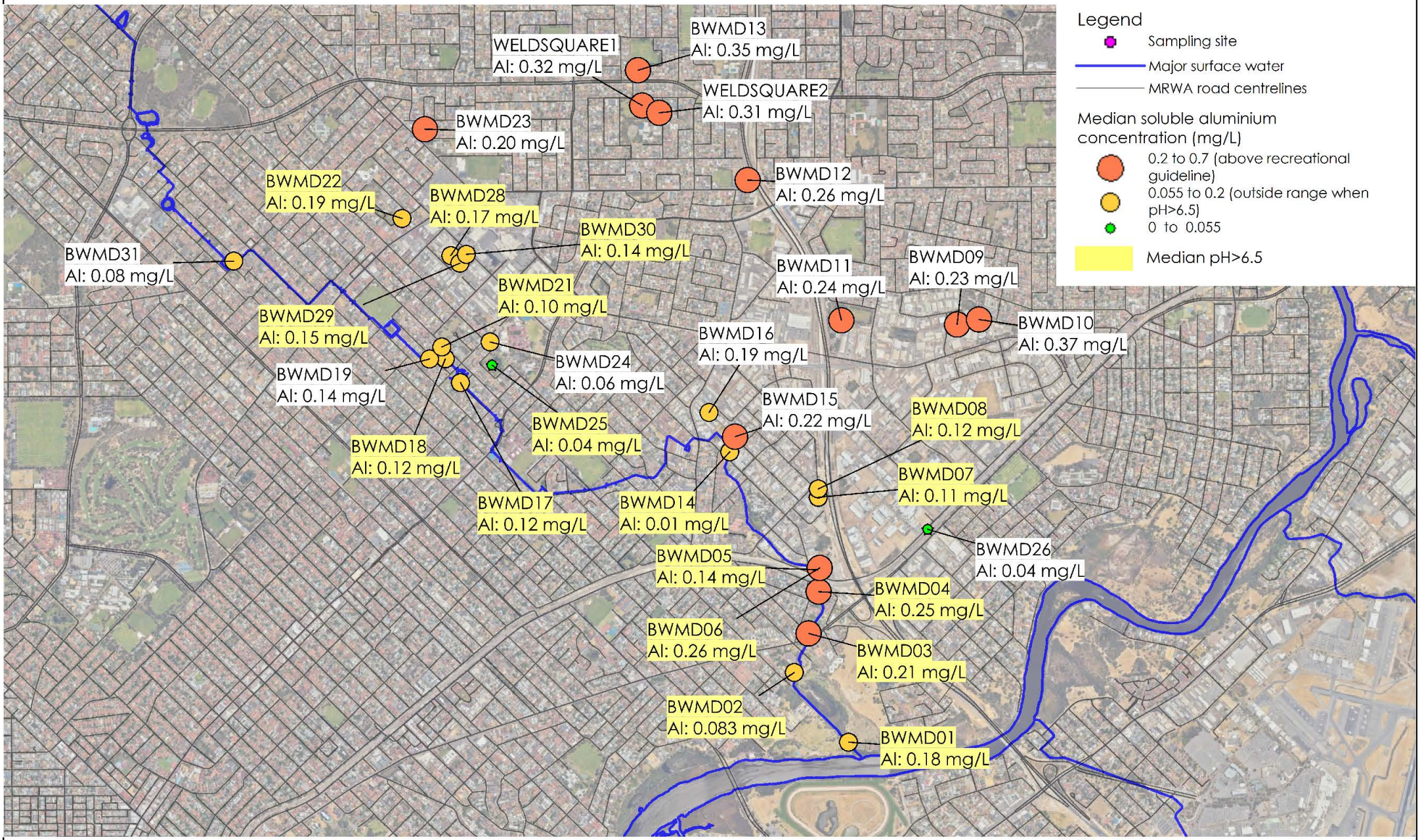
Figure 30 - Median Soluble Aluminium Concentration (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.5.2 Chromium

The ANZG (2018) toxicant trigger value for a 95% level of species protection for chromium is 0.001 mg/L and the ANZG (2018) recreational purposes guideline value is 0.05 mg/L. The HMTV varies with water hardness at the time of sampling and was calculated on sample-by-sample basis.

2020 Results

The concentration of soluble chromium during the 2020 monitoring program ranged from a minimum of 0.0004 mg/L at BWMD24 and BWMD25 in September to a maximum of 0.027 mg/L at BWMD16 in July (Figure 31). Exceedances of the HMTV were observed at BWMD09 and BWMD15 in July and BWMD16 during all events.

2021 Results

The concentration of soluble chromium during the 2021 monitoring program ranged from a minimum of 0.0006 mg/L at BWMD26 during all events and BWMD21 in September to a maximum of 0.021 mg/L at BWMD16 in August (Figure 32). Exceedances of the HMTV were observed at BWMD15 in July and BWMD16 during all events.

Table 18 provides a summary of the notable results from laboratory chromium measurements taken during the 2020-2021 monitoring program.

Table 18: Soluble chromium concentration results summary 2020-2021

Soluble chromium concentration results	Site
≥ 50% of samples in exceedance of HMTV (highlighted in Figure 33)	BWMD16
No exceedances of HMTV	All sites except BWMD09, BWMD15, BWMD16
Number of sites with one or more exceedance of HMTV in 2020	3
Number of sites with one or more exceedance of HMTV in 2021	2
Maximum	0.027 mg/L (BWMD16, July 2020)
Minimum	0.0004 mg/L (BWMD24, BWMD25, September 2020)

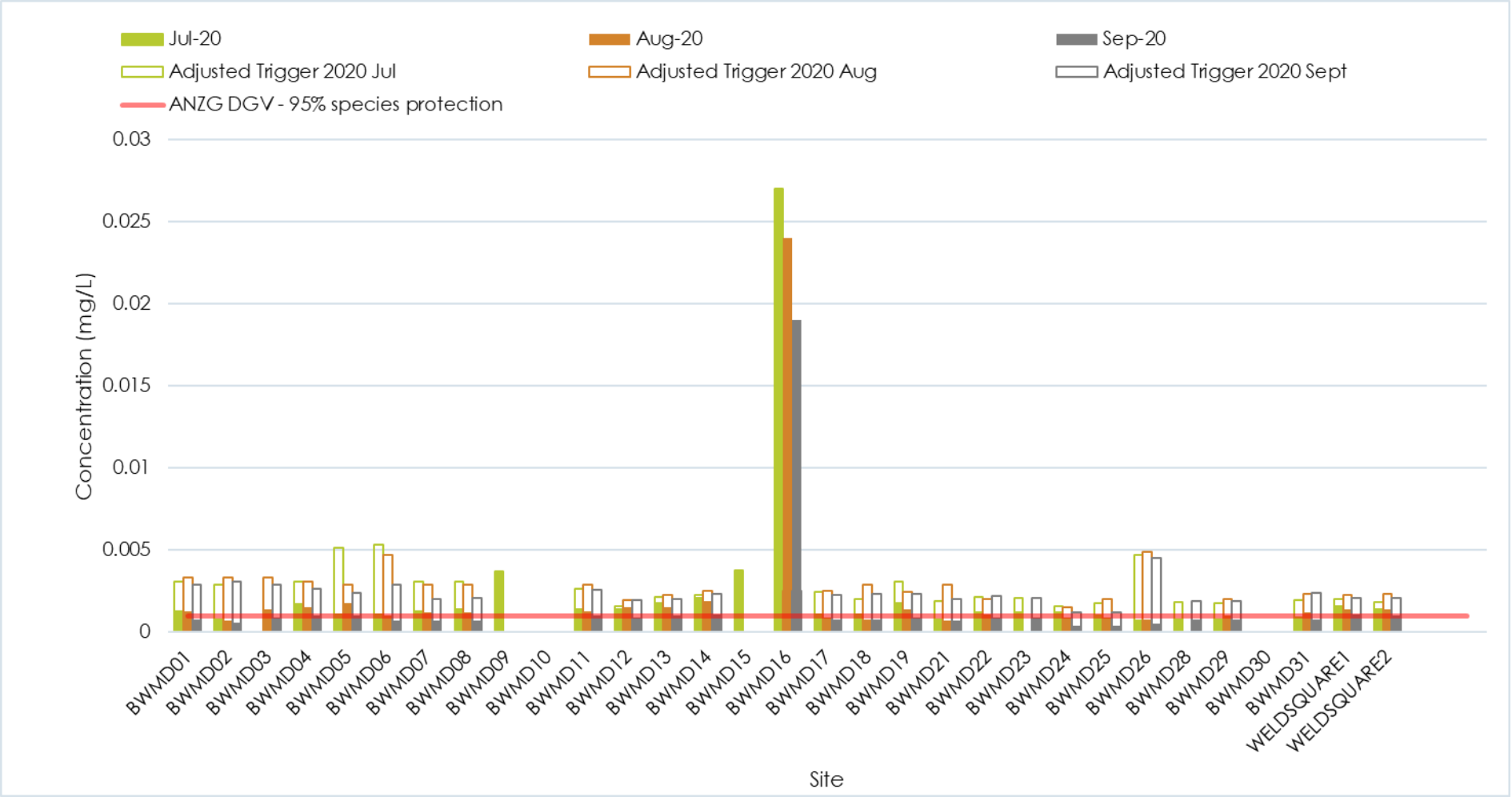

Figure 31: Soluble chromium concentration recorded at Bayswater Brook surface water sampling sites 2020

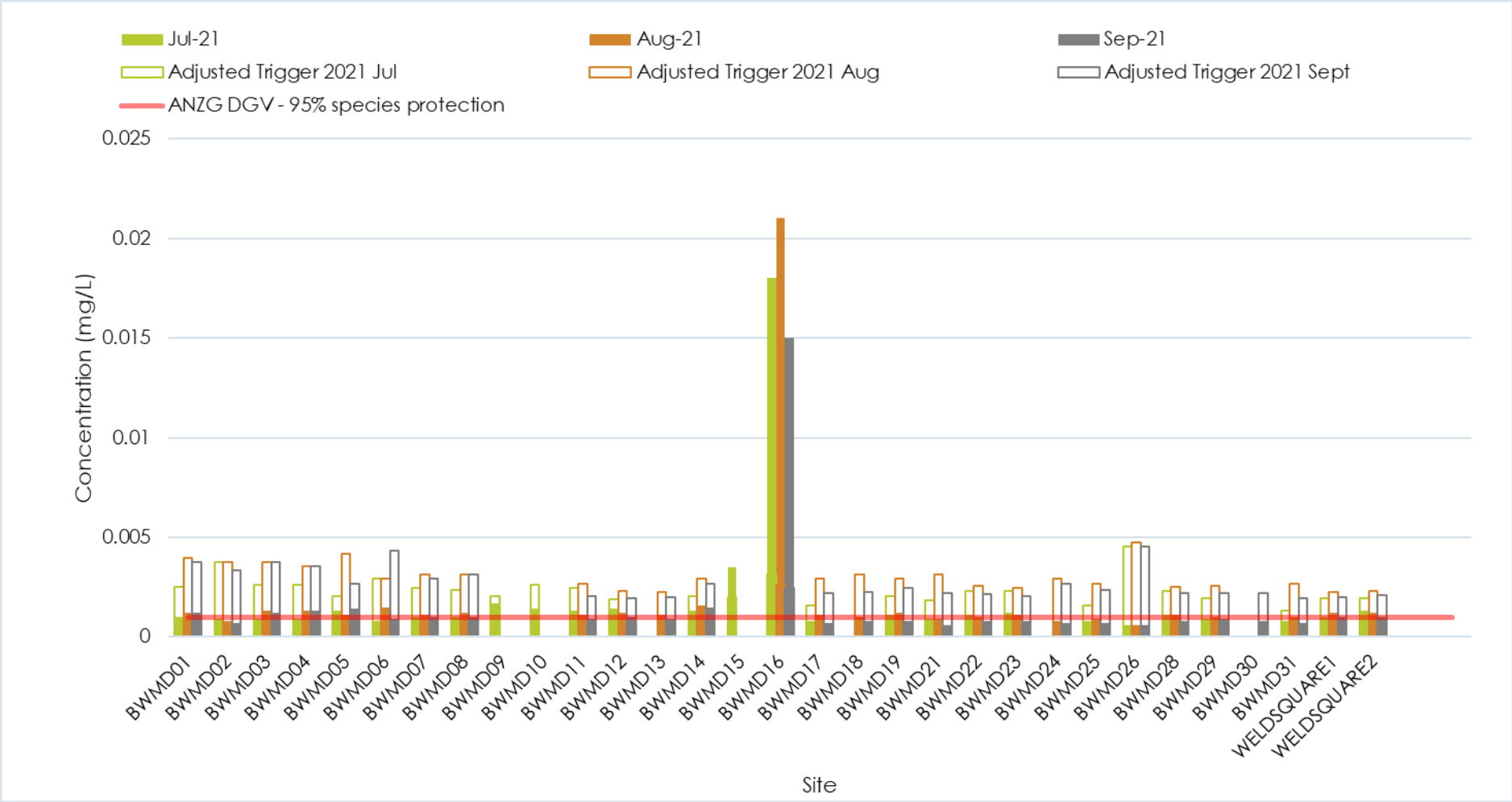

Figure 32: Soluble chromium concentration recorded at Bayswater Brook surface water sampling sites 2021

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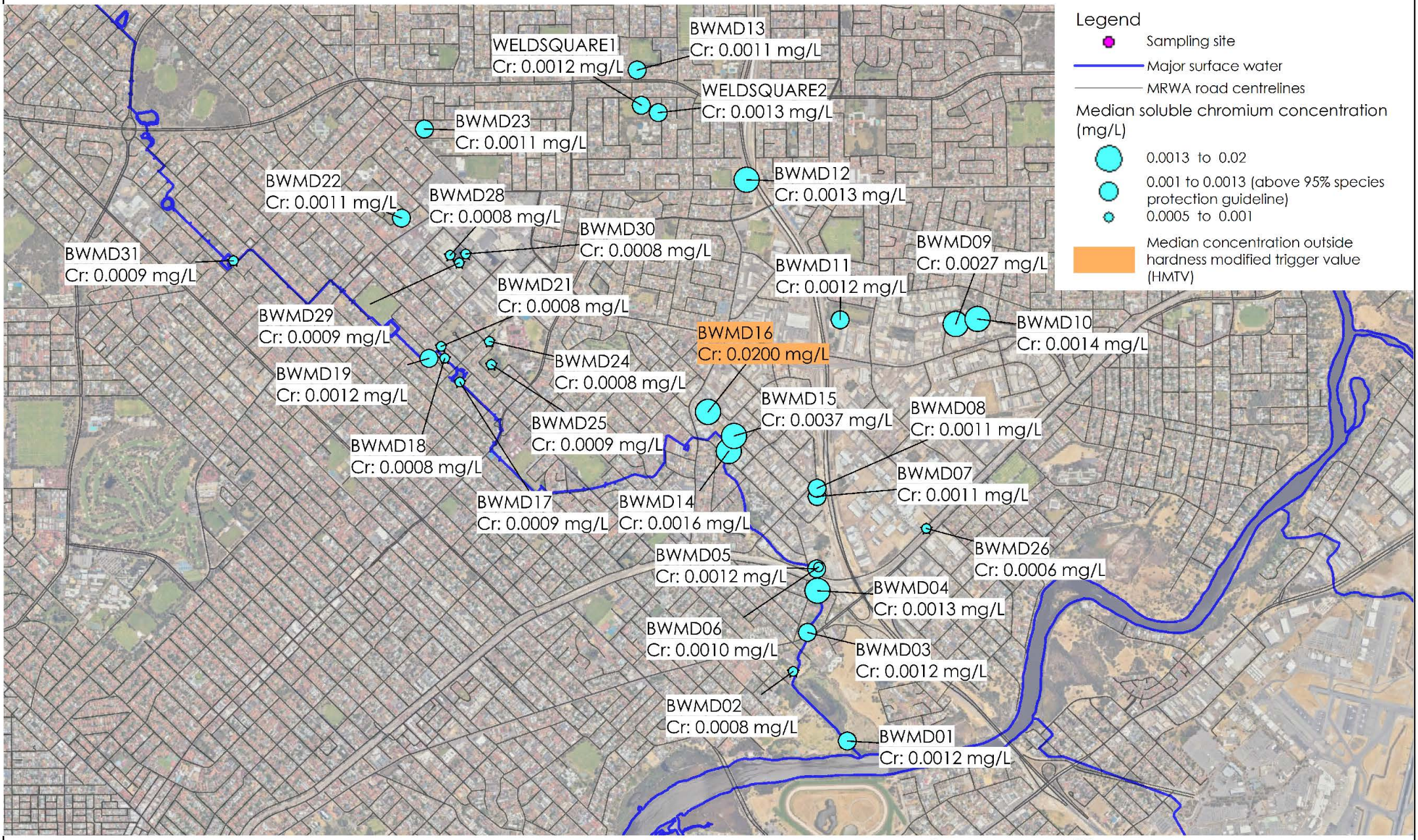
Figure 33 - Median soluble chromium (Cr) concentration (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.5.3 Copper

The ANZG (2018) toxicant trigger value for a 95% level of species protection for copper is 0.0014 mg/L and the recreational purposes guideline value is 1.0 mg/L. The HMTV varies with water hardness at the time of sampling and was calculated on a sample-by-sample basis.

2020 Results

The concentration of soluble copper during the 2020 monitoring program ranged from a minimum of <0.0001 mg/L (the limit of reporting) at BWMD sites 11,12,13 and 31 as well as WELDSQUARE2 in September to a maximum of 0.0098 mg/L at BWMD09 in July (Figure 34). Nine exceedances of the HMTV values occurred throughout the year. BWMD24 exceeded the HMTV values at every event. July exceedances include: BWMD09, BWMD12 and WELDSQUARE2. August exceedances include BWMD01 and WELDSQUARE1. BWMD25 exceeded the HMTV value in September.

2021 Results

The concentration of soluble copper during the 2021 monitoring program ranged from a minimum of 0.0006 mg/L at BWMD16 in August to a maximum of 0.011 mg/L at WELDSQUARE1 in August (Figure 35). Fourteen (14) exceedances of HMTV values occurred throughout the year. Most occurred in July: BWMD sites 17, 19, 21, 25, 29 and 31 as well as both WELDSQUARE sites. In August, BWMD12 and WELDSQUARE1 exceeded HMTV values. In September, BWMD01, BWMD02, BWMD17 and BWMD18 exceeded HMTV values.

Table 19 provides a summary of the notable results from laboratory copper measurements taken during the 2020-2021 monitoring program.

Table 19: Soluble copper concentration results summary 2020-2021

Soluble copper concentration results	Site
≥ 50% of the samples taken during 2020-2021 in exceedance of the HMTV (highlighted in Figure 36)	BWMD24, WELDSQUARE1
No exceedance of HMTV	BWMD03, BWMD04, BWMD05, BWMD06, BWMD07, BWMD08, BWMD10, BWMD11, BWMD13, BWMD14, BWMD15, BWMD16, BWMD 22, BWMD23, BWMD26, BWMD30.
Number of sites with one or more exceedance of HMTV in 2020	7
Number of sites with one or more exceedance of HMTV in 2021	12
Maximum	0.011 mg/L (WELDSQUARE1 in August 2021)
Minimum	<0.0001 mg/L (BWMD11, BWMD12, BWMD13, BWMD31, WELDSQUARE2, in September 2020)

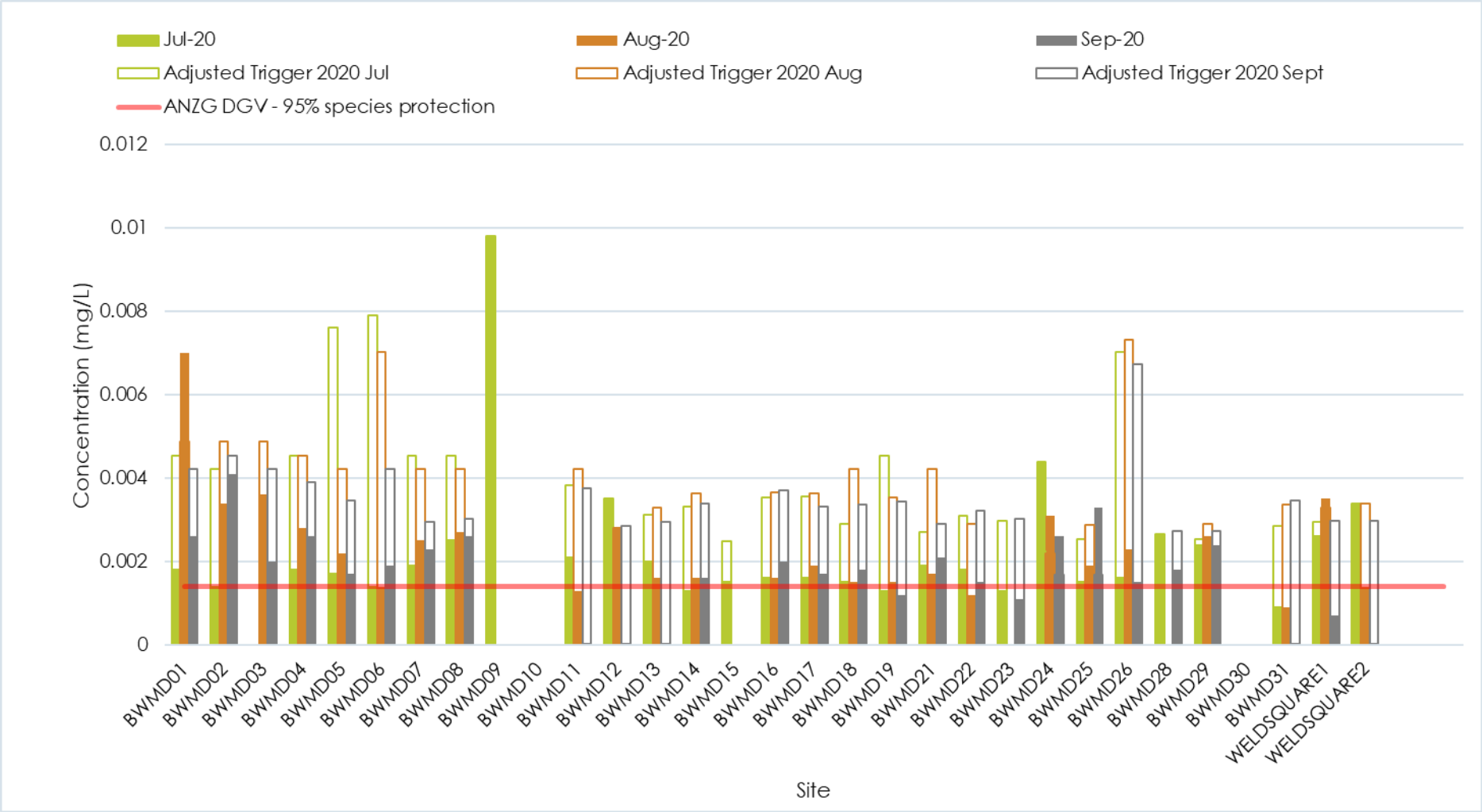

Figure 34: Soluble copper concentration recorded at Bayswater Brook surface water sampling sites 2020

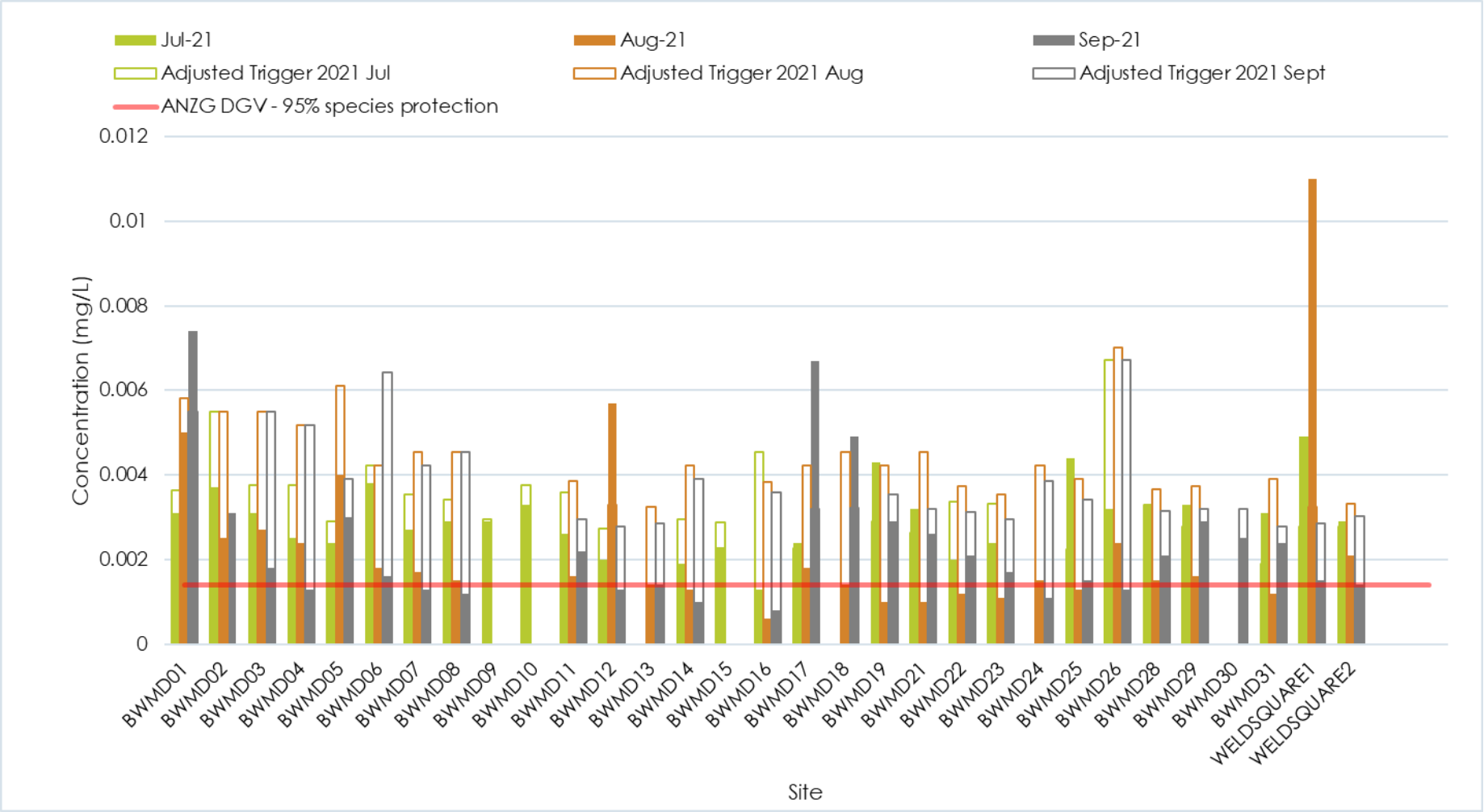

Figure 35: Soluble copper concentration recorded at Bayswater Brook surface water sampling sites 2021

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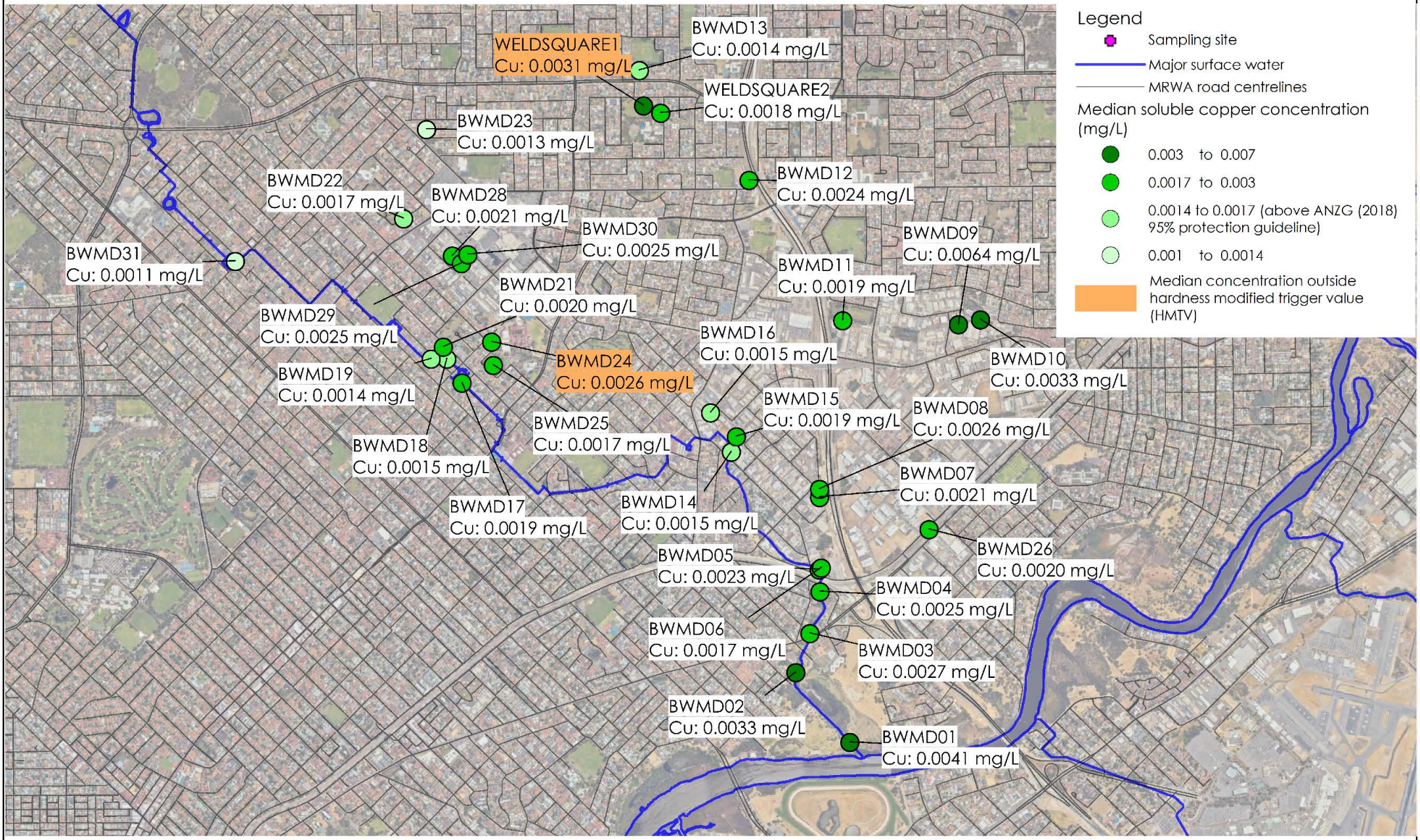
Figure 36 - Median soluble copper (Cu) concentration (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.5.4 Lead

The ANZG (2018) toxicant trigger value for a 95% level of species protection for lead is 0.0034 mg/L and the ANZG (2018) recreational purposes guideline value is 0.05 mg/L. The HMTV varies with water hardness at the time of sampling and was calculated on a sample-by-sample basis.

2020 Results

The concentration of soluble lead during the 2020 monitoring program ranged from a minimum of 0.00005 mg/L at BWMD26 in July and August to a maximum of 0.0051 mg/L at BWMD25 in September (Figure 37). There was a single exceedance of the HMTV coinciding with the local maxima at BWMD25 in September.

2021 Results

The concentration of soluble lead during the 2021 monitoring program ranged from a minimum of 0.00005 mg/L at BWMD26 in August and September to a maximum of 0.002 mg/L at BWMD09 in July (Figure 38). There were no exceedances of the HMTV.

Table 20 provides a summary of the notable results from laboratory lead measurements taken during the 2020-2021 monitoring program.

Table 20: Soluble lead concentration results summary 2020-2021

Soluble lead concentration results	Site
≥ 50% of samples taken during 2020-2021 in exceedance of the HMTV	None
No exceedances of HMTV	All except for BWMD25
Number of sites with one or more exceedance of HMTV in 2020	1
Number of sites with one or more exceedance of HMTV in 2021	0
Maximum	0.0051 mg/L (BWMD25, September 2020)
Minimum	0.00005 mg/L (BWMD26, July 2020, August 2020 and 2021, September 2021)

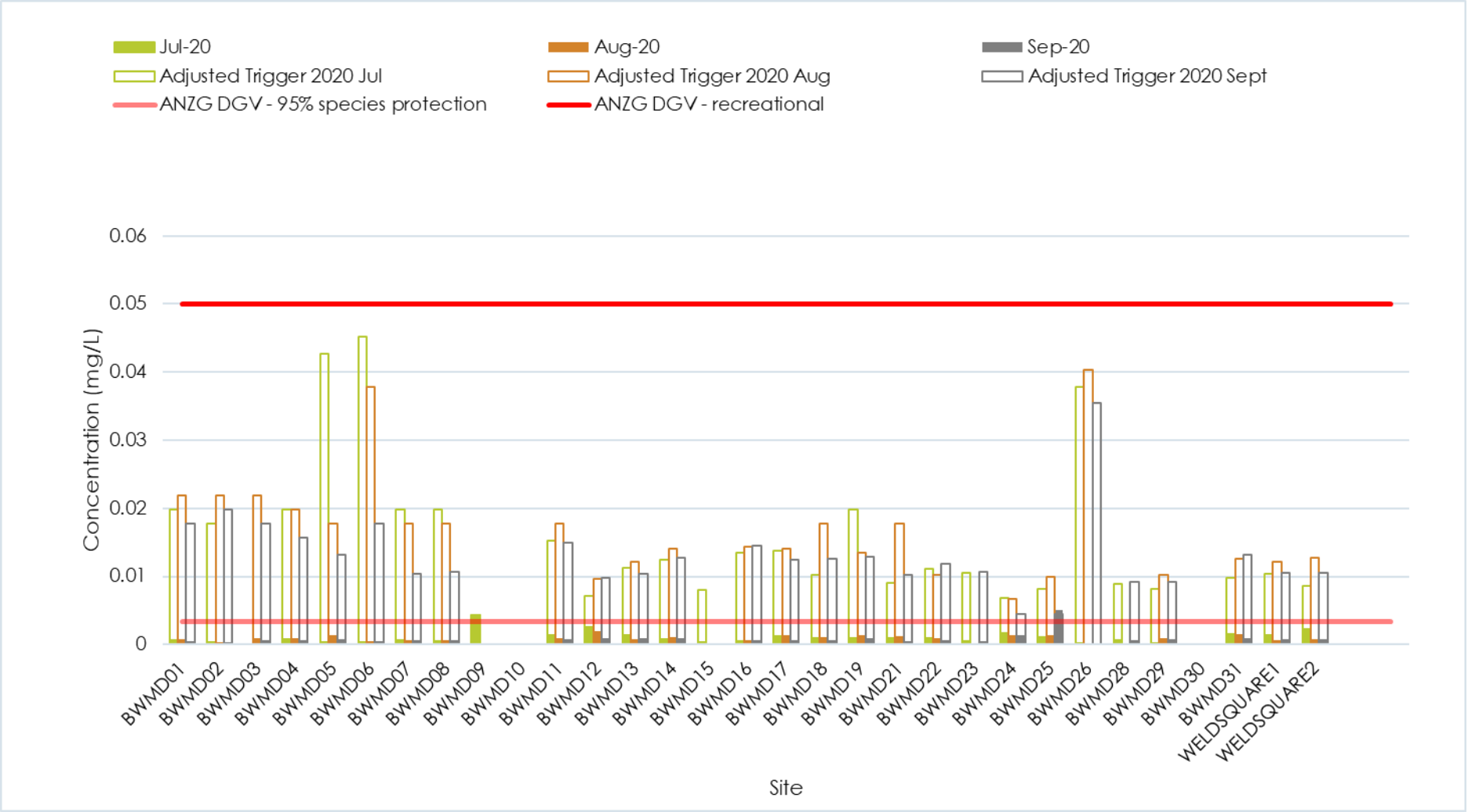

Figure 37: Soluble lead concentration recorded at Bayswater Brook surface water sampling sites 2020

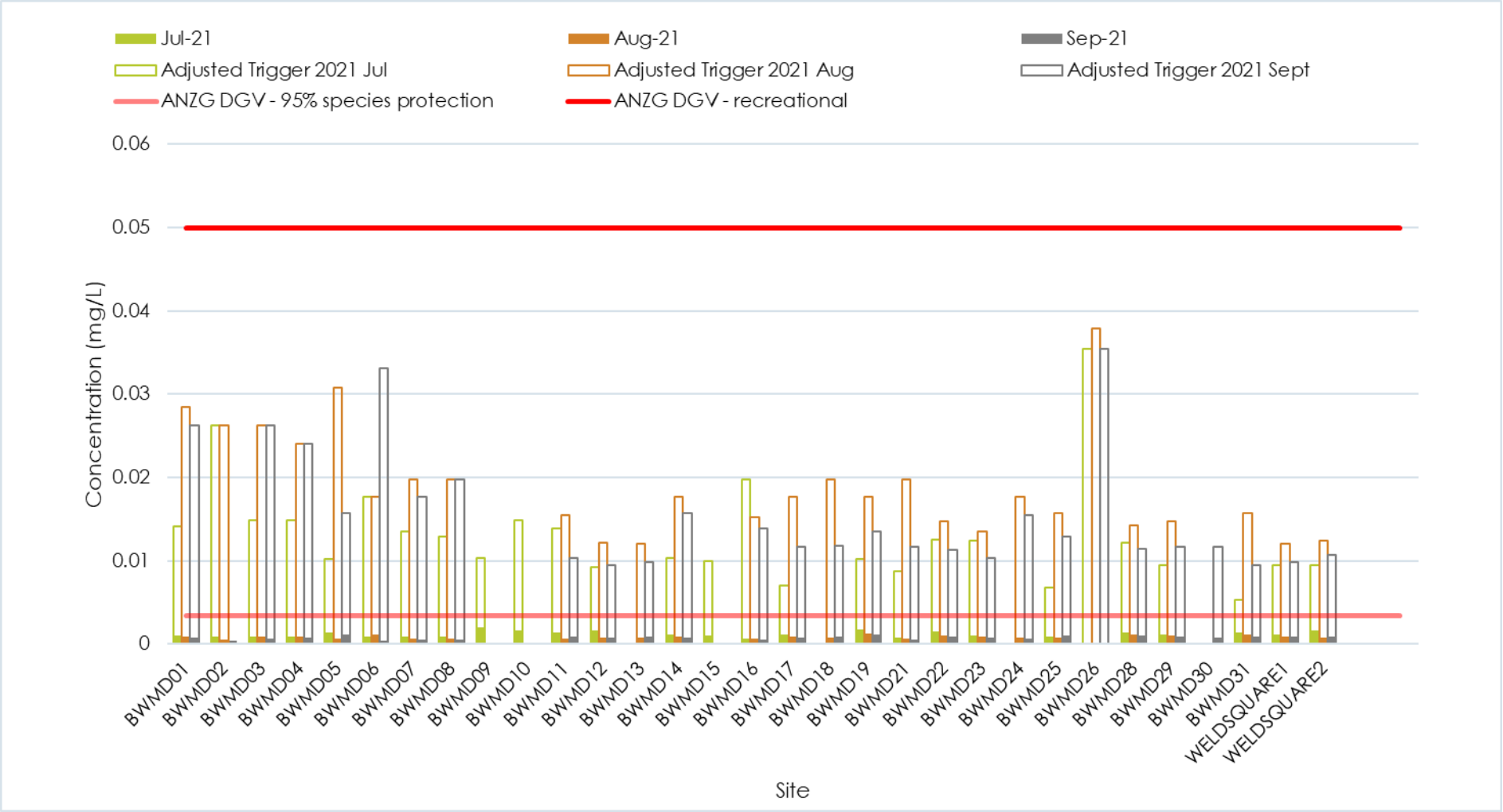

Figure 38: Soluble lead concentration recorded at Bayswater Brook surface water sampling sites 2021

3.5.5 Nickel

The ANZG (2018) toxicant trigger value for a 95% level of species protection for nickel is 0.011 mg/L and the ANZG (2018) recreational purposes guideline value is 0.1 mg/L. The HMTV varies with water hardness at the time of sampling and was calculated on a sample-by-sample basis.

2020 Results

The concentration of soluble nickel during 2020 ranged from a minimum of <0.0005 mg/L (LOR) at BWMD23 and BWMD31 in July and BWMD22 in September to a maximum of 0.24 mg/L at BWMD16 in both August and September (Figure 39). All samples at BWMD16 exceeded the HMTV, as in 2018-2019. No other site exceeded the HMTV.

2021 Results

The concentration of soluble nickel during 2021 ranged from a minimum of <0.0005 mg/L (LOR) at BWMD31 in July and then at BWMD sites 17, 18, 21, 22, 23, 28, 29 and 30 in September, to a maximum of 0.25 mg/L at BWMD16 in August (Figure 40). All samples at BWMD16 exceeded the HMTV. No other site exceeded the HMTV.

Table 21 provides a summary of the notable results from laboratory nickel measurements taken during the 2020-2021 monitoring program.

Table 21: Soluble nickel concentration results summary 2020-2021

Soluble nickel concentration results	Site
≥ 50% of samples taken during 2020-2021 in exceedance of HMTV (highlighted in **Error! Reference source not found.** 41)	BWMD16
No exceedances of HMTV	All sites except BWMD02 and BWMD16
Number of sites with one or more exceedance of HMTV in 2020	1
Number of sites with one or more exceedance of HMTV in 2021	2
Maximum	0.25 mg/L (BWMD16, August 2021)
Minimum	<0.0005 mg/L (LOR) (several sites)

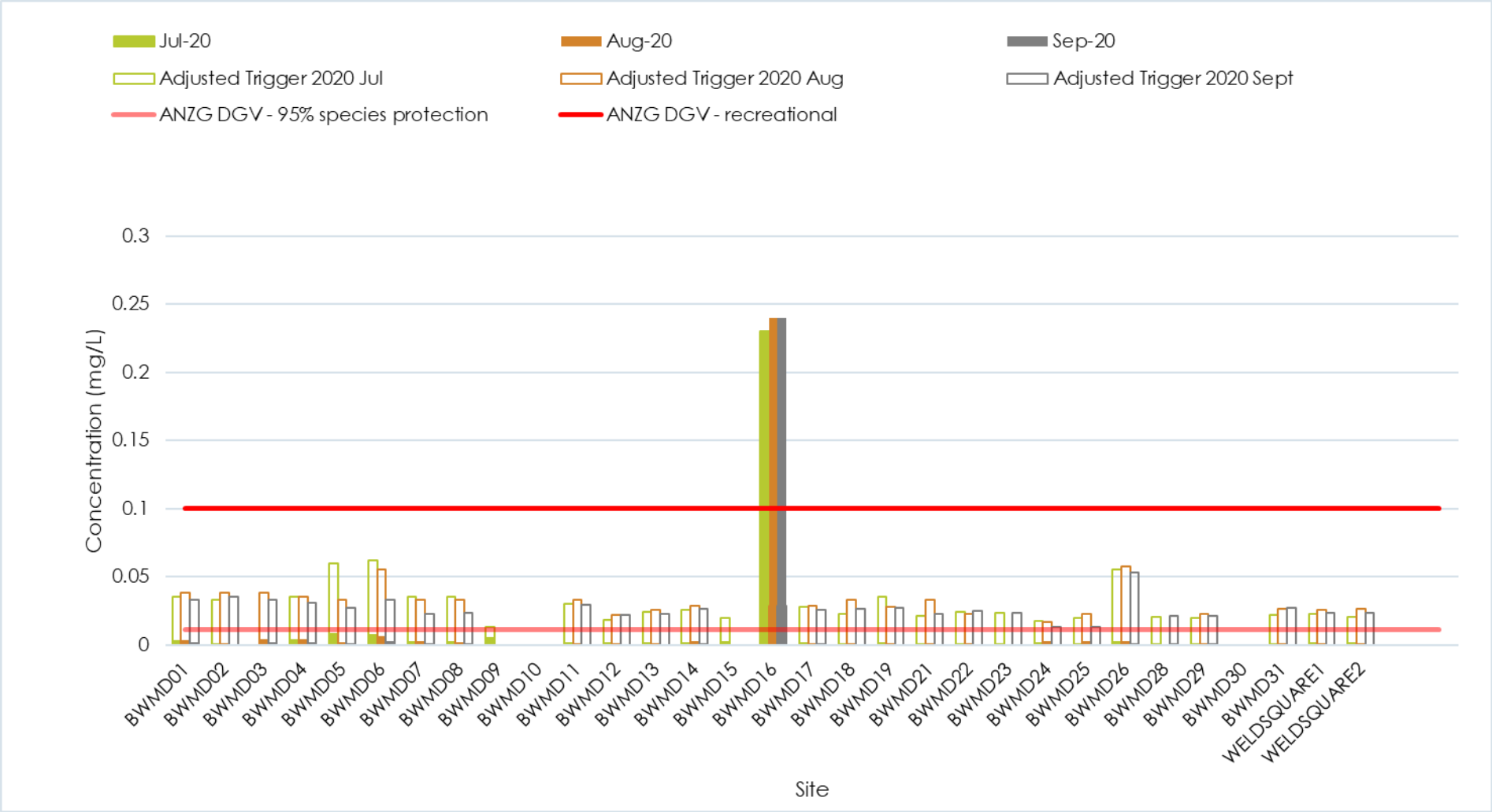

Figure 39: Soluble nickel concentration recorded at Bayswater Brook surface water sampling sites 2020

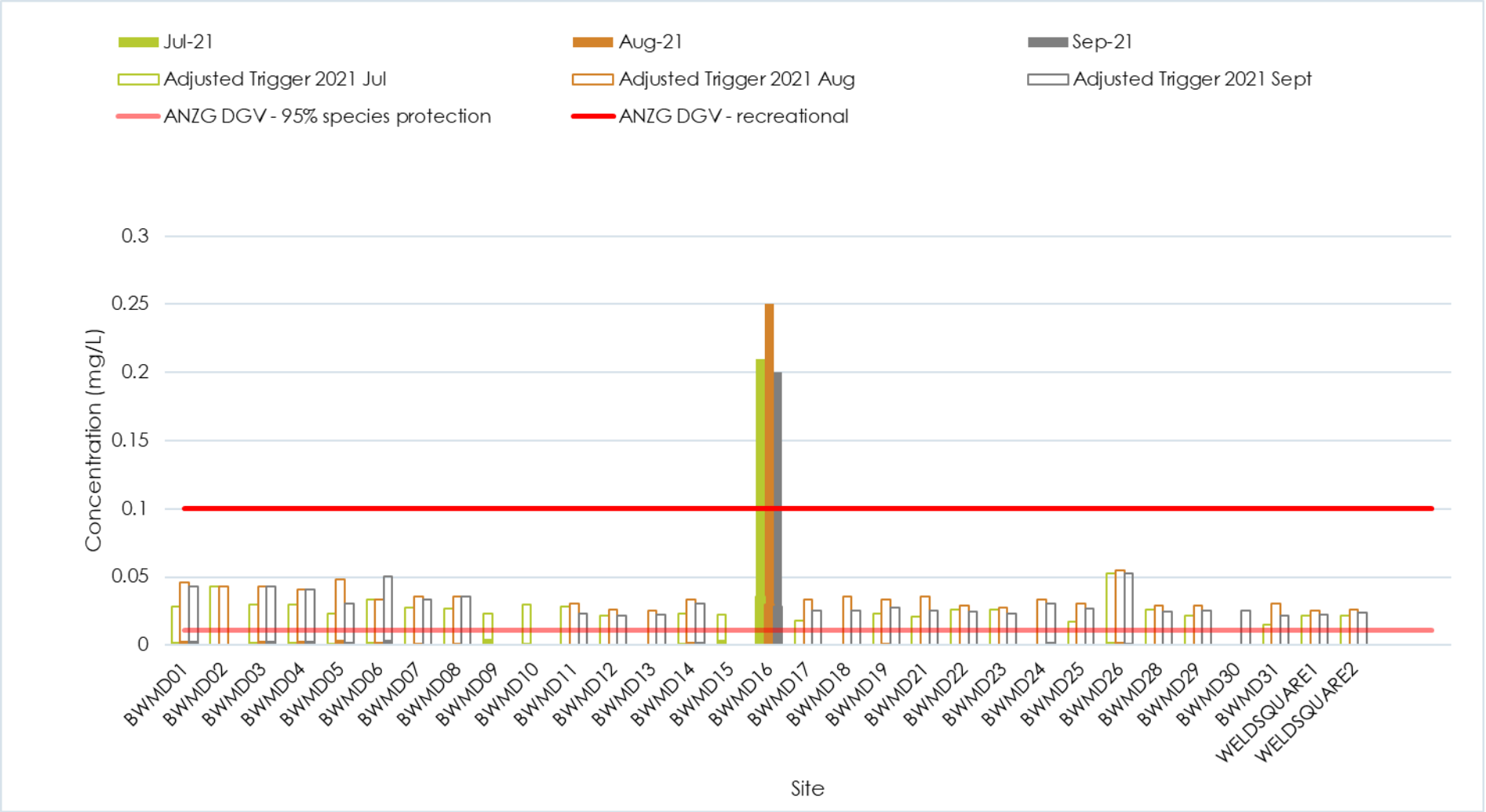

Figure 40: Soluble nickel concentration recorded at Bayswater Brook surface water sampling sites 2021

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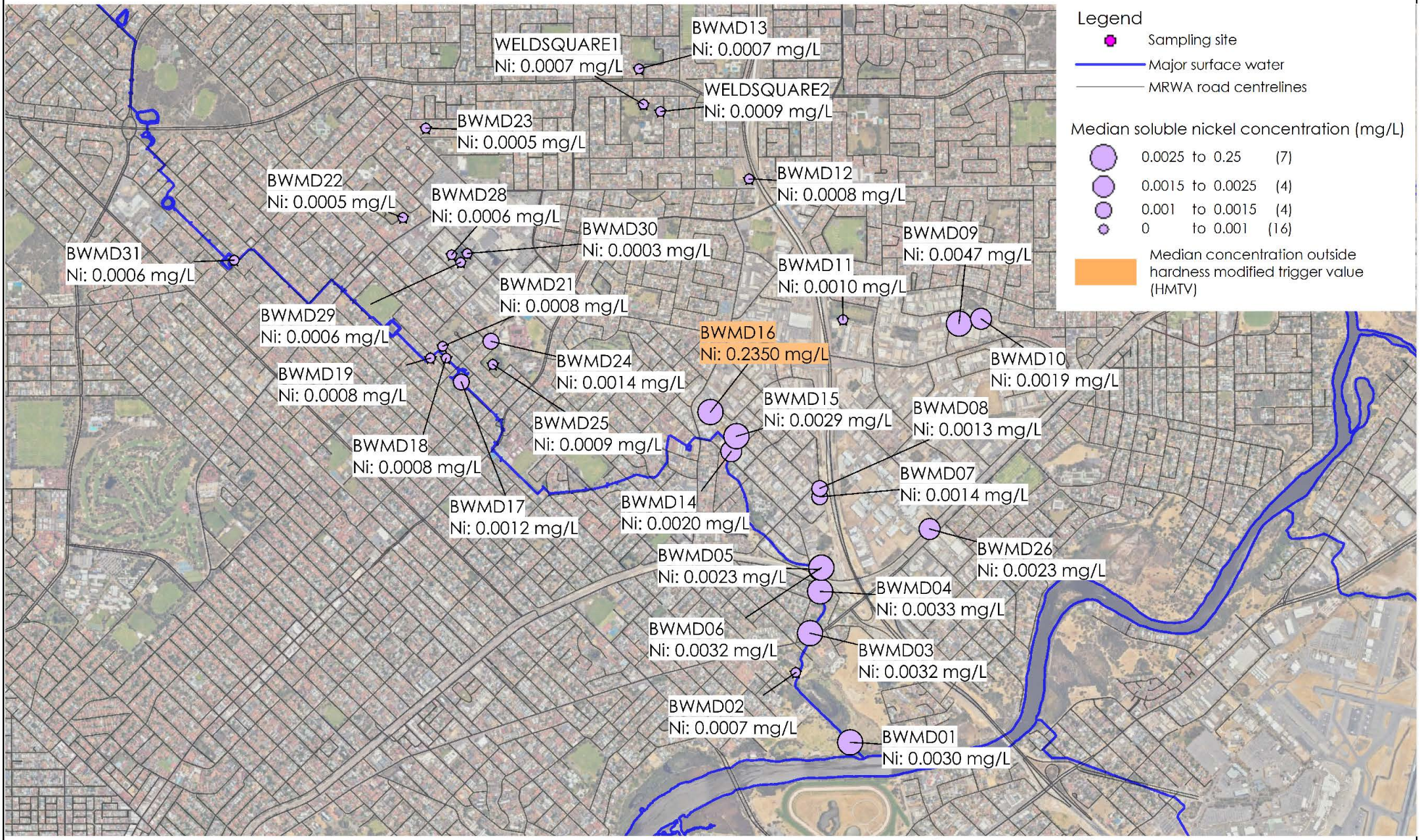
Figure 41 - Median soluble nickel (Ni) concentration (2020-2021)



Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.5.6 Zinc

The ANZG (2018) toxicant trigger value for a 95% level of species protection for zinc is 0.008 mg/L and the ANZG (2018) recreational purposes guideline value is 5 mg/L. The HMTV varies with water hardness at the time of sampling and was calculated on a sample-by-sample basis.

2020 Results

The concentration of soluble zinc during 2020 ranged from a minimum of 0.005 mg/L at BWMD19 in July to a maximum of 0.037 mg/L at BWMD26 in July (Figure 42). All sites recorded exceedances of the HMTV except for BWMD20, BWMD27 and BWMD30 which were not tested. BWMD sites 01, 03, 04, 05, 06, 07, 08, 09, 12, 13, 14, 17, 21, 24, 25, 26 and 29 as well as WELDSQUARE1 and WELDSQUARE2 all exceeded the HMTV on all sampling occasions.

2021 Results

The concentration of soluble zinc during 2021 ranged from a minimum of 0.018 mg/L at BWMD16 in September to a maximum of 0.59 mg/L at BWMD15 in July (Figure 43). As in 2020, all sites recorded exceedances of the HMTV except BWMD20 and BWMD27 which were not tested. BWMD sites 01, 03, 04, 05, 06, 07, 11, 12, 13, 14, 15, 17, 18, 19, 22, 23, 25, 26, 28, 29, 30 and 31 as well as both WELDSQUARE1 and WELDSQUARE2 exceeded the HMTV on all sampling locations.

Table 22 provides a summary of the notable results from laboratory zinc measurements taken during the 2020-2021 monitoring program.

Table 22: Soluble zinc concentration results summary 2020-2021

Soluble zinc concentration results	Site
≥ 50% of samples taken during 2020-2021 in exceedance of HMTV (highlighted in Figure 44)	All
No exceedances of HMTV	None
Number of sites with one or more exceedance of HMTV in 2020	31
Number of sites with one or more exceedance of HMTV in 2021	31
Maximum	0.59 mg/L (BWMD15, July 2021)
Minimum	0.005 mg/L (BWMD19, July 2020)

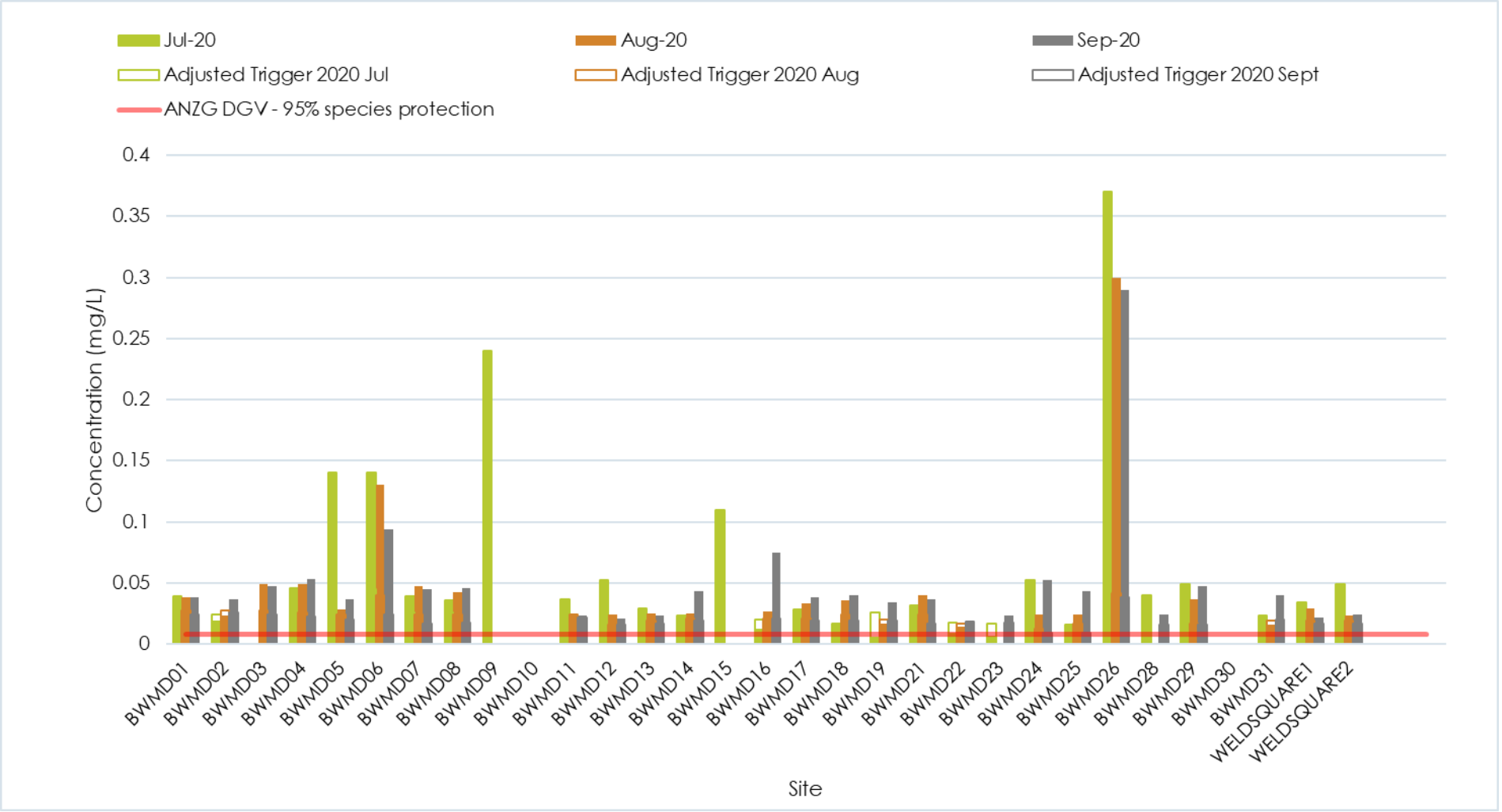

Figure 42: Soluble zinc concentrations recorded at Bayswater Brook surface water sampling sites 2020

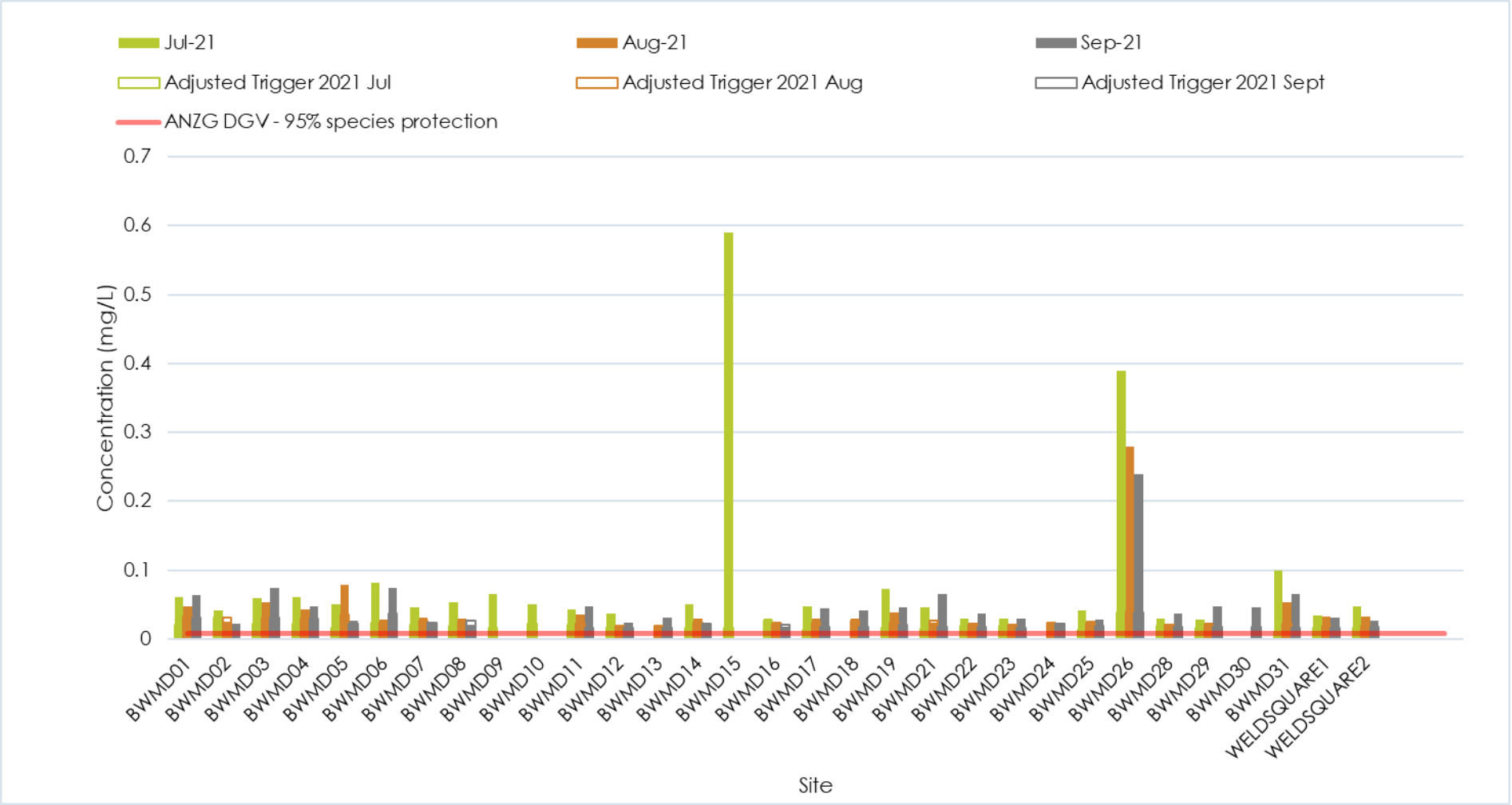

Figure 43: Soluble zinc concentrations recorded at Bayswater Brook surface water sampling sites 2021

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Figure 44 - Median soluble zinc (Zn) concentration (2020-2021)

Data source: Landgate, MRWA, DWER, COB, GHD. Created by: RV. Projection: MGA: zone 50.

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3.6 Metals in Sediment

Sediment samples were collected and analysed for a suite of metals during the final monitoring monthly event of each year from 2012 to 2021. Sediment samples were collected from four sampling sites that were identified as hotspots for metals on the basis of elevated metals concentrations in water samples. The full metals in sediment results from the 2020-2021 monitoring program have been included in Appendix A.

Sediment samples were compared to the ANZG (2018) toxicant default guideline values (DGVs).

3.6.1 Aluminium (Al)

There is no guideline for aluminium in sediment. The DWER have previously referred to the Canadian Sediment Quality Guideline of 14,900 mg/kg for aluminium (Canadian Council of Ministers of the Environment 2002). In the absence of a local guideline the Canadian guideline is used for comparative purposes.

2020 Results

The concentration of aluminium in sediment ranged from a minimum of 1450 mg/kg at BWMD16 to 5250 mg/kg at BWMD26. No samples exceeded the Canadian guideline. In comparison, no samples exceeded the Canadian guideline in 2016, 2017 or 2019 either. There was one exceedance at BWMD26 in 2018.

2021 Results

The concentration of aluminium in sediment ranged from a minimum of 2110 mg/kg at BWMD24 to 12500 mg/kg at BWMD26. No samples exceeded the Canadian guideline.

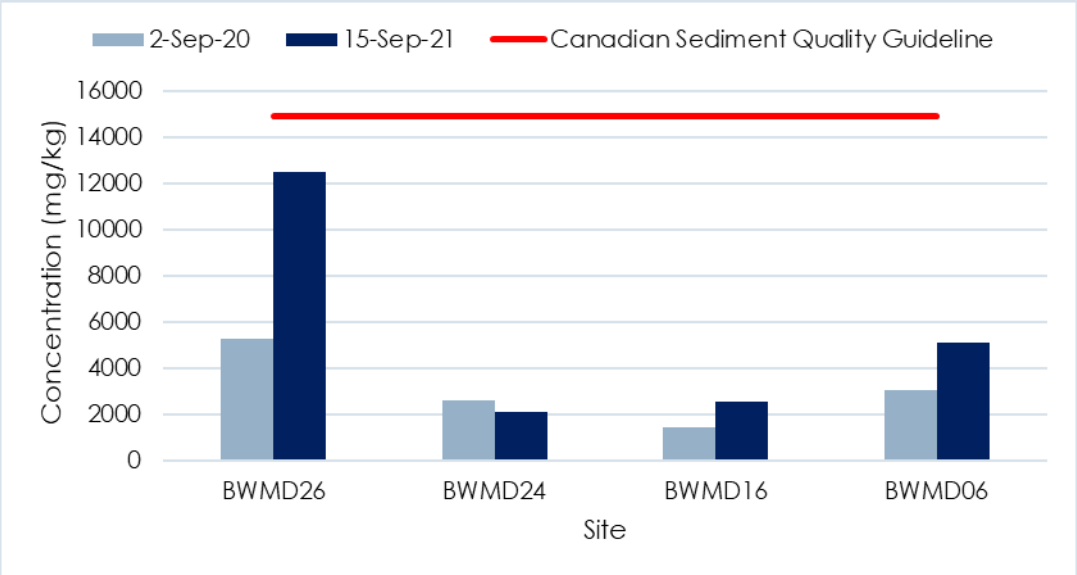

Figure 45: Aluminium concentration in sediment recorded at Bayswater Brook sediment sampling sites 2020-2021

3.6.2 Chromium

The ANZG (2018) DGV concentration for chromium in sediment is 80 mg/kg and the GV-high concentration is 370 mg/kg.

2020 Results

The concentration of chromium in sediment ranged from a minimum of 3.6 mg/kg at BWMD06 to a maximum of 9.2 mg/kg at BWMD24. No samples exceeded the DGV or GV-high concentrations. No samples from 2016-2019 exceeded these guidelines either.

2021 Results

The concentration of chromium in sediment ranged from a minimum of 5.4 mg/kg at BWMD06 to a maximum of 44 mg/kg at BWMD26. No samples exceeded the DGV or GV-high concentrations.

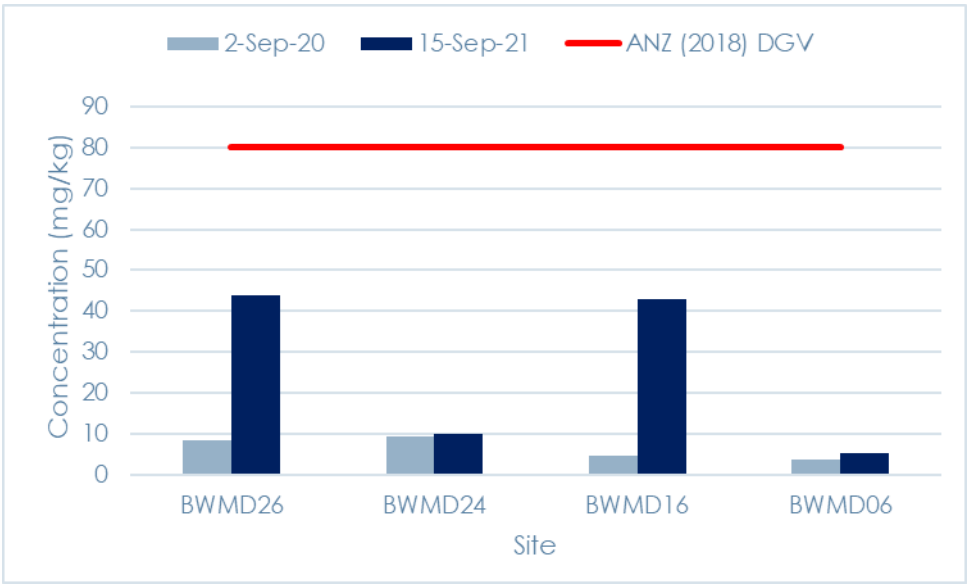

Figure 46: Chromium concentration in sediment recorded at Bayswater Brook sediment sampling sites 2020-2021

3.6.3 Copper

The ANZG (2018) DGV concentration for copper in sediment is 65 mg/kg and the GV-high concentration is 270 mg/kg.

2020 Results

The concentration of copper in sediment ranged from a minimum of 14 mg/kg at BWMD06 to a maximum of 61 mg/kg at BWMD24. No value exceeded the DGV or GV-High concentrations.

2021 Results

The concentration of copper in sediment ranged from a minimum of 16 mg/kg at 55 mg/kg at BWMD26. No sites exceeded the DGV or GV-high concentrations.

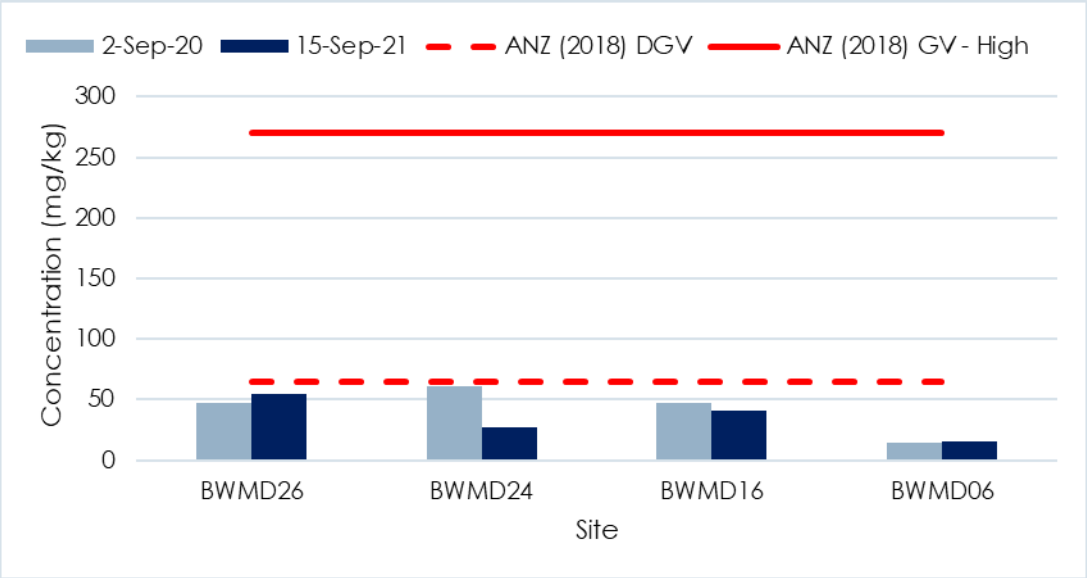

Figure 47: Copper concentration in sediment recorded at Bayswater Brook sediment sampling sites 2020-2021

3.6.4 Lead

The ANZG (2018) DGV concentration for lead in sediment is 50 mg/kg and the GV-high concentration is 220 mg/kg.

2020 Results

The concentration of lead in sediment ranged from a minimum of 8 mg/kg at BWMD16 to a maximum of 42 mg/kg at BWMD06. No exceedances of the DGV triggers were observed (Figure 48).

2021 Results

The concentration of lead in sediment ranged from a minimum of 19 mg/kg at BWMD16 to a maximum of 72 mg/kg at BWMD26. BWMD26 is the only exceedance of the DGV trigger.

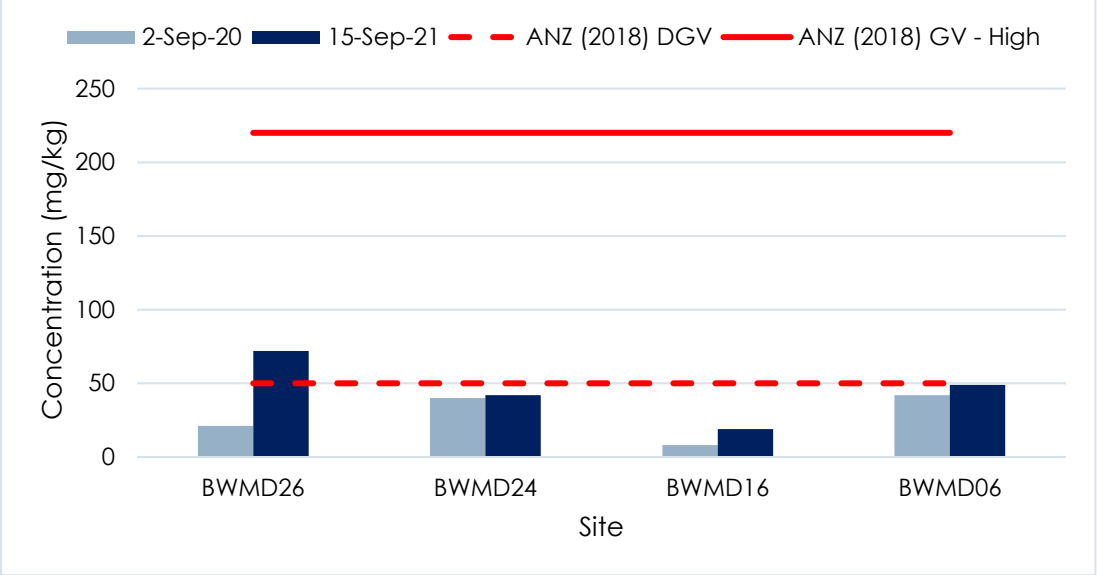

Figure 48: Lead concentration in sediment recorded at Bayswater Brook sediment sampling sites 2020-2021

3.6.5 *Nickel*

The ANZG (2018) DGV concentration for nickel in sediment is 21 mg/kg and the GV-high concentration is 52 mg/kg.

2020 Results

The concentration of nickel in sediment ranged from a minimum of 2.5 mg/kg at BWMD06 to a maximum of 16 mg/kg at BWMD16. No samples exceeded the DGV or GV-high concentrations. Similarly, these triggers were not exceeded in 2016-2019.

2021 Results

The concentration of nickel in sediment ranged from a minimum of 2.8 mg/kg at BWMD24 to a maximum of 390 mg/kg at BWMD16. This maximum was in exceedance of both the DGV and GV-high triggers (Figure 49).

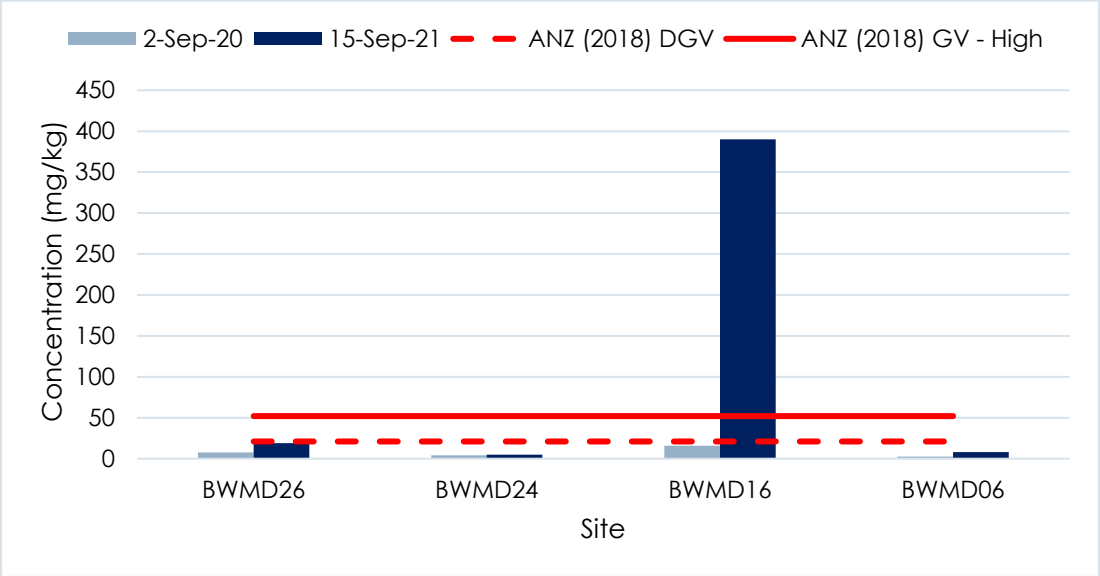

Figure 49: Nickel concentration in sediment recorded at Bayswater Brook sediment sampling sites 2020-2021

3.6.6 *Zinc*

The ANZG (2018) DGV concentration for zinc in sediment is 200 mg/kg and the GV-high concentration is 410 mg/kg.

2020 Results

The concentration of zinc in sediment ranged from a minimum of 41 mg/kg at BWMD06 to a maximum of 1000 mg/kg at BWMD26. This maximum exceeds both the DGV and GV-High triggers. BWMD24 exhibited a concentration of 210 mg/kg which exceeds the DGV trigger. This is similar to results from 2016-2019.

2021 Results

The concentration of zinc in sediment ranged from a minimum of 72 mg/kg at BWMD06 to a maximum of 1600 mg/kg at BWMD26. This maximum was the only exceedance, greater than both the DGV and GV-high triggers (Figure 50).

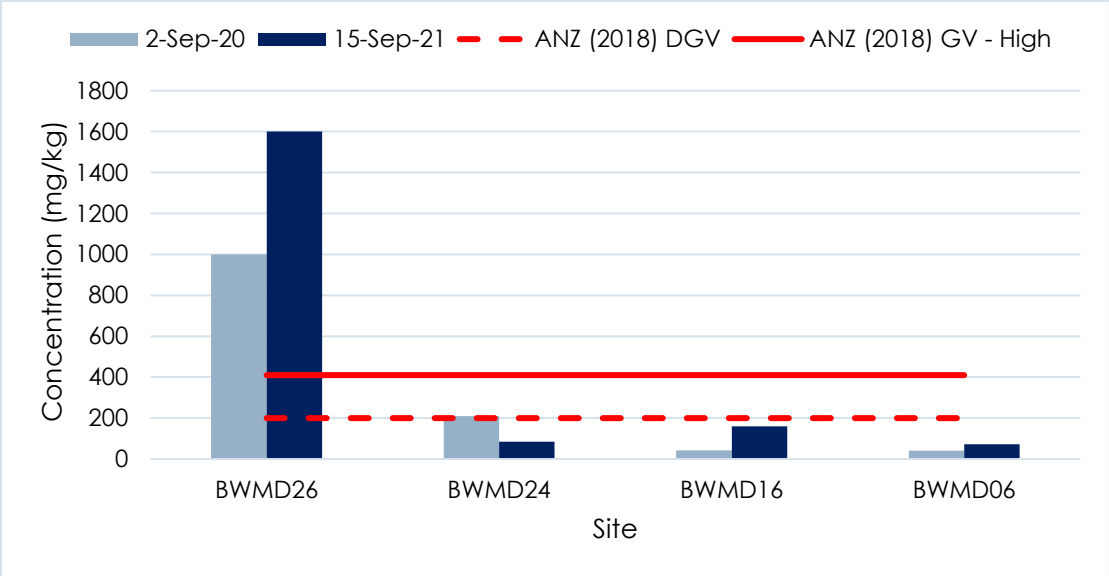

Figure 50: Zinc concentration in sediment recorded at Bayswater Brook sediment sampling sites 2020-2021

4 ENVIRONMENTAL HEALTH ASSESSMENT

A separate investigation was conducted to assess microbiological parameters in the Bayswater Brook area over the course of 2019-2021. The results and analysis of this can be found in Appendix C.

The conclusions from the 2019-2021 report are as follows:

The environmental health sampling program revealed concentrations of Thermotolerant Coliforms and Enterococci that were above the default guideline values for secondary contact in a number of locations within the Bayswater Brook. While the concentrations are elevated, the results from this sampling alone cannot provide insight into the source of contamination which may be related to sewage discharge or more likely plant and animal sources.

5 DISCUSSION

The following sections provide discussion on the physio-chemical, nutrients, metals and sediment quality sampling that was undertaken in 2020 and 2021.

5.1 Physio-chemical

The pH measured at the Bayswater Brook catchment during the 2020-2021 sampling period was generally neutral, tending towards slightly acidic. This is similar to what has been seen in previous years. Lower pH levels were recorded at the sites further upstream in the catchment (Figure 5) and became more neutral towards the Bayswater Brook outlet into the Swan River. There was one highly basic reading at BWMD26 in September of 2020 with a pH of 9.13. Field notes state there was algae present at this time. There is a positive correlation in between basic pH levels and algae presence.

The median electrical conductivity (EC) recorded across the study area was in exceedance of the ANZG (2018) guideline range, suggesting that the majority of sites within the catchment reflect slightly brackish conditions. EC appeared to be slightly higher at sites that were downstream of the industrial area (Figure 8). Only five sites recorded EC measurements within the ANZG (2018) guideline range on any occasion; BWMD09, BWMD10, BWMD24, BWMD25 and BWMD31. All other sites were consistently above of the guideline levels.

Dissolved oxygen is subject to diurnal and seasonal variation, with concentrations predominantly affected on a daily basis by biogeochemical processes, atmospheric exchange, and water temperature variations (Connell and Miller 1984). Low dissolved oxygen concentrations may adversely affect aquatic biota that depend on oxygen for functioning and may also result in increased toxicity of several contaminants (zinc, lead, copper, ammonia) (ANZG 2018).

The median dissolved oxygen (DO) concentration recorded across the study area was below the ANZG (2018) guidelines advisable range at the majority of the sampling sites.

Most of the sites that recorded a median DO concentration within the guideline range were located along the Bayswater Brook, aside from BWMD08 and BWMD28, while the lowest median DO concentrations were measured at BWMD09 and BWMD10, as well as northernmost sites around the Weld Square living stream. The only site to record a median DO% above ANZG (2018) guidelines was site BWMD25, which exceeded the guidelines on 3 separate occasions. These sites often had little flow or were stagnant, so a lower DO% is expected. Compared to 2018-2019, BWMD25 has a significantly higher DO, while BWMD09 and BWMD10 have had a significant decrease. This should be monitored closely in future years.

Total suspended solids are a measure of silt, phytoplankton and organic matter (GHD 2016). Phosphorus, metals and other contaminants commonly bind to sediment and are transported with the particulate matter in stormwater runoff and drainage. As the monitoring program did not target rainfall events the sampling events were typically conducted under base flow conditions. The highest TSS concentrations were recorded at BWMD06, BWMD03 and BWMD04 during the September 2021 sampling events with concentrations of 88 mg/L, 79 mg/L and 53 mg/L respectively. TSS was also high at BWMD26 in August of 2021. Both of these periods were unseasonably dry with minimal to no rainfall during and preceding sampling events. It is recommended to closely monitor TSS in this area in future.

The field notes suggested that there was a pollution event on this occasion in September of 2021. The DWER pollution response unit was called and investigated this further. They used Methylene Blue Active Substances to test for surfactant discharge. Results of this testing are provided in Appendix D.

A summary of the sites where physico-chemical measurements exceeded their respective default guideline values or range is provided in Table 23.

Table 23: Summary of physio-chemical exceedances (2020-2021)

Site	Median in exceedance of default guideline value or range			
	pH	DO	EC	TSS
BWMD01	-	-	X	-
BWMD02	-	-	X	-
BWMD03	-	-	X	X
BWMD04	-	-	X	-
BWMD05	-	-	X	-
BWMD06	-	-	X	X
BWMD07	-	X	X	-
BWMD08	-	-	X	-
BWMD09	X	X	X	X
BWMD10	X	X	-	-
BWMD11	X	X	X	-
BWMD12	X	X	X	-
BWMD13	X	X	X	-
BWMD14	-	-	X	-
BWMD15	X	X	X	-
BWMD16	X	X	X	-
BWMD17	-	-	X	-
BWMD18	-	X	X	-
BWMD19	X	X	X	-
BWMD21	-	X	X	-
BWMD22	-	-	X	-
BWMD23	X	X	X	-
BWMD24	X	X	X	X
BWMD25	-	-	X	-
BWMD26	X	X	X	-
BWMD28	-	-	X	-
BWMD29	-	X	X	-
BWMD30	-	X	X	-
BWMD31	X	X	X	-
WELDSQUARE1	X	X	X	-
WELDSQUARE2	X	X	X	-

5.2 Nutrients

Nutrients are noted as a key concern for the water quality within the *Swan Canning Water Quality Improvement Plan* (SRT 2009), which identifies the Bayswater Brook as a key sub-catchment for TN load reduction (target reduction of 59% on existing levels, as of 2009). Further SRT (2009) has set target reductions of 27% of current TP loads for the Bayswater Brook catchment. Long and short term targets mentioned below are taken from this document.

Nutrient sampling during the 2020 and 2021 monitoring period recorded a number of sites within the catchment that had median nutrient concentrations in exceedance of the relative guideline concentrations. The number of exceedances has decreased since the 2018-2019 reporting period. The exceedances are summarised in Table 24.

The median total nitrogen (TN) concentration was highest towards the lower end of the catchment, near the outlet to the Swan River. The sites located in the section of open drain that runs alongside Tonkin Hwy (BWMD06, BMWD07 and BWMD08) all recorded elevated TN concentrations. Sites BWMD01, BWMD02, BWMD03, and BMWD04 are located downstream of the confluence open drains and reflect the combination of the higher concentration channels upstream to the north (BWMD06, BWMD07 and BWMD08) and to the east (BWMD26). High-nutrient stormwater runoff from the surrounding public open space may have attributed to higher TN concentrations at BWMD01 and BWMD02. These trends are the same as those observed in the 2018-2019 monitoring period however median TN has dropped slightly from 1mg/L to 0.9 mg/L in 2020-2021.

All samples besides 6 were below the short-term target (2 mg/L) identified in the *Swan Canning Water Quality Improvement Plan* (SRT 2009). These exceedances occurred in July of 2020 at BWMD16, BWMD06 and BWMD05 and in 2021 at BWMD16 and BWMD26 in July and BWMD24 in September. 29 samples exceeded the long-term target of 1 mg/L in 2020, while 32 exceeded this target in 2021. Oxidised nitrogen maintained high exceedance rates. Ammonium/ammonia exceedances significantly dropped from 21 median exceedances in 2018-2019 to 7 median exceedances in 2020-2021.

Significant spikes in total phosphorus were observed in September of 2021 at BWMD03, BWMD04 and BWMD06 at 1.4 mg/L, 0.85 mg/L and 1.8 mg/L respectively. However, annual median TP concentrations were below the short term and long-term nutrient reduction targets (0.2 and 0.1 mg/L respectively) for both years with no sites recording medians in exceedance of the long-term nutrient reduction targets in either year. Aside from BWMD06 and BWMD24, no sites recorded an annual median in exceedance of the short-term nutrient reduction targets.

There were two sites (BWMD06 and BWMD24) that recorded medians in exceedance of the default guidelines for soluble reactive phosphorus (SRP). This is an increase from no exceedances of median SRP in 2018-2019. BWMD24 is in a residential area, while BWMD06 is in the light industrial region. Given these exceedances did not occur in previous year, it is recommended to continue monitoring these sites closely for further exceedances of SRP.

The Swan River Trust (2009) modelled several management scenarios to assess the contribution of different scenarios to nutrient load reduction for the Swan Canning River system. Specifically, a selection of management scenarios was modelled individually and in combination for the Bayswater Brook catchment. The modelling exercise identified that a combination of management scenarios applied as a treatment train approach was able to reduce the annual nitrogen and phosphorous load below the maximum acceptable total nitrogen load (SRT 2009). Based on the outcomes of the modelling the combination of management actions that were found to be effective for both nitrogen and phosphorus loads within the Bayswater Brook catchment were:

- 100% septic tank infill
- Wetland implementation
- 50% public open space (POS) fertiliser reduction
- 15% urban fertiliser reduction.

While the residential infill sewerage program was completed within the catchment in the early 2018s, septic tanks are still reported to be present throughout the Bayswater industrial area and are therefore considered a local source of nutrients. An additional source of nitrogen within the lower section of the catchment is the former Cresco/CSBP site which is identified as contributing 25% of the annual Bayswater Brook catchment TN load (Barron *et al.* 2010).

Additional anthropogenic sources of nutrients within the catchment may include diffuse sources in the catchment such as urban runoff (detergents, fertilisers) and legacy nutrients in groundwater from historic land uses and residential septic tanks or point sources such as industrial sources (Nice *et al*. 2009).

Table 24: Summary of nutrient exceedances (2020-2021)

Site	Median in exceedance of default guideline value or range				
	NH_x-N	TN	NO_x-N	TP	SRP
BWMD01	X	-	X	-	-
BWMD02	-	X	X	-	-
BWMD03	X	-	X	X	-
BWMD04	X	-	X	X	-
BWMD05	-	-	X	-	-
BWMD06	X	X	X	X	X
BWMD07	-	-	X	-	-
BWMD08	-	-	X	-	-
BWMD09	-	-	-	-	-
BWMD10	-	-	-	-	-
BWMD11	X	-	X	-	-
BWMD12	-	-	-	-	-
BWMD13	-	-	-	-	-
BWMD14	-	-	X	-	-
BWMD15	X	-	X	-	-
BWMD16	X	X	X	-	-
BWMD17	-	-	X	-	-
BWMD18	-	-	-	-	-
BWMD19	-	-	-	-	-
BWMD21	-	-	X	-	-
BWMD22	-	-	X	-	-
BWMD23	-	-	X	-	-
BWMD24	-	-	-	X	X
BWMD25	-	-	-	X	-
BWMD26	-	X	X	-	-
BWMD28	-	-	X	-	-
BWMD29	-	-	X	-	-
BWMD30	-	-	X	-	-
BWMD31	-	-	-	-	-
Weldsquare01	-	-	-	-	-
Weldsquare02	-	-	-	-	-

5.3 Metals

Metals can have a number of impacts on ecosystems including toxicity to aquatic biota, bioaccumulation within some animals and persistence within the environment, as well as aesthetic and health impacts (GHD, 2016).

Similar to the results of the previous years' monitoring programs, a majority of the sampling sites recorded multiple exceedances of the guideline values for both aluminium and zinc. As was discussed in the *Water and Sediment Quality in the Bayswater Brook Catchment: 2018-2019 monitoring report* (Urbaqua, 2020) the widespread presence of these metals in the surface water network is unlikely to be a result of stormwater runoff contamination and is more likely related to the groundwater conditions and surface geology in the surrounding area. Based on the catchment's positions within the regional hydrogeological system, it is expected that the Bayswater Brook receives regional groundwater contributions from recharge zones at the Gnangara Mound (Barron *et al*. 2010). Sites of concern for metals remain unchanged from previous reports.

There were 3 sites that recorded exceedances of the HMTV for chromium, BWMD09. BWMD15 and BWMD16. All 3 sites exceeded the HMTV on every occasion. BWMD16 was also only one of two sites to record exceedances of the HMTV for nickel, which it did at all sampling events in 2020 and 2021. BWMD02 was the only other site to record an exceedance of the HMTV of nickel and only on one occasion in September of 2021. BWMD16 has been identified in every previous report as a site of concern with regards to chromium and nickel concentrations.

It is noted that the site directly downstream of BWMD16, BWMD15 which is located directly upstream of the confluence with another main branch of the Bayswater Brook, was unable to be sampled due to lack of flow in all sampling events except July of both 2020 and 2021. It can be inferred from the observations of stagnant water at BWMD15 that the northern branch of the Bayswater Brook only connects to the downstream section and therefore the Swan River during periods of high flow, likely directly after significant rainfall events. This is confirmed by field observations, with notes taken during the August 2020 sampling event describing BWMD15 as wet but "too shallow to sample". The consequence of this periodic connectivity is that the stagnant water that is high in dissolved chromium and nickel concentrations is flushed downstream during rainfall events and not observed in the regular monitoring program. However, with the limited data at BWMD15 it is difficult to determine the downstream impact of the high chromium and nickel concentrations at BWMD16. This trend has been ongoing every monitoring year since 2016 with limited samples due to the lack of water available.

The high concentrations of chromium and nickel at BWMD16 suggest a potential point-source/s of contamination for these metals in the catchment area around or directly upstream of the site. Information provided by DWER states there is suspected chromium releases from the light industrial area. It is noted that BWMD16 appears to be downstream of nearby chrome metal plating businesses as discussed in the environmental health investigation (Appendix C), and it is also the only to site to have demonstrated exceedances of the ANZG (2018) chromium trigger values. In addition, uncovered construction or scrap materials and stored wrecked car bodies were observed in the surrounding area that may also be associated with the localised increase in soluble metals.

The exceedances of the soluble metal guidelines during the 2020-2021 monitoring period are summarised in Table 25.

With regards to sediment quality, BWMD26 exceeded ANZG (2018) high trigger values for Zinc on both occasions. This is an improved results compared to 2018 and 2019 where all metal guidelines were exceeded. It is noted that all sites exceeded in soluble zinc on almost all occasions. The only other sediment exceedance was observed at BWMD16 in September of 2021 where the nickel reading exceeded the ANZG (2018) high trigger value.

Table 25: Summary of soluble metals exceedances (2020-2021)

Site	≥ 50% of samples exceed guideline value	All samples exceeded guideline value
BWMD01	Zn	Zn
BWMD02	Al[1], Zn	-
BWMD03	Al[1,2], Zn	Zn
BWMD04	Al[1,2], Zn	Zn
BWMD05	Al[1], Zn	Zn
BWMD06	Al[1,2], Zn	Zn
BWMD07	Al[1], Zn	Zn
BWMD08	Al[1], Zn	-
BWMD09	Al[2], Zn	Zn
BWMD10	Al[2], Zn	Zn
BWMD11	Al[1,2], Zn	-
BWMD12	Al[1,2], Zn	Al[2]
BWMD13	Al[2], Zn	Al[2]
BWMD14	Zn	Zn
BWMD15	Al[2], Zn	Zn
BWMD16	Al[1], Cr, Ni, Zn	Cr, Ni
BWMD17	Al[1], Zn	Zn
BWMD18	Al[1], Zn	-
BWMD19	Al[1], Zn	-
BWMD21	Al[1], Zn	Zn
BWMD22	Al[1], Zn	-
BWMD23	Zn	Zn
BWMD24	Cu, Zn	-
BWMD25	Zn	Zn
BWMD26	Zn	Zn
BWMD28	Zn	Zn
BWMD29	Al[1], Zn	Zn
BWMD30	Al[1], Zn	Zn
BWMD31	Zn	-
Weldsquare01	Al[2], Cu, Zn	Al[2]
Weldsquare02	Al[2], Zn	Al[2]

[1] Aluminium exceeds ANZG (2018) 95% species level protection (0.055 mg/L & pH > 6.5)

[2] Aluminium concentrations exceeds ANZG (2018) recreational guideline value (0.2 mg/L)

Metals can have a number of impacts on ecosystems including toxicity to aquatic biota, bioaccumulation within some animals and persistence within the environment, as well as aesthetic impacts and health impacts (GHD, 2016).

Baseline surface water quality assessments of urban (Nice et al. 2009) and industrial (Foulsham 2009) drainage throughout the Perth metropolitan region completed by the Department of Water identified that surface water concentrations of aluminium, iron, zinc and copper exceeded guidelines in the majority of catchments. These studies measured total metal concentrations and are therefore not directly comparable to the current monitoring program, however they highlight the common occurrence of these contaminants in urban and industrial drainages within Perth. Aluminium has potential to leach from natural deposits in the soil under low pH conditions, however Foulsham (2009) notes that a number of industries present in Bayswater including car wreckers, building product suppliers, automotive repair shops, sheet metal and fabrication facilities also widely use aluminium.

Table 26 reproduces a table of sources of metals in stormwater from the 2013 water and sediment quality report for the Bayswater Brook (included again in the 2014 & 2015 water and sediment quality report (GHD 2016) (SERCUL 2014) for the metals that were included in the Bayswater Brook monitoring program. Foulsham (2009) identifies small to medium industries present in the Bayswater Industrial area include car wreckers, automotive electricians, building product supplies, mechanical repair workshops, printing companies, cabinet makers, tyre repairers, service stations, battery suppliers, radiator specialists, gas suppliers, cleaning supplies, fridge and washer suppliers, panel and paint facilities, sheet metal and fabrication facilities, aluminium and chrome product suppliers, plasterers, sand blasting facilities, tile supplies and engineering companies.

Table 26: Sources of metals in stormwater (reproduced from SERCUL 2013)

Source	Al	Cr	Cu	Ni	Pb	Zn
Exists naturally	✓	✓		✓		✓
Combustion/burning of fossil fuels		✓			✓	
Waste water, sewerage sludge and landfill leachate	✓	✓	✓		✓	✓
Industrial activities and emissions					✓	✓
Chemical manufacturing (dyes, paints, plastics,		✓		✓	✓	✓
Electrical products		✓	✓			
Electroplating/alloys			✓	✓		
Metal industry and domestic products	✓	✓	✓	✓	✓	✓
Corrosion of metal objects			✓			✓
Wear of vehicle tyre and brake pads			✓		✓	✓
Battery manufacture				✓	✓	✓
Engine parts		✓		✓		
Lubrication oil – oil/gas industries						✓
Pesticides, fertilisers and agricultural/gardening		✓	✓	✓		✓
Wood treatment/products		✓				✓
Leather industry			✓			
Manufacturing of ceramics, clay, paper, glass,	✓	✓				
Disinfectants/Antiseptics						✓
Computer and TV screen					✓	
Pharmaceuticals/medicines/medicine treatment		✓				
Steam and air conditioning supplies		✓				
Cement product plants		✓				
Construction						✓
Pipes					✓	✓
Fluorescent lighting/power plants				✓		
Waste incinerator				✓		
Food products equipment/food industry				✓		

6 RECOMMENDATIONS

This section provides recommendations that are intended to support the long-term vision for the Bayswater Brook. The recommendations are linked back to the proposed management actions identified within plans prepared for the catchment, the most recent being the Waterwise Bayswater Strategy (Urbaqua, 2020), which superseded the Bayswater Brook Action Plan (Bluesands Environmental, 2012).

The results from the 2020-2021 monitoring program are largely consistent with the results from the 2018-2019 monitoring program and therefore the recommendations for water quality improvement actions carry over from the *Water and Sediment Quality in the Bayswater Brook Catchment 2018-2019* (Urbaqua, 2020) report.

The Bayswater Brook monitoring program has identified elevated concentrations of nutrients and metals at various locations across the study area, which are listed below. A number of water quality parameters recorded exceedances of ecosystem health guidelines (ANZG 2018 south-west lowland rivers trigger values and site specific HMTV), as well as recreational guidelines (ANZG 2018).

Within the catchment the biggest concern is widespread elevated concentrations of nitrogen and soluble metals. This is consistent with previous years' monitoring programs; sources of nutrients and metals in the catchment are likely associated with both current and historic land use practises within the catchment (GHD, 2016). The *Swan Canning Water Quality Improvement Plan* (SRT 2009) identified the Bayswater Brook sub-catchment as having an unacceptable total nitrogen load requiring a load reduction of > 45%.

A risk management approach is recommended to assist with source identification across all potential water quality parameters of concern in surface waters, and prioritisation of future management actions.

Soluble metal concentrations were elevated across the study area, particularly soluble aluminium and zinc. As was previously stated, the widespread nature indicates that the source is more likely from the surrounding surface geology and groundwater intrusion rather than contamination from surface runoff. However, there were a number of sites that had multiple exceedances of soluble metals that indicate poor water quality that could potentially impact the ecosystem health. The City of Bayswater is completing small-medium enterprise audits by local government environmental health officers.

The sub catchment surrounding BWMD16 should be the focus of any future audits and investigation into potential sources of metal contamination in surface water. BWMD16 has consistently returned elevated concentrations of chromium and nickel for at least the past 7 years of monitoring and therefore consideration should be given to specifically identifying and potentially rectifying the origin of these metals in the system. Sites to consider for further investigation include:

- BWMD02 (TN, NOx, SRP)
- BWMD06 (NH_x-N) (Al, Cu, Zn)
- BWMD09 (DO) (TP) (Al, Cr, Cu, Zn)
- BWMD15 (Al, Zn)
- BWMD16 (TN, NOx) (Al, Cr, Ni, Zn)
- BWMD24 (DO) (TP, SRP) (Cu, Zn)
- BWMD26 (TN, NOx, TP) (Zn)
- WELDSQUARE1 (Al, Cu, Zn)

It is also recommended that an alternative to site BWMD15 be explored due to inconsistent availability of water in the last few years. If possible, a site within close proximity is recommended as it is immediately downstream of site BWMD16 and thus may be considered a significant monitoring location within the catchment.

Water quality improvement plans

Future water quality improvement planning within the catchment should consider the identification of high groundwater contribution to the Bayswater Brook to further target baseflow water quality. It is recommended that as water quality improvement planning within the catchment progresses the prioritisation and design of appropriate structural best management practises should consider the dominant transport pathways and key water quality parameters of concern of the contributing sub-catchment through targeted monitoring programs, as well as site specific constraints to design and construction (GHD, 2016).

As per the Delivering WSUD in the City of Bayswater document (Urbaqua, 2022), it is recommended that consideration is given into Water Sensitive Urban Design (WSUD) strategies to better manage stormwater and drainage.

It is also advised to continue progressing with the implementation of the City's living streams program. A number of sections of open drain located within the Morley Activity Centre redevelopment area, in the mid to upper catchment, have been previously identified as sites for opportunities including:

- Rudloc Road open drain
- Vera Street open drain
- Nora Hughes open drain

As mentioned in previous years, it is recommended that consideration be given to identification of additional WQIP sites within the lower catchment downstream of the identified large potential nitrogen sources (Bayswater industrial area and former Cresco/CSBP site), in order to provide a treatment train for baseflow in conjunction with the Eric Singleton Bird Sanctuary wetland, which was completed in October 2015. In particular there are numerous sections of open drain that may present opportunities for linear WQIP such as living streams or groundwater treatment curtains in areas of high groundwater discharge to the drainage network. It is recommended that the separate *Eric Singleton Bird Sanctuary Sampling and Analysis Plan* and results be considered in future monitoring assessments for the Bayswater Brook catchment.

If any sites are transformed into living streams or wetlands which are part of the Bayswater Brook, it is proposed that additional baseline upstream and downstream monitoring be undertaken in order to support future performance assessment of the project.

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Appendix A Results of water and sediment quality

		Barometer	Specific Conductivity	Salinity	TDS	Temp	TSS (mg/L)	pH	ORP	ODO	ODO	Depth
	LOR	-	-	-	-	-	-	-	-	-	-	-
	Unit	mmHg	µS/cm	ppt	mg/L	°C	mg/L	-	mV	% Sat	mg/L	m
ANZG (2018) lowland river			0.13-0.3					6.5 - 8.0				
ANZG (2018) Recreational					1000			6.5 - 8.5				
BWMD01	Jul-20	770.1	0.75	0.37	487	59.1	0	6.85	65.6	76.6	7.69	0.586
	Aug-20	764.2	0.716	0.35	466	15.1	0	6.55	128	82.2	8.26	0.274
	Sep-20	759.5	0.575	0.28	374	15.8	0	7.21	88.8	82.7	8.19	0.314
	Jul-21	757.7	0.734	0.36	477	15.9	0	6.91	108.8	92.4	9.12	0.332
	Aug-21	761.9	0.645	0.32	419	17.9	0	7.34	125.8	88.4	8.37	0.428
	Sep-21	758.8	0.616	0.3	400	16.6	0	7.09	241.6	-	-	0.384
BWMD02	Jul-20	770.1	0.806	0.4	524	64.2	0	7.09	54.3	81.8	7.74	0.353
	Aug-20	764.3	0.765	0.38	497	18.4	0	7.03	71.6	85.9	8.05	0.307
	Sep-20	759.8	0.655	0.32	426	18.6	0	6.86	74.3	82.7	7.73	0.346
	Jul-21	758.2	1.385	0.7	900	18.5	0	7.13	120.7	84.3	7.87	0.365
	Aug-21	762	0.634	0.31	412	19	0	7.46	158.2	92.9	8.6	0.333
	Sep-21	758.6	0.616	0.3	401	19.7	0	7.21	211.1	-	-	0.285
BWMD03	Jul-20	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	764.3	0.687	0.34	446	15.6	0	6.92	18.5	93.3	9.27	0.359
	Sep-20	759.9	0.525	0.25	341	16.2	0	6.9	42	97.5	9.57	0.348
	Jul-21	758.2	0.748	0.37	486	16.2	0	6.82	91.6	96.2	9.44	0.835
	Aug-21	761.8	0.61	0.3	396	18.3	0	7.07	60.6	96.4	9.06	0.521
	Sep-21	758.4	0.608	0.3	396	17	0	6.89	119	-	-	0.294
BWMD04	Jul-20	770.5	0.717	0.35	466	60.5	0	7.03	2.8	96.4	9.53	0.438
	Aug-20	764.3	0.674	0.33	438	15.8	0	6.92	3.6	96.8	9.58	0.493
	Sep-20	759.9	0.51	0.25	331	16.3	0	6.82	47.6	99.1	9.71	0.446
	Jul-21	758.2	0.729	0.36	474	16.2	0	6.72	87.1	97.8	9.6	0.483
	Aug-21	761.7	0.598	0.29	389	18.4	0	7.01	59.5	98.8	9.27	0.716
	Sep-21	758.6	0.596	0.29	388	17.6	0	6.97	97.6	-	-	0.331
BWMD05	Jul-20	770.1	0.917	0.45	596	59.2	0	6.21	55.5	66.9	6.72	0.349
	Aug-20	764	0.619	0.3	402	16.3	0	7.11	72.4	100.5	9.83	0.844
	Sep-20	760	0.495	0.24	322	18	0	7.03	102.3	109.6	10.36	0.825
	Jul-21	757.8	0.767	0.38	499	17.6	0	7.19	143.6	97.9	9.32	0.352
	Aug-21	761.4	0.659	0.32	428	18.3	0	6.62	81.8	88.8	8.35	0.478
	Sep-21	756.6	0.542	0.26	352	20.6	0	7.1	173.7	-	-	0.36
BWMD06	Jul-20	770	0.837	0.41	544	61	0	6.55	-5	73.4	7.22	0.377
	Aug-20	764	0.777	0.38	505	15.7	0	6.3	4.4	78	7.72	0.394
	Sep-20	760.1	0.491	0.24	319	16.4	0	6.44	26.9	89.5	8.75	0.384
	Jul-21	758	0.741	0.36	481	16.1	0	6.97	68.8	89.2	8.77	0.284
	Aug-21	761.4	0.542	0.26	353	19.1	0	7.2	121	101.3	9.37	0.346
	Sep-21	756.3	0.67	0.33	436	19.3	0	6.51	103.5	-	-	0.343
BWMD07	Jul-20	769.2	0.705	0.35	458	59.6	0	6.63	73.1	38.8	3.88	0.492
	Aug-20	763.2	0.649	0.32	422	15.4	0	6.53	85.2	45.7	4.56	0.628
	Sep-20	759.3	0.408	0.2	265	17.2	0	6.33	124	92.5	8.9	0.643
	Jul-21	757.1	0.641	0.31	417	16.3	0	7.22	143.2	65	6.37	0.298
	Aug-21	760.5	0.588	0.29	382	18.6	0	6.53	132.3	68.9	6.44	0.32
	Sep-21	755.1	0.586	0.28	381	19.9	0	6.65	117.2	-	-	0.311
BWMD08	Jul-20	768.9	0.705	0.34	458	65.6	0	6.69	79.9	81.5	7.59	0.338
	Aug-20	763.3	0.661	0.32	430	17.9	0	6.48	94	80.7	7.63	0.495
	Sep-20	759.3	0.422	0.2	274	17	0	6.38	123.1	89.4	8.63	0.491
	Jul-21	757.1	0.619	0.3	403	15.8	0	7.32	154.4	65.9	6.52	0.299
	Aug-21	760.5	0.588	0.29	382	18.8	0	6.48	145.9	72.9	6.78	0.532
	Sep-21	755.1	0.587	0.29	382	18.1	0	6.62	180.9	-	-	0.292
BWMD09	Jul-20	767.1	0.135	0.06	88	55.4	0	6.46	97.2	17.2	1.81	0.547
	Aug-20	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	762.9	0.315	0.15	205	16.7	0	5.99	9.6	18.6	1.8	0.256
	Jul-21	760.6	0.417	0.2	271	15.3	0	6.47	71.5	20.6	2.06	0.321
	Aug-21	758.4	0.693	0.34	451	16.8	0	6.59	102.5	24.1	2.33	0.283
	Sep-21	759.3	0.471	0.23	306	15.8	0	6.44	141.3	51.3	5.08	-
BWMD10	Jul-20	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	768.2	0.159	0.08	103	14.2	0	6.2	15.6	11.6	1.19	0.346
	Sep-20	762.6	0.16	0.08	104	17.2	0	6.48	57.8	45.6	4.39	0.459
	Jul-21	760.5	0.644	0.32	419	16.9	0	6.25	157.2	32.5	3.15	0.311
	Aug-21	758.2	0.798	0.39	519	17.8	0	6.1	135.6	31.7	3.01	0.305
	Sep-21	759.3	0.293	0.14	190	16.3	0	6.66	134.6	77.6	7.61	-
BWMD11	Jul-20	764.4	0.639	0.31	416	67.5	0	5.95	-21.7	40.9	3.73	0.274
	Aug-20	768.5	0.681	0.33	442	18.5	0	6.14	30.4	46.4	4.34	0.479
	Sep-20	762.9	0.604	0.29	393	18.1	0	6.15	75	61.1	5.76	0.279
	Jul-21	761.1	0.524	0.25	340	17.2	0	6.46	127.2	66.1	6.35	0.318
	Aug-21	758.5	0.55	0.27	358	17.8	0	6.28	109.4	56.3	5.34	0.316
	Sep-21	759.2	0.429	0.21	279	17.6	0	6.38	126.9	72.9	6.95	-
BWMD12	Jul-20	763.9	0.407	0.2	265	65.1	0	5.81	7.9	46.6	4.37	0.266
	Aug-20	768.3	0.529	0.26	344	17.4	0	5.92	44.3	51.5	4.93	0.355
	Sep-20	762.6	0.496	0.24	322	17.9	0	6.21	56.2	72.7	6.89	0.278
	Jul-21	761.1	0.414	0.2	269	16.7	0	6.46	148.5	82.8	8.03	0.319
	Aug-21	758.1	0.483	0.23	314	17.4	0	6.71	140.2	77.3	7.4	0.279
	Sep-21	758.7	0.428	0.21	278	17.9	0	6.36	107.6	109.9	10.42	-
BWMD13	Jul-20	763	0.568	0.28	369	61	0	5.51	121.8	33.8	3.32	0.255
	Aug-20	767.9	0.616	0.3	400	13	0	5.31	33.5	19.9	2.09	0.474
	Sep-20	762.3	0.519	0.25	337	15.8	0	5.63	69.7	24.2	2.4	0.287
	Jul-21	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	758.1	0.472	0.23	307	16.9	0	6.54	63.8	17.8	1.72	0.444

	Sep-21	758.3	0.435	0.21	283	17.4	0	6.3	147	50.4	4.83	-
BWMD14	Jul-20	768.6	0.615	0.3	400	64.8	0	6.87	13.2	95.3	8.96	0.332
	Aug-20	763.1	0.625	0.3	406	18.7	0	6.79	66.8	98	9.13	0.317
	Sep-20	759.6	0.489	0.24	318	18.4	0	6.74	90.2	99.1	9.29	0.333
	Jul-21	756.9	0.81	0.4	526	18.2	0	7.24	116.5	94.1	8.84	0.452
	Aug-21	760.3	0.559	0.27	364	20	0	6.86	124.4	97.5	8.85	0.61
	Sep-21	755.1	0.554	0.27	360	20.6	0	6.92	154.6	-	-	0.238
BWMD15	Jul-20	768.2	0.522	0.25	339	66.9	0	6.31	44.6	69.2	6.36	0.35
	Aug-20	762.9	0.507	0.25	330	18.8	0	6.37	111.4	81.7	7.6	0.257
	Sep-20	759.5	0.46	0.22	299	21	0	6.32	126.4	92.7	8.26	0.283
	Jul-21	756.7	0.813	0.4	529	18.6	0	6.53	126.1	28.6	2.67	0.262
	Aug-21	760.1	0.374	0.18	243	18.8	0	6.21	131.7	20.9	1.95	0.384
	Sep-21	754.8	0.363	0.17	236	18.2	0	6.77	166.2	-	-	0.264
BWMD16	Jul-20	767.4	0.65	0.32	423	69.3	0	6.43	59.4	28.6	2.56	0.493
	Aug-20	762.4	0.597	0.29	388	19.5	0	6.28	67.2	54.5	5	0.552
	Sep-20	759	0.507	0.25	330	19.6	0	6.1	84.4	44.7	4.09	0.48
	Jul-21	756.8	0.998	0.49	649	19.9	0	6.86	96.1	34.7	3.16	0.261
	Aug-21	759.6	0.411	0.2	267	20.5	0	6.11	103.1	19.4	1.75	0.359
	Sep-21	754.2	0.437	0.21	284	19.7	0	6.29	157.8	-	-	0.226
BWMD17	Jul-20	766.5	0.588	0.29	382	64.3	0	6.86	79.2	82.3	7.79	0.312
	Aug-20	761.7	0.564	0.27	367	17.7	0	6.79	70.9	96.2	9.15	0.435
	Sep-20	759.6	0.514	0.25	334	19.1	0	6.89	42.5	95.9	8.86	0.265
	Jul-21	756.6	0.584	0.28	380	17.5	0	6.99	156.4	79.6	7.6	0.337
	Aug-21	758.7	0.531	0.26	345	20.3	0	6.71	160.1	109.9	9.93	0.709
	Sep-21	757.3	0.485	0.24	315	16.6	0	7.22	132.8	64	6.23	-
BWMD18	Jul-20	766.3	0.496	0.24	323	64.4	0	6.62	41.6	61.1	5.77	0.38
	Aug-20	761.5	0.594	0.29	386	18.1	0	6.84	78.4	73.7	6.95	0.266
	Sep-20	759.6	0.497	0.24	323	18.6	0	6.64	66.6	80.3	7.5	0.354
	Jul-21	761.9	0.408	0.2	265	16.4	0	6.59	109.4	54.6	5.33	0.33
	Aug-21	758.6	0.565	0.27	367	20	0	6.66	155.2	75	6.81	0.701
	Sep-21	757.3	0.488	0.24	317	16.7	0	7.47	125.2	72	6.99	-
BWMD19	Jul-20	766.2	0.684	0.34	445	61.6	0	6.3	63.1	27.1	2.65	0.535
	Aug-20	761.6	0.622	0.3	404	17.8	0	6.25	91.3	29.6	2.81	0.289
	Sep-20	759.4	0.513	0.25	333	18.9	0	6.24	41.9	62.5	5.8	0.229
	Jul-21	761.9	0.417	0.2	271	16.5	0	6.68	137.5	51	4.97	0.425
	Aug-21	758.4	0.55	0.27	357	20	0	6.34	109.1	70.5	6.41	0.436
	Sep-21	757.3	0.525	0.25	341	17.6	0	6.87	108.6	61.6	5.87	-
BWMD20	Jul-20	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-	-	-
BWMD21	Jul-20	766.3	0.414	0.2	269	63.5	0	6.92	20.5	61.1	5.84	0.302
	Aug-20	761.5	0.595	0.29	387	17.7	0	6.99	90.3	69.4	6.6	0.401
	Sep-20	759.4	0.474	0.23	308	18.2	0	6.73	73.1	79.8	7.51	0.493
	Jul-21	762	0.388	0.19	252	16.2	0	6.67	105.9	58.6	5.76	0.472
	Aug-21	758.3	0.571	0.28	371	20.5	0	6.95	137.3	82	7.37	0.342
	Sep-21	757.8	0.448	0.22	291	17	0	7.45	129.6	71.3	6.88	-
BWMD22	Jul-20	766.4	0.588	0.29	382	63.2	0	6.66	104.8	78.4	7.51	0.44
	Aug-20	761.7	0.588	0.29	382	18	0	6.59	109.7	110.4	10.43	0.298
	Sep-20	762.4	0.561	0.27	365	17.4	0	6.19	106.6	64.1	6.13	0.407
	Jul-21	761.7	0.523	0.25	340	17.4	0	6.47	18.6	58.5	5.6	0.8
	Aug-21	757.9	0.512	0.25	333	20.2	0	6.42	108.4	85.8	7.75	0.282
	Sep-21	757.8	0.494	0.24	321	17.7	0	7.21	114.2	83.1	7.9	-
BWMD23	Jul-20	766.4	0.617	0.3	401	63.7	0	6.4	122.6	61.8	5.89	0.361
	Aug-20	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	758.5	0.53	0.26	345	18.1	0	6.38	129.9	82.8	7.81	0.199
	Jul-21	761.4	0.569	0.28	370	17.9	0	6.41	157.9	58.8	5.57	0.379
	Aug-21	757.6	0.505	0.24	328	20.7	0	6.22	168.2	64.6	5.79	0.324
	Sep-21	758.2	0.494	0.24	321	18.6	0	6.63	149	76.6	7.16	-
BWMD24	Jul-20	766.4	0.315	0.15	205	64	0	6.52	-57.4	34.7	3.3	-
	Aug-20	761.9	0.219	0.1	143	17.8	0	6.44	-52.7	39.2	3.72	0.278
	Sep-20	759.2	0.248	0.12	161	16.6	0	6.43	-58.4	48.4	4.71	0.205
	Jul-21	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	758.2	0.474	0.23	308	20.5	0	6.37	101.4	26.2	2.36	0.484
	Sep-21	753.9	0.433	0.21	282	19.8	0	6.65	165.2	-	-	0.262
BWMD25	Jul-20	766.3	0.328	0.16	213	59.2	0	6.71	9.1	40.5	4.07	0.419
	Aug-20	762	0.37	0.18	240	16.2	0	6.78	82.4	149.9	14.72	0.394
	Sep-20	759.6	0.206	0.1	134	16.9	0	9.12	56.3	158.4	15.34	0.304
	Jul-21	761.7	0.199	0.09	130	14.5	0	6.55	215.5	25.2	2.57	0.452
	Aug-21	758.2	0.446	0.22	290	18.7	0	6.77	154.8	104.5	9.74	0.288
	Sep-21	753.9	0.401	0.19	261	18.5	0	6.96	158.7	-	-	0.369
BWMD26	Jul-20	769.7	0.938	0.46	610	63.4	0	6.46	42.5	28	2.67	0.348
	Aug-20	763.5	0.786	0.39	511	16.7	0	6.48	57.8	41.9	4.07	0.367
	Sep-20	759.1	0.662	0.32	430	17.6	0	6.29	75.4	51.2	4.87	0.28
	Jul-21	757.5	1.126	0.56	732	18.6	0	6.57	143.4	27.8	2.59	0.272
	Aug-21	760.9	0.561	0.27	365	18.7	0	6.67	122.6	29.2	2.72	0.343
	Sep-21	756.9	0.555	0.27	361	17.4	0	6.43	164.3	-	-	0.33
BWMD27	Jul-20	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-	-	-
BWMD28	Jul-20	766.4	0.39	0.19	254	61.9	0	7.18	68.2	94.5	9.2	0.309

	Aug-20	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	758.6	0.454	0.22	295	17	0	6.67	126.2	78.4	7.57	0.593
	Jul-21	761.9	0.523	0.25	340	16.9	0	6.81	164.1	60.4	5.84	0.412
	Aug-21	757.9	0.505	0.24	328	20.1	0	6.54	172.1	98.7	8.94	0.328
	Sep-21	757.7	0.502	0.24	326	17.6	0	6.94	139.9	82.1	7.82	-
BWMD29	Jul-20	766.3	0.375	0.18	243	61.6	0	7.08	81.5	81.2	7.92	0.311
	Aug-20	762.1	0.502	0.24	327	15.8	0	6.59	121.8	59	5.85	0.265
	Sep-20	758.6	0.451	0.22	293	16.3	0	6.46	129.9	62.9	6.16	0.415
	Jul-21	762	0.398	0.19	259	16.5	0	7	182.1	69.8	6.82	0.344
	Aug-21	758.1	0.511	0.25	332	19.7	0	6.55	169.5	74.2	6.78	0.509
	Sep-21	758	0.497	0.24	323	17.2	0	6.84	143.7	82.5	7.92	-
BWMD30	Jul-20	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	758.2	0.496	0.24	322	17.2	0	6.7	151.6	79.1	7.59	-
BWMD31	Jul-20	766.8	0.406	0.2	264	58.4	0	6.33	-30.2	21.4	2.17	0.406
	Aug-20	761.7	0.546	0.27	355	17.3	0	6.16	91.3	44.3	4.25	0.644
	Sep-20	762.4	0.52	0.25	338	16.7	0	5.8	59.2	23.6	2.29	0.377
	Jul-21	762	0.293	0.14	190	16	0	6.88	95.6	49.9	4.92	0.331
	Aug-21	758	0.531	0.26	345	20	0	6.44	127.9	50.3	4.57	0.471
	Sep-21	757.7	0.349	0.17	227	17.5	0	7.42	91.9	63.8	6.09	-
WELDSQUARE1	Jul-20	763.2	0.539	0.26	350	61.4	0	5.52	158.2	39.1	3.82	0.257
	Aug-20	767.9	0.606	0.3	394	13.2	0	5.64	73.8	27.3	2.86	0.349
	Sep-20	762.3	0.518	0.25	337	16.1	0	5.64	109.9	31.6	3.11	0.332
	Jul-21	761.3	0.453	0.22	294	16.6	0	6.19	86.8	32.9	3.21	0.322
	Aug-21	757.9	0.471	0.23	306	17	0	6.59	133.5	21.9	2.11	0.366
	Sep-21	758.5	0.442	0.21	287	17.4	0	6.32	152.1	52.4	5.02	-
WELDSQUARE2	Jul-20	763.2	0.468	0.23	304	60.2	0	5.57	168	47.7	4.73	0.262
	Aug-20	768.1	0.593	0.29	385	12.8	0	5.87	116.1	33.2	3.51	0.478
	Sep-20	762.3	0.513	0.25	334	15.9	0	5.8	112.7	25.2	2.49	0.307
	Jul-21	761.2	0.442	0.21	288	16.2	0	6.3	143.9	44.2	4.34	0.421
	Aug-21	757.8	0.484	0.23	314	16.8	0	6.37	121.3	21.2	2.05	0.414
	Sep-21	758.6	0.462	0.22	300	17	0	6.26	155.6	49.8	4.8	-

		Ammonia as N	FRP	Organic Nitrogen - Filterable	Organic Nitrogen - Total	Total Kjeldahl Nitrogen (Calc)	Total Nitrogen	Total Oxidised Nitrogen (TON)	Total Phosphorus	Total Suspended Solids
	LOR	<0.010	<0.005	<0.025	<0.025	<0.025	<0.025	<0.010	<0.005	<1
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ANZG (2018) lowland river		0.08	0.04				1.2	0.15	0.065	
ANZG (2018) Recreational		0.01								
BWMD01	Jul-20	0.2	0.025	0.39	0.47	0.67	1.2	0.54	0.059	4
	Aug-20	0.15	0.019	0.42	0.42	0.58	1.1	0.49	0.045	4
	Sep-20	0.08	0.015	0.42	0.48	0.56	0.9	0.33	0.045	5
	Jul-21	0.049	0.013	0.4	0.46	0.51	0.97	0.46	0.059	7
	Aug-21	0.25	0.016	0.5	0.56	0.81	1.4	0.6	0.057	5
	Sep-21	0.18	0.013	0.53	0.54	0.72	1.2	0.48	0.046	5
BWMD02	Jul-20	0.095	0.04	0.66	0.71	0.81	1.3	0.53	0.06	3
	Aug-20	0.088	0.034	0.44	0.48	0.57	1.3	0.71	0.065	5
	Sep-20	0.034	0.029	0.34	0.35	0.38	1.1	0.74	0.042	<1
	Jul-21	0.054	0.049	0.5	0.53	0.59	1.9	1.3	0.072	<1
	Aug-21	0.06	0.045	0.37	0.41	0.47	1.9	1.4	0.076	4
	Sep-21	0.011	0.031	0.43	0.48	0.49	1.7	1.2	0.048	1
BWMD03	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	0.16	0.023	0.45	0.47	0.63	1.1	0.49	0.051	4
	Sep-20	0.059	0.022	0.4	0.46	0.52	0.84	0.32	0.053	<1
	Jul-21	0.053	0.019	0.47	0.53	0.58	1	0.45	0.069	7
	Aug-21	0.13	0.021	0.49	0.55	0.68	1.2	0.56	0.066	7
	Sep-21	0.098	0.015	0.58	1.1	1.2	1.6	0.43	1.4	79
BWMD04	Jul-20	0.28	0.03	0.54	0.63	0.91	1.4	0.49	0.067	5
	Aug-20	0.2	0.026	0.45	0.48	0.68	1.2	0.49	0.052	4
	Sep-20	0.073	0.023	0.4	0.41	0.49	0.84	0.35	0.056	4
	Jul-21	0.064	0.019	0.44	0.53	0.59	0.99	0.4	0.078	8
	Aug-21	0.14	0.026	0.46	0.54	0.68	1.2	0.55	0.067	6
	Sep-21	0.091	0.016	0.49	0.84	0.93	1.4	0.47	0.85	53
BWMD05	Jul-20	0.64	0.037	0.49	0.6	1.2	2	0.79	0.13	25
	Aug-20	0.074	0.016	0.41	0.46	0.53	1	0.47	0.037	4
	Sep-20	0.014	0.013	0.39	0.45	0.46	0.73	0.27	0.032	2
	Jul-21	0.005	0.007	0.43	0.44	0.44	0.88	0.44	0.038	5
	Aug-21	0.25	0.038	0.52	0.59	0.84	1.3	0.5	0.1	9
	Sep-21	0.005	0.007	0.57	0.62	0.62	0.99	0.38	0.037	4
BWMD06	Jul-20	0.64	0.041	0.41	0.51	1.1	2.1	0.94	0.13	16
	Aug-20	0.44	0.048	0.35	0.36	0.8	1.5	0.68	0.1	9
	Sep-20	0.16	0.044	0.39	0.46	0.62	0.97	0.35	0.098	7
	Jul-21	0.12	0.041	0.51	0.57	0.69	1.1	0.38	0.13	10
	Aug-21	0.05	0.017	0.43	0.52	0.57	1.1	0.56	0.038	4
	Sep-21	0.36	0.02	0.5	1	1.4	1.7	0.3	1.8	88
BWMD07	Jul-20	0.16	0.014	0.57	0.59	0.74	1.2	0.42	0.033	2
	Aug-20	0.049	0.01	0.49	0.51	0.55	1.1	0.52	0.024	2
	Sep-20	0.005	0.012	0.4	0.46	0.46	0.66	0.2	0.028	3
	Jul-21	0.005	0.006	0.61	0.65	0.65	0.83	0.17	0.047	5
	Aug-21	0.091	0.012	0.57	0.62	0.72	1.1	0.38	0.032	4
	Sep-21	0.005	0.0025	0.62	0.67	0.67	0.93	0.26	0.024	2
BWMD08	Jul-20	0.13	0.012	0.54	0.6	0.73	1.2	0.46	0.029	1
	Aug-20	0.032	0.009	0.51	0.55	0.58	1.2	0.58	0.029	6
	Sep-20	0.005	0.011	0.43	0.46	0.46	0.69	0.23	0.029	2
	Jul-21	0.005	0.0025	0.56	0.64	0.64	0.81	0.18	0.045	6
	Aug-21	0.087	0.014	0.58	0.62	0.71	1.1	0.35	0.038	3
	Sep-21	0.061	0.0025	0.58	0.6	0.66	0.96	0.3	0.027	2
BWMD09	Jul-20	0.005	0.049	0.7	0.88	0.88	0.9	0.021	0.15	13
	Aug-20	0.054	0.021	0.39	0.44	0.49	0.49	0.005	0.068	8
	Sep-20	0.027	0.011	0.37	0.49	0.52	0.53	0.013	0.055	6
	Jul-21	0.005	0.025	0.69	0.79	0.79	0.82	0.021	0.073	14
	Aug-21	0.12	0.014	0.6	0.63	0.75	0.85	0.1	0.041	6
	Sep-21	0.005	0.005	0.39	0.5	0.5	0.57	0.067	0.033	10
BWMD10	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	0.061	0.019	0.22	0.26	0.33	0.4	0.076	0.047	3
	Jul-21	0.015	0.016	0.62	0.67	0.69	0.94	0.25	0.048	6
	Aug-21	0.045	0.007	0.64	0.65	0.69	0.9	0.2	0.026	5
	Sep-21	0.005	0.0025	0.33	0.52	0.52	0.58	0.062	0.035	9
BWMD11	Jul-20	0.23	0.032	0.61	0.63	0.86	1.2	0.37	0.048	<1
	Aug-20	0.2	0.023	0.47	0.54	0.74	1.1	0.41	0.033	<2
	Sep-20	0.11	0.018	0.54	0.56	0.67	1	0.34	0.034	3
	Jul-21	0.058	0.013	0.65	0.68	0.74	1.2	0.45	0.036	3
	Aug-21	0.071	0.009	0.65	0.69	0.76	1.1	0.37	0.04	6
	Sep-21	0.017	0.027	0.55	0.58	0.6	0.8	0.2	0.053	5
BWMD12	Jul-20	0.13	0.0025	0.57	0.66	0.79	1.1	0.28	0.026	7
	Aug-20	0.087	0.0025	0.65	0.75	0.83	0.95	0.12	0.022	9
	Sep-20	0.035	0.007	0.58	0.6	0.64	0.69	0.054	0.02	4
	Jul-21	0.005	0.0025	0.69	0.69	0.69	0.84	0.15	0.028	3
	Aug-21	0.015	0.0025	0.66	0.75	0.77	0.9	0.13	0.03	15
	Sep-21	0.005	0.0025	0.61	0.76	0.76	0.82	0.055	0.021	2
BWMD13	Jul-20	0.13	0.021	1	1.3	1.4	1.4	0.018	0.099	18
	Aug-20	0.074	0.019	0.86	0.88	0.96	0.97	0.014	0.039	6
	Sep-20	0.058	0.012	0.63	0.69	0.75	0.77	0.025	0.031	4
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	0.057	0.006	0.64	0.7	0.75	0.86	0.11	0.021	2
	Sep-21	0.005	0.0025	0.59	0.66	0.66	0.78	0.12	0.017	2
BWMD14	Jul-20	0.13	0.02	0.45	0.5	0.63	0.94	0.31	0.041	2
	Aug-20	0.11	0.017	0.41	0.42	0.53	0.94	0.41	0.03	2
	Sep-20	0.005	0.011	0.47	0.49	0.49	0.76	0.27	0.031	2
	Jul-21	0.047	0.011	0.42	0.46	0.51	0.89	0.38	0.036	3

	Aug-21	0.075	0.016	0.48	0.53	0.6	1.1	0.45	0.036	5
	Sep-21	0.026	0.007	0.52	0.55	0.58	0.96	0.38	0.034	3
BWMD15	Jul-20	0.23	0.009	0.4	0.44	0.67	0.79	0.12	0.023	3
	Aug-20	0.24	0.007	0.45	0.48	0.73	0.9	0.18	0.028	5
	Sep-20	0.28	0.009	0.45	0.46	0.74	0.95	0.21	0.021	2
	Jul-21	0.025	0.006	0.52	0.54	0.56	0.84	0.28	0.034	<2
	Aug-21	0.23	0.014	0.59	0.63	0.86	1.2	0.32	0.035	4
	Sep-21	0.005	0.007	0.48	0.53	0.53	0.65	0.12	0.045	6
BWMD16	Jul-20	0.19	0.011	0.61	0.69	0.89	2.4	1.5	0.017	<2
	Aug-20	0.14	0.01	0.33	0.35	0.49	1.7	1.3	0.012	<2
	Sep-20	0.08	0.01	0.28	0.3	0.38	1.2	0.84	0.023	2
	Jul-21	0.23	0.0025	0.68	0.7	0.93	2	1	0.016	3
	Aug-21	0.22	0.0025	0.33	0.35	0.57	1.1	0.54	0.007	<2
	Sep-21	0.2	0.0025	0.41	0.49	0.69	1.7	1	0.008	1
BWMD17	Jul-20	0.066	0.012	0.57	0.62	0.69	0.76	0.074	0.032	3
	Aug-20	0.065	0.01	0.49	0.54	0.61	0.74	0.13	0.028	3
	Sep-20	0.005	0.007	0.48	0.52	0.52	0.61	0.086	0.024	2
	Jul-21	0.005	0.0025	0.44	0.46	0.46	0.67	0.22	0.027	2
	Aug-21	0.024	0.008	0.51	0.54	0.56	0.87	0.31	0.023	2
	Sep-21	0.005	0.0025	0.52	0.57	0.57	0.78	0.21	0.02	2
BWMD18	Jul-20	0.072	0.015	0.5	0.57	0.64	0.72	0.081	0.039	6
	Aug-20	0.097	0.009	0.45	0.48	0.58	0.72	0.15	0.024	3
	Sep-20	0.005	0.008	0.51	0.52	0.52	0.61	0.09	0.023	2
	Jul-21									
	Aug-21	0.036	0.006	0.5	0.55	0.58	0.79	0.21	0.024	4
	Sep-21	0.005	0.0025	0.48	0.49	0.49	0.77	0.28	0.019	2
BWMD19	Jul-20	0.14	0.038	0.9	0.98	1.1	1.1	0.032	0.075	6
	Aug-20	0.11	0.026	0.73	0.73	0.84	0.9	0.057	0.049	4
	Sep-20	0.012	0.019	0.59	0.65	0.66	0.71	0.05	0.046	3
	Jul-21	0.041	0.009	0.48	0.54	0.58	0.71	0.13	0.032	3
	Aug-21	0.11	0.02	0.51	0.54	0.64	0.82	0.17	0.045	3
	Sep-21	0.005	0.0025	0.47	0.52	0.52	0.66	0.14	0.029	3
BWMD20	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-
BWMD21	Jul-20	0.041	0.0025	0.36	0.42	0.46	0.51	0.043	0.029	2
	Aug-20	0.086	0.0025	0.4	0.43	0.52	0.66	0.14	0.016	2
	Sep-20	0.005	0.005	0.46	0.48	0.48	0.54	0.06	0.016	1
	Jul-21	0.027	0.007	0.4	0.44	0.46	0.78	0.32	0.014	3
	Aug-21	0.034	0.0025	0.44	0.51	0.55	0.75	0.2	0.016	3
	Sep-21	0.005	0.0025	0.4	0.43	0.43	0.6	0.17	0.009	2
BWMD22	Jul-20	0.033	0.005	0.52	0.54	0.57	0.66	0.084	0.021	1
	Aug-20	0.013	0.0025	0.53	0.54	0.55	0.62	0.069	0.01	<1
	Sep-20	0.02	0.0025	0.5	0.51	0.53	0.57	0.038	0.014	<1
	Jul-21	0.035	0.01	0.52	0.53	0.56	1	0.44	0.025	2
	Aug-21	0.021	0.006	0.46	0.47	0.5	0.92	0.42	0.016	3
	Sep-21	0.005	0.0025	0.39	0.45	0.45	0.78	0.33	0.015	2
BWMD23	Jul-20	0.077	0.0025	0.5	0.54	0.62	0.69	0.074	0.021	<2
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	0.005	0.0025	0.53	0.54	0.54	0.61	0.073	0.015	2
	Jul-21	0.042	0.007	0.53	0.57	0.61	1	0.43	0.024	5
	Aug-21	0.067	0.006	0.46	0.47	0.54	0.95	0.41	0.015	3
	Sep-21	0.024	0.0025	0.48	0.48	0.51	0.85	0.34	0.012	2
BWMD24	Jul-20	0.053	0.12	0.38	0.58	0.63	0.67	0.036	0.21	8
	Aug-20	0.045	0.098	0.31	0.54	0.58	0.61	0.034	0.16	28
	Sep-20	0.005	0.051	0.29	0.35	0.35	0.4	0.05	0.082	5
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	0.16	0.044	0.38	0.41	0.57	0.97	0.4	0.07	2
	Sep-21	0.12	0.02	0.49	1.5	1.6	2.2	0.57	0.22	16
BWMD25	Jul-20	0.15	0.039	0.46	0.54	0.7	0.72	0.025	0.093	5
	Aug-20	0.005	0.028	0.44	0.54	0.54	0.54	0.005	0.067	4
	Sep-20	0.005	0.015	0.27	0.52	0.52	0.52	0.005	0.068	5
	Jul-21	0.061	0.02	0.38	0.56	0.62	0.69	0.072	0.08	5
	Aug-21	0.005	0.016	0.52	0.87	0.87	1	0.15	0.096	4
	Sep-21	0.005	0.005	0.58	0.76	0.76	0.77	0.011	0.075	5
BWMD26	Jul-20	0.11	0.018	0.46	0.48	0.59	1.9	1.3	0.058	4
	Aug-20	0.09	0.013	0.27	0.34	0.44	1.5	1	0.086	9
	Sep-20	0.045	0.015	0.25	0.27	0.31	1.6	1.2	0.039	4
	Jul-21	0.005	0.013	0.26	0.27	0.27	2.6	2.3	0.045	<1
	Aug-21	0.086	0.012	0.093	0.54	0.63	1.9	1.3	0.36	77
	Sep-21	0.011	0.01	0.22	0.23	0.24	1.1	0.87	0.035	1
BWMD27	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-
BWMD28	Jul-20	0.01	0.013	0.38	0.74	0.75	0.79	0.034	0.071	3
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	0.005	0.007	0.47	0.47	0.47	0.49	0.022	0.021	2
	Jul-21	0.025	0.009	0.53	0.55	0.58	1	0.45	0.025	2
	Aug-21	0.016	0.005	0.46	0.48	0.49	0.9	0.41	0.015	2
	Sep-21	0.005	0.0025	0.4	0.42	0.42	0.74	0.32	0.013	1
BWMD29	Jul-20	0.021	0.007	0.38	0.52	0.54	0.57	0.034	0.044	3
	Aug-20	0.057	0.0025	0.5	0.55	0.61	0.7	0.1	0.024	<2
	Sep-20	0.005	0.006	0.54	0.55	0.55	0.6	0.049	0.028	1
	Jul-21	0.005	0.0025	0.43	0.44	0.44	0.84	0.4	0.024	7

	Aug-21	0.037	0.007	0.49	0.6	0.63	1.1	0.42	0.022	2
	Sep-21	0.005	0.0025	0.55	0.56	0.56	0.84	0.28	0.021	3
BWMD30	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-
	Sep-21	0.005	0.0025	0.47	0.57	0.57	0.88	0.31	0.02	1
BWMD31	Jul-20	0.022	0.011	0.35	0.47	0.49	0.51	0.018	0.054	4
	Aug-20	0.037	0.037	0.48	0.5	0.54	0.54	0.005	0.054	3
	Sep-20	0.02	0.035	0.43	0.5	0.52	0.53	0.012	0.072	6
	Jul-21	0.005	0.009	0.31	0.53	0.53	0.61	0.077	0.059	19
	Aug-21	0.081	0.028	0.37	0.38	0.46	0.63	0.16	0.039	3
	Sep-21	0.005	0.019	0.39	0.42	0.42	0.45	0.033	0.054	3
WELDSQUARE1	Jul-20	0.079	0.012	0.91	1	1.1	1.1	0.016	0.05	5
	Aug-20	0.071	0.012	0.81	0.9	0.97	0.97	0.005	0.043	8
	Sep-20	0.057	0.01	0.63	0.98	1	1.1	0.019	0.084	14
	Jul-21	0.038	0.006	0.71	0.72	0.76	0.91	0.15	0.025	3
	Aug-21	0.028	0.006	0.69	0.7	0.73	0.86	0.13	0.025	4
	Sep-21	0.005	0.0025	0.63	0.63	0.63	0.75	0.12	0.022	2
WELDSQUARE2	Jul-20	0.046	0.011	0.83	0.88	0.93	0.97	0.043	0.047	4
	Aug-20	0.079	0.012	0.81	0.86	0.94	0.94	0.005	0.036	4
	Sep-20	0.07	0.012	0.64	0.7	0.77	0.78	0.017	0.035	6
	Jul-21	0.038	0.0025	0.7	0.71	0.75	0.92	0.17	0.025	2
	Aug-21	0.063	0.009	0.67	0.7	0.77	0.9	0.13	0.028	3
	Sep-21	0.005	0.0025	0.64	0.99	0.99	1.1	0.12	0.022	2

		Hardness as CaCO3 (Calc)	pH	Aluminium - Filterable	Aluminium - Total	Chromium HMTV	Chromium - Filterable	Chromium - Total	Copper HMTV	Copper - Filterable	Copper - Total	Lead HMTV	Lead - Filterable	Lead - Total	Nickel HMTV	Nickel - Filterable	Nickel - Total	Zinc HMTV	Zinc - Filterable	Zinc - Total
LOR		<1	-	<0.005	<0.005		<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001		<0.0005	<0.0005		<0.001	<0.005
Unit		mg/L	-	mg/L	mg/L		mg/L	mg/L		mg/L	mg/L		mg/L	mg/L		mg/L	mg/L		mg/L	mg/L
ANZG (2018) lowland river			>6.5	0.055		0.001			0.0014			0.0034			0.011			0.008		
ANZG (2018) Recreational				0.2		0.82			0.85			1.27			0.85			0.85		
BWMD01	Jul-20	120	6.85	0.17	0.53	0.0031	0.0013	0.002	0.0045	0.0018	0.0025	0.0198	0.0006	0.0016	0.0357	0.0028	0.0043	0.0260	0.039	0.053
	Aug-20	130	6.55	0.19	-	0.0033	0.0013	-	0.0049	0.007	-	0.0219	0.0008	-	0.0383	0.0035	-	0.0278	0.038	-
	Sep-20	110	7.21	0.17	-	0.0029	0.0008	-	0.0042	0.0026	-	0.0177	0.0005	-	0.0332	0.0019	-	0.0241	0.038	-
	Jul-21	92	6.91	0.18	0.45	0.0025	0.001	0.0014	0.0036	0.0031	0.0039	0.0141	0.001	0.0028	0.0285	0.0023	0.0023	0.0207	0.061	0.064
	Aug-21	160	7.34	0.21	-	0.0039	0.0012	-	0.0058	0.005	-	0.0285	0.0009	-	0.0456	0.0031	-	0.0332	0.048	-
	Sep-21	150	7.09	0.18	-	0.0037	0.0012	-	0.0055	0.0074	-	0.0263	0.0008	-	0.0432	0.0033	-	0.0314	0.064	-
BWMD02	Jul-20	110	7.09	0.041	0.11	0.0029	0.0008	0.0011	0.0042	0.0014	0.0017	0.0177	0.0003	0.0011	0.0332	0.0006	0.0012	0.0241	0.018	0.029
	Aug-20	130	7.03	0.047	-	0.0033	0.0007	-	0.0049	0.0034	-	0.0219	0.0004	-	0.0383	0.0012	-	0.0278	0.023	-
	Sep-20	120	6.86	0.08	-	0.0031	0.0006	-	0.0045	0.0041	-	0.0198	0.0003	-	0.0357	0.0006	-	0.0260	0.037	-
	Jul-21	150	7.13	0.14	0.33	0.0037	0.0009	0.0011	0.0055	0.0037	0.0042	0.0263	0.0009	0.0013	0.0432	0.001	0.0025	0.0314	0.042	0.032
	Aug-21	150	7.46	0.19	-	0.0037	0.0008	-	0.0055	0.0025	-	0.0263	0.0005	-	0.0432	0.0007	-	0.0314	0.025	-
	Sep-21		7.21	0.085	-	0.0000	0.0007	-	0.0000	0.0031	-	0.0000	0.0004	-	0.0000	0.0007	-	0.0000	0.022	-
BWMD03	Jul-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	130	6.92	0.26	-	0.0033	0.0014	-	0.0049	0.0036	-	0.0219	0.0009	-	0.0383	0.0041	-	0.0278	0.049	-
	Sep-20	110	6.9	0.21	-	0.0029	0.0009	-	0.0042	0.002	-	0.0177	0.0006	-	0.0332	0.0019	-	0.0241	0.047	-
	Jul-21	96	6.82	0.18	0.51	0.0026	0.0009	0.0014	0.0038	0.0031	0.0038	0.0149	0.0009	0.0031	0.0296	0.0022	0.0025	0.0215	0.059	0.069
	Aug-21	150	7.07	0.23	-	0.0037	0.0013	-	0.0055	0.0027	-	0.0263	0.0009	-	0.0432	0.0034	-	0.0314	0.054	-
	Sep-21	150	6.89	0.13	-	0.0037	0.0012	-	0.0055	0.0018	-	0.0263	0.0007	-	0.0432	0.0032	-	0.0314	0.074	-
BWMD04	Jul-20	120	7.03	0.24	0.64	0.0031	0.0017	0.0023	0.0045	0.0018	0.0023	0.0198	0.0008	0.0017	0.0357	0.0036	0.0047	0.0260	0.046	0.058
	Aug-20	120	6.92	0.29	-	0.0031	0.0015	-	0.0045	0.0028	-	0.0198	0.001	-	0.0357	0.0044	-	0.0260	0.049	-
	Sep-20	100	6.82	0.25	-	0.0027	0.001	-	0.0039	0.0026	-	0.0157	0.0006	-	0.0306	0.0021	-	0.0223	0.053	-
	Jul-21	96	6.72	0.19	0.51	0.0026	0.0009	0.0015	0.0038	0.0025	0.0038	0.0149	0.0009	0.0032	0.0296	0.0024	0.0027	0.0215	0.061	0.065
	Aug-21	140	7.01	0.27	-	0.0035	0.0013	-	0.0052	0.0024	-	0.0241	0.0009	-	0.0407	0.0032	-	0.0296	0.043	-
	Sep-21	140	6.97	0.16	-	0.0035	0.0013	-	0.0052	0.0013	-	0.0241	0.0008	-	0.0407	0.0033	-	0.0296	0.048	-
BWMD05	Jul-20	220	6.21	0.55	1.4	0.0051	0.0011	0.0017	0.0076	0.0017	0.0026	0.0427	0.0003	0.0009	0.0598	0.008	0.0088	0.0435	0.14	0.14
	Aug-20	110	7.11	0.08	-	0.0029	0.0018	-	0.0042	0.0022	-	0.0177	0.0013	-	0.0332	0.0024	-	0.0241	0.028	-
	Sep-20	87	7.03	0.097	-	0.0024	0.001	-	0.0035	0.0017	-	0.0131	0.0008	-	0.0272	0.0013	-	0.0198	0.037	-
	Jul-21	71	7.19	0.16	0.26	0.0020	0.0013	0.0015	0.0029	0.0024	0.0028	0.0102	0.0014	0.0029	0.0229	0.0017	0.0018	0.0166	0.05	0.047
	Aug-21	170	6.62	0.44	-	0.0041	0.0011	-	0.0061	0.004	-	0.0308	0.0007	-	0.0481	0.004	-	0.0349	0.079	-
	Sep-21	100	7.1	0.12	-	0.0027	0.0014	-	0.0039	0.003	-	0.0157	0.0012	-	0.0306	0.0022	-	0.0223	0.027	-
BWMD06	Jul-20	230	6.55	0.59	1.5	0.0053	0.0011	0.0019	0.0079	0.0014	0.0027	0.0452	0.0003	0.0012	0.0621	0.0074	0.0087	0.0452	0.14	0.14
	Aug-20	200	6.3	0.75	-	0.0047	0.001	-	0.0070	0.0014	-	0.0378	0.0005	-	0.0552	0.0069	-	0.0401	0.13	-
	Sep-20	110	6.44	0.43	-	0.0029	0.0007	-	0.0042	0.0019	-	0.0177	0.0005	-	0.0332	0.0026	-	0.0241	0.094	-
	Jul-21	110	6.97	0.22	0.57	0.0029	0.0008	0.0015	0.0042	0.0038	0.0047	0.0177	0.0009	0.0037	0.0332	0.0025	0.0029	0.0241	0.081	0.076
	Aug-21	110	7.2	0.14	-	0.0029	0.0015	-	0.0042	0.0018	-	0.0177	0.0011	-	0.0332	0.0022	-	0.0241	0.028	-
	Sep-21	180	6.51	0.19	-	0.0043	0.0009	-	0.0064	0.0016	-	0.0331	0.0004	-	0.0504	0.0037	-	0.0367	0.074	-
BWMD07	Jul-20	120	6.63	0.086	0.14	0.0031	0.0013	0.0016	0.0045	0.0019	0.0032	0.0198	0.0006	0.0011	0.0357	0.0024	0.003	0.0260	0.039	0.045
	Aug-20	110	6.53	0.092	-	0.0029	0.0012	-	0.0042	0.0025	-	0.0177	0.0007	-	0.0332	0.0025	-	0.0241	0.047	-
	Sep-20	72	6.33	0.1	-	0.0021	0.0007	-	0.0029	0.0023	-	0.0103	0.0006	-	0.0232	0.001	-	0.0168	0.045	-
	Jul-21	89	7.22	0.12	0.35	0.0024	0.001	0.0022	0.0035	0.0027	0.0039	0.0135	0.0009	0.0028	0.0277	0.0013	0.0014	0.0202	0.046	0.035
	Aug-21	120	6.53	0.18	-	0.0031	0.0011	-	0.0045	0.0017	-	0.0198	0.0007	-	0.0357	0.0014	-	0.0260	0.031	-
	Sep-21	110	6.65	0.13	-	0.0029	0.001	-	0.0042	0.0013	-	0.0177	0.0005	-	0.0332	0.0012	-	0.0241	0.025	-
BWMD08	Jul-20	120	6.69	0.09	0.15	0.0031	0.0014	0.0015	0.0045	0.0025	0.0066	0.0198	0.0005	0.001	0.0357	0.0023	0.0029	0.0260	0.036	0.043
	Aug-20	110	6.48	0.098	-	0.0029	0.0012	-	0.0042	0.0027	-	0.0177	0.0006	-	0.0332	0.0022	-	0.0241	0.042	-
	Sep-20	74	6.38	0.11	-	0.0021	0.0007	-	0.0030	0.0026	-	0.0107	0.0006	-	0.0237	0.001	-	0.0172	0.046	-
	Jul-21	86	7.32	0.12	0.34	0.0024	0.001	0.0014	0.0034	0.0029	0.0038	0.0130	0.0009	0.0027	0.0269	0.0012	0.0013	0.0196	0.054	0.035
	Aug-21	120	6.48	0.17	-	0.0031	0.0012	-	0.0045	0.0015	-	0.0198	0.0007	-	0.0357	0.0014	-	0.0260	0.03	-
	Sep-21	120	6.62	0.15	-	0.0031	0.001	-	0.0045	0.0012	-	0.0198	0.0005	-	0.0357	0.0012	-	0.0260	0.021	-
BWMD09	Jul-20	36	6.46	0.2	0.3	0.0012	0.0037	0.005	0.0016	0.0098	0.015	0.0043	0.0043	0.0076	0.0128	0.0049	0.006	0.0093	0.24	0.24
	Aug-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	5.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	72	6.47	0.25	0.31	0.0021	0.0017	0.0019	0.0029	0.0029	0.0049	0.0103	0.002	0.0037	0.0232	0.0045	0.0052	0.0168	0.065	0.059
	Aug-21	-	6.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	-	6.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BWMD10	Jul-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	-	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	6.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	96	6.25	0.37	0.51	0.0026	0.0014	0.0015	0.0038	0.0033	0.0032	0.0149	0.0016	0.0027	0.0296	0.0019	0.0031	0.0215	0.05	0.038
	Aug-21	-	6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	-	6.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BWMD11	Jul-20	98	5.95	0.19	0.26	0.0026	0.0014	0.0017	0.0038	0.0021	0.0031	0.0153	0.0013	0.002	0.0301	0.0015	0.0016	0.0219	0.037	0.039
	Aug-20	110	6.14	0.3	-	0.0029	0.0013	-	0.0042	0.0013	-	0.0177	0.0009	-	0.0332	0.0016	-	0.0241	0.024	-
	Sep-20	96	6.15	0.24	-	0.0026	0.001	-	0.0038	0.00005	-	0.0149	0.0008	-	0.0296	0.0008	-	0.0215	0.023	-
	Jul-21	91	6.46	0.28	0.34	0.0025	0.0013	0.0015	0.0036	0.0026	0.0033	0.0139	0.0014	0.0026	0.0283	0.0011	0.0014	0.0205	0.043	0.034
	Aug-21	99	6.28	0.23	-	0.0027	0.0011	-	0.0039	0.0016	-	0.0155	0.0007	-	0.0303	0.0008	-	0.0221	0.035	-
	Sep-21	72	6.38	0.17	-	0.0021	0.0009	-	0.0029	0.0022	-	0.0103	0.0009	-	0.0232	0.0007	-	0.0168	0.048	-
BWMD12	Jul-20	54	5.81	0.23	0.35	0.0016	0.0014	0.0018	0.0023	0.0035	0.005	0.0072	0.0026	0.0053	0.0181	0.0013	0.0013	0.0132	0.052	0.053
	Aug-20	68	5.92	0.45	-	0.0020	0.0015	-	0.0028	0.0028	-	0.0096	0.002	-	0.0221	0.0012	-	0.0160	0.024	-
	Sep-20	69	6.21	0.26	-	0.0020	0.0009	-	0.0028	0.00005	-	0.0098	0.0009	-	0.0223	0.0006	-	0.0162	0.021	-
	Jul-21	66	6.46	0.31	0.34	0.0019	0.0014	0.0012	0.0027	0.002	0.0025	0.0093	0.0016	0.002	0.0215	0.0009	0.001	0.0156	0.037	0.036
	Aug-21	82	6.71	0.26	-	0.0023	0.0012	-	0.0033	0.0057	-	0.0122	0.0008	-	0.0259	0.0007	-	0.0188	0.019	-
	Sep-21	67	6.36	0.21	-	0.0019	0.001	-	0.0028	0.0013	-	0.0094	0.0008	-	0.0218	0.0005	-	0.0158	0.023	-
BWMD13	Jul-20	77	5.51	0.36	0.63	0.0022	0.0018	0.0025	0.0031	0.002	0.0033	0.0113	0.0013	0.0034	0.0245	0.0015	0.0015	0.0178	0.029	0.035
	Aug-20	82	5.31	0.48	-	0.0023	0.0015	-	0.0033	0.0016	-	0.0122	0.0008	-	0.0259	0.0011	-	0.0188	0.025	-
	Sep-20	72	5.63	0.35	-	0.0021	0.001	-	0.0029	0.00005	-	0.0103	0.001	-	0.0232	0.0007	-	0.0168	0.023	-
	Jul-21	-	-	-	-	-	-	-	#VALUE!	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	81	6.54	0.31	-	0.0023	0.0011	-	0.0033	0.0014	-	0.0120	0.0008	-	0.0256	0.0007	-	0.0186	0.02	-
	Sep-21	69	6.3	0.24	-	0.0020	0.0009	-	0.0028	0.0014	-	0.0098	0.0009	-	0.0223	0.0005	-	0.0162	0.031	-
BWMD14	Jul-20	83	6.87	0.09	0.2	0.0023	0.0021	0.0025	0.0033	0.0013	0.002	0.0124	0.0008	0.0015	0.0261	0.0016	0.0021	0.0190	0.023	0.026
	Aug-20	92	6.79	0.074	-	0.0025	0.0019	-	0.0036	0.0016	-	0.0141	0.0011	-	0.0285	0.0029	-	0.0207	0.025	-
	Sep-20	85	6.74	0.093	-	0.0023	0.0011	-	0.0034	0.0016	-	0.0128	0.0009	-	0.0267	0.0013	-	0.0194	0.043	-
	Jul-21	72	7.24	0.14	0.25	0.0021	0.0013	0.002	0.0029	0.0019	0.0026	0.0103	0.0012	0.0021	0.0232	0.0015	0.041	0.0168	0.051	0.043
	Aug-21	110	6.86	0.12	-	0.0029	0.0016	-	0.0042	0.0013	-	0.0177	0.0009	-	0.0332	0.0024	-	0.0241	0.029	-
	Sep-21	100	6.92	0.1	-	0.0027	0.0015	-	0.0039	0.001	-	0.0157	0.0008	-	0.0306	0.0024	-	0.0223	0.023	-
BWMD15	Jul-20	59	6.31	0.18	0.29	0.0017	0.0038	0.0048	0.0025	0.0015	0.0017	0.0080	0.0003	0.0006	0.0195	0.0021	0.0028	0.0142	0.11	0.13
	Aug-20	-	6.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	6.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	70	6.53	0.25	0.29	0.0020	0.0035	0.0037	0.0029	0.0023	0.0025	0.0100	0.001	0.0014	0.0226	0.0036	0.0038	0.0164	0.59	0.63
	Aug-21	-	6.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	-	6.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BWMD16	Jul-20	89	6.43	0.19	0.24	0.0024	0.027	0.031	0.0035	0.0016	0.0022	0.0135	0.0005	0.0007	0.0277	0.23	0.23	0.0202	0.012	0.018
	Aug-20	93	6.28	0.15	-	0.0025	0.024	-	0.0037	0.0016	-	0.0143	0.0007	-	0.0288	0.24	-	0.0209	0.027	-
	Sep-20	94	6.1	0.19	-	0.0026	0.019	-	0.0037	0.002	-	0.0145	0.0007	-	0.0290	0.24	-	0.0211	0.075	-
	Jul-21	120	6.86	0.24	0.51	0.0031	0.018	0.022	0.0045	0.0013	0.0024	0.0198	0.0007	0.0016	0.0357	0.21	0.27	0.0260	0.03	0.02
	Aug-21	98	6.11	0.17	-	0.0026	0.021	-	0.0038	0.0006	-	0.0153	0.0006	-	0.0301	0.25	-	0.0219	0.025	-
	Sep-21	91	6.29	0.2	-	0.0025	0.015	-	0.0036	0.0008	-	0.0139	0.0005	-	0.0283	0.2	-	0.0205	0.018	-
BWMD17	Jul-20	90	6.86	0.11	0.26	0.0025	0.0011	0.0014	0.0036	0.0016	0.0019	0.0137	0.0012	0.002	0.0280	0.0012	0.0012	0.0204	0.028	0.028
	Aug-20	92	6.79	0.093	-	0.0025	0.0009	-	0.0036	0.0019	-	0.0141	0.0013	-	0.0285	0.0013	-	0.0207	0.033	-
	Sep-20	83	6.89	0.11	-	0.0023	0.0008	-	0.0033	0.0017	-	0.0124	0.0007	-	0.0261	0.0015	-	0.0190	0.038	-
	Jul-21	53	6.99	0.12	0.19	0.0016	0.0008	0.0013	0.0023	0.0024	0.0025	0.0070	0.0011	0.0017	0.0178	0.0007	0.0006	0.0130	0.047	0.046
	Aug-21	110	6.71	0.16	-	0.0029	0.0011	-	0.0042	0.0018	-	0.0177	0.0009	-	0.0332	0.0012	-	0.0241	0.03	-
	Sep-21	79	7.22	0.12	-	0.0022	0.0007	-	0.0032	0.0067	-	0.0116	0.0008	-	0.0251	0.00025	-	0.0182	0.045	-
BWMD18	Jul-20	71	6.62	0.1	0.13	0.0020	0.0011	0.0013	0.0029	0.0015	0.0018	0.0102	0.0009	0.0012	0.0229	0.0007	0.0008	0.0166	0.015	0.03
	Aug-20	110	6.84	0.082	-	0.0029	0.0008	-	0.0042	0.0015	-	0.0177	0.0011	-	0.0332	0.0016	-	0.0241	0.036	-
	Sep-20	84	6.64	0.12	-	0.0023	0.0008	-	0.0034	0.0018	-	0.0126	0.0007	-	0.0264	0.0008	-	0.0192	0.04	-
	Jul-21		6.59															0.0000		
	Aug-21	120	6.66	0.13	-	0.0031	0.001	-	0.0045	0.0014	-	0.0198	0.0008	-	0.0357	0.0008	-	0.0260	0.029	-
	Sep-21	80	7.47	0.13	-	0.0022	0.0008	-	0.0032	0.0049	-	0.0118	0.0009	-	0.0253	0.00025	-	0.0184	0.042	-
BWMD19	Jul-20	120	6.3	0.19	0.25	0.0031	0.0018	0.0022	0.0045	0.0013	0.0013	0.0198	0.0009	0.0017	0.0357	0.001	0.001	0.0260	0.005	0.009
	Aug-20	89	6.25	0.11	-	0.0024	0.0014	-	0.0035	0.0015	-	0.0135	0.0014	-	0.0277	0.0011	-	0.0202	0.017	-
	Sep-20	86	6.24	0.13	-	0.0024	0.0009	-	0.0034	0.0012	-	0.0130	0.0009	-	0.0269	0.0006	-	0.0196	0.034	-
	Jul-21	71	6.68	0.15	0.2	0.0020	0.0011	0.0013	0.0029	0.0043	0.0084	0.0102	0.0017	0.0029	0.0229	0.0006	0.0007	0.0166	0.073	0.065
	Aug-21	110	6.34	0.16	-	0.0029	0.0012	-	0.0042	0.001	-	0.0177	0.0013	-	0.0332	0.0018	-	0.0241	0.039	-
	Sep-21	89	6.87	0.11	-	0.0024	0.0008	-	0.0035	0.0029	-	0.0135	0.0011	-	0.0277	0.0005	-	0.0202	0.046	-
BWMD20	Jul-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BWMD21	Jul-20	65	6.92	0.087	0.16	0.0019	0.0008	0.0009	0.0027	0.0019	0.0026	0.0091	0.0009	0.0013	0.0212	0.0006	0.0008	0.0154	0.032	0.038

	Aug-20	110	6.99	0.073	-	0.0029	0.0007	-	0.0042	0.0017	-	0.0177	0.0012	-	0.0332	0.0015	-	0.0241	0.04	-
	Sep-20	71	6.73	0.11	-	0.0020	0.0007	-	0.0029	0.0021	-	0.0102	0.0005	-	0.0229	0.0009	-	0.0166	0.037	-
	Jul-21	63	6.67	0.14	0.18	0.0018	0.0009	0.0009	0.0026	0.0032	0.0023	0.0087	0.0008	0.0012	0.0207	0.0005	0.0005	0.0150	0.046	0.031
	Aug-21	120	6.95	0.11	-	0.0031	0.0009	-	0.0045	0.001	-	0.0198	0.0006	-	0.0357	0.0012	-	0.0260	0.024	-
	Sep-21	79	7.45	0.094	-	0.0022	0.0006	-	0.0032	0.0026	-	0.0116	0.0005	-	0.0251	0.00025	-	0.0182	0.066	-
BWMD22	Jul-20	76	6.66	0.16	0.21	0.0021	0.0012	0.0014	0.0031	0.0018	0.0023	0.0111	0.001	0.0015	0.0242	0.0005	0.0007	0.0176	0.008	0.017
	Aug-20	71	6.59	0.14	-	0.0020	0.0011	-	0.0029	0.0012	-	0.0102	0.0009	-	0.0229	0.001	-	0.0166	0.014	-
	Sep-20	80	6.19	0.18	-	0.0022	0.0009	-	0.0032	0.0015	-	0.0118	0.0007	-	0.0253	0.00025	-	0.0184	0.019	-
	Jul-21	84	6.47	0.23	0.31	0.0023	0.0011	0.0013	0.0034	0.002	0.0023	0.0126	0.0015	0.0023	0.0264	0.0006	0.0007	0.0192	0.029	0.019
	Aug-21	95	6.42	0.21	-	0.0026	0.001	-	0.0037	0.0012	-	0.0147	0.001	-	0.0293	0.0005	-	0.0213	0.024	-
	Sep-21	77	7.21	0.19	-	0.0022	0.0008	-	0.0031	0.0021	-	0.0113	0.0009	-	0.0245	0.00025	-	0.0178	0.037	-
BWMD23	Jul-20	73	6.4	0.16	0.23	0.0021	0.0012	0.0014	0.0030	0.0013	0.0013	0.0105	0.0005	0.0009	0.0234	0.00025	0.0006	0.0170	0.006	0.013
	Aug-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	74	6.38	0.2	-	0.0021	0.0009	-	0.0030	0.0011	-	0.0107	0.0005	-	0.0237	0.0006	-	0.0172	0.023	-
	Jul-21	83	6.41	0.24	0.31	0.0023	0.0012	0.0013	0.0033	0.0024	0.0018	0.0124	0.001	0.0015	0.0261	0.0006	0.0007	0.0190	0.029	0.014
	Aug-21	89	6.22	0.26	-	0.0024	0.0011	-	0.0035	0.0011	-	0.0135	0.0009	-	0.0277	0.0005	-	0.0202	0.021	-
	Sep-21	72	6.63	0.2	-	0.0021	0.0008	-	0.0029	0.0017	-	0.0103	0.0008	-	0.0232	0.00025	-	0.0168	0.029	-
BWMD24	Jul-20	52	6.52	0.06	0.21	0.0016	0.0012	0.0021	0.0022	0.0044	0.012	0.0068	0.0017	0.0077	0.0176	0.0014	0.0019	0.0128	0.052	0.12
	Aug-20	51	6.44	0.041	-	0.0015	0.0009	-	0.0022	0.0031	-	0.0067	0.0013	-	0.0173	0.0028	-	0.0126	0.024	-
	Sep-20	37	6.43	0.04	-	0.0012	0.0004	-	0.0017	0.0026	-	0.0044	0.0014	-	0.0131	0.0007	-	0.0096	0.052	-
	Jul-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	110	6.37	0.069	-	0.0029	0.0008	-	0.0042	0.0015	-	0.0177	0.0008	-	0.0332	0.0008	-	0.0241	0.023	-
	Sep-21	99	6.65	0.066	-	0.0027	0.0007	-	0.0039	0.0011	-	0.0155	0.0007	-	0.0303	0.0022	-	0.0221	0.023	-
BWMD25	Jul-20	60	6.71	0.037	0.061	0.0018	0.001	0.0011	0.0025	0.0015	0.0028	0.0082	0.0011	0.0019	0.0198	0.0009	0.001	0.0144	0.016	0.017
	Aug-20	70	6.78	0.039	-	0.0020	0.0009	-	0.0029	0.0019	-	0.0100	0.0014	-	0.0226	0.0025	-	0.0164	0.024	-
	Sep-20	37	9.12	0.037	-	0.0012	0.0004	-	0.0017	0.0033	-	0.0044	0.0051	-	0.0131	0.0007	-	0.0096	0.043	-
	Jul-21	52	6.55	0.053	0.13	0.0016	0.0008	0.0009	0.0022	0.0044	0.0038	0.0068	0.0009	0.0021	0.0176	0.0007	0.0008	0.0128	0.041	0.025
	Aug-21	100	6.77	0.045	-	0.0027	0.0009	-	0.0039	0.0013	-	0.0157	0.0008	-	0.0306	0.0013	-	0.0223	0.027	-
	Sep-21	86	6.96	0.047	-	0.0024	0.0007	-	0.0034	0.0015	-	0.0130	0.001	-	0.0269	0.0009	-	0.0196	0.028	-
BWMD26	Jul-20	200	6.46	0.03	0.066	0.0047	0.0007	0.0009	0.0070	0.0016	0.0019	0.0378	0.00005	0.0003	0.0552	0.0024	0.0033	0.0401	0.37	0.44
	Aug-20	210	6.48	0.034	-	0.0049	0.0008	-	0.0073	0.0023	-	0.0402	0.00005	-	0.0575	0.0028	-	0.0418	0.3	-
	Sep-20	190	6.29	0.047	-	0.0045	0.0005	-	0.0067	0.0015	-	0.0354	0.0001	-	0.0528	0.0017	-	0.0384	0.29	-
	Jul-21	190	6.57	0.066	0.31	0.0045	0.0006	0.0013	0.0067	0.0032	0.0092	0.0354	0.0001	0.0048	0.0528	0.0026	0.0032	0.0384	0.39	0.46
	Aug-21	200	6.67	0.037	-	0.0047	0.0006	-	0.0070	0.0024	-	0.0378	0.00005	-	0.0552	0.0022	-	0.0401	0.28	-
	Sep-21	190	6.43	0.039	-	0.0045	0.0006	-	0.0067	0.0013	-	0.0354	0.00005	-	0.0528	0.0019	-	0.0384	0.24	-
BWMD27	Jul-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BWMD28	Jul-20	64	7.18	0.091	0.13	0.0019	0.0008	0.0009	0.0027	0.0026	0.003	0.0089	0.0007	0.001	0.0209	0.0006	0.0006	0.0152	0.04	0.044
	Aug-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	66	6.67	0.15	-	0.0019	0.0008	-	0.0027	0.0018	-	0.0093	0.0007	-	0.0215	0.0015	-	0.0156	0.024	-
	Jul-21	82	6.81	0.21	0.27	0.0023	0.0011	0.0013	0.0033	0.0033	0.0025	0.0122	0.0014	0.0023	0.0259	0.0006	0.0008	0.0188	0.029	0.021
	Aug-21	93	6.54	0.2	-	0.0025	0.0011	-	0.0037	0.0015	-	0.0143	0.0011	-	0.0288	0.0007	-	0.0209	0.022	-
	Sep-21	78	6.94	0.17	-	0.0022	0.0008	-	0.0032	0.0021	-	0.0114	0.001	-	0.0248	0.00025	-	0.0180	0.037	-
BWMD29	Jul-20	60	7.08	0.074	0.077	0.0018	0.0008	0.0009	0.0025	0.0024	0.0027	0.0082	0.0002	0.0003	0.0198	0.0006	0.0006	0.0144	0.049	0.049
	Aug-20	71	6.59	0.11	-	0.0020	0.001	-	0.0029	0.0026	-	0.0102	0.001	-	0.0229	0.001	-	0.0166	0.037	-
	Sep-20	66	6.46	0.14	-	0.0019	0.0008	-	0.0027	0.0024	-	0.0093	0.0008	-	0.0215	0.0013	-	0.0156	0.047	-
	Jul-21	67	7	0.17	0.22	0.0019	0.0009	0.0018	0.0028	0.0033	0.0053	0.0094	0.0012	0.003	0.0218	0.0005	0.0014	0.0158	0.028	0.024
	Aug-21	95	6.55	0.18	-	0.0026	0.001	-	0.0037	0.0016	-	0.0147	0.001	-	0.0293	0.0006	-	0.0213	0.024	-
	Sep-21	79	6.84	0.15	-	0.0022	0.0009	-	0.0032	0.0029	-	0.0116	0.0009	-	0.0251	0.00025	-	0.0182	0.047	-
BWMD30	Jul-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Sep-21	79	6.7	0.14	-	0.0022	0.0008	-	0.0032	0.0025	-	0.0116	0.0008	-	0.0251	0.00025	-	0.0182	0.046	-
BWMD31	Jul-20	69	6.33	0.045	0.092	0.0020	0.0009	0.0011	0.0028	0.0009	0.0015	0.0098	0.0015	0.0034	0.0223	0.00025	0.0006	0.0162	0.023	0.023
	Aug-20	84	6.16	0.081	-	0.0023	0.0012	-	0.0034	0.0009	-	0.0126	0.0015	-	0.0264	0.001	-	0.0192	0.016	-
	Sep-20	87	5.8	0.086	-	0.0024	0.0008	-	0.0035	0.00005	-	0.0131	0.001	-	0.0272	0.0007	-	0.0198	0.04	-
	Jul-21	43	6.88	0.12	0.48	0.0013	0.0008	0.0019	0.0019	0.0031	0.0057	0.0054	0.0014	0.0092	0.0149	0.00025	0.0009	0.0109	0.1	0.12
	Aug-21	100	6.44	0.13	-	0.0027	0.001	-	0.0039	0.0012	-	0.0157	0.0011	-	0.0306	0.0008	-	0.0223	0.054	-
	Sep-21	67	7.42	0.076	-	0.0019	0.0007	-	0.0028	0.0024	-	0.0094	0.0009	-	0.0218	0.0005	-	0.0158	0.066	-
WELDSQUARE1	Jul-20	72	5.52	0.32	0.4	0.0021	0.0016	0.0021	0.0029	0.0026	0.0034	0.0103	0.0013	0.002	0.0232	0.0013	0.0013	0.0168	0.034	0.037
	Aug-20	82	5.64	0.42	-	0.0023	0.0014	-	0.0033	0.0035	-	0.0122	0.0007	-	0.0259	0.0011	-	0.0188	0.029	-
	Sep-20	73	5.64	0.32	-	0.0021	0.0011	-	0.0030	0.0007	-	0.0105	0.0008	-	0.0234	0.0007	-	0.0170	0.022	-
	Jul-21	67	6.19	0.37	0.4	0.0019	0.001	0.0018	0.0028	0.0049	0.0025	0.0094	0.0011	0.0024	0.0218	0.0006	0.0012	0.0158	0.034	0.025
	Aug-21	81	6.59	0.31	-	0.0023	0.0012	-	0.0033	0.011	-	0.0120	0.0009	-	0.0256	0.0007	-	0.0186	0.033	-
	Sep-21	69	6.32	0.24	-	0.0020	0.001	-	0.0028	0.0015	-	0.0098	0.0009	-	0.0223	0.0006	-	0.0162	0.031	-
WELDSQUARE2	Jul-20	62	5.57	0.29	0.4	0.0018	0.0014	0.0019	0.0026	0.0034	0.0045	0.0085	0.0023	0.0037	0.0204	0.0014	0.0014	0.0148	0.049	0.053
	Aug-20	85	5.87	0.41	-	0.0023	0.0014	-	0.0034	0.0014	-	0.0128	0.0008	-	0.0267	0.0012	-	0.0194	0.023	-
	Sep-20	73	5.8	0.3	-	0.0021	0.001	-	0.0030	0.00005	-	0.0105	0.0008	-	0.0234	0.0007	-	0.0170	0.024	-
	Jul-21	67	6.3	0.37	0.42	0.0019	0.0013	0.0014	0.0028	0.0029	0.0021	0.0094	0.0016	0.0024	0.0218	0.001	0.0012	0.0158	0.048	0.027
	Aug-21	83	6.37	0.32	-	0.0023	0.0012	-	0.0033	0.0021	-	0.0124	0.0008	-	0.0261	0.0008	-	0.0190	0.033	-
	Sep-21	74	6.26	0.25	-	0.0021	0.001	-	0.0030	0.0014	-	0.0107	0.0009	-	0.0237	0.0006	-	0.0172	0.026	-

RESULTS *OTHER*		Turbidity - NTU	Pressure (psi a)	Conductivity µS/cm	nLFCond (µS/cm)	pH (mV)	Vertical Position (m)	Resistivity (ohms-cm)	Sigma-T (st)	Sigma (s)
BWMD01	Jul-20	7.3	0.447	607.8	761.3	0.7	0.603	1645.3	-0.6	-0.6
	Aug-20	4.94	0.003	580.3	727	8.9	0.274	1723.1	-0.6	-0.6
	Sep-20	4.79	0.06	474	583.2	-28.3	0.297	2109.5	-0.8	-0.8
	Jul-21	6.61	0.085	605.6	744	-28.4	0.334	1651.3	-0.8	-0.8
	Aug-21	4.92	0.222	557.4	652.7	-59.5	0.425	1793.9	-1.1	-1.1
	Sep-21	6.85	0.16	516.6	624.2	-52.7	0.387	1935.6	-0.9	-0.9
BWMD02	Jul-20	3.08	0.116	696.9	815.6	-13.3	0.353	1435	-1.1	-1.1
	Aug-20	5.11	0.05	667.9	773.4	-17.2	0.307	1497.3	-1.2	-1.2
	Sep-20	3.51	0.105	574.3	662.1	-8.8	0.347	1741.3	-1.3	-1.3
	Jul-21	4.33	0.132	1211.5	1400	-41	0.368	825.4	-0.9	-0.9
	Aug-21	7.7	0.086	561.7	640.6	-66.5	0.332	1780.3	-1.4	-1.4
	Sep-21	2.67	0.018	553.3	622	-59.7	0.285	1807.4	-1.5	-1.5
BWMD03	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	4.85	0.124	563.7	696.6	-11.3	0.359	1774.1	-0.7	-0.7
	Sep-20	4.22	0.108	436.2	532.1	-11.1	0.347	2292.7	-0.9	-0.9
	Jul-21	7.2	0.8	621.3	758.1	-23	0.838	1609.5	-0.8	-0.8
	Aug-21	7.27	0.353	531	616.5	-43.7	0.52	1883.2	-1.2	-1.2
	Sep-21	105.96	0.032	515.8	616.4	-41.5	0.286	1938.8	-1	-1
BWMD04	Jul-20	7.81	0.235	591.4	727.4	-9.5	0.439	1690.9	-0.8	-0.8
	Aug-20	4.67	0.314	554.8	683.3	-11.1	0.493	1802.5	-0.8	-0.8
	Sep-20	3.8	0.247	424.5	516.6	-6.4	0.49	2355.9	-0.9	-0.9
	Jul-21	8.16	0.3	606.4	739.3	-17.2	0.482	1649	-0.8	-0.8
	Aug-21	3.88	0.631	522.7	605.2	-40.5	0.717	1913.3	-1.2	-1.2
	Sep-21	55.73	0.084	512.3	603.8	-45.9	0.321	1951.9	-1.1	-1.1
BWMD05	Jul-20	12.92	0.11	743.4	930.6	36.2	0.349	1345.2	-0.6	-0.6
	Aug-20	3.37	0.813	516.2	627.2	-21.8	0.844	1937	-0.9	-0.9
	Sep-20	3.1	0.786	429.2	501.3	-18.1	0.805	2330	-1.2	-1.2
	Jul-21	4.29	0.114	659.3	776.4	-44.2	0.36	1516.7	-1	-1
	Aug-21	6.09	0.293	574	666.4	-18	0.473	1742.3	-1.2	-1.2
	Sep-21	4.12	0.124	496.2	546.4	-53	0.365	2015.4	-1.7	-1.7
BWMD06	Jul-20	15.2	0.149	694.9	849	17.3	0.42	1439.1	-0.8	-0.8
	Aug-20	9.32	0.174	639.5	788.1	23.1	0.394	1563.6	-0.7	-0.7
	Sep-20	9.26	0.16	410.6	497.7	14.4	0.248	2435.3	-0.9	-0.9
	Jul-21	8.01	0.017	614.3	751.2	-31.5	0.284	1627.8	-0.8	-0.8
	Aug-21	2.59	0.105	480.9	547.9	-51.1	0.355	2079.4	-1.4	-1.4
	Sep-21	103.36	0.1	596.9	677	-19.8	0.344	1675.4	-1.4	-1.4
BWMD07	Jul-20	10.39	0.312	575.1	715.6	12.6	0.443	1738.7	-0.7	-0.7
	Aug-20	9.36	0.506	530	658.4	10.5	0.628	1886.9	-0.7	-0.7
	Sep-20	1.4	0.527	346.8	413	20.9	0.644	2883.8	-1.1	-1.1
	Jul-21	5.3	0.037	534.6	650	-46	0.303	1870.5	-0.9	-0.9
	Aug-21	0.96	0.069	515.2	594.1	-12.4	0.32	1940.9	-1.3	-1.3
	Sep-21	35.49	0.056	529.7	591.6	-27.3	0.289	1887.8	-1.6	-1.6
BWMD08	Jul-20	1.24	0.093	619.5	712.2	9.5	0.342	1614.3	-1.3	-1.3
	Aug-20	1.85	0.317	571.7	668.7	13.2	0.495	1749.1	-1.1	-1.1
	Sep-20	2.66	0.311	357.8	427.8	17.9	0.46	2795	-1.1	-1.1
	Jul-21	32.75	0.039	510.8	628.3	-51.5	0.3	1957.6	-0.8	-0.8
	Aug-21	3.98	0.369	517.7	594.1	-9.4	0.526	1931.7	-1.3	-1.3
	Sep-21	0.48	0.028	509.7	593.8	-26.1	0.302	1962.1	-1.2	-1.2
BWMD09	Jul-20	4.02	0.39	104.2	137.4	22.3	0.517	9593.2	-0.6	-0.6
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	8.69	-0.023	265.3	319.2	43.2	0.256	3769.2	-1.1	-1.1
	Jul-21	25.55	0.069	340	423.6	-5.6	0.321	2941.4	-0.8	-0.8
	Aug-21	10.56	0.016	585.3	702.4	-16	0.283	1708.6	-0.9	-0.9
	Sep-21	10.16	-	387.8	477.3	9.5	-	2578.4	-0.8	-0.8
BWMD10	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	5.53	0.105	126	161.4	33.3	0.345	7937.1	-0.7	-0.7
	Sep-20	2.73	0.266	136	161.9	16	0.459	7354	-1.2	-1.2
	Jul-21	2.26	0.055	544.7	653	7.7	0.31	1836	-1	-1
	Aug-21	2.87	0.047	688.4	807.7	11.6	0.305	1452.6	-1.1	-1.1
	Sep-21	40.39	-	243.8	296.6	-2.3	-	4100.9	-1	-1
BWMD11	Jul-20	0.65	0.003	575	645.2	43.5	0.274	1739	-1.5	-1.5
	Aug-20	1.82	0.294	596.5	688	37.6	0.479	1676.5	-1.2	-1.2
	Sep-20	0.74	0.009	524.3	611	34.6	0.297	1907.3	-1.2	-1.2
	Jul-21	1.3	0.066	445.8	530.5	-4.5	0.318	2243.3	-1.1	-1.1
	Aug-21	2.18	0.063	474.9	556.7	1.7	0.312	2105.8	-1.2	-1.2
	Sep-21	4.47	-	369	434.5	13	-	2710.2	-1.2	-1.2
BWMD12	Jul-20	13.6	-0.008	355.8	412	51.6	0.266	2810.2	-1.3	-1.3

	Aug-20	10.26	0.118	452.6	536.1	49.5	0.355	2209.4	-1.1	-1.1
	Sep-20	1.21	0.008	428.9	502	31.1	0.277	2331.6	-1.2	-1.2
	Jul-21	0.84	0.067	349	419.8	-4.7	0.319	2865.3	-1	-1
	Aug-21	2.45	0.009	413.3	489.4	-23.3	0.279	2419.8	-1.1	-1.1
	Sep-21	1.09	-	369.4	432.8	14.5	-	2706.8	-1.2	-1.2
BWMD13	Jul-20	13.9	-0.024	471.5	575.8	67.7	0.255	2121	-0.9	-0.9
	Aug-20	90.24	0.287	475	626.1	82.9	0.474	2105.4	-0.4	-0.4
	Sep-20	87.72	0.021	427.6	526.2	63.2	0.259	2338.7	-0.8	-0.8
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	1.12	0.245	398.6	478.2	-13.6	0.459	2509	-1	-1
	Sep-21	0.81	-	371.4	440.2	17.9	-	2692.4	-1.1	-1.1
BWMD14	Jul-20	3.19	0.086	535.7	622.4	-0.6	0.332	1866.8	-1.2	-1.2
	Aug-20	2.21	0.065	550	631.8	-3.8	0.318	1818	-1.3	-1.3
	Sep-20	1.75	0.087	427.7	494.5	-1.8	0.333	2338.1	-1.3	-1.3
	Jul-21	8.21	0.256	705.3	819.2	-47.3	0.454	1417.7	-1.1	-1.1
	Aug-21	3.19	0.48	505.9	564.2	-31.5	0.61	1976.6	-1.6	-1.6
	Sep-21	3.24	-0.049	507.9	558.7	-42.8	0.238	1968.9	-1.7	-1.7
BWMD15	Jul-20	1.18	0.111	465.7	526.8	31.1	0.351	2147.4	-1.5	-1.5
	Aug-20	2.02	-0.022	447.1	512.4	19.3	0.257	2236.5	-1.4	-1.4
	Sep-20	1.23	0.016	424.7	463.5	22.1	0.285	2354.5	-1.8	-1.8
	Jul-21	1.04	-0.015	714.1	822.1	-6	0.262	1400.3	-1.2	-1.2
	Aug-21	1.68	0.159	329.9	378.5	5.9	0.404	3031.5	-1.4	-1.4
	Sep-21	5.82	-0.011	316	367.4	-34.7	0.27	3164.8	-1.3	-1.3
BWMD16	Jul-20	-0.32	0.314	597.4	655.2	24.7	0.493	1673.9	-1.7	-1.7
	Aug-20	-0.23	0.397	534.7	603	24.7	0.552	1870.3	-1.5	-1.5
	Sep-20	5.56	0.295	454.5	511.9	34	0.48	2200	-1.5	-1.5
	Jul-21	124.32	-0.016	901.1	1007.3	-25.2	0.261	1109.8	-1.4	-1.4
	Aug-21	1.99	0.123	375.3	414.2	12	0.358	2664.3	-1.7	-1.7
	Sep-21	10.82	-0.065	392.8	441.4	-7.2	0.226	2546	-1.6	-1.6
BWMD17	Jul-20	7.05	0.056	508.4	594.9	-0.2	0.311	1966.9	-1.2	-1.2
	Aug-20	65.41	0.231	485.1	570.8	-4	0.435	2061.6	-1.1	-1.1
	Sep-20	164.57	-0.01	456.8	519.7	-10.6	0.266	2189.3	-1.4	-1.4
	Jul-21	2.03	0.092	500.8	591.7	-32.6	0.35	1996.9	-1.1	-1.1
	Aug-21	9.7	0.621	482.8	535.1	-23.1	0.717	2071.2	-1.7	-1.6
	Sep-21	1.21	-	407.4	491.9	-33.4	-	2454.8	-1	-1
BWMD18	Jul-20	3.27	0.154	430.1	502.3	13.6	0.342	2325.1	-1.2	-1.2
	Aug-20	3.72	-0.009	515.9	600.5	-6.6	0.266	1938.3	-1.2	-1.2
	Sep-20	1.05	0.116	436	502.1	3.7	0.354	2293.4	-1.3	-1.3
	Jul-21	1.84	0.082	341.3	413.6	-12	0.33	2930.1	-1	-1
	Aug-21	4.45	0.609	510.7	569.8	-19.8	0.701	1958.1	-1.6	-1.6
	Sep-21	1.21	-	410.7	494.1	-47	-	2435.1	-1	-1
BWMD19	Jul-20	3.81	0.373	572.5	693.2	31.8	0.535	1746.8	-0.9	-0.9
	Aug-20	6.54	0.024	536.8	629.7	26.1	0.272	1862.9	-1.1	-1.1
	Sep-20	7.13	-0.061	452.8	518.5	26	0.221	2208.5	-1.4	-1.4
	Jul-21	2.24	0.218	349.7	422.7	-17.2	0.425	2859.6	-1	-1
	Aug-21	4.33	0.232	496.7	554.4	-1.2	0.435	2013.3	-1.6	-1.6
	Sep-21	18.79	-	450.5	531.1	-13.8	-	2219.6	-1.1	-1.1
BWMD20	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-
BWMD21	Jul-20	1.17	0.043	355	419.5	-3.6	0.302	2816.9	-1.2	-1.2
	Aug-20	3.3	0.184	512.5	602.3	-14.9	0.401	1951.1	-1.1	-1.1
	Sep-20	0.98	0.314	412.7	479.5	-1.3	0.493	2423.3	-1.3	-1.3
	Jul-21	1.28	0.284	322.7	393.2	-16.6	0.473	3098.7	-0.9	-0.9
	Aug-21	2.56	0.099	522.4	576	-36.6	0.335	1914.1	-1.7	-1.7
	Sep-21	1.61	-	380.1	454	-45.9	-	2630.9	-1.1	-1.1
BWMD22	Jul-20	1.81	0.239	502.5	595.8	11.3	0.44	1990	-1.1	-1.1
	Aug-20	0.97	0.038	509.6	595	7	0.299	1962.2	-1.2	-1.2
	Sep-20	10.43	0.192	479	567.8	32.4	0.253	2087.5	-1.1	-1.1
	Jul-21	97.58	0.75	447	529.6	-5	0.572	2237.3	-1.1	-1.1
	Aug-21	4.13	0.014	465.9	516.8	-5.8	0.28	2146.3	-1.7	-1.7
	Sep-21	1.84	-	425.7	500.3	-33.1	-	2349.1	-1.2	-1.2
BWMD23	Jul-20	0.61	0.127	530.1	624.8	26.1	0.36	1886.3	-1.1	-1.1
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	21.17	-0.104	460.2	536.3	18.3	0.199	2172.8	-1.2	-1.2
	Jul-21	2.2	0.152	491.7	575.7	-1.6	0.383	2033.7	-1.2	-1.2
	Aug-21	0.53	0.074	463.5	509.2	5.8	0.333	2157.4	-1.8	-1.8
	Sep-21	1.62	-	433	499	-0.4	-	2309.5	-1.3	-1.3
BWMD24	Jul-20	7.63	-	271.6	319	19	-	3682.6	-1.2	-1.2
	Aug-20	3.63	0.008	189.5	222.1	15.4	0.278	5278.2	-1.3	-1.3
	Sep-20	29.79	-0.096	208.5	251.5	15.4	0.204	4796.9	-1.1	-1.1
	Jul-21	-	-	-	-	-	-	-	-	-

	Aug-21	301.48	0.301	432.8	477.5	-3.3	0.484	2310.7	-1.7	-1.7
	Sep-21	20.24	-0.014	390	437.4	-27.5	0.269	2564.1	-1.6	-1.6
BWMD25	Jul-20	6.51	0.209	265.9	332.5	8.2	0.419	3761.5	-0.8	-0.8
	Aug-20	30.37	0.174	307.4	374.7	-3.8	0.394	3253.5	-0.9	-0.9
	Sep-20	6.7	0.046	173.8	208.4	-135.3	0.303	5754.4	-1.1	-1.1
	Jul-21	12.5	0.255	159.3	202.5	-9.8	0.405	6276.3	-0.7	-0.7
	Aug-21	4.84	0.023	392.4	450.6	-26.4	0.287	2548.1	-1.4	-1.4
	Sep-21	16.88	0.137	351.1	405.6	-45.1	0.37	2847.8	-1.3	-1.3
BWMD26	Jul-20	10.9	0.108	802.3	949.5	22.8	0.347	1246.4	-0.9	-0.9
	Aug-20	6.42	0.135	660.9	796.2	13.4	0.373	1513	-0.9	-0.9
	Sep-20	2.39	0.012	568.8	670.4	23	0.28	1758.1	-1.1	-1.1
	Jul-21	1.3	0	987.8	1137.9	-8.6	0.272	1012.3	-1.1	-1.1
	Aug-21	0.48	0.101	494	567.4	-21	0.343	2024.3	-1.3	-1.3
	Sep-21	-0.07	0.082	473.9	561.9	-15.2	0.263	2110.1	-1.1	-1.1
BWMD27	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-
	Sep-21	-	-	-	-	-	-	-	-	-
BWMD28	Jul-20	1.53	0.052	327.8	395.6	-18.3	0.309	3050.4	-1	-1
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	96.46	0.456	384.6	460.3	2	0.559	2599.9	-1	-1
	Jul-21	1.37	0.199	442.4	530.2	-24.6	0.412	2260.5	-1	-1
	Aug-21	-0.12	0.08	458.1	509.4	-13.1	0.331	2183	-1.6	-1.6
	Sep-21	0.93	-	431.1	507.9	-17.9	-	2319.8	-1.1	-1.1
BWMD29	Jul-20	2.19	0.055	313.5	379.7	-12.4	0.311	3189.3	-1	-1
	Aug-20	1.29	-0.009	413.9	509.7	6.8	0.265	2416.3	-0.8	-0.8
	Sep-20	0.64	0.204	376.5	457.3	13.5	0.432	2655.8	-0.9	-0.9
	Jul-21	1.37	0.102	333	403.3	-36	0.344	3002.6	-1	-1
	Aug-21	-0.18	0.336	459.4	516.1	-13.8	0.542	2176.9	-1.5	-1.5
	Sep-21	1.28	-	423.7	503.8	-12.4	-	2360	-1.1	-1.1
BWMD30	Jul-20	-	-	-	-	-	-	-	-	-
	Aug-20	-	-	-	-	-	-	-	-	-
	Sep-20	-	-	-	-	-	-	-	-	-
	Jul-21	-	-	-	-	-	-	-	-	-
	Aug-21	-	-	-	-	-	-	-	-	-
	Sep-21	1.24	-	422.4	502.1	-4.7	-	2367.4	-1.1	-1.1
BWMD31	Jul-20	21.39	0.19	325.5	411.9	29.8	0.316	3072.7	-0.7	-0.7
	Aug-20	6.45	0.528	466.2	553.3	30.9	0.644	2145	-1.1	-1.1
	Sep-20	12.01	0.15	437	526.6	54	0.286	2288.2	-1	-1
	Jul-21	11.74	0.084	242.5	297	-28.6	0.331	4123.2	-0.9	-0.9
	Aug-21	1.66	0.283	480.8	535.9	-7.3	0.472	2079.8	-1.6	-1.6
	Sep-21	4.4	-	299.2	353.5	-44.6	-	3342.5	-1.2	-1.2
WELDSQUARE1	Jul-20	11.04	-0.021	449.7	546	67.3	0.257	2223.7	-0.9	-0.9
	Aug-20	7.71	0.11	469.5	615.6	64.7	0.35	2130	-0.4	-0.4
	Sep-20	7.09	0.085	429.8	525.4	63.1	0.332	2326.6	-0.9	-0.9
	Jul-21	4.95	0.071	379.9	459	10.7	0.322	2632.5	-1	-1
	Aug-21	0.67	0.134	398.7	477	-16	0.37	2507.9	-1	-1
	Sep-21	0.96	-	377.7	447.5	16.4	-	2647.5	-1.1	-1.1
WELDSQUARE2	Jul-20	5.78	-0.015	384.4	474.6	64.1	0.262	2601.7	-0.8	-0.8
	Aug-20	4.28	0.293	454.3	603	51.3	0.478	2201.1	-0.4	-0.4
	Sep-20	1.83	0.05	424.6	520.7	53.9	0.308	2355.3	-0.9	-0.9
	Jul-21	1.33	0.212	368.3	448.6	4.3	0.425	2715.5	-0.9	-0.9
	Aug-21	2.3	0.202	408.3	490	-3.5	0.416	2449.3	-1	-1
	Sep-21	1.8	-	391.6	468	19.7	-	2553.6	-1.1	-1.1

			BWMD26	BWMD26	BWMD24	BWMD24	BWMD16	BWMD16	BWMD06	BWMD06
Analyte	**Unit**	**Limit of reporting**	2-Sep-20	15-Sep-21	2-Sep-20	15-Sep-21	2-Sep-20	15-Sep-21	2-Sep-20	15-Sep-21
Moisture	**%ar**	**<0.1**	26.1	94.8	32.5	34.1	15.5	24.3	21.1	21.9
Aluminium	**mg/kg**	**<10**	5250	12500	2600	2110	1450	2530	3070	5080
Chromium	**mg/kg**	**<0.05**	8.5	44	9.2	10	4.8	43	3.6	5.4
Copper	**mg/kg**	**<0.5**	47	55	61	27	47	41	14	16
Lead	**mg/kg**	**<0.5**	21	72	40	42	8	19	42	49
Nickel	**mg/kg**	**<0.1**	7.8	19	4.1	4.8	16	390	2.5	8.2
Zinc	**mg/kg**	**<0.25**	1000	1600	210	85	42	160	41	72

Appendix B Field Observations

Department of Water

Field Observation Form - Surfacewater 4

COC# 64392

Instrument PRODSS #3 (FRED) Sampler(s) Jake Watsham & Michelle Crow Project SG-C-13AYMD

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code		Comments
BWMD10	201906356	1	GRS			WSL	Ø			
~~BWMD09~~	201906357									
BWMD11	201906358	1	GRS	16:23	1/7/20	WSL	Ø	F	0.31	Clear sediment (sand) blackberry on banks
BWMD12	201906359			15:56				F	0.20	✓ Shallow. Sampled at drain behind grate (below confluence). Clear tanked water
WELDSQUARE2	201906360			15:05				F	0.23	Clear - lots quacking frog
WELDSQUARE1	201906361			14:43				F	0.26	Shallow - tannins } well vegetated banks
BWMD13	201906362			14:17				F	0.28	~~* CHANGE SAP - OPEN DRAIN - SAMPLED AT OUTLET.~~ FROM FLOC. SHALLOW. Quacking frog. barking frog
WELDSQUARE2A	201906363			15:05				F		Rep Site weldsquare 2
WELDSQUARE2B	201906364	↓	↓	15:05	↓	↓	↓	F		Blank site weldsquare 2

General Comments

Version: October 2006

Flow Codes	Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64394 & 64395

Instrument: PRODSS #3 (FRED) Sampler(s): J. Watham & M. Crow Project: SC-C-BAYMD

Misc for bank use

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
BWMD01	201906365	1	GPS	8:18	2/7/20	WSC	ø	F	0.37 Check SAP - Park Stream footbridge in [ ] Park. GPS correct - water clear, tannins. Channel clear, trees minimal grass
BWMD02 BW	201906366			8:41	"			F	0.806 ~10m upstream of confluence with MD. Kingwilliam trib sampled - Clear, slight yellow colour. Channel clear, grass banks
BWMD03	~~201906367~~							~~F~~	Lockwood #234B45 Watercorp + open. NB: SC Site ≈ 100 down stream SLade St. Unable to access
BWMD04	201906368			9:18				F	0.35 Clear slight tannin. also Channel clear, grass banks some overstory
BWMD26	201906369			9:48				F	0.46 Ank Key - sampled from "well" below grate. Typha filled channel. * GPS Point + Δ from sample point.
BWMD05 (delete)	201906370			~~10:52~~ 10:37				F	~~0.79~~ 0.45 Sampled @ confluence of trib & 1° trib to MD (ponds) because trib over-vegetated but flowing. HH Fe floc. Abundant 'clicking frogs' channel blocked with veg - grass/typha.
BWMD06	201906371			10:53				F	0.41 Heavy Fe Floc. Coloured - Channel clear - grass fringe some overstory
BWMD07	201906372			11:21				F	0.35 Clear water - wetland with some typha. good overstorey quantity (less)
BWMD08	201906373			11:34				F	0.34 Clear water. channel clear with grassed banks
BWMD14	201906374			12:07				F	0.30 Steep grassed banks - water clear
BWMD15	201906375			12:22				F	0.25 SONDE - FLAT - V.V. shallow. Sampled above trapezoidal drop. Narrow shallow flow, bank vegetated with grass.
BWMD16	201906376			12:51				F	0.32 Clear "reddish" but water sampled with slight coloration. Steep banks with boards & grass growing above: sampled at King St. * GPS in Δ location
BWMD17	201906377			14:00				F	0.29 tannins, wetland - revegsite, aquatic weeds

General Comments

Version: October 2006

Flow Codes	Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64393 & 64394

Instrument PROBOSS #3 (FRED) Sampler(s) J. Waldham & M. Crow Project SG-C-BAYMD

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
BWMD18	201906378	1	EB	14:16	2/7/20	WSC	0	F	0.24
BWMD19	201906379			14:31					
BWMD25	201906380			14:59					
BWMD24	201906381			15:31					
BWMD21	201906382			14:43					
BWMD29	201906383			15:52					0.18
BWMD28	201906384			15:35					0.19
BWMD30	201906385			~~15:5~~					DRY
BWMD22	201906386			16:12					0.29
BWMD23	201906387			16:34					0.30
BWMD31	201906388			17:00					020
BWMD09	201906357			13:12					
BWMD10	201906~~56~~								DRY

General Comments

Version: October 2006

Flow Codes	Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64395, 64396

Instrument PRODSS #3 "FRED" Sampler(s) Jake Patsham & Michelle Crow Project SG-C-BWMO (BAYSWATER)

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
201906401	BWMD01	1	EPS	08:30	5/8/20		Ø	F	light tannins
201906402	BWMD02			08:57					light tannin
201906403	BWMD03			09:14					light tannin
201906404	BWMD04			09:35					foam bubbles on surface - NOT dense.
201906405	BWMD05			10:06 ~~09:45~~					~~Sampled before drain 'pit' dense typha~~ Sampled at Clavering St drain outfall after culvert (~~Change GPS~~) * Site @ Railway Crossing GPS incorrect in SAP -31.91869 115.92251
201906406	BWMD06			10:17 ~~10:06~~					~~Sampled at Clavering St drain out fall~~ (GPS incorrect in SAP) before Sampled ~~after~~ bend that leads to confluence GPS ✓✓
201906407	BWMD07			10:50					
201906408	BWMD08			10:38					Clear - ribbon weed
201906425	BWMD26			09:48					Sampled before drain 'pit' - dense typha * Site @ Railway Crossing (Change GPS - incorrect in SAP)
201906414	BWMD14			11:29					Cannon - sediment slug . water clear
201906415	BWMD15			11:13					~~No~~ DO shallow & sample ~~from~~ upstream of "Drop", sampled at drop (photos taken)
201906416	BWMD16			11:43					drying down - # trickle still flowing from outfall * Sampled at outfall off King St change GPS
201906417	BWMD17			12:54					Algae

General Comments

Version: October 2006

Flow Codes	Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64395, 64396

Instrument PRO DSS #3 "FRED" Sampler(s) Jake Waldram; Michelle Crew Project SG-C-BWMD GROUNDWATER

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
201906418	BWMD18	1	PS	13:07	5/8/20				
201906419	BWMD19			13:27					
201906420	BWMD21			13:40					
201906421	BWMD22			14:16					
201906422	~~BWMD23~~							S	Not sampled
201906428	BWMD30							D	Not sampled
201906427	BWMD29			15:02	5/8/20				
201906426	~~BWMD28~~								Fenced - No access - Not sampled
~~201906424~~	BWMD25			12:08	5/8/20				Algae (Docks)
201906429	BWMD31			13:59	5/8/20				
201906423	BWMD24			12:20	5/8/20				Typha actively growing - oily smell

General Comments

Version: October 2006

Flow Codes: Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64347

Instrument Pro DSS Fred Sampler(s) J. Watsham, Michelle Crow Project BAYMD

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
201906409	BWMD09	F	EPS	~	06/08/20		WSL	S	Stagnant Pool @ outfall/sample Point. No surface flow - sit groundwater fed? NO. SAMPLE
201906410	BWMD10			1048				F	Turbid, Iron floc. gambusia.
201906411	BWMD11			1024				F	very clear. light tannins. filamentous algae.
201906412	BWMD12		↓	0958	↓			F	clear. Tannins. filamentous algae
201906413	BWMD13		EPS	08:39	06/08/20			F	Odours. High TSS. Iron floc.
201906431	WELDSQUARE 2			09:11				F	Clear. Living Stream.
201906430	WELDSQUARE 1	F	EPS	0935	06/08/20			F	clear. Living Stream.
201906423	BWMD 24								
201906424	BWMD25		EPS		06/08/20		WSL		

General Comments

Version: October 2006

Flow Codes	Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64398

Instrument Pro DSS (Fred) Sampler(s) M. Craw, J. Watsham, A. McGilvery Project SG-C-BASSENDEAN

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
201906389	BASS07		EDS	13:09:47	06/08/2020	WSL		F	Slow flowing.
201906390	BASS14			—				—	Car parked over drain grate. Not sampled.
201906391	Bass15			12:14:27				F	Surface scum; oily residue. Outlet dripping.
201906392	Bass 16			12:50				F	Water not deep enough to submerge Sonde. Water skimming the concrete.
201906393	Bass 17			13:20:50				S	Dense filamentous green & brown algae.
201906394	Bass18			—				S	Stagnant pool; not flowing. Not sampled.
201906395	Bass 19			—				D	Dry - Not sampled
201906396	Bass 20			—				S	Drying stagnant pool @ outfall point, No sample
201906397	Bass 21			—				S	Drying stagnant pool @ outfall point. No sample.
201906398	Bass 26			13:44:41				f	Clear, tannin stained; lots of frogs. Some light surface bubbles.
201906399	Bass 27			14:01:07	↓	↓		f	Clear. Sandy base. Some frogs; not as many as site 26.
201906400	Bass 28		EDS	14:24:57	06/08/2020	WSL		f	Fast flowing @ outlet. Sandy base in drain. Water clear; slightly tannin stained

General Comments

Version: October 2006

Flow Codes	Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64399 & 64400

Instrument PRO DSS #3 "FRED" Sampler(s) Jake Watsham & Michelle Crow Project SG-C-BAYMD (BAYSWATER)

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
201906432	BWMD01	1	G	08:32	29/20	WSL	ø	F	High tannin - Fast flow
201906433	BWMD02	1	G	08:56		WSL	ø		Fast flow - Clear For m ora (smell) + Dead bird (ibis?)
201906434	BWMD03	1	G	09:11		WSL	ø		slight tannins - fast flow - excess litter accumulation at bridge - photos taken sent to CoS
201906435	BWMD04	1	G	09:28		WSL	ø		Fast flow, odor, photos from BWMD03-04 - multiple discharge points from residents - photos sent to WC via CoS
20190645 56	BWMD26	1	G	09:41		WSL	ø	V	
20190645 6		3	CC	10:05-25		SSC	0.05	-	Time to sample 10:05-10:25 (20min)+ Bunting recorded on other side of road
201906436	BWMD05	1	G	11:11		WSL	ø	F	clear strong flow
201906437	BWMD06	1	G	10:47		WSL	ø	F	cloudy ~~High~~ Strong flow
201906437		3	CC	10:55		SSC	0.05	-	sandy - sampling straight forward
201906438	BWMD07	1	G	11:42		WSL	ø	F	clear Frogs
201906439	BWMD08	1	G	11:31		WSL	ø		clear Frogs
201906445	BWMD14	1	G	12:16		WSL	ø		clear Frogs
201906446	BWMD15	1	G	11:59		WSL	ø		sampled below trapezoidal drop - u/s stream was too shallow
201906447	BWMD16	1	G	12:37		WSL	ø		Flow-a continuous trickle - slight tannins
201906447		3	CC	12:40		SSC	0.05		
201906448	BWMD17	1	G	15:28		WSL	ø		High tannins & Algae

General Comments

Version: October 2006

Flow Codes: Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 64399 & 64400

Instrument ADO DSS #3 "FRED" Sampler(s) Jake Watsham & Michelle Crow Project SG-C-BAYMD (BAYWATER)

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
201906449	BWMD18	1	G	15:38	2/9/20	WSL	0		Clear
201906450	BWMD19	↓	↓	15:51	↓	↓	↓		Clear
201906451	BWMD21	↓	↓	16:03	↓	↓	↓		Clear
201906454	BWMD24	1	G	14:46	↓	WSL	0	—	Silver shell, low flow
201906454		3	-	14:55	↓	SSC	0.05		
201906455	BWMD25	1	G	13:12	↓	WSL	0		√ High Algae - Dark water
201906457	BWMD28	↓	↓	13:35	↓	↓	↓		#28 - No visible flow in lagoon. Dark Jamming.
201906458	BWMD29	↓	↓	13:49	↓	↓	↓		#29 Flowing out of lagoon.
201906459	BWMD30	↓	↓	N/A	↓	↓	↓	D	DRY - Not Sampled
201906452	BWMD22	↓	↓	↓	↓	↓	↓	↓	↓
201906453	BWMD23	1	G	14:19	2/9/20	WSL	0	F	Vegetated - weeds.

General Comments

Version: October 2006

Flow Codes: Dry = D; Flowing = F; Stationary = S

Government of Western Australia
Department of Water

Field Observation Form - Surfacewater 4

COC# 68651

Instrument: PRO DSS #3 "FRED" Sampler(s): Jake Watsham, Michelle Crow Project: SG-C-BAYMO (BAYSWATER)

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
201906460	BWMO31	1	G	8:37	3/9/20	WSL	ϕ	F	Abundant filamentous green algae - Flow slightly tannins. Dark water
201906453	BWMO23								
201906444	BWMO 13			09:10					Filamentous algae, slight tannins
201906461	WELD 01			09:25					Clear - abundant (WA) fringing veg - re-veg site
201906462	WELD 02			09:45					Clear abundant fringing veg (WA) some Brazillian pepper growing - advised COB. Frog calls
201906443	BWMO12			10:03					~~[illegible]~~ Water clear, Iron stained sediment
201906442	BWMO 11			10:40					Clear - tree canopy - shaded. Waterway has weeds along banks but there is overhanging (weed) grasses. Blackberry on Δ bank - COB informed. Frog calls
201906440	BWMO9			10:58				✓	
201906441	BWMO10	↓	↓	11:06	↓	↓	↓	S	Sampled because there appears to have been recent flow (1) water level higher than previous sampling & (2) outlet was wet (but not draining) - photo. Frogs downstream
201906452	BWMO22	1	G	08:52	3/9/20	WSL	ϕ	F	Clear - Abundant (weed) fringing & aquatic veg

General Comments

Version: October 2006

Flow Codes	Dry = D; Flowing = F; Stationary = S

Department of Water

Field Observation Form - Surfacewater 4

COC# 68652

Instrument YSI DSS #3 'FRED' Sampler(s) Jake Waltham, Michelle Crow Project SG-C-BASSENDEAN

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Comments
BASS07	201906463	1	9	-	3/9/20	WSL	Ø	S	No flow - No sample - Stagnant water with high gross algae content on top.
BASS17	201906467			13:33				F*	Flow extremely slow - only usable by seeing fine grass/leaves moving slowly from inlet - sampled at inlet - High iron flocc - water cloudy - opaque almost!
BASS14	201906464							S	Full of water but NO Flow ∴ Not Sampled.
BASS18	201906468							S	Stagnant puddle - No flow - Not Sampled
BASS16	201906466			11:30				F*	
BASS19	201906469							S	Stagnant pool - No flow - Not Sampled
BASS05	201906465			12:05 ~~11:55~~				F*	Flow from both inlets minimal - sample technique compromised due to shallowness of flow. Too shallow for probe.
BASS20	201906470							S	Stgnt pools - No Flow Not Sampled
BASS21	201906471							S	
BASS26	201906472			14:03				F	Clear - C. glauerti present
BASS27	201906473			~~14:15~~				F	clear - slight tannin stain in sediment. C. glauerti calling.
BASS28	201906474			14:35					slight tannin coloration.
									BASS15 Flow a trickle. No visible outflow. Sampled from inlet by holding catch cup at mouth of inlet until enough sample captured

NB - Abundant sediment accumulation at confluence of all inlets. Abundant Typha & exotic grasses - #26 comments

General Comments

Version: October 2006

Flow Codes: Dry = D; Flowing = F; Stationary = S

DAY 1 July

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Department of Water & Environmental Regulation

Chain of Custody

coc# 68653

Send samples to: Chemcentre

Collection Agency/Branch: CoB / DBCA

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Laboratory Use Only

Purchase Order Number: (mandatory)

Sampling frequency: (regular, irregular etc.) Regular

Send electronic results to: datain@dwer.wa.gov.au
rebecca.cooper@dwgswater.wa.gov.au
@dwer.wa.gov.au

Lab Batch Code:

Address correspondence to: DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919
61 Brown Ave Morley

Names of Samplers: (print first & last name)
Michelle Crow
Matt Moore
Zane Gates

Lab remarks:

Project Code: (mandatory) SG - C - KAYMD

Remarks:
Invoice CoB Attn: Rebecca Cooper 9270 4177

Group Analysis Sheet Attached (check box)

Sample analysis (samples may contain hazardous substances)

Container	Volume	125mL				1L				
	Type *	P				P				
Treatment	Filtered	N	Y	Y	Y	N	N			
	Type	-	Acid	Acid	-	-	-			
	Porosity	-	Unfil	Filt	-	-	-			
	Preserved	N	Y	Y	Y	N	N			
Storage	Temp	1-4				1-4				
	Time	10				10				
Lab to filter **		N				N				

** Indicates the laboratory is required to filter samples prior to analysis

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers
	20190475	1	F	G	EPS	09:11	21/07/2021		BWMD01		WL	0	5
	20190476					10:05			BWMD02				
	20190477					10:29			BWMD03				
	20190478					10:51			BWMD04				
	20190479					11:15			BWMD26				
	20190480					12:07			BWMD05				
	20190481					11:44			BWMD06				
	20190482					13:04			BWMD07				
	20190483					12:45			BWMD08				
	20190484					12:27			BWMD11				
	20190485					14:15			BWMD15				
	20190486					13:00			BWMD16				
	20190487					13:21			BWMD17				

Total number of sample containers / filter papers: 65

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete: 2 ☐ Collection/Measurement 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): Michelle Crow Signature: Date: 21/7/21 Time: 16:45

Received by (Lab use only) (print name): Dale Carter Signature: Date: 21/7/21 Time: 14:46

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

DAY 1 July

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Department of Water & Environmental Regulation

Chain of Custody

COC# 68659

Send samples to:	Chem Centre
Collection Agency/Branch:	CoB / DBCA
Purchase Order Number: (mandatory)	
Sampling frequency: (regular, irregular etc.)	Regular
Send electronic results to:	datain@dwer.wa.gov.au; roberta.cooper@bgswater.wa.gov.au (?); @dwer.wa.gov.au
Address correspondence to:	Dr Kerry Trayler (?) Anne Morley (?); DWER Science Data Branch, Locked Bag 10, Joondalup DC WA 6919
Names of Samplers: (print first & last name)	Michelle Crow, Matt Moore, Zane Gulas (?)
Project Code: (mandatory)	SG-C-BAYMD

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Laboratory Use Only

Lab Batch Code:

Lab remarks:

Remarks: Invoice CoB Attn: Roberta Cooper 9210 4127 (?) Joint DBCA project

Group Analysis Sheet Attached (check box) ☐

Sample analysis (samples may contain hazardous substances)

	Group A (Total Nutrients)	Group B (Soluble Nutrients)	Group C (Soluble Metals)	Group D (Total Metals)	[illegible] Hardness
Container: Volume	125mL	→	→	→	1L
Container: Type *	P	→	→	→	P
Treatment: Filtered	N	Y	Y	N	N
Treatment: Type	-	AC/CL	AC/CL	-	-
Treatment: Porosity	-	0.45um	0.45um	-	-
Treatment: Preserved	N	→	→	→	N
Storage: Temp	1-4	→	→	→	→
Storage: Time	D	→	→	→	D
Lab to filter **					

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers	Group A	Group B	Group C	Group D	[illegible] Hardness
	202004751					12.48	21/07/21		BWMD08	WS	Ø		5	✓	✓	✓	✓	✓
	202004779								BWMD17A				5	✓	✓	✓	✓	✓
	"								BWMD17B				5	✓	✓	✓	✓	✓

Total number of sample containers / filter papers: 15

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): Michelle Crow — Signature: [signature] — Date: 21/7/21 — Time: 15:45

Received by (Lab use only) (print name): Dale Carter — Signature: [signature] — Date: 21/07/21 — Time: 16:45

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

** Indicates the laboratory is required to filter samples prior to analysis

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

Biodiversity and Conservation Science

Catchment Field Observation Form

COC# 68653 + 68654 68659

Date: 21.07.21

Instrument:

Field Samplers: M. Crow M. Moore Z. Gates

Run comment:

Site	Sample Number	Matrix	Sample: Salinity (ppt)	Sample: Time	Collection Method	Depth Ref Point (m)	Flow Status	Stage height	Site comments
BWMD01	20190647S	1	0.732	9:11am	EPS	WSL	F		Turbid
BWMD02	20190647G	1	0.70	10:05am	EPS	WSL	F		clear water
BWMD03	20190647[illegible]8	1	0.37	10.24	EPS	WSL	F		Turbid
BWMD04	20190647[illegible]8	1	0.36	10:51*	EPS	WSL	FM		Vegetation on banks (Button hit twice)*
BWMD26	20190647[illegible]9	1	0.56	11:15	EPS	WSL	FL		very little flow. High Vegetation
BWMD06	20190648[illegible]	1	0.36	11:44am	EPS	WSL	FM		Turbid (slow silt) Set down area for transline
BWMD07	20190648[illegible]	1	0.31	1:14 pm	EPS	WSL			Sand inflow from construction
BWMD08	20190648[illegible]	1	0.30	12:48	EPS	WSL	FH		
BWMD14	20190648[illegible]	1	0.4	13:53	EPS	WSL	F		Heavy vegetation
BWMD15	20190648[illegible]	1	0.4	14:18	EPS	WSL	FL		Heavy Vegetation fuel smell, yellow, slow filtering
BWMD16	20190648[illegible]	1	0.5	15:00	EPS	WSL	FL		Heavy sediment, very shallow, yellowish
BWMD17	20190648[illegible]	1	0.28	15.21	EPS	WSL	F		Clear
BWMD18	20190648[illegible]	1			EPS	WSL			
BWMD19	20190648[illegible]	1			EPS	WSL			
BWMD25	20190649[illegible]	1			EPS	WSL			
BWMD24	20190649[illegible]	1			EPS	WSL			
BWMD21	20190649[illegible]	1			EPS	WSL			
BWMD29	20190649[illegible]	1			EPS	WSL			
BWMD30	20190649[illegible]	1			EPS	WSL			
BWMD05	20190648[illegible]		0.38	12:07	EPS	WSL	F (Turbid)		

New COF for 22/7

= Telemetry Guage

= Staff Guage

EPS-Extendable pole sampler; WSL-Water surface level; Flow codes: F-Flowing; FL-Low flow; FH-High flow; FM-Moderate flow; S-Stationary; D-Dry

slow silt ↑

Poly styrene

opp. sample site has infill

DAY 2 · July

Department of Water & Environmental Regulation

Chain of Custody

coc# 68654

Send samples to: Chemcentre

Collection Agency/Branch: CoB / DBCA

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Laboratory Use Only

Purchase Order Number: (mandatory)

Send electronic results to: datain@dwer.wa.gov.au
rebecca.cooper@bayswater.wa.gov.au @dwer.wa.gov.au

Sampling frequency: (regular, irregular etc.) Regular

Lab Batch Code:

Address correspondence to: 61 Broun Ave Morley
DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name)
Michelle Crow
Matt Moore
Zane Gates

Lab remarks:

Project Code: (mandatory) SG - C - BAYMD

Remarks: Invoice CoB Attn: Rebecca Cooper 4200 4127

Group Analysis Sheet Attached (check box) ☐

Sample analysis (samples may contain hazardous substances)

Container	Volume	125mL				1L			
	Type *	P				P			
Treatment	Filtered	N	Y	Y	N	N			
	Type	-	ACIDIC	ACID	-	-			
	Porosity	-	0.45µm	0.45µm	-	-			
	Preserved	N	-	-	-	N			
Storage	Temp	4				4			
	Time	10				10			
Lab to filter **		N				N			

** Indicates the laboratory is required to filter samples prior to analysis

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers
	20190689	1	F	G	EPS	08:56	22/07/2019		BWMD19		WSL	0	5
	20190690					09:09	22/7		BWMD25				
	~~20190691~~								~~BWMD24~~				
	20190690					7:07			BWMD21				
	20190694					8:39			BWMD29				
	~~20190695~~								~~BWMD30~~				
	20190696					10:47			BWMD22				
	20190697					11:15			BWMD23				
	20190698					10:23			BWMD31				
	20190699					13:22			BWMD10				
	20190500					12:31			BWMD09				
	20190693					09:52			BWMD28				
	~~20190~~												

Total number of sample containers / filter papers:

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): Michelle Crow Signature: Date: 22/7/19 Time: 16:40

Received by (Lab use only) (print name): Signature: Date: 22-7-19 Time: 4:45pm

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

DAY 2 JM

Page 2 / 2

Department of Water & Environmental Regulation

Chain of Custody

coc# 68655

Send samples to: ChemCentre

Collection Agency/Branch: CoB / DBCA

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Laboratory Use Only

Purchase Order Number: (mandatory)

Send electronic results to: datain@dwer.wa.gov.au
rebecca.cooper@bgwater.wa.gov.au
@dwer.wa.gov.au

Sampling frequency: (regular, irregular etc.) Regular

Lab Batch Code:

Address correspondence to: 61 Brown Ave Morley
DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name)
Michelle Crew
Matt Moore
Zane Gates

Lab remarks:

Project Code: (mandatory) SG - C - BAYMD

Remarks: Invoice CoB Attn: Rebecca Cooper 92704177
Dept DBCA project

Group Analysis Sheet Attached (check box)

Sample analysis (samples may contain hazardous substances)

Container	Volume	1Bottle							
	Type *	P			P	P			
Treatment	Filtered	N	Y	Y	N	N			
	Type	-	Field	Field	-	-			
	Porosity	-	Unfilt	Unfilt	-	-			
	Preserved	N							
Storage	Temp	4D							
	Time	7D							
Lab to filter **		N							

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers
	20200[illegible]52	W	F	G	CB	12:30	22/01/21	BWM011			WSL	0	5
	20200[illegible]53					12:12		BWM012					
	20200[illegible]54					11:58		weldsquare02					
	20200[illegible]55					11:30		weldsquare01					
	20200[illegible]56							SAMPLE					
	20200[illegible]92					09:30		[illegible]					

Total number of sample containers / filter papers:

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): Signature: Date: Time:

Received by (Lab use only) (print name): Signature: Date: Time:

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

** Indicates the laboratory is required to filter samples prior to analysis

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

Biodiversity and Conservation Science

COC# 68654

Catchment Field Observation Form

Date: 22.07.21

Instrument:

Field Samplers: M. Crow, M. Moore, Z. Gates

Run comment:

Site	Sample Number	Matrix	Sample: Salinity (ppt)	Sample: Time	Collection Method	Depth Ref Point (m)	Flow Status	Stage height	Site comments
BWMD22	201906496	1	0.25	10:47	EPS	WSL	FL		Jakobsen stream
BWMD23	201906497	1	0.28	11:13	EPS	WSL			Heavy vegetation in stream
BWMD31	201906498	1	0.14	10:28	EPS	WSL	FL		Low flow with pumping station off
BWMD10	201906499	1	0.32	13:20	EPS	WSL	FL		Low flow and dense surrounding veget
BWMD09	201906500	1	0.20	12:56	EPS	WSL	FL		Dense vegetation
BWMD28	201906693	1	0.25	9:52	EPS	WSL	FL		Lake sample, Low flow, High tannins
		1			EPS	WSL			
~~BWMD06 Rep~~	202004751	1	0.30	12:48	EPS	~~WSL~~	FH		
		1	~~0.20~~	~~8:38~~	EPS	WSL			
BWMD18	201906492	1	~~0.09~~	~~8:08~~	EPS	WSL	F		Flowing into drain (~~Nora Hughes Extra~~)
BWMD19	201906489	1	0.20	8:56	EPS	WSL	F		Vegetation in stream
BWMD25	201906488	1	0.09	8:08	EPS	WSL	F		Nora Hughes Sample
BWMD24	201906491	1	—	—	~~EPS~~	~~WSL~~	D		Not Sampled.
BWMD21	201906490	1	0.19	9:07	EPS	WSL	FL		Vegetation in stream
BWMD29	201906494	1	0.19	9:39	EPS	WSL	F		Russell Street drain
BWMD30	201906495	1	—	—	~~EPS~~	~~WSL~~	S		Not Sampled
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			

= Telemetry Guage

= Staff Guage

EPS-Extendable pole sampler; WSL-Water surface level; Flow codes: F-Flowing; FL-Low flow; FH-High flow; FM-Moderate flow; S-Stationary; D-Dry

Biodiversity and Conservation Science

COC# 68655

Catchment Field Observation Form

Field Samplers: M. Crow, M. Moore, 2. Gates

Date: 22/07/21

Instrument:

Run comment:

Site	Sample Number	Matrix	Sample		Collection Method	Depth Ref Point (m)	Flow Status	Stage height	Site comments
			Salinity (ppt)	Time					
BWMD11	202004752	1	0.52	12:36	EPS	WSL	F		New drain systems (Joan Rycroft reserve)
BWMD12	202004753	1	0.20	12:12	EPS	WSL	F		Shallow flow
weldsquare 02	202004754	1	0.21	11:51	EPS	WSL	FL		Low flow, Dense vegetation along stream (High Tanners)
weldsquare 01	202004755	1	0.22	11:36	EPS	WSL	FL		Little flow, Dense vegetation in stream (High Tanners)
BWMD13	202004756	1	—	—	~~EPS~~	~~WSL~~			No access to site, No sample
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			

= Telemetry Guage

= Staff Guage

EPS-Extendable pole sampler; WSL-Water surface level; Flow codes: F-Flowing; FL-Low flow; FH-High flow; FM-Moderate flow; S-Stationary; D-Dry

Day 2 July

2/2

Biodiversity and Conservation Science

COC# 68654

Catchment Field Observation Form

Date: 22.07.21

Instrument:

Field Samplers: M. Crow, M. Moore, Z. Gates

Run comment:

Site	Sample Number	Matrix	Sample		Collection Method	Depth Ref Point (m)	Flow Status	Stage height	Site comments
			Salinity (ppt)	Time					
BWMD22	20190646	1			EPS	WSL			
BWMD23	20190649	1			EPS	WSL			
BWMD 31	20190649	1			EPS	WSL			
BWMD 10	20190649	1			EPS	WSL			
BWMD09	20190650	1			EPS	WSL			
BWMD28	20190649	1			EPS	WSL			
		1			EPS	WSL			
BWMD08 Rep	20200475	1	0.30	12:48	EPS	WSL	FH		
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			
		1			EPS	WSL			

Keep

= Telemetry Guage

= Staff Guage

EPS-Extendable pole sampler; WSL-Water surface level; Flow codes: F-Flowing; FL-Low flow; FH-High flow; FM-Moderate flow; S-Stationary; D-Dry

DAY 1 August

Page /

Department of Water & Environmental Regulation

Chain of Custody

coc# 68660

Send samples to: Chem Centre

Collection Agency/Branch: CoB / DBCA

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Purchase Order Number: (mandatory)

Sampling frequency: (regular, irregular etc.) Regular

Send electronic results to: datain@dwer.wa.gov.au
rebecca.ferguson@bayswater.wa.gov.au
@dwer.wa.gov.au

Laboratory Use Only

Lab Batch Code:

Address correspondence to: 61 Broun Avenue Morley
DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name)
M. Crow
M. Moore
Z. Gates

Lab remarks:

Project Code: (mandatory) SG - C - BAYMD

Remarks: Invoice City of Bayswater. Joint DBCA Project

Group Analysis Sheet Attached (check box)

Sample analysis (samples may contain hazardous substances)

Container	Volume	125ml	250ml	125ml	1L	1L			
	Type *	P	P	P	P	P			
Treatment	Filtered	N	Y	Y	N	N			
	Type	-	Nitric	Nitric	-	-			
	Porosity	-	Low	Low	-	-			
	Preserved	N	N	N	N	N			
Storage	Temp	1-4	1-4	1-4	1-4	1-4			
	Time	10	10	10	10	10			
Lab to filter **		N	N	N	N	N			
		Group A (total nutrients)	Group B (soluble nutrients)	Group C (soluble nutrients)	Suspended Solids	TSS only			

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers
	20200479 0	1	5	6	23	08:24	18/8/21		BWMD01		WX	0	4
	20200479 1					9:05			BWMD02				4
	20200479 2					9:21			BWMD 03				4
	20200479 3					9:38			BWMD 04				4
	20200479 4					9:58			BWMD 2C				4
	20200479 5					10:24			BWMD 05				4
	20200479 6					10:3			BWMD 06				4
	20200479 7					11:00			BWMD 07				4
	20200479 8					11:11			BWMD 08				4
	20200479 9					11:20			BWMD 14				4
	20200480 0					11:47			BWMD 15				3
	20200479 1					12:11			BWMD 16				4
	20200479 2					12:55			BWMD 17				4
	20200479 3					13:12			BWMD 18				4

Total number of sample containers / filter papers:

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): Michelle Cox Signature: Date: Time: 16:45

Received by (Lab use only) (print name): Signature: Date: Time:

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

** Indicates the laboratory is required to filter samples prior to analysis

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

DAY 1 August.

Department of Water & Environmental Regulation

Chain of Custody

coc# 68661

Send samples to: Chem Centre

Collection Agency/Branch: Cob / DBCA

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Purchase Order Number: (mandatory)

Sampling frequency: (regular, irregular etc.) Regular

Send electronic results to: datain@dwer.wa.gov.au
rebecca.ferguson@bayswater.wa.gov.au @dwer.wa.gov.au

Laboratory Use Only

Lab Batch Code:

Address correspondence to: 61 Broun Ave Morley
DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name)
M. Crow
M. Moore
Z. Glaser

Lab remarks:

Project Code: (mandatory) SG - C - BAYMD _ _ _ _ _ _ _ _ _ _

Remarks: Invoice City of Bayswater Joint DBCA Project

Group Analysis Sheet Attached (check box) ☐

Sample analysis (samples may contain hazardous substances)

Container	Volume	125m	125m	125m	1L				
	Type *	P	P	P	P				
Treatment	Filtered	N	Y	Y	N				
	Type	–	Nitric	Nitric	–				
	Porosity	–	0.45	0.45	–				
	Preserved	N	N	Y	N				
Storage	Temp	1-4	1-4	1-4	1-4				
	Time	10	10	10	10				
Lab to filter **		N	N	N	N				

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers	Group A (total nutrients)	Group B (soluble nutrients)	Group C (soluble metals)	Water isotopes
	20200479[illegible]	1	F	G	ERS	13:26	18/8/21		BWMD19		WS	0	4	✓	✓	✓	✓
	20200479[illegible]					14:04			BWMD25				4	✓	✓	✓	✓
	20200479[illegible]					14:03			BWMD24				4	✓	✓	✓	✓
	20200479[illegible]					13:43			BWMD21				4	✓	✓	✓	✓
	20200479[illegible]					14:44			BWMD29				4	✓	✓	✓	✓
	20200479[illegible]					14:56			BWMD28				4	✓	✓	✓	✓
	~~20200479[illegible]~~								~~BWMD30~~				~~4~~	~~✓~~	~~✓~~	~~✓~~	~~✓~~
	20200480[illegible]					15:31			BWMD22				4	✓	✓	✓	✓
	20200480[illegible]					15:17			BWMD23				4	✓	✓	✓	✓
	20200480[illegible]					15:44			BWMD31				4	✓	✓	✓	✓

Total number of sample containers / filter papers:

** Indicates the laboratory is required to filter samples prior to analysis

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): Michelle Cro Signature: MCro Date: 19/8/21 Time: 16:25

Received by (Lab use only) (print name): Signature: Date: Time:

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Day 1. August

Department of Water

Field Observation Form - Surfacewater 4

COC# 68660

Instrument YSI | Sampler(s) M. Crow, M. Moore, Z. Gates | Project SG-C-BAYMD

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Conduct. S	Comments
BWMD01	202004780	1	G	8:24	18/8/21	WSL	0	F	.32	Tannins present, slow flow
BWMD02	202004781			9:05				F	.31	Turbid,
BWMD03	202004782			9:21				F	.61	Fast flow, Logged twice
BWMD04	202004783			9:38				F	.21	Fast flow, white bubbles at surface, dark water.
BWMD26	202004784			9:56				F	.27	Heavy Typha, Lots of organic's, shallow permission (PPA required next time) YSI horizontal
BWMD05	202004785			10:24				F	.32	Good flow
BWMD06	202004786			10:38				F	.26	Dangerous site to sample (Review Location)
BWMD07	202004787			11:00				F	.29	
BWMD08	202004788			11:11				F	0.29	
BWMD14	202004789			11:28				F	0.56	Steep.
BWMD15	202004790			11:47				F	0.374	Clear flow, instream veg.
BWMD16	202004791			12:11				F	0.411	Very slow, low flow. Some filamentous algae in stream
BWMD17	202004792			12:55				F	0.530	fast clear flow

General Comments

Version: October 2006

Flow Codes: Dry = D; Flowing = F; Stationary = S

Day 1.

Department of Water

Field Observation Form - Surfacewater 4

COC# 68660 + 68661

Instrument YSI | Sampler(s) M. Crow, M. Moore, Z. Gates | Project SG-C-BAYMD

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Conduct	Comments
BWMD 18	202004793	1	G	13:12	18/8/21	WSL	Ø	F	0.566	
BWMD 19	202004794			13:26				F	0.550	~~deep~~ Slow flow, filamentous algae scum on surface
BWMD 25	202004795			14:14				F	0446	~~clear~~ drain at full cleared from debris Dark tannins in water
BWMD 24	202004796			14:03				F	0'474	V. slow flow. Algal scum on surface, macrophyte weeds in drain. Tannins.
BV 221	202004797			13:43				F	0.571	flowing quite fast, some in stream veg. Clear flow.
BWMD 29	202004798			14:41				F	0.512	Scum, debris & litter at outlet
BWMD 28	202004799			14:56				F	0.505	No obvious flow
BWMD 30	202004800			—				S	—	Not sampled - No flow - stagnant water from lake. Dense scum on surface at outfall
BWMD 22	202004801			15:31				F	0.512	Deep water
BWMD 23	202004802			15:17				F	0.505	Dense vegetation (Typha, Watercress, Dock)
BWMD 31	202004803			15:44				F	.532	Low flow, pump inactive, sediments accumulation, clear water

General Comments

Version: October 2006

Flow Codes: Dry = D; Flowing = F; Stationary = S

DAY 2 August

Page 1 /

Department of Water & Environmental Regulation

Chain of Custody

coc# 68662

Send samples to: Chem Centre

Collection Agency/Branch: CoB/DBCA

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Laboratory Use Only

Purchase Order Number: (mandatory)

Send electronic results to: datain@dwer.wa.gov.au
rebecca.ferguson@bayswater.wa.gov.au
@dwer.wa.gov.au

Sampling frequency: (regular, irregular etc.) Regular

Lab Batch Code:

Address correspondence to: 61 Broun Ave Morley
DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name)
M. Crow
M. Moore
Z. Eaton

Lab remarks:

Project Code: (mandatory) SB - [ ] - BAYMD

Remarks: Invoice City of Bayswater Join DBCA Project

Group Analysis Sheet Attached (check box) ☐

Sample analysis (samples may contain hazardous substances)

Container	Volume	125ml	125ml	125ml	1L	1L			
	Type *	P	P	P	P	P			
Treatment	Filtered	N	Y	Y	N	N			
	Type	-	A(L)	A(L)	-	-			
	Porosity	-	0.45	0.45	-	-			
	Preserved	N	N	Y	N	N			
Storage	Temp	1-4	1-4	1-4	1-4	1-4			
	Time	1D	1D	1D	1D	1D			
Lab to filter **		N	N	N	N	N			

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers	Group A (total nutrients)	Group B (soluble nutrients)	Group C (soluble metals)	Group C (soluble metals) + TSS + hardness	TSS only			
	20200480 4	1	F	G	CB	8:59	19/8/21		BWMD13		WSL	0	4	✓	✓	✓	✓				
	20200480 5					9:18			WELDSQUARE01				4	✓	✓	✓	✓				
	20200480 6					9:33			WELDSQUARE02				4	✓	✓	✓	✓				
	20200480 7					9:56			BWMD12				4	✓	✓	✓	✓				
	20200480 8					10:19			BWMD11				4	✓	✓	✓	✓				
	20200480 9					10:51			BWMD09				3	✓	✓			✓			
	20200481 0	↓	↓	↓	↓	11:06	↓		BWMD10		↓	↓	3	✓	✓			✓			

Total number of sample containers / filter papers:

** Indicates the laboratory is required to filter samples prior to analysis

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete: 2 ☐ Collection/ Measurement 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): Michelle Crow Signature: MCrow Date: 19/8/21 Time: 16:15

Received by (Lab use only) (print name): Signature: Date: 19/8 Time: 0915

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

Day 2.

Field Observation Form - Surfacewater 4

Department of Water

COC# 68662.

Instrument DBCA YSI DSS 'FRED' Sampler(s) M. Crow, M. Moore, T. Gates Project SG-C-BAYMD

Reference Number / Name:	Sample No.	Matrix	Collection Method	Time Collected HH:MM	Date Collected DD/MM/YYYY	Depth ref Point	Sample Depth (m)	Flow Code	Conduct	Comments
BWMD13	202004804	1	G	8:59	19/8/21	WL	Ø	F	.472	Macrophytes, filamentas algae 8:59
weldsquare01	202004805			9:18				Fslow	.471	litter present, tannins.
weldsquare02	202004806			9:33				F slow	.484	Macrophytes
BWMD12	202004807			9:56				F	0.434	sampled at confluence infront of culvert (2 drains). surface algae. white foam. filamentas algae sediment accumulated at confluence * Photo *
BWMD11	202004808			10:19				F	0.550	Tannins.
BWMD09	202004809			10:51				F	0.693	chanel vegetated - typha + juncas algae
BWMD10	202004810			11:06				F slow	0.798	grass present in chanel

General Comments

Version: October 2006

Flow Codes: Dry = D; Flowing = F; Stationary = S

DAY 1

Page /

Department of Water & Environmental Regulation

Chain of Custody

coc# 68667

Send samples to: Chem Centre

Collection Agency/Branch: DBCA / CoB

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Purchase Order Number: (mandatory)

Sampling frequency: (regular, irregular etc.) Regular

Send electronic results to: datain@dwer.wa.gov.au
jessica.langston@[illegible]@dwer.wa.gov.au

Laboratory Use Only

Lab Batch Code:

Address correspondence to: 61 Brun Ave Mates
DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name)
M. Crew
M. Moon
Z. Goss

Lab remarks:

Project Code: (mandatory) SG - C - BAYMD

Remarks: Swan DBCA Project
Invoice City of Bays

Group Analysis Sheet Attached (check box)

Sample analysis (samples may contain hazardous substances)

Container	Volume	125ml	125ml	125ml	250ml	1L	250ml	1L	1L	
	Type *	P	P	P	P	P	P	P	P	
Treatment	Filtered	No	No	Yes	No	No	No	No	No	
	Type	-	Nitric	Nitric	-	-	-	-	-	
	Porosity	-	0.45	0.45	-	-	-	-	-	
	Preserved	No	No	Yes	No	No	No	No	No	
Storage	Temp	1-4								
	Time	10								
Lab to filter **		No								

** Indicates the laboratory is required to filter samples prior to analysis

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers
	20200823	1	F	6	LRS	9:03	15/9/21		BWMD01		WW	0	4
	20200824	1	F	6	LRS	9:37			BWMD02		WW	0	4
	20200825	1	F	6	LRS	9:53			BWMD03		WW	0	4
	20200826	1	F	6	LRS	10:21			BWMD04		WW	0	4
	20200827	1	F	6	LRS	11:10			BWMD26		WW	0	4
	20200828	3	F	CC		11:16			BWMD26		WW	0	2
	20200829	1	F	6	LRS	12:37			BWMD05		WW	0	4
	20200830	1	F	6	LRS	12:57			BWMD06		WW	0	4
	20200831	3	F	CC		12:57			BWMD06		WW	0	2
	20200832	1	F	6	LRS	14:23			BWMD07		WW	0	4
	20200833	1	F	6	LRS	14:39			BWMD08		WW	0	4
	20200834	1	F	6	LRS	15:14			BWMD14		WW	0	4
	20200835	1	F	6	LRS	15:22			BWMD15		WW	0	4
	20200836	1	F	6	LRS	15:20			BWMD16		WW	0	4

Total number of sample containers / filter papers:

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): M Crew — Signature: — Date: 15/9/21 — Time: 3pm

Received by (Lab use only) (print name): Kevin Robins — Signature: — Date: 15-09-2021 — Time: 17:00

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

DAY 1

Page /

Department of Water & Environmental Regulation

Chain of Custody

coc# 68668

Send samples to: CHEM CENTRE

Collection Agency/Branch: DBCA / CB

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Laboratory Use Only

Purchase Order Number: (mandatory)

Send electronic results to: datain@dwer.wa.gov.au
@dwer.wa.gov.au

Sampling frequency: (regular, irregular etc.) Regular

Lab Batch Code:

Address correspondence to: DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name) Mr. Moore, Mr. Crow, 2 Guests

Lab remarks:

Project Code: (mandatory) SC - C - BAYMD

Remarks: Invoice DBCA Project, Invoice City of Bays

Group Analysis Sheet Attached (check box)

Sample analysis (samples may contain hazardous substances)

Container	Volume	125ml	125ml	125ml	1L	125ml	250ml		
	Type *	P	P	P	P	G	G		
Treatment	Filtered	No	Yes	Yes	No	No	No		
	Type	-	Acid	Acid	-	-	-		
	Porosity	-	0.45	0.45	-	-	-		
	Preserved	No	No	Yes	No	No	No		
Storage	Temp	4							
	Time	10							
Lab to filter **		No							

** Indicates the laboratory is required to filter samples prior to analysis

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers
	702004834	3	F	C		15:20	15/9/21		BWMD16		SSL		2
	702004835	1	F	C					BWMD17		WSL		4
16/9	702004836								BWMD18		WSL		
	702004837								BWMD19		WSL		
	702004838								BWMD21		WSL		
	702004839	1	F	C		15:50	15/9/21		BWMD24		WSL		4
	702004839	3		CC		15:50			BWMD24		SSL		2
	702004840	1	F	C		16:07			BWMD25		WSL		4

Total number of sample containers / filter papers:

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): M. Crow Signature: Date: 15/9/21 Time: 5pm

Received by (Lab use only) (print name): Kevin Robins Signature: Date: 15-09-2021 Time: 17:00

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

Biodiversity and Conservation Science

COC# 68667 & 68668 S 591418

Catchment Field Observation Form

Date: 15/09/21

Instrument:

Field Samplers: M.CROW, M.MOORE, Z.GATES

Run comment: SG-C-BAYMD, DAY 1

Site	Sample Number	Matrix	Sample		Collection Method	Depth Ref Point (m)	Flow Status	Stage height	Site comments
			Salinity (ppt)	Time					
BWMD01	202004823	1		9:03	EPS	WSL	F		slow flow, turning
BWMD02	202004824	1	0.616	9:37	EPS	WSL	F		slow low flow, clear
BWMD03	202004825	1	0.606	9:53	EPS	WSL	F		Turbid, fast flow DWER pollution response unit called to investigate 1300 784 782
BWMD04	202004826	1	0.596	10:21	EPS	WSL	F		Polluted flow
BWMD26	202004827	1	~~0.555 0.556~~	~~10:54 11:16~~	EPS	WSL	S		No flow, ~~not~~ sampled
BWMD26	202004827	3	~~0.555 0.556~~	~~10:57 11:10~~	CC	SSL	S		SEDIMENT
BWMD05	202004828	1	0.542	12:37	EPS	WSL	F		Area mowed since last time, clear water
BWMD06	202004829	1	0.670	12:57	EPS	WSL	F		Turbid (same as 03 & 04) Temp 30°
BWMD06	202004829	3	0.670	12:57	CC	SSL	F		SEDIMENT
BWMD07	202004830	1	0.586	14:23	EPS	WSL	F		Good flow. - clear water
BWMD08	202004831	1	0.587	14:09	EPS	WSL	F		Clear water, good flow
BWMD14	202004832	1	0.554	14:45	EPS	WSL	F		Good flow, heavy veg. on banks
BWMD15	202004833	1	0.363	15:06	EPS	WSL	F		contaminated water, ie fuel odor
BWMD16	202004834	1	0.437	15:20	EPS	WSL	F		V. slow flow
BWMD16	202004834	3	0.437	15:20	CC	SSL	F		SEDIMENT
16/9/21 BWMD17	202004835	1	0.465	8:52	EPS	WSL	F		fast flowing, debri accumulation at outlet
16/9/21 BWMD18	202004836	1	0.487	9:09	EPS	WSL	F		
16/9/21 BWMD19	202004837	1		1	EPS	WSL	F		scum on surface, some typha in channel
16/9/21 BWMD21	202004838	1	~~0.357~~	10:50	EPS	WSL	F		Clear, typha growing in channel

= Telemetry Guage

= Staff Guage

EPS-Extendable pole sampler; WSL-Water surface level; Flow codes: F-Flowing; FL-Low flow; FH-High flow; FM-Moderate flow; S-Stationary; D-Dry

Biodiversity and Conservation Science

COC# 68667 & 68668

Catchment Field Observation Form

Field Samplers:

M.CROW, M.MOORE, Z.GATES

Date: 15/09/21

Instrument:

Run comment: SG-C-BAYMD, DAY 1

Site	Sample Number	Matrix	Sample		Collection Method	Depth Ref Point (m)	Flow Status	Stage height	Site comments
			Salinity (ppt)	Time					
BWMD24	202004839	1	0.433	15:50	EPS	WSL	F		Slow flow
BWMD24	202004839	3	0.433	15:50	CC	SSL	F		SEDIMENT
BWMD25	202004840	1	0.401	16:07	EPS	WSL			

= Telemetry Guage

= Staff Guage

EPS-Extendable pole sampler; WSL-Water surface level; Flow codes: F-Flowing; FL-Low flow; FH-High flow; FM-Moderate flow; S-Stationary; D-Dry

DAY 2.

Department of Water

Chain of Custody

coc# 59418

Send samples to: Chem Centre

Collection Agency: COB

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Laboratory Use Only

Purchase Order Number: (mandatory)

Send electronic results to: datain@water.wa.gov.au
research.frogs@dbca.wa.gov.au

Sampling frequency: (regular, irregular etc.)
Regular

Lab Batch Code:

Address correspondence to: 61 Brae Ave, Morley

QA Officer - Water Information Branch
PO Box K822
Perth WA 6842
Fax (08) 9426 4817

Names of Samplers: (print first & last name)
M Crow
Z Gates

Lab remarks:

WIN Project Code: (mandatory) SG - C - BA - MD _ _ _ _

Remarks: Joint DBCA project
Invoice COB

Sample analysis (samples may contain hazardous substances)

Container	Volume	125ml	→	→	1L				
	Type *	P	→	→	→				
Treatment	Filtered	NO	Yes	Yes	NO				
	Type	F	Acid	Acid	-				
	Porosity	-	0.45	0.45	-				
	Preserved	NO	NO	Yes	NO				
Storage	Temp	4	→	→	→				
	Time	10	→	→	→				
Lab to filter **			Group A (Anions)	Group B (Soluble Nutrients)	Group C (Soluble Metals)	Rn Water Analysis			

Laboratory Sample Number	DoW Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HHMM)	Date (DDMMYYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of containers/ filter papers
	2020048835	1	F	G	GPS	8:52	16/9/21		BWMD17		WL	0	4
	2020048836	1	↓	↓	↓	9:09	↓		BWMD18		WL	0	4
	2020048837	1	↓	↓	↓	09:25	↓		BWMD19		WL	0	4
	2020048838	1	↓	↓	↓	10:50	↓		BWMD21		WL	0	4

Total number of sample containers / filter papers

Distribution: White and pink copies accompany samples to lab. LAB: confirm condition and number of samples received; fax annotated copy to Department of Water within 24 hours; return white copy to DoW with final report. FIELD: fax yellow copy to WIB.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): M Crow Signature: M Crow Date: 16/9/21 Time: 15:55

Lab use only

Received by (print name): Donna Signature: D Date: 16.9.21 Time: 15:

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

* P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

** Indicates the laboratory is required to filter samples prior to analysis

DAY 2

Page /

Department of Water & Environmental Regulation

Chain of Custody

coc# 68669

Send samples to: Chem Centre

Collection Agency/Branch: CoB

Instructions for laboratory
Provide laboratory QA/QC report with analysis results

Purchase Order Number: (mandatory)

Sampling frequency: (regular, irregular etc.) Regular

Send electronic results to: datain@dwer.wa.gov.au
rebecca.ferguson@dwer.wa.gov.au @dwer.wa.gov.au

Laboratory Use Only

Lab Batch Code:

Address correspondence to: 61 Bicton Ave Mosman
DWER
Science Data Branch,
Locked Bag 10
Joondalup DC WA 6919

Names of Samplers: (print first & last name)
A. Crow
M. Moore
J. Gates

Lab remarks:

Project Code: (mandatory) SG - C - BAYMD

Remarks: Joint DBCA Project
Invoice CoB.

Group Analysis Sheet Attached (check box)

Sample analysis (samples may contain hazardous substances)

Container	Volume	125ml	125ml	125ml	1L	1L			
	Type *	P	P	P	P	P			
Treatment	Filtered	No	Yes	Yes	No	No			
	Type	-	Nylon	Nylon	-	-			
	Porosity	-	0.45	0.45	-	-			
	Preserved	No	No	Yes	No	No			
Storage	Temp	4							
	Time	1D							
Lab to filter **		No							

Laboratory Sample Number	DWER Sample Number	Matrix	Matrix Quality	Collection Method	Collection Instrument	Time 24 hr (HH:MM)	Date (DD/MM/YYYY)	Site Reference Number / Code	Site Name	Sample Type	Depth Ref Point	Depth (m)	Number of sample containers / filter papers
	20200441	1	F	6	GR	11:09	16/9/21		BWMD31		WSL	0	4
	20200442					12:11			BWMD29				4
	43					12:26			BWMD30				4
	44					11:56			BWMD28				4
	45					11:27			BWMD22				4
	46					13:05			BWMD23				4
	46					13:2			BWMD				4
	47					13:47			WellSquare01				4
	48					14:01			WellSquare02				4
	49					13:27			BWMD13				4
	50					14:20			BWMD12				4
	51					14:43			BWMD11				4
	52					15:02			BWMD09				3
	20200453					15:18			BWMD10				3

Total number of sample containers / filter papers:

Distribution: White *and pink* copies accompany samples to lab. LAB: confirm condition and number of samples received; scan and e-mail annotated copy to DWER within 24 hours; also with final report. FIELD: scan and e-mail yellow copy to Water Data Management Section.

Actual Sample QA — Use data quality guidelines to complete — 2 ☐ Collection/ Measurement — 3 ☐ Quality Control

See explanatory notes on CoC booklet cover

Required turnaround time: 15 or ( ) working days

Relinquished by (print name): M. Crow Signature: Date: 16/9/21 Time: 15:55

Received by (Lab use only) (print name): Signature: Date: Time:

All sample containers accounted for ? Yes / No
All samples stored as described above? Yes / No

** Indicates the laboratory is required to filter samples prior to analysis

* Container type: P = plastic, e.g. high density polyethylene; AW = acid washed; DkGl = dark glass.

Generic: February 2019

Biodiversity and Conservation Science

COC# 68669

Catchment Field Observation Form

Field Samplers: M.CROW, M.MOORE, Z.GATES

Date: 16/09/21

Instrument:

Run comment: SG-C-BAYMD, DAY 2

Site	Sample Number	Matrix	Sample		Collection Method	Depth Ref Point (m)	Flow Status	Stage height	Site comments
			Salinity (ppt)	Time					
BWMD31	202004841	1	0.349	11:09	EPS	WSL	F		
BWMD29	202004842	1	0497	12:11	EPS	WSL	F		
BWMD30	202004843	1	0495	12:25	EPS	WSL	?		unable to detect flow status
BWMD28	202004844	1	0.502	11:58	EPS	WSL	?		unable to detect flow status
BWMD22	202004845	1	0.494	11:27	EPS	WSL			
BWMD23	202004846	1	0493	13:05	EPS	WSL			channel recently mechanically cleared of all veg (c. Frogs ☺)
WELDSQUARE01	202004847	1	0442	13:47	EPS	WSL			
WELDSQUARE02	202004848	1	0462	14:02	EPS	WSL			filamentous algae at surface, fine debris at ~~at~~ outlet
BWMD13	202004849	1	0438	13:26	EPS	WSL			
BWMD12	202004850	1	0.428	14:20	EPS	WSL	F		
BWMD11	202004851	1	0.429	14:45	EPS	WSL	F		
BWMD09	202004852	1	0.470	15:02	EPS	WSL	F		
BWMD10	202004853	1	0.292	15:18	EPS	WSL	FL		

= Telemetry Guage

= Staff Guage

EPS-Extendable pole sampler; WSL-Water surface level; Flow codes: F-Flowing; FL-Low flow; FH-High flow; FM-Moderate flow; S-Stationary; D-Dry

Appendix C Environmental Health Report

28/06/2021

Binh Luong
City of Bayswater
61 Broun Avenue
MORLEY WA 6943

Dear Binh,

BAYSWATER MAIN DRAIN

ENVIRONMENTAL HEALTH REPORT 2019-2021

The following letter report summarised the results of the environmental health sampling undertaken by the City of Bayswater between 2019 and 2021 at the Bayswater Main Drain.

Surface water sampling was undertaken to assess the concentration of microbiological indicators in the Bayswater Main Drain. Spikes in microbiological indicators, specifically faecal contaminants can offer a reliable means of identifying unregulated raw sewage discharge.

Methodology

Surface water samples were collected at 11 sites within the Bayswater Main Drain and at the point of discharge to the Swan River (Figure 1). Samples were collected over 15 sampling events from August 2019 to June 2021. The sampling dates are listed in Table 1 below:

Table 1: Sample collection dates

Year	Sample date	Sites
2019	• 1/08 • 20/09 • 10/10	All sites except BY3/004
2020	• 20/01 • 28/02 • 27/03 • 22/05 • 26/06 • 17/07 • 30/10 • 27/11	All sites except BY3/004, and BWMD08 from 28/02 onwards
2021	• 16/03 • 19/03 • 25/03 • 4/06	All sites except BWMD08

Samples were submitted to the PathWest laboratory for analysis of Thermotolerant Coliforms, *Escherichia Coli (E. Coli)* and *Enterococci.*

ABN 95 614 256 834

Suite 4/226 Carr Place, Leederville WA 6007
P: 08 9328 4663 F: 08 6316 1431
Email: info@urbaqua.org.au www.urbaqua.org.au

Figure 1: Sampling locations

Assessment levels

The National Health and Medical Research Council (NHMRC) Guideline for Managing Risks in Recreational Water (2008) is the latest publication defining environmental health guidelines, including microbial parameters. However, no Default Guideline Values (DGVs) are defined in this document, rather the process for determining guideline values based on the 95th percentile approach. This is considered the best approach currently as it takes into account the inherent variability in the distribution of water quality data (NHMRC, 2008). However, this method requires a minimum of 100 data points to determine stable guideline values.

Given that 2019 was the first year of monitoring as part of the environmental health investigation of the Bayswater industrial area, initial results were compared to DGVs defined by the *Australian and New Zealand guidelines for freshwater and marine water quality* (ANZECC & ARMCANZ, 2000). While ANZG (2018) supersedes ANZECC & ARMCANZ (2000), it refers to the NHMRC (2008) guidelines which offer no DGVs, as previously stated.

ANZG (2018) and ANZECC & ARMCANZ (2000) define two recreational categories describing the allowable degree of contamination:

- Primary contact –for activities such as swimming, bathing, and other direct water-contact sports.
- Secondary contact –for activities such as boating and fishing, or any activities where bodily contact is limited.

As a main drainage network, the Bayswater Main Drain should be assessed against the secondary contact DVGs.

Thermotolerant coliforms

The presence of thermotolerant coliforms in water can indicate faecal contamination, and almost 95% of thermotolerant coliforms isolated from water are the gut organisms *Escherichia coli* rendering a more targeted analysis of *E. coli* more redundant (WHO, 1996).

The ANZECC & ARMCANZ (2000) primary contact trigger limit for Thermotolerant coliforms in fresh and marine waters taken over the bathing season is 150 CFU/100 mL, while the secondary contact trigger value is 1000 CFU/100 mL.

Enterococci

Enterococci are another member of gut-communities in mammals and birds but become opportunistic pathogens that may cause infections in humans and animals. Because *enterococci* are shed in faeces, they can be used as surrogates for waterborne pathogens and as faecal indicator bacteria in water quality testing (Byappanahalli, 2012).

Results

A summary of the environmental health sampling undertaken in 2019-21 is provided below. Due to the limitations of the bacterial coliform counting methodology, a number of the lab results were provided by PathWest as estimated concentrations (i.e. est. >1000). For ease of analysis these results were considered equal to the estimated value, however it is possible that a number of the recorded concentrations were notably higher. The full results for Thermotolerant Coliforms and *Enterococci* are shown in Charts 1 and 2.

E.coli represented more than 75% of the total Thermotolerant Coliform count in 90% of the samples collected.

Tables 2 shows the median concentration of Thermotolerant Coliforms recorded at each site over the monitoring period. The median concentration of Thermotolerant Coliforms was in exceedance of the secondary contact DGV at;

- BWMD07 in 2019;
- BWMD04, BWMD05, BWMD06, BWMD07, BWMD 08 and BWMD14 in 2020; and,
- BWMD07 in 2021.

Table 2: Thermotolerant Coliforms - median concentration 2019-2021 (CFU/100mL)

Site	2019	2020	2021	All samples
BWMD01	390	785	395	500
BWMD02	780	875	490	750
BWMD03	480	975	830	730
BWMD04	490	1000	960	1000
BWMD05	600	1000	940	880
BWMD06	590	1000	845	1000
BWMD07	1000	1000	1000	1000
BWMD08	920	1000		960
BWMD14	470	1000	905	810
BWMD16	400	930	145	740
BY3/004	-	-	275	275

*Highlighted values indicate exceedance of ANZEC & ARMCANZ 2000 guideline value for secondary contact (1000 CFU/100mL)

Table 3 shows the median concentration of Enterococci recorded at each site over the monitoring period. The median concentration of *Enterococci* was in exceedance of the secondary contact DGV at;

- All sites except BWMD01 and BWMD06 in 2019;
- All sites except BWMD05 and BWMD06 in 2020;
- All sites in 2021; and,
- All sites except BWMD06 overall.

Table 3: Enterococci - median concentration 2019-2021 (MPN/100mL)

Site	2019	2020	2021	All samples
BWMD01	180	475	480	350
BWMD02	700	490	940	700
BWMD03	330	675	995	610
BWMD04	290	910	1050	820
BWMD05	310	1400	750	830
BWMD06	96	165	305	170
BWMD07	750	2600	18000	4750
BWMD08	960	340	-	900
BWMD14	230	655	1500	720
BWMD16	300	360	2565	410
BY3/004	-	-	735	735

*Highlighted values indicate exceedance of ANZEC & ARMCANZ 2000 guideline value for secondary contact (230 MPN/100mL)

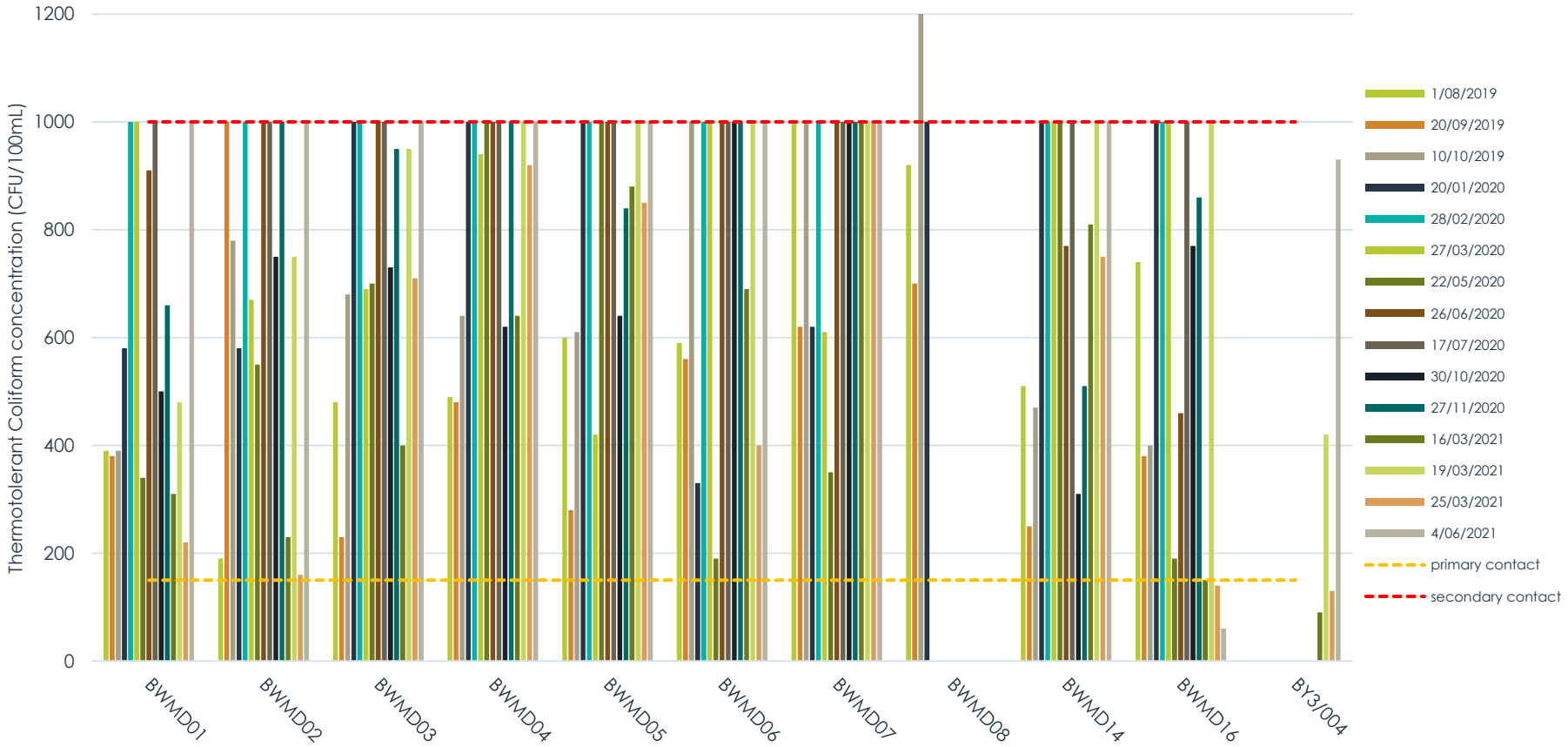

Chart 1: Thermotolerant Coliform concentration 2019-21

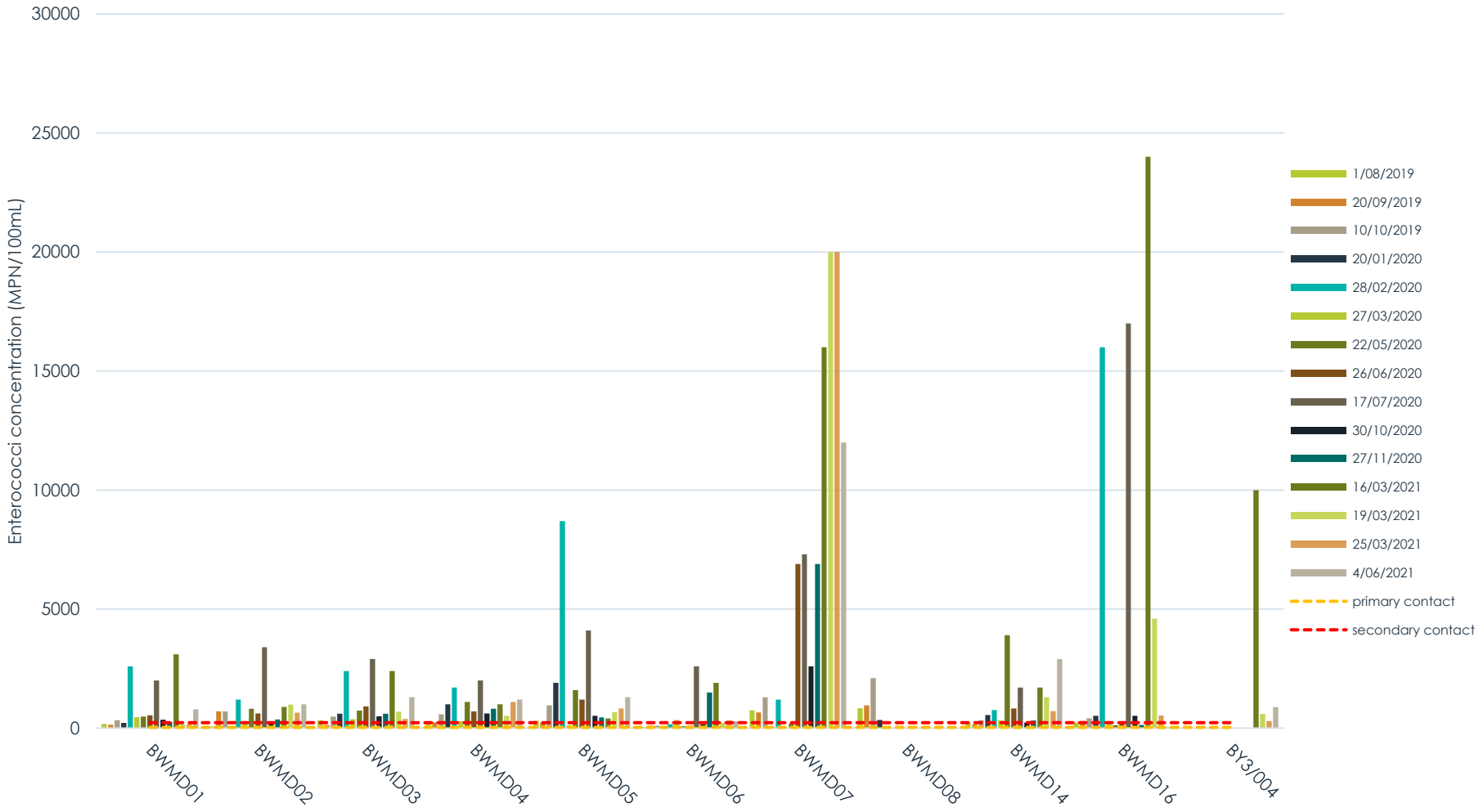

Chart 2: Enterococci concentration 2019-21

Discussion

The results shown in Charts 1 and 2 show the widespread exceedances of the DGVs for both Thermotolerant Coliforms and *Enterococci* across the Bayswater Main Drain monitoring sites. Some of the key findings are discussed below.

BWMD07

BWMD07 recorded exceedances of the Thermotolerant Coliform DGV in all periods of the monitoring program as well as recording the highest median concentration of *Enterococci* in all periods of the monitoring program.

BWMD07 is located at the outlet of a wetland that discharges into the Bayswater Main Drain. While these results are of concern, the elevated concentrations of thermotolerant Coliforms and *Enterococci* are not sufficient evidence to conclude the presence of raw sewage discharge in the system. The use of Thermotolerant Coliforms and *Enterococci* as indicators of human faecal pollution or contamination can be problematic because *Enterococci* are also found in animal faeces, in soils, and on plants (Boehm & Sassoubre, 2014). Given, the location of the sampling point, it is more likely that the higher concentrations of Thermotolerant Coliforms and *Enterococci* are related to higher plant and animal activity in the wetland rather than sewage discharge.

BWMD16

Exceedances of the secondary contact DGV for Enterococci were widely spread across all the sampling sites, however Chart 2 shows two sites that recorded significantly higher concentrations than the others; BWMD07 (as described above) and BWM16.

BWMD16 is located toward the upstream end of the catchment in an arterial open drain that flows into the Bayswater Main Drain. BWMD16 recorded the highest concentration of Enterococci of all the sites across all sampling events (24,000 MPN/100mL in March 2021), more than 10 times the DGV for secondary contact.

As was the case with BWMD07, it cannot be attributed directly to raw sewage contamination from the bacterial results alone. However, the site is surrounded by industrial activity and compared to the wetland at BWMD07 the plant and animal activity would presumably be lower. It is possible that the extremely elevated concentrations of Enterococci could be connected to improper sewage discharge but further information is required.

Conclusions/recommendations

The environmental health sampling program revealed concentrations of Thermotolerant Coliforms and Enterococci that were above the default guideline values for secondary contact in a number of locations within the Bayswater Main Drain. While the concentrations are elevated, the results from this sampling alone cannot provide insight into the source of contamination which may be related to sewage discharge or more likely plant and animal sources.

To investigate the potential contamination from sewage discharge, future sampling programs should include analysis for caffeine. Recent studies suggest measuring caffeine in municipal waters can provide a good estimate of faecal contamination caused solely by humans and is often used as a trace chemical by the Water Corporation.

Please do not hesitate to contact me on (08) 9328 4663 or at alex@urbaqua.org.au should you have any questions. I look forward to hearing from you with regards to this proposal.

Yours sincerely,

Alex Towler
Senior Environmental Engineer
URBAQUA

References

ANZECC & ARMCANZ (2000) Australian and New Zealand guidelines for fresh and marine water quality.

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Boehm, A.B., and Sassoubre, L.M (2014). *Enterococci as Indicators of Environmental Fecal Contamination*. In: Gilmore MS, Clewell DB, Ike Y, et al., editors. Enterococci: From Commensals to Leading Causes of Drug Resistant Infection.

Byappanahalli, M. N., Nevers, M. B., Korajkic, A., Staley, Z. R., & Harwood, V. J. (2012). *Enterococci in the environment.* Microbiology and molecular biology reviews.

Appendix D DWER Pollution Response

Job Number: 21-17225
Revision: 00
Date: 11 October 2021

LABORATORY REPORT

ADDRESS: **Local Health Authorities Analytical Committee**
Edith Cowan University
Building 19, 270 Joondalup Drive
JOONDALUP WA 6027

ATTENTION: Trevor Chapman

DATE RECEIVED: 17/09/2021

YOUR REFERENCE: City of Bayswater

PURCHASE ORDER:

WORLD RECOGNISED ACCREDITATION
Accredited for compliance with ISO/IEC 17025 - Testing

APPROVALS:

Paul Nottle
Organics Manager

Min How
Organics Supervisor

Sean Sangster
Inorganics Supervisor

REPORT COMMENTS:

This report is issued by Eurofins ARL Pty Ltd. The report shall not be reproduced except in full without written approval from the laboratory.

Samples are analysed on an as received basis unless otherwise noted.

METHOD REFERENCES:

Methods prefixed with "ARL" are covered under NATA Accreditation Number: 2377
Methods prefixed with "PM", "EDP" and "MM" are covered under NATA Accreditation Number: 2561

Method ID	Method Description
ARL No. 025	Methylene Blue Active Substances (MBAS) in Water
ARL No. 009	Total Petroleum Hydrocarbons (TPH) in Water
ARL No. 402/403	Metals in Water by ICPOES/ICPMS
ARL No. 406	Mercury by Cold Vapour Atomic Absorption Spectrophotometry

LABORATORY REPORT

Misc. Organics in Water		Sample No	21-17225-1
		Sample Description	WS1 - Bayswater Surfactant Discharge (BSD)
		Sample Date	17/09/2021
ANALYTE	**LOR**	**Units**	**Result**
Methylene Blue Active Substances	0.05	mg/L as LAS342	0.26

TRH in Water		Sample No	21-17225-1
		Sample Description	WS1 - Bayswater Surfactant Discharge (BSD)
		Sample Date	17/09/2021
ANALYTE	**LOR**	**Units**	**Result**
TRH C_{6-9}	0.02	mg/L	<0.02
TRH C_{10-14}	0.02	mg/L	<0.02
TRH C_{15-28}	0.04	mg/L	<0.04
TRH C_{29-36}	0.04	mg/L	<0.04
TRH $C_{>36}$	0.04	mg/L	<0.04

8 Heavy Metals in Water		Sample No	21-17225-1
		Sample Description	WS1 - Bayswater Surfactant Discharge (BSD)
		Sample Date	17/09/2021
ANALYTE	**LOR**	**Units**	**Result**
Arsenic - Total	0.001	mg/L	0.003
Cadmium - Total	0.0001	mg/L	<0.0001
Chromium - Total	0.001	mg/L	0.002
Copper - Total	0.001	mg/L	0.005
Mercury - Total	0.0001	mg/L	<0.0001
Nickel - Total	0.001	mg/L	0.008
Lead - Total	0.001	mg/L	0.002
Zinc - Total	0.005	mg/L	0.051

Result Definitions
LOR Limit of Reporting [NT] Not Tested [ND] Not Detected at indicated Limit of Reporting
* Denotes test not covered by NATA Accreditation

[1]pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.

FOR MICROBIOLOGICAL TESTING - The results relate only to the sample tested and may not be representative of a lot, batch or other samples and may not necessarily justify the acceptance or rejection of a lot or batch, a product recall or support legal proceedings. Tests are not routinely performed as duplicates unless specifically requested. Changes occur in the bacterial content of biological samples. Samples should be examined as soon as possible after collection, preferably within 6 hrs and must be stored at 4 degrees Celsius or below. Samples tested after 24 hrs cannot be regarded as satisfactory because of temperature abuse and variations.

Client: City of Bayswater

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Preliminary draft	V1	SBFuente	RFerguson	Electronic	Feb 2023

Urbaqua
land & water solutions
Suite 4/226 Carr Place
p: 08 9328 4663 | f: 08 6316 1431
e: info@urbaqua.org.au
www.urbaqua.org.au