Water and sediment quality in the Bull Creek catchment and City of Melville lakes 2020

Prepared by the South East Regional Centre for Urban Landcare for the City of Melville

Outlet of Brentwood Living Stream

FINAL

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For further information contact:

SERCUL

1 Horley Road

Beckenham 6107

Western Australia

Telephone: (08) 9458 5664

Email: sarahmuller@sercul.org.au

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This assessment of surface water and sediment quality within the Melville Bull Creek catchment was undertaken in 2020 as part of an annual monitoring partnership program between the City of Melville (the City), SERCUL and Department of Biodiversity, Conservation and Attractions (DBCA). Initiated in 2007, the purpose of this monitoring program is to determine the water and sediment quality in the western side of the Bull Creek catchment (closest to the City) to guide management responses within the catchment.

This assessment is based on four surface water sampling events and one sediment sampling event. This report also compares the 2020 data with data from the previous 13 years of monitoring (2007 - 2019).

Water and sediment results recorded in samples collected in 2020 were generally similar to results recorded in previous years. The key water and sediment quality issues that have been identified in the catchment over the 14 years of monitoring are outlined below.

1. Bull Creek Main Drain Branch

This branch includes John Creaney Park, John Creaney Park inlet, Downstream Elizabeth Manion Park and Brockman Park (sites 15, 5, 16 and 2, respectively) and Bull Creek main drain (site MELDR-01, previously called PSDTBCMD).

- Total nitrogen concentrations exceeding the ANZECC trigger value for lowland rivers have consistently been recorded in some Bull Creek main drain sites, including the site closest to the drain outfall (site 1).
- A significant proportion of this nitrogen enters the drain in the form of ammonia nitrogen between the convergence of the two main upstream branches of the drain and Brockman Park.
- Total phosphorus concentrations exceeding the ANZECC trigger value for lowland rivers have often been recorded at John Creaney Park lake.
- Oxygen saturations have consistently been below the ANZECC acceptable range for lowland rivers in all Bull Creek main drain sites; except for downstream Elizabeth Manion Park with all samples in 2018, 2019 and 2020 falling within the acceptable range for lowland rivers, as well as one sample from John Creaney Park outlet in 2020 falling within the acceptable range for lowland rivers.
- Sediment samples collected from John Creaney Park lake have recorded lead concentrations exceeding the ANZECC low trigger value in six out of seven occasions it has been sampled.
- Concentrations of iron and aluminium (total and soluble) exceeding ANZECC trigger values are consistently recorded at all Bull Creek main drain sites, with the exception of soluble iron on all four sampling occasions in 2020 (recording below the ANZECC trigger value).
- Concentrations of total zinc exceeding ANZECC trigger values have been regularly recorded at John Creaney Park inlet and downstream Elizabeth Manion Park (since monitoring at these sites began in 2014); a significant proportion of these total metal fractions are likely to be soluble.
- Concentrations of total copper exceeding ANZECC trigger values have often been recorded at downstream Elizabeth Manion Park (since monitoring at this site began in 2014).

2. Brentwood Drain Branch

- This branch Brentwood Drain, RAFF Drain and Bateman Park (sites 13, 14 and 6, respectively
    - Water quality is generally better at Brentwood drain sites than Bull Creek main drain sites, with total nitrogen, total phosphorus and most metals generally below relevant ANZECC trigger values, although total oxidised nitrogen regularly exceeds the guideline value (although appears less so in 2020 with less than usual exceedances of total oxidised nitrogen recorded).
    - A pattern of generally declining concentrations of nitrogen as ammonia/ammonium, total and soluble iron and total aluminium has been noted at the most downstream Brentwood drain site (at Bateman Park) over the 14 years of monitoring.
    - Oxygen saturations have consistently been below the ANZECC acceptable range for lowland rivers at all Brentwood main drain sites.
    - Concentrations of total and soluble iron and aluminium exceeding ANZECC trigger values are often recorded at all Brentwood drain sites.
    - The sediment at Brentwood Branch drain sites had always recorded concentrations below the low trigger value since monitoring of metals in sediment began in 2013, except for site 13 (Brentwood drain) in 2016 when concentrations above the low trigger value were recorded for chromium, copper, nickel, lead and zinc.

3. Melville Lakes

- This includes Booragoon Lake, Piney Lakes, Quenda Lake, Frederick Baldwin, Marmion Reserve and Blue Gum Lake (sites 7, 8, 9, 10, 11 and 12, respectively).
    - Total nitrogen (and ammonia) and total phosphorus (and filterable reactive phosphorus) concentrations exceeding the respective ANZECC trigger values for lowland rivers have been recorded on almost all sampling occasions at Booragoon Lake outlet and Blue Gum Lake outlet.
    - Although pH values recorded in 2019 and 2020 at Blue Gum Lake were greater than 6.9 on all sampling occasions, pH values at this site and Booragoon Lake have often been significantly below the acceptable range for wetlands (7-8.5) in the years of monitoring previous to 2017.
    - Dissolved oxygen saturations are lower, and total nitrogen (and dissolved organic nitrogen) and total aluminium concentrations are higher at Quenda Lake outlet from 2014 to 2020 (with the exception of two records in July and October of 2020 recording within the ANZECC acceptable range) when compared to 2007 to 2013.
    - In Booragoon Lake sediment samples, lead concentrations equal or exceeding the lower ANZECC trigger value have been recorded on six out of seven sampling occasions, and arsenic, copper, mercury and nickel exceeding ANZECC trigger values have been recorded on at least one sampling occasion since monitoring started in 2013.
    - Regular exceedances of the ANZECC trigger value for soluble zinc have been recorded at Frederick Baldwin Lake, partially as a result of the soft water at this site; additionally sediment concentrations for zinc, lead and copper have been recorded exceeding ANZECC trigger values on at least one sampling occasion at this site.
    - Concentrations of total and soluble iron and aluminium exceeding ANZECC trigger values are consistently recorded at most Melville Lakes sites, and total and soluble iron concentrations recorded at Booragoon Lake outlet and Blue Gum Lake outlet are particularly high in the water column; and often the highest concentration in the catchment at Booragoon Lake sediment sampling.
    - Oxygen saturations have usually been below the ANZECC acceptable range for wetlands at all Melville Lakes sites.

Based on the above findings, it is considered that Bull Creek main drain, Booragoon Lake and Blue Gum Lake have the poorest water quality in the catchment and therefore management responses should be focussed on improvement of these sites.

It is recommended that the monitoring program be continued in 2021 to detect any changes in water quality and to evaluate the impacts of changes to the catchment (such as the Brentwood Living Stream project and the ongoing works in the Bull Creek Reserves and the lakes). Further recommendations are focussed on suggested structural and non-structural controls to improve water quality and continued implementation of existing City of Melville management plans, restoration projects and to adopt the recently published City of Melville Stormwater Management Guidelines (SERCUL 2019).

1. Introduction

1.1 City of Melville

The City of Melville (the City) is located 8 kilometers (km) south-east of the central business district of Perth and has an area of approximately 53 km2 with 18 km of foreshore (City of Melville 2021). The City encompasses 18 suburbs connected by over 1,300 km of local, arterial and major roads (City of Melville 2021). The City is the third largest local government in the metropolitan region (Melville Talks 2018) and in 2019 had an estimated population of 102,307 with an average of 19.29 persons per hectare (ha; .id 2020). The City residents enjoy more than 200 parks and reserves comprising 778 ha of public open space and 295 ha of bushland (City of Melville 2021). In the City, there are approximately 67 drainage sumps (City of Melville 2010) and over 341 km of stormwater drainage pipes (City of Melville 2016a).

1.2 Melville Bull Creek catchment

The Bull Creek Catchment contains the sub-catchments of Bull Creek itself and six other adjacent drainage catchments that have outfalls to the Canning River (SRT 2012). The entire Bull Creek Catchment covers an area of approximately 43.5 km2 (SRT 2012). The catchment includes areas within the cities of Melville and Canning in Perth's southern and south-eastern suburbs Willagee, Kardinya, Winthrop, Murdoch, Leeming, Bull Creek, Rossmoyne, Willetton, Riverton, Shelley and Parkwood. Most of the Bull Creek Catchment has been cleared for urban residential development, with some recreational areas and a light industrial area in Willetton. To accommodate this development, the drainage network within the Bull Creek Catchment is highly modified and is largely piped, however some natural wetlands remain. There is over 10 km of foreshore within the Bull Creek catchment, some of which is in relatively natural condition (Swan River Trust 2012).

This water quality assessment concerns the western part of the Bull Creek catchment within the City. The assessment includes the Bull Creek main drain and Brentwood drain, as well as the chain of lakes to the west of Bull Creek (Booragoon Lake, Blue Gum Lake, Piney Lakes, Quenda Wetland, Frederick Baldwin Lake and Marmion Reserve). Collectively, hereafter, referred to as the "Melville Bull Creek catchment".

Bull Creek main drain meanders through a series of parks and urban landscape in the lower catchment, receiving stormwater from local drains, before discharging directly into Bull Creek and the Canning River (SRT 2012). Bull Creek main drain has strong flow all throughout the year, even in summer, suggesting it also receives some input through groundwater (Foulsham et al 2009).

The Brentwood drain also flows permanently due to groundwater interception and receives additional water when flood control pumps at Frederick Baldwin Lake and Kingston Place in Kardinya are in operation. Frederick Baldwin Lake and Kingston Place receive stormwater and groundwater from the suburbs of Kardinya and Murdoch (City of Melville 2004). The Brentwood main drain also receives water from local drains and converges with the Mandala Crescent Branch Drain (also known as the RAAF drain) at the Brentwood Living Stream site before passing through Bateman Park and discharging into the Canning River. The Brentwood Living Stream project, driven by a partnership of several agencies (including Department of Biodiversity, Conservation and Attractions [DBCA] Rivers and Estuaries Branch, the City, South East Regional Centre for Urban Landcare [SERCUL], Water Corporation and Main Roads) was launched in 2012 to mitigate some of the water quality issues identified in Brentwood drain at Bateman Park. The project involved the reconstruction of the water course where the Brentwood and Mandala Crescent drains converge (upstream of Bateman Park) using urban water sensitive nutrient/non-nutrient stripping designs.

Booragoon Lake, Blue Gum Lake outlet and Piney Lakes Reserve represent the northern extent of the Beeliar Wetland chain, a system consisting of inter-dunal depressions between the Spearwood and Bassendean dune systems which include a series of lakes running parallel with the coast (City of Melville 2019a, 2019b and 2016d). The chain of wetlands holds significance for the local aboriginal people (Whadjuk people) as they were important camping and ceremonial areas, as well as having provided an abundant source of food, offering fish, waterfowl, shellfish, vegetable roots and bulbs (City of Melville n.d.). These wetlands are a surface expression of the underlying Jandakot Groundwater Mound aquifer (Natural Area Consulting 2012a).

Booragoon Lake Reserve is located approximately 10.5 km south of Perth CBD in the suburb of Booragoon, bounded by Leach Highway, Aldridge Road and Lang Street, and occupies an area of approximately 13.5 ha. The reserve is comprised of wetland areas, upland remnant vegetation and parkland cleared spaces (Natural Area Consulting 2012a). In the 1970s and 80s the Council drew water from a subterranean bore in the Alfred Cove area and pumped it into Blue Gum and Booragoon Lakes during summer to maintain the water level (City of Melville 2004). However this practice no longer occurs and the Lake now has a water regime typical of Swan Coastal Plain wetlands, with water levels fluctuating in response to rainfall and groundwater level. Stormwater also enters the Lake from the surrounding urban catchment via six drains (including one drain collecting water from Leach Highway) and one drainage basin (City of Melville 2019b).

Blue Gum Lake Reserve is a wetland reserve located approximately 9.5 km south of Perth Central Business District in the suburb of Mount Pleasant, and occupies an area of approximately 11.1 ha. The Reserve is bounded by Canning Avenue, Moolyeen Road and Rountree Road and is comprised of wetland areas, upland remnant vegetation and parkland cleared spaces. The Reserve is comprised of four main areas: two wetland basins with an artificial island located between them, two areas of upland Banksia woodland community, a transitional zone characterised by *Melaleuca spp.* and *Eucalyptus rudis* woodlands, and parkland cleared areas with an over storey of predominantly non-native eucalyptus. In addition to being a surface expression of the groundwater, Blue Gum Lake also receives water from stormwater inflow from seven drains collecting water from the surrounding urban catchment, two of which have defective basins at their outlet (Natural Area Consulting 2012b). Historically Blue Gum Lake would respond to fluctuations of the water table relating to seasonality and climatic variations; however following development in its surrounding area the lake has experienced significant changes to its natural water cycle (Natural Area Consulting 2012b).

Piney Lakes Reserve is a dryland and wetland remnant area surrounded by urban development in the suburb of Winthrop. The Reserve is bound by Leach Highway to the north and Murdoch Drive to the east and encompasses approximately 67 ha (50 ha of bushland and wetland environments and approximately 17 ha of developed parklands to the south and west) (Natural Area Consulting 2016a). Piney Lakes includes two conservation category groundwater dependent wetlands, conservation category sumpland 6503 (eastern wetland) and conservation category sumpland 6504 (western sumpland) (DPaW 2016). The western wetland is sampled for the purposes of this assessment. The western wetland historically contained water permanently, although since 2014 has shown no surface water expression (City of Melville 2016c).

Quenda Wetland is a small unique reserve of a high conservation value located at the corner of Murdoch Drive and South Street in the suburb of Murdoch. The wetland is a conservation category sumpland with a man-made lake that collects stormwater runoff from surrounding development areas (City of Melville 2016b). The wetland was originally seasonal, drying out in the summer months; however it was artificially deepened to accommodate for the increased surrounding land uses (i.e. pine plantations). Since the recent increase in surrounding urban construction, increased stormwater flows enter the lake through various stormwater drains (including a large drain collecting water from Murdoch St John of God Hospital carparks), keeping the lake inundated throughout majority of the year (City of Melville 2016b).

Marmion Reserve is located in the suburb of Myaree. In 2012 the lake was found to be infested with a pest eel-tailed catfish species (Tandanus tandanus) and the aquatic weed Salvinia molesta (City of Melville 2016d). In an effort to control these species the lake was drained in 2014 and the species successfully eradicated (Clayton 2015). Revegetation and removal of old vegetation has been occurring immediately surrounding the lake since this time (City of Melville 2016d).

1.3 Background of the monitoring program

The City began sampling its lakes and the Bull Creek drainage biannually in 1996. In 2006, the Australian Government's Coastal Catchments Initiative identified the Swan Canning river system as a coastal 'hot spot' and funding was provided to the Swan River Trust (now DBCA Rivers and Estuaries Branch) to coordinate a Water Quality Improvement Plan (WQIP) for the region. The Swan River Trust developed the Local WQIP for the Bull Creek Catchment which was released on November 2012. The Bull Creek Catchment WQIP aims to reduce nutrient loads entering the Canning River through nutrient intervention and changed management practices. By using a treatment train approach, a combined set of management actions are applied along the nutrient pathways to meet water quality targets in the catchment (SRT 2012). The water quality monitoring partnership program between the City, SERCUL and DBCA forms part of the "Prevention" approach.

In 2007 a partnership between the City, SERCUL the Department of Water (now Department of Water and Environmental Regulation [DWER]) and the Swan River Trust (now DBCA Rivers and Estuaries Science) was established in order to standardise all water quality monitoring data collection, management and storage methods. Since this time, the sites and parameters monitored have been modified in response to changes in budget and requirements (see Appendix B). The City has utilised data collected from this ongoing monitoring program to develop management plans for surface water assets within the city.

1.4 Purpose of the sampling

The purpose of this sampling program is to:

- assess current water and sediment quality in the Melville Bull Creek Catchment;
- identify patterns in water and sediment quality over time in the Catchment;
- identify any pollutant hotspots in the Catchment; and
- make recommendations for improvement of water and sediment quality in the Catchment.

This water quality monitoring program also contributes valid data to the DWER Water Information (WIN) database, which is utilised in the management of the State's water resources.

2. Methodology

For more information regarding the methodology of this monitoring program see City of Melville Bull Creek Catchment and Melville Lakes Water and Sediment Quality Sampling and Analysis Plan 2019 (SERCUL 2020).

2.1 Site locations

Fourteen sites from the Melville Bull Creek catchment were sampled to represent the water quality in different portions of Bull Creek catchment and the Melville lakes, whilst taking into account accessibility and historical sampling sites.

Table 2-1 provides a detailed description and Easting and Northing of each of the sample sites. A map showing the location of the sites is provided in **Figure 2-1**.

Note that hereafter, sites will be referred to as their number only, without the prefix "MELDR-", for the purposes of brevity. Also, site MELDR-01 historically was called PSDTBCMD although will be referred to as site 1 throughout the rest of this report.

Table 2-1: List and description of sampling sites

Site No.	WIR site ref.	Drain section/component	Sampling point location	Easting	Northing
MELDR-01 (previously PSDTBCMD)	6162178	Bull Creek Park Main Drain	Culvert under Leach Hwy	392965.3	6453785.6
MELDR-02	6162370	Brockman Park	Where piped drain opens	393466.5	6453208.5
MELDR-05	6162373	John Creaney Park outlet	Compensation Basin Outlet	392359	6452734.7
MELDR-06	6161691	Bateman Park	Downstream of the confluence of the two drains	392269.8	6453880.2
MELDR-07	6162375	Booragoon Lake	In the lake at the end of the boardwalk jetty	390734.68	6454164.09
MELDR-08	6162376	Piney Lakes	At the lake outlet	390151.59	6453473.10
MELDR-09	6140831	Quenda Lake	At the lake outlet	390749.20	6451597.51
MELDR-10	6162377	Frederick Baldwin	At the lake outlet	387989.87	6452295.91
MELDR-11	6162378	Marmion Reserve	At the lake outlet	387774.89	6454629.75
MELDR-12	6162379	Blue Gum Lake	In front of car park inlet	391282.81	6454886.75
MELDR-13	6165324	Brentwood drain	Pulo Rd & Leach highway, 10 m walking from Pulo Rd. Site moved at beginning of 2015-16 sampling due to construction works reshaping the drain.	392126.59	6453865.28
MELDR-14	6165325	RAAF drain	10 m down from pipe under Leach highway	392195	6453841

Site No.	WIR site ref.	Drain section/component	Sampling point location	Easting	Northing
MELDR-15	6165331	John Creaney Park inlet	Approx. 5 m upstream of the main inlet into John Creaney Park, access via Water Corp drain man hole (lid lifting and bucket and rope required)	392256.48	6452699.35
MELDR-16	6165332	Closed pipe Downstream Elizabeth Manion Park	On Nicholls Cres close to Hurley Way, in front of pathway, access via Water Corp man hole (lid lifting and bucket and rope required)	393327.76	6452478.47

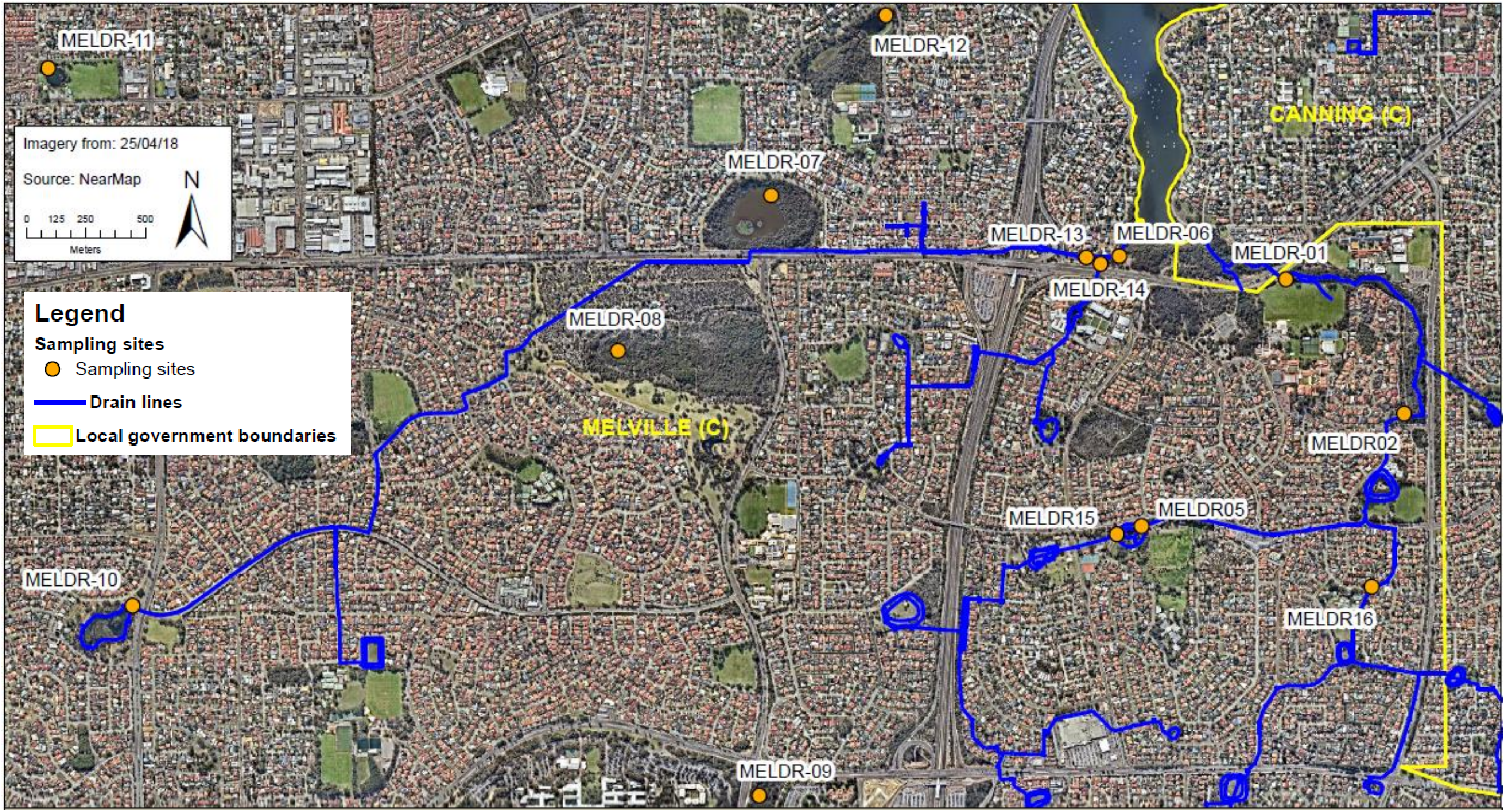

Figure 2-1: Melville Bull Creek Catchment and Melville Lakes sampling sites for 2020

2.2 Sampling schedule and procedures

Samples were collected in accordance with the protocols outlined in the Catchment specific Sampling and Analysis Plan authored by SERCUL (2020).

Sampling was conducted at the 14 Melville sites on four sampling occasions (16th July, 20th August, 17th September, and 15th October 2020). All sites were able to be sampled on all sampling occasions. Temperature and rainfall data for the duration of the sampling is detailed in Appendix C (BOM 2020a).

Field observation forms were filled out for all water samples and transported under chain of custody (COC) to and analysed by the ChemCentre laboratory. ChemCentre is an accredited laboratory by the National Association of Testing Authorities (NATA). Sediment samples were submitted to Microanalysis Australia for particle characterisation.

2.3 Parameters measured

Water at each of the 14 sites was measured in situ for physical properties (dissolved oxygen, pH, electrical conductivity, temperature and turbidity). It should be noted that electrical conductivity has been measured as specific conductance: that is, values have been corrected to 25°C to allow for comparisons to be made between samples taken at different temperatures (i.e. between different sites and different months). Samples were collected from each site and analysed for a range of contaminants likely to be present in urban and industrial catchments.

Water samples at all Melville Bull Creek sites were analysed for:

- Nutrients - total phosphorus (TP), total nitrogen (TN), total oxidised nitrogen (NOx-N), total organic nitrogen (TON), dissolved organic nitrogen (DON), filterable reactive phosphorus (FRP) and nitrogen as ammonia/ammonium (NH_3-N/NH_4^+-N) at all sites on all four sampling occasions.
- Total metals - aluminium (Al), chromium (Cr), copper (Cu), iron (Fe), lead (Pb) and zinc (Zn) tested at all sites on the first sampling occasion for surveillance.
- Total and soluble mercury (Hg) tested at 3 sites (13, 14 and 6) on all four sampling occasions.
- Total metals mercury (Hg), arsenic (As) and nickel (Ni) at site 7 on the first sampling occasion.
- Soluble metals aluminium (Al), chromium (Cr), copper (Cu), iron (Fe), lead (Pb) and zinc (Zn) tested at all sites on all four sampling occasions.
- Soluble metals mercury (Hg), arsenic (As) and nickel (Ni) at site 7 on all sampling occasions.
- Total suspended solids and total water hardness at all sites on all four sampling occasions.

Sediment was collected from nine of the 12 scheduled sites (sites 1, 2, 5, 6, 7, 9, 10, 11 and 12) for the analysis of:

- total metals/metalloids (Al, As, Cr, Cu, Fe, Hg, Ni, Pb, Se (Selenium), and Zn);
- moisture; and
- particle size analysis.

It is noted that sediment could not be sampled at site 8 due to too much organic matter present covering the sediment layer.

2.4 Analysis methodology

All water samples collected were analysed by ChemCentre.

Laboratory results were reported as per the limits of reporting (LOR; being the minimum detection level) for each parameter listed in Table 2-2.

Table 2-2: Analysis method and maximum limits of reporting (LOR) for water and sediment samples

Measured parameter	LOR (mg/L)	Measured Parameter	LOR (mg/kg)
WATER		**SEDIMENT**	
Total phosphorus	0.005	Aluminium – total	10
Total nitrogen	0.025	Arsenic – total	0.2
Total organic nitrogen	0.025 m	Chromium - total	0.05
Filterable reactive phosphorus	0.005	Copper - total	0.5
Total oxidised nitrogen	0.01	Iron - total	5
Nitrogen as ammonia	0.01	Lead - total	0.5
Dissolved organic nitrogen	0.025	Mercury	0.02
Total Suspended Solids	1	Nickel - total	0.1
Total water hardness	1 m	Selenium	0.05
Aluminium – total and soluble	0.005 mg	Zinc - total	0.25 or 5
Arsenic – total and soluble	0.0001		
Chromium - total and soluble	0.0001		
Copper - total and soluble	0.0001		
Iron – total and soluble	0.005		
Lead - total and soluble	0.0001		
Mercury – total and soluble	0.00005		
Nickel – total and soluble	0.0005		
Zinc – total	0.005		
Zinc – soluble	0.001		

Sediment samples were also analysed by Microanalysis Australia for particle size distribution. Particles were grouped into the following size classes (Table 2-3) according to the Wentworth scale (Wentworth 1922) using wet sieving followed by laser diffraction (Murdoch et al. 1997).

Table 2-3: Particle size classification

Class	Size
Clay	<4 µm
Silt	4-62 µm
Fine sand	62-250 µm
Medium sand	250-500 µm
Coarse sand	500-2,000 µm
Gravel	>2,000 µm

3. Guidelines

To provide a frame of reference for water and sediment quality data collected from the Melville Bull Creek catchment, laboratory results have been compared to trigger levels from the ANZECC and ARMCANZ (2000) Australian and New Zealand Guideline for Fresh and Marine Water Quality (hereafter referred to as the "ANZECC guidelines"). Exceedance of a trigger value from the ANZECC guidelines indicates that there is the potential for an impact to occur and should therefore prompt a management response. The rationale for the trigger values used in the ANZECC guidelines is provided in volume 2, chapter 8 of the guidelines. The ANZECC trigger values used to compare the results of the analysed parameters are shown in Appendix A.

The ANZECC guidelines specify trigger values that should not be exceeded for physical and chemical stressors of different ecosystem types. The results of some sites (1, 2, 5, 6, 13, 14, 15 and 16) were compared to the 'lowland rivers' trigger values and others (7, 8, 9, 10, 11 and 12) to the 'wetlands' ecosystem trigger values. These are considered to be most applicable for drain and lake sites respectively. The ANZECC guidelines do not provide a trigger value for total suspended solids; however there has been an experimentally derived guideline value (6 mg/L) developed for CSIRO and Waters and Rivers commission (by Hosking Chemical Services; pers. comms. Dominic Head, DWER), which was used for comparison purposes in this assessment.

To better graph the site results in accordance with their referenced trigger values, sites have been grouped into lowland rivers and wetlands and displayed as such on the graphs. The 'lowland rivers' sites have been separated into the two main drainage lines (Bull Creek Main Drain and Brentwood Main Drain) and arranged from the top of the catchment to the bottom (entrance to the Canning River) creating a more visual display of the individual segments allowing for better interpretation of flow and spatial patterns and understanding the aquatic conditions upstream and downstream.

Total nitrogen and total phosphorus concentrations will also be compared to the long-term and short-term nutrient concentration targets in catchment tributaries of the Swan Canning river system in the Healthy Rivers Action Plan (SRT 2008).

The ANZECC guidelines also specify "high reliability" trigger values for toxicants (including metals and ammonia) in fresh waters where sufficient "No Observed Effect Concentration" data is available and is published in chapter 3 of the ANZECC guidelines. Several trigger values (99%, 95%, 90% or 80%) have been derived for each toxicant depending on the proportion of species for which protection is sought. Urban and industrial catchments tend to be highly modified and are often artificial ecosystems, where the risk of toxicant contamination is high and current environmental value is low. On that basis, the ANZECC trigger values for 80% protection of freshwater biota would be applicable to the waterbodies/tributaries within the City. However, the Bull Creek and Brentwood drains discharge into the Canning River where environmental values are high and for this reason, toxicant concentrations were compared to the level of 95% protection trigger values (where available; high conservation value and slightly to moderately disturbed ecosystems).

For the metals cobalt and molybdenum, "high reliability" values are not available and therefore the ANZECC guidelines recommend the use of "low reliability" trigger values calculated by different means. For chromium (III), the "high reliability" trigger value is considered too high and therefore the use of an interim value for freshwater protection is recommended. For iron, the ANZECC guidelines suggest the use of an interim value based upon the current Canadian guideline level (CCREM 1991). The ANZECC guideline trigger values for protection of biota for chromium (III), copper, lead and zinc are hardness dependent, and as such specific trigger values for each sample have been calculated and adjusted based on corresponding site hardness levels (see relevant tables in Appendix D for the details and calculations).

The system being monitored is largely a piped system that ultimately discharges into the Canning River. Much of the monitoring captures data from water running directly off roads and residential areas with no treatment prior to entering the lakes and drains. From a human-use perspective, Bull Creek is not a source of drinking water but may be accessed by the public at several points, on public and privately owned land. Therefore it is reasonable to compare the toxicant results to the National Health and Medical Research Council's (NHMRC) Guidelines for Managing Risks in Recreational Water (2008) (hereafter referred to as the "NHMRC recreational guidelines"). Trigger values for pH and dissolved oxygen are specified in NHRMC recreational guidelines. For toxicant parameters (i.e. metals and ammonia), the NHRMC guidelines recommend that recreational trigger values be calculated by multiplying the relevant trigger values in the NHMRC (2016) Australian Drinking Water Guidelines 6: 2011 (ADWG) by ten. An exceedance of the referenced trigger level does not indicate that 'standards' are not being met, but is an indication that further consideration should be given to the situation.

The revision to the ANZECC guidelines for sediment (Simpson et al 2013) provides both low and high trigger values for metals in sediment. Background concentrations should be investigated where concentrations are between the low and high trigger values. If the results exceed the high trigger value guidelines or are above the background concentrations a further assessment for the bioavailability of the metal is required.

4. Field observations

The following relevant observations were recorded at Melville Bull Creek catchment sites on at least one sampling occasion in the 2020 sampling period (Table 4-1).

Table 4-1: Field observations made during the 2020 sampling occasions.

Sites	1	2	5	6	7	8	9	10	11	12	13	14	15[1]	16[1]
Turbid[2]		x		x	x	x	x	x	x		x		-	-
Emergent macrophytes	x			x	x	x	x		x	x	x	x	-	-
Submergent macrophytes					x	x				x			-	-
Clear[2]	x			x	x	x	x	x	x	x		x	-	-
Tanins		x	x		x				x	x			-	-
Iron flocc or iron reducing bacteria		x											-	-
Algae present		x		x	x		x	x	x			x	-	-
Surface water ‘scum’ and/or biofilm			x			x		x		x	x	x	-	-
Unpleasant odour*	x	x	x	x		x							-	-
Sediment deposition	x												-	-
Litter		x	x					x			x		-	-
Organic debris	x		x			x		x				x	-	-
Macroinvertebrates present					x			x					-	-
Turtles observed										x			-	-

*could be indicative of anoxic conditions
[1] no obvious observations were made at these sites
[2] variations in water visibility are subject to weather conditions and events leading up to the sampling event. As such, sites can experience either very turbid or clear waters on any given day dependent on time of sampling.

It is important to note that vegetation surrounding site 10 had been cleared and nearby construction had commenced for the duration of the four sampling events. Also, two days prior to the October sampling event at site 10, a nearby soap factory had caught fire and had caused significant contamination to the lake. Personnel from the City of Melville were present during the October sampling undertaking treatment of the water. These events appear to have some impact on parameters, discussed below.

5. Physicochemical Properties

All physicochemical parameter data (pH, dissolved oxygen, electrical conductivity, total suspended solids, and temperature) collected in 2020 from Melville Bull Creek catchment sites are shown in Table D-1 to Table D-6 in Appendix D. The factors that influence changes in these physicochemical parameters and the impacts that changes to these parameters can have to aquatic ecosystems are shown in Table E-1 in Appendix E.

5.1 pH

pH is a measure of the acidity or alkalinity of a water body and is measured on a logarithmic scale. As such, for example, a pH of 5 is ten times more acidic than a pH of 6.

When compared against the appropriate ANZECC lowland rivers (6.5 – 8) or wetlands (7 – 8.5) acceptable range, 28 out of the 56 samples collected from nine out of the 14 Melville Bull Creek catchment sites (15, 5, 2, 13, 7, 8, 9, 10 and 12) recorded pH values below the acceptable range (Figure 5-1 and Table D-1 in Appendix D).

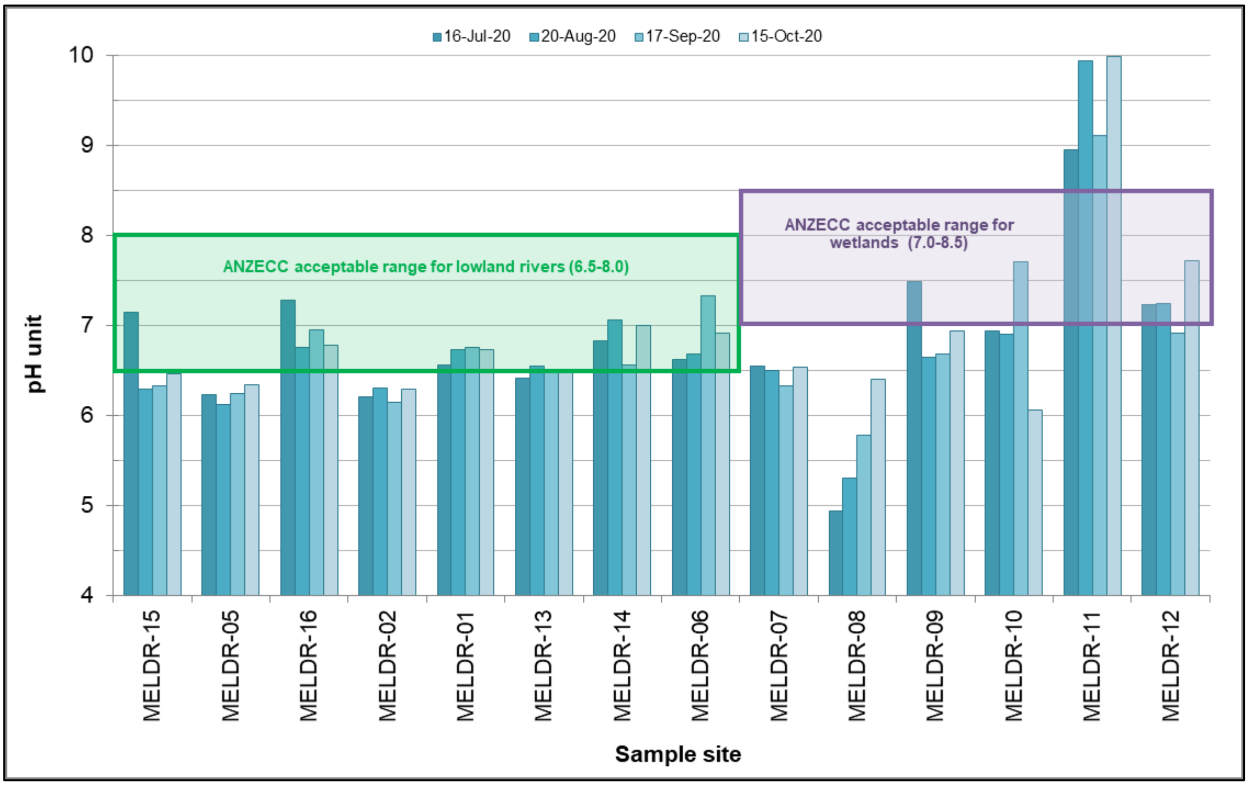

Figure 5-1: a) pH values recorded in Melville Bull Creek catchment sites in 2020

Nineteen samples recorded pH values below the NHMRC recreational guidelines acceptable range (6.5 – 8.5). All samples from site 11 (Marmion Reserve) exceeded the NHMRC recreational guidelines acceptable range. The highest pH of 9.99 was recorded in October at site 11 (Marmion Reserve) and the lowest of 4.94 in July at site 8 (Piney Lakes outlet) (Figure 5-2 and Table D-1 in Appendix D).

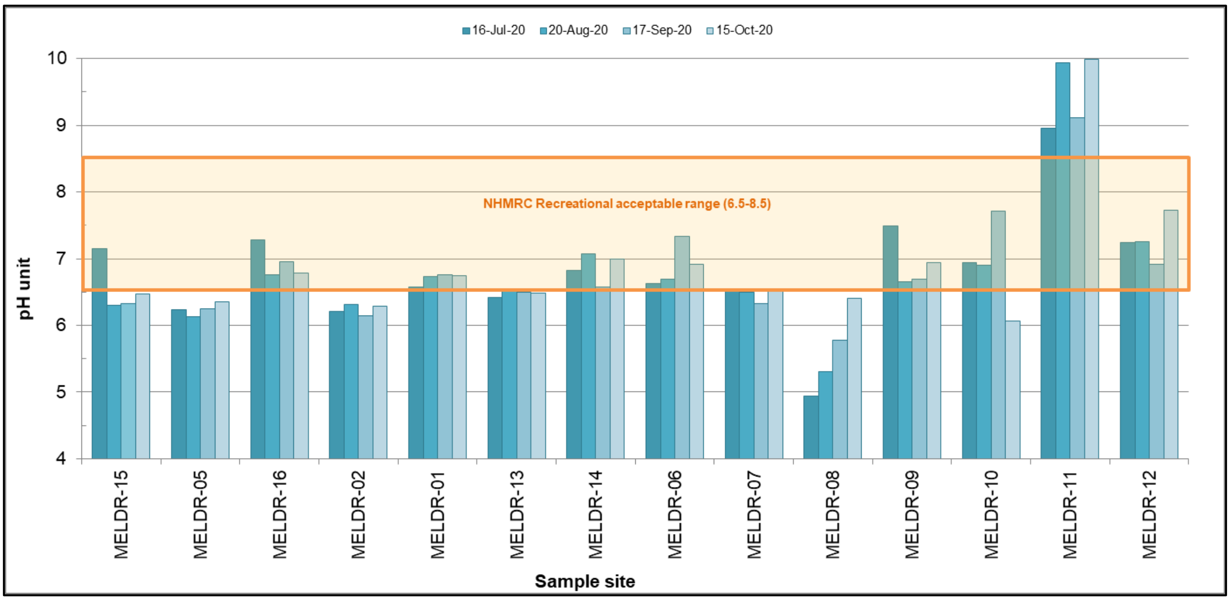

Figure 5-2: pH values recorded in Melville Bull Creek catchment sites in 2020

The pH values recorded in 2020 are similar to those recorded in the preceding 13 years of monitoring (Table G-1). Historically, site 7 (Booragoon Lake) and site 12 (Blue Gum Lake) have recorded particularly low pH values (<5), typically during the winter sampling months where new rains are beginning to flush the sites after a period of dry weather. All pH values recorded for site 7 in 2020 were below the acceptable range for wetlands (after a year of all values falling within the acceptable range in 2019).

Site 12 (Blue Gum Lake) saw 75% of pH values recorded to be within the acceptable range for wetlands (July, August and October), with the September sample only just falling short of being considered acceptable (pH of 6.92).

Something to note is site 8 (Piney Lakes outlet) that recorded a low pH value of 4.94 in July 2020. This site has not recorded a pH value less than five since August of 2012. The average of the pH values recorded during the 2020 sampling season was 5.61, these levels have not been seen since sampling in 2014 which recorded a pH average of 5.35 across the four sampling events. This may be linked to lower than expected rainfall occurring in July or potentially if there has been a change in land use nearby.

Throughout the 14 year monitoring period, sites 2, 7, 8, 9 and 12 (Brockman Park, Booragoon Lake outlet, Piney Lakes outlet, Quenda Lake outlet and Blue Gum Lake outlet) have recorded pH outside the acceptable range for lowland rivers or wetlands on at least 65% of sampling occasions. Site 11 (Marmion Reserve) has often recorded results above the relevant acceptable range 33% of sampling occasion.

On the Bull Creek main drain branch, pH values are generally more acidic at site 5 (John Creaney Park) than at site 16 (downstream Elizabeth Manion Park), suggesting that the low pH values recorded downstream at site 2 (Brockman Park) may be attributed to contributions from the western branch (sites 15 and 5) feeding into the Bull Creek main drain. However, pH levels are generally within acceptable limits further downstream at site 1 (Bull Creek main drain) closest to the river.

5.2 Dissolved oxygen

Forty of the 56 samples collected from Melville Bull Creek catchment sites recorded dissolved oxygen (DO) saturations below the ANZECC acceptable ranges (lowland rivers: 80-120%, wetlands: 90-120%) and the NHMRC recreational guidelines lower limit (80%) (Figure 5-3 and Table D-2 in Appendix D). Only site 16 (Downstream Elizabeth Manion Park) recorded saturations within the acceptable range on all occasions when sampled. Two samples from site 11 (Marmion Reserve) recorded DO saturations greater than the acceptable range with readings of 128.8% and 129.5% in August and October respectively. Similarly, one sample at site 12 (Blue Gum Lake outlet) recorded a DO saturation greater than the acceptable range in October 2020 with a reading of 121.6%. Site 5 (John Creaney Park) recorded the lowest saturation in the catchment of 9.1% in October.

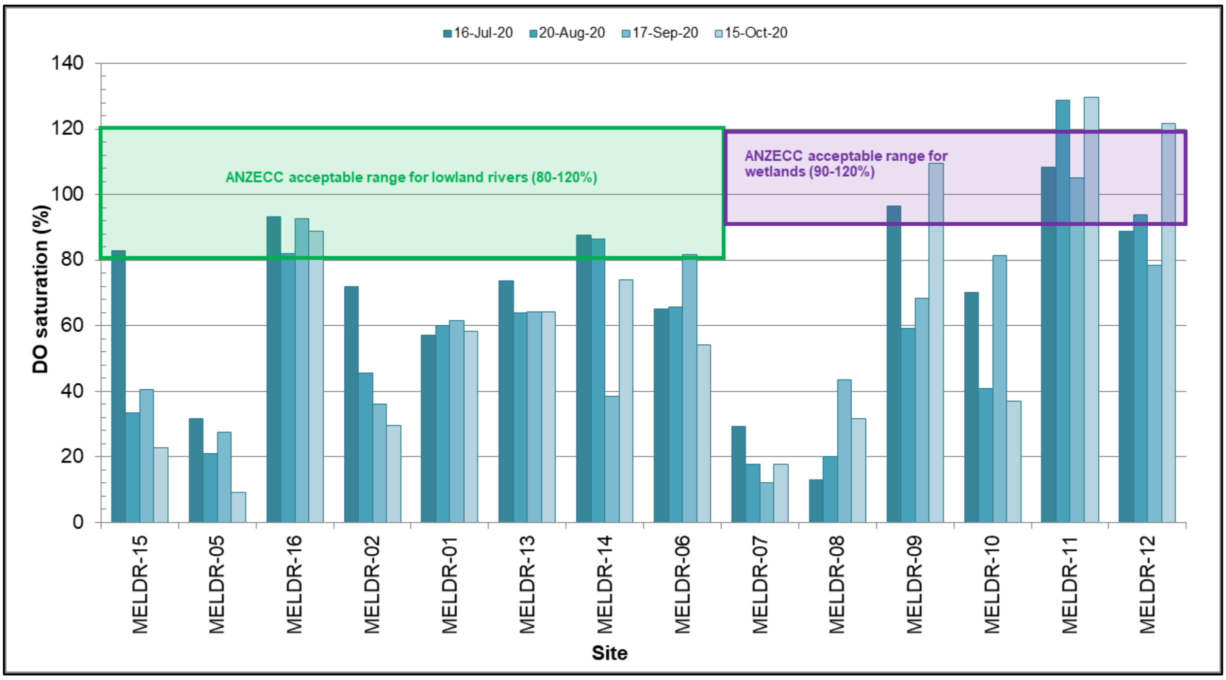

Figure 5-3: Dissolved oxygen (DO %) saturations recorded at Melville Bull Creek catchment sites in 2020

For DO in terms of concentration (mg/L), of the 56 total samples taken during the 2020 sampling year, six were considered hypoxic (>0 mg/L - ≤2 mg/L), 13 samples were classed as having how oxygen (>2 mg/L - ≤4 mg/L), nine samples were classed as oxygenated (>4 mg/L - ≤6 mg/L) and 28 samples were considered to be well oxygenated (>6 mg/L) (in accordance with DBCA standards [DPaW 2015])(Figure 5-4 and Table D-3 in Appendix D).

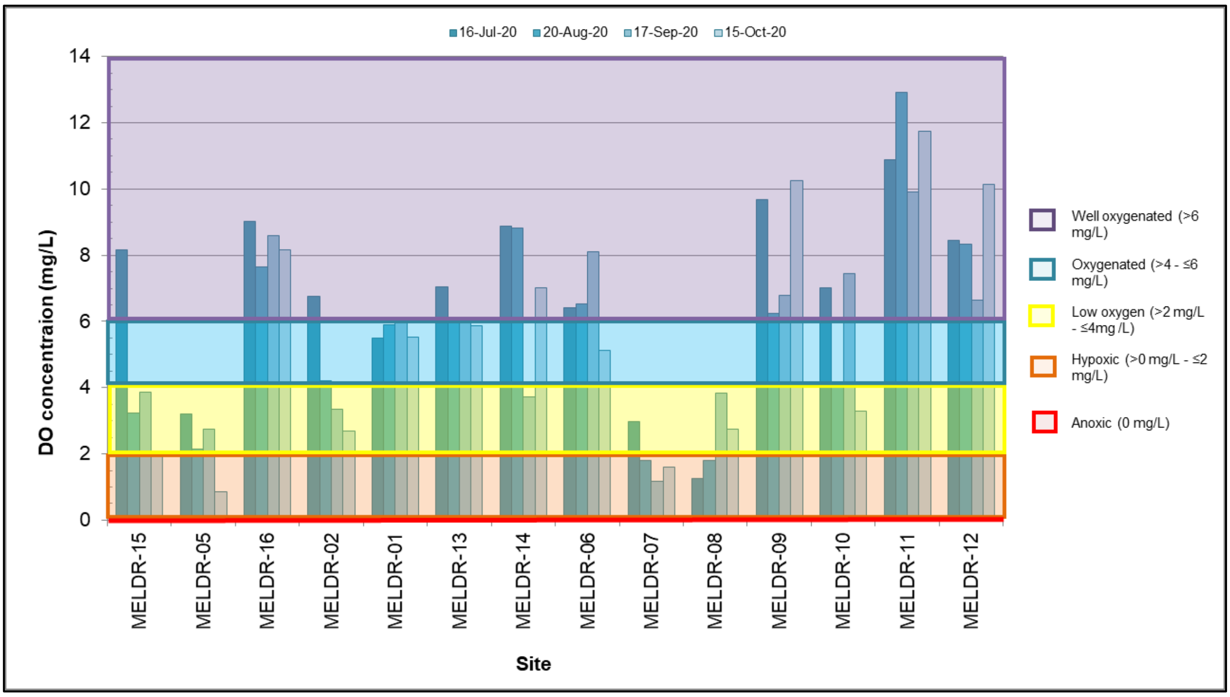

Figure 5-4: Dissolved oxygen concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Dissolved oxygen saturations and concentrations recorded in 2020 were similar to those recorded in the preceding 13 years of monitoring (Table G-1). However, it should be noted that DO saturations recorded at site 12 (Blue Gum Lake outlet) for the 2020 sampling year has a higher average (ranging from 78.3% – 121.6%) than experienced in previous years at this site. Site 9 (Quenda Lake outlet) had notably higher than typically experienced DO saturation recordings in July and October of the 2020 sampling season (96.5% and 109.4%, respectively). Site 15 (John Creaney Park Inlet) had an unusually high reading of 82.9% in July 2020, the highest recording at this site since sampling at this site began in 2014 (the next highest being 60.6% in July 2018). It should also be noted that site 9 (Quenda Lake outlet) has recorded generally higher nitrogen concentrations and lower oxygen saturations since 2013 and site 12 (Blue Gum Lake outlet) has recorded generally higher nitrogen and phosphorus concentrations and lower oxygen saturations since 2012 than in previous years (see Section 6.1), suggesting a possible link between eutrophication and low dissolved oxygen saturations at these sites.

Over the 14 year monitoring period, most sites have generally recorded oxygenated to well oxygenated median DO concentrations, and DO saturations generally below the acceptable range for lowland rivers and wetlands. Only site 16 (downstream Elizabeth Manion Park) has record acceptable saturations on more than 50% of sampling occasions.

DO saturations have generally been slightly lower at site 13 (Brentwood drain) than at site 14 (RAAF drain), with saturations at downstream site 6 (Bateman Park) similar to those at site 13. Site 14 adjoins the drainage line between site 6 and site 13 and has no noticeable effect to improve DO downstream at site 6. DO saturations are generally significantly lower at the outlet of John Creaney Park (site 5) than at the inlet (site 15) and also significantly lower than the other branch of the Bull Creek main drain at site 16 (downstream Elizabeth Manion Park). DO saturation values at site 2 (Brockman Park) (which receives flow from sites 5 and 16) are typically between the values at sites 5 and 16. DO is usually slightly higher at the most downstream Bull Creek main drain site (site 1).

5.3 Electrical conductivity

Electrical conductivity (EC) (mS/cm) is the ability of water or soil to conduct an electrical current. It is commonly used as a measure of salinity or total dissolved salts. Solutions with high salt concentrations will conduct electricity better than pure water. EC is increased when the total concentration of inorganic ions (particularly sodium, chlorides, carbonates, magnesium, calcium, potassium and sulphates) is increased.

EC values recorded in Melville Bull Creek catchment sites were varied. Eleven samples from the lakes recorded values within the acceptable range for wetlands except one sample from site 9 (Quenda Lake outlet), three samples from site 10 (Frederick Baldwin) and all four samples from site 7 (Booragoon Lake outlet) and site 11 (Lake Marmion) recording concentrations below the acceptable range for wetlands (0.3-1.5 mS/cm). Two samples from the drain sites (site 15 and 16) recorded EC values below the acceptable range for lowland rivers (in July 2020). One sample at site 5 (John Creaney Park outlet) recorded an EC value within the acceptable range for lowland rivers (0.12 – 0.3 mS/cm). Twenty-nine samples from the drain sites (15, 5, 16, 2, 1, 13, 14 and 6) recorded values above ANZECC acceptable ranges for lowland rivers (0.12-0.3 mS/cm) or wetlands (0.3-1.5 mS/cm) respectively (Figure 5-5 and Table D-4 in Appendix D). Site 5 (John Creaney Park) in July was the only sample of the drain sites that fell within the ANZECC acceptable range.

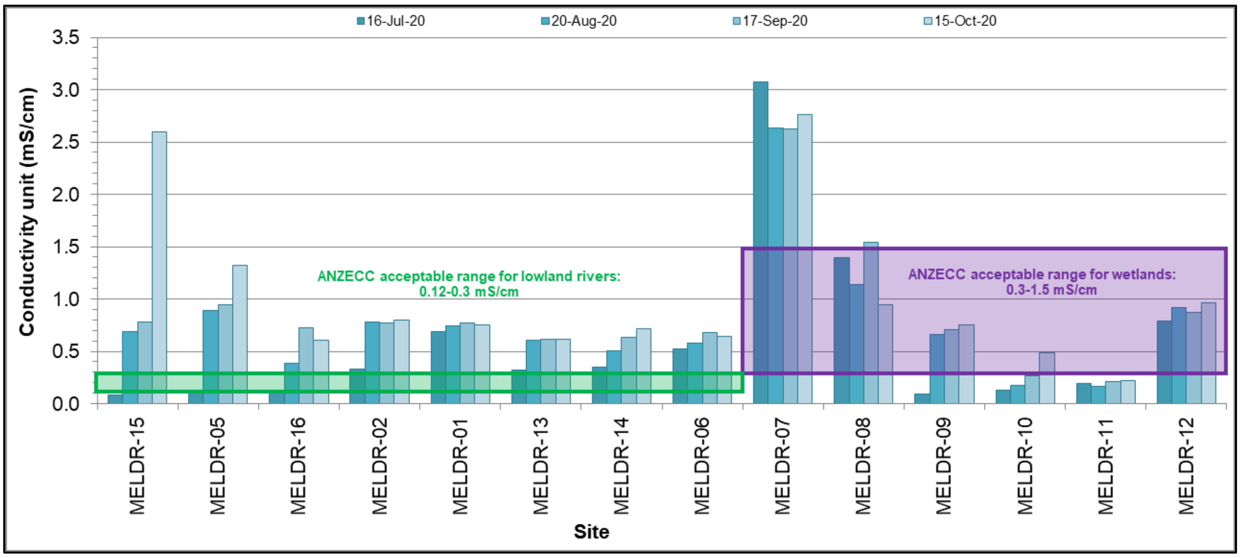

Figure 5-5: Electrical conductivity (mS/cm) recorded in Melville Bull Creek catchment sites in 2020

The lowest EC reading (0.083 mS/cm) was recorded at site 15 (John Creaney Park inlet) and the highest of 3.076 mS/cm was recorded at site 7 (Booragoon Lake outlet) both during July 2020.

EC values recorded at most sites in 2020 are generally similar to those recorded in the preceding 13 years of sampling. After three years of recording EC values in the 'acceptable range' (2017, 2018 and 2019), site 7 (Booragoon Lake) has since recorded values above the acceptable range on all four sampling occasions in 2020 (similar to results recorded from 2016 and early). Over the 14 year monitoring period, all drain sites (15, 5, 16, 2, 1, 13, 14 and 6) have generally recorded EC levels higher than the applicable acceptable range (Table D-4). Similarly, over the 14 year period, two of the lake sites, sites 10 and 11 (Frederick Baldwin and Lake Marmion respectively), have recorded EC levels outside the acceptable range in 58% and 63% of the sampling occasions. The only site that has consistently remained within the acceptable range is site 12 (Blue Gum Lake) with a median EC of 0.785 mS/cm over the 14 years monitoring. Although EC levels recorded in the Melville Bull Creek catchment are often outside ANZECC acceptable ranges, they do not appear to be changing substantially over time and therefore any biota living in these lakes and drainage lines are likely to be adapted to these levels.

5.4 Total suspended solids

Total Suspended Solids (TSS) in a waterbody is a measure of the concentration of suspended materials in the water that can be removed by filtration. TSS can include a wide variety of material, most often comprising soil particles and organic material (e.g. algae, microorganisms, decaying plant and animal matter).

TSS concentrations were notably higher across the catchment than historically experienced, with 32 out of 56 samples (57%) collected from Melville Bull Creek catchment sites 15, 5, 16, 13, 6, 7, 8 and 12 (John Creaney Park inlet, John Creaney Park, Downstream Elizabeth Manion Park, Brentwood Drain, Bateman Park, Booragoon Lake outlet, Piney Lakes outlet and Blue Gum Lake outlet respectively) recording concentrations equal to or above the experimentally derived guideline (6 mg/L) (Figure 5-6 and Table D-5 in Appendix D). The highest concentrations of 52 mg/L was recorded at site 15 (John Creaney Park inlet) in July. Sites 9, 13 and 16 recorded exceeding TSS concentrations on all four sampling occasions. Six samples recorded concentrations below the LOR of 1.0 mg/L (and site 11 below the LOR of 2 mg/L in August1).

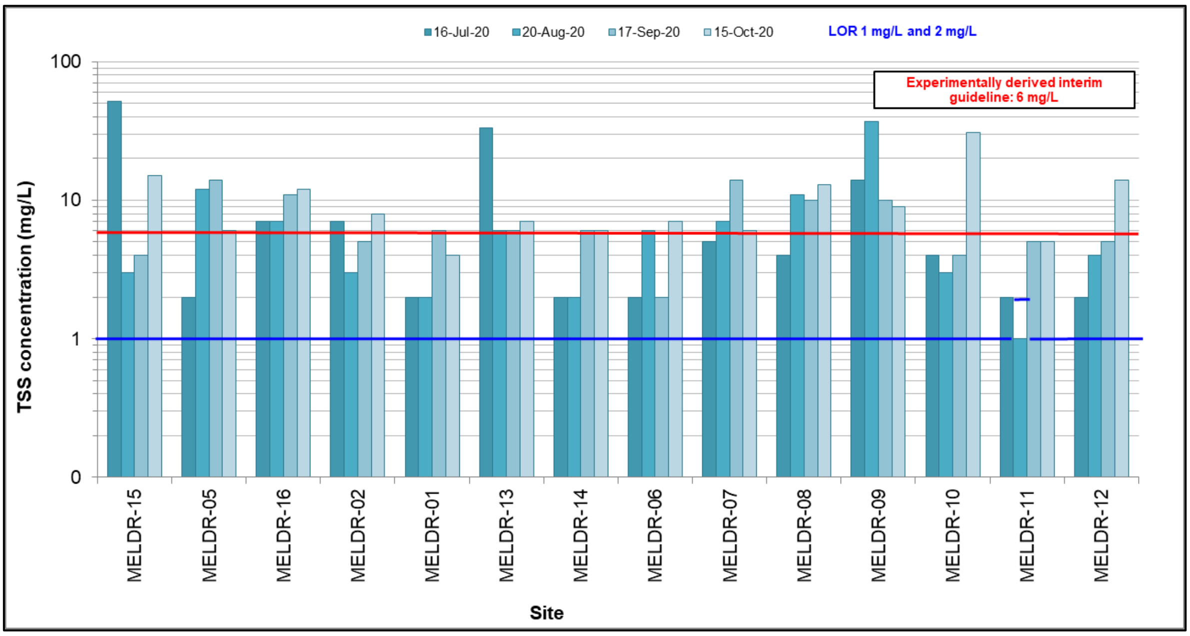

Figure 5-6: Total suspended solids (mg/L) recorded in Melville Bull Creek catchment sites in 2020[2] ***(note this graph is on a logarithmic scale)***

TSS concentrations recorded in 2020 are, on average, higher than those recorded in the preceding 13 years (Table D-5). Sites 15, 16, 13 and 6 (John Creaney Park inlet, downstream Elizabeth Manion Park, Brentwood Drain and Bateman Park) have recorded concentrations above the interim guideline more than 58% of the sampling occasions for each site (63%, 69%, 77% and 59%, respectively) and site 7 (Booragoon Lake) and site 12 (Blue Gum Lake) have recorded exceedances on 57% and 46% of the sampling occasions over the 14 year monitoring period. Twenty-twenty was the first year in which site 15 recorded the highest concentration for the year (52 mg/L in July) since sampling began at this site in 2014.

When comparing results between sites 13 and 14 (Brentwood Drain and RAAF Drain respectively), TSS concentrations have historically always been lower at site 14 than at site 13 (excluding one sampling occasion in October 2016). To note, site 14 has recorded two values exceeding the trigger value for TSS in September and October 2020 (both 6 mg/L). This is the first exceedance recorded for this site since sampling began here in 2013. Site 13 records exceedances on approximately 81% of the time and site 14 recording exceedances on <1% of occasions. TSS at site 6 is often somewhere in between the two sites

[1] Site 11 has a differing LOR to all other samples due to a smaller volume of sample was used for the analysis of this particular sample because it was analysed in duplicate as part of the laboratory's QC processes.

[2] A value equal to half the LOR was substituted for occasions where concentrations were recorded as 'below the laboratory limit of reporting', which is a standard technique to allow these 'unknown' values to be represented graphically and to differentiate them from those samples that recorded concentrations equal to the limit of reporting (Helsel 1990).

(13 and 14), suggesting the clearer water at site 14 may be diluting the more turbid water at site 13. Although, this year site 14 mimicked very similar results to site 6.

On the Bull Creek main drain, TSS results are usually lower at site 5 than site 15, perhaps indicating that some particulate material settles to the bottom of the John Creaney Park lake after flowing through the drainage pipes.

5.5 Temperature

It should be noted that water temperature will often increase throughout the day, and hence sampling time can partially influence recorded water temperature (Figure 5-8). During the 2020 monitoring period, sampling was conducted at varying times between 08:00 and 14:30 hours.

Seven out of 56 samples (from four sites) recorded concentrations below the ANZECC acceptable range (15°C-35°C) and no samples exceeded the upper limit of this range. Temperatures in the surface waters of the Melville Bull Creek catchments ranged from 12.7°C in August at site 9 (Quenda Lake outlet) to 24.3°C in October at site 12 (Blue Gum Lake outlet) (Figure 5-7 and Table D-6 in Appendix D). Temperatures at all sites were considered to lie within a normal seasonal range and are comparable to those recorded in the previous 13 years of monitoring (Table D-6).

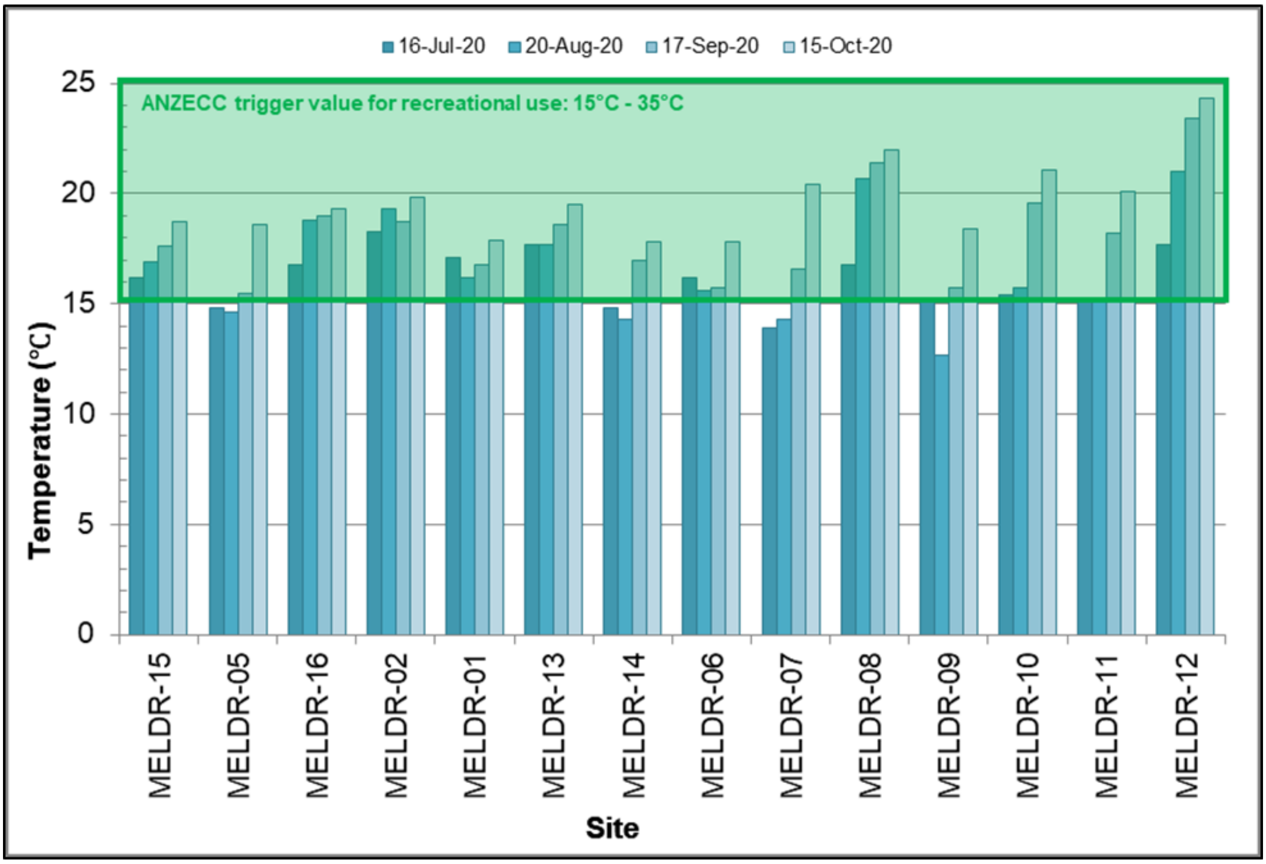

Figure 5-7: Water temperatures (°C) recorded in Melville Bull Creek catchment sites in 2020

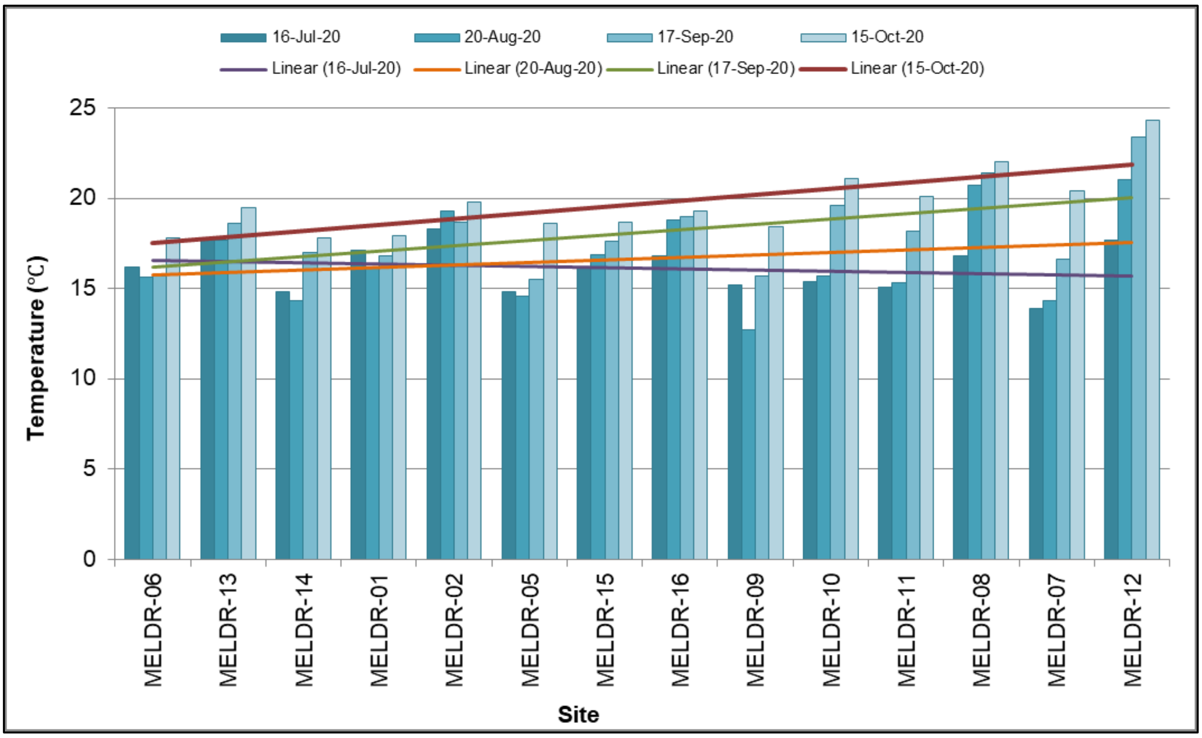

Figure 5-8: Sampling sites and their recorded temperatures in order of sampling during sample runs and their associated trend lines

6. Nutrients

The nutrient forms analysed during the 2020 monitoring program include TN, NH_3-NH_4^+-N, NO_x-N, TON, DON, TP and FRP.

Nutrient concentrations recorded in Melville Bull Creek catchment sites are displayed in Table D-7 to Table D-13 in Appendix D. Table E-1 in Appendix E outlines the sources of nitrogen and phosphorus nutrients and the impacts that changes in these nutrients can have to aquatic ecosystems.

For all graphs, a value equal to half the LOR was substituted for those occasions where concentrations were recorded as 'below the laboratory limit of reporting' (<LOR) which is a standard technique (Helsel 1990) to allow these 'unknown' values to be represented graphically and to differentiate them from those samples that recorded concentrations equal to the LOR.

6.1 Nitrogen

Nitrogen in waterways can exist in both inorganic forms, including oxidised nitrogen (encompassing nitrate (NO_3^-) and nitrite (NO_2^-)), ammonia nitrogen (including both ammonium (NH_4^+) and ammonia (NH_3)), and dissolved and particulate organic forms. Nitrogen is converted between these forms, as well as nitrogen gas (N_2), via physical and biological processes known collectively as the nitrogen cycle. When plants and animals die or when animals excrete their wastes, organic nitrogen in the water is converted by bacteria to ammonium/ammonia (mineralisation), then to nitrite and nitrate (nitrification). Ammonium can be converted to ammonia gas (volatilisation) in alkaline conditions and nitrate can be converted to nitrogen gas (denitrification) in anoxic conditions, with the release of these gases into the atmosphere resulting in a loss of nitrogen from the water (Northern Territory Government 2003).

Tables containing concentrations for TN, NO_x-N, NH_3/NH_4^+-N, TON and DON in the Melville Bull Creek catchment in 2020 from the 2007-2020 sampling period are displayed in Table G-2.

6.1.1 Total nitrogen

TN concentrations exceeded ANZECC trigger values for lowland rivers (1.2 mg/L) or wetlands (1.5 mg/L) in 20 of 56 samples collected from Melville Bull Creek catchment sites (Figure 6-1 and Table D-7 in Appendix D). The highest concentration was recorded at site 7 (Booragoon Lake outlet) with a reading of 11 mg/L in August 2020. Exceeding concentrations were recorded on all sampling occasions at sites 2, 1, 7 and 12 (Brockman Park, Bull Creek MD, Booragoon Lake and Blue Gum Lake), and on at least one sampling occasion at sites 5 and 10 (John Creaney Park outlet and Frederick Baldwin outlet, respectively). The lowest concentration was recorded at site 10 (Frederick Baldwin outlet; 0.33 mg/L) in July of 2020.

Seventeen out of 56 samples also exceeded the HRAP short term target (2 mg/L) (from sites 1, 2, 7, 10 and 12) and 26 out of 56 samples exceeded the HRAP long term target (1 mg/L) (from sites 1, 2, 5, 7, 10, 12 and 15).

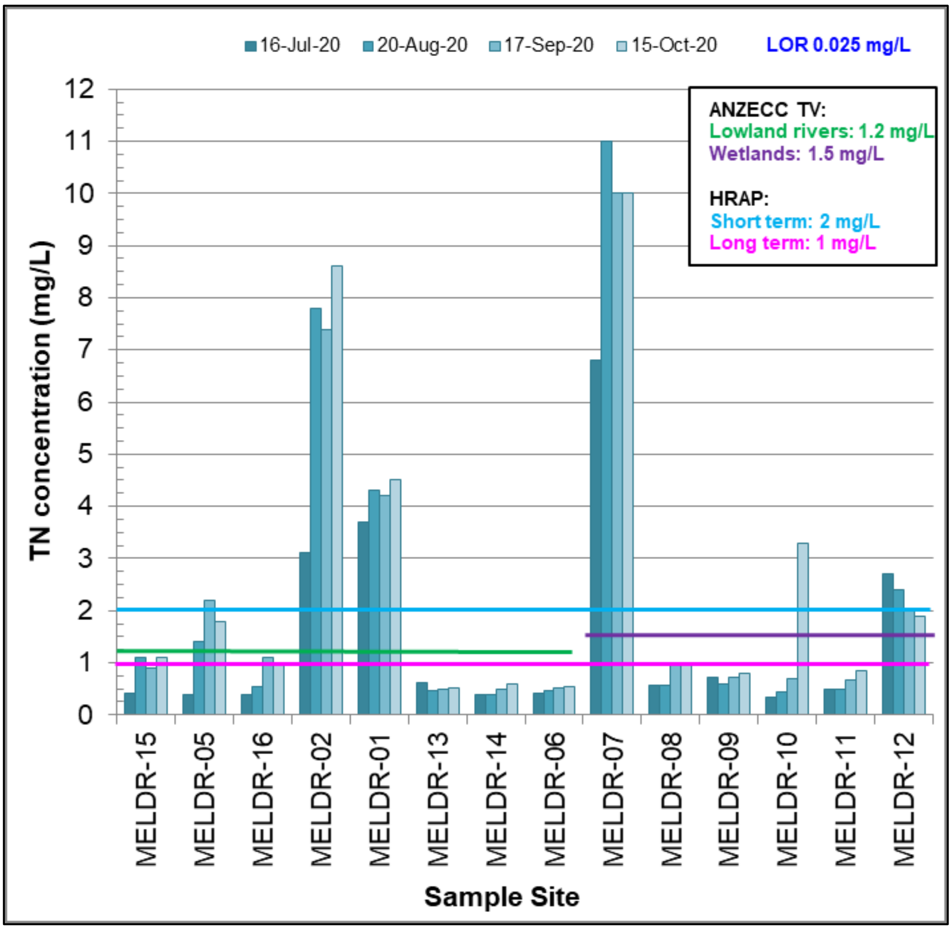

Figure 6-1: Total nitrogen concentrations (mg/L) recorded at the City of Melville catchment sites in 2020

6.1.2 Total oxidised nitrogen

NO_x-N concentrations above relevant ANZECC trigger values (lowland rivers: 0.15 mg/L, wetlands: 0.1 mg/L) were recorded at 23 of the 56 samples from nine sites (Figure 6-2 (A and B) and Table D-8 in Appendix D). The four highest concentrations in the catchment were all recorded at site 1 (Bull Creek Main Drain) being 3.1 mg/L, 3.1 mg/L, 2.5 mg/L and 2.4 mg/L in October, July, September and August, respectively (where the highest concentration approximately 20 times greater than the trigger value). Site 12 (Blue Gum Lake outlet) also recorded exceeding NOx-N concentrations on all four sampling occasions in 2020. Sites 15, 16, 13 and 7 (John Creaney Park Inlet, D/S Elizabeth Manion Park, Brentwood Drain and Booragoon Lake outlet, respectively) recorded exceeding NO_x-N concentrations on 75% of sampling occasions, all occurring in August, September and October of 2020. Eleven samples recorded concentrations below the LOR of 0.01 mg/L. Once in July (site 8, Piney Lakes outlet), three times in August (sites 8, 9 and 11 being Piney Lakes outlet, Quenda Lake outlet and Marmion Reserve, respectively), four times in September (at sites 5, 9, 10 and 11 being John Creaney Park, Quenda Lake outlet, Frederick Baldwin Lake and Marmion Reserve), and three times in September at sites 5, 8 and 11 (being John Creaney Park, Piney Lakes outlet and Marmion Reserve, respectively).

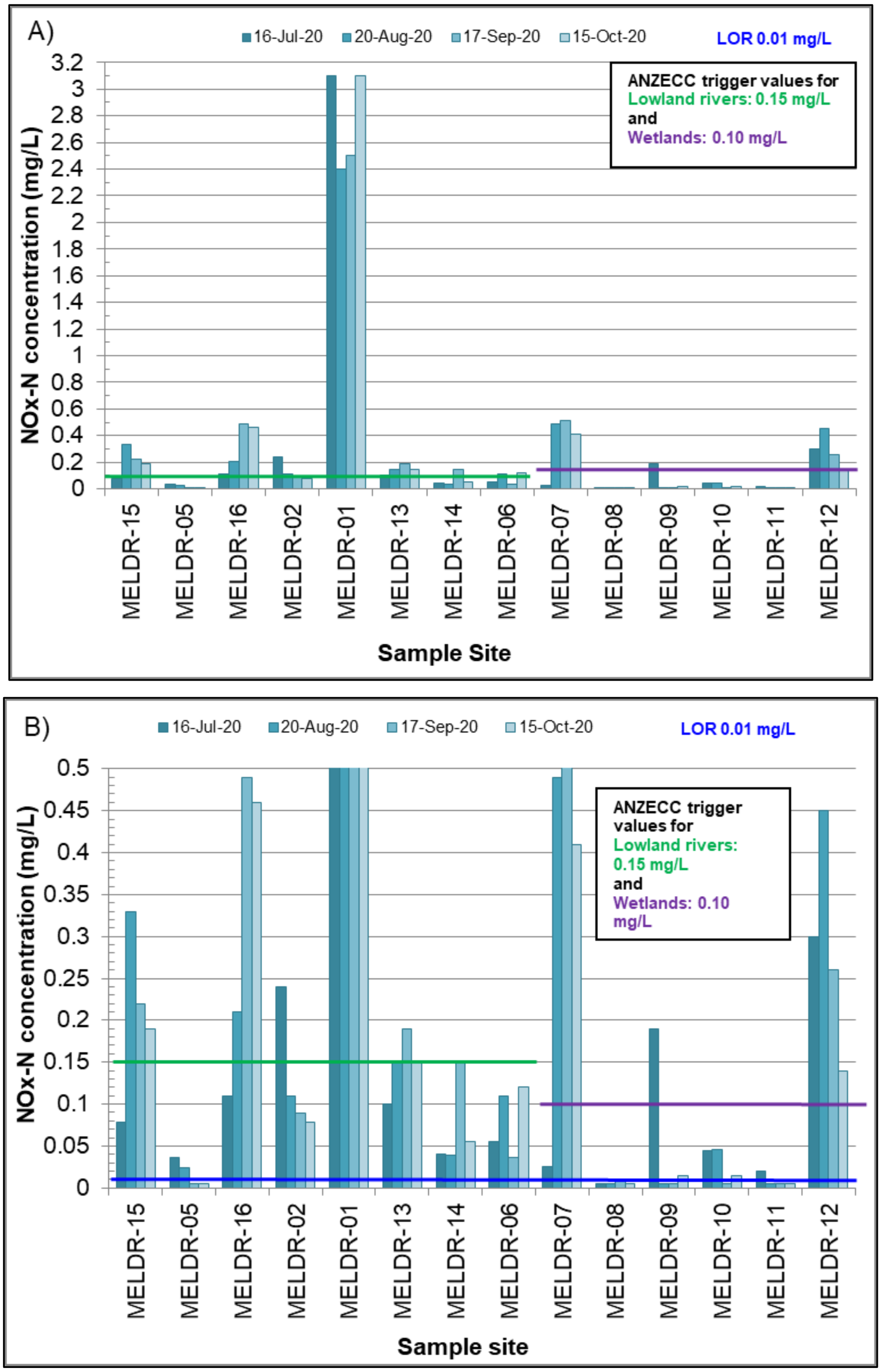

Figure 6-2: A) overview, and B) finer detail of total oxidised nitrogen concentrations (mg/L) recorded at the City of Melville catchment sites in 2020

6.1.3 Nitrogen as ammonium/ammonia

Nitrogen as ammonium/ammonia (NH_4^+/NH_3-N) concentrations exceeded or equalled relevant ANZECC trigger values (lowland rivers: 0.08 mg/L, wetlands: 0.04 mg/L) in 30 out of 56 samples from 13 sites (Figure 6-3 (A and B) and Figure 6-4, and Table D-9 in Appendix D). It is important to mention that the trigger value for 95% level of protection is only applicable at pH 8 and 20°C as per table 8.3.7 in the ANZECC guidelines (ANZECC and ARMCANZ 2000). The trigger value decreases with increasing pH and increases with decreasing pH. Sites 2, 1, 13, 7 and 12 (Brockman Park, Bull Creek Main Drain, Brentwood Drain, Booragoon Lake outlet and Blue Gum Lake outlet) recorded NH_4^+/NH_3-N concentrations exceeding the trigger value for lowland rivers and wetlands on all sampling occasions. All four samples from site 2 (2.7 mg/L, 7.4 mg/L, 7.3 mg/L and 8.3 mg/L in July, August, September and October respectively) and site 7 (4.3 mg/L, 7.9 mg/L, 7 mg/L and 7 mg/ in July, August, September and October, respectively) recorded NH_4^+/NH_3-N concentrations exceeding adjusted ANZECC freshwater protection trigger values for 95% level of protection (Figure 6-3 (A and B)). The August, September and October samples for site 2 and 7 also recorded concentrations exceeding the NHMRC (2008) recreational trigger value of 0.5 mg/L. One sample recorded a concentration below the LOR of 0.01 mg/L (site 11 [Marmion Reserve] in August). One site (Site 9; Quenda Lake outlet) recorded a value equal to the LOR (0.01 mg/L) in October 2020.

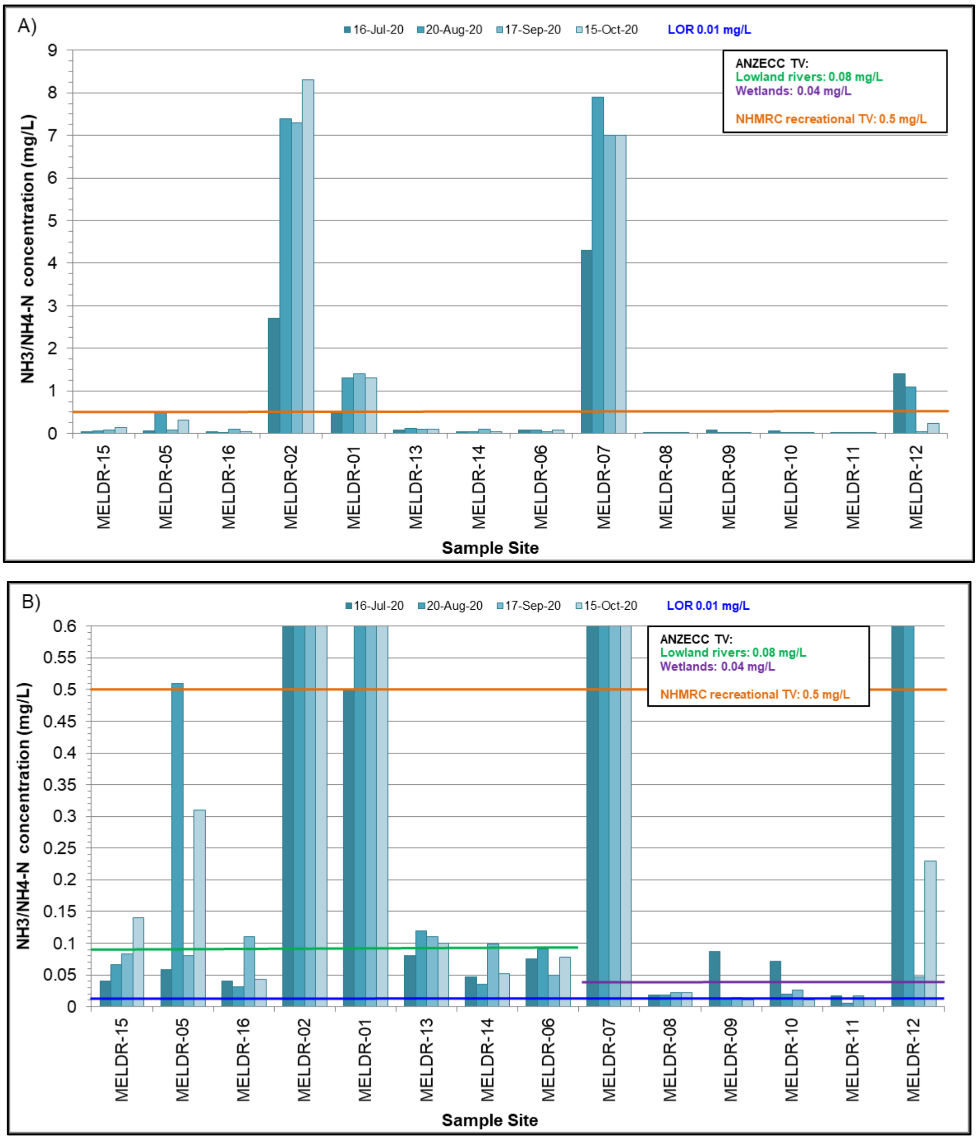

Figure 6-3: A) Overview of ammonia/ammonium (mg/L) recorded at the City of Melville Catchment sites in 2020; B) Detailed graph of ammonia/ammonium (mg/L) recorded at the City of Melville Catchment sites in 2020.

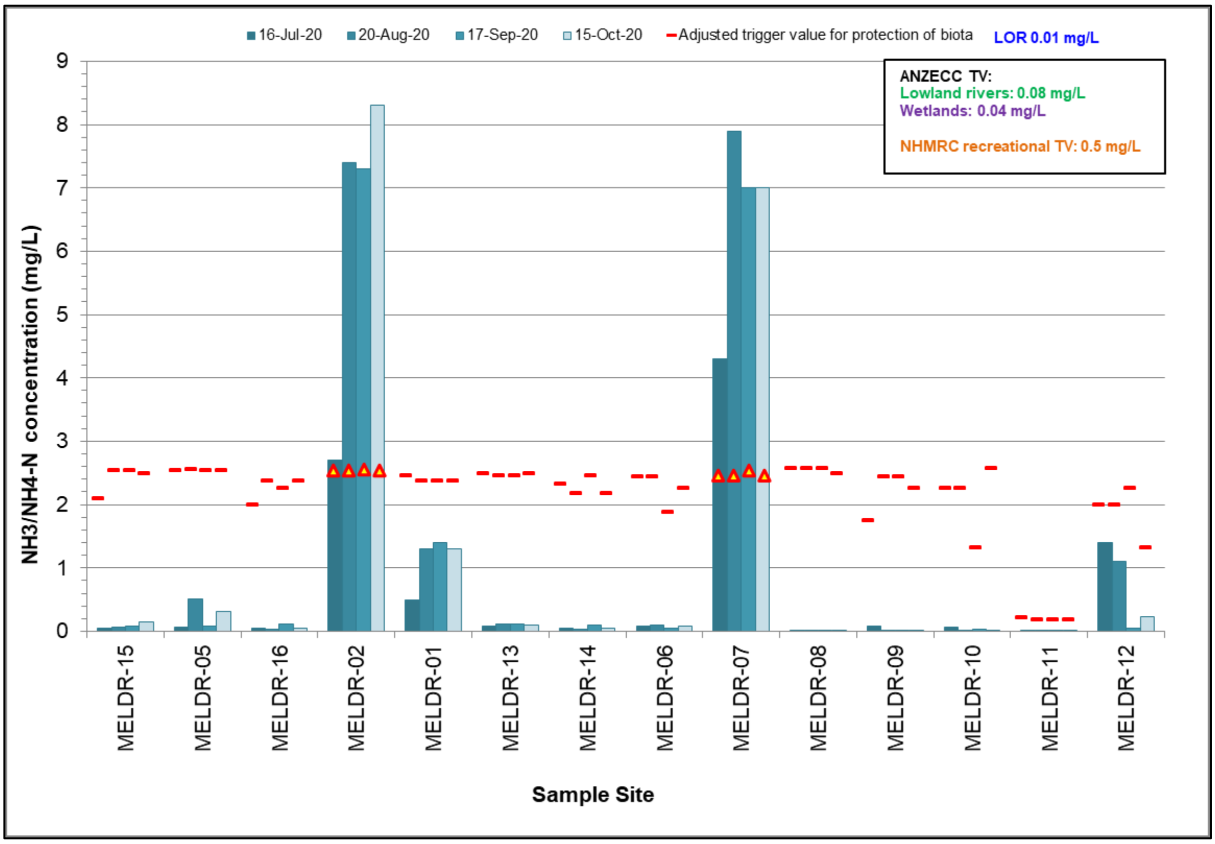

Figure 6-4: Ammonia/ammonium (mg/L) and associated adjusted trigger values recorded at the City of Melville Catchment sites in 2020

6.1.4 Organic nitrogen (total and dissolved)

As no guideline currently exists for TON and DON it is difficult to assess the results for these parameters in terms of threats to ecosystem and/or human health. Although, there is some evidence that organic nitrogen compounds are taken up by phytoplankton and bacteria and therefore can affect composition and densities. Therefore, collecting this information may be helpful in determining source/s of total nitrogen.

Site 10 (Frederick Baldwin Lake) recorded the highest concentration of TON (3.2 mg/L) in October (likely attributed to the soap factory fire that occurred nearby). Site 7 (Booragoon Lake) recorded the second highest TON concentrations in the range of 2.4 to 2.8 mg/L. The lowest TON was recorded at site 2 (Brockman Park) in September 2020 and was less than the LOR of <0.025 mg/L. The highest DON concentration was recorded at site 7 (Booragoon Lake) in the range of 1.7 to 2.8 mg/L (Figure 6-5 and Figure 6-6). Site 1 and 2 (Bull Creek Main Drain and Brockman Park) recorded the lowest DON concentration below the LOR of 0.025 mg/L in July for site 1 and September and October for site 2.

Organic nitrogen (and mainly DON) comprised the majority (or the highest proportion) of TN at most sites (Figure 6-7). However, inorganic forms of nitrogen comprised the majority (or the highest proportion) of total nitrogen at three sites:

- site 2 (Brockman Park) and site 7 (Booragoon Lake outlet) on average 94% and 69%, respectively, for ammonia/ammonium nitrogen;
- site 1 (Bull Creek Main Drain) on average 67% oxidised nitrogen;

To note, site 12 (Blue Gum Lake outlet) found one occurrence where oxidised nitrogen was the most prominent fraction (52% in July), although on average across the four sampling occasions only sits at 28%.

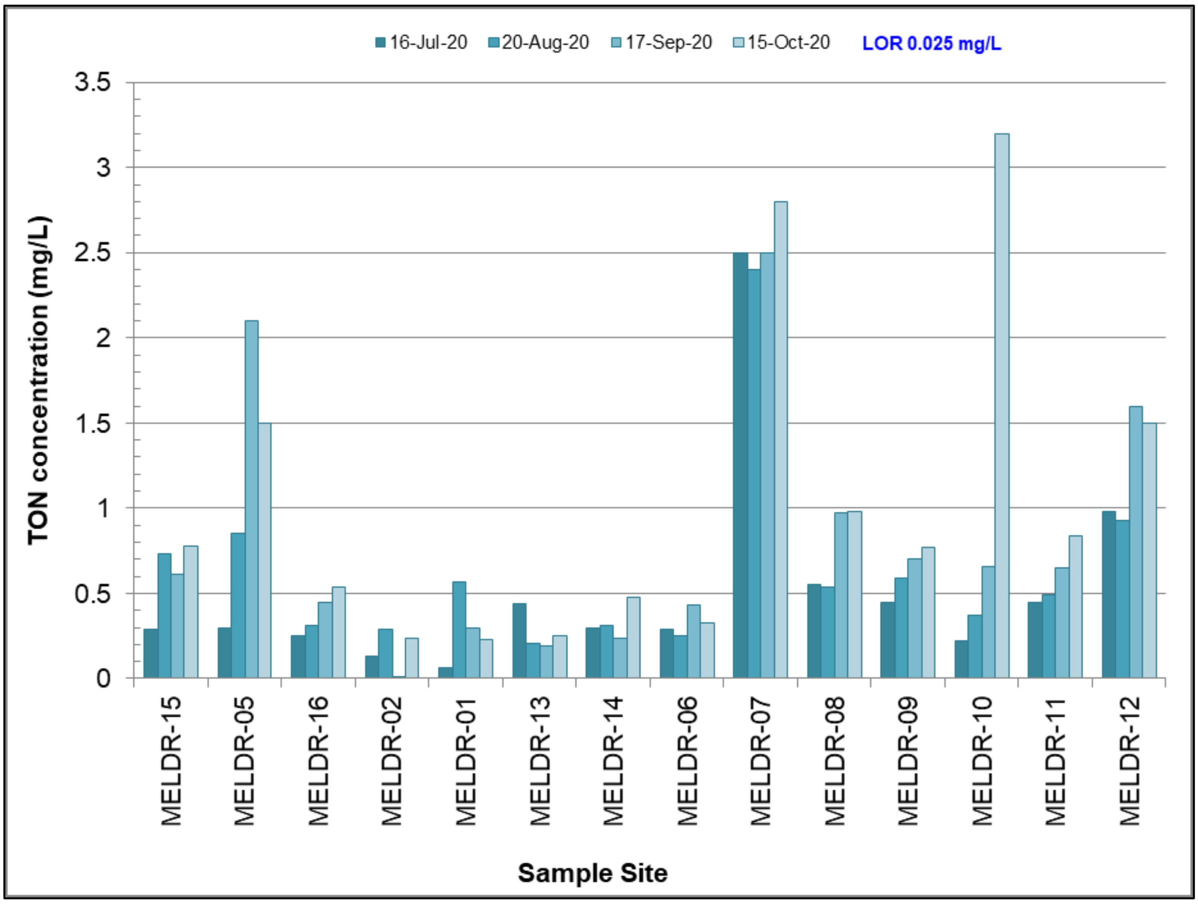

Figure 6-5: Total organic nitrogen (mg/L) concentration recorded at City of Melville catchment sites in 2020

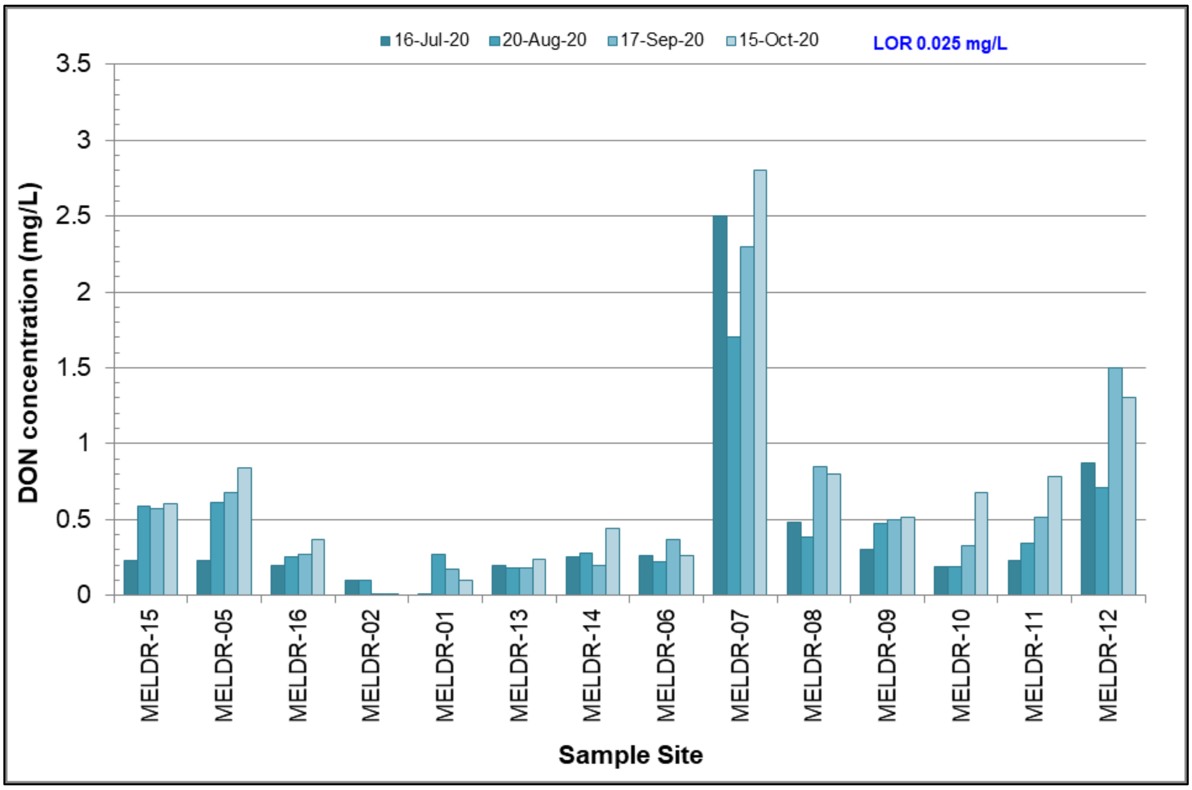

Figure 6-6: Dissolved organic nitrogen (mg/L) concentration recorded at City of Melville catchment sites in 2020

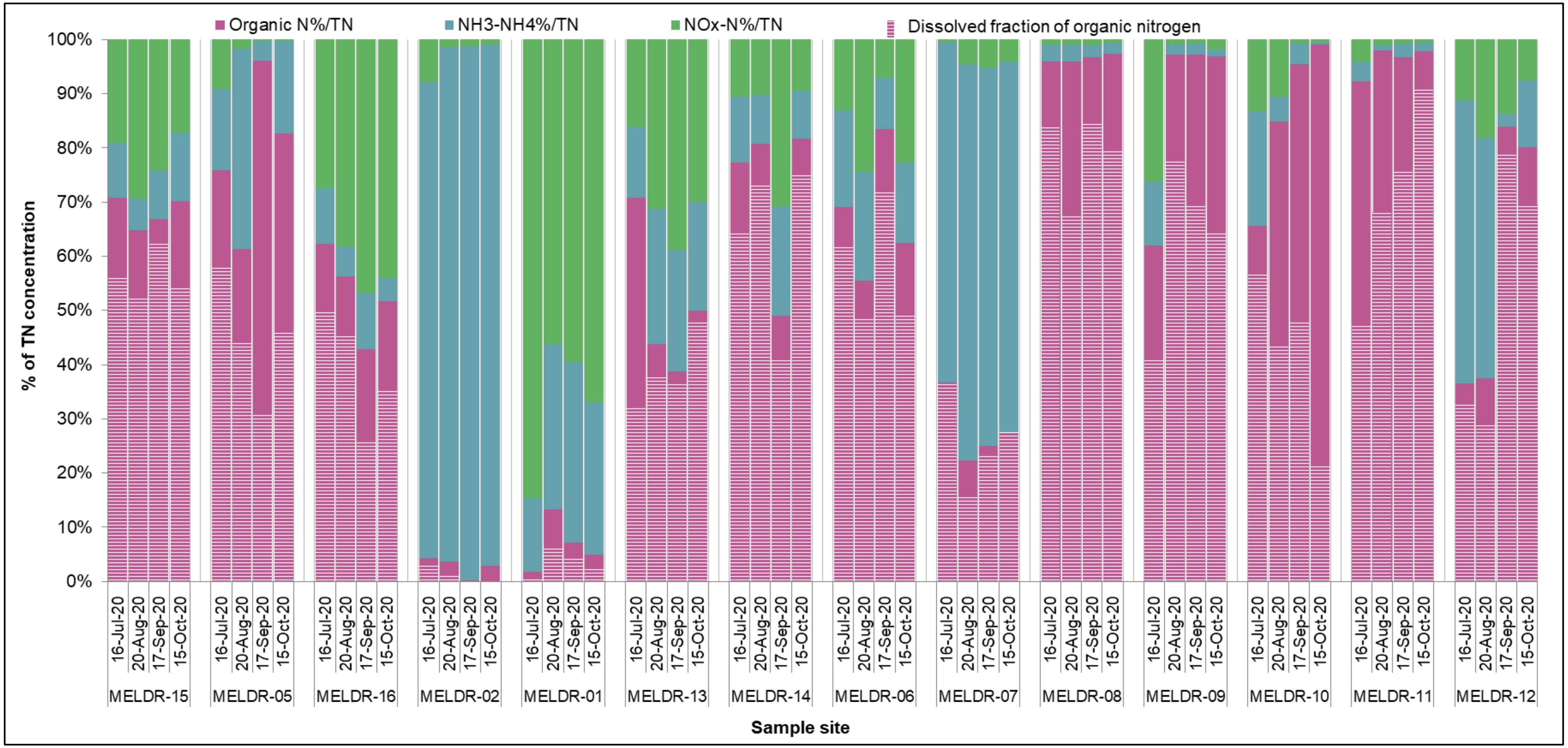

Figure 6-7: Nitrogen speciation in surface water of the City of Melville catchment sites in 2020

TN concentrations recorded in 2020 are generally similar to those recorded in the preceding 13 years of monitoring (Table G-2). The main exception to this is that one TN concentration recorded at site 10 (Frederick Baldwin Lake) in October 2020 exceeded the ANZECC trigger value which has not occurred at this site since sampling began in 2007.

Comparing the two main drainage branches in the catchment that discharge into the Canning River, total nitrogen concentrations in the most downstream site 1 (Bull Creek Main Drain site) have consistently exceeded the ANZECC lowland rivers trigger value throughout the 14 years sampling period, whereas concentrations at the most downstream Brentwood Drain site, site 6 (Bateman Park), have almost always been below the trigger value (Table G-2). The majority of nitrogen entering the Bull Creek Main Drain appears to come from upstream of site 2 (Brockman Park), where concentrations are consistently very high and are predominantly in the form of ammonia/ammonium. It is also important to note that site 1 would also gain input from the ROSSTAFE site sampled as part of the SG-C-BULLCKEAST program for the City of Canning. The ROSSTAFE has experienced exceedances on majority of sampling occasions since 2016. More importantly, historically TN at ROSSTAFE has typically been less than or similar to TN recorded at site 1 indicating that site 1 is heavily influenced by concentrations in water received from site 2. As water flows from site 2 to the most downstream site 1, total nitrogen concentrations reduce by an average of approximately 50% with the remaining nitrogen predominantly in the form of oxidised nitrogen rather than ammonia nitrogen.

TN concentrations are also consistently high at site 7 (Booragoon Lake) and site 12 (Blue Gum Lake) (Table G-2). This is usually predominantly in the form of organic nitrogen, with nitrogen as ammonium/ammonia concentrations also often exceeding the wetlands trigger value at these sites and occasionally exceeding the trigger value for protection of biota at site 7 (Booragoon Lake). High total nitrogen concentrations tend to correspond with high phosphorus concentrations at these sites, and particularly at site 12 (see Section 6.2). It should be noted that site 7, while although consistently recording very high and variable concentrations, has recorded TN values similar to that previously observed during sampling between 2007 and 2011 after a period of lower (in terms of this site) values from 2012 to 2019. Furthermore, at site 12 (Blue Gum Lake), higher yearly maximum concentrations of total nitrogen were recorded from 2012 to 2020 than from 2007 to 2011, the maximum concentrations of this parameter recorded in all the years of monitoring is 7.1 mg/L recorded in August 2012.

6.2 Phosphorus

Phosphorus in water exists in both soluble and particulate forms. Soluble phosphorus is largely comprised of inorganic phosphate ions (PO_4^{3-}, also known as orthophosphate) but small amounts of condensed phosphate (polyphosphates and metaphosphates) and dissolved organic forms of phosphorus may be present. Filterable reactive phosphorus (FRP) is a measure of the phosphates that pass through a 0.45 µm filter and respond to colorimetric tests without preliminary hydrolysis or oxidative digestions of the sample and is largely a measure of orthophosphate. Particulate phosphorus is comprised of organic material (decaying plant and animal matter); phosphorus adsorbed to particulate material and phosphorus minerals (e.g. apatite).

6.2.1 Total phosphorous

TP is a measure of all phosphorus in the water including soluble forms and particulate forms. TP concentrations recorded in Melville Bull Creek catchment sites in 2020 exceeded relevant ANZECC trigger values (lowland rivers: 0.065 mg/L, wetlands: 0.06 mg/L) in 17 out of 56 samples from six sites being 5, 16, 7, 10, 11 and 12 (John Creaney Park, downstream Elizabeth Manion Park, Booragoon Lake, Frederick Baldwin, Marmion Reserve and Blue Gum Lake, respectively) (Figure 6-8 and Figure 6-9, and Table D-12 in Appendix D). TP concentrations exceeded the wetlands trigger value on all sampling occasions at sites 7 and 12 (Booragoon Lake and Blue Gum Lake), and the highest concentration was recorded at site 7 (0.78 mg/L in October 2020). No concentrations were recorded that were equal to or below the LOR (0.005 mg/L) at any point during the four sampling events in 2020. The lowest concentration of 0.008 mg/L was recorded at site 1 (Bull Creek MD) in July.

Five samples exceeded the HRAP short term target (0.2 mg/L) including all four samples at site 7 and one sample at site 10 in October. Nine samples exceeded the HRAP long term target (0.1 mg/L) from four sites (7, 4, 12 and 10).

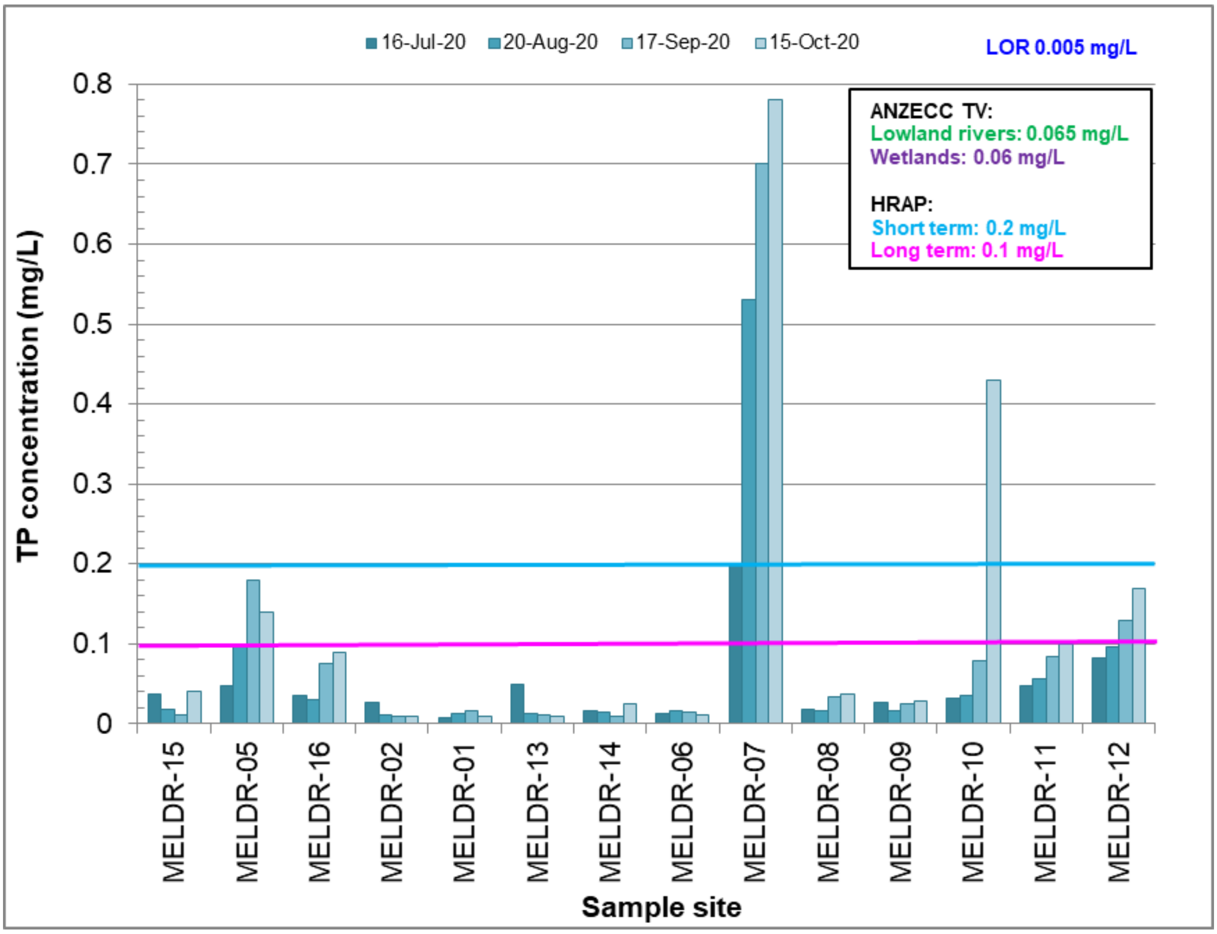

Figure 6-8: Overview of Total Phosphorous concentrations recorded in the City of Melville catchment sites in 2020

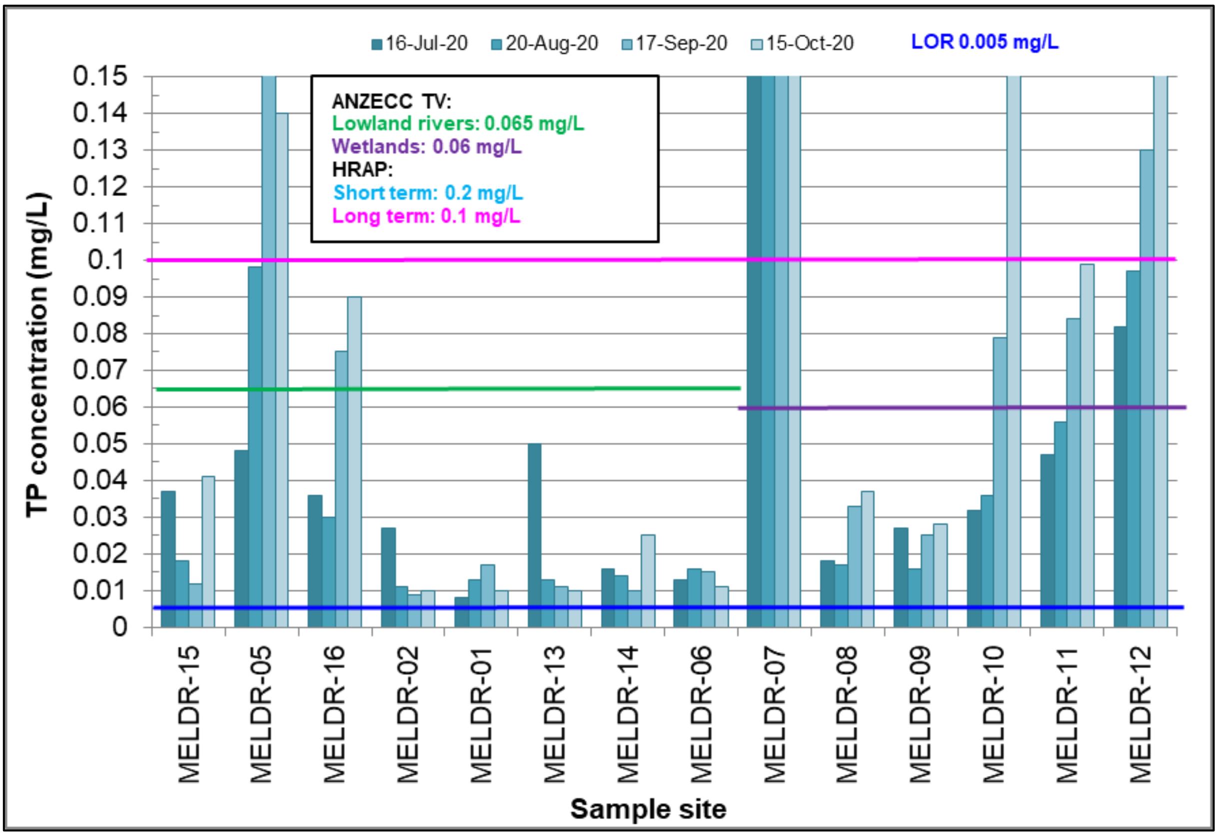

Figure 6-9: More detailed view of Total Phosphorous concentrations recorded in the City of Melville catchment sites in 2020

6.2.2 Filterable reactive phosphorous

FRP concentrations exceeded relevant ANZECC trigger values (lowland rivers: 0.04 mg/L, wetlands: 0.03 mg/L) in nine of 56 samples: all samples from sites 7 and 12 (Booragoon Lake and Blue Gum Lake respectively) and August sample from site 5 (John Creaney Park) (Figure 6-10 [A and B] and Table D-13 in Appendix D). The highest concentrations were recorded at site 7 (0.57 mg/L, 0.4 mg/L, 0.25 mg/L and 0.059 mg/L in October, September, August and July respectively). Thirty samples recorded a concentration below the LOR (0.005 mg/L).

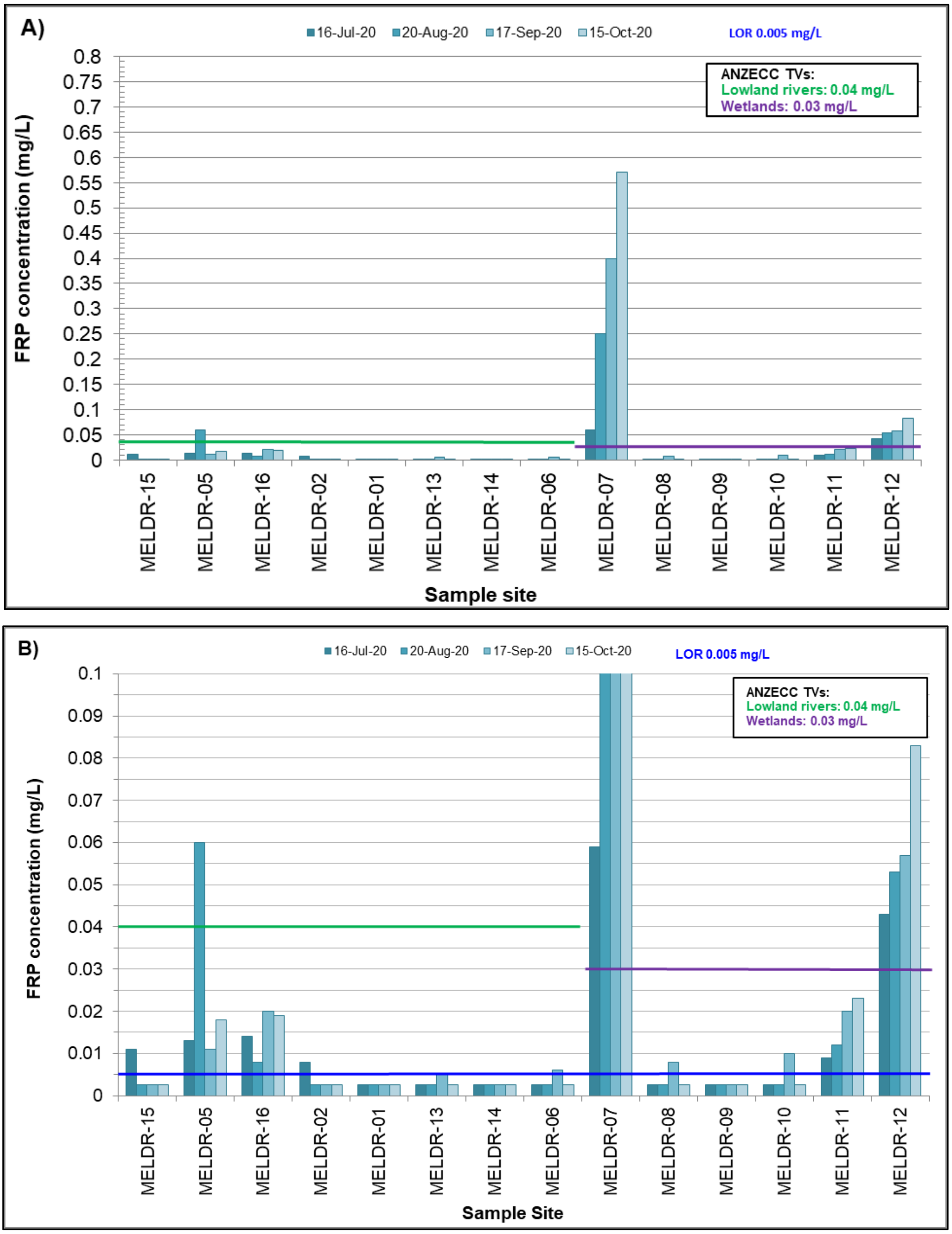

Figure 6-10: A) overview and B) detailed, finer scale view of Filterable Reactive Phosphorus (FRP) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

All sites except site 5, 7 and 12 found all samples to be comprised of predominately particulate forms of phosphorous (Figure 6-11). Samples at site 5 (August), site 7 (September and October) and site 12 (July and August) comprised of predominately soluble forms of phosphorous.

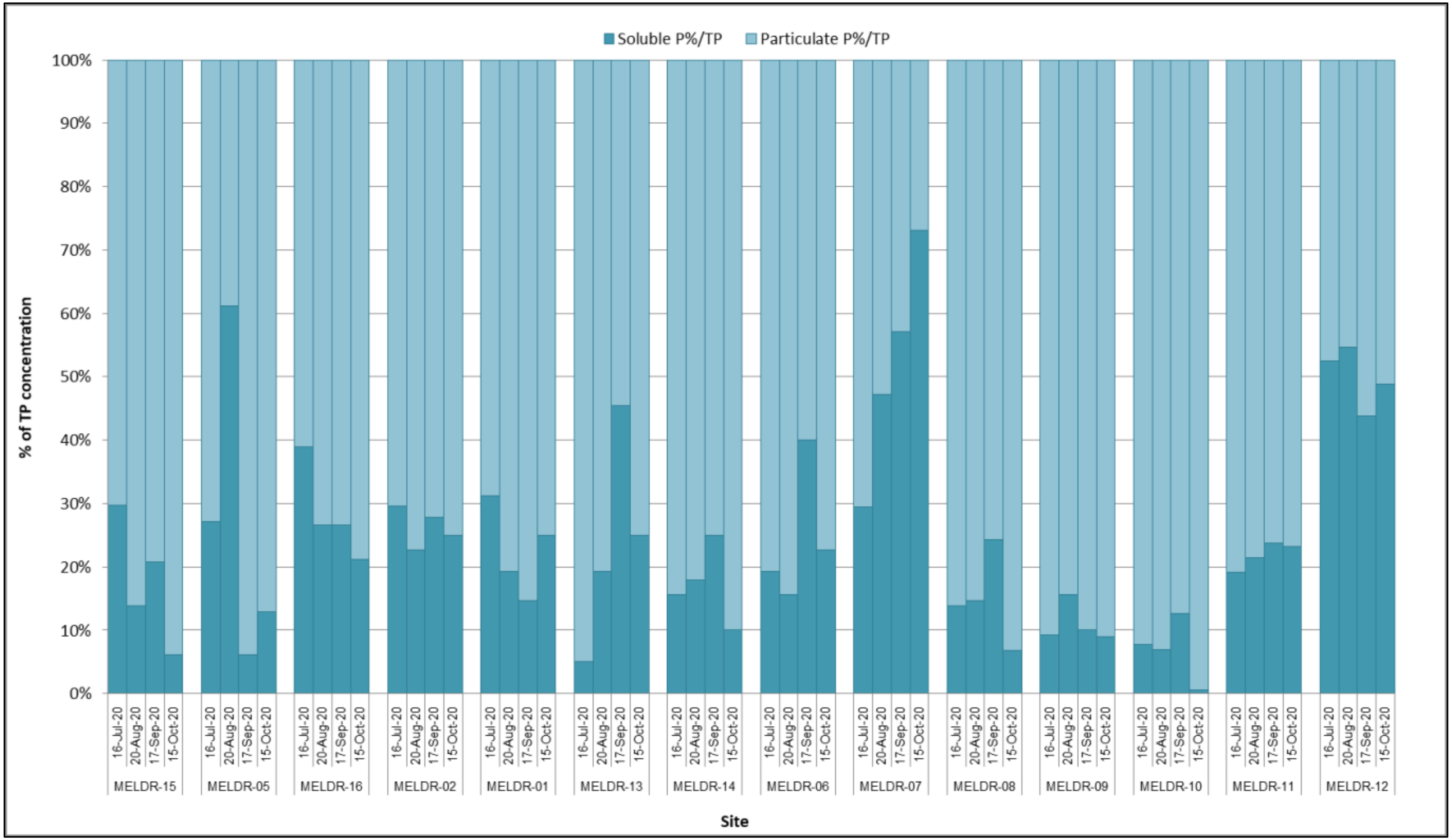

Figure 6-11: Phosphorous speciation in surface water of the City of Melville catchment sites in 2020.

TP and FRP concentrations recorded at most sites in 2020 are generally similar to those recorded in the preceding 13 years of monitoring, with exceedances of the ANZECC trigger value for wetlands consistently recorded at sites 7 and 12 (Booragoon Lake and Blue Gum Lake respectively) and some exceedances of the ANZECC trigger value for lowland rivers at site 5 (John Creaney Park) (Table G-3). Although in the preceding three sampling years (2017, 2018 and 2019) values recorded for TP and FRP at site 7 had been increasing dramatically since 2017, it appears that (although still recording exceedances) that the values of TP and FRP has seen a significant reduction in concentrations in the samples collected in 2020. FRP also constituted an average of 52% of TP at site 7 similar to the average experienced for the site in years 2012 – 2016, with FRP sporadically being such a high proportion of TP, with an average proportion of 44.4% calculated from preceding samples prior to 2017. Furthermore, while TP concentrations recorded at site 12 still exceeded the ANZECC trigger value on all sampling occasions in 2020, the maximum concentration recorded (0.17 mg/L) is the lowest maximum recorded since September 2012 (0.081 mg/L).

Throughout the 14 year monitoring period, TP and FRP concentrations recorded at drain sites have generally been below the lowland rivers trigger value. Although, TP concentrations are often exceeded at site 5 (John Creaney Park) which may cause local problems in the lake (particularly as high nitrogen is also often recorded here), phosphorus levels are usually low in the most downstream site, site 1 (Bull Creek main drain).

7. Metals

Refer to Table D-14 to Table D-28 in Appendix D for all metal and hardness concentration data collected in the Melville Bull Creek catchments for the 2019 water quality sampling program. Table F-1 in Appendix F outlines potential sources of metals and hardness and the impacts of these parameters on aquatic ecosystems. For all graphs, a value equal to half the LOR was substituted for those occasions where concentrations were recorded as 'below the laboratory limit of reporting' (<LOR) to allow these 'unknown' values to be represented graphically and to differentiate them from those samples that recorded concentrations equal to the LOR.

7.1 Hardness

Total hardness, expressed as calcium carbonate ($CaCO_3$), is the combined concentration of earth-alkali metals, predominantly magnesium (Mg^{2+}) and calcium (Ca^{2+}), and some strontium (Sr^{2+}) in the water. Other metal ions (such as aluminium, iron, zinc and manganese) also contribute to water hardness. The source of this hardness is limestone dissolved by water that is rich in carbon dioxide. Increasing calcium and magnesium in water (hardness) is frequently associated with increases in alkalinity (as calcium and/or magnesium carbonate), and thus, pH (ANZECC and ARMCANZ 2000).

In 2020 water hardness in the surface water of the Melville Bull Creek catchments varied from a minimum of 15 mg/L recorded at site 15 (John Creaney Park inlet) to a maximum of 860 mg/L recorded at site 7 (Booragoon Lake), both recorded in July (Figure 7-1 and Table D-14 in Appendix D). As classified by in the ANZECC guidelines, of the 56 samples collected, nine can be classified as Soft (0 to 59 mg/L), 15 as Moderate hardness (60 to 119 mg/L), 21 as Hard (120 to 179 mg/L), six as Very hard (180 to 240 mg/L) and five as Extremely hard (>240 mg/L).

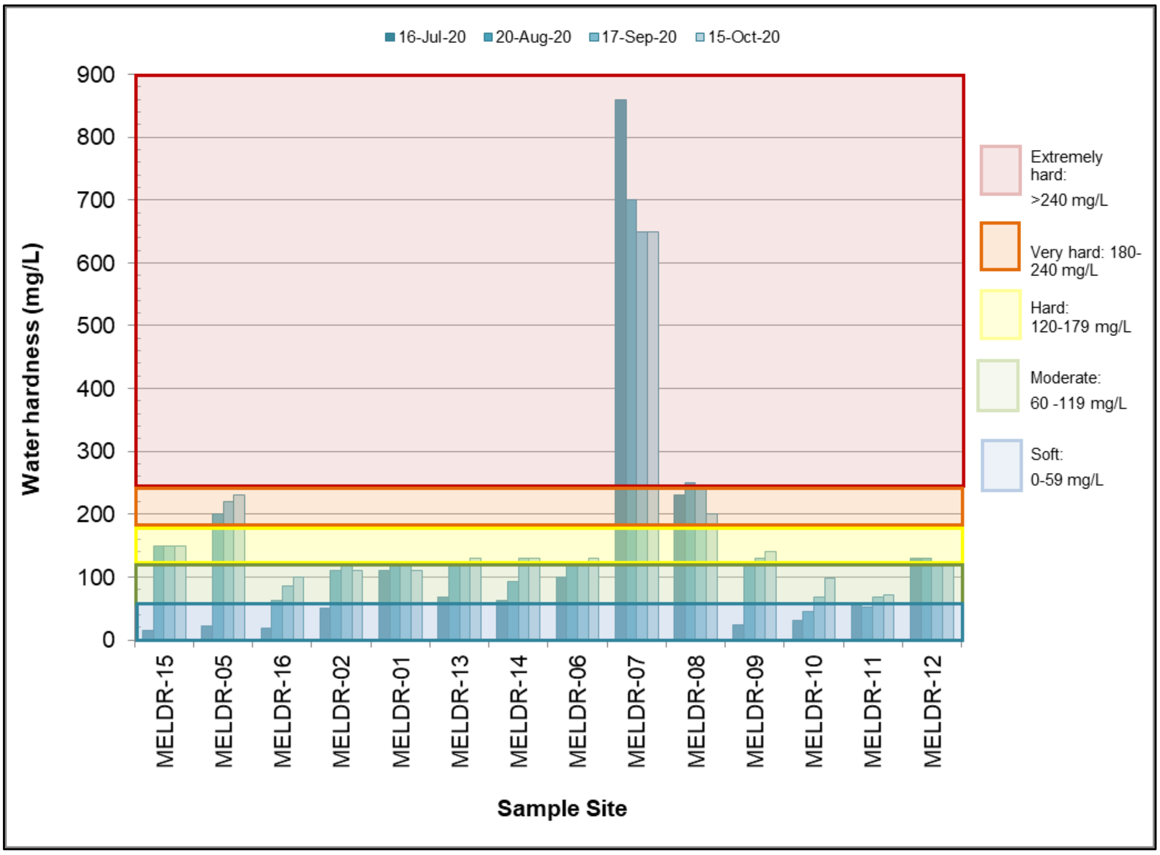

Figure 7-1: Water hardness concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Water hardness values recorded in Melville Bull Creek catchment sites in 2020 are generally similar to those recorded in the preceding 13 years of monitoring (Table G-4). Most sites have usually recorded concentrations classified as Moderate or Hard and have only sporadically recorded concentrations classified as Very hard or Extremely hard. There were more records classified as Soft in July and August of 2020 than what is typically experienced. Site 7 recorded Extremely Hard water on all sampling occasions for 2020 which has not occurred since 2016. Site 12 recorded Hard water on all sampling occasions for 2020 which had not occurred at this site since sampling began in 2007.

7.2 Aluminium

Concentrations of total aluminium were high across the catchment, with 13 out of 14 sites in exceedance of the ANZECC trigger value for 95% level of protection of 0.055 mg/L (and therefore for samples with pH <6.5, the low reliability interim value for freshwater protection of 0.0008 mg/L; Figure 7-2 and Table D-15 in Appendix D). Five out of 14 sites exceeded the NHMRC guideline value for aesthetics (0.2 mg/L).

Thirty six of 56 samples recorded soluble aluminium concentrations3 exceeding the ANZECC trigger value for 95% level of protection (and therefore for samples with pH <6.5, the low reliability interim value for freshwater protection) (Figure 7-3 [A and B] and Table D-16 in Appendix D). The highest concentration of total (0.75 mg/L) and soluble aluminium (0.31 mg/L) were recorded at site 9 (Quenda Lake outlet) in July, and site 15 (John Creaney Park inlet) in August and September, respectively. The lowest total aluminium concentrations (0.047 mg/L) was recorded at site 12 (Blue Gum Lake outlet) in July and the lowest soluble aluminium (0.012 mg/L) at site 7 (Booragoon Lake outlet) in July. Seven out of 56 samples exceeded the NHMRC guideline value for aesthetics (0.2 mg/L).

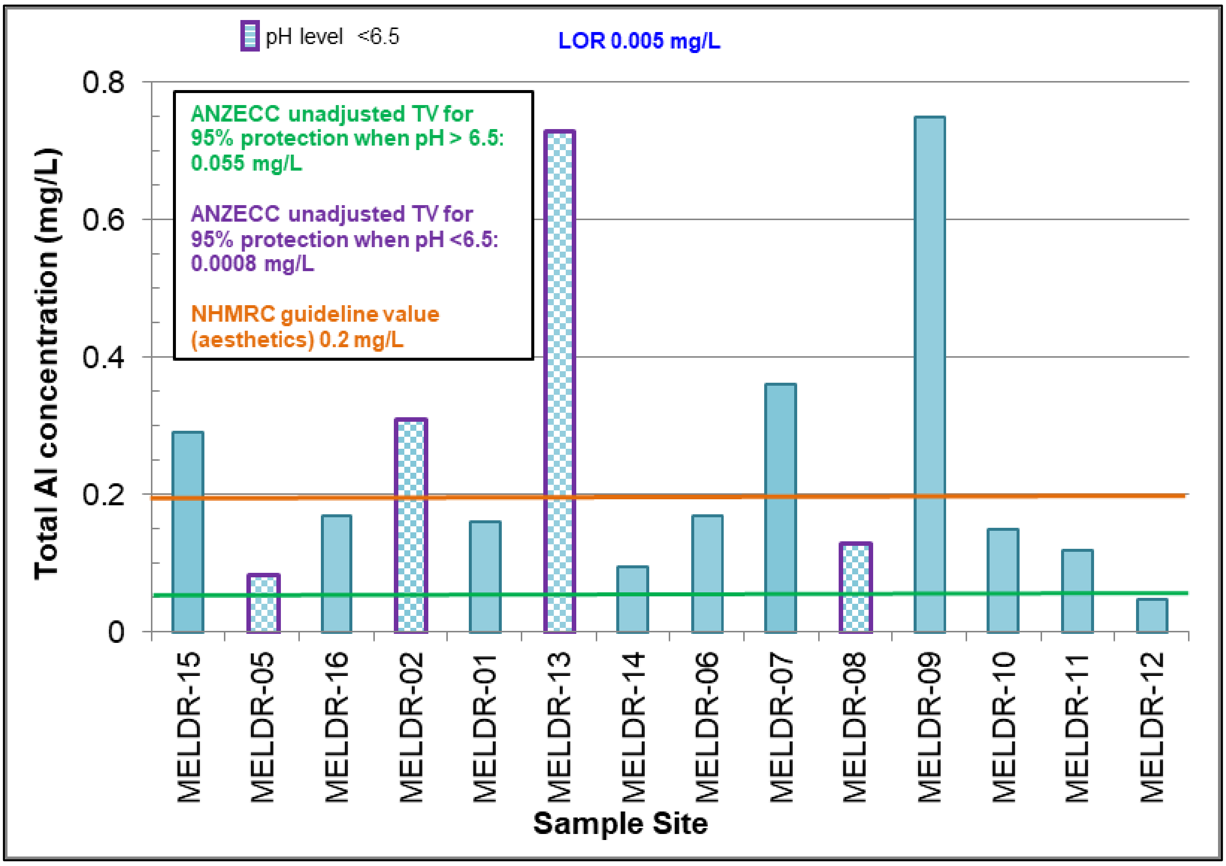

Figure 7-2: Total aluminium (Al) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in July 2020

[3] Analysis of soluble Aluminium concentrations by the laboratory in July 2020 at site 8 returned a soluble concentration that was higher than total concentration for the same sites. As, theoretically, this is not possible, the concentrations for this site has been adjusted so that the soluble concentration equalled the total concentration (with the assumption that the soluble form of Aluminium makes up 100% of the overall Aluminium concentration in that sample at that site).

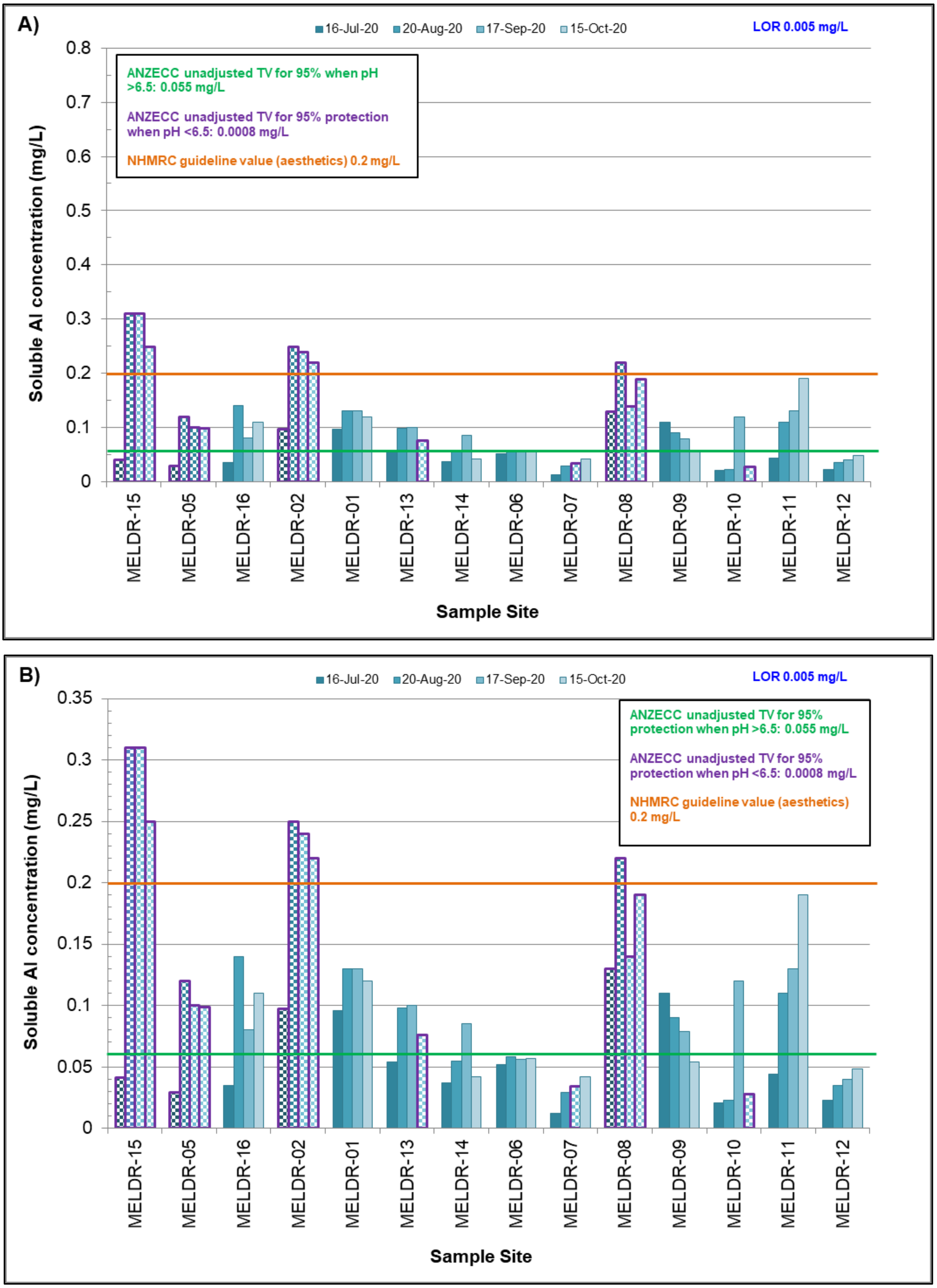

Figure 7-3: A) overview of and B) finer scale of Soluble Aluminium (Al) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Considering that soluble aluminium corresponds to the concentrations available for biological uptake and potential impact on the biota; it is important to highlight that at two of the 14 sampled sites (sites 1 and 8) aluminium was predominantly present as soluble (≥60%) during the July sampling event. At the remaining 12 sites soluble aluminium represented between 3% (at site 7) and 49% (at site 12) of the total.

Total and soluble aluminium concentrations recorded in Melville Bull Creek catchment sites in 2020 are generally similar to those recorded in the preceding 13 years of monitoring (Table G-4). Although, a notable reduction in concentrations is seen at sites 5, 9, 13, 14 and 6 in 2020, similar to concentrations experienced in 2013 - 2015. Soluble concentrations at site 9 have seen a significant reduction from July concentrations compared to October concentrations in the 2019 and 2020 sampling years (similarly to 2015). Soluble aluminium concentrations at site 13 have been relatively lower in 2020 compared to concentrations recorded in 2015 – 2019, similar to that experienced in 2013 and 2014. Sites 14 and 6 in 2020 had relatively low concentrations (similarly to results in 2015) in comparison to concentrations recorded in 2016-2019).

Concentrations of both total and soluble aluminium exceeding the trigger values for protection of biota have generally been recorded at all sites, and sporadically occurs for sites 10 and 11 (Frederick Baldwin and Marmion Reserve, respectively). Total and soluble aluminium concentrations throughout the 14 year sampling period have generally been higher at site 2 (Brockman Park) than site 5 (John Creaney Park), which appears to be due to high inputs from the drainage branch running through Elizabeth Manion Park (and downstream site 16). However, concentrations are then somewhat lower at site 1 (the most downstream Bull Creek main drain site). In the Brentwood drain, total and soluble aluminium concentrations coming from the Brentwood drain site before the living stream (site 13) are greater than those coming from the RAAF drain (site 14). Soluble aluminium concentrations at site 6 (Bateman Park) are generally similar to those at site 13 on previous years but closer to site 14 in 2019 and 2020.

Although the source of aluminium is currently unknown, there is the potential that these aluminium concentrations in water may be due to the natural release of aluminium from sediment. The catchment has a history of high aluminum concentrations in the sediment (Section 8.1). Under the right conditions, this aluminium may be released from the sediment into the water column, and too much aluminium may cause toxicity and negatively impact biota (ANZECC and ARMCANZ 2000).

7.3 Chromium

Total chromium and soluble[4] chromium (where both include Cr^{3+} and Cr^{6+} chromium fractions) concentrations recorded at all (but one) Melville Bull Creek catchment sites were below ANZECC hardness adjusted trigger values for 95% protection of biota (unmodified trigger value for chromium: 0.0033 mg/L) in 2020 (Figure 7-4 and Figure 7-5, Table D-17 and Table D-18 in Appendix D). Site 9 (Quenda Lake outlet) exceeded the ANZECC hardness adjusted trigger value recording a value of 0.004 mg/L. The trigger value for Cr^{3+}has been selected (and not Cr^{6+}) as in natural water Cr^{3+} is the predominant species present due to a range of factors. The trigger value for chromium is affected by water hardness. Therefore, the modified trigger values shown on the graph vary, dependent on the water hardness concentration recorded at each site (see Table D-17 in Appendix D).

The highest total chromium concentration of 0.0077 mg/L was recorded at site 13 (Brentwood Drain) and the highest soluble chromium concentration of 0.0022 mg/L was recorded at site 15 (John Creaney Park inlet) in September. The lowest total chromium concentration of 0.0005 mg/L was recorded at sites 8 and 11 (Piney Lakes outlet and Marmion Reserve) in July. The lowest soluble chromium concentration of 0.0002 was recorded once in July at site 10 (Frederick Baldwin) and at sites 10 and 11 (Frederick Baldwin and Marmion Reserve, respectively) in August, September and October. No sites recorded values equal to or below the LOR. No total or soluble chromium concentration exceeded the NHMRC recreational guideline value for health (0.05 mg/L).

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[4] Analysis of soluble Chromium concentrations by the laboratory in July 2020 at site 8 returned a soluble concentration that was higher than total concentration for the same sites. As, theoretically, this is not possible, the concentrations for this site has been adjusted so that the soluble concentration equalled the total concentration (with the assumption that the soluble form of Chromium makes up 100% of the overall Chromium concentration in that sample at that site).

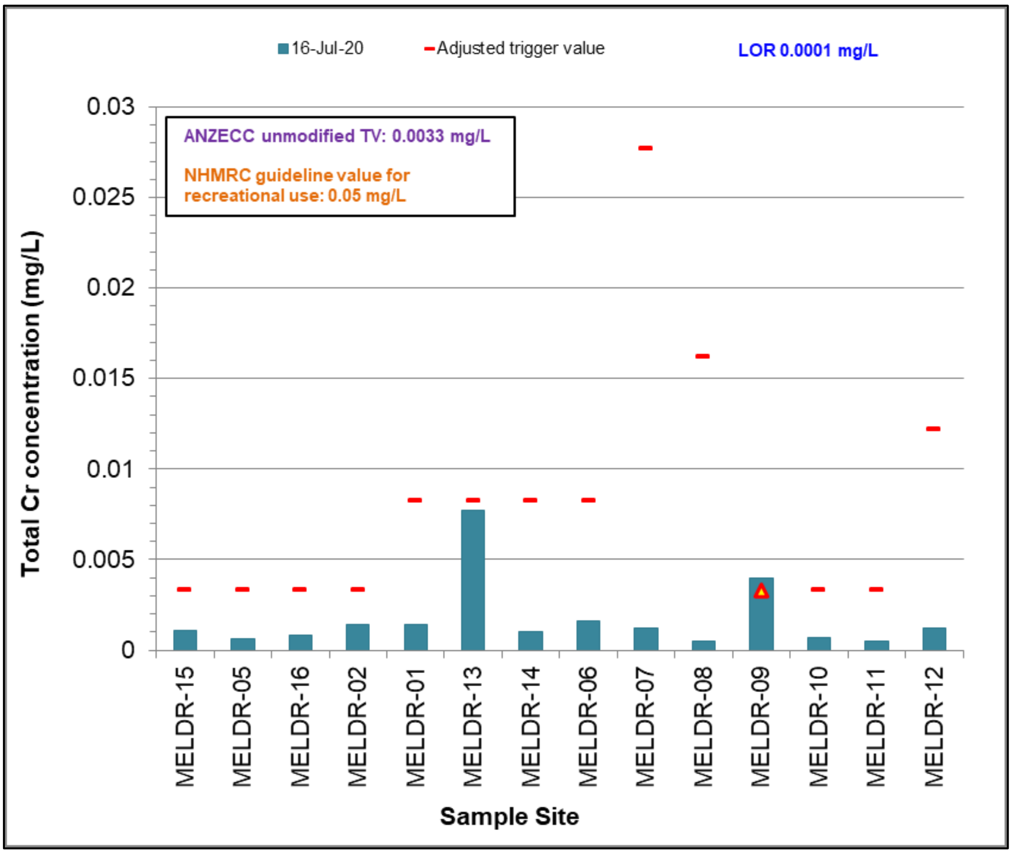


Figure 7-4: Total chromium (Cr) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in July 2020

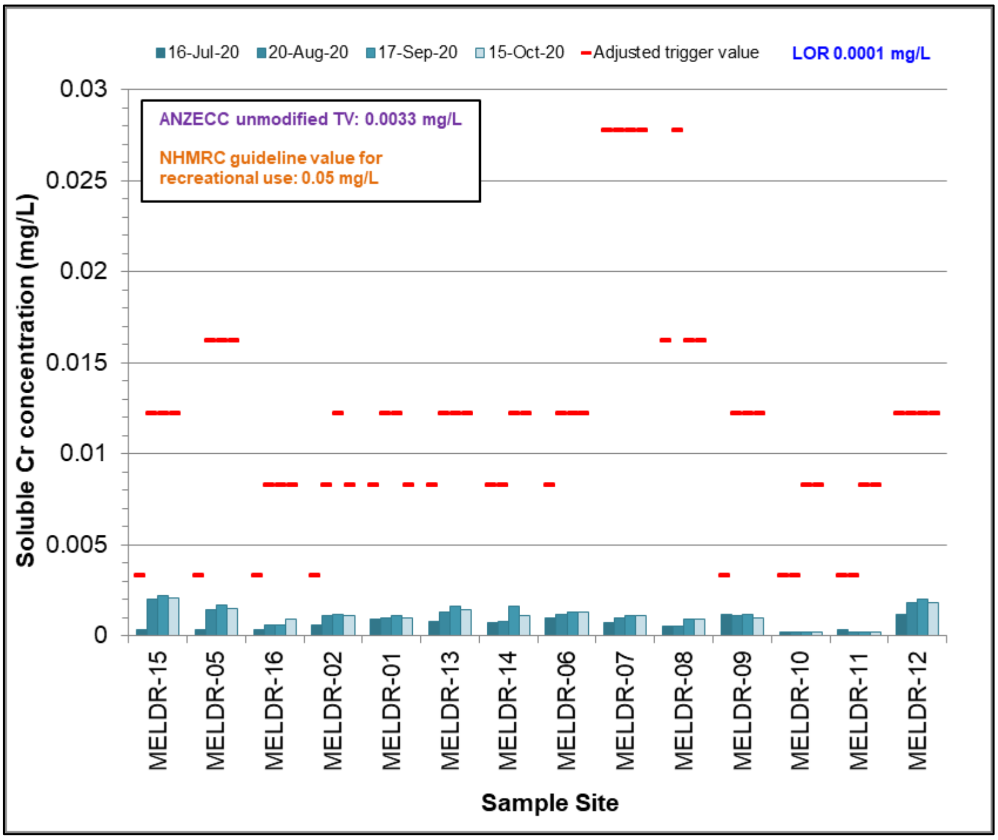


Figure 7-5: Soluble chromium (Cr) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Soluble chromium concentration have always been below adjusted ANZECC trigger values (adjusted in conduction with impacts of water hardness) since sampling of this parameter began in 2009, and total chromium concentrations have experienced exceedances of the adjusted ANZECC trigger values in 2007 twice at site 6 (Bateman Park) and once at site 12 (Blue Gum Lake), in 2008 once at Bateman Park and site 1 (Bull Creek main drain) and site 6 and once at site 9 (Quenda lake outlet) in 2020 (Table G-4).

7.4 Copper

The ANZECC guidelines unmodified trigger value for copper in water for 95% level of protection is 0.0014 mg/L. The 95% protection trigger value for copper is affected by water hardness. Therefore, the modified trigger values shown on the graph vary, dependant on the water hardness concentration recorded at each site. For the details and calculations see Table D-19 and Table D-20 in Appendix D.

Concentrations of total and soluble[5] copper had higher than usual exceedances of the hardness adjusted ANZECC trigger values for 95% protection of biota in 2020, particularly in July. Total copper exceeded the hardness adjusted ANZECC trigger value at eight out of 14 sites (sites 15, 5, 16, 2, 13, 9, 10 and 11), with the highest value (0.031 mg/L) recorded at site 9 (Quenda Lake outlet) and the lowest value (0.0013 mg/L) recorded at site 7 (Booragoon Lake outlet).

Soluble copper exceeded the hardness adjusted ANZECC trigger value at eight out of 14 sites (sites 15, 5, 16, 2, 13, 6, 9 and 10) in July, on one occasion in August (site 10), and one in October (site 16). The highest value recorded was 0.0075 mg/L at site 9 (Quenda Lake outlet) in July 2020, and the lowest value recorded was 0.0003 mg/L at site 2 (Brockman Park) in September (Table D-19 in Appendix D). No total or soluble copper concentration exceeded the NHMRC recreational guideline for aesthetic value (1 mg/L) or health value (2 mg/L) (Figure 7-6 and Figure 7-7 and Table D-20 in Appendix D).

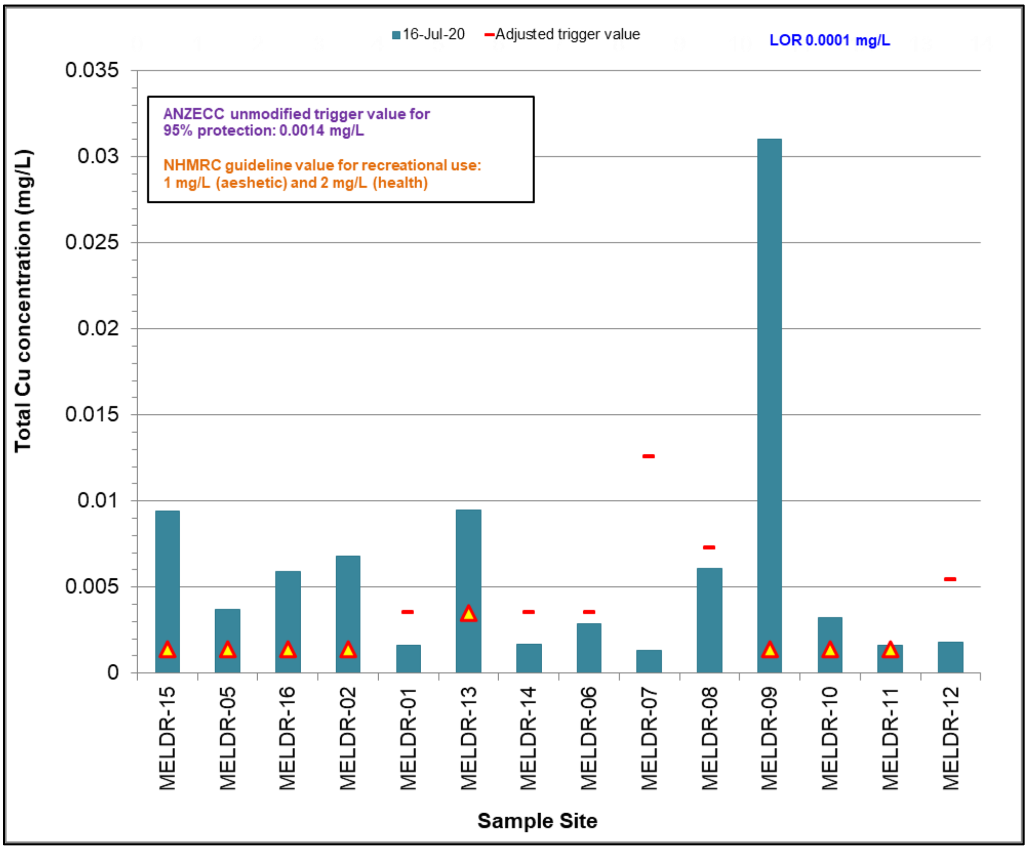


Figure 7-6: Total copper (Cu) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

[5] Analysis of soluble Copper concentrations by the laboratory in July 2020 at site 1 returned a soluble concentration that was higher than total concentration for the same sites. As, theoretically this is not possible, the concentrations for this site has been adjusted so that the soluble concentration equalled the total concentration (with the assumption that the soluble form of Copper makes up 100% of the overall Copper concentration in that sample at that site).

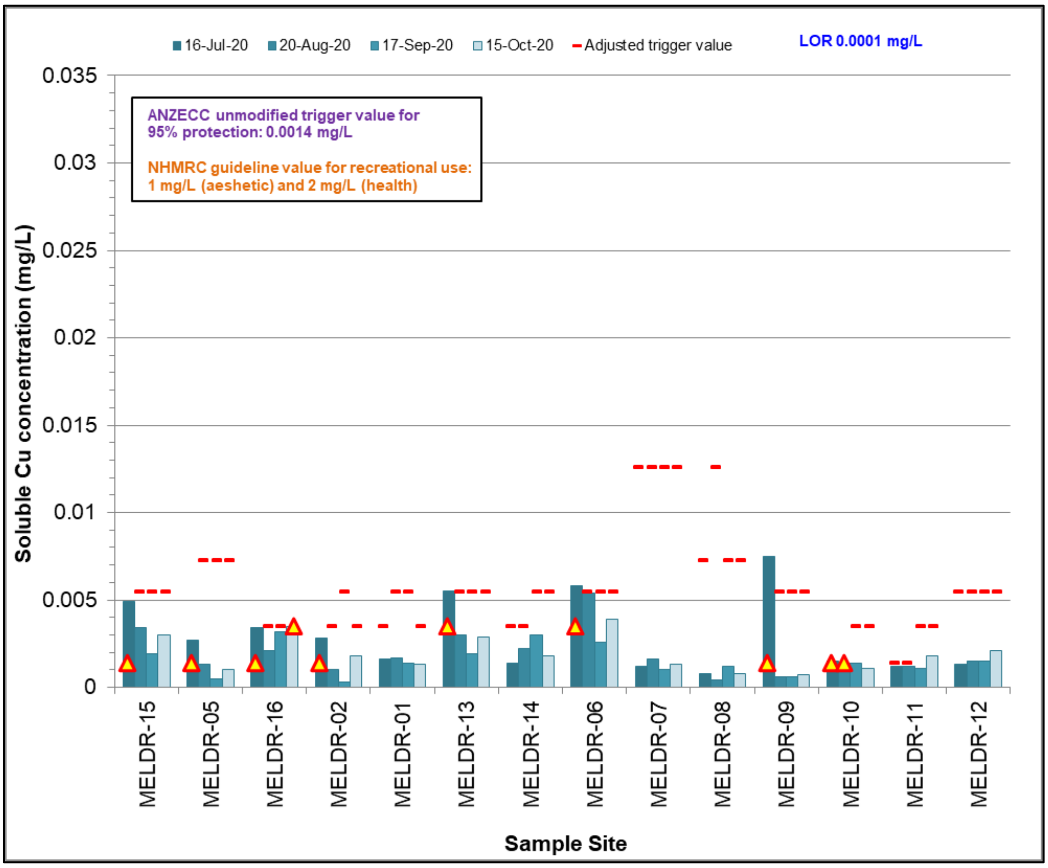


Figure 7-7: Soluble copper (Cu) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Total and soluble copper concentrations recorded in Melville Bull Creek catchment sites in 2020 had an unusually high proportion of exceedances (particularly in July) compared to values recorded in the preceding 13 years of monitoring (Table G-5). All sites along the branch upstream and including the Bull Creek main drain sites (15, 5, 16 and 2) for total and soluble copper all experienced exceedances. Concentrations coming from the site 15 (John Creaney Park inlet) appear to be higher than concentrations of copper coming from the site 16 (downstream Elizabeth Manion Park) branch. The most western branch flowing into the Canning River (sites 10, 13 and 6) also experienced exceedances of soluble copper during July. Although copper concentrations at site 10 (Frederick Baldwin) are similar to those recorded at other wetland sites, this site has recorded the greatest number of exceedances of total and soluble copper of any site, which is partially a consequence of the relatively soft water found at the site. Site 16 (Downstream Elizabeth Park) had recorded 57% and 53% of concentrations (total and soluble respectively) above adjusted trigger value of its seven year sampling period.

7.5 Iron

Eleven out of 14 Melville Bull Creek catchment sites recorded total iron concentrations exceeding the ANZECC interim guideline value for iron (0.3 mg/L) in 2020 (Figure 7-8 and Table D-21 in Appendix D) and 35 of 56 samples from all sites recorded soluble iron concentrations exceeding the interim guideline value for iron (Figure 7-9 [A and B] and Table D-22 in Appendix D). The highest total and soluble iron concentration (5 mg/L and 14 mg/L) were recorded at site 13 (Brentwood Drain) and site 5 (John Creaney Park) in July and August, respectively. The lowest total iron concentration (0.084 mg/L) and the lowest soluble iron concentration (0.033 mg/L) were recorded at site 8 (Piney Lakes outlet) and site 16 (downstream Elizabeth Manion Park) in July. Eleven total iron concentrations and 35 soluble iron concentrations also exceeded the NHMRC recreational guideline for aesthetic value (0.3 mg/L).

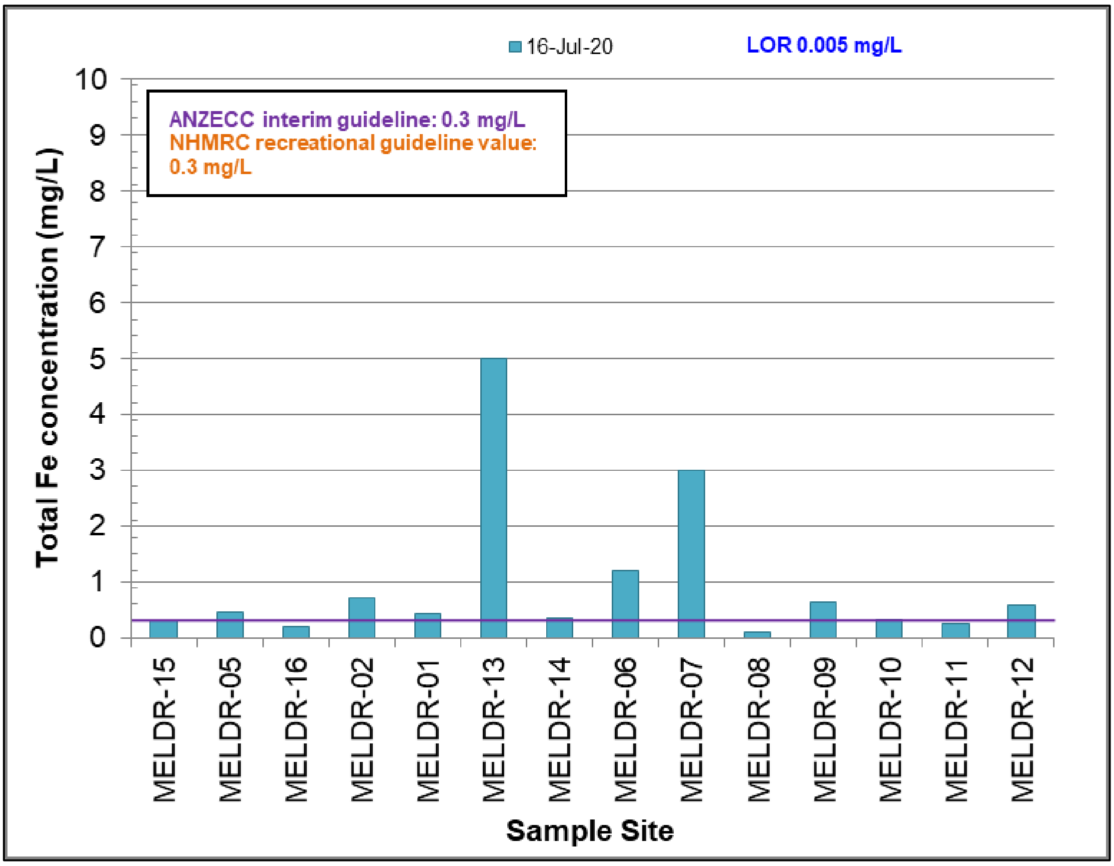
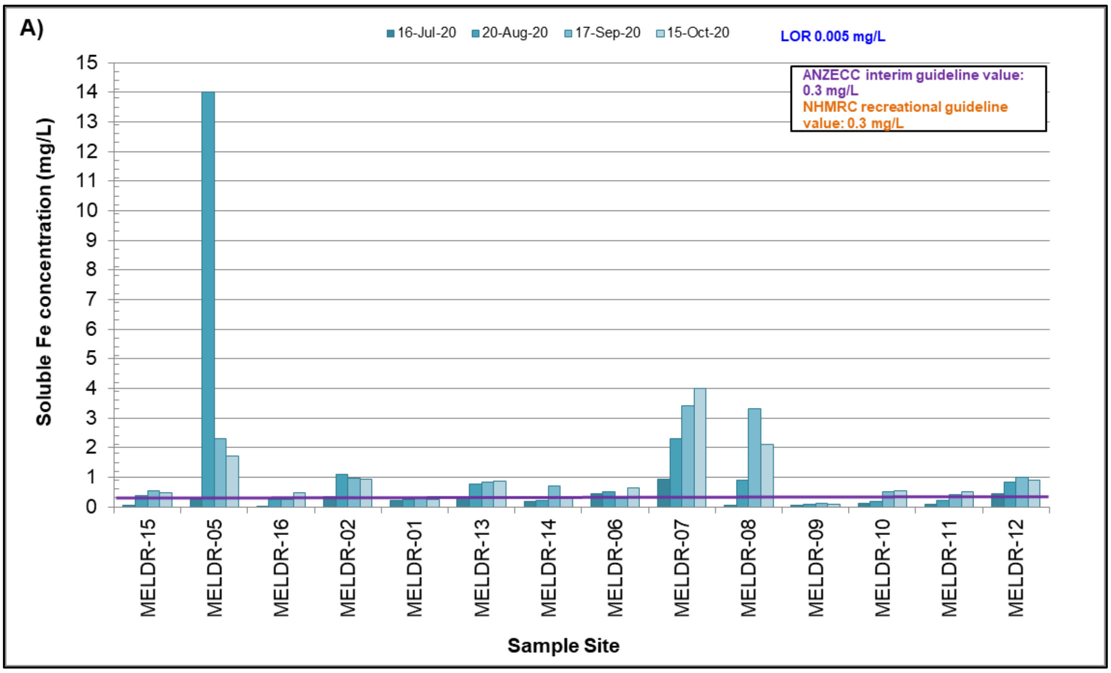


Figure 7-8: Total iron (Fe) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020



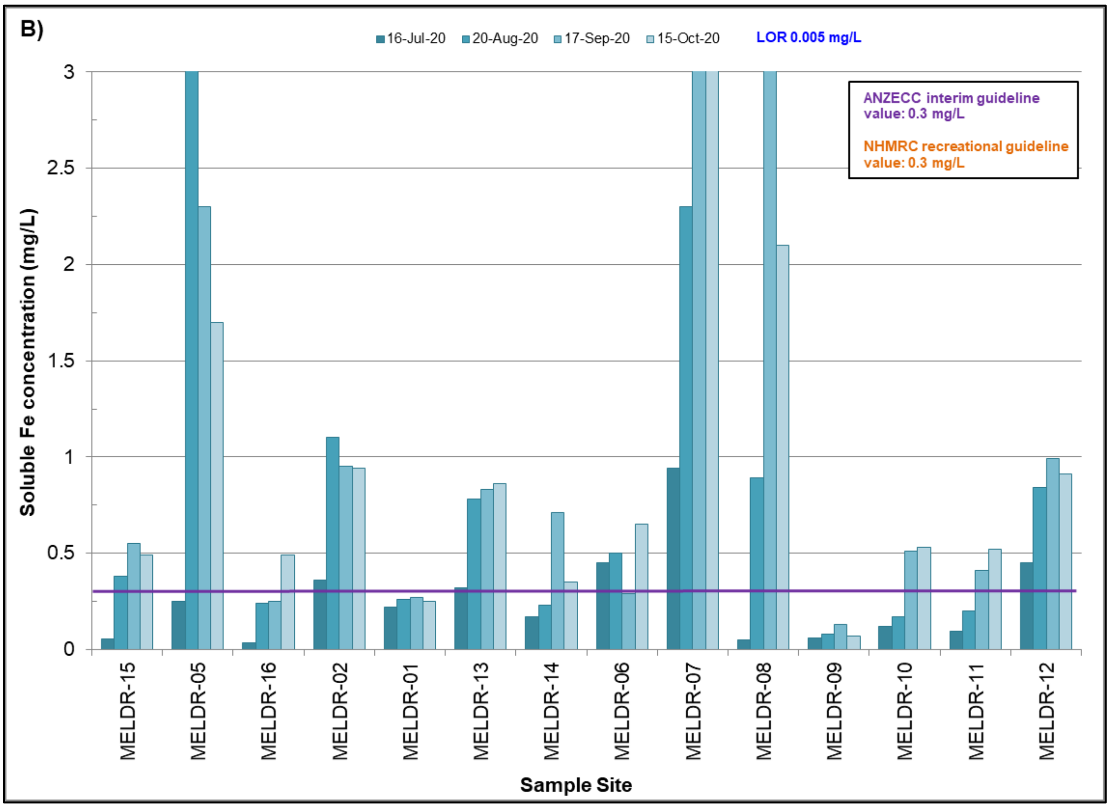


Figure 7-9: A) overview of and B) finer detail of soluble iron (Fe) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Total and soluble iron concentrations recorded in Melville Bull Creek catchment sites in 2020 are similar to those recorded in the preceding 13 years of monitoring (Table G-5). Notably though, total iron concentrations at site 7 have experienced fluctuations, where fluctuations have become less dramatic since November 2010. Throughout the 14 year monitoring period, total iron concentrations have always exceeded the interim trigger value at all Melville Bull Creek catchment sites 2, 1, 13, 14, 6, 7 and 12. This sampling year is the first time since sampling began at site 8 (Piney Lakes outlet) that this site recorded a value within the acceptable range for the interim value for total iron and soluble iron (0.084 mg/L and 0.05 mg/L, respectively). Soluble iron concentrations have also often exceeded the interim trigger value at all sites except 10 and 11 (Frederick Baldwin and Marmion Reserve); however, in recent years exceedances have been more common at site 10. Total and soluble iron concentrations are generally highest at sites 15, 13, 6, 7 and 12 (John Creaney Park, John Creaney Park inlet, Brentwood Drain, Bateman Park, Booragoon Lake and Blue Gum Lake).

Total and soluble iron concentrations appear to reduce as water moves through the Bull Creek Main Drain, with soluble iron concentration generally only slightly greater than the interim value at site 1 (the most downstream Bull Creek main drain site). In the Brentwood drain, total and soluble iron concentrations coming from the Brentwood drain site before the living stream (site 13) are generally greater than those coming from site 14 (the Mandala Crescent branch/RAAF drain), with total and soluble iron concentrations at site 6 (Bateman Park) fluctuating between sites 13 and 14 concentration.

7.6 Lead

Two out of 14 samples collected from Melville Bull Creek catchment sites in 2020 recorded total lead concentrations above adjusted ANZECC trigger values for 95% protection of biota (unadjusted trigger value: 0.0034 mg/L) (Figure 7-10 and Figure 7-11 [A and B], Table D-23 and Table D-24 in Appendix D). All sampled collected from the Melville Bull Creek catchment sites in 2020 recorded soluble lead concentrations below the adjusted ANZECC trigger values for 95% protection of biota (unadjusted trigger value: 0.0034 mg/L). The highest total lead concentration (0.0075 mg/L) was recorded at site 10 (Frederick Baldwin) in July and the highest soluble lead concentration (0.013 mg/L) was recorded at site 12 (Blue Gum Lake outlet) in October. The lowest total lead concentration of 0.0006 mg/L was recorded at site 6 (Bateman Park) in July. Numerous sites recorded soluble lead concentrations equal or less than the LOR (0.0001 mg/L), being site 9 (Quenda Lake outlet; August and October), site 13 (Brentwood drain; September and October) and site 14 (RAAF drain; September). All recorded total and soluble lead concentrations were below the NHMRC recreational guideline for health value (0.01 mg/L).

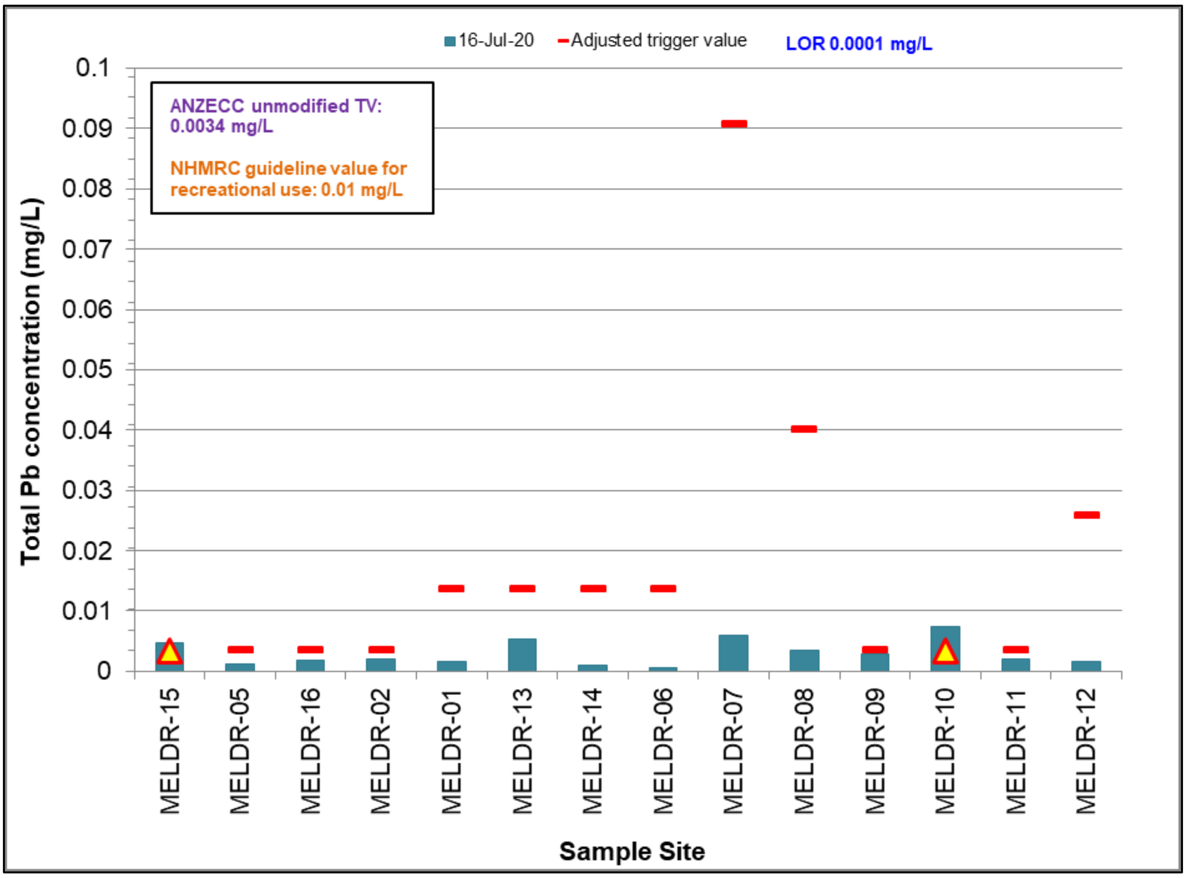


Figure 7-10: Total lead (Pb) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

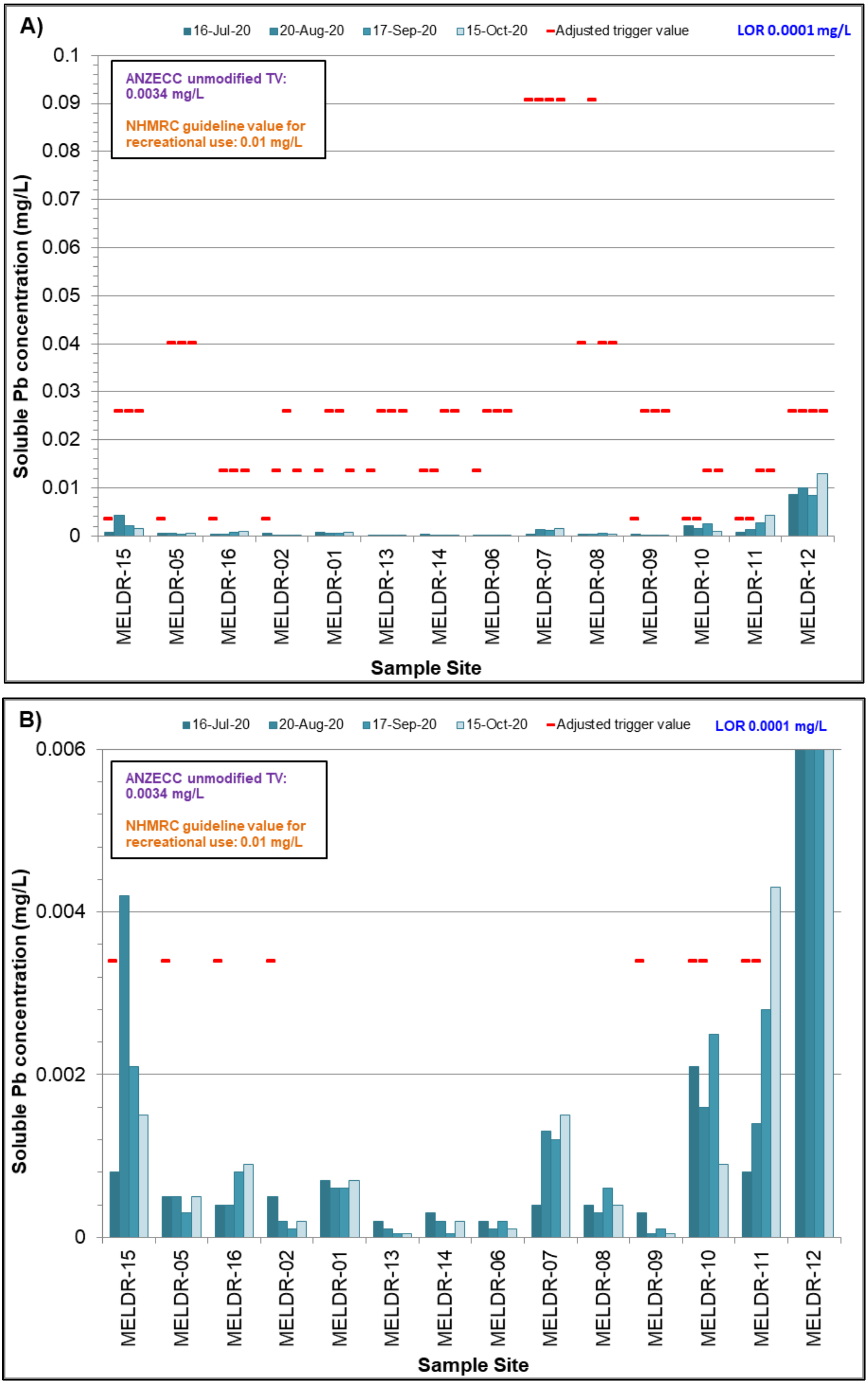


Figure 7-11: A) detailed overview and B) finer scale of soluble lead (Pb) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Total and soluble lead concentrations recorded in Melville Bull Creek catchment sites in 2020 are similar to those recorded in the preceding 13 years of monitoring (Table G-6). Concentrations of total lead exceeding the hardness modified trigger values have sporadically been recorded throughout the 14 year sampling period at sites 5, 10, 11 and 12 (John Creaney Park, Marmion Reserve, Frederick Baldwin and Blue Gum Lake), and again this year at sites 10 in July, and for the first time at site 15 also in July. Concentrations of soluble lead exceeding the hardness modified trigger values have been recorded once at site 10 and twice at site 12 (Frederick Baldwin and Blue Gum Lake) throughout the 14 year sampling period with the highest total and soluble lead concentrations generally recorded at site 12.

7.7 Mercury

Total and soluble mercury concentrations were below the LOR (0.00005 mg/L) and therefore below the ANZECC trigger value for 95% protection of biota (0.0006 mg/L) and the NHMRC recreational guideline health value (0.001 mg/L) at all sites where these parameters was analysed (sites 13, 14, 6, and 7 [Brentwood drain, RAAF drain, Bateman Park and Booragoon Lake]) (Figure 7-12 and Figure 7-13, Table D-25 and Table D-26 in Appendix D).

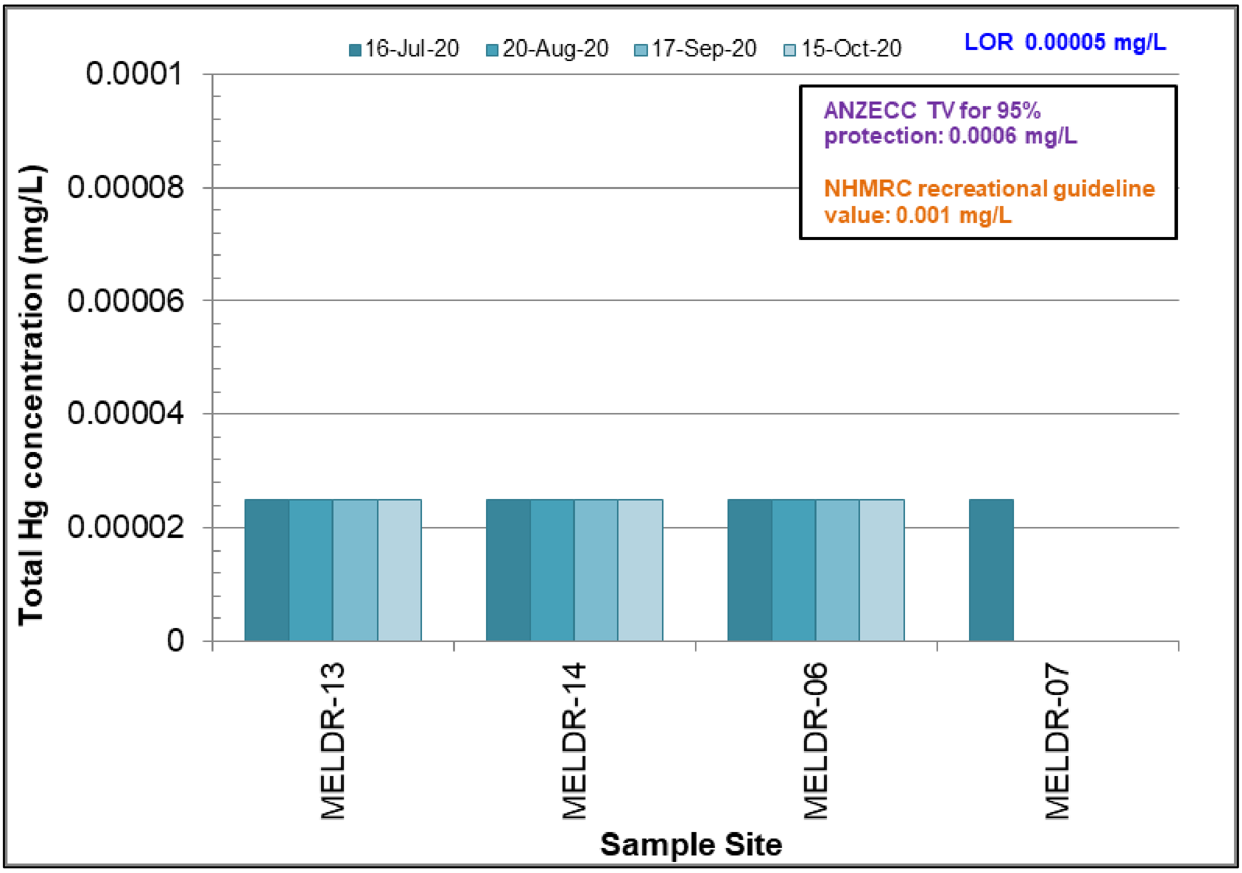


Figure 7-12: Total mercury (Hg) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

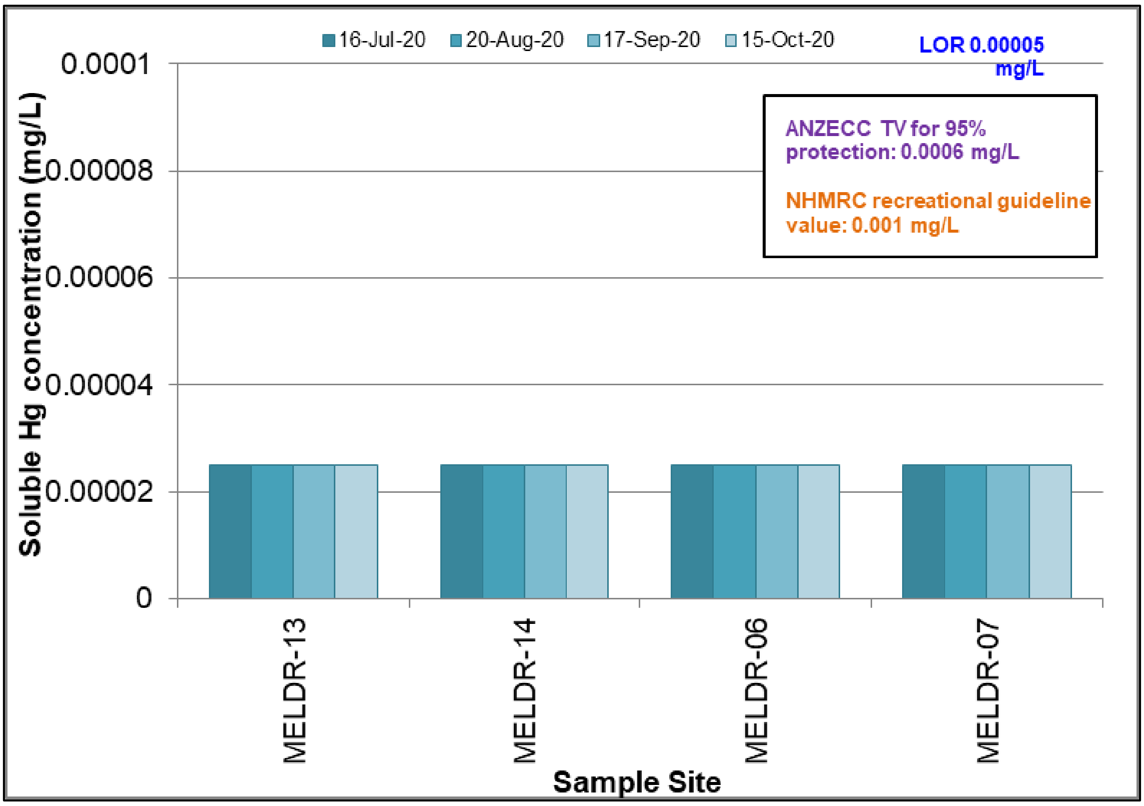


Figure 7-13: Soluble mercury (Hg) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Total and soluble mercury concentrations recorded in sites 15, 16, 13, 14 and 6 (John Creaney Park inlet, downstream Elizabeth Manion Park, Brentwood drain, RAAF drain and Bateman Park) have always been below the trigger value for protection of biota on all occasions at which samples have been taken (Table G-6). In fact, since analysis of mercury began in 2014, concentrations have always been below the used LOR except for total mercury on September 2016 and sites 13 and 14 for total and soluble mercury on July 2017 sampling occasions. Note due to a sample ID error site 8 was analysed in August instead of site 7 in 2019.

7.8 Zinc

Concentrations of total zinc exceeded hardness adjusted ANZECC trigger values for 95% level of protection (unmodified trigger value: 0.008 mg/L) at eight out of 14 Melville Bull Creek catchment sites in July 2020, being sites 15, 5, 16, 2, 13, 9, 10 and 11 (John Creaney Park inlet, John Creaney Park, downstream Elizabeth Manion Park, Brockman Park, Brentwood Drain, Quenda Lake outlet, Frederick Baldwin and Marmion Reserve respectively) (Figure 7-14 and Table D-27 in Appendix D). Seventeen out of 56 samples recorded soluble zinc concentrations[6] exceeding hardness adjusted ANZECC trigger values at the same sites that exceeded total zinc in at least one sampling occasion, with less exceedances occurring in September and October (Figure 7-15 and Table D-28 in Appendix D). The highest total zinc concentrations (0.084 mg/L) in July and soluble zinc (0.14 mg/L) in September were recorded at site 9 (Quenda Lake outlet) and site 15 (John Creaney Park inlet), respectively. Site 11 (Marmion reserve) recorded the lowest total and soluble zinc concentration (0.014 mg/L and 0.002 mg/L) in July and August respectively. No total or soluble zinc concentration exceeded the NHMRC recreational guideline for aesthetic value (3 mg/L).

[6] Analysis of soluble Zinc concentrations by the laboratory in July 2020 at site 1, 14, 6 and 8 returned soluble concentrations that were higher than total concentrations for the same sites. As, theoretically, this is not possible, the concentrations for these sites have been adjusted so that the soluble concentration equalled the total concentration (with the assumption that the soluble form of Zinc makes up 100% of the overall Zinc concentration in that sample at that site).

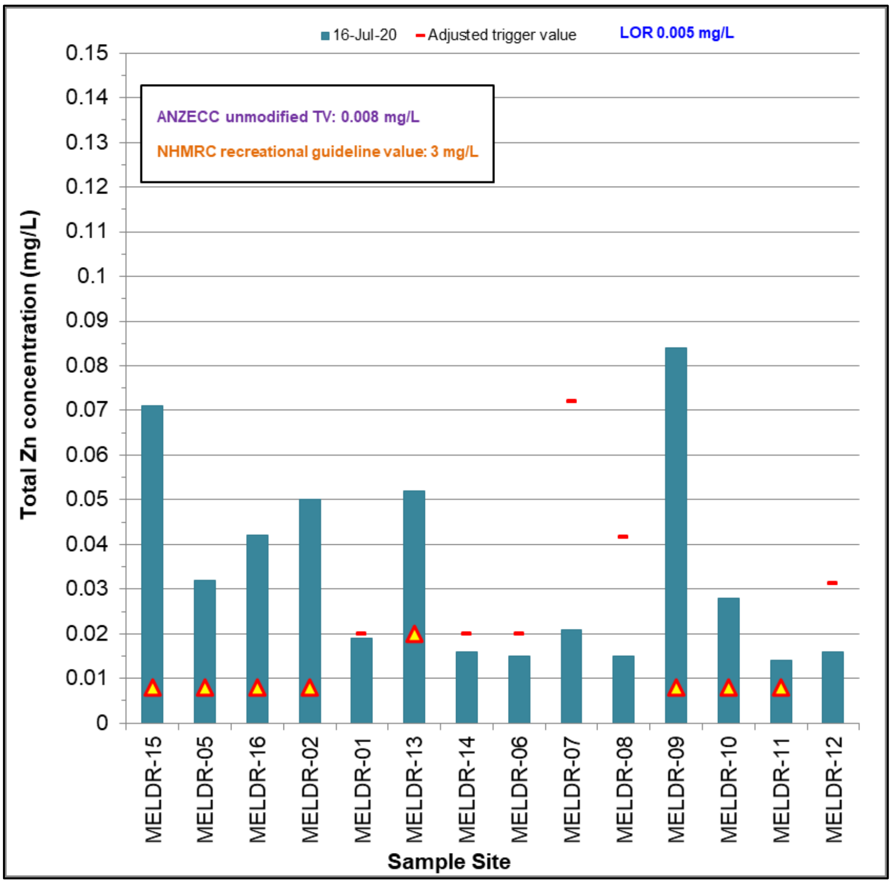


Figure 7-14: Total zinc (Zn) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

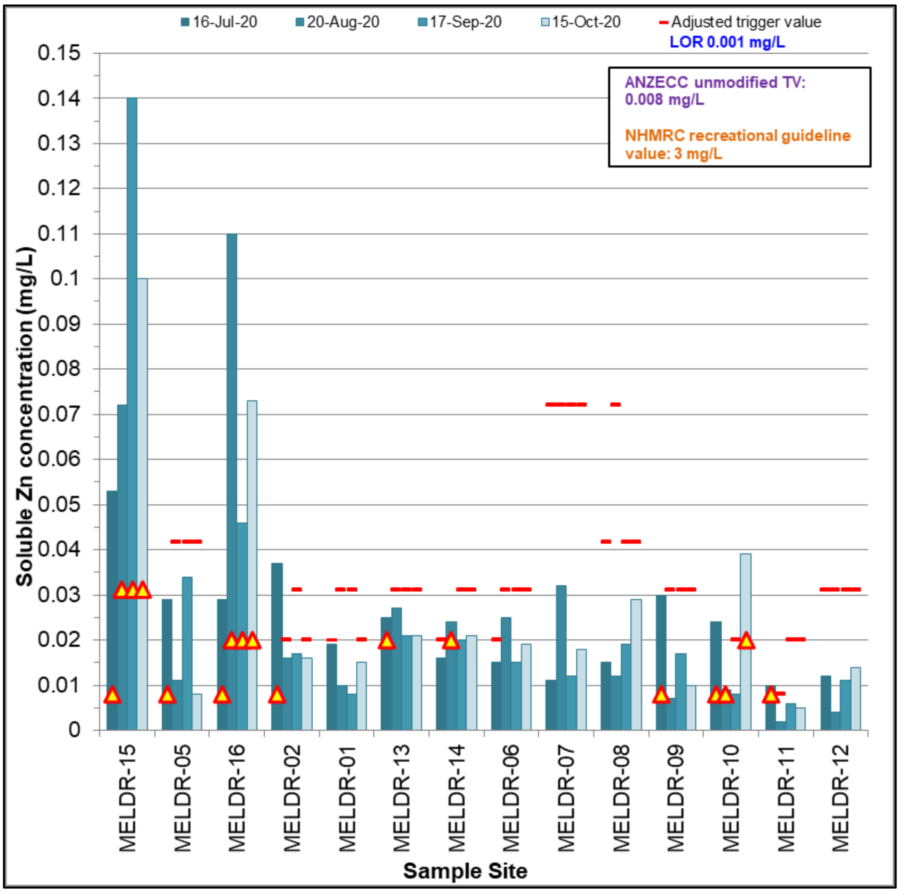


Figure 7-15: Soluble zinc (Zn) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Soluble and total zinc concentrations recorded in 2020 are similar to those recorded in the previous 13 years of monitoring (Table G-6), although more exceedances for both total and soluble zinc have been recorded in 2020 than in the preceding three years (similar to that recorded in 2016). Sites 15 (John Creaney Park inlet) and 16 (downstream Elizabeth Manion Park) on the upstream branches of the Bull Creek main drain have generally recorded total zinc and soluble zinc concentrations exceeding hardness adjusted trigger values, and the highest concentrations in the catchment, since 2014 and 2017 respectively when analysis of these parameters was initiated at these sites. Despite this, concentrations recorded at downstream sites 2 and 1 (Brockman Park and Bull Creek Main Darin respectively) have generally not exceeded trigger values and are significantly lower (excluding the July 2020 sample of site 2). Site 10 (Frederick Baldwin) has also regularly recorded exceedances of total and soluble zinc hardness adjusted trigger values, however concentrations at this site are lower than at sites 15 and 16 and exceedances are partially the result of the softer water recorded at this site (see Section 7.1). Site 9 (Quenda Lake outlet) recorded its first exceedance of soluble zinc in July 2020 since sampling began at this site in 2015.

7.9 Arsenic

Total and soluble7 arsenic concentrations were below the ANZECC trigger value (of 0.024 mg/L for 95% level of protection of biota) (ANZECC and ARMCANZ 2000) and the NHMRC recreational use guideline value for arsenic in water (of 0.007 mg/L for health value) (NHMRC 2008) at site 7 (Booragoon Lake) where this parameter was analysed. The highest soluble arsenic (0.0025 mg/L) was recorded in October (Figure 7-16 and Figure 7-17, Table D-29 and Table D-30 in Appendix D).

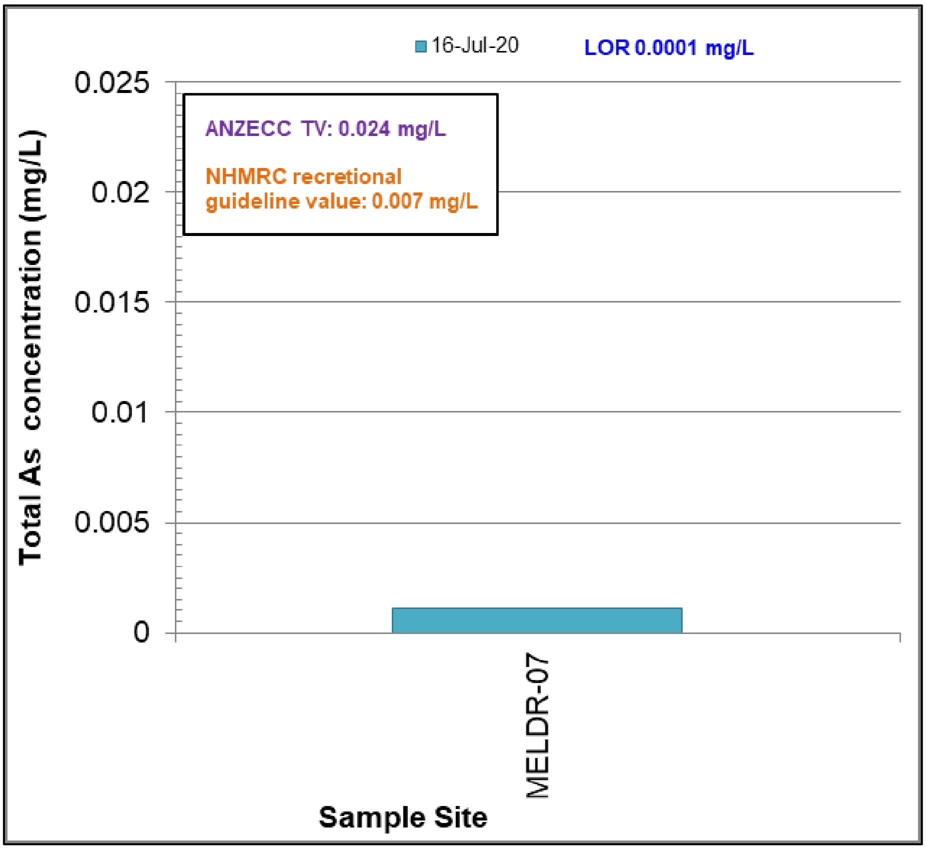


Figure 7-16: Total arsenic (As) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

[7] Analysis of soluble Arsenic concentrations by the laboratory in July 2020 at site 7 returned a soluble concentration that was higher than total concentration for the same sites. As, theoretically, this is not possible, the concentrations for this site has been adjusted so that the soluble concentration equalled the total concentration (with the assumption that the soluble form of Arsenic makes up 100% of the overall Arsenic concentration in that sample at that site).

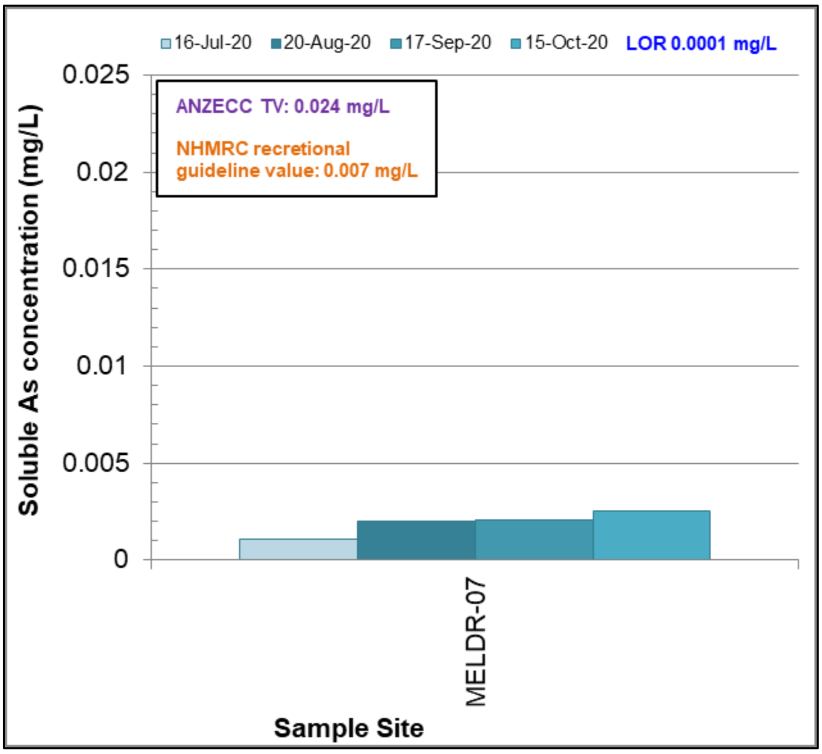


Figure 7-17: Soluble arsenic (As) concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

For previous total arsenic concentrations in the surface water of the Melville Bull Creek catchments between 2007 and 2020 refer to Figure 7-18. It is important to note that a reduction of sites sampled for total arsenic occurred for the 2015 – 2017 sampling seasons (from 14 sites to 2 sites) and again in 2018 where no samples were analysed for total arsenic. Total arsenic has been reintroduced since 2019 for site 7. Exceedances of the 95% protection trigger value have not been recorded at any site in the catchment throughout the 14 years of monitoring. The graph below Figure 7-18 shows the variation in arsenic concentration at site 7 (Booragoon Lake) since analysis of total arsenic began in July 2007; concentrations have been below the LOR (0.001 mg/L) in four occasions in August 2011, October 2012, August and September 2014. To note that samples were not taken at this site between 2015 and 2018.

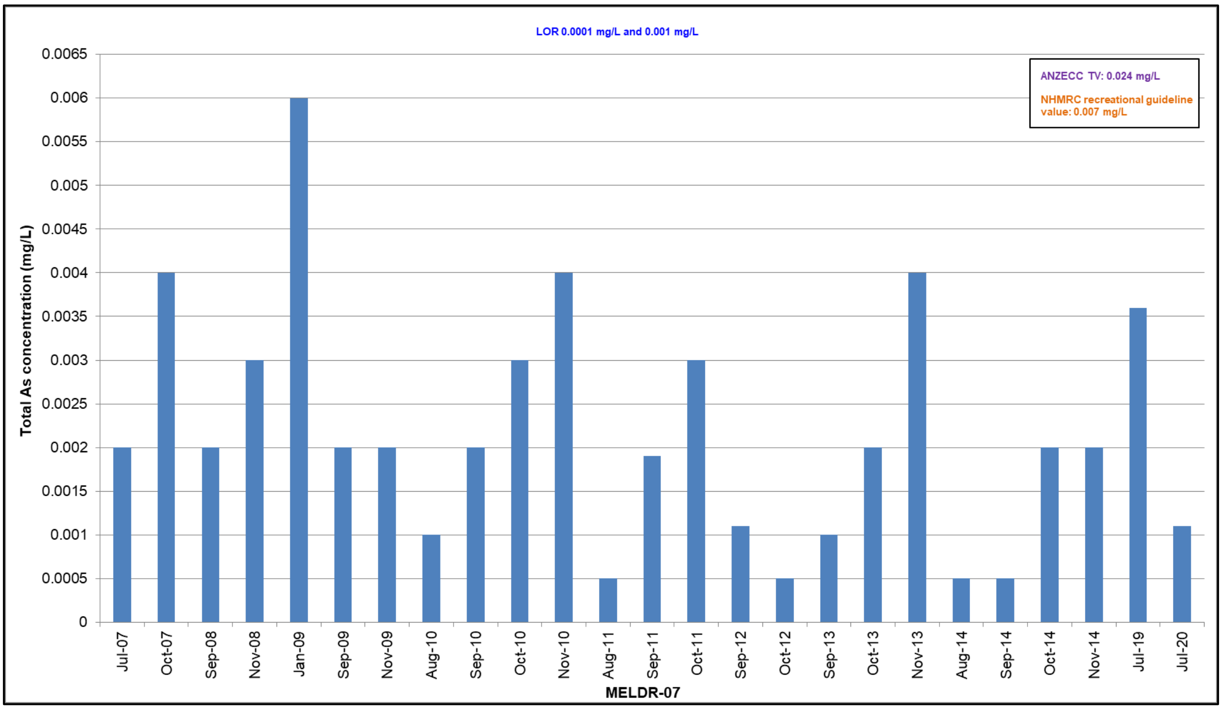


Figure 7-18: Total arsenic (as) concentrations (mg/L) recorded at MELDR-07 from 2007 till 2020

7.10 Nickel

The ANZECC guidelines hardness unmodified trigger values for nickel is 0.011 mg/L for 95% level of freshwater protection and the NHMRC (2008) recreational use guideline (for health) is 0.02 mg/L. Since the trigger values for Nickel are affected by water hardness, the trigger values are variable, dependent on the water hardness concentration recorded at each site. For the details and calculations see Table D-31 and Table D-32 in Appendix D.

Total nickel was only tested at site 7 (Booragoon Lake) in the first sampling event and soluble nickel on four sampling occasions. Concentrations were all below the hardness modified trigger values and the recreational trigger value (Figure 7-19 and Table D-31 and Table D-32 in Appendix D). The highest soluble nickel concentration of 0.0013 mg/L was recorded at site 7 in July.

For previous total nickel concentrations in the surface water of the Melville Bull Creek catchments between 2007 and 2020 please refer to Table G-6. It is important to note that a reduction in sites sampled for total nickel occurred for the 2015 and 2016 sampling year (from 14 sites to just sites 4 and 6). Sampling for total nickel did not occur in any sites between 2017 and 2019. Sampling for soluble nickel has not occurred in the Melville Bull Creek catchment at any of the 14 sites until 2020 where site 7 was analyse for soluble nickel (Figure 7-20 [A and B]). Exceedances of the 95% protection trigger value have not been recorded at any site in the catchment throughout the 14 years of monitoring.

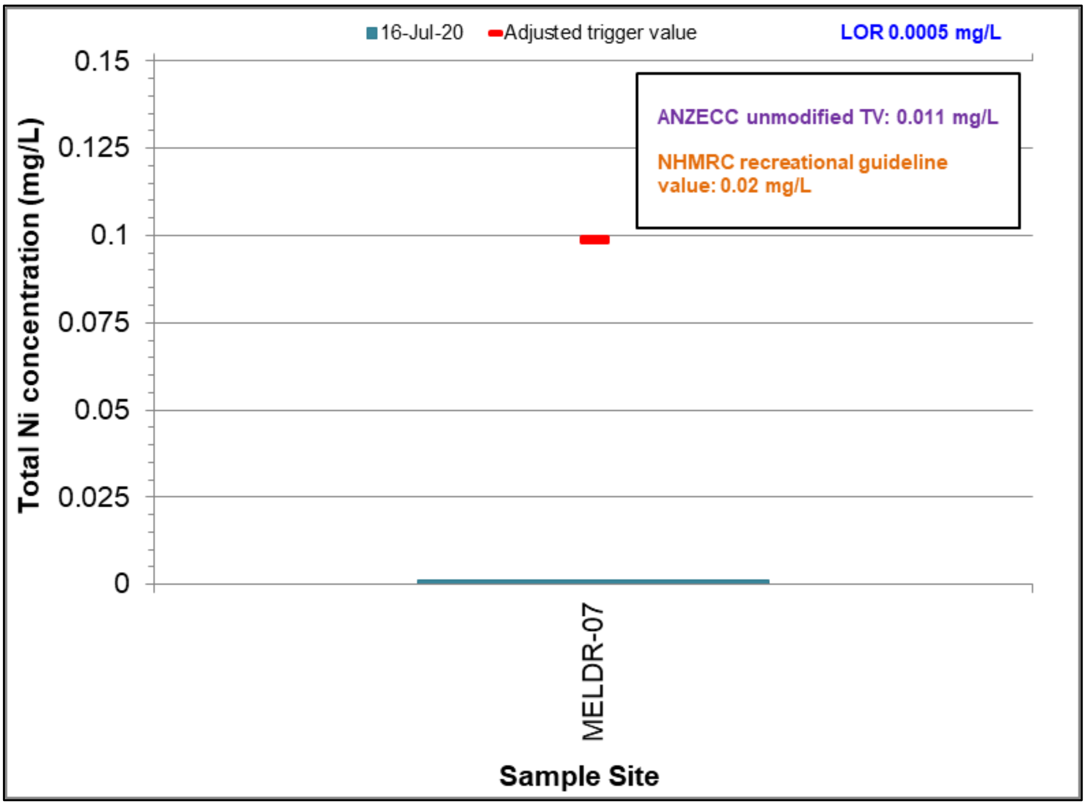


Figure 7-19: Total nickel (Ni) concentrations (mg/L) recorded at site 7 within the Melville Bull Creek catchment in 2020

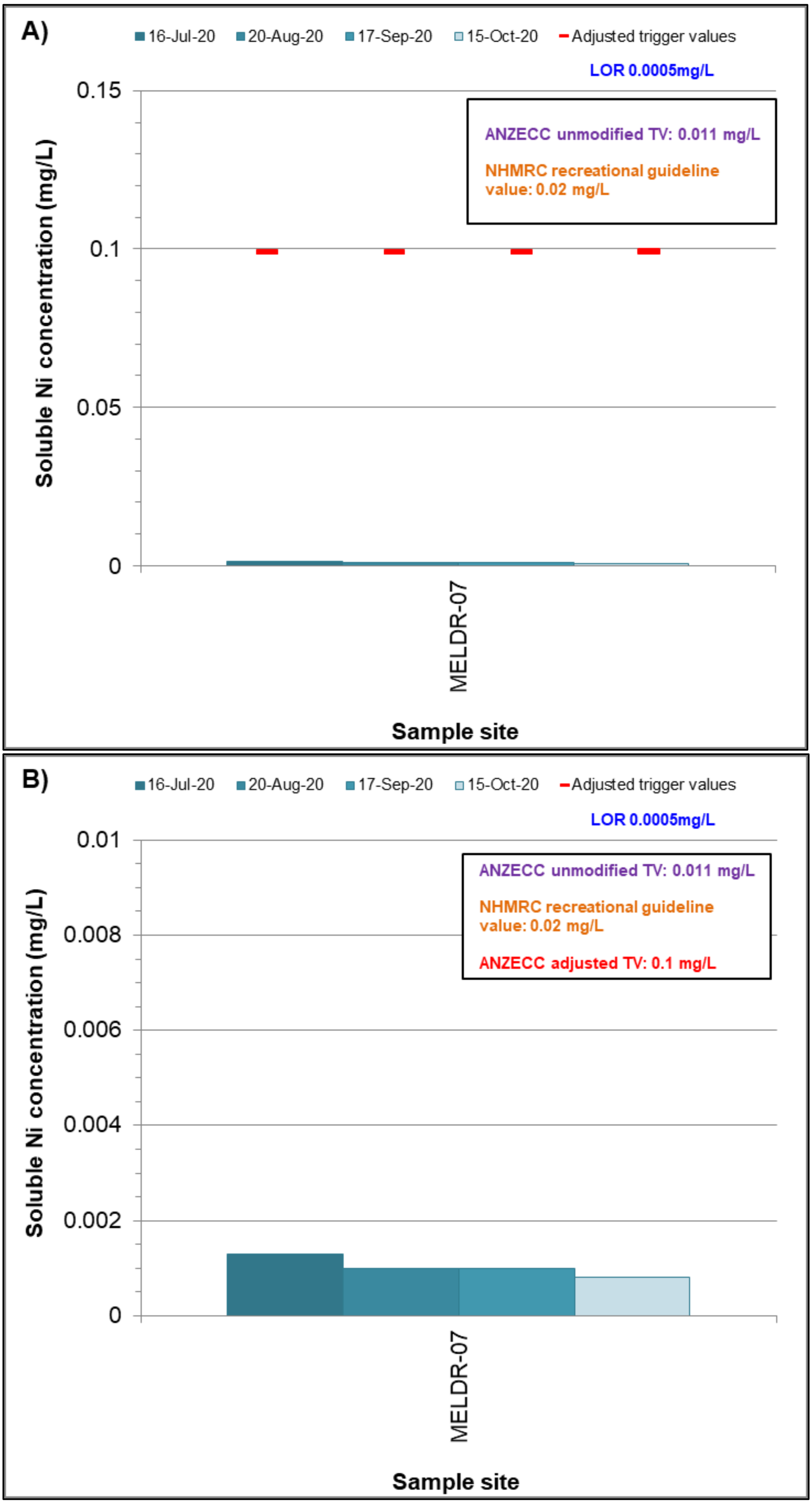


Figure 7-20: A) overview of and B) finer detail of soluble nickel (Ni) concentrations (mg/L) recorded at site 7 in Melville Bull Creek catchment in 2020

8. Metals in sediment

A study of sediments in Bull Creek (Nice 2009) identified sediment concentrations of zinc, mercury, lead and selenium exceeding ANZECC guidelines. Following this, an ecotoxicological investigation by Nice (2011) found that sediment collected in Bull Creek in the vicinity of the Bull Creek Main Drain and the Brentwood Main Drain was toxic to test organisms (mussels [*Mytilus edulis planulatus*], copepods [*Gladioferans imparipes*], amphipods [*Grandidiella japonica*] and pink snapper [*Pagrus auratus*]). This investigation subsequently recommended investigation of disturbance in the Bull Creek catchment. This water and sediment quality assessment will help determine the source of these metals in the catchment.

Refer to Table D-33 to Table D-42 in Appendix D for all sediment total metal concentrations data collected in the Melville Bull Creek catchments in 2020. Potential sources of these metals are outlined in Table F-1 of Appendix F.

For all graphs, a value equal to half the LOR was substituted for those occasions where concentrations were recorded as <LOR which is a standard technique (Helsel 1990) to allow these 'unknown' values to be represented graphically and to differentiate them from concentrations equal to the LOR. Sites that underwent sediment sampling and analysis are outlined in section 2.2.

8.1 Aluminium

No guideline currently exists for aluminium concentrations in sediment; therefore, it is difficult to gauge the severity of any potential impacts arising from the concentrations recorded in the sediment of the Bull Creek catchment. Sediment total aluminium concentrations in 2020 varied across the catchment, with the highest concentration of 11,000 mg/kg recorded at site 5 (John Creaney Park) and the lowest concentration of 527 mg/kg recorded at site 1 (Bull Creek Main Drain) (Figure 8-1 and Table D-33 in Appendix D).

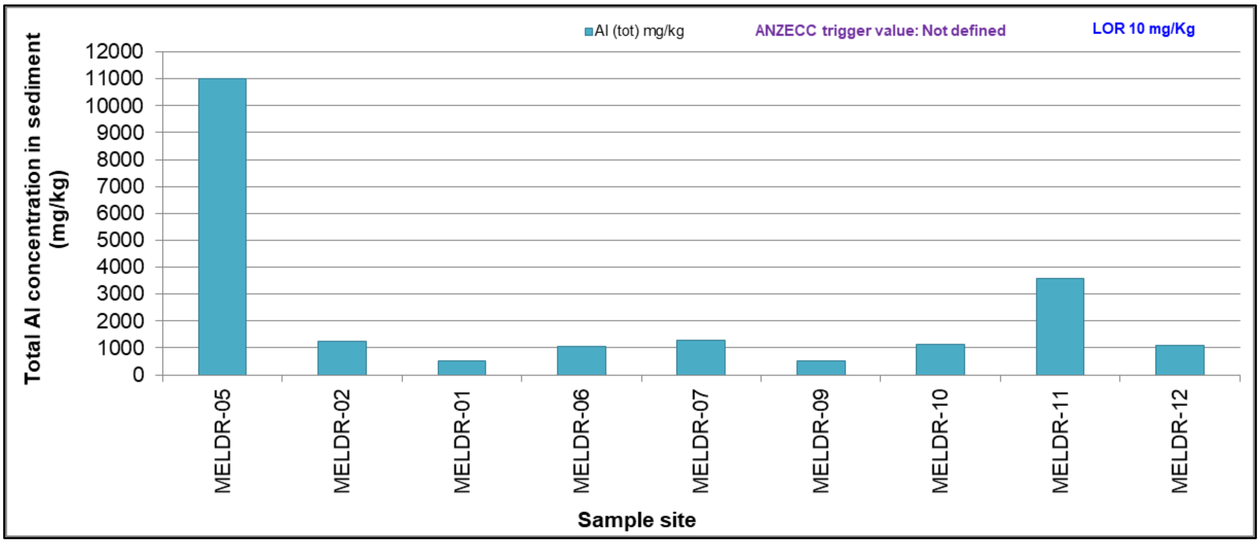


Figure 8-1: Sediment total aluminium concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Total aluminium concentrations have varied greatly in sediment of Melville Bull Creek catchment sites (over the last eight years of monitoring, with no strong patterns evident (Table H-1). It is notable that the very high result (30,000 mg/kg) recorded at site 13 (Brentwood drain) in 2016 is significantly higher than all other recorded concentrations, including those recorded in other years at site 13. Site 7 (Booragoon Lake) has recorded the highest concentration in the catchment on three occasions (2013, 2017, 2019).

8.2 Arsenic

Total arsenic concentrations in sediments in 2020 were all below the ANZECC low (20 mg/kg) and high (70 mg/kg) trigger values (Figure 8-2 and Table D-34 in Appendix D). The highest concentration of 4.3 mg/kg was recorded at site 5 (John Creaney Park), followed by 3.5 mg/kg at site 6 (Bateman Park). Site 9 (Quenda Lake outlet) was the only that recorded a concentration equal to the LOR (0.2 mg/kg).

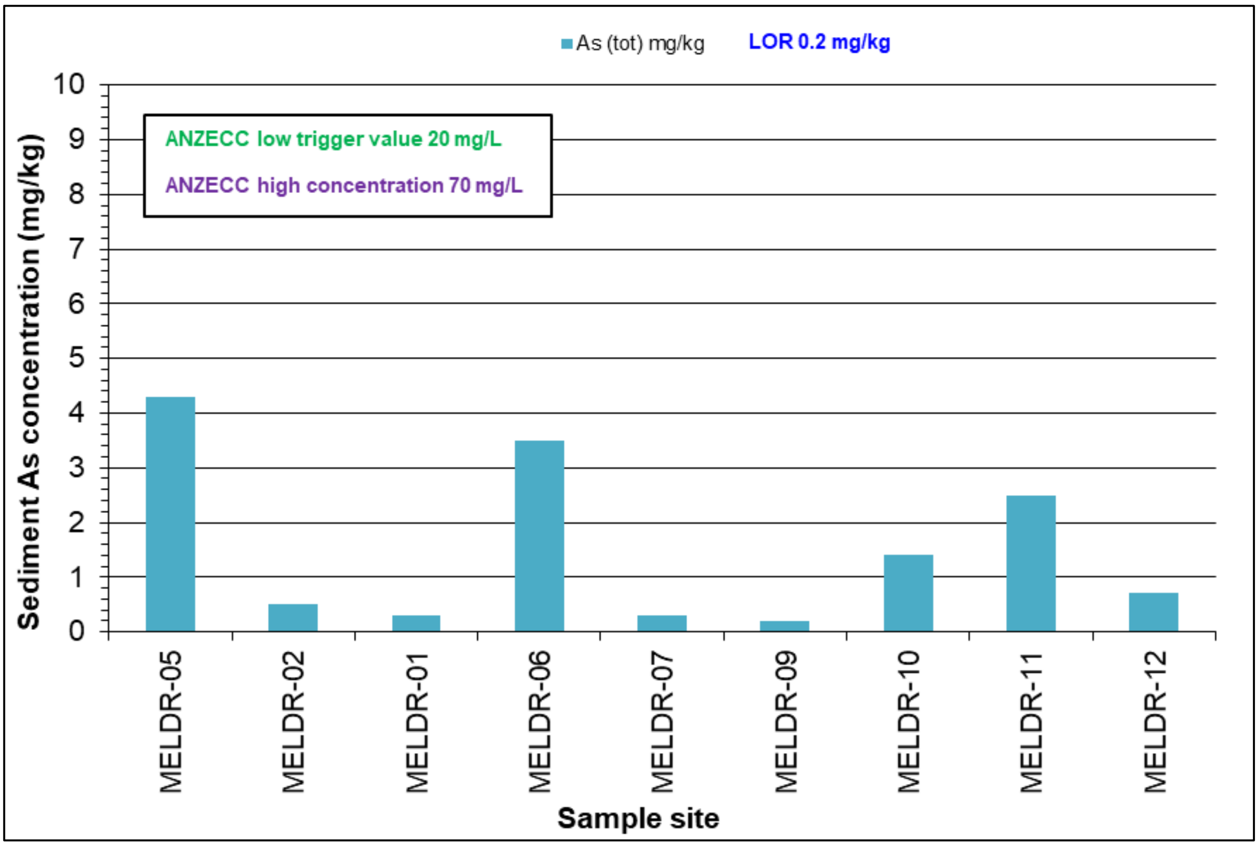


Figure 8-2: Sediment total arsenic concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Total arsenic concentrations in sediment at Melville Bull Creek catchment sites have generally been low throughout the eight years of monitoring (Table H-1). Site 7 (Booragoon Lake outlet) has recorded the highest concentrations in the catchment each year when sediment was collected from this site except 2018 and 2020 when the highest concentration of 4.3 mg/kg and 3.5 mg/kg, respectively, were recorded at site 5 and 6 (John Creaney Park outlet and Bateman Park respectively). Site 7, in 2015, has been the only site to record exceedances of the low trigger value.

8.3 Chromium

Total chromium (including Cr3+ and Cr6+) concentrations in sediment at all Melville Bull Creek catchment sites were below ANZECC low (80 mg/kg) and high (370 mg/kg) trigger values in 2020 (Figure 8-3 and Table D-35 in Appendix D). The highest concentration in the catchment of 29 mg/kg was recorded at site 5 (John Creaney Park) and the lowest concentration of 0.9 mg/kg was recorded at site 1 (Bull Creek Main Drain).

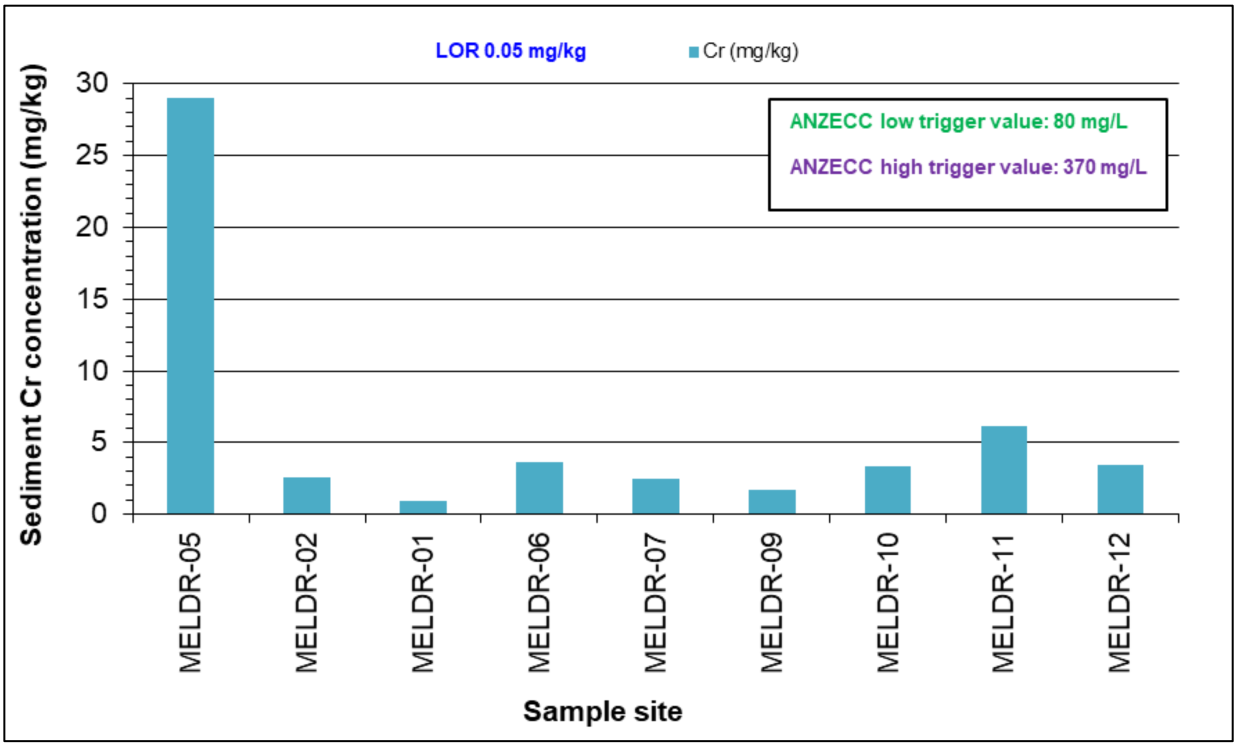


Figure 8-3: Sediment total chromium concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Total chromium concentrations in sediment at Melville Bull Creek catchment sites have been generally low throughout the eight years of monitoring (Table H-1). The concentration of 180 mg/kg recorded at site 13 (Brentwood drain) in 2016 is by far the highest concentration recorded in the catchment over the monitoring period and has been the only sample to exceed the low trigger value. Site 7 (Booragoon Lake outlet) has recorded the highest concentrations in the catchment each year that sediment was collected from this site except 2016 and 2020; however concentrations at this site in 2020 have been the lowest it has been since monitoring began (2.5 mg/kg in 2020, compared to 19 mg/kg, 15 mg/kg and 26 mg/kg in 2019, 2018 and 2017, respectively).

8.4 Copper

Total copper concentrations in sediment collected from all Melville Bull Creek catchment sites in 2020 were below ANZECC low (65 mg/kg) and high (270 mg/kg) trigger values (Figure 8-4 and Figure 8-5, and Table D-36 in Appendix D). The highest concentration in the catchment (61 mg/kg) was recorded at site 5 (John Creaney Park) and site 7 (Booragoon Lake outlet) recorded the lowest concentration (0.5 mg/kg).

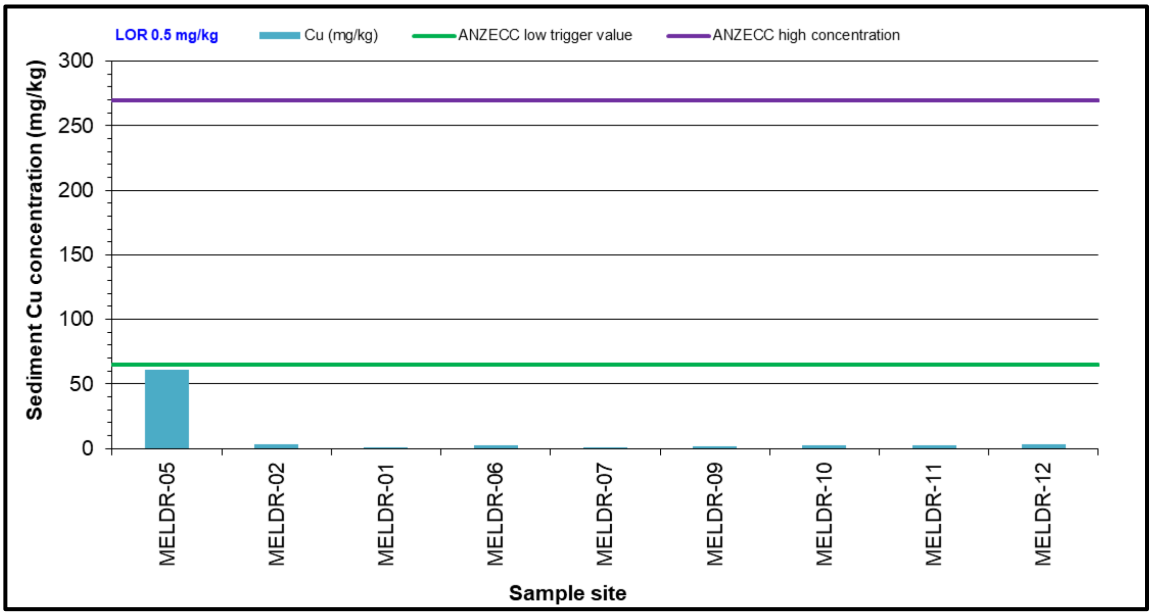


Figure 8-4: Sediment total copper concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

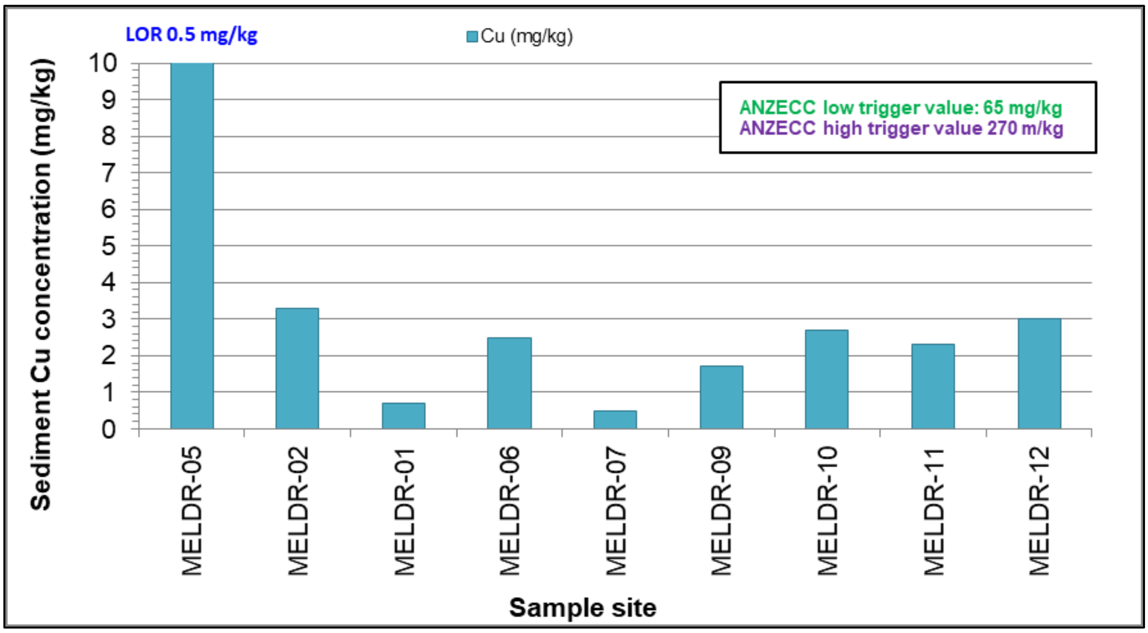


Figure 8-5: Finer scale of total copper (Cu) concentrations (mg/kg) in sediment recorded in Melville Bull Creek catchment sites in 2020

Total copper concentrations in sediment at Melville Bull Creek catchment sites have been generally low in the previous eight years of monitoring (Table H-1). Only three samples (at site 13 [Brentwood drain] and site 10 [Frederick Baldwin] in 2016, and site 7 [Booragoon Lake] in 2015) have recorded exceedances of the low trigger value in the monitoring period. Concentrations in these three samples were significantly higher than other concentrations recorded at these sites over the years.

8.5 Iron

No guideline currently exists for iron concentrations in sediment; therefore, it is difficult to gauge the severity of any potential impact arising from the concentrations recorded in the sediment collected from Melville Bull Creek catchment sites. In 2020 total iron concentrations in sediment were varied (Figure 8-6 and Table D-37 in Appendix D). The highest concentration of 21,000 mg/kg was recorded at site 5 (John Creaney Park) and the lowest concentration of 250 mg/kg was recorded at site 9 (Quenda Lake outlet).

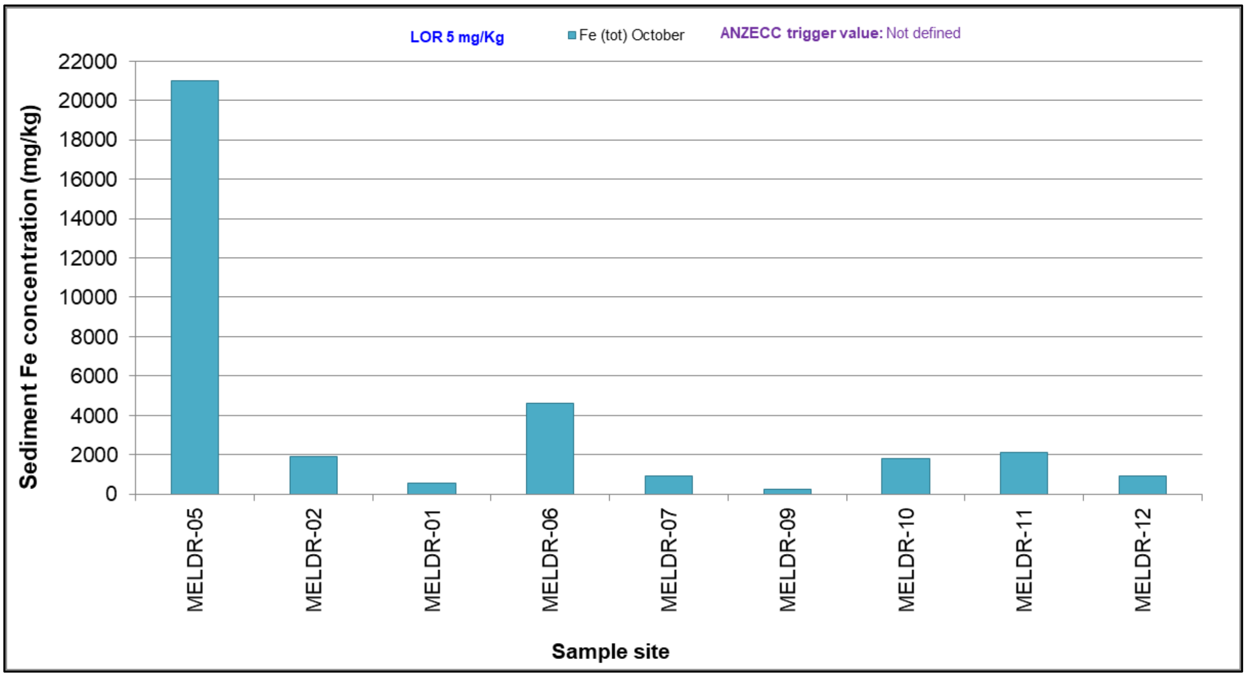


Figure 8-6: Sediment total iron concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Sediment total iron concentrations recorded in 2020 are within the range of those collected in the preceding eight years of monitoring, although concentrations have varied somewhat between years (Table H-2). Site 7 (Booragoon Lake) has generally recorded the highest total iron concentrations in sediment and site 9 (Quenda Lake outlet) has always recorded the lowest concentrations of total iron in sediment. It is notable that the very high results (56,000 and 57,000 mg/kg) recorded at site 1 (the most downstream site in Bull Creek main drain) in 2015 and 2016, respectively, and 54,000 mg/kg in 2016 at site 13 (Brentwood drain) are significantly higher than all other recorded concentrations, including those recorded in other years at those sites. Iron concentrations at site 5 in 2018 and 2020 (24,000 mg/kg and 21,000 mg/kg, respectively) also significantly exceed concentrations recorded throughout the Melville Bull Creek catchment sites.

8.6 Lead

Eight out of nine lead concentrations in sediments collected from Melville Bull Creek catchment sites in 2020 were below the ANZECC low trigger value (50 mg/kg). Site 5 (John Creaney Park) recorded a concentration of 91 mg/kg (Figure 8-7 and Table D-38 in Appendix D). No sample recorded an exceedance of the high trigger value (220 mg/kg). The lowest concentration of 2 mg/kg was recorded at site 7 (Booragoon Lake outlet).

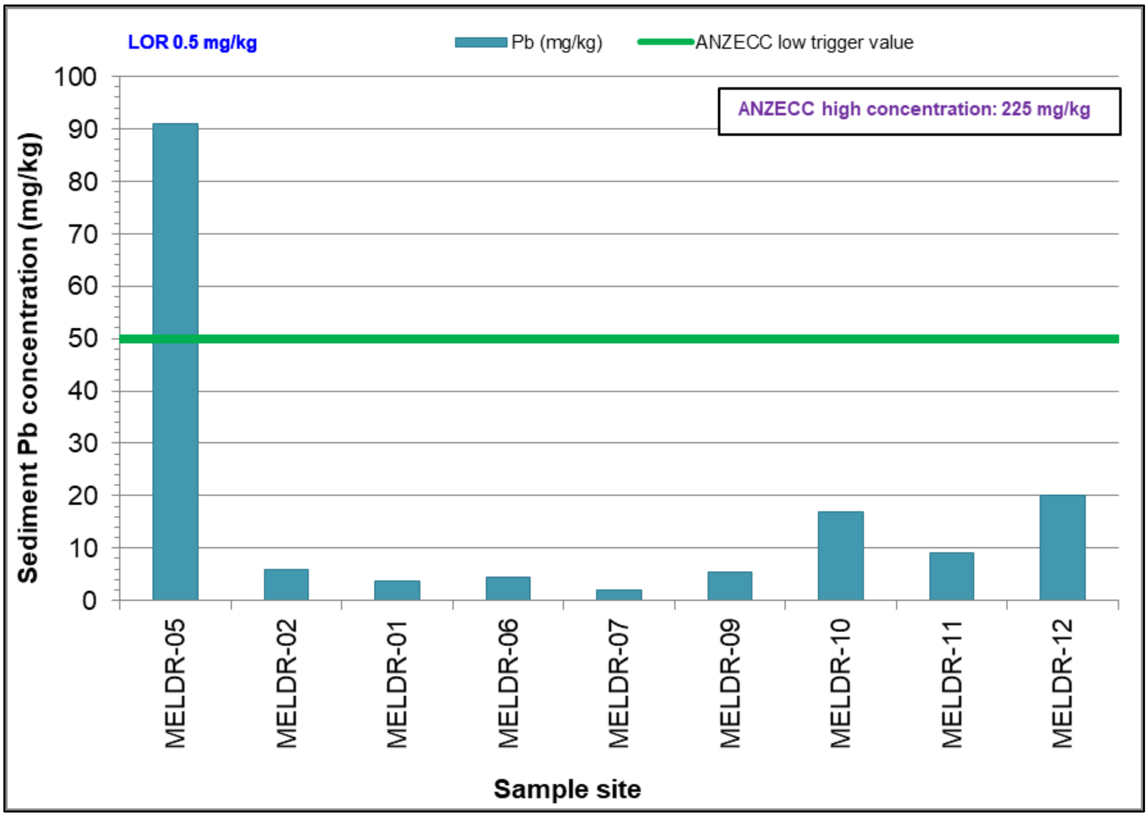


Figure 8-7: Sediment total lead concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Total lead concentrations in sediment collected in 2020 are similar to those collected in the preceding seven years of monitoring (Table H-2). Concentrations exceeding the low trigger value have been recorded at six sites (site 5 [John Creaney Park], 13 [Brentwood drain], 7 [Booragoon Lake], 8 [Piney Lakes outlet], 10 [Frederick Baldwin] and 12 [Blue Gum Lake] on at least one sampling occasion throughout the eight year monitoring period. Site 7 has always recorded concentrations above the lower trigger value when samples have been collected, excluding the sample for 2020 where site 7 recorded the lowest concentration out of the all the sample sites. Site 5, similarly to site 7, has experienced concentrations that exceed the ANZECC lower trigger value (and equalled ANZECC higher trigger value in 2013) in six out of seven sampling occasions.

8.7 Mercury

Total mercury concentrations in sediment were all below the ANZECC low (0.15 mg/kg) and high (1.0 mg/kg) trigger values at Melville Bull Creek catchment sites in 2020 (Figure 8-8 and Table D-39 in Appendix D). Only site 5 (John Creaney Park) recorded a concentration greater than the LOR (0.02 mg/kg) with a concentration of 0.15 mg/kg.

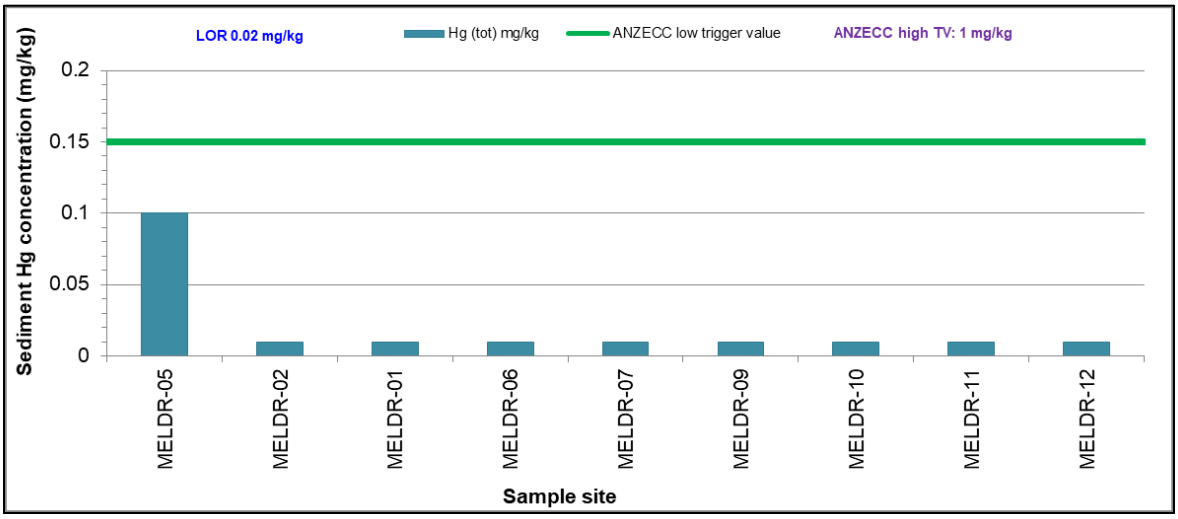


Figure 8-8: Sediment total mercury concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Concentrations of total mercury in sediment of the Melville Bull Creek catchment throughout the eight years of monitoring have generally been low and below the LORs (Table H-2). The only exceedance (0.2 mg/kg) of the ANZECC low trigger value during this time was recorded at site 7 (Booragoon Lake) in 2016.

8.8 Nickel

Total nickel concentrations in sediment were all below the ANZECC low (21 mg/kg) and high (52 mg/kg) trigger values at Melville Bull Creek catchment sites in 2020 (Figure 8-9 and Table D-40 in Appendix D). The highest total nickel concentration of 9.9 mg/kg was recorded at site 5 (John Creaney Park) and site 1 (Bull Creek Main Drain) recorded the lowest concentration (0.4 mg/kg).

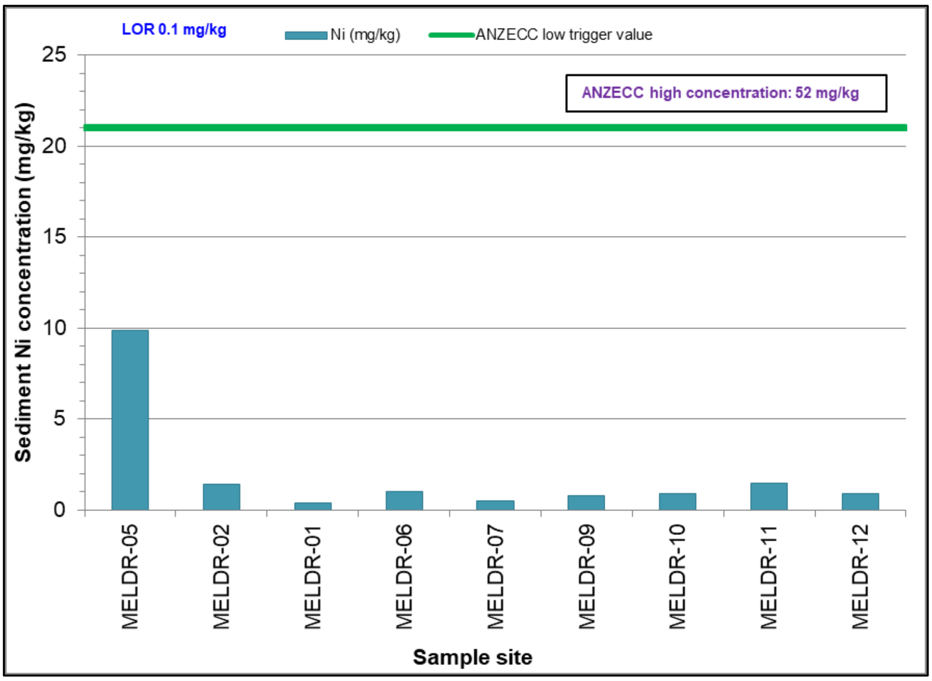


Figure 8-9: Sediment total nickel concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Concentrations of total nickel in sediment of the Melville Bull Creek catchment over the past eight years of monitoring have generally been low (Table H-2). The only exceedances of the ANZECC low trigger value recorded during this time have been at site 13 (Brentwood drain) in 2016 and site 7 (Booragoon Lake) in 2015.

8.9 Selenium

No guideline currently exists for selenium concentrations in sediment; therefore, it is difficult to gauge the severity of any potential impact arising from the concentrations recorded Melville Bull Creek catchment sediments in 2020. The highest selenium concentration (1 mg/L) was recorded at site 5 (John Creaney Park) and four sites recorded concentrations below the LOR (0.05 mg/kg) (Figure 8-10 and Table D-41 in Appendix D).

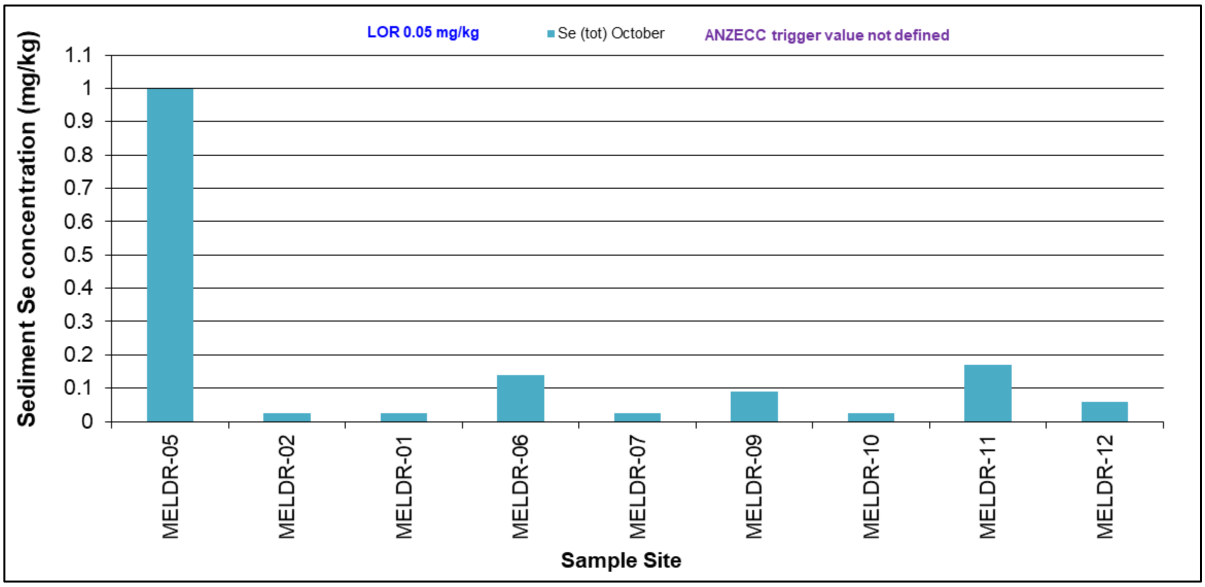


Figure 8-10: Sediment total selenium concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Total selenium concentrations recorded in 2020 are similar to those recorded in the preceding seven years (Table H-3). Site 7 (Booragoon Lake outlet) has always recorded the highest concentration in the catchment, excluding for the 2020 sampling season where site 5 recorded the highest concentration.

8.10 Zinc

Concentrations of total zinc in sediment throughout the Melville Bull Creek catchment sites in 2020 were low, with all concentrations below ANZECC low (200 mg/kg) and high (410 mg/kg) trigger values (Figure 8-11 and Table D-42 in Appendix D). The highest concentration (180 mg/kg) was recorded at site 58 (John Creaney Park) and the lowest (2.5 mg/kg) at site 7 (Booragoon Lake outlet).

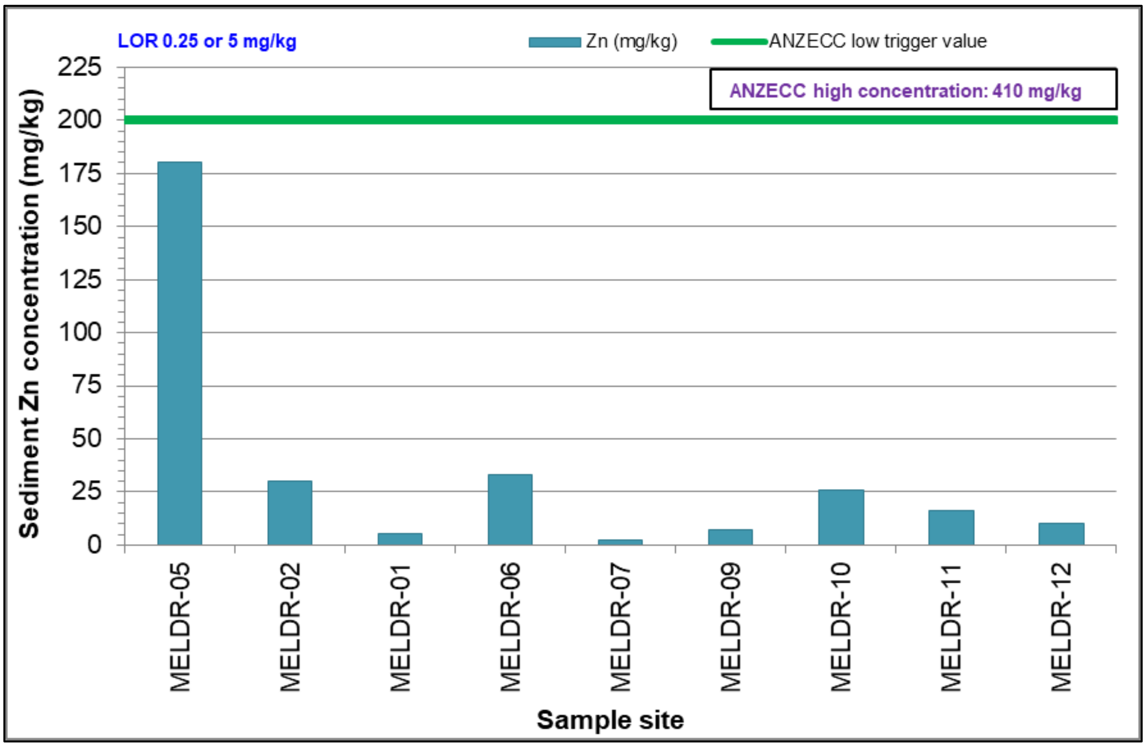


Figure 8-11: Sediment total zinc concentrations (mg/kg) recorded in Melville Bull Creek catchment sites in 2020

Concentrations of total zinc in sediment recorded in 2020 are similar to those recorded in the preceding seven years of monitoring (Table H-3). During the eight years of monitoring, only sites 13 and 10 (Brentwood drain and Frederick Baldwin respectively) have recorded zinc concentrations in exceedance of the low trigger value, recording anomalously high concentrations in 2016. Site 9 (Quenda Lake outlet) has recorded the lowest zinc concentrations in the catchment during the eight years monitoring period except in 2019 and 2020 when the lowest concentration was at site 1 (Bull Creek Main Drain).

8.11 Particle size analysis

Sediment particles were classified into several classes of differing sizes according to the Wentworth scale (Wentworth 1922; Table 2-3)

The highest particle size for eight of the nine sites where sediment sample was collected was coarse sand. The dominant sediment particle size fractions for sites 6 and 11 (Bateman Park and Marmion Park, respectively) were coarse sand and silt (see Table 8-1 and Figure 8-12). Sediment from sites 7, 12, 9, 10 and 1 (Booragoon Lake, Blue Gum Lake, Quenda Lake outlet, Frederick Baldwin and Bull Creek main drain, respectively), can be described as medium and coarse sand. Site 5 (John Creaney Park) had silt and gravel dominant sediment. Site 2 (Brockman Park) had coarse sand and gravel dominant sediment.

It should be noted that sediment from sites 5, which contained the highest proportions of fine particles (3.91% and 33.03% as clay and silt, respectively) in 2020, recorded the highest concentrations of most metals (aluminium, arsenic, chromium, copper, iron, selenium, mercury, nickel, lead and zinc). This is likely to be due to finer sediments being able to bind greater concentrations of trace metals because of their

[8] A different LOR was used for analysis of site 5 being 5 mg/kg instead of 0.25 mg/kg that was used for all other sites. This was because the Zinc was present in a much higher concentration at site 5. This meant that it was over-range on the laboratory's ICP-MS (which has an LOR of 0.25 mg/kg) and was instead reported off the ICP-AES, which has an LOR of 5 mg/kg.

greater surface area to volume ratio (Parizanganeh 2008). Concentrations of these metals in water, other than for iron and aluminium, were below relevant trigger values and were similar to concentrations at other sites (excluding on some occasions results for total and soluble copper and zinc). This may indicate that the fine sediment is acting as a sink for metals at this site and preventing them from entering the water column.

These results highlight the importance of including particle size analysis to gain a better understanding of the nature of the contamination and potentially help ‘explain’ the high concentrations of these metals both in water and in sediment.

Table 8-1: Particle size analysis results from Melville Bull Creek catchment sites in October 2020

Site Name	Site Ref No.	Date Collected	Client ID #	Clay % (<4 µm)	Silt % (4-62 µm)	Fine sand % (62-250 µm)	Medium sand % (250-500 µm)	Coarse sand % (500-2,000 µm)	Gravel % (>2,000 µm)	Total %
JOHN CREANEY PARK	MELDR-05	15-Oct-20	20S1644/018	3.91	**33.03**	13.46	1.61	10.82	**37.16**	**100.0**
BROCKMAN PARK	MELDR-02	15-Oct-20	20S1644/017	0.25	3.57	1.82	15.29	**63.51**	**15.55**	**100.0**
BULL CREEK MD	MELDR-01	15-Oct-20	20S1644/016	1.05	18.13	9.33	**35.64**	**35.74**	0.11	**100.0**
BATEMAN PARK	MELDR-06	15-Oct-20	20S1644/015	1.56	**26.03**	20.88	18.12	**28.97**	4.44	**100.0**
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	20S1644/022	1.29	13.52	11.25	**20.73**	**53.20**	0.00	**100.0**
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	20S1644/019	0.28	6.30	13.85	**26.02**	**46.93**	6.63	**100.0**
FREDERICK BALDWIN	MELDR-10	15-Oct-20	20S1644/020	0.16	4.21	10.30	**32.93**	**46.05**	6.34	**100.0**
MARMION RESERVE	MELDR-11	15-Oct-20	20S1644/021	3.24	**31.08**	20.23	9.70	**35.22**	0.53	**100.0**
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	20S1644/023	0.21	13.76	15.87	**26.16**	**41.89**	2.11	**100.0**

Highest particle size % (grey)

Second highest particle size % (yellow)

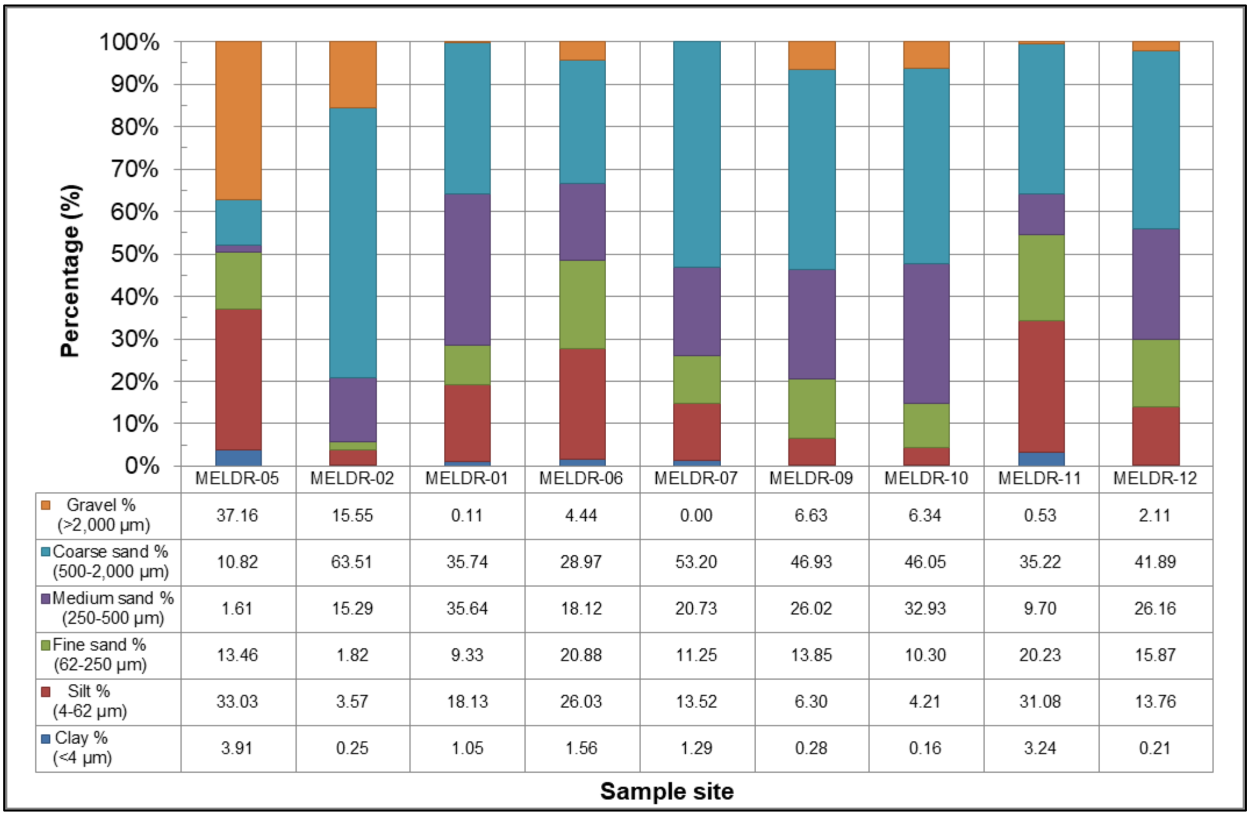


Figure 8-12: Sediment particle size distribution (%) in Melville Bull Creek catchment sites in October 2020.

Overall composition of the particle size at each site has not particularly changed since sediment sampling began in 2015 (Appendix H). Notable changes include site 2 experiencing a coarse sand/gravel dominant composition in 2020 rather than a coarse sand/medium sand dominate composition as previously experienced from 2015-2019. Site 6 experienced a silt/coarse sand dominate composition in 2020 rather than a medium sand/coarse sand composition as previously experienced from 2015-2019. Site 7 found no evidence of gravel in the 2020 sample, which has not been the case in samples collected from 2015-2019, with the highest portion of gravel being 37% in 2018. Site 11 experienced a medium sand/coarse sand dominant composition from 2015-2018, although in 2019 and 2020 has recorded a silt/coarse sand dominant composition. Site 12 typically records a medium sand/coarse sand dominant composition since sampling began in 2015, although in 2019 recorded a silt/fine sand dominant composition.

9. Summary of 2020 results

Figure 9-1 to Figure 9-4 below include catchment maps showing sites sampled in 2020 with water physicochemical properties, water nutrients, metals in water and metals in sediment respectively exceeding relevant trigger values/outside acceptable ranges. Table 9-2 and Table 9-3 and contain summaries of the physicochemical, nutrient and metal water quality data, and Table 9-4 contains a summary of sediment metal concentrations, recorded in Melville Bull Creek catchment sites in 2020.

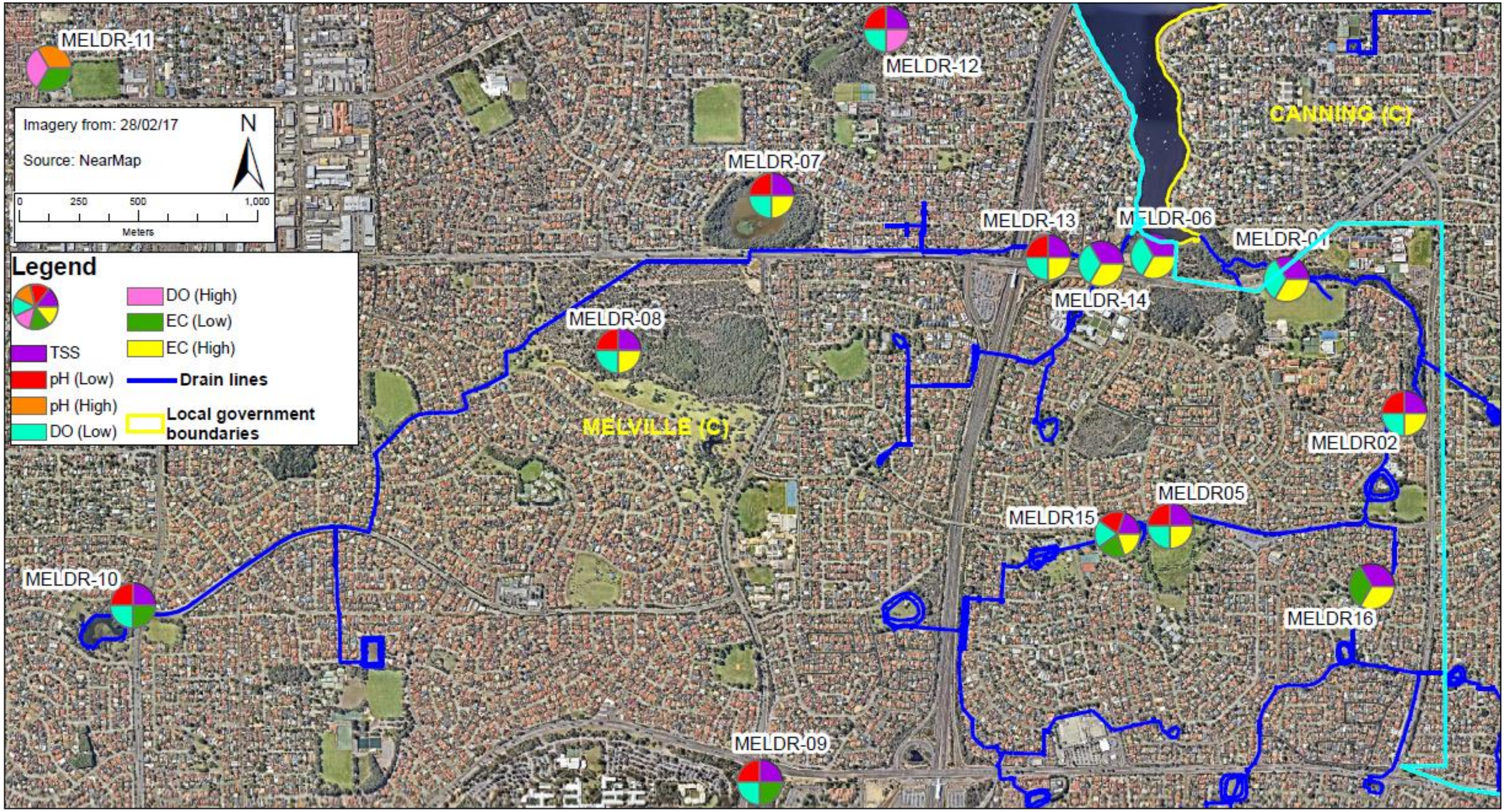


Figure 9-1: Map of Melville Bull Creek catchment sites with values outside of ANZECC acceptable ranges for lowland rivers for pH, dissolved oxygen % (DO) and electrical conductivity (EC) and exceeding the experimentally derived interim value for total suspended solids (TSS) in 2020.

Table 9-1: Summary of physicochemical parameter data recorded in Melville Bull Creek catchment sites in 2020.

		Parameter	pH	Dissolved Oxygen (%)	Conductivity (mS/cm)	TSS (mg/L)
		Acceptable range/trigger value	**ANZECC acceptable range: lowland rivers: 6.5-8 wetlands: 7.0 - 8.5**	**ANZECC acceptable range: lowland rivers: 80 - 120 wetlands: 90 - 120**	**ANZECC acceptable range: lowland rivers: 0.12-0.3 wetlands: 0.3-1.5**	**DWER interim trigger value: 6**
Site			Number outside range/above trigger value			
Drain sites	JOHN CREANEY PARK INLET	MELDR-15	3 (low)	3 (low)	1 low, 3 high	2
Drain sites	JOHN CREANEY PARK	MELDR-05	4 (low)	4 (low)	3 (high)	3
Drain sites	DOWNSTREAM ELIZABETH M	MELDR-16	0	0	1 low, 3 high	4
Drain sites	BROCKMAN PARK	MELDR-02	4 (low)	4 (low)	4 (high)	2
Drain sites	BULL CREEK MD	MELDR-01	0	4 (low)	4 (high)	1
Drain sites	BRENTWOOD DRAIN	MELDR-13	2 (low)	4 (low)	4 (high)	4
Drain sites	RAAF DRAIN	MELDR-14	0	2 (low)	4 (high)	2
Drain sites	BATEMAN PARK	MELDR-06	0	3 (low)	4 (high)	2
Wetland sites	BOORAGOON LAKE OUTLET	MELDR-07	4 (low)	4 (low)	4 (high)	3
Wetland sites	PINEY LAKES OUTLET	MELDR-08	4 (low)	4 (low)	1 (high)	3
Wetland sites	QUENDA LAKE OUTLET	MELDR-09	3 (low)	2 (low)	1 (low)	4
Wetland sites	FREDERICK BALDWIN	MELDR-10	3 (low)	4 (low)	3 (low)	1
Wetland sites	MARMION RESERVE	MELDR-11	4 (high)	2 (high)	4 (low)	0
Wetland sites	BLUE GUM LAKE OUTLET	MELDR-12	1 (low)	2 low, 1 high	0	1
		Total above acceptable range/trigger value	4	3	34	32
		Total below acceptable range	28	40	10	NA
		Total below LOR	NA	NA	NA	1
		Min (site)	4.94 (MELDR 08)	9.1 (MELDR 05)	0.83 (MELDR 15)	<2 (MELDR-11)
		Max (site)	9.99 (MELDR 11)	129.5 (MELDR 11)	3.076 (MELDR 07)	52 (MELDR 15)
		Key	Exceedances recorded for this parameter on all sampling occasions when analysed	Exceedances recorded for this parameter on at least one sampling occasion	Exceedances not recorded for this parameter	

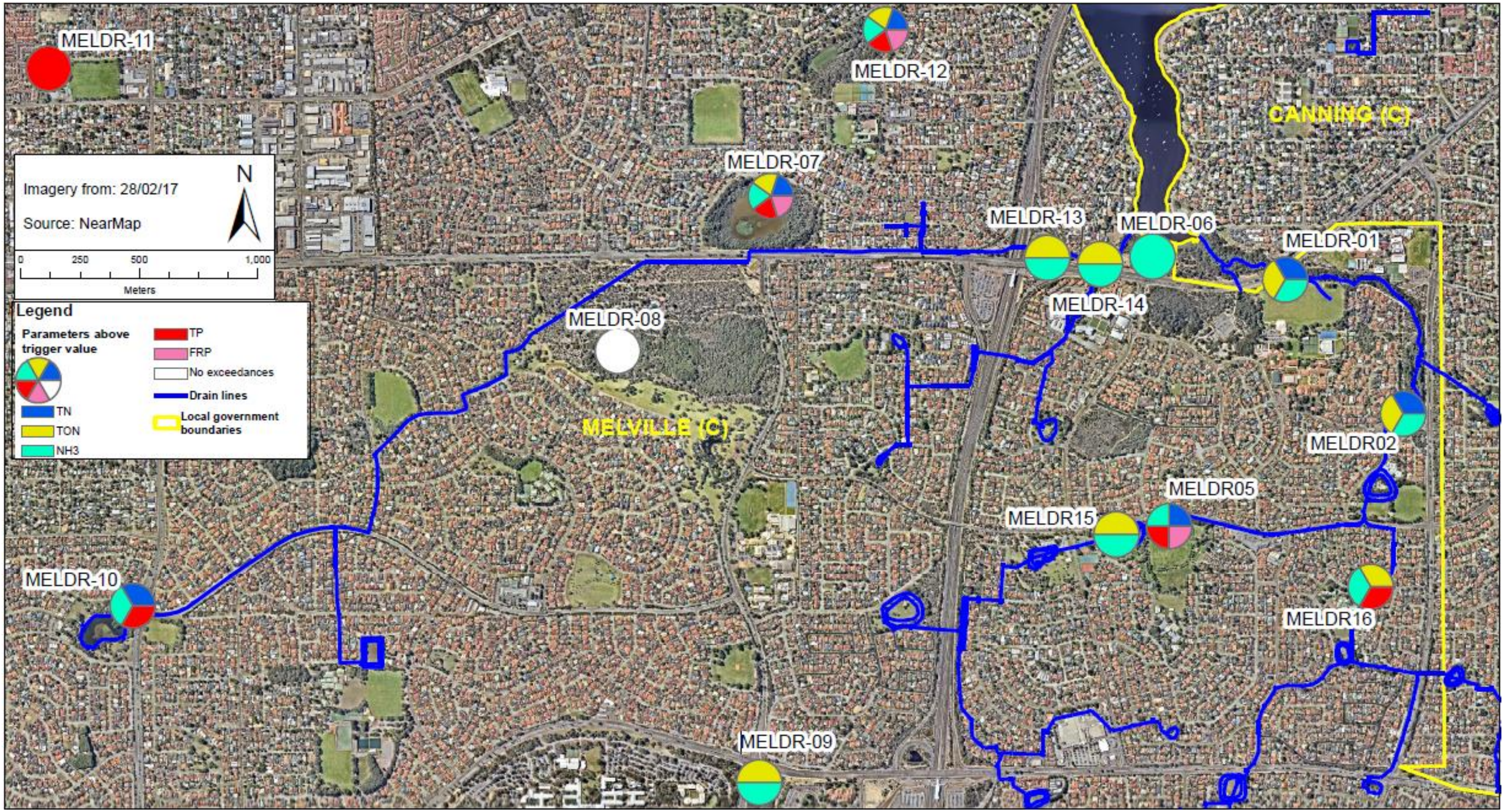


Figure 9-2: Map of Melville Bull Creek catchment sites with total nitrogen (TN), total oxidised nitrogen (NOx-N), ammonia nitrogen (NH_3/NH^{4+}-N), total phosphorus (TP) and filterable reactive phosphorus (FRP) concentrations (mg/L) exceeding ANZECC trigger values for lowland rivers or wetlands in 2020.

Table 9-2: Summary of nutrient data recorded in Melville Bull Creek catchment sites in 2020.

		Parameter	Total Nitrogen (mg/L)	Total Oxidised Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)		Dissolved Organic Nitrogen (mg/L)	Total Organic Nitrogen (mg/L)	Total Phosphorus (mg/L)	Soluble Reactive Phosphorus (mg/L)
		Trigger value	ANZECC stressor TVs: lowland rivers: 1.2 wetlands: 1.5	ANZECC stressor TVs: lowland rivers: 0.15 wetlands: 0.1	ANZECC stressor TVs: lowland rivers: 0.08 wetlands: 0.04	ANZECC TV for protection of biota (unadjusted): 0.9	No TV	No TV	ANZECC stressor TVs: lowland rivers: 0.065 wetlands: 0.06	ANZECC stressor TVs: lowland rivers: 0.04 wetlands: 0.03
Site			Number of samples above trigger value							
Drain sites	JOHN CREANEY PARK INLET	MELDR-15	0	3	2	0			0	0
	JOHN CREANEY PARK	MELDR-05	3	0	3	0			3	1
	DOWNSTREAM ELIZABETH M	MELDR-16	0	3	1	0			2	0
	BROCKMAN PARK	MELDR- 02	4	1	4	4			0	0
	BULL CREEK MD	MELDR-01	4	4	4	3			0	0
	BRENTWOOD DRAIN	MELDR-13	0	3	4	0			0	0
	RAAF DRAIN	MELDR-14	0	1	1	0			0	0
	BATEMAN PARK	MELDR-06	0	0	1	0			0	0
Wetland sites	BOORAGOON LAKE OUTLET	MELDR-07	4	3	4	4			4	4
	PINEY LAKES OUTLET	MELDR-08	0	0	0	0			0	0
	QUENDA LAKE OUTLET	MELDR-09	0	1	1	0			0	0
	FREDERICK BALDWIN	MELDR-10	1	0	1	0			2	0
	MARMION RESERVE	MELDR-11	0	0	0	0			2	0
	BLUE GUM LAKE OUTLET	MELDR-12	4	3	4	2			4	4
		Total above trigger value	20	22	30	13	NA	NA	17	9
		Total below LOR	0	11	1		3	1	0	30
		Min (site)	0.33 (MELDR 10)	<0.01 (5 sites)	<0.01 (MELDR-11)		<0.025 (2 sites)	<0.025 (MELDR 02)	0.008 (MELDR 11)	<0.005 (10 sites)
		Max (site)	11 (MELDR 07)	3.1 (MELDR-01)	8.3 (MELDR 02)		2.8 (MELDR 07)	3.2 (MELDR 10)	0.78 (MELDR 07)	0.57 (MELDR 07)
		Key	Exceedances recorded for this parameter on all sampling occasions when analysed	Exceedances recorded for this parameter on at least one sampling occasion	Exceedances not recorded for this parameter	No trigger value for this paramater				

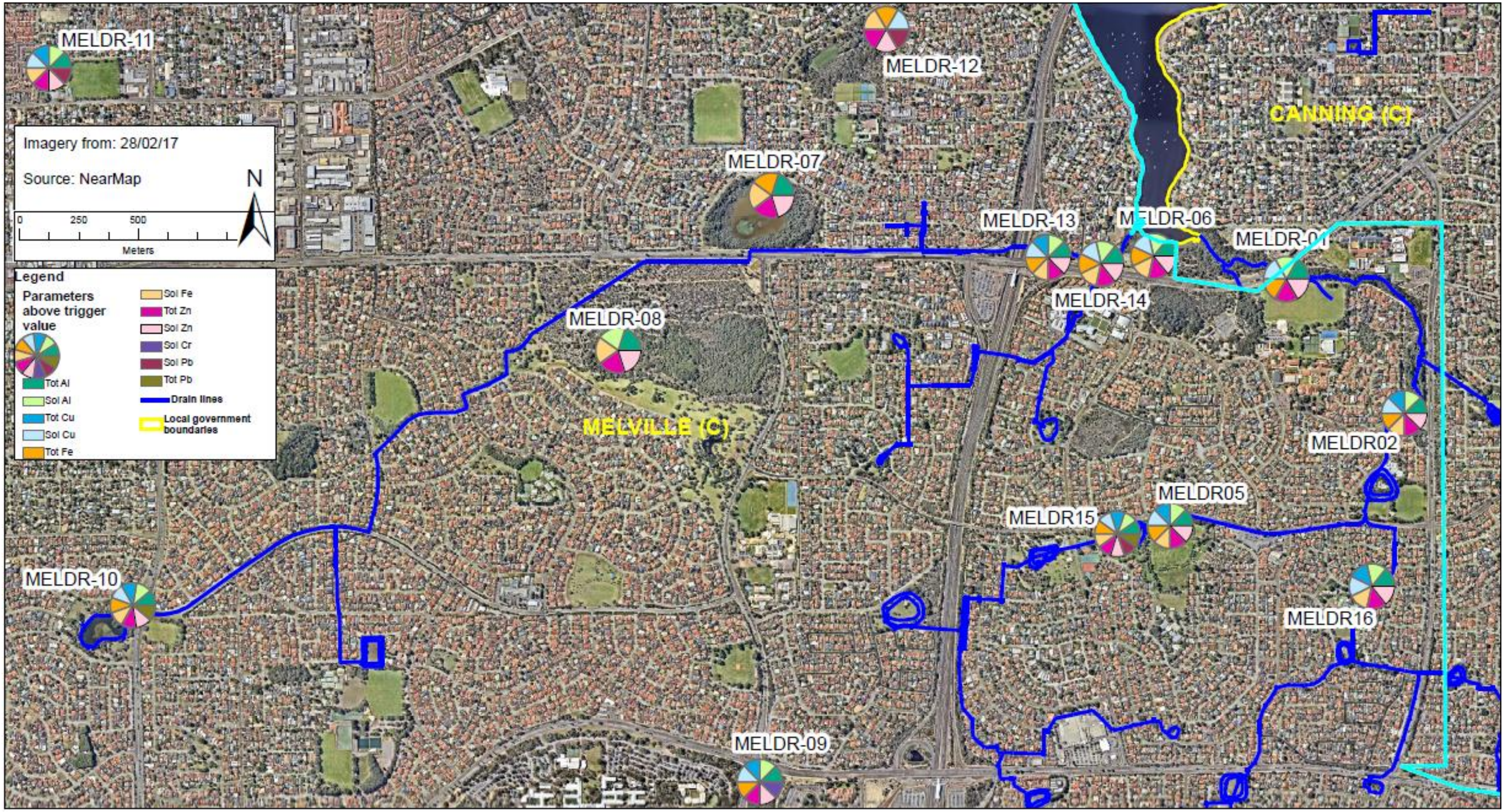


Figure 9-3: Map of Melville Bull Creek catchment sites with metal concentrations exceeding the ANZECC trigger value for protection of biota in 2020.

Table 9-3: Summary of metal and hardness data in Melville Bull Creek catchment sites in 2020 (pt 1 and 2).

		Parameter	Aluminium (mg/L)		Arsenic (mg/L)		Chromium (mg/L)		Copper (mg/L)	
		Trigger value for protection of biota	0.055		0.024		0.0033 (unadjusted)		0.0014 (unadjusted)	
			Total	Soluble	Total	Soluble	Total	Soluble	Total	Soluble
	Site		Number of samples above trigger value							
Drain sites	JOHN CREANEY PARK INLET	MELDR-15	1	3			0	0	1	4
Drain sites	JOHN CREANEY PARK	MELDR-5	1	3			0	0	1	1
Drain sites	D/S ELIZABETH MANION PAR	MELDR-16	1	3			0	0	1	4
Drain sites	BROCKMAN PARK	MELDR-2	1	4			0	0	1	2
Drain sites	BULL CREEK MD	MELDR-01	1	4			0	0	0	3
Drain sites	BRENTWOOD DRAIN	MELDR-13	1	3			0	0	1	4
Drain sites	RAAF DRAIN	MELDR-14	1	2			0	0	0	4
Drain sites	BATEMAN PARK	MELDR-06	1	3			0	0	0	4
Wetland sites	BOORAGOON LAKE OUTLET	MELDR-07	1	0	0	0	0	0	0	1
Wetland sites	PINEY LAKES OUTLET	MELDR-08	1	4			0	0	0	0
Wetland sites	QUENDA LAKE OUTLET	MELDR-09	1	3			1	0	1	1
Wetland sites	FREDERICK BALDWIN	MELDR-10	1	1			0	0	1	3
Wetland sites	MARMION RESERVE	MELDR-11	1	3			0	0	1	1
Wetland sites	BLUE GUM LAKE OUTLET	MELDR-12	0	0			0	0	0	3
		Total above trigger value	13	36	0	0	1	0	8	35
		Total below LOR	0	0	0	0	0	0	0	0
		Min (site)	0.047 (MELDR 12)	0.012 (MELDR 07)	NA	0.0011 (MELDR 07)	0.0005 (2 sites)	0.0002 (2 sites)	0.0013 (MELDR 07)	0.0003 (MELDR 02)
		Max (site)	0.75 (MELDR 09)	0.31 (MELDR 15)	0.0011 (MELDR 07)	0.0025 (MELDR 07)	0.0077 (MELDR 13)	0.0022 (MELDR 15)	0.031 (MELDR 09)	0.0075 (MELDR 09)

		Parameter	Iron (mg/L)		Lead (mg/L)		Mercury (mg/L)		Nickel (mg/L)		Zinc (mg/L)		Hardness (mg/L)
		Trigger value for protection of biota	0.3 (interim)		0.0034 (unadjusted)		0.0006		0.011 (unadjusted)		0.008 (unadjusted)		No TV
			Total	Soluble	Total	Soluble	Total	Soluble	Total	Soluble	Total	Soluble	
	Site		Number of samples above trigger value										
Drain sites	JOHN CREANEY PARK INLET	MELDR-15	1	3	1	1					1	4	
Drain sites	JOHN CREANEY PARK	MELDR-5	1	3	0	0					1	4	
Drain sites	D/S ELIZABETH MANION PAR	MELDR-16	0	1	0	0					1	4	
Drain sites	BROCKMAN PARK	MELDR-2	1	4	0	0					1	4	
Drain sites	BULL CREEK MD	MELDR-01	1	0	0	0					1	4	
Drain sites	BRENTWOOD DRAIN	MELDR-13	1	4	0	0	0	0			1	4	
Drain sites	RAAF DRAIN	MELDR-14	1	2	0	0	0	0			1	4	
Drain sites	BATEMAN PARK	MELDR-06	1	3	0	0	0	0			1	4	
Wetland sites	BOORAGOON LAKE OUTLET	MELDR-07	1	4	0	0	0	0	0	0	1	4	
Wetland sites	PINEY LAKES OUTLET	MELDR-08	0	3	0	0					1	4	
Wetland sites	QUENDA LAKE OUTLET	MELDR-09	1	0	0	0					1	3	
Wetland sites	FREDERICK BALDWIN	MELDR-10	1	2	1	0					1	4	
Wetland sites	MARMION RESERVE	MELDR-11	0	2	0	1					1	1	
Wetland sites	BLUE GUM LAKE OUTLET	MELDR-12	1	4	0	4					1	3	
		Total above trigger value	11	35	2	6	0	0	0	0	14	51	NA
		Total below LOR	0	0	0	5	13	16	0	0	0	0	0
		Min (site)	0.084 (MELDR 08)	0.033 (MELDR 16)	0.0006 (MELDR 06)	<0.0001 (3 sites)	<0.00005 (all sites)	<0.00005 (all sites)	NA	0.0008 (MELDR 07)	0.014 (MELDR 11)	0.002 (MELDR 11)	15 (MELDR 15)
		Max (site)	5 (MELDR 13)	14 (MELDR 05)	0.0075 (MELDR 10)	0.013 (MELDR 12)	NA	NA	0.0014 (MELDR 07)	0.0013 (MELDR 07)	0.084 (MELDR 09)	0.014 (MELDR 15)	860 (MELDR 07)

Key					
Key	Exceedances recorded for this parameter on all sampling occasions when analysed	Exceedances recorded for this parameter on at least one sampling occasion	Exceedances not recorded for this parameter	No trigger value for this paramater	Parameter not analysed at this site

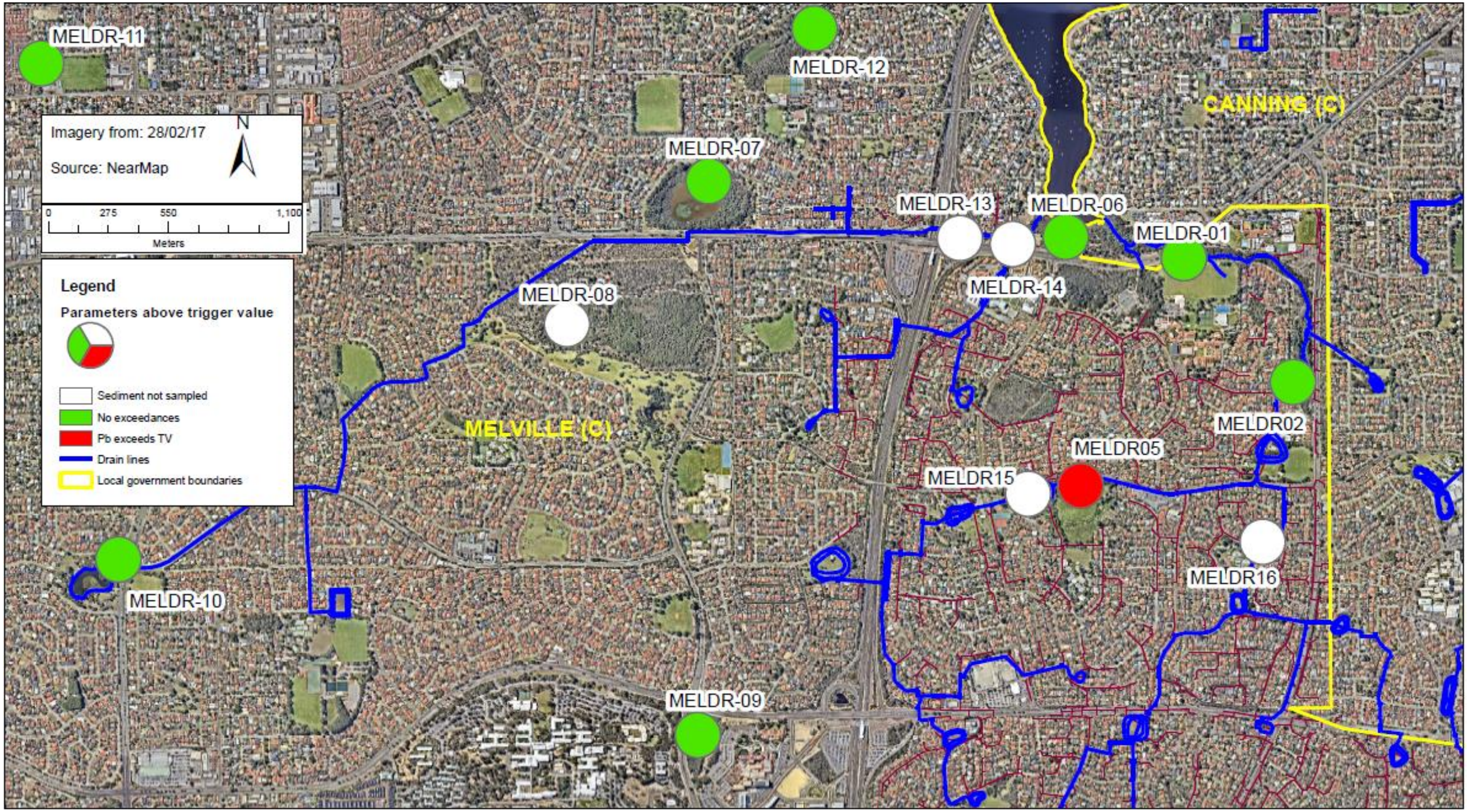


Figure 9-4: Map of Melville Bull Creek catchment sites with sediment metal concentrations exceeding ANZECC trigger values for protection of biota in 2020.

Table 9-4: Summary of sediment metal data in Melville Bull Creek catchment sites in 2020 (pt 1 and 2).

		Parameter	Total Aluminium (mg/kg)	Total Arsenic (mg/kg)	Total Chromium (mg/kg)	Total Copper (mg/kg)	Total Iron (mg/kg)
		Trigger value	No TV	Low TV: 20 High TV: 70	Low TV: 80 High TV: 370	Low TV: 65 High TV: 270	No TV
	Site		Number of samples above low trigger value				
Drain sites	JOHN CREANEY PARK INLET	MELDR-15					
	JOHN CREANEY PARK	MELDR-05		0	0	0	
	D/S ELIZABETH MANION PAR	MELDR-16					
	BROCKMAN PARK	MELDR-02		0	0	0	
	BULL CREEK MD	MELDR-01		0	0	0	
	BRENTWOOD DRAIN	MELDR-13					
	RAAF DRAIN	MELDR-14					
	BATEMAN PARK	MELDR-06		0	0	0	
Wetland sites	BOORAGOON LAKE OUTLET	MELDR-07		0	0	0	
	PINEY LAKES OUTLET	MELDR-08					
	QUENDA LAKE OUTLET	MELDR-09		0	0	0	
	FREDERICK BALDWIN	MELDR-10		0	0	0	
	MARMION RESERVE	MELDR-11		0	0	0	
	BLUE GUM LAKE OUTLET	MELDR-12		0	0	0	
		Total above trigger value	NA	0	0	0	NA
		Total below LOR	0	0	0	0	0
		Min (site)	527 (MELDR 01)	0.2 (MELDR 09)	0.9 (MELDR 01)	0.5 (MELDR 07)	250 (MELDR 09)
		Max (site)	11,000 (MELDR 05)	4.3 (MELDR 05)	29 (MELDR 05)	61 (MELDR 05)	21,000 (MELDR 05)

		Parameter	Total Lead (mg/kg)	Total Mercury (mg/kg)	Total Nickel (mg/kg)	Total Selenium (mg/kg)	Total Zinc (mg/kg)
		Trigger value	Low TV: 50 High TV: 220	Low TV: 0.15 High TV: 1	Low TV: 21 High TV: 52	No TV	Low TV: 200 High TV: 410
	Site		Number of samples above low trigger value				
Drain sites	JOHN CREANEY PARK INLET	MELDR-15					
	JOHN CREANEY PARK	MELDR-05	1		0		0
	D/S ELIZABETH MANION PAR	MELDR-16					
	BROCKMAN PARK	MELDR-02	0	0	0		0
	BULL CREEK MD	MELDR-01	0	0	0		0
	BRENTWOOD DRAIN	MELDR-13					
	RAAF DRAIN	MELDR-14					
	BATEMAN PARK	MELDR-06	0	0	0		0
Wetland sites	BOORAGOON LAKE OUTLET	MELDR-07	0	0	0		0
	PINEY LAKES OUTLET	MELDR-08					
	QUENDA LAKE OUTLET	MELDR-09	0	0	0		0
	FREDERICK BALDWIN	MELDR-10	0	0	0		0
	MARMION RESERVE	MELDR-11	0	0	0		0
	BLUE GUM LAKE OUTLET	MELDR-12	0	0	0		0
		Total above trigger value	1	0	0	NA	0
		Total below LOR	0	8	0	4	0
		Min (site)	2 (MELDR 07)	<0.02 (8sties)	0.4 (MELDR 01)	<0.05 (4 sites)	2.5 (MELDR 07)
		Max (site)	91 (MELDR 05)	0.1 (MELDR 05)	9.9 (MELDR 05)	1 (MELDR 05)	78 (MELDR 05)
			Exceedances recorded for this parameter on all sampling occasions when analysed	Exceedances recorded for this parameter on at least one sampling occasion	Exceedances not recorded for this parameter	No trigger value for this paramater	Parameter not analysed at this site

10. Discussion

10.1 Comparison of 2020 data to previous data

Water and sediment results from samples collected in 2020 were generally similar to results recorded in previous years, with the following exceptions:

- Site 7 (Booragoon Lake) produced results similar to that experienced from 2007 to 2018, after a year of pH values within the acceptable range (2019). .
- Site 12 (Blue Gum Lake) recorded more samples within the ANZECC acceptable range for pH in 2020 than what has historically been recorded in the since 2009, mimicking 2008 sampling results.
- Site 15 recorded its first ever DO saturation reading within the ANZECC acceptable range in July.
- Site 15 and 16 recorded values below the ANZECC acceptable range for EC for the first time since sampling began at these sites in 2014. Site 5 recorded a value within the ANZECC acceptable range for EC for the first time since 2012.
- Site 9 recorded unusually high exceedances of TSS on all sampling occasions. An exceedance of TSS has only occurred on one other occasion, in September 2008.
- Site 2 recorded exceedances in TSS in July and October; this has not occurred since March 2010.
- Site 10 recorded a concentration above the ANZECC trigger value for TN in October 2020; this is the first time this has happened since sampling began at this site in 2007. This could have been a result of the fire at the nearby soap factory potentially washing contaminants downstream. Site 10 also had a spike in total phosphorous in October, which also may be linked to the soap factory fire.
- After three years of high exceedances for TP and FRP at site 7 (2017, 2018, 2019), it appears that concentrations at this site may be reverting back to their pre-2017 values.
- All sites sampled recorded concentrations of total metals in sediment below the low trigger value in 2020 (when trigger values existed), which have been similar to results recorded in 2017-2019 (except for Total Pb which exceeded the lower trigger value at site 5).
- This year found site 5 (John Creaney Park) recording the highest concentration in all total metals sampled for sediment.

10.2 Long term patterns

Monitoring of some sites in the Melville Bull Creek catchment have occurred for 14 years, allowing long term patterns to be assessed. The following noteworthy long-term patterns have been observed in the catchment:

- Dissolved oxygen saturations and pH values are lower, and total nitrogen (and dissolved organic nitrogen) and total aluminium concentrations are higher at site 9 (Quenda Lake outlet) from 2014 to 2020 when compared to 2007 to 2013.
- Site 7 (Booragoon Lake), while still recording very high and variable concentrations, has recorded significantly lower maximum concentrations of total nitrogen from 2012 to 2020 (excepting a high maximum concentration recorded in 2017) than from 2007 to 2011.
- Site 12 (Blue Gum Lake) recorded higher yearly maximum concentrations of total nitrogen and total phosphorus from 2012 to 2020 than from 2007 to 2011. However, the maximum concentrations of these parameters recorded in 2018 are in the range of those recorded from 2007 to 2011. Dissolved oxygen saturations have also been lower at site 12 (Blue Gum Lake) since 2013 than in the preceding years.

10.3 Key Issues

Based on the results, it is considered that Bull Creek main drain, Booragoon Lake and Blue Gum Lake have the poorest water quality in the catchment and therefore management responses should be focussed on improvement of these sites.

10.3.1 Drainage branches

10.3.1.1. Bull Creek main drain

High total nitrogen concentrations, well in exceedance of the ANZECC trigger value for lowland rivers, have been recorded over the years at particular sites along the Bull Creek main drain since monitoring began in 2007. Total nitrogen is often high at sites along the two upstream branches of the Bull Creek main drain (represented by John Creaney Park outlet (site 5) and downstream Elizabeth Manion Park (site 16)). However a significant portion of nitrogen, predominantly as ammonia/ammonium, is being introduced to the drainage line between the convergence of these two branches and Brockman Park (site 2). This may be originating from groundwater, as high concentrations of ammonia have been recorded in the Jandakot Mound (Larsen et al 1998), and could possibly be even higher in this area as a result of the historical landfill at John Creaney Park (DWER 2017). As water flows from Brockman Park to the most downstream Bull Creek site (site 1), historically total nitrogen concentrations tend to reduce by an average of approximately 55%, (likely due to uptake of nitrogen by macrophytes or dilution from the drainage branch coming from Rossmoyne Senior High School), although results 2020 showed that there was minimal reduction in TN from site 2 downstream to site 1. The remaining nitrogen at site 1 is predominantly in the form of oxidised nitrogen rather than ammonia nitrogen, perhaps due to the slight oxygenation of the water occurring between these two sites. The exceeding total nitrogen concentrations consistently recorded at site 2 and site 1 are of concern as this nitrogen would contribute to eutrophication of the Canning River. Furthermore, the ammonia concentrations in exceedance of the freshwater protection trigger value at site 2 (Brockman Park) are concerning as the portion of site 1 (Bull Creek main drain) downstream of site 2 (Brockman Park) is known to support a variety of native fauna species including frogs, fish and macroinvertebrates (City of Melville 2014). While some concentrations of nitrogen fractions were above the trigger value at upstream sites (5, 16), the significantly higher concentration at site 2 (Brockman Park) suggest that there is a source of nitrogen between site 5 (John Creaney Park) and site 16 (downstream Elizabeth Manion Park) and site 2 (Brockman Park) which may come from the nearby large public open spaces/ovals.

The often high phosphorus concentrations at site 5 (John Creaney Park), while not resulting in high phosphorus concentrations in downstream site 1 (Bull Creek main drain sites), could, in conjunction with high nitrogen concentrations (which is often experienced at this site), result in algal and nuisance macrophyte growth in the lake. Filamentous algae have often been observed at this lake over the 14 years of sampling which may be an indication of the high phosphorous and high nitrogen levels experienced at this site.

Sediment samples were collected from site 5 (John Creaney Park) in 2020 and historic records show lead concentrations exceeding the ANZECC low trigger value in six out of seven occasions it has been sampled. These high concentrations may be a legacy of previous contamination (possibly from the previous landfill at the site) persisting in the sediment due to their fine, organic nature, as lead is strongly bound by fine and organic particles (ANZECC and ARMCANZ 2000). Although total lead concentrations in water samples from this site have only exceeded 95% freshwater protection hardness modified trigger values once in the 14 years of monitoring (in 2007), under certain conditions (e.g. low pH) it could be released from the sediments and into the water column and have toxic effects on biota within the lake, as well as contributing to lead contamination in downstream site 1 (Bull Creek main drain) and the Canning River. There is also a possibility that the release of lead and uptake by biota could lead to bioaccumulation/biomagnification through the food chain.

The high concentrations of iron and aluminium recorded at Bull Creek main drain sites are concerning as these metals can have negative effects on biota (in acidic, soft hardness and/or warmer water conditions; ANZECC and ARMCANZ 2000), however the concentrations recorded are similar to those recorded across all Swan and Canning River drainage catchments (Nice et al 2009). High concentrations of total zinc have been regularly recorded at site 15 (John Creaney Park inlet) and site 16 (downstream Elizabeth Manion Park), and high total copper concentrations have often been recorded at site 16 (downstream Elizabeth Manion Park) since monitoring of these sites began in 2014. Soluble zinc and copper concentrations recorded at these sites (site 15 and 16) since 2017 indicate a significant proportion of these total metals are likely to be soluble. The source of zinc is unknown. Again however, high exceedances of the trigger values for these metals is common across Swan and Canning River drainage catchments (Nice et al 2009), and concentrations have generally been acceptable at downstream Bull Creek Main Drain sites (e.g. site 1).

Low oxygen saturations have been consistently recorded in Bull Creek main drain sites over the 14 years of sampling the catchment, excepting for downstream Elizabeth Manion Park with three years in a row with all samples falling within the acceptable range for lowland rivers (2018, 2019 and 2020). Low oxygen saturations is a common finding with heavily piped catchments and/or wetlands with excessively high organic loads (either from animal waste or vegetation decomposition), however this is still a concerning issue as low oxygen saturations can be directly harmful to biota, result in increased toxicity of some metals to biota, and result in phosphorus release from sediment and subsequent eutrophication. Dissolved oxygen saturations are particularly low at site 5 (John Creaney Park), and much lower than at the inlet (site 15) to the lake. When sampled, the lake (site 5) at John Creaney Park always contains a large amount of leaf litter and organic debris, which may be contributing to high oxygen demand as this material decomposes. Groundwater, which is generally lower in oxygen than stormwater, may also be filling this lake.

10.3.1.2. Brentwood drain

Water quality is comparatively good in the Brentwood and Mandala Crescent Branch drain sites (13, 14 and 6). Concentrations of nitrogen as ammonia/ammonium, total and soluble iron and total aluminium have been declining over the 14 years of monitoring at site 6 (Bateman Park), the most downstream site sampled along the Brentwood Drain. It is too early to determine whether the Brentwood Living Stream project has resulted in improvement of water quality at site 6 (Bateman Park), as this project was only completed in early 2018.

Although exceedances of total nitrogen had only been recorded once at site 6 (Bateman Park), the exceedances of total oxidised nitrogen and nitrogen as ammonia and ammonium (i.e. forms of nitrogen highly available for plant growth) generally recorded at site 6 could result in algal or nuisance macrophyte growth in areas of the drains where water is still. The 2020 sampling season saw less exceedances in total oxidised nitrogen and nitrogen as ammonia than previously recorded prior to 2020. This is only one occurrence and cannot be assumed to be a new pattern for the site. The high concentrations of iron and aluminium recorded at these sites (13, 14 and 6) are also concerning as these metals can have negative effects on biota, however the concentrations recorded are representative of those recorded across all Swan and Canning River drainage catchments (Nice et al 2009).

Dissolved oxygen saturation has also generally been below the ANZECC acceptable range at site 13 (Brentwood drain) and site 6 (Bateman Park) and often within range at site 14 (RAAF drain).

Sediment at sites 13 and 14 could not be tested during the 2020 sampling season. Although, the sediment at Brentwood Branch drain sites (13, 14 and 6) have always recorded concentrations below the low trigger value for seven out of 10 metals (of which, those seven have trigger values and the remaining three do not) tested since monitoring of sediment began in 2013, excepting for site 13 (Brentwood drain) which recorded exceedances of low trigger values for five metals in the 2016 sampling (chromium, copper, lead, nickel and zinc). Selenium has only been detected above LOR once at site 13 (2018) and once at site 6 (2020) and the three sites had relatively low concentrations of aluminium and iron in these years, in contrast to recent years where these metal concentrations were relatively high. Selenium, aluminium and iron do not have ANZECC trigger values to compare against.

10.3.2 Melville lakes

Sites 7 and 12 (Booragoon Lake and Blue Gum Lake) have usually recorded high total nitrogen (and ammonia) concentrations and almost always recorded high total phosphorus (and filterable reactive phosphorus) concentrations over the past 14 years of sampling. Concentrations of these nutrients recorded since 2007 have been highly variable between years, however often concentrations are higher in spring months than autumn months, which may be due to an accumulation of nutrients in the lakes over winter and/or due to large waterbird populations in the lakes in spring increasing the amount of feces (rich in T and P) in the water column and thus increasing the amount of nutrients (TN and TP) (. Total phosphorus and filterable reactive phosphorus at Site 7 (Booragoon Lake) had been increasing since 2017, although this year saw values similar to those recorded in 2014. The combination of high soluble phosphorus and soluble nitrogen is likely to be a contributing factor to the algae often observed in these lakes, such as the blue-green algal bloom (Microcystis aeruginosa) spotted in Blue Gum Lake on several sampling occasions in the past. This is of concern as these lakes have high conservation value and algal blooms can negatively impact upon both the biota and aesthetic value of the lakes.

Total aluminium concentrations at site 9 (Quenda Lake) have been higher since 2014 (with concentrations often the highest of all the Melville Lakes) and pH values somewhat lower. It is possible that the lake could be receiving more nutrient rich runoff as a result of the surrounding development in the recent years (Fiona Stanley hospital and surrounding infrastructure). Natural Area Consulting (2016) noted that “stormwater drainage from the hospital car park to the east is causing erosion of the Water Corporation sewerage line embankment, with dislodged soil being washed across the limestone path and into the wetland", which may be resulting in these changes to water quality.

The pH values recorded in 2020 at site 7 (Booragoon Lake) did not meet the ANZECC lower limit for wetlands on all four sampling occasions (with a pH range of 6.33 – 6.55). Site 12 (Blue Gum Lake) did not meet the ANZECC lower limit for wetlands on one out of four sampling occasions (September) with a pH range of 6.92 – 7.72. The pH values at these site 7 and 12 have often been particularly low (<5) in the years of monitoring prior to 2017. Low pH levels are of concern as low pH can increase the toxicity of some metals, and can also have a direct negative effect on biota (ANZECC and ARMCANZ 2000). It is possible that the somewhat higher water levels observed at these lakes in winter and spring since 2017 may be resulting in less oxidation of acid sulfate soils in the lake beds and therefore less acidity entering the lake waters. Low pH can also be caused by the presence of high concentration of tannins in the water. Tannins are organic compounds derived from plant materials that give water a brown (often described as "tea coloured") hue, and break down into humic and fulvic acids. The presence of excess plant material in the water is likely to result in the production of high concentrations of tannins. Tannin staining was noted in 2020 on various sampling occasions at sites 7. Pine needles are known to be a rich source of acidic tannins (Northup et al 1995) and the pine trees adjacent to the wetland at Piney Lakes reserve may be partly responsible for the low pH values at this site.

Regular exceedances of soluble zinc have been recorded at site 10 (Frederick Baldwin Lake), partially as a result of the soft water at this site (on three of four sampling occasions in 2020). Exceedances of adjusted trigger values for zinc are reasonably common across the Swan and Canning River drainage catchments (Nice et al 2009). Metal speciation testing could determine the proportion of labile (not complexed) zinc complexed to organic material in water at this site, and thus its actual potential for toxicity (CSIRO 2015);

Site 10 (Frederick Baldwin) had not been sampled since 2016. This sampling year was the first time since sampling began that site 7 (Booragoon Lake) did not have the highest value recorded for the entire suit of parameters. Values recorded for each metal at site 7 (Booragoon Lake) were significantly lower than what has previously been recorded at this site from 2013 – 2019. Site 5 (John Creaney Park) had the highest values for each metal recorded out of all sites sampled for sediment in 2020, and had lower than usual amounts of metals recorded in the water samples on all occasions except for soluble iron recorded in August. This may be an indication that the sediment at site 5 is removing some of the metals from the water column and holding it within the soils at site 5.

Sediment lead concentrations have almost always exceeded the low trigger value at Booragoon Lake; however lead concentrations in Booragoon Lake waters have always been below adjusted trigger values. This may be because the comparatively silty and fine sandy sediments at Booragoon Lake are effectively trapping lead within the sediments so it is not easily released into the water column.

The high concentrations of iron and aluminium recorded at many Melville lakes sites are concerning as these metals can have negative effects on biota, although the concentrations recorded at most Melville lakes sites are generally similar to those recorded across all Swan and Canning River drainage catchments (Nice et al 2009). Possibly as a result of acid sulfate soil oxidation (DER 2015), total iron concentrations at Booragoon Lake and Blue Gum Lake are particularly high and thus may be more likely to result in damage to biota and/or unsightly iron flocs that compromise water clarity. It is noted that comparatively high concentrations of aluminium and iron were also found at Booragoon Lake and Blue Gum Lake which could potentially be released into the water column in certain conditions.

Dissolved oxygen has generally been below the ANZECC acceptable range for wetlands at all Melville lakes sites throughout the past 14 years of monitoring, with particularly low median values at site 7 (Booragoon Lake outlet), site 8 (Piney Lakes outlet) and historically site 12 (Blue Gum Lake outlet). Low oxygen can occur in wetlands as a result of excessively high organic loads (either from animal waste or vegetation decomposition), or interaction with groundwater, which is generally comparatively low in oxygen. The lower oxygen at site 7 and site 8 (Booragoon Lake outlet and Piney Lakes outlet, respectively) in recent years could indicate an increase in oxygen demand at these sites. The low oxygen in these lakes is concerning issue as low oxygen saturations can be directly harmful to biota, result in increased toxicity of some metals to biota, and result in phosphorus release from sediments and subsequent eutrophication.

The pH at site 11 (Marmion Reserve) was very high in 2020 (and previously in 2019) and has often be high in late spring and summer months. This may be due to the high number of algae observed at the site in October, which would also explain the very high dissolved oxygen concentration observed. This algal growth has occurred despite total nitrogen concentrations being below ANZECC wetland guideline values and low nitrogen as ammonia/ammonium; although the site did record values exceeding the total phosphorous ANZECC wetland trigger values in September and October (0.084 mg/L and 0.099 mg/L).

11. Recommendations

This water quality monitoring program is continuing to contribute valid data to the Western Australian water quality database (Water Information Reporting - WIR database) which is utilised in the management of the State's water resources. This source can also provide supporting evidence for the City to prioritise investment in water quality improvement technologies and management practices within the local government's catchment. Therefore, it is recommended to continue monitoring the water and sediment quality at all sites in the catchment to generate more interpretable data about the condition of the catchment, to determine long term patterns and changes that may occur over time and to detect anomalies in the concentrations of parameters that may occur in response to events.

It is important to continue with the implementation of the Bull Creek Water Quality Improvement Plan (WQIP) and to disseminate and consider the City Stormwater Management Guidelines (SERCUL 2019) when making decisions that may impact stormwater quality. These guidelines reference appropriate guidelines and regulations and prescribe ideal structural and non-structural practices for managing stormwater to ensure the best environmental outcomes for the City's waterbodies as well as the Swan Canning River system.

Below are recommendations and management actions based on the key findings at each specific site:

11.1 Site specific recommendations

11.1.1 Bull Creek main drain (MELDR-01)

1. Continue to implement the current Bull Creek Reserves Strategic Management Plan: 2014-2019 (City of Melville 2014) until an up to date version is released, to ensure that the restoration of the foreshore is congruent with the long term stability of the natural waterway's ecological and drainage functions.
2. Continue and extend the current floodplain restoration works throughout the Bull Creek reserve.
3. A macroinvertebrate assessment in the restored portion of Bull Creek main drain (starting at site 2 through to site 1) is recommended to assess ecological health of the waterway. Annual assessments would allow the effect of changes to the Creek (i.e. water quality changes and habitat development as plants become established) on macroinvertebrates to be assessed.
4. It is encouraged to install riffles along Bull Creek to improve dissolved oxygen levels and enhance nitrification (conversion of ammonia to nitrate) in the future. Hydrological studies would need to be conducted to inform riffle construction. Potential locations within the Creek at which these riffles could be installed (as shown in Figure 11-1) include:
   a. at the beginning of the Bull Creek Reserve at Brockman Park: This location is considered ideal as it easily accessible to plant and is visible to the public;
   b. at the point in the creek in line with the end of the cul-de-sac Forster Court; and
   c. near the amphitheatre of Rossmoyne Senior High School.
5. Riffles should be alternated with deeper pools with anoxic zones to allow denitrification (conversion of nitrate to nitrogen gas).

Figure 11-1: Approximate potential location riffles could be installed in Bull Creek.

11.1.2 Brockman Park (MELDR-02)

1. Continue to implement the current Bull Creek Reserves Strategic Management Plan: 2014-2019 (City of Melville 2014) until an up to date version is released, to ensure that the restoration of the foreshore is congruent with the long term stability of the natural waterway's ecological and drainage functions.
2. Continue and extend the current floodplain restoration works throughout the Bull Creek reserve.
3. Further investigation to determine the source of the very high nitrogen as ammonia/ammonium concentrations at Brockman Park is recommended, as this ammonia/ammonium appears to be contributing a significant amount of the total nitrogen into Bull Creek. This could include the following:
   a. review of detailed stormwater drainage maps in the area;
   b. review of groundwater flow maps; and
   c. groundwater monitoring upstream of Brockman Park.
4. Discuss with WaterCorp the potential for primary physical treatment in the area prior to the Brockman Park stormwater pipe inlet to prevent gross pollutants, particulate matter and sediment entering Bull Creek Park waterway and its foreshore. The existing inlet structure requires regular maintenance to remove gross pollutants and sediment. Maintenance should be conducted once a year at minimum, preferably in autumn.
5. Continue investigation into the source of sediment deposition at the Brockman Park outlet structure into Bull Creek and develop appropriate management actions such as installation of sediment and gross pollutant trapping structure at nearby compensation basin.
6. Ensure planting conducted in the Trevor Gribble basin is surviving and growing to help stabilise bare sand areas (see Figure 11-2A) and thus prevent sediment runoff into the basin outlet and drain during storm events that may potentially flow on to MELDR-02.

Figure 11-2: grate in Trevor Gribble Park compensation basin with leaf litter and sediment sitting on top.

11.1.3 John Creaney Park (inlet: MELDR-15, outlet: MELDR-05)

1. Redesign and/or restoration of the lake at John Creaney Park is recommended to improve its water quality, as well as that of the downstream receiving environment (Bull Creek main drain and the Canning River). This restoration could include:
   a. planting fringing in lake bed vegetation to take up nutrients and metals;
   b. installation of a circulator or aerator to improve oxygenation);
   c. dredging and disposing of excess silty, organic sediment at this site; and
   d. creating a larger buffer between lawn and wetland area to reduce organic load entering the basin.
2. Conduct groundwater sampling at John Creaney Park to determine whether contaminated groundwater from the previous landfill at the site is the source of the often high nutrients and poor sediment quality at the site.
3. Drain stencilling may be beneficial at sites along the drainage line such as Stocklands Shopping Centre and West Leeming Primary School to prevent discharge of contaminants into this drainage.

11.1.4 Downstream Elizabeth Manion Park (MELDR-16)

1. Drain stencilling may be beneficial at sites along the drainage line such as Leeming Senior High School and Leeming Primary School to prevent discharge of contaminants into the drainage here.
2. Further investigation by sampling upstream of site 16 to determine the source of metal (copper and zinc) and nutrient (total nitrogen and often phosphorus) contamination. Notice it may be difficult (as two of the closest drainage basins upstream at Barracuda Park and William Hall Park were unable be sampled when attempted in 2007 due to lack of flow).
3. Consider “opening up” closed pipe systems beneath upstream stormwater compensating basins that are generally dry to incorporate some form of treatment to water passing through the site. This may be appropriate for the basin at William Hall Park; however the feasibility of this would require further investigation.

11.1.5 Bateman Park (MELDR-06), Brentwood drain (MELDR-13) and RAAF drain (MELDR-14)

1. Continue to facilitate the maintenance of the Brentwood Living Stream restoration site: the rock riffles installed as part of the Brentwood Living stream project trap sediment that require routine removal by the Water Corporation.
2. Following construction of the Brentwood drain, it is very important to continue monitoring this site for changes to the water quality to assess the impact/effectiveness of the restoration works. It may take several years before the Living Stream’s capacity to improve water quality reaches full effectiveness. Furthermore, Water Corporation and Main Roads are in the planning stages for the reconstruction of the upstream Cloverleaf compensating basin (located at the off ramp of Leach Highway to Kwinana Freeway South bound) to mitigate the poor water quality issues from the freeway runoff and subsequently reduce negative impacts in the Brentwood drain downstream. Water quality monitoring results at site 13 will allow for the assessment of the impact of these works on the overall outcome of the Brentwood Living Stream project.
3. It may of benefit to consider providing education materials to the grounds staff at the RAAF nursing home facility to ensure optimal management of the lake and so they continue to keep the nutrient contamination low there to reduce nitrogen entering this drainage line. This could include any of the strategies suggested on how to raise community awareness of the link between stormwater drains and natural waterways suggested in section 10 of *the City of Melville Stormwater Quality Management Guidelines* (SERCUL 2019).

11.1.6 Booragoon Lake outlet (MELDR-07)

1. Continue to implement the current Booragoon Lake Reserve Strategic Management Plan (Melville 2019b) to ensure that the restoration of the Lake is congruent with the long-term stability of the lake's ecological and drainage functions.
2. Continue the replacement of grass surrounding the Lake with native species to prevent further ingress of grass into the Lake and help to filter runoff entering the lake from the surrounding area.
3. Continue the removal and control of other invasive species, which contribute to the large loads of organic material to the lake and prevent the growth of native understorey species, and replacement of these with native species.
4. It is recommended that all drainage outlets to the lake are revegetated in a similar manner to the recently redesigned outlets on the western side of the lake in an effort to improve gross pollution management.
5. Ensure that excess sediment and litter is periodically removed from the drainage basin in the north-east corner of the Lake, as necessary. This will decrease sediments (and associated nutrients and metals) entering the Lake body (DoE 2004), or consider introducing rubbish traps to capture the litter before it enters the Lake. .
6. Considering the excessively high levels of total and soluble phosphorus it is recommended to investigate possible treatment methods for the control/removal of phosphorus in a wetland environment such as an application program for Phoslock.
7. Continue monitoring pH levels in the Lake. After a year of recording pH values within the ANZECC acceptable range for wetlands (ranging from 7 – 7.11 between July and October 2019), pH values at this site have recorded values below the ANZECC acceptable range for wetlands (ranging from 6.33 – 6.55 between July and October in 2020) which has been typical for this site since sampling began in 2007. The increasing Lake pH may reduce mobilisation of metals from sediment, resulting in lower water concentrations of some metals. However if pH lowers again in the future it may be possible to neutralise acidity in the Lake originating from oxidation of acid sulphate soils with materials such as aglime, sodium bicarbonate, hydrated lime or quicklime as described by Department of Environment Regulation (2015).
8. Continue analysis of water samples for arsenic, mercury and nickel, as exceedances of trigger values for these metals have been recorded in sediment collected from this site in previous years.
9. Consider speciation testing for zinc and copper to determine the labile (and therefore bioavailable) proportion of these metal concentrations, as a proportion of the metals present may be complexed with dissolved organic material and therefore may not be toxic.
10. Macroinvertebrate sampling is recommended to provide an indication of eutrophic status and species richness in this lake of high conservation value.

11.1.7 Piney Lakes outlet (MELDR-08)

1. Investigation into ecological water requirements (EWRs) for this groundwater dependant wetland (which is also a Bush Forever Site 399) is required to determine the possible risk-of-impact of drawdown on the key elements of wetland ecosystem integrity (ecosystem processes, biodiversity, abundance and biomass of biota and quality of water and sediment) and allow for appropriate mitigation strategies to be devised.
2. Reducing the amount of grass and implementing hydrozoning of vegetation in parklands surrounding Piney Lakes will help to reduce groundwater abstraction and may help to increase maintain sufficient water levels at the Lakes.
3. As pH values have generally been below the lower acceptable limit for wetlands, consider conducting an acid sulphate soil investigation at the Lakes to determine whether this is the cause of low pH levels, and assess possible mitigation strategies. Particularly due to the site recording a pH value of 4.94 in July 2020 – a value this low has not been recorded at this site since 2012, and that the site is considered to have a high potential for acid sulfate soils (Landgate 2016).

11.1.8 Blue Gum Lake outlet (MELDR-12):

1. Continue to implement the Blue Gum Lake Reserve Strategic Management Plan (City of Melville 2019a) to ensure the stormwater objectives are met.
2. Continue restoration works on the foreshore of the lake with native species particularly with native sedges and wetland plants.
3. Continue the removal and control of other invasive species, which contribute to the large loads of organic material to the lake and prevent the growth of native understorey species, and replacement of these with native species.

4. Several outlets to the Lake have been redesigned in recent years to incorporate nutrient stripping plant species and rocky bases. Consider undertaking similar works in the remaining outlets to the Lake as outlined in the Blue Gum Lake Reserve Strategic Management Plan.
5. Reticulation and fertiliser application practices of upstream Karoonda Park should be reviewed to ensure that a minimum of nutrient enriched runoff is entering the lake from this park.
6. Considering the excessively high levels of total and soluble phosphorus it is recommended to investigate possible treatment methods for the control/removal of phosphorus in a wetland environment such as an application program for Phoslock.
7. Where this has not already been done, create a barrier between the foreshore and lawn verge to prevent encroachment of lawn grasses and weeds to facilitate a definite edge for more efficient park management.
8. Continue to regularly inspect the premises of the Tennis Club as per the Memorandum Of Understanding (MOU) between the City and the Blue Gum Park Tennis Club in regards to fertiliser use and the storage of fertiliser within the precinct
9. Given the particularly low pH of waters previously recorded at the site (although less since 2017), consider conducting an acid sulfate soil investigation at the lake to determine the extent of acid sulfate soils and consider options for mitigation.
10. Consider speciation testing for aluminium, zinc and copper to determine the labile (and therefore bioavailable) proportion of these metal concentrations, as some of the metals present may be complexed with dissolved organic material.
11. Macroinvertebrate sampling is recommended to provide an indication of eutrophic status and species richness in this lake of high conservation value.

11.1.9 Quenda Lake outlet (MELDR-09):

1. Continue to implement the Quenda Wetland Reserve Strategic Management Plan (City of Melville 2016b), to ensure the stormwater objectives are met.
2. Continued monitoring of this site is recommended to see the long term impact of the new drainage works from Main Roads, road construction and new building infrastructure upgrades in the surrounding areas.
3. As recommended by Natural Area Consulting (2016), it is recommended the City in liaison with stakeholders from St. John of God Hospital and the Water Corporation, upgrade the stormwater drainage system to manage the erosion caused by the stormwater entering the site from the hospital car park.

11.1.10 Frederick Baldwin (MELDR-10):

1. Continue consideration of the replacement of *Casuarina cunninghamiana* (Sydney she-oak) with local wetland tree species (*Melaleuca rhaphiophylla, Eucalyptus rudis*) in a staged fashion to reduce the weed seeding of downstream wetlands and waterways and increase nutrient uptake. Removing these trees will remove the needles which prevent the growth of understorey riparian vegetation.
2. Implement a foreshore revegetation program simultaneously with installation of bio-filtration sedge plantings to provide a buffer between the lawn recreational area and the lake foreshore. This will improve the aesthetics as well as improving the filtration of surface water entering the lake.
3. It is understood that signage at the lake had been developed to increase community awareness of where this lake's water comes from and where the lake water flows to encourage the community to consider responsible use of stormwater drainage.

11.1.11 Marmion Reserve (MELDR-11):

1. The playground equipment was scheduled to be renewed in July 2020, use this opportunity to educate the community regarding how to protect the wetlands. If this has not been renewed due to Covid-19, then ensuring community education is still incorporated into the renewal of the playground equipment at this site when it occurs is strongly encouraged.
2. It may be of benefit to consider providing educational materials to the grounds staff at the adjacent retirement villages on the west side of Marmion reserve to ensure gardening activities do not result in additional pollution to the lake. This could include the City's Protecting Your Wetlands brochure, which is understood to have been recently updated, or SERCUL's Phosphorus Awareness Project brochure (http://sercul.org.au/docs/PAP.pdf).
3. Continue to maintain the City foreshore restoration project including planting with native tree species on the island and large areas surrounding the lake. It is understood that the City has removed collapsed

and aging willows on the Lake island and from around the lake as well as older shrubs and weedy shrubs from around the lake and plans to replace this with native tree species. As willow trees are deciduous and known to produce large volumes of leaf litter (Latta 1974), this should provide a positive benefit to lake water quality by reducing the leaf litter previously entering the lake.

4. As low water levels have been observed at this lake in previous years (although not in 2017 and 2018) consider monitoring of water levels throughout the year to allow for appropriate planning to occur.

11.2 Catchment wide recommendations

1. Continue with the implementation of the Bull Creek Water Quality Improvement Plan (WQIP).
2. Continue monitoring the water and sediment quality at all sites in the catchment to generate more interpretable data about the condition of the catchment, to determine patterns and changes that may occur over time and to detect anomalies in the concentrations of parameters that may occur in response to events.
3. Disseminate and consider the City of Melville Stormwater Management Guidelines (SERCUL 2019) when making decision that may impact stormwater quality. These guidelines reference appropriate guidelines and regulations and prescribe ideal structural and non-structural practices for managing stormwater to ensure the best environmental outcomes for the City's waterbodies as well as the Swan Canning River system.
4. Low oxygen saturations within the wetlands, lakes and waterways of this catchment are common. This is a consistent finding with heavily piped catchments and/or wetlands with excessively high organic loads (either from animal waste or vegetation decomposition). It is recommended that wherever possible open water inlets and if possible outlets should flow over loosely arranged rocky substrate to provide some oxygenation during medium to high flow events. Additionally, this implementation of rocky substrate may increase surface area for bacteria to inhabit and assist with the nitrogen cycle and break down of other nutrients (Aczel 2019). This, along with open water areas that allow wind driven oxygen transfer and appropriate wetland designs which allow for seasonal wetting/drying processes to assist microbial activity (breaking down organic matter) may provide a collective improvement in oxygenation over time.
5. It is recommended that audits of industrial premises, consistent with the Light Industry Program (LIP), are continued to be conducted by trained City of Melville officers with the aim of reducing contaminants being released into groundwater and stormwater drainage.
6. It is understood that City of Melville parks and gardens staff have undertaken SERCUL's Fertilise Wise training in the past (http://www.fertilisewise.com.au/docs/FWFertiliserTrainingAdvert.pdf). It is recommended that all parks and gardens staff who have not previously attended this training (or a similar course) should do so. The best management practices taught as part of this training should be implemented when managing parks, including optimal timing of fertiliser application and calculation of optimal rates of fertiliser application.
7. Continue to encourage schools in the City of Melville to participate in SERCUL's Phosphorus Awareness Program, which involves education of both primary and high school students about how actions undertaken in the home and garden can impact the environment (https://www.sercul.org.au/for-educators/incursions-and-excursions/).
8. Continue to educate residents about appropriate plant species, fertiliser and water use (Piney programs, brochures, mail outs and work with community groups).
9. As proposed in the WQIP for the Bull Creek Catchment, review historical and current land use data, in particular contaminated and old tip sites, to identify potential sources of contaminants, prioritise areas requiring further investigation and identify management options.
10. As recommended in the Stormwater Management Manual for Western Australia (DoE 2004), coordinate road sweeping with maintenance activities (i.e. road or construction works) and specific events (i.e. storm events or public major events). Best results can be achieved by focusing on 'hot spots' rather than routinely sweeping all streets.
11. Continue to regularly remove accumulated pollutants (e.g. sediment and gross pollutants) from nodes in the stormwater network, such as pits and infiltration sumps.
12. Incorporate water sensitive urban design techniques into management practices when upgrading the catchment (e.g. permeable paving, bio-retention swales, pipe-less streets and rain gardens).

13. Continue to ensure the use of herbicides and insecticides on roadsides is undertaken as per manufacturer's recommendations, and ensure maintenance staff use appropriate handling and application procedures for these materials.
14. Continue to regularly conduct soil testing and leaf tissue analysis on turf areas before applying fertilisers.
15. Continue to use native vegetation along roadsides, paths and in swales.
16. Continue to revegetate natural areas and remove weeds to increase biodiversity.
17. The following issues should be considered when formulating Acid Sulfate Soil (ASS) environmental management strategies:
    a) The sensitivity and environmental values of the receiving environment. This includes the conservation, protected or other relevant status of the receiving environment (e.g. wetlands, Marine Parks, etc.).
    b) Whether groundwater and/or surface water are likely to be directly or indirectly affected.
    c) The heterogeneity, geochemical and textural properties of soils on site.
    d) The management and planning strategies of local government and/or state government.
18. The following examples of structural best management practices to be incorporated into management plans where appropriate:
    - onsite detention;
    - stormwater infiltration systems;
    - buffer strips;
    - pollutant traps;
    - grass or reed swale drains;
    - broken or flush kerbing;
    - pervious paving materials;
    - nutrient intervention installation
    - native landscaping; and
    - ponds and wetlands including implementation of living streams with the involvement of the community to provide multiple positive effects by increasing public awareness and further improving water quality.

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Appendix A ANZECC Trigger Values and Guidelines

Table A-1: Trigger values for physicochemical parameters and nutrients

Guideline	pH	DO % Sat	EC (mS/cm)	TSS (mg/L)	TN (mg/L)	NO_X-N (mg/L)	NH_3-N/NH_4-N (mg/L)	TP (mg/L)	FRP (mg/L)
Guideline values for recreational use (NHMRC 2008)	6.5-8.5	>80	-	-	-	30 (for NO_2^-) 500 (for NO_3^-) (health)	5 (aesthetic)	-	-
ANZECC Water Quality Trigger Values - lowland river (2000)	6.5-8.0	80-120	0.12-0.3	-	1.2	0.15	0.08	0.065	0.04
ANZECC Water Quality Trigger Values wetland (2000)	7-8.5	90-120 (>6mg/L)	0.3-1.5	-	1.5	0.10	0.04	0.06	0.03
ANZECC Water Quality Trigger Values - freshwater protection (2000)	-	-	-	-	-	-	0.9	-	-
Experimentally derived guideline by Hosking Chemical Services	-	-	-	6	-	-	-	-	
SRT Healthy River Action Plan (SRT 2008)	-	-	-	-	2^S 1^L	-	-	0.2^S 0.1^L	-
ChemCentre Limit of Reporting	-	-	-	1	0.025	0.01	0.01	0.005	0.005

[1]*Trigger value not adjusted for pH and temperature*

[S]*Short term*

[L]*Long term*

Table A-2: Trigger values for metals in water

Guideline	Al (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Hg (mg/L)	Zn (mg/L)	As (mg/L)	Ni (mg/L)	Hardness (mg/L)
Recreational use guideline values (NHMRC 2008, NHMRC 2016)	0.2 (aesthetics)	0.05[5] (health)	1 (aesthetic) 2 (health)	0.3 (aesthetic)	0.01 (health)	0.001 (health)	3 (aesthetic)	0.007 (health)	0.02	-
ANZECC Water quality trigger value – Freshwater 95% (2000)	0.055[1]	0.0033[2,3]	0.0014[2]	0.3[4]	0.0034[2]	0.0006	0.008[2]	0.024[2]	0.011	-
ChemCentre Limit of Reporting (required)	0.005	0.0001	0.0001	0.005	0.0001	0.0001	0.001	0.0001	0.0005	5

[1]*Applicable only when pH>6.5, when pH<6.5 a low reliability interim value of 0.0008 mg/L is applicable*

[2]*Trigger values not adjusted for water hardness.*

[3]*Low reliability interim value*

[4]*Interim guideline*

[5] *Value for* Cr^{6+} *used*

Table A-3: ANZECC trigger values for metals in sediment

Guideline	Al (mg/kg)	As (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Hg (mg/kg)	Pb (mg/kg)	Ni (mg/kg)	Se (mg/kg)	Zn (mg/kg)
ANZECC Low Trigger Value (2013)	N.D.	20	80	65	N.D.	0.15	50	21	N.D.	200
ANZECC High trigger value (2013)	N.D.	70	370	270	N.D.	1.0	220	52	N.D.	410
ChemCentre Limit of Reporting	1	0.5	0.5	0.5	1	0.02	0.05	0.1	0.05	1

Appendix B Changes to the monitoring program since 2007

In 2008 the following changes were made:

- Sites MELDR-03, MELDR-04 and MELDR-05 were dropped from the project as they were always dry in 2007 and are only overflow points from the drains rather than being representatives of the drainage network itself.
- The collection of organic carbon samples was discontinued due to insufficient funds.
- Analysis for polycyclic aromatic hydrocarbons, benzene, ethyl benzene, toluene and xylene (BTEX) and total petroleum hydrocarbons in water samples was discontinued from all sites, as they were rarely detected above laboratory limits of reporting in 2007 and due to reduced budget.
- Sampling frequency was altered from quarterly in 2007 to once every two months for 4 events in total in 2008. This is due to the very late start for the project in 2008 due to funding uncertainty.
- Sampling for sediment was discontinued as the City could not provide sufficient funds to continue this component of the sampling program.

The project started very late in 2008 (September) due to funding uncertainty from the major stakeholder and as a result all winter rains and flows have been missed for the 2008 sampling project. It is possible that this may have an effect on the water quality of the collected samples and the number of samples that can be collected.

In 2009 the following change was made:

- Soluble metals analysis (for soluble aluminium, chromium, copper, iron, lead and zinc) was added at two sites (MELDR-01 and MELDR-06) based on the recommendations from the previous year's results.
-

In 2010 the following change was made:

- Sampling frequency was altered from every two months to monthly during the winter for four events in total during 2010. This is due to the dry conditions at most of the sites throughout the year.

In 2011 the following changes were made:

- Sampling for metals that have recorded concentrations below the limit of report during the four-year sampling period was discontinued. Therefore, only eight total metals were included in the 2011 sampling program (aluminium, arsenic, chromium, copper, iron, nickel, lead and zinc) and cadmium and mercury were dropped. Surveillance monitoring of arsenic and nickel will be continued as these metals have consistently been detected above the LORs at some sites (particularly arsenic at Bateman Park, Booragoon lake, Frederick Baldwin, Marmion Reserve and Blue Gum Lake and nickel at John Creaney, Bateman Park and Booragoon Lake), despite having not been detected above trigger values.
- Considering the consistent, sometimes widespread, contamination of some metals in the catchment, soluble metals were included to provide data about the concentrations of these metals that may be available for biological uptake and therefore potentially impact on the biota. Soluble metals analysis for aluminium, chromium, copper, iron, lead and zinc was added at four more sites (MELDR-05, MELDR-10, MELDR-11 and MELDR-12). These four sites have consistently recorded concentrations above the trigger value.
- The City included soluble metals analysis for a fifth site; Booragoon Lake (MELDR-07) due to the works that the City has undertaken there.

There were additional changes to those included in the 2011 SAP due to some very low pH values (<4.5) recorded in Booragoon and Blue Gum Lakes and turtle deaths at Blue Gum lake.

- Addition of six new sites, one at Booragoon Lake (MELDR-BL1) and five at Blue Gum Lake (MELDR-BGL1, MELDR-BGL2, MELDR-BGL3, MELDR-BGL4 and MELDR-BGL5).

- Sampling for total acidity and total alkalinity in water at two existing sites (MELDR-07 and MELDR-12) and the new six sites (listed above).
- Sampling for titratable actual acidity (TAA) in sediment at these two lakes at two existing sites (MELDR-07 and MELDR-12) and the new six sites.

In 2012 the following change was made:

- Sampling at the six new sites (included in 2011) at Booragoon Lake (MELDR-BL1) and Blue Gum Lake (MELDR-BGL1, MELDR-BGL2, MELDR-BGL3, MELDR-BGL4 and MELDR-BGL5) was discontinued. However, if Blue Gum Lake pH falls rapidly again after a period of drying and rewetting, these sites would be sampled for the same parameters than in 2011.

In 2013 the following change were made:

- Due to proposed restoration works upstream Bateman Park site (site 6) two new sites were added upstream of this site to collect baseline data from the two drains (Brentwood drain and RAAF drain) before they merge. These two new sites (sites 13 and 14) were sampled during October and November 2013 sampling events and were continued in the 2014 sampling monitoring program. These sites were sampled for the same parameters included at Bateman Park site (site 6).

In 2014 the following changes were made:

- Total metal analysis for mercury (Hg) (originally discontinued in 2011) was added to Bateman Park, Brentwood Drain and RAAF Drain (sites 6, 13 and 14) for suspicions of elevated levels where the proposed earth works may occur in the pending Brentwood MD restoration project. Earlier sediment testing conducted by SRT indicated Hg contamination at the site but subsequent testing was not consistent.
- In an effort to isolate the pollution source/s that were contributing with the poor water quality entering at Brockman Park site (site 2) two new sites were added to the last three sampling events. John Creaney Park inlet and Down Stream Elizabeth Manion Park (site 15 and 16) were tested for the same nutrients and physical parameters included in Brockman Park: dissolved oxygen, pH, temperature and electrical conductivity, total and soluble nutrients and total suspended solids. Additionally, these two sites were tested for the 14 total metals suite recommended by the Department of Water for new sites: aluminium, cadmium, arsenic, chromium, cobalt, copper, iron, mercury, nickel, lead, manganese, molybdenum, selenium, and zinc. Since soluble metals were not included in Brockman Park, they were also no included at the two new sites.
- The eastern side of the catchment (within the City of Canning) was monitored for the first time in 2014 including the Brockman Park inlet (ROSSTAFE) which enters the Bull Creek main drain downstream Brockman Park (site 2) and before Bull Creek MD (PSDTBCMD). The inclusion of the analysis of Brockman Park inlet in this report will provide insight into the relative contributions from the individual segments (Brockman Park in the City and Rossmoyne Drain in the City of Canning) and their impact downstream on Bull Creek MD (site1).

In 2015 the following changes were made:

- Total arsenic and total nickel in water were discontinued at the 12 original sites (1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14) as they have always recorded concentrations below the trigger values and on many occasions they have been equal to the limits of reporting at all sites. At the above mentioned 12 sites, six total metals (aluminium, chromium, copper, iron, lead and zinc) were included on one sampling occasion for surveillance, and six soluble metals (aluminium, chromium, copper, iron, lead and zinc) were included on all four sampling occasions.
- The addition of particle size analysis in sediment samples to enable better interpretation of metals concentrations in these samples. Particle size analysis was performed on the same sampling event when sediment samples were taken at 12 of the 15 sites included in the SAP.

In 2017, samples from sites 15 and 16 (introduced in 2014) were analysed for the same suite of parameters as the majority of the other sites. i.e. for total metals (Al, Cr, Cu, Fe, Pb and Zn) in the first round of sampling and soluble metals (Al, Cr, Cu, Fe, Pb and Zn) for all four sampling events instead of being analysed for the full suite of metals and for total metals only (Al, As, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se and Zn). As samples from sites 15 and 16 did not record particularly high concentrations of any of the other metals included in the full suite of metals in the previous three years of sampling, but at least one of the sites has recorded high concentrations of total aluminium, iron, copper and zinc, it was decided that is was more critical to determine the soluble portions of aluminium, iron, copper and zinc, as this has implications for the negative impacts the metals can have.

In 2019, metals arsenic, mercury and nickel will be added to the water analysis suite for samples collected from Booragoon Lake, as high concentrations of these metals have been detected in sediments at this site in previous years.

Appendix C Temperature and rainfall data

Rain fell only during one sampling date, the 16th July (1 mm) (Figure C-1). Rainfall occurred in the three days prior to the July sampling and six days prior to the August sampling events (totals of 30.8 mm and 34.2 mm, respectively). In contrast, there was null rain registered six days prior to the September and October sampling events, and no rain occurring on either of these sampling days. The maximum air temperatures recorded for the four sampling days were 20.2°C on July 16th, 20°C on August 20th, and 20.4 °C on September 17th and 22.5°C on 15th October (Australian Bureau of Meteorology 2020a).

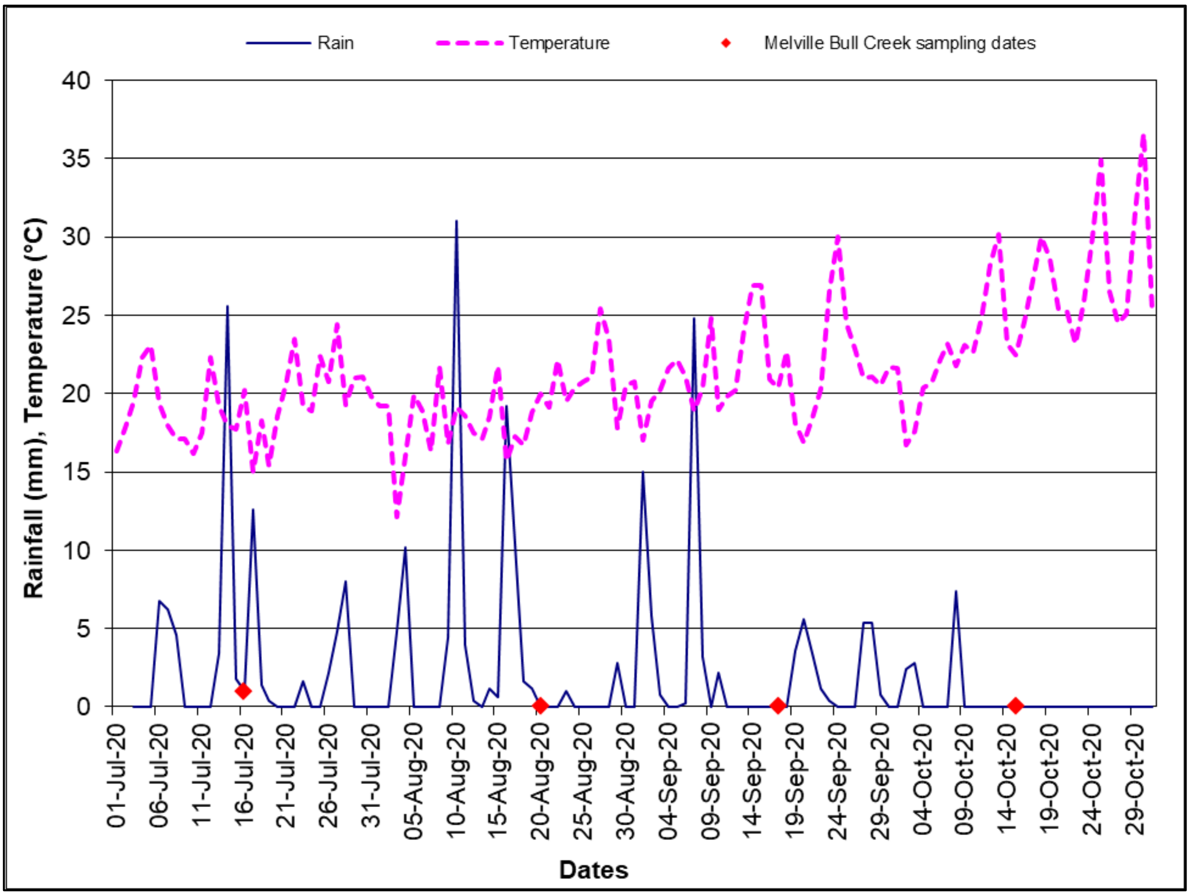

Figure C-1: Daily rainfall (mm) and temperature (°C) in Perth (a combination of observations from Mount Lawley and Perth Airport Metropolitan region) from beginning of July to the end of October 2020 (Source: BOM 2020a)

Annual rainfall for the Perth metro in 2020 was below average, with Perth experiencing its fourth driest winter (BOM 2020b). Although, November was an unusually wet month with some places recording more than double the November average. Perth metro's recorded 92 mm of rain in November which made it the highest rainfall to be recorded in November at any central Perth site since 1867. The Perth metro recorded annual rainfall estimated in 673.4 mm. Annual mean maximum temperatures were above average, Perth metro's mean maximum temperature was 25.3°C which was 0.5°C above the long term average. Perth metro's mean minimum temperature was 13.5°C, which is 0.7°C above the long term average of 12.8°C (BOM 2020b).

Appendix D Water quality results tables

D1 Physicochemical parameters in water

Table D-1: pH values recorded in Melville Bull Creek catchment sites in 2020

pH Max (red) 9.99 Min (blue) 4.94

ANZECC trigger value for lowland rivers of SW Australia 6.5 - 8.0; for wetlands 7.0 - 8.5; NHMRC recreational guideline value 6.5 - 8.5

Site Name	Site Number	Collect Date	pH (pH units)	Comparison to ANZECC lower limit: 6.5 (lowland rivers) or 7 (wetlands)	Comparison to ANZECC upper limit: 8 (lowland rivers) or 8.5 (wetlands)	Comparison to NHMRC recreational lower limit: 6.5	Comparison to NHMRC recreational upper limit: 8.5
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	7.15	Acceptable	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	6.24	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	7.28	Acceptable	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	6.21	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
BULL CREEK MD	MELDR-01	16-Jul-20	6.57	Acceptable	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	6.42	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	6.83	Acceptable	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	6.63	Acceptable	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	6.55	Does not meet guidelines	Acceptable	Acceptable	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	4.94	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	7.49	Acceptable	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	6.94	Does not meet guidelines	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	8.96	Acceptable	Does not meet guidelines	Acceptable	Does not meet guidelines
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	7.24	Acceptable	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	6.3	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	6.13	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	6.76	Acceptable	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	6.31	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	6.73	Acceptable	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	6.55	Acceptable	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	7.07	Acceptable	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	6.69	Acceptable	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	6.5	Does not meet guidelines	Acceptable	Acceptable	Acceptable
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	5.31	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	6.65	Does not meet guidelines	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	6.9	Does not meet guidelines	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	9.94	Acceptable	Does not meet guidelines	Acceptable	Does not meet guidelines
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	7.25	Acceptable	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	6.33	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	6.25	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	6.96	Acceptable	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	6.15	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	6.76	Acceptable	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	6.5	Acceptable	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	6.57	Acceptable	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	7.33	Acceptable	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	6.33	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	5.78	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	6.69	Does not meet guidelines	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	7.71	Acceptable	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	9.11	Acceptable	Does not meet guidelines	Acceptable	Does not meet guidelines
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	6.92	Does not meet guidelines	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	6.47	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
JOHN CREANEY PARK	MELDR-05	15-Oct-20	6.35	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	6.78	Acceptable	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	6.29	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
BULL CREEK MD	MEIDR-01	15-Oct-20	6.74	Acceptable	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	6.49	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	7	Acceptable	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	6.92	Acceptable	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	6.54	Does not meet guidelines	Acceptable	Acceptable	Acceptable
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	6.4	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	6.94	Does not meet guidelines	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	6.06	Does not meet guidelines	Acceptable	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	9.99	Acceptable	Does not meet guidelines	Acceptable	Does not meet guidelines
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	7.72	Acceptable	Acceptable	Acceptable	Acceptable

Table D-2: Dissolved oxygen saturations recorded in Melville Bull Creek catchment sites in 2020

Dissolved oxygen (saturation) Max (red) 129.5 Min (blue) 9.1

ANZECC acceptable range for lowland rivers: 80-120%, wetlands: 90-120%; NHMRC recreational value: >80%

Site Name	Site Number	Collect Date	DO (%)	Comparison to ANZECC lower limit: 80 % (lowland rivers) or 90 % (wetlands)	Comparison to ANZECC upper limit: 120% (lowland rivers and wetlands)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	82.9	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	31.6	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	93.1	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	71.8	Does not meet guidelines	Acceptable
BULL CREEK MD	MELDR-01	16-Jul-20	57.2	Does not meet guidelines	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	73.8	Does not meet guidelines	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	87.7	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	65.2	Does not meet guidelines	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	29.2	Does not meet guidelines	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	12.9	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	96.5	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	70.1	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	108.3	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	88.9	Does not meet guidelines	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	33.4	Does not meet guidelines	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	21	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	82.1	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	45.7	Does not meet guidelines	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	60.2	Does not meet guidelines	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	63.9	Does not meet guidelines	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	86.3	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	65.7	Does not meet guidelines	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	17.7	Does not meet guidelines	Acceptable
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	20.2	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	59.1	Does not meet guidelines	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	40.9	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	128.8	Acceptable	Does not meet guidelines
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	93.8	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	40.6	Does not meet guidelines	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	27.5	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	92.6	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	36	Does not meet guidelines	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	61.7	Does not meet guidelines	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	64.2	Does not meet guidelines	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	38.6	Does not meet guidelines	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	81.8	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	12.1	Does not meet guidelines	Acceptable
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	43.6	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	68.5	Does not meet guidelines	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	81.3	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	105.2	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	78.3	Does not meet guidelines	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	22.7	Does not meet guidelines	Acceptable
JOHN CREANEY PARK	MELDR-05	15-Oct-20	9.1	Does not meet guidelines	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	88.7	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	29.6	Does not meet guidelines	Acceptable
BULL CREEK MD	MEIDR-01	15-Oct-20	58.3	Does not meet guidelines	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	64.1	Does not meet guidelines	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	73.9	Does not meet guidelines	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	54.1	Does not meet guidelines	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	17.8	Does not meet guidelines	Acceptable
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	31.6	Does not meet guidelines	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	109.4	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	37	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	129.5	Acceptable	Does not meet guidelines
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	121.6	Acceptable	Does not meet guidelines

Table D-3: Dissolved oxygen concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Dissolved oxygen (concentration)

Max (red) 12.91 Min (blue) 0.85

Site Name	Site Number	Collect Date	DO (mg/L)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	8.16
JOHN CREANEY PARK	MELDR-05	16-Jul-20	3.2
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	9.03
BROCKMAN PARK	MELDR-02	16-Jul-20	6.75
BULL CREEK MD	MELDR-01	16-Jul-20	5.51
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	7.03
RAAF DRAIN	MELDR-14	16-Jul-20	8.88
BATEMAN PARK	MELDR-06	16-Jul-20	6.4
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	2.98
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	1.25
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	9.68
FREDERICK BALDWIN	MELDR-10	16-Jul-20	7.01
MARMION RESERVE	MELDR-11	16-Jul-20	10.89
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	8.45
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	3.23
JOHN CREANEY PARK	MELDR-05	20-Aug-20	2.14
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	7.65
BROCKMAN PARK	MELDR-02	20-Aug-20	4.21
BULL CREEK MD	MELDR-01	20-Aug-20	5.91
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	6.08
RAAF DRAIN	MELDR-14	20-Aug-20	8.83
BATEMAN PARK	MELDR-06	20-Aug-20	6.52
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	1.79
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	1.81
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	6.25
FREDERICK BALDWIN	MELDR-10	20-Aug-20	4.06
MARMION RESERVE	MELDR-11	20-Aug-20	12.91
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	8.34
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	3.87
JOHN CREANEY PARK	MELDR-05	17-Sep-20	2.74
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	8.58
BROCKMAN PARK	MELDR-02	17-Sep-20	3.35
BULL CREEK MD	MELDR-01	17-Sep-20	5.97
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	6
RAAF DRAIN	MELDR-14	17-Sep-20	3.72
BATEMAN PARK	MELDR-06	17-Sep-20	8.11
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	1.17
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	3.84
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	6.79
FREDERICK BALDWIN	MELDR-10	17-Sep-20	7.45
MARMION RESERVE	MELDR-11	17-Sep-20	9.9
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	6.65
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	2.1
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.85
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	8.16
BROCKMAN PARK	MELDR-02	15-Oct-20	2.69
BULL CREEK MD	MEIDR-01	15-Oct-20	5.52
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	5.87
RAAF DRAIN	MELDR-14	15-Oct-20	7.02
BATEMAN PARK	MELDR-06	15-Oct-20	5.13
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	1.59
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	2.75
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	10.24
FREDERICK BALDWIN	MELDR-10	15-Oct-20	3.28
MARMION RESERVE	MELDR-11	15-Oct-20	11.73
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	10.15

Table D-4: Electrical conductivity (mS/cm) recorded in Melville Bull Creek catchment sites in 2020

Electrical Conductivity (EC) Max (red) 3.076 Min (blue) 0.083

ANZECC trigger value 0.12-0.3 mS/cm for lowland rivers; 0.3 - 1.5 mS/cm for wetlands

Site Name	Site Number	Collect Date	EC (mS/cm)	Comparison to ANZECC lower limit: 0.12 (lowland rivers) or 0.3 (wetlands)	Comparison to ANZECC upper limit: 0.3 (lowland rivers) or 1.5 (wetlands)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.083	Does not meet guidelines	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.127	Acceptable	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.102	Does not meet guidelines	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.329	Acceptable	Does not meet guidelines
BULL CREEK MD	MELDR-01	16-Jul-20	0.686	Acceptable	Does not meet guidelines
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.324	Acceptable	Does not meet guidelines
RAAF DRAIN	MELDR-14	16-Jul-20	0.346	Acceptable	Does not meet guidelines
BATEMAN PARK	MELDR-06	16-Jul-20	0.527	Acceptable	Does not meet guidelines
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	3.076	Acceptable	Does not meet guidelines
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	1.398	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.095	Does not meet guidelines	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.131	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.191	Does not meet guidelines	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.791	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.692	Acceptable	Does not meet guidelines
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.893	Acceptable	Does not meet guidelines
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.382	Acceptable	Does not meet guidelines
BROCKMAN PARK	MELDR-02	20-Aug-20	0.78	Acceptable	Does not meet guidelines
BULL CREEK MD	MELDR-01	20-Aug-20	0.747	Acceptable	Does not meet guidelines
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.604	Acceptable	Does not meet guidelines
RAAF DRAIN	MELDR-14	20-Aug-20	0.502	Acceptable	Does not meet guidelines
BATEMAN PARK	MELDR-06	20-Aug-20	0.579	Acceptable	Does not meet guidelines
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	2.63	Acceptable	Does not meet guidelines
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	1.136	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.661	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.171	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	0.162	Does not meet guidelines	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.919	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.777	Acceptable	Does not meet guidelines
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.944	Acceptable	Does not meet guidelines
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.727	Acceptable	Does not meet guidelines
BROCKMAN PARK	MELDR-02	17-Sep-20	0.774	Acceptable	Does not meet guidelines
BULL CREEK MD	MELDR-01	17-Sep-20	0.767	Acceptable	Does not meet guidelines
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.615	Acceptable	Does not meet guidelines
RAAF DRAIN	MELDR-14	17-Sep-20	0.631	Acceptable	Does not meet guidelines
BATEMAN PARK	MELDR-06	17-Sep-20	0.683	Acceptable	Does not meet guidelines
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	2.626	Acceptable	Does not meet guidelines
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	1.544	Acceptable	Does not meet guidelines
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.711	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.268	Does not meet guidelines	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	0.208	Does not meet guidelines	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.872	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	2.599	Acceptable	Does not meet guidelines
JOHN CREANEY PARK	MELDR-05	15-Oct-20	1.325	Acceptable	Does not meet guidelines
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.604	Acceptable	Does not meet guidelines
BROCKMAN PARK	MELDR-02	15-Oct-20	0.803	Acceptable	Does not meet guidelines
BULL CREEK MD	MEDR-01	15-Oct-20	0.753	Acceptable	Does not meet guidelines
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.619	Acceptable	Does not meet guidelines
RAAF DRAIN	MELDR-14	15-Oct-20	0.719	Acceptable	Does not meet guidelines
BATEMAN PARK	MELDR-06	15-Oct-20	0.646	Acceptable	Does not meet guidelines
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	2.764	Acceptable	Does not meet guidelines
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.944	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.757	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.488	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	0.222	Does not meet guidelines	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.963	Acceptable	Acceptable

Table D-5: Total suspended solids (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Total Suspended Solids (TSS)			LOR 1 mg/L and 2 mg/L	
Experimentally derived guideline 6 mg/L		Max (red) 52		Min (blue) <2
Site Name	**Site Number**	**Collect Date**	**TSS (mg/L)**	**Comparison to DWER interim guideline: 6**
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	52	Does not meet guidelines
JOHN CREANEY PARK	MELDR-05	16-Jul-20	2	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	7	Does not meet guidelines
BROCKMAN PARK	MELDR-02	16-Jul-20	7	Does not meet guidelines
BULL CREEK MD	MELDR-01	16-Jul-20	2	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	33	Does not meet guidelines
RAAF DRAIN	MELDR-14	16-Jul-20	2	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	2	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	5	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	4	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	14	Does not meet guidelines
FREDERICK BALDWIN	MELDR-10	16-Jul-20	4	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	2	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	2	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	3	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	12	Does not meet guidelines
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	7	Does not meet guidelines
BROCKMAN PARK	MELDR-02	20-Aug-20	3	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	2	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	6	Does not meet guidelines
RAAF DRAIN	MELDR-14	20-Aug-20	2	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	6	Does not meet guidelines
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	7	Does not meet guidelines
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	11	Does not meet guidelines
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	37	Does not meet guidelines
FREDERICK BALDWIN	MELDR-10	20-Aug-20	3	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	<2	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	4	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	4	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	14	Does not meet guidelines
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	11	Does not meet guidelines
BROCKMAN PARK	MELDR-02	17-Sep-20	5	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	6	Does not meet guidelines
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	6	Does not meet guidelines
RAAF DRAIN	MELDR-14	17-Sep-20	6	Does not meet guidelines
BATEMAN PARK	MELDR-06	17-Sep-20	2	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	14	Does not meet guidelines
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	10	Does not meet guidelines
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	10	Does not meet guidelines
FREDERICK BALDWIN	MELDR-10	17-Sep-20	4	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	5	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	5	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	15	Does not meet guidelines
JOHN CREANEY PARK	MELDR-05	15-Oct-20	6	Does not meet guidelines
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	12	Does not meet guidelines
BROCKMAN PARK	MELDR-02	15-Oct-20	8	Does not meet guidelines
BULL CREEK MD	MEIDR-01	15-Oct-20	4	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	7	Does not meet guidelines
RAAF DRAIN	MELDR-14	15-Oct-20	6	Does not meet guidelines
BATEMAN PARK	MELDR-06	15-Oct-20	7	Does not meet guidelines
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	6	Does not meet guidelines
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	13	Does not meet guidelines
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	9	Does not meet guidelines
FREDERICK BALDWIN	MELDR-10	15-Oct-20	31	Does not meet guidelines
MARMION RESERVE	MELDR-11	15-Oct-20	5	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	14	Does not meet guidelines

Table D-6: Water temperature (°C) recorded in Melville Bull Creek catchment sites in 2020

Water temperature

Max (red) 24.3 Min (blue) 12.7

Site Name	Site Number	Collect Date	Temperature (°C)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	16.2
JOHN CREANEY PARK	MELDR-05	16-Jul-20	14.8
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	16.8
BROCKMAN PARK	MELDR-02	16-Jul-20	18.3
BULL CREEK MD	MELDR-01	16-Jul-20	17.1
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	17.7
RAAF DRAIN	MELDR-14	16-Jul-20	14.8
BATEMAN PARK	MELDR-06	16-Jul-20	16.2
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	13.9
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	16.8
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	15.2
FREDERICK BALDWIN	MELDR-10	16-Jul-20	15.4
MARMION RESERVE	MELDR-11	16-Jul-20	15.1
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	17.7
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	16.9
JOHN CREANEY PARK	MELDR-05	20-Aug-20	14.6
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	18.8
BROCKMAN PARK	MELDR-02	20-Aug-20	19.3
BULL CREEK MD	MELDR-01	20-Aug-20	16.2
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	17.7
RAAF DRAIN	MELDR-14	20-Aug-20	14.3
BATEMAN PARK	MELDR-06	20-Aug-20	15.6
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	14.3
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	20.7
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	12.7
FREDERICK BALDWIN	MELDR-10	20-Aug-20	15.7
MARMION RESERVE	MELDR-11	20-Aug-20	15.3
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	21.0
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	17.6
JOHN CREANEY PARK	MELDR-05	17-Sep-20	15.5
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	19
BROCKMAN PARK	MELDR-02	17-Sep-20	18.7
BULL CREEK MD	MELDR-01	17-Sep-20	16.8
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	18.6
RAAF DRAIN	MELDR-14	17-Sep-20	17
BATEMAN PARK	MELDR-06	17-Sep-20	15.7
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	16.6
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	21.4
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	15.7
FREDERICK BALDWIN	MELDR-10	17-Sep-20	19.6
MARMION RESERVE	MELDR-11	17-Sep-20	18.2
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	23.4
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	18.7
JOHN CREANEY PARK	MELDR-05	15-Oct-20	18.6
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	19.3
BROCKMAN PARK	MELDR-02	15-Oct-20	19.8
BULL CREEK MD	MEIDR-01	15-Oct-20	17.9
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	19.5
RAAF DRAIN	MELDR-14	15-Oct-20	17.8
BATEMAN PARK	MELDR-06	15-Oct-20	17.8
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	20.4
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	22
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	18.4
FREDERICK BALDWIN	MELDR-10	15-Oct-20	21.1
MARMION RESERVE	MELDR-11	15-Oct-20	20.1
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	24.3

D2 Nutrients in water

Table D-7: Total nitrogen concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Total Nitrogen (TN) LOR 0.025 mg/L

ANZECC trigger value for lowland rivers (1.2 mg/L); for wetlands (1.5 mg/L)

Max (red) 11 Min (blue) 0.33

Site Name	Site Number	Collect Date	TN (mg/L)	Comparison to ANZECC trigger value: 1.2 (lowland rivers) or 1.5 (wetlands)	Comparison to HRAP short term target: 2 mg/L	Comparison to HRAP long term target: 1 mg/L
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.41	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.39	Acceptable	Acceptable	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.4	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	3.1	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	3.7	Guideline exceeded	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.62	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	0.38	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.42	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	6.8	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.57	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.73	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.33	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.48	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	2.7	Guideline exceeded	Guideline exceeded	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	1.1	Acceptable	Acceptable	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	20-Aug-20	1.4	Guideline exceeded	Acceptable	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.55	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	7.8	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	20-Aug-20	4.3	Guideline exceeded	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.47	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	0.38	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	0.46	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	11	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.56	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.6	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.44	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	0.49	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	2.4	Guideline exceeded	Guideline exceeded	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.91	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	2.2	Guideline exceeded	Guideline exceeded	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	1.1	Acceptable	Acceptable	Guideline exceeded
BROCKMAN PARK	MELDR-02	17-Sep-20	7.4	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	17-Sep-20	4.2	Guideline exceeded	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.49	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	0.48	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	0.51	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	10	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	1	Acceptable	Acceptable	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.71	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.69	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	0.67	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	2	Guideline exceeded	Guideline exceeded	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	1.1	Acceptable	Acceptable	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	15-Oct-20	1.8	Guideline exceeded	Acceptable	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	1	Acceptable	Acceptable	Guideline exceeded
BROCKMAN PARK	MELDR-02	15-Oct-20	8.6	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	15-Oct-20	4.5	Guideline exceeded	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.51	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	0.59	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	0.53	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	10	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	1	Acceptable	Acceptable	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.8	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	3.3	Guideline exceeded	Guideline exceeded	Guideline exceeded
MARMION RESERVE	MELDR-11	15-Oct-20	0.85	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	1.9	Guideline exceeded	Acceptable	Guideline exceeded

Table D-8: Total oxidised nitrogen concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Total Oxidised Nitrogen (NOx) LOR 0.01 mg/L

ANZECC trigger value: 0.15 mg/L for lowland rivers; 0.10 mg/L for wetlands

Max (red) 3.1 Min (blue) <0.01

Site Name	Site Number	Collect Date	NOx (mg/L)	Comparison to ANZECC trigger value: 0.15 (lowland rivers) or 0.1 (wetlands)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.078	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.036	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.11	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.24	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	3.1	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.1	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	0.041	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.055	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.025	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	<0.010	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.19	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.044	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.02	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.3	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.33	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.024	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.21	Guideline exceeded
BROCKMAN PARK	MELDR-02	20-Aug-20	0.11	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	2.4	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.15	Guideline exceeded
RAAF DRAIN	MELDR-14	20-Aug-20	0.039	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	0.11	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.49	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	<0.010	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	<0.010	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.046	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	<0.010	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.45	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.22	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	17-Sep-20	<0.010	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.49	Guideline exceeded
BROCKMAN PARK	MELDR-02	17-Sep-20	0.089	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	2.5	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.19	Guideline exceeded
RAAF DRAIN	MELDR-14	17-Sep-20	0.15	Guideline exceeded
BATEMAN PARK	MELDR-06	17-Sep-20	0.036	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.51	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.011	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	<0.010	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	<0.010	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	<0.010	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.26	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.19	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	15-Oct-20	<0.010	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.46	Guideline exceeded
BROCKMAN PARK	MELDR-02	15-Oct-20	0.078	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	3.1	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.15	Guideline exceeded
RAAF DRAIN	MELDR-14	15-Oct-20	0.055	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	0.12	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.41	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	<0.010	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.015	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.015	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	<0.010	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.14	Guideline exceeded

Table D-9: Nitrogen as ammonia/ammonium concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Nitrogen as ammonia/ammonium (sol mg/L) LOR 0.01 mg/L

ANZECC trigger value for lowland rivers: 0.08 mg/L, wetlands: 0.04 mg/L; NHMRC guideline for recreational value: 5 mg/L

Max (red) 8.30 Min (blue) <0.01

Site name	Site number	Date	NH3-N/NH4-N (sol) (mg/L)	pH	Adjusted ANZECC freshwater protection trigger value (mg/L)	Comparison to adjusted ANZECC freshwater protection trigger value	Comparison to ANZECC trigger value: 0.08 mg/L (lowland rivers) or 0.04 mg/L (wetlands)	Comparison to NHMRC trigger value for recreation: 0.5 mg/L
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.041	7.15	2.09	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.059	6.24	2.54	Acceptable	Acceptable	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.041	7.28	1.99	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	2.7	6.21	2.54	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	0.5	6.57	2.46	Acceptable	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.081	6.42	2.49	Acceptable	Guideline exceeded	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	0.047	6.83	2.33	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.075	6.63	2.43	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	4.3	6.55	2.46	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.018	4.94	2.57	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.087	7.49	1.75	Acceptable	Guideline exceeded	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.071	6.94	2.26	Acceptable	Guideline exceeded	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.017	8.96	0.21	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	1.4	7.24	1.99	Acceptable	Guideline exceeded	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.066	6.3	2.54	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.51	6.13	2.555	Acceptable	Guideline exceeded	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.031	6.76	2.38	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	7.4	6.31	2.54	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	20-Aug-20	1.3	6.73	2.38	Acceptable	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.12	6.55	2.46	Acceptable	Guideline exceeded	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	0.035	7.07	2.18	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	0.091	6.69	2.43	Acceptable	Guideline exceeded	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	7.9	6.5	2.46	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.018	5.31	2.57	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.012	6.65	2.43	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.02	6.9	2.26	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	<0.010	9.94	0.18	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	1.1	7.25	1.99	Acceptable	Guideline exceeded	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.083	6.33	2.54	Acceptable	Guideline exceeded	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.08	6.25	2.54	Acceptable	Guideline exceeded	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.11	6.96	2.26	Acceptable	Guideline exceeded	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	7.3	6.15	2.555	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	17-Sep-20	1.4	6.76	2.38	Acceptable	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.11	6.5	2.46	Acceptable	Guideline exceeded	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	0.099	6.57	2.46	Acceptable	Guideline exceeded	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	0.049	7.33	1.88	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	7	6.33	2.54	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.022	5.78	2.57	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.015	6.69	2.43	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.026	7.71	1.32	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	0.017	9.11	0.18	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.047	6.92	2.26	Acceptable	Guideline exceeded	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.14	6.47	2.49	Acceptable	Guideline exceeded	Acceptable
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.31	6.35	2.54	Acceptable	Guideline exceeded	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.043	6.78	2.38	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	8.3	6.29	2.54	Guideline exceeded	Guideline exceeded	Guideline exceeded
BULL CREEK MD	MELDR-01	15-Oct-20	1.3	6.74	2.38	Acceptable	Guideline exceeded	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.1	6.49	2.49	Acceptable	Guideline exceeded	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	0.052	7	2.18	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	0.078	6.92	2.26	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	7	6.54	2.46	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.022	6.4	2.49	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.01	6.94	2.26	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.011	6.06	2.57	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	0.013	9.99	0.18	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.23	7.72	1.32	Acceptable	Guideline exceeded	Acceptable

Table D-10: Total organic nitrogen concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Total Organic Nitrogen (TON)			LOR 0.025 mg/L
	Max (red) 3.2		Min (blue) <0.025
Site Name	**Site Number**	**Collect Date**	**TON (mg/L)**
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.29
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.3
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.25
BROCKMAN PARK	MELDR-02	16-Jul-20	0.13
BULL CREEK MD	MELDR-01	16-Jul-20	0.062
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.44
RAAF DRAIN	MELDR-14	16-Jul-20	0.3
BATEMAN PARK	MELDR-06	16-Jul-20	0.29
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	2.5
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.55
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.45
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.22
MARMION RESERVE	MELDR-11	16-Jul-20	0.45
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.98
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.73
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.85
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.31
BROCKMAN PARK	MELDR-02	20-Aug-20	0.29
BULL CREEK MD	MELDR-01	20-Aug-20	0.57
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.21
RAAF DRAIN	MELDR-14	20-Aug-20	0.31
BATEMAN PARK	MELDR-06	20-Aug-20	0.25
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	2.4
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.54
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.59
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.37
MARMION RESERVE	MELDR-11	20-Aug-20	0.49
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.93
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.61
JOHN CREANEY PARK	MELDR-05	17-Sep-20	2.1
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.45
BROCKMAN PARK	MELDR-02	17-Sep-20	<0.025
BULL CREEK MD	MELDR-01	17-Sep-20	0.3
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.19
RAAF DRAIN	MELDR-14	17-Sep-20	0.24
BATEMAN PARK	MELDR-06	17-Sep-20	0.43
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	2.5
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.97
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.7
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.66
MARMION RESERVE	MELDR-11	17-Sep-20	0.65
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	1.6
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.78
JOHN CREANEY PARK	MELDR-05	15-Oct-20	1.5
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.54
BROCKMAN PARK	MELDR-02	15-Oct-20	0.24
BULL CREEK MD	MELDR-01	15-Oct-20	0.23
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.25
RAAF DRAIN	MELDR-14	15-Oct-20	0.48
BATEMAN PARK	MELDR-06	15-Oct-20	0.33
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	2.8
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.98
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.77
FREDERICK BALDWIN	MELDR-10	15-Oct-20	3.2
MARMION RESERVE	MELDR-11	15-Oct-20	0.84
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	1.5

Table D-11: Dissolved organic nitrogen concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2019

Dissolved Organic Nitrogen (DON)			LOR 0.025 mg/L
	Max (red) 2.8		Min (blue) <0.025
Site Name	**Site Number**	**Collect Date**	**DON (mg/L)**
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.23
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.23
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.2
BROCKMAN PARK	MELDR-02	16-Jul-20	0.1
BULL CREEK MD	MELDR-01	16-Jul-20	<0.025
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.2
RAAF DRAIN	MELDR-14	16-Jul-20	0.25
BATEMAN PARK	MELDR-06	16-Jul-20	0.26
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	2.5
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.48
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.3
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.19
MARMION RESERVE	MELDR-11	16-Jul-20	0.23
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.87
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.59
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.61
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.25
BROCKMAN PARK	MELDR-02	20-Aug-20	0.095
BULL CREEK MD	MELDR-01	20-Aug-20	0.27
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.18
RAAF DRAIN	MELDR-14	20-Aug-20	0.28
BATEMAN PARK	MELDR-06	20-Aug-20	0.22
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	1.7
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.38
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.47
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.19
MARMION RESERVE	MELDR-11	20-Aug-20	0.34
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.71
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.57
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.68
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.27
BROCKMAN PARK	MELDR-02	17-Sep-20	<0.025
BULL CREEK MD	MELDR-01	17-Sep-20	0.17
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.18
RAAF DRAIN	MELDR-14	17-Sep-20	0.2
BATEMAN PARK	MELDR-06	17-Sep-20	0.37
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	2.3
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.85
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.5
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.33
MARMION RESERVE	MELDR-11	17-Sep-20	0.51
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	1.5
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.6
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.84
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.37
BROCKMAN PARK	MELDR-02	15-Oct-20	<0.025
BULL CREEK MD	MELDR-01	15-Oct-20	0.1
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.24
RAAF DRAIN	MELDR-14	15-Oct-20	0.44
BATEMAN PARK	MELDR-06	15-Oct-20	0.26
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	2.8
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.8
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.51
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.68
MARMION RESERVE	MELDR-11	15-Oct-20	0.78
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	1.3

Table D-12: Total phosphorus concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Total Phosphorus (TP) (mg/L) LOR 0.005 mg/L

ANZECC trigger value: 0.065mg/L for lowland rivers; 0.06 mg/L for wetlands

Max (red) 0.78 Min (blue) 0.008

Site Name	Site Number	Collect Date	TP (mg/L)	Comparison to ANZECC trigger value: 0.065 (lowland rivers) or 0.06 (wetlands)	Comparison to HRAP short term target: 0.2 mg/L	Comparison to HRAP long term target: 0.1 mg/L
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.037	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.048	Acceptable	Acceptable	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.036	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.027	Acceptable	Acceptable	Acceptable
BULL CREEK MD	MELDR-01	16-Jul-20	0.008	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.05	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	0.016	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.013	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.2	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.018	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.027	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.032	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.047	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.082	Guideline exceeded	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.018	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.098	Guideline exceeded	Acceptable	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.03	Acceptable	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	0.011	Acceptable	Acceptable	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	0.013	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.013	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	0.014	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	0.016	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.53	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.017	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.016	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.036	Acceptable	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	0.056	Acceptable	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.097	Guideline exceeded	Acceptable	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.012	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.18	Guideline exceeded	Acceptable	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.075	Guideline exceeded	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	0.009	Acceptable	Acceptable	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	0.017	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.011	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	0.01	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	0.015	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.7	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.033	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.025	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.079	Guideline exceeded	Acceptable	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	0.084	Guideline exceeded	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.13	Guideline exceeded	Acceptable	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.041	Acceptable	Acceptable	Acceptable
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.14	Guideline exceeded	Acceptable	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.09	Guideline exceeded	Acceptable	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	0.01	Acceptable	Acceptable	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	0.01	Acceptable	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.01	Acceptable	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	0.025	Acceptable	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	0.011	Acceptable	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.78	Guideline exceeded	Guideline exceeded	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.037	Acceptable	Acceptable	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.028	Acceptable	Acceptable	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.43	Guideline exceeded	Guideline exceeded	Guideline exceeded
MARMION RESERVE	MELDR-11	15-Oct-20	0.099	Guideline exceeded	Acceptable	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.17	Guideline exceeded	Acceptable	Guideline exceeded

Table D-13: Filterable reactive phosphorus concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Filterable Reactive Phosphorus (FRP) All data in blue were <0.005 (LOR)

ANZECC trigger value: 0.04 mg/L for lowland rivers and 0.03 mg/L for wetlands

Max (red) 0.57 Min (blue) <0.005

Site Name	Site Number	Collect Date	FRP (mg/L)	Comparison to ANZECC trigger value: 0.04 (loalnd rivers) or 0.03 (wetlands)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.011	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.013	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.014	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.008	Acceptable
BULL CREEK MD	MELDR-01	16-Jul-20	<0.005	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	<0.005	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	<0.005	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	<0.005	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.059	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	<0.005	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	<0.005	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	<0.005	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.009	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.043	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	<0.005	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.06	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.008	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	<0.005	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	<0.005	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	<0.005	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	<0.005	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	<0.005	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.25	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	<0.005	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	<0.005	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	<0.005	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	0.012	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.053	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	<0.005	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.011	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.02	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	<0.005	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	<0.005	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.005	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	<0.005	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	0.006	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.4	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.008	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	<0.005	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.01	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	0.02	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.057	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	<0.005	Acceptable
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.018	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.019	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	<0.005	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	<0.005	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	<0.005	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	<0.005	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	<0.005	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.57	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	<0.005	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	<0.005	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	<0.005	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	0.023	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.083	Guideline exceeded

D3 Metals in water

Table D-14: Water hardness (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Water Hardness			LOR 1 mg/L
Max (red) 860		Min (blue) 15	
Site Name	**Site Number**	**Collect Date**	**Total Water Hardness (mg/L)**
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	15
JOHN CREANEY PARK	MELDR-05	16-Jul-20	23
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	18
BROCKMAN PARK	MELDR-02	16-Jul-20	50
BULL CREEK MD	MELDR-01	16-Jul-20	110
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	69
RAAF DRAIN	MELDR-14	16-Jul-20	62
BATEMAN PARK	MELDR-06	16-Jul-20	100
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	860
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	230
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	24
FREDERICK BALDWIN	MELDR-10	16-Jul-20	31
MARMION RESERVE	MELDR-11	16-Jul-20	55
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	130
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	150
JOHN CREANEY PARK	MELDR-05	20-Aug-20	200
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	63
BROCKMAN PARK	MELDR-02	20-Aug-20	110
BULL CREEK MD	MELDR-01	20-Aug-20	120
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	120
RAAF DRAIN	MELDR-14	20-Aug-20	92
BATEMAN PARK	MELDR-06	20-Aug-20	120
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	700
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	250
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	120
FREDERICK BALDWIN	MELDR-10	20-Aug-20	46
MARMION RESERVE	MELDR-11	20-Aug-20	53
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	130
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	150
JOHN CREANEY PARK	MELDR-05	17-Sep-20	220
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	85
BROCKMAN PARK	MELDR-02	17-Sep-20	120
BULL CREEK MD	MELDR-01	17-Sep-20	120
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	120
RAAF DRAIN	MELDR-14	17-Sep-20	130
BATEMAN PARK	MELDR-06	17-Sep-20	120
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	650
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	240
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	130
FREDERICK BALDWIN	MELDR-10	17-Sep-20	69
MARMION RESERVE	MELDR-11	17-Sep-20	68
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	120
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	150
JOHN CREANEY PARK	MELDR-05	15-Oct-20	230
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	100
BROCKMAN PARK	MELDR-02	15-Oct-20	110
BULL CREEK MD	MELDR-01	15-Oct-20	110
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	130
RAAF DRAIN	MELDR-14	15-Oct-20	130
BATEMAN PARK	MELDR-06	15-Oct-20	130
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	650
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	200
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	140
FREDERICK BALDWIN	MELDR-10	15-Oct-20	99
MARMION RESERVE	MELDR-11	15-Oct-20	72
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	120

Table D-15: Total aluminium concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Total Aluminium (Al) LOR 0.005 mg/L

ANZECC trigger value: 0.055mg/L for 95% protection when pH > 6.5 (or 0.0008 if pH<6.5)

Max (red) 0.75 Min (blue) 0.047

Site Name	Site Number	Collect Date	Al (tot) (mg/L)	pH	Comparison to ANZECC trigger value 95% protection: 0.055 mg/L (or 0.0008 if pH<6.5)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.29	7.15	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.084	6.24	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.17	7.28	Guideline exceeded
BROCKMAN PARK	MELDR-02	16-Jul-20	0.31	6.21	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	0.16	6.57	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.73	6.42	Guideline exceeded
RAAF DRAIN	MELDR-14	16-Jul-20	0.095	6.83	Guideline exceeded
BATEMAN PARK	MELDR-06	16-Jul-20	0.17	6.63	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.36	6.55	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.13	4.94	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.75	7.49	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.15	6.94	Guideline exceeded
MARMION RESERVE	MELDR-11	16-Jul-20	0.12	8.96	Guideline exceeded
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.047	7.24	Acceptable

Table D-16: Soluble aluminium concentrations (mg/L) recorded in Melville Bull Creek catchment sites in 2020

Soluble Aluminium (Al) LOR 0.005 mg/L

ANZECC trigger value: 0.055mg/L for 95% protection when pH >6.5 (or 0.0008 if pH<6.5)

Max (red) 0.31 Min (blue) 0.012

Site Name	Site Number	Collect Date	Al (sol) (mg/L)	pH	Comparison to ANZECC trigger value 95% Level of Protection: 0.055 (or 0.0008 if pH<6.5)
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.041	7.15	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.029	6.24	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.035	7.28	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.097	6.21	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	0.096	6.57	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.054	6.42	Guideline exceeded
RAAF DRAIN	MELDR-14	16-Jul-20	0.037	6.83	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.052	6.63	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.012	6.55	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.13	4.94	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.11	7.49	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.021	6.94	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.044	8.96	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.023	7.24	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.31	6.3	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.12	6.13	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.14	6.76	Guideline exceeded
BROCKMAN PARK	MELDR-02	20-Aug-20	0.25	6.31	Guideline exceeded
BULL CREEK MD	MELDR-01	20-Aug-20	0.13	6.73	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.098	6.55	Guideline exceeded
RAAF DRAIN	MELDR-14	20-Aug-20	0.055	7.07	Guideline exceeded
BATEMAN PARK	MELDR-06	20-Aug-20	0.058	6.69	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.029	6.5	Acceptable
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.22	5.31	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.09	6.65	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.023	6.9	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	0.11	9.94	Guideline exceeded
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.035	7.25	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.31	6.33	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.1	6.25	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.08	6.96	Guideline exceeded
BROCKMAN PARK	MELDR-02	17-Sep-20	0.24	6.15	Guideline exceeded
BULL CREEK MD	MELDR-01	17-Sep-20	0.13	6.76	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.1	6.5	Guideline exceeded
RAAF DRAIN	MELDR-14	17-Sep-20	0.085	6.57	Guideline exceeded
BATEMAN PARK	MELDR-06	17-Sep-20	0.056	7.33	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.034	6.33	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.14	5.78	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.079	6.69	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.12	7.71	Guideline exceeded
MARMION RESERVE	MELDR-11	17-Sep-20	0.13	9.11	Guideline exceeded
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.04	6.92	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.25	6.47	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.099	6.35	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.11	6.78	Guideline exceeded
BROCKMAN PARK	MELDR-02	15-Oct-20	0.22	6.29	Guideline exceeded
BULL CREEK MD	MELDR-01	15-Oct-20	0.12	6.74	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.076	6.49	Guideline exceeded
RAAF DRAIN	MELDR-14	15-Oct-20	0.042	7	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	0.057	6.92	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.042	6.54	Acceptable
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.19	6.4	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.054	6.94	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.028	6.06	Guideline exceeded
MARMION RESERVE	MELDR-11	15-Oct-20	0.19	9.99	Guideline exceeded
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.048	7.72	Acceptable

Table D-17: Total chromium concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Chromium (Cr III) (total) Max (red) 0.0077 Min (blue) 0.0005 LOR 0.0001 mg/L

ANZECC unmodified trigger value for protection of biota: 0.0033 mg/L; NHMRC guideline for recreational use (health value): 0.05 mg/L

Site name	Site number	Date	Cr (tot) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.0011	15	1	0.0033	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.0006	23	1	0.0033	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.0008	18	1	0.0033	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.0014	50	1	0.0033	Acceptable
BULL CREEK MD	MELDR-01	16-Jul-20	0.0014	110	2.5	0.00825	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.0077	69	2.5	0.00825	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	0.001	62	2.5	0.00825	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.0016	100	2.5	0.00825	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0012	860	8.4	0.02772	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.0005	230	4.9	0.01617	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.004	24	1	0.0033	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.0007	31	1	0.0033	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.0005	55	1	0.0033	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.0012	130	3.7	0.01221	Acceptable

Hardness range (mg/L)	Adjust factor
0-59	1
60-119	2.5
120-179	3.7
180-240	4.9
>240	8.4

Table D-18: Soluble chromium concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Chromium (Cr III) (soluble)   Max (red) 0.0022   Min (blue) 0.0002   LOR 0.0001 mg/L

ANZECC unmodified trigger value for protection of biota: 0.0033 mg/L; NHMRC guideline for recreational use (health value): 0.05 mg/L

Site name	Site number	Date	Cr (sol) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.0003	15	1	0.0033	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.0003	23	1	0.0033	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.0003	18	1	0.0033	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.0006	50	1	0.0033	Acceptable
BULL CREEK MD	MELDR-01	16-Jul-20	0.0009	110	2.5	0.00825	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.0008	69	2.5	0.00825	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	0.0007	62	2.5	0.00825	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.001	100	2.5	0.00825	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0007	860	8.4	0.02772	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.0005	230	4.9	0.01617	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.0012	24	1	0.0033	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.0002	31	1	0.0033	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.0003	55	1	0.0033	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.0012	130	3.7	0.01221	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.002	150	3.7	0.01221	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.0014	200	4.9	0.01617	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.0006	63	2.5	0.00825	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	0.0011	110	2.5	0.00825	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	0.001	120	3.7	0.01221	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.0013	120	3.7	0.01221	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	0.0008	92	2.5	0.00825	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	0.0012	120	3.7	0.01221	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.001	700	8.4	0.02772	Acceptable
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.0005	250	8.4	0.02772	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.0011	120	3.7	0.01221	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.0002	46	1	0.0033	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	0.0002	53	1	0.0033	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.0018	130	3.7	0.01221	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.0022	150	3.7	0.01221	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.0017	220	4.9	0.01617	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.0006	85	2.5	0.00825	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	0.0012	120	3.7	0.01221	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	0.0011	120	3.7	0.01221	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.0016	120	3.7	0.01221	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	0.0016	130	3.7	0.01221	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	0.0013	120	3.7	0.01221	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.0011	650	8.4	0.02772	Acceptable
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.0009	240	4.9	0.01617	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.0012	130	3.7	0.01221	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.0002	69	2.5	0.00825	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	0.0002	68	2.5	0.00825	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.002	120	3.7	0.01221	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.0021	150	3.7	0.01221	Acceptable
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.0015	230	4.9	0.01617	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.0009	100	2.5	0.00825	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	0.0011	110	2.5	0.00825	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	0.001	110	2.5	0.00825	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.0014	130	3.7	0.01221	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	0.0011	130	3.7	0.01221	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	0.0013	130	3.7	0.01221	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.0011	650	8.4	0.02772	Acceptable
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.0009	200	4.9	0.01617	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.001	140	3.7	0.01221	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.0002	99	2.5	0.00825	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	0.0002	72	2.5	0.00825	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.0018	120	3.7	0.01221	Acceptable

Hardness range (mg/L)	Adjust factor
0-59	1
60-119	2.5
120-179	3.7
180-240	4.9
>240	8.4

Table D-19: Total copper concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Copper (Cu) (total mg/L) Max (red) 0.031 Min (blue) 0.0013 LOR 0.0001 mg/L

ANZECC unmodified freshwater 95% trigger value: 0.0014 mg/L, NHMRC guidelines for recreational use - aesthetic: 1 mg/L, health: 2 mg/L

Site name	Site number	Date	Cu (tot) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value	Hardness range (mg/L)	Adjust factor
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.0094	15	1	0.0014	Guideline exceeded	0-59	1
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.0037	23	1	0.0014	Guideline exceeded	60-119	2.5
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.0059	18	1	0.0014	Guideline exceeded	120-179	3.9
BROCKMAN PARK	MELDR-02	16-Jul-20	0.0068	50	1	0.0014	Guideline exceeded	180-240	5.2
BULL CREEK MD	MELDR-01	16-Jul-20	0.0016	110	2.5	0.0035	Acceptable	>240	9
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.0095	69	2.5	0.0035	Guideline exceeded		
RAAF DRAIN	MELDR-14	16-Jul-20	0.0017	62	2.5	0.0035	Acceptable		
BATEMAN PARK	MELDR-06	16-Jul-20	0.0029	100	2.5	0.0035	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0013	860	9	0.0126	Acceptable		
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.0061	230	5.2	0.00728	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.031	24	1	0.0014	Guideline exceeded		
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.0032	31	1	0.0014	Guideline exceeded		
MARMION RESERVE	MELDR-11	16-Jul-20	0.0016	55	1	0.0014	Guideline exceeded		
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.0018	130	3.9	0.00546	Acceptable		

Table D-20: Soluble copper concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Copper (Cu) (soluble mg/L) Max (red) 0.0075 Min (blue) 0.0003 LOR 0.0001 mg/L

ANZECC unmodified freshwater 95% trigger value: 0.0014 mg/L, NHMRC guidelines for recreational use - aesthetic: 1 mg/L, health: 2 mg/L

Site name	Site number	Date	Cu (sol) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.0049	15	1	0.0014	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.0027	23	1	0.0014	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.0034	18	1	0.0014	Guideline exceeded
BROCKMAN PARK	MELDR-02	16-Jul-20	0.0028	50	1	0.0014	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	0.0016	110	2.5	0.0035	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.0055	69	2.5	0.0035	Guideline exceeded
RAAF DRAIN	MELDR-14	16-Jul-20	0.0014	62	2.5	0.0035	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.0058	100	2.5	0.0035	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0012	860	9	0.0126	Acceptable
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.0008	230	5.2	0.00728	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.0075	24	1	0.0014	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.0015	31	1	0.0014	Guideline exceeded
MARMION RESERVE	MELDR-11	16-Jul-20	0.0012	55	1	0.0014	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.0013	130	3.9	0.00546	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.0034	150	3.9	0.00546	Acceptable
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.0013	200	5.2	0.00728	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.0021	63	2.5	0.0035	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	0.001	110	2.5	0.0035	Acceptable
BULL CREEK MD	MELDR-01	20-Aug-20	0.0017	120	3.9	0.00546	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.003	120	3.9	0.00546	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	0.0022	92	2.5	0.0035	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	0.0054	120	3.9	0.00546	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.0016	700	9	0.0126	Acceptable
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.0004	250	9	0.0126	Acceptable
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.0006	120	3.9	0.00546	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.0014	46	1	0.0014	Guideline exceeded
MARMION RESERVE	MELDR-11	20-Aug-20	0.0012	53	1	0.0014	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.0015	130	3.9	0.00546	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.0019	150	3.9	0.00546	Acceptable
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.0005	220	5.2	0.00728	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.0032	85	2.5	0.0035	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	0.0003	120	3.9	0.00546	Acceptable
BULL CREEK MD	MELDR-01	17-Sep-20	0.0014	120	3.9	0.00546	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.0019	120	3.9	0.00546	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	0.003	130	3.9	0.00546	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	0.0026	120	3.9	0.00546	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.001	650	9	0.0126	Acceptable
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.0012	240	5.2	0.00728	Acceptable
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.0006	130	3.9	0.00546	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.0014	69	2.5	0.0035	Acceptable
MARMION RESERVE	MELDR-11	17-Sep-20	0.0011	68	2.5	0.0035	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.0015	120	3.9	0.00546	Acceptable
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.003	150	3.9	0.00546	Acceptable
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.001	230	5.2	0.00728	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.0035	100	2.5	0.0035	Guideline exceeded
BROCKMAN PARK	MELDR-02	15-Oct-20	0.0018	110	2.5	0.0035	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	0.0013	110	2.5	0.0035	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.0029	130	3.9	0.00546	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	0.0018	130	3.9	0.00546	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	0.0039	130	3.9	0.00546	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.0013	650	9	0.0126	Acceptable
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.0008	200	5.2	0.00728	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.0007	140	3.9	0.00546	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.0011	99	2.5	0.0035	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	0.0018	72	2.5	0.0035	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.0021	120	3.9	0.00546	Acceptable

Hardness range (mg/L)	Adjust factor
0-59	1
60-119	2.5
120-179	3.9
180-240	5.2
>240	9

Table D-21: Total iron concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Total Iron (Fe) LOR 0.005 mg/L

ANZECC interim guideline for biota protection: 0.3 mg/L, NHMRC guideline for recreation (aesthetic): 0.3 mg/L

Max (red) 5 Min (blue) 0.084

Site Name	Site Number	Collect Date	Fe (mg/L)	Comparison to interim and recreational guideline: 0.3
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.31	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.45	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.2	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.71	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	0.44	Guideline exceeded
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	5	Guideline exceeded
RAAF DRAIN	MELDR-14	16-Jul-20	0.35	Guideline exceeded
BATEMAN PARK	MELDR-06	16-Jul-20	1.2	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	3	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.084	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.63	Guideline exceeded
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.33	Guideline exceeded
MARMION RESERVE	MELDR-11	16-Jul-20	0.24	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.57	Guideline exceeded

Table D-22: Soluble iron concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Soluble Iron (Fe) LOR 0.005 mg/L

ANZECC interim guideline for biota protection: 0.3 mg/L ; NHMRC guideline for recreation (aesthetic): 0.3 mg/L

Max (red) 14 Min (blue) 0.033

Site Name	Site Number	Collect Date	Fe (mg/L)	Comparison to interim and recreation guideline: 0.3
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.053	Acceptable
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.25	Acceptable
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.033	Acceptable
BROCKMAN PARK	MELDR-02	16-Jul-20	0.36	Guideline exceeded
BULL CREEK MD	MELDR-01	16-Jul-20	0.22	Acceptable
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.32	Guideline exceeded
RAAF DRAIN	MELDR-14	16-Jul-20	0.17	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	0.45	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.94	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.052	Acceptable
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.058	Acceptable
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.12	Acceptable
MARMION RESERVE	MELDR-11	16-Jul-20	0.097	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.45	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.38	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	20-Aug-20	14	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.24	Acceptable
BROCKMAN PARK	MELDR-02	20-Aug-20	1.1	Guideline exceeded
BULL CREEK MD	MELDR-01	20-Aug-20	0.26	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.78	Guideline exceeded
RAAF DRAIN	MELDR-14	20-Aug-20	0.23	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	0.5	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	2.3	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.89	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.08	Acceptable
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.17	Acceptable
MARMION RESERVE	MELDR-11	20-Aug-20	0.2	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.84	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.55	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	17-Sep-20	2.3	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.25	Acceptable
BROCKMAN PARK	MELDR-02	17-Sep-20	0.95	Guideline exceeded
BULL CREEK MD	MELDR-01	17-Sep-20	0.27	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.83	Guideline exceeded
RAAF DRAIN	MELDR-14	17-Sep-20	0.71	Guideline exceeded
BATEMAN PARK	MELDR-06	17-Sep-20	0.29	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	3.4	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	3.3	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.13	Acceptable
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.51	Guideline exceeded
MARMION RESERVE	MELDR-11	17-Sep-20	0.41	Guideline exceeded
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.99	Guideline exceeded
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.49	Guideline exceeded
JOHN CREANEY PARK	MELDR-05	15-Oct-20	1.7	Guideline exceeded
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.49	Guideline exceeded
BROCKMAN PARK	MELDR-02	15-Oct-20	0.94	Guideline exceeded
BULL CREEK MD	MELDR-01	15-Oct-20	0.25	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.86	Guideline exceeded
RAAF DRAIN	MELDR-14	15-Oct-20	0.35	Guideline exceeded
BATEMAN PARK	MELDR-06	15-Oct-20	0.65	Guideline exceeded
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	4	Guideline exceeded
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	2.1	Guideline exceeded
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.071	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.53	Guideline exceeded
MARMION RESERVE	MELDR-11	15-Oct-20	0.52	Guideline exceeded
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.91	Guideline exceeded

Table D-23: Total lead concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Lead (Pb) (total mg/L) Max (red) 0.0075 Min (blue) 0.0006 LOR 0.0001mg/L

ANZECC unmodified TV for 95% protection: 0.0034 mg/L; NHMRC recreational guideline value (health): 0.01 mg/L

Site name	Site number	Date	Pb (tot) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value	Hardness range (mg/L)	Adjust factor
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.0047	15	1	0.0034	Guideline exceeded	0-59	1
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.0012	23	1	0.0034	Acceptable	60-119	4
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.0018	18	1	0.0034	Acceptable	120-179	7.6
BROCKMAN PARK	MELDR-02	16-Jul-20	0.0021	50	1	0.0034	Acceptable	180-240	11.8
BULL CREEK MD	MELDR-01	16-Jul-20	0.0016	110	4	0.0136	Acceptable	>240	26.7
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.0053	69	4	0.0136	Acceptable		*
RAAF DRAIN	MELDR-14	16-Jul-20	0.0011	62	4	0.0136	Acceptable		
BATEMAN PARK	MELDR-06	16-Jul-20	0.0006	100	4	0.0136	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.006	860	26.7	0.09078	Acceptable		
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.0034	230	11.8	0.04012	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.0028	24	1	0.0034	Acceptable		
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.0075	31	1	0.0034	Guideline exceeded		
MARMION RESERVE	MELDR-11	16-Jul-20	0.0021	55	1	0.0034	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.0016	130	7.6	0.02584	Acceptable		

Table D-24: Soluble lead concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Lead (Pb) (soluble mg/L) Max (red) 0.013 Min (blue) <0.0001 LOR 0.0001 mg/L

ANZECC unmodified TV for 95% protection: 0.0034 mg/L; NHMRC recreational guideline value (health value): 0.01 mg/L

Site name	Site number	Date	Pb (sol) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value	Hardness range (mg/L)	Adjust factor
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.0008	15	1	0.0034	Acceptable	0-59	1
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.0005	23	1	0.0034	Acceptable	60-119	4
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.0004	18	1	0.0034	Acceptable	120-179	7.6
BROCKMAN PARK	MELDR-02	16-Jul-20	0.0005	50	1	0.0034	Acceptable	180-240	11.8
BULL CREEK MD	MELDR-01	16-Jul-20	0.0007	110	4	0.0136	Acceptable	>240	26.7
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.0002	69	4	0.0136	Acceptable		
RAAF DRAIN	MELDR-14	16-Jul-20	0.0003	62	4	0.0136	Acceptable		
BATEMAN PARK	MELDR-06	16-Jul-20	0.0002	100	4	0.0136	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0004	860	26.7	0.09078	Acceptable		
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.0004	230	11.8	0.04012	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.0003	24	1	0.0034	Acceptable		
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.0021	31	1	0.0034	Acceptable		
MARMION RESERVE	MELDR-11	16-Jul-20	0.0008	55	1	0.0034	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.0087	130	7.6	0.02584	Acceptable		
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.0042	150	7.6	0.02584	Acceptable		
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.0005	200	11.8	0.04012	Acceptable		
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.0004	63	4	0.0136	Acceptable		
BROCKMAN PARK	MELDR-02	20-Aug-20	0.0002	110	4	0.0136	Acceptable		
BULL CREEK MD	MELDR-01	20-Aug-20	0.0006	120	7.6	0.02584	Acceptable		
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.0001	120	7.6	0.02584	Acceptable		
RAAF DRAIN	MELDR-14	20-Aug-20	0.0002	92	4	0.0136	Acceptable		
BATEMAN PARK	MELDR-06	20-Aug-20	0.0001	120	7.6	0.02584	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.0013	700	26.7	0.09078	Acceptable		
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.0003	250	26.7	0.09078	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	<0.0001	120	7.6	0.02584	Acceptable		
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.0016	46	1	0.0034	Acceptable		
MARMION RESERVE	MELDR-11	20-Aug-20	0.0014	53	1	0.0034	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.01	130	7.6	0.02584	Acceptable		
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.0021	150	7.6	0.02584	Acceptable		
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.0003	220	11.8	0.04012	Acceptable		
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.0008	85	4	0.0136	Acceptable		
BROCKMAN PARK	MELDR-02	17-Sep-20	0.0001	120	7.6	0.02584	Acceptable		
BULL CREEK MD	MELDR-01	17-Sep-20	0.0006	120	7.6	0.02584	Acceptable		
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	<0.0001	120	7.6	0.02584	Acceptable		
RAAF DRAIN	MELDR-14	17-Sep-20	<0.0001	130	7.6	0.02584	Acceptable		
BATEMAN PARK	MELDR-06	17-Sep-20	0.0002	120	7.6	0.02584	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.0012	650	26.7	0.09078	Acceptable		
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.0006	240	11.8	0.04012	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.0001	130	7.6	0.02584	Acceptable		
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.0025	69	4	0.0136	Acceptable		
MARMION RESERVE	MELDR-11	17-Sep-20	0.0028	68	4	0.0136	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.0084	120	7.6	0.02584	Acceptable		
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.0015	150	7.6	0.02584	Acceptable		
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.0005	230	11.8	0.04012	Acceptable		
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.0009	100	4	0.0136	Acceptable		
BROCKMAN PARK	MELDR-02	15-Oct-20	0.0002	110	4	0.0136	Acceptable		
BULL CREEK MD	MELDR-01	15-Oct-20	0.0007	110	4	0.0136	Acceptable		
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	<0.0001	130	7.6	0.02584	Acceptable		
RAAF DRAIN	MELDR-14	15-Oct-20	0.0002	130	7.6	0.02584	Acceptable		
BATEMAN PARK	MELDR-06	15-Oct-20	0.0001	130	7.6	0.02584	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.0015	650	26.7	0.09078	Acceptable		
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.0004	200	11.8	0.04012	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	<0.0001	140	7.6	0.02584	Acceptable		
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.0009	99	4	0.0136	Acceptable		
MARMION RESERVE	MELDR-11	15-Oct-20	0.0043	72	4	0.0136	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.013	120	7.6	0.02584	Acceptable		

Table D-25: Total mercury concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Total Mercury (Hg) LOR 0.00005 mg/L

ANZECC unmodified TV for 95% protection: 0.0006 mg/L; NHMRC guideline for recreation (health): 0.001 mg/L

Max (red) N/A Min (blue) <0.00005

Site Name	Site Number	Collect Date	Hg (mg/L)	Comparison to ANZECC TV for 95% protection	Comparison to NHMRC recreational guideline
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	<0.00005	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	<0.00005	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	<0.00005	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	<0.00005	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	<0.00005	Acceptable	Acceptable

Table D-26: Soluble mercury concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Soluble Mercury (Hg) LOR 0.00005 mg/L

ANZECC unmodified TV for 95% protection: 0.0006 mg/L; NHMRC guideline for recreation (health): 0.001 mg/L

Max (red) N/A Min (blue) <0.00005

Site Name	Site Number	Collect Date	Hg (mg/L)	Comparison to ANZECC trigger value 95% protection	Comparison to NHMRC recreational guideline
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	16-Jul-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	16-Jul-20	<0.00005	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	<0.00005	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	20-Aug-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	20-Aug-20	<0.00005	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	<0.00005	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	17-Sep-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	17-Sep-20	<0.00005	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	<0.00005	Acceptable	Acceptable
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	<0.00005	Acceptable	Acceptable
RAAF DRAIN	MELDR-14	15-Oct-20	<0.00005	Acceptable	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	<0.00005	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	<0.00005	Acceptable	Acceptable

Table D-27: Total zinc concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Zinc (Zn) (total mg/L) Max (red) 0.084 Min (blue) 0.014 LOR 0.005 mg/L

ANZECC unmodified TV for 95% protection: 0.008 mg/L; NHMRC recreational use guideline (aesthetic value): 3 mg/L

Site name	Site number	Date	Zn (tot) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value	Hardness range (mg/L)	Adjust factor
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.071	15	1	0.008	Guideline exceeded	0-59	1
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.032	23	1	0.008	Guideline exceeded	60-119	2.5
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.042	18	1	0.008	Guideline exceeded	120-179	3.9
BROCKMAN PARK	MELDR-02	16-Jul-20	0.05	50	1	0.008	Guideline exceeded	180-240	5.2
BULL CREEK MD	MELDR-01	16-Jul-20	0.019	110	2.5	0.02	Acceptable	>240	9
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.052	69	2.5	0.02	Guideline exceeded		
RAAF DRAIN	MELDR-14	16-Jul-20	0.016	62	2.5	0.02	Acceptable		
BATEMAN PARK	MELDR-06	16-Jul-20	0.015	100	2.5	0.02	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.021	860	9	0.072	Acceptable		
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.015	230	5.2	0.0416	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.084	24	1	0.008	Guideline exceeded		
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.028	31	1	0.008	Guideline exceeded		
MARMION RESERVE	MELDR-11	16-Jul-20	0.014	55	1	0.008	Guideline exceeded		
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.016	130	3.9	0.0312	Acceptable		

Table D-28: Soluble zinc concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Zinc (Zn) (soluble mg/L) Max (red) 0.14 Min (blue) 0.002 LOR 0.001 mg/L

ANZECC unmodified TV for 95% protection: 0.008 mg/L; NHMRC recreational use guideline (aesthetic value): 3 mg/L

Site name	Site number	Date	Zn (sol) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value	Hardness range (mg/L)	Adjust factor
JOHN CREANEY PARK INLET	MELDR-15	16-Jul-20	0.053	15	1	0.008	Guideline exceeded	0-59	1
JOHN CREANEY PARK	MELDR-05	16-Jul-20	0.029	23	1	0.008	Guideline exceeded	60-119	2.5
D/S ELIZABETH MANION PARK	MELDR-16	16-Jul-20	0.029	18	1	0.008	Guideline exceeded	120-179	3.9
BROCKMAN PARK	MELDR-02	16-Jul-20	0.037	50	1	0.008	Guideline exceeded	180-240	5.2
BULL CREEK MD	MELDR-01	16-Jul-20	0.019	110	2.5	0.02	Acceptable	>240	9
BRENTWOOD DRAIN	MELDR-13	16-Jul-20	0.025	69	2.5	0.02	Guideline exceeded		
RAAF DRAIN	MELDR-14	16-Jul-20	0.016	62	2.5	0.02	Acceptable		
BATEMAN PARK	MELDR-06	16-Jul-20	0.015	100	2.5	0.02	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.011	860	9	0.072	Acceptable		
PINEY LAKES OUTLET	MELDR-08	16-Jul-20	0.015	230	5.2	0.0416	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	16-Jul-20	0.03	24	1	0.008	Guideline exceeded		
FREDERICK BALDWIN	MELDR-10	16-Jul-20	0.024	31	1	0.008	Guideline exceeded		
MARMION RESERVE	MELDR-11	16-Jul-20	0.01	55	1	0.008	Guideline exceeded		
BLUE GUM LAKE OUTLET	MELDR-12	16-Jul-20	0.012	130	3.9	0.0312	Acceptable		
JOHN CREANEY PARK INLET	MELDR-15	20-Aug-20	0.072	150	3.9	0.0312	Guideline exceeded		
JOHN CREANEY PARK	MELDR-05	20-Aug-20	0.011	200	5.2	0.0416	Acceptable		
D/S ELIZABETH MANION PARK	MELDR-16	20-Aug-20	0.11	63	2.5	0.02	Guideline exceeded		
BROCKMAN PARK	MELDR-02	20-Aug-20	0.016	110	2.5	0.02	Acceptable		
BULL CREEK MD	MELDR-01	20-Aug-20	0.01	120	3.9	0.0312	Acceptable		
BRENTWOOD DRAIN	MELDR-13	20-Aug-20	0.027	120	3.9	0.0312	Acceptable		
RAAF DRAIN	MELDR-14	20-Aug-20	0.024	92	2.5	0.02	Guideline exceeded		
BATEMAN PARK	MELDR-06	20-Aug-20	0.025	120	3.9	0.0312	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.032	700	9	0.072	Acceptable		
PINEY LAKES OUTLET	MELDR-08	20-Aug-20	0.012	250	9	0.072	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	20-Aug-20	0.007	120	3.9	0.0312	Acceptable		
FREDERICK BALDWIN	MELDR-10	20-Aug-20	0.009	46	1	0.008	Guideline exceeded		
MARMION RESERVE	MELDR-11	20-Aug-20	0.002	53	1	0.008	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	20-Aug-20	0.004	130	3.9	0.0312	Acceptable		
JOHN CREANEY PARK INLET	MELDR-15	17-Sep-20	0.14	150	3.9	0.0312	Guideline exceeded		
JOHN CREANEY PARK	MELDR-05	17-Sep-20	0.034	220	5.2	0.0416	Acceptable		
D/S ELIZABETH MANION PARK	MELDR-16	17-Sep-20	0.046	85	2.5	0.02	Guideline exceeded		
BROCKMAN PARK	MELDR-02	17-Sep-20	0.017	120	3.9	0.0312	Acceptable		
BULL CREEK MD	MELDR-01	17-Sep-20	0.008	120	3.9	0.0312	Acceptable		
BRENTWOOD DRAIN	MELDR-13	17-Sep-20	0.021	120	3.9	0.0312	Acceptable		
RAAF DRAIN	MELDR-14	17-Sep-20	0.02	130	3.9	0.0312	Acceptable		
BATEMAN PARK	MELDR-06	17-Sep-20	0.015	120	3.9	0.0312	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.012	650	9	0.072	Acceptable		
PINEY LAKES OUTLET	MELDR-08	17-Sep-20	0.019	240	5.2	0.0416	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	17-Sep-20	0.017	130	3.9	0.0312	Acceptable		
FREDERICK BALDWIN	MELDR-10	17-Sep-20	0.008	69	2.5	0.02	Acceptable		
MARMION RESERVE	MELDR-11	17-Sep-20	0.006	68	2.5	0.02	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	17-Sep-20	0.011	120	3.9	0.0312	Acceptable		
JOHN CREANEY PARK INLET	MELDR-15	15-Oct-20	0.1	150	3.9	0.0312	Guideline exceeded		
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.008	230	5.2	0.0416	Acceptable		
D/S ELIZABETH MANION PARK	MELDR-16	15-Oct-20	0.073	100	2.5	0.02	Guideline exceeded		
BROCKMAN PARK	MELDR-02	15-Oct-20	0.016	110	2.5	0.02	Acceptable		
BULL CREEK MD	MELDR-01	15-Oct-20	0.015	110	2.5	0.02	Acceptable		
BRENTWOOD DRAIN	MELDR-13	15-Oct-20	0.021	130	3.9	0.0312	Acceptable		
RAAF DRAIN	MELDR-14	15-Oct-20	0.021	130	3.9	0.0312	Acceptable		
BATEMAN PARK	MELDR-06	15-Oct-20	0.019	130	3.9	0.0312	Acceptable		
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.018	650	9	0.072	Acceptable		
PINEY LAKES OUTLET	MELDR-08	15-Oct-20	0.029	200	5.2	0.0416	Acceptable		
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.01	140	3.9	0.0312	Acceptable		
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.039	99	2.5	0.02	Guideline exceeded		
MARMION RESERVE	MELDR-11	15-Oct-20	0.005	72	2.5	0.02	Acceptable		
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.014	120	3.9	0.0312	Acceptable		

Table D-29: Total arsenic concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Total Arsenic (As) Max 0.0011 Min (blue) 0.0011 LOR 0.0001 mg/L

ANZECC trigger for 95% protection: 0.024 mg/L, NHMRC guideline for recreation (health): 0.007 mg/L

Site Name	Site Number	Collect Date	As (mg/L)	Comparison to ANZECC TV for 95% protection	Comparison to NHMRC recreation guideline
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0011	Acceptable	Acceptable

Table D-30: Soluble arsenic concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Soluble Arsenic (As) LOR 0.0001 mg/L

ANZECC trigger for 95% protection: 0.024 mg/L, NHMRC guideline for recreation (health): 0.007 mg/L

Max 0.0025 Min (blue) 0.0011

Site Name	Site Number	Collect Date	As (mg/L)	Comparison to ANZECC TV for 95% protection	Comparison to NHMRC recreation guideline
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0011	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.002	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.0021	Acceptable	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.0025	Acceptable	Acceptable

Table D-31: Total nickel concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Nickel (Ni) (total mg/L) LOR 0.0005 mg/L

ANZECC freshwater 95% trigger value: 0.011 mg/L; NHMRC recreational use guildeine (aesthetic value): 0.02 mg/L

Site name	Site number	Date	Ni (tot) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value	Hardness range (mg/L)	Adjust factor
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0014	860	9	0.099	Acceptable	0-59	1
								60-119	2.5
								120-179	3.9
								180-240	5.2
								>240	9

Table D-32: Soluble nickel concentrations (mg/L) recorded at Melville Bull Creek catchment sites in 2020

Nickel (Ni) (soluble mg/L) Max (red) 0.0013 Min (blue) 0.0008 LOR 0.0005 mg/L

ANZECC freshwater 95% trigger value: 0.011 mg/L; NHMRC recreational use guildeine (aesthetic value): 0.02 mg/L

Site name	Site number	Date	Ni (sol) (mg/L)	Hardness (mg/)	Adjust factor*	Adjusted trigger value	Comparison to ANZECC trigger ADJUSTED value	Hardness range (mg/L)	Adjust factor
BOORAGOON LAKE OUTLET	MELDR-07	16-Jul-20	0.0013	860	9	0.099	Acceptable	0-59	1
BOORAGOON LAKE OUTLET	MELDR-07	20-Aug-20	0.001	700	9	0.099	Acceptable	60-119	2.5
BOORAGOON LAKE OUTLET	MELDR-07	17-Sep-20	0.001	650	9	0.099	Acceptable	120-179	3.9
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.0008	650	9	0.099	Acceptable	180-240	5.2
								>240	9

D4 Sediment metals

Table D-33: Sediment total aluminium concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Aluminium (Al) (total) **ANZECC trigger value: ND** LOR 10 mg/Kg

Max (red) 11,000 Min (blue) 527

Site name	Site number	Date	Al (tot) mg/kg
JOHN CREANEY PARK	MELDR-05	15-Oct-20	11000
BROCKMAN PARK	MELDR-02	15-Oct-20	1250
BULL CREEK MD	MELDR-01	15-Oct-20	527
BATEMAN PARK	MELDR-06	15-Oct-20	1050
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	1270
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	537
FREDERICK BALDWIN	MELDR-10	15-Oct-20	1140
MARMION RESERVE	MELDR-11	15-Oct-20	3580
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	1080

Table D-34: Sediment total arsenic concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Arsenic (As) (total) Max (red) 4.3 Min (blue) 0.2

ANZECC trigger value: low 20 mg/kg and high 70 mg/Kg LOR 0.2 mg/kg

Site name	Site number	Date	As (tot) mg/kg	Comparison to ANZECC lower trigger value: 20
JOHN CREANEY PARK	MELDR-05	15-Oct-20	4.3	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	0.5	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	0.3	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	3.5	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.3	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.2	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	1.4	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	2.5	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.7	Acceptable

Table D-35: Sediment total chromium concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Chromium (Cr) (total) Max (red) 29 Min (blue) 0.9

ANZECC lower trigger value: 80 mg/kg and higher 370 mg/kg LOR 0.05 mg/kg

Site name	Site number	Date	Cr (mg/kg)	Comparison to ANZECC lower trigger value: 80
JOHN CREANEY PARK	MELDR-05	15-Oct-20	29	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	2.6	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	0.9	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	3.6	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	2.5	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	1.7	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	3.3	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	6.1	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	3.4	Acceptable

Table D-36: Sediment total copper concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Copper (Cu) (total)

Max (red) 61 Min (blue) 0.50

ANZECC lower trigger value: 65 mg/kg & higher 270 mg/kg LOR 0.05 mg/kg

Site name	Site number	Date	Cu (mg/kg)	Comparison to ANZECC lower trigger value: 65
JOHN CREANEY PARK	MELDR-05	15-Oct-20	61	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	3.3	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	0.7	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	2.5	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.5	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	1.7	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	2.7	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	2.3	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	3	Acceptable

Table D-37: Sediment total iron concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Iron (Fe) (total)

Max (red) 21,000 Min (blue) 250

ANZECC trigger value: ND LOR 5 mg/Kg

Site name	Site number	Date	Fe (tot) October
JOHN CREANEY PARK	MELDR-05	15-Oct-20	21000
BROCKMAN PARK	MELDR-02	15-Oct-20	1900
BULL CREEK MD	MELDR-01	15-Oct-20	550
BATEMAN PARK	MELDR-06	15-Oct-20	4600
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	910
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	250
FREDERICK BALDWIN	MELDR-10	15-Oct-20	1800
MARMION RESERVE	MELDR-11	15-Oct-20	2100
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	940

Table D-38: Sediment total lead concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Lead (Pb) (total)

Max (red) 91 Min (blue) 2.0

ANZECC lower trigger value: 50 mg/kg & higher 220 mg/kg LOR 0.5 mg/kg

Site name	Site number	Date	Pb (mg/kg)	Comparison to ANZECC lower trigger value 50 mg/kg
JOHN CREANEY PARK	MELDR-05	15-Oct-20	91	Guideline exceeded
BROCKMAN PARK	MELDR-02	15-Oct-20	5.8	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	3.8	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	4.5	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	2	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	5.4	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	17	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	9	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	20	Acceptable

Table D-39: Sediment total mercury concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Mercury (Hg) (total) Max (red) 0.10 Min (blue) <0.02

ANZECC lower trigger value: 0.15 mg/kg and higher 1.0 mg/kg LOR 0.02 mg/kg

Site name	Site number	Date	Hg (tot) mg/kg	Comparison to ANZECC lower trigger value 0.15 mg/kg
JOHN CREANEY PARK	MELDR-05	15-Oct-20	0.1	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	<0.02	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	<0.02	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	<0.02	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	<0.02	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	<0.02	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	<0.02	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	<0.02	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	<0.02	Acceptable

Table D-40: Sediment total nickel concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Nickel (Ni) (total) Max (red) 9.9 Min (blue) 0.4

ANZECC lower trigger value: 21 mg/kg & higher 52 mg/kg LOR 0.1 mg/kg

Site name	Site number	Date	Ni (mg/kg)	Comparison to ANZECC lower trigger value 21 mg/kg
JOHN CREANEY PARK	MELDR-05	15-Oct-20	9.9	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	1.4	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	0.4	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	1	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	0.5	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.8	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	0.9	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	1.5	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.9	Acceptable

Table D-41: Sediment total selenium concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 200

Selenium (Se) (total) Max (red) 1 Min (blue) <0.05

ANZECC trigger value: ND LOR 0.05 mg/kg

Site name	Site number	Date	Se (tot) mg/kg
JOHN CREANEY PARK	MELDR-05	15-Oct-20	1
BROCKMAN PARK	MELDR-02	15-Oct-20	<0.05
BULL CREEK MD	MELDR-01	15-Oct-20	<0.05
BATEMAN PARK	MELDR-06	15-Oct-20	0.14
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	<0.05
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	0.09
FREDERICK BALDWIN	MELDR-10	15-Oct-20	<0.05
MARMION RESERVE	MELDR-11	15-Oct-20	0.17
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	0.06

Table D-42: Sediment total zinc concentrations (mg/kg) recorded at Melville Bull Creek catchment sites in 2020

Zinc (Zn) (total)

Max (red) 180 Min (blue) 2.5

ANZECC lower trigger value: 200 mg/kg & higher 410 mg/kg LOR 0.25 mg/kg or 5 mg/kg

Site name	Site number	Date	Zn (mg/kg)	Comparison to ANZECC lower trigger value 200 mg/kg
JOHN CREANEY PARK	MELDR-05	15-Oct-20	180	Acceptable
BROCKMAN PARK	MELDR-02	15-Oct-20	30	Acceptable
BULL CREEK MD	MELDR-01	15-Oct-20	5.5	Acceptable
BATEMAN PARK	MELDR-06	15-Oct-20	33	Acceptable
BOORAGOON LAKE OUTLET	MELDR-07	15-Oct-20	2.5	Acceptable
QUENDA LAKE OUTLET	MELDR-09	15-Oct-20	7.2	Acceptable
FREDERICK BALDWIN	MELDR-10	15-Oct-20	26	Acceptable
MARMION RESERVE	MELDR-11	15-Oct-20	16	Acceptable
BLUE GUM LAKE OUTLET	MELDR-12	15-Oct-20	10	Acceptable

Appendix E Potential effects of stressors on aquatic environments

In the context of water quality, stressors can be described as chemical compounds or indicators that are naturally occurring in waterways, for which values outside of certain ranges can have multiple negative effects. Stressors often reach undesirable levels in waterways as a result of human intervention. Stressors analysed in this monitoring program included physicochemical parameters (pH, dissolved oxygen, electrical conductivity, total suspended solids and temperature), nutrients (nitrogen and phosphorus in their various forms) and hardness. Table E-1 describes the undesirable effects that these stressors can have on surface water bodies.

Table E-1: Effects of stressors on aquatic environments

Parameter	Factors/sources impacting stressor levels	Ecosystem impacts

pH	• Natural;
	• rainfall - (CO_2) in atmosphere decreases pH of precipitation;
	• algal or plant growth (photosynthesis increases pH, respiration decreases pH);
	  ○ pH often higher during the day (more photosynthesis) and lower at night (more respiration).
	• Salinity;
	• underlying soil type (e.g. Bassendean sands – acidic, limestone – alkaline);
	• influence of groundwater;
	• presence of acidic tannins from vegetation – decreases pH;
	• anthropogenic;
	• oxidation of acid sulfate soils due to manual disturbance or anthropogenic change in water levels – decreases pH;
	• acidic or alkaline discharges from industry;
	• acidic mining runoff or exposure of acidic rocks from mining; and
	• acid rain resulting from certain industrial processes.
		• High or low pH can result in increased toxicity of certain metals (ANZECC and ARMCANZ 2000).
		• High – e.g. aluminium (pH>9).
		• Low –e.g. chromium (VI), nickel.
		• High or low levels can be directly toxic to biota – different species tolerate different ranges.
		  ○ changes can result in altered compositions and/or reduced biodiversity of plants and animals
		• Mosquitoes can tolerate low pH waters and can therefore become a nuisance in acidic wetlands where other macroinvertebrate predators may not survive.
		• Alkaline conditions can result in conversion of ammonium (generally non-toxic) to ammonia (toxic).
		• Low pH can weaken shells and exoskeletons and kill macroinvertebrates.

Dissolved Oxygen (DO)	• Natural; • depth of waterbody (deeper waters more likely to have low oxygen levels) • depth of measurement - surface waters often higher, bottom often lower	• Low DO - directly toxic to biota, especially fish and molluscs. • High DO saturations can also be harmful. • Oxygen bubbles can block blood vessels in fish resulting in death • Changes in DO result in altered redox conditions which can facilitate certain chemical reactions.

Parameter	Factors/sources impacting stressor levels	Ecosystem impacts
	○ Stratification (e.g. different layers of salinity) can enhance this effect • algal or plant growth (photosynthesis increases pH, respiration decreases pH); ○ DO often higher during the day (more photosynthesis) and lower at night (more respiration) • decomposition of organic material – process consumes DO; • temperature; • rain and wind can introduce oxygen into water; • influence of groundwater; • anthropogenic; • microbial breakdown of excess organic material (e.g. from grass clippings, sewage, industrial wastes or as a result of eutrophication) – decreases DO; • oxidation of hydrocarbons, reduction of metals, microbial (bacterial and archaea) activity and nitrification – decreases DO; • excess plant/macroalgal growth on the water surface from eutrophication can smother water – decreasing DO; • excess algal growth can also increase DO (high levels of photosynthesis); and • aeration through fountains and subsurface aeration - increases DO.	• Low DO results in phosphorus release from sediments – can lead to eutrophication (Correll 1998). • Low DO results in formation of reduced compounds, such as hydrogen sulphide, resulting in toxic effects on aquatic animals (Camargo & Alonso 2006). • Low DO can increase toxicity of certain metals (e.g. copper) and ammonia (ANZECC and ARMCANZ 2000). • Low DO levels also halt nitrogen loss from water by preventing nitrification of ammonia (Geoscience Australia 2015).
Electrical Conductivity (EC)	• Natural; • communication with the ocean will increase EC; • proximity to ocean – fine sea spray or atmospheric salt can eventuate in waterbodies; • depth of measurement - salt water heavier than freshwater so will sink ○ Stratification (e.g. different layers of salinity) can enhance this effect • underlying geology; • temperature; • influence of groundwater; • seasonal water level changes - increased rainfall and runoff can dilute water (decreasing EC) and evaporation concentrates ions (increasing EC); • anthropogenic; • discharges from industry;	• High or low levels can be directly toxic to biota – different species tolerate different ranges (Hart et al 1991). ○ changes can result in altered compositions and/or reduced biodiversity of plants and animals. • In this catchment water is naturally reasonably fresh; therefore high EC will result in loss of many endemic plant and animal species. • Particularly leeches, flatworms and macroinvertebrates without impermeable skeletons (pulmonate gastropods) (Dunlop et al 2005).

Parameter	Factors/sources impacting stressor levels	Ecosystem impacts
	○ E.g. sewage contamination can increase EC; and • oil spills can decrease EC.	
Total Suspended Solids (TSS)	• Natural. • Sources include soil particles and organic material (e.g. algae, microorganisms, decaying plant and animal matter). • Windy conditions can result in increased resuspension of bottom sediments and introduction of soil particles. • Heavy rainfall will result in increased erosion of surrounding soils and increased introduction of particles through runoff. • Anthropogenic. • Discharges from industry from runoff and dust. • Products of vehicle wear from road run-off. • Increased amounts of soil particulate material entering waterbodies as a result of construction and demolition operations.	• Deposition of suspended solids can block pipes, change flow conditions in open channels (Institute of Engineers Australia (IEA 2006), alter streambed properties and aquatic habitat for fish, smother benthic organisms, and reduce the food supply and refuge for bottom feeding organisms, macrophytes, and benthic organisms (Chetia 2014). • High concentrations can reduce water clarity and light available to support photosynthesis → loss of submerged macrophytes (i.e. seagrasses). • High concentrations can impair the function of fish gills (ANZECC and ARMCANZ 2000). • Suspended solids can alter predator-prey relationships (e.g. could make it difficult for fish to see prey). • Suspended solids can also provide surface area for the sorption and transport of nutrients and other pollutants (e.g. metals and bacteria). ○ often used as an "indicator" of nutrients/other pollutants.
Temperature	• Natural; • air temperature and sun exposure; ○ Therefore time of day. • turbidity – increases temperature through scattering of solar radiation; • waterbody depth and depth of measurement; • vegetation - temperatures in unvegetated water bodies will vary more than those with vegetation due to greater exposure to weather conditions, but will generally be higher due to lack of shade; • anthropogenic; • industrial discharges – can increase or decrease temperature; • stormwater runoff from hot surfaces (e.g. roads and carparks) could increase the temperature of receiving water bodies; and • reservoirs could discharge cooler water to waterbodies.	• Higher rates of plant and algae growth. • As soon as the temperature cools or other supporting processes cease, growth declines and biological decay commences → increased oxygen demand. • Influences sediment redox reactions. • E.g. increased temperatures result in increased sediment phosphorus release (Lehtoranta 1995). • Increased temperatures increase metabolic rate of bacteria and therefore mineralisation of organic matter → release of bioavailable phosphorus and nitrogen species into the water (Lehtoranta 1995). • High temperatures reduce oxygen solubility. • High temperatures increase solubility of salts. • Many chemicals exhibit between a two and four fold increase or decrease in toxicity for each 10°C rise in temperature (ANZECC and ARMCANZ 2000). • Some organisms become more vulnerable to toxic wastes, parasites and diseases at low water temperatures. • Increased metabolic rate of organisms with increasing temperature → increased oxygen demand (compounded by decreased oxygen solubility) • Different species tolerant to different ranges → changes can result in differing biotic communities.

Parameter	Factors/sources impacting stressor levels	Ecosystem impacts
		• Fish and macro-invertebrates are ectotherms as their body temperature is controlled by the temperature of the surrounding environment (Marsh et al 2005) – as such they particularly sensitive to temperature changes • Low temperatures - loss of spawning trigger for fish.

Nitrogen	• Natural
	• soil type – e.g. highly mineral soils will store less nitrogen available to be mobilised into the water
	• fringing and emergent vegetation type and volume
	• seasonal conditions
	• hydrology – loss of nitrogen as N_2 gas may occur more readily in certain wetland hydrology
	• sources include plant and animal decomposition, faecal material, lightning and volcanic activity
	• anthropogenic
	• fertilisers;
	• sewerage;
	• feed lots;
	• pet droppings;
	• combustion of fossil fuels;
	• plant debris (e.g. from glass clippings);
	• industrial and household cleaning products (e.g. runoff from car washing);
	• ammonia/ammonium specific:
	  ○ Industrial processes including the preparation of synthetic fibres (e.g. nylons), plastics and explosives, resins, human and veterinary medicines, fuel cells, rocket fuel, dyes, metal treating operations, refrigeration, and petroleum (DoE 2016); and
	• proportion of ammonia/ammonium in water varies with pH & temperature (ammonium is predominant at pH 5 to 8) and as such levels can vary throughout the day.
		• Some nitrogen is required for life - wetlands with very low concentrations of nitrogen and phosphorus will support little life (oligotrophic).
		• High concentrations (particularly of bioavailable forms) in conjunction with high phosphorus result in nuisance growth of aquatic plants/algae/cyanobacteria (blue green algae) known as eutrophication, which can have flow-on negative effects:
		• Toxic effects of cyanobacterial toxins (particularly due to cyanobacteria in fresh and brackish waters) to humans, birds and aquatic biota.
		• Decreased dissolved oxygen from surface growth acting as physical barrier and decomposition of excessive growth → harm to fish, macroinvertebrates and desirable macrophyte species.
		• Decreased light available to desirable macrophyte species.
		• Reduction in recreational amenity (phytoplankton blooms and macrophytes in wetlands and lakes) from cyanobacterial toxins and odours produced from decomposing material.
		• Physical blocking of waterways.
		• Reduction in biodiversity or change in species composition.
		  ○ E.g. mosquitoes (tolerant to poor water quality) can become predominant in eutrophic waterways.
		• Nitrogenous fertilisers and car emissions can lead to acidification of waterbodies.
		• High levels of ammonia are directly toxic to fish & aquatic organisms.

Phosphorus	• Natural; • decomposition of organic matter; • weathering of rocks; • anthropogenic; • motor vehicle exhaust, fuels, lubricants, fertilisers, detergents, car wash products, eroded soils, and industrial wastes (IEA 2006); and	• Some phosphorus is required for life - wetlands with very low concentrations of phosphorus and nitrogen will support little life (oligotrophic). • Excessive concentrations (particularly bioavailable forms (i.e. FRP)) in conjunction with high nitrogen concentrations can result in eutrophication (see ecosystem impacts of nitrogen for more information).

Parameter	Factors/sources impacting stressor levels	Ecosystem impacts
	• runoff from impervious surfaces such as roads, parking lots and rooftops (especially in commercial, industrial and high-density residential areas) can potentially contribute a large portion of phosphorus to the water bodies as this water is not filtered (Department of Environment (Western Australia) 2004).	
Hardness	• Natural; • underlying geology – e.g. wetlands over limestone generally have hard water; • anthropogenic; • discharges from operating and disused rock quarries; and • inorganic chemical industry.	• Generally, hard waters are more alkaline, and waters with greater hardness are generally less susceptible to acidification. • Increasing water hardness and alkalinity specifically reduces the uptake and toxicity to freshwater organisms of several metals (such as cadmium, chromium III, copper, lead, nickel and zinc).

Appendix F Potential sources and impacts of metals found in urban stormwater

The metals analysed as part of this monitoring program can be derived from a wide variety of sources, some natural and some anthropogenic. Understanding the sources of these metals can provide potential avenues for investigation if high concentrations are detected. Furthermore, if high metal concentrations are encountered, other water quality indicators and local factors may provide an indication of the severity of the impact of these concentrations. The impact of hardness on concentrations has been quantified for some metals (see tables in Appendix D), but also, for example, for metals that adsorb to suspended particles, the presence of these particles may reduce the bioavailability of some (but not all) of these metals to biota, thus effectively reducing their toxicity. As metals are generally more bioavailable in soluble form, factors that increase solubility will increase their toxicity. Different functional groups of biota may also differ in their sensitivity to metals. The main impact of metals to surface waters is generally toxicity to biota, but some metals (such as iron) can have other negative environmental impacts.

Table F-1 describes the potential sources, factors affecting impacts and toxic and other impacts of metals. Information regarding sources of metals is taken from The National Pollutant Inventory (Australian Government Department of Environment (DoE) 2016) and information regarding factors affecting toxicity and impacts to biota are derived from ANZECC and ARMCANZ (2000) unless otherwise stated.

Table F-1: Potential sources, factors affecting impacts and impacts of metals typically found in urban stormwater

Metal	Sources/uses	Factors affecting impacts	Impacts
Aluminium (Al)	• natural leaching from soil and rock; • increased in soluble groundwater concentrations under acidic conditions, therefore strongly linked to the presence of Acid Sulfate Soils (ASS) (DER 2015); • anthropogenic sources include industrial discharges and corrosion of products containing aluminium; and • used in construction, automotive, aircraft and electrics industries, in the production of metal alloys, cooking utensils and food packaging (WHO 2010).	• Toxicity to fish and invertebrates increased at pH<5.5 and >9, with a maximum toxicity around pH 5.0-5.2. • Toxicity reduced by complexing with humic (organic) substances. • Toxicity reduced at high water hardness. • Toxicity possibly increased with increased temperature.	• toxic to biota at high concentrations; • among aquatic plants, single celled plants most susceptible; • fish more susceptible than aquatic macroinvertebrates; and • can affect the function of fish gills (Exley et al 1991).
Arsenic (As)	• naturally present in the earth's crust; • can enter waterways through wind-blown dust and water run-off; • naturally released into the environment through weathering of rocks and volcanic activity; • high arsenic concentrations in groundwater (and communicating surface waters) linked to the presence of Acid Sulfate Soils (ASS) (DER 2015b);	• Several valencies exist in water – most common are As (III) and As (V). • both bond with carbon to form numerous organo-arsenic compounds, some of which are very toxic (e.g. methylarsine). • Valency state main factor affecting toxicity – As (III) most toxic form.	• toxic to biota; • can bio-accumulate in some animals; • Phytoplankton is among the most sensitive organisms to both forms of arsenic; • higher trophic levels are less sensitive to arsenic because they generally accumulate the element from food rather than the water column; and

Metal	Sources/uses	Factors affecting impacts	Impacts
	• mining and metal manufacturing main anthropogenic source of arsenic in Australia; • other uses of arsenic in industry include manufacturing of food, paper products, glass products, petroleum and coal products and chemicals; and • also released from combustion of fuels and other incineration activities.	• Toxicity of As (V) increases with increasing temperature. • As (III) removed by sulfides, As (V) by clays.	• adult freshwater fish are generally less sensitive to arsenic.
Chromium (Cr)	• exists naturally in low concentrations (rocks, soil, plants, animals, volcanic dust, gasses); • enters waterways through settling of atmospheric particles and rainfall and contaminated water and soil; • chromium in stormwater is mostly associated with suspended solids (IEA 2006); • two forms: The trivalent form (Cr^{3+}) is mainly discharged from the metal industry where it is used for chrome plating, and the hexavalent form (Cr^{6+}) is mainly discharged from tanning & painting (IEA 2006); • predominant form of chromium in the environment is Cr^{3+}; and • it is also used in industry to produce the following: electrical products, engine parts, fungicides, wood treatment products, ceramics, clay, paper, glass, porcelain, pharmaceuticals/medicines/medical treatment, steam & air conditioning supplies and cement products Other sources include combustion of fossil fuels, incineration of waste and sewerage sludge.	• Toxicity of both forms decreases with increasing water hardness and/or alkalinity. • Cr^{6+} toxicity increases in freshwater at lower pH. • Cr^{6+} not affected by presence of suspended material, whereas Cr^{3+} is readily removed from the water column with both dissolved organic matter and suspended material. • Toxicity decreases with increasing salinity and sulfate. • More toxic at high temperatures.	• Chromium VI is toxic to aquatic organisms, and a carcinogen for animals & humans. • Cr^{3+} is far less toxic than Cr^{6+}. • Chromium VI may bio-accumulate to some degree. • Freshwater algae & invertebrates are more sensitive to Cr^{6+} than fish, with crustaceans particularly sensitive.
Copper (Cu)	• Copper compounds naturally occur in rocks, soil, water, plants, animals and humans. • Enters water from settling of atmospheric particles or dissolved in waters. • Natural sources include decaying vegetation, forest fires and sea spray. • Mining and metal manufacturing are the largest sources of copper emissions in Australia. • Other industrial sources include electricity supply and manufacturing of chemicals, cement, lime, plaster and concrete products, transport equipment, petroleum, coal, beverages, paper products, glass products, motor vehicles and parts, wood	• Toxicity increases when hardness, alkalinity & dissolved oxygen decrease. • Strongly attaches to organic matter and suspended material. • Levels of dissolved organic matter in freshwaters usually remove copper toxicity (except in very soft waters). • Its toxicity in algae, invertebrates & fish generally increases as salinity decreases. • Copper and lead toxicity appear to interact in synergism.	• It is a micro-nutrient and essential to life at low concentrations, toxic at higher concentrations to freshwater fish, invertebrates and plants. • Some species of algae are particularly sensitive. • Negatively affects fish and macro-invertebrates in various body systems across multiple life stages. • It can bio-accumulate in aquatic organisms.

Metal	Sources/uses	Factors affecting impacts	Impacts
	products, ceramic products, food and beverage products, and textiles (DoE 2016). • Found to be related to the flow of vehicles and road network characteristics (Beasley & Kneale 2002). • Also possible release from solid and liquid fuel combustion, lawn mowing, leaching from antifouling paint on ships and boats.		
Iron (Fe)	• fourth most abundant metal in earth's crust; • naturally present in water in varying quantities depending upon local geology and other chemical factors; • insoluble ferric state (Fe^{3+}) usually more prevalent in surface waters (ANZECC and ARMCANZ 2000); • soluble ferrous state (Fe^{2+}) present in reducing (anaerobic) waters and usually originates from groundwater (ANZECC and ARMCANZ 2000); • industrial production of the following iron containing products could produce anthropogenic iron pollution: pigments of paints and plastics, food colours, construction materials (WHO 2003); and • many pipes are constructed of cast iron, steel or galvanised iron which may become sources of iron (WHO 2003).	• solubility increases in acidic water; and • solubility higher in anaerobic waters.	• essential for both plants and animals; • has been shown to be toxic to some macroinvertebrate species; • in aerobic waters, ferric iron can form colloidal suspensions which can either form suspended flocs or settle and harden; and • may cause problems with turbidity, decreased light penetration and smothering of benthic organisms.
Lead (Pb)	• rare in nature, anthropogenic sources outweigh natural sources (ANZECC and ARMCANZ 2000); • Lead reaches aquatic environment through rainfall, lead dust, street runoff and industrial discharges (ANZECC and ARMCANZ 2000); • also fires and fuel combustion; • Lead used to be used in water pipes, stained glass windows, paint and fuel and as such these products may be partially responsible for the legacy of lead in waterways; • mining and metal manufacturing greatest industrial emitters; and • also used in production of cement, plaster, concrete, iron, steel, petroleum, coal products, paper products, glass products, metal products, motor vehicles and parts, wood products, yarn and fabric.	• toxicity increases when water hardness decreases; • low solubility in water reduces toxicity; • strongly adsorbed by suspended clay, humic substances and other suspended material; • strongly complexed by dissolved organic material; and • toxicity possibly increased at low pH.	• non-essential, highly poisonous element; • shown to affects chlorophyll synthesis in plants (e.g. Mesmar and Jaber 1991); and • can potentially bioaccumulate but not generally present in great enough concentrations that bioaccumulation has much effect.
Mercury (Hg)	• naturally occurring element found in rocks and ores; • can enter waterways from atmospheric particles settling or deposited by rain, or through emissions in water and soil;	• present as inorganic Hg (II) and organomercurial compounds (such as methyl mercury) -	• inorganic mercury relatively low toxicity and low ability to bioaccumulate;

Metal	Sources/uses	Factors affecting impacts	Impacts
	• natural sources of mercury in waterways include emissions from volcanoes and evaporation of water from soil; • largest source of mercury emissions in Australia from manufacturing, mining and alumina production of non-ferrous metals; • also can be released from burning of fossil fuels, precious metal mining, cement manufacturing, chemical manufacturing and sewerage; and • landfills and disposal of batteries, thermometers and other mercury containing products can emit mercury to land, which can eventually end up in water.	microorganisms can convert Hg (II) to methyl mercury; • increased toxicity with decreased hardness; • strongly adsorbed by particles, often associated with sediments; and • strong affinity for chloride – toxicity of inorganic mercury reduced in saline waters.	• Methyl mercury particularly toxic - can be absorbed quickly; • can bioaccumulate in fish and their food chains; and • in mercury polluted areas, larger and older fish tend to have higher levels.
Nickel (Ni)	• exists naturally in soils and rocks often with arsenic, antimony and sulfur; • found at background concentrations in natural waters (ANZECC and ARMCANZ 2000); • can enter waterways from settling of atmospheric particles or dissolved compounds in waters; • natural sources include weathering of rocks (ANZECC and ARMCANZ 2000) and volcanoes; • Anthropogenic sources of atmospheric nickel include combustion of fossil fuels, mining and refining operations, steel production, nickel alloy production, electroplating, municipal waste incineration and nickel refineries; and • can enter water in wastewater from municipal sewage treatment plants, stormwater runoff and from groundwater near landfill sites.	• toxicity increases with decreased hardness; • toxicity usually increases with decreased pH; • complexed by dissolved organic material; • less bioavailable when adsorbed to suspended material; and • toxicity increases with decreasing salinity.	• essential to life; • moderately toxic to freshwater organisms; • reduces growth of freshwater algae at relatively low concentrations; and • fish less sensitive to nickel, but it differs between species.
Selenium (Se)	• occurs naturally in the environment at varying concentrations, usually combined with other compounds (such as sulphide ores of other metals); • commonly found in sedimentary rock formations; • can enter waterways from settling of atmospheric particles or dissolved compounds in waters; • exists in water as oxyions selenate (selenium (VI)) and selenite (selenium (IV)); • natural sources in water include weathering of rocks; • released into the air and water from combustion of fossil fuels, smelting and refining of metals, glass and ceramics manufacturing and refuse incinerators; and	• toxicity of selenate increases with decreasing sulfate and phosphate concentrations; • Selenite uptake increases at low pH; • toxicity ameliorated by mercury and copper; and • binding of selenium to particles does not reduce bioavailability	• toxicity dependent on valency state – Se (IV) more toxic than Se (VI); • Selenites readily removed form water column, but selenates can bioaccumulate in aquatic ecosystems; and • food chain uptake more significant than water uptake.

Metal	Sources/uses	Factors affecting impacts	Impacts
	• can also enter waterways from anti dandruff shampoos and application as fungicides and insecticides		
Zinc (Zn)	• exists naturally in rocks, soil, air, waters, plants and humans; • can enter waterways from settling of atmospheric particles or dissolved compounds in waters; • natural sources in water include weathering of rocks; • anthropogenic sources include mining, steel production, waste incineration, chemical waste dumps & landfills, sewage treatment plants, corrosion of galvanised structures, fertilisers and herbicides; and • urban runoff also potential source from wear of car tyres or fuel combustion	• toxicity increases with decreasing hardness and alkalinity; • levels of organic matter present in freshwater generally sufficient to remove zinc toxicity; • pH determines stability of these compounds; • adsorbed by suspended material; • toxicity generally decreases with decreasing pH when pH <8; and • uptake and toxicity decrease with increasing salinity.	• essential for life; • labile Zn^{+2} most toxic form; and • bioaccumulates in freshwater animal tissues but not a major problem.

Appendix G Compilation data tables of water parameters tested at each sample site from 2007 - 2020

Table G-1: Physicochemical parameter (pH, dissolved oxygen (DO) saturation (%), DO concentration (mg/L), conductivity (mS/cm) and temperature (°C)) results recorded in Melville Bull Creek catchment sites from 2007 to 2020

pH ANZECC acceptable range for lowland rivers: 6.5 - 8 wetlands: 7 - 8.5 Max 10.02 Min 3.24

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14
MELDR-15																													
MELDR-05	6.74	6.65			6.45	7.18	7.35		6.65	6.85			6.93	6.91	7.1	7.31	7.22	6.33	6.29	6.45	6.23	6.62	6.52	6.67	6.51	6.57	6.96	7.1	6.13
MELDR-16																													
MELDR-02	6.07	6.21	6.44	6.23	6.14	6.94	6.34	6.39	6.29	6.54	6.36		6.24	6.34	6.28	6.37	6.31	6.45	6.18	6.28	6.22	6.18	6.33	6.38	6.27	6.32	6.54	6.71	6.1
MELDR-01	6.89	6.88	6.47	7.3	6.82	7.46	7.47	7.2	7.07	7.24	7.23		6.92	7.29	7.51	7.49	6.73	7.36	6.58	7.27	6.81	6.74	7.25	7.07	6.62	7.27	6.6	6.8	6.61
MELDR-13																											6.67	6.72	6.59
MELDR-14																											6.29	6.33	6.99
MELDR-06	6.17	6.51	7.6	6.35	6.35	7.27	6.58	6.68	6.74	6.52	6.67		6.98	6.94	7.26	6.87	7.15	7.01	6.46	7.07	6.88	6.89	7.08	7.12	6.71	7.06	6.12	6.25	6.82
MELDR-07	3.26	4.69			5.71	7.17	7.19		3.94	6.77			6.23	6.55	6.88	5.6		5.45	6.29	6.78			3.91	3.94		3.74	6.38	6.68	4.5
MELDR-08	4.3	5.03			5.67	7.33			5.87										4.19	4.73		4.99	5.62	5.68	5.02	5.37	7.25	7.26	5.23
MELDR-09	7.08	7.37			7.11	7.69	7.52	7.51	7.04	7.14	6.96		7.5	7.53	7.26		5.14	6.91	6.07	6.83	7.08	6.74	7.21	7.03	6.92	6.6	8.04	9.29	6.02
MELDR-10	7.21	8.4			9.3	8.16	7.1	7.07	9.01	9.39	6.88		7.55	7.51	7.32	7.55	6.96	7.95	6.99	7.62	7.31	7.4	8.42	7.1	7.14	7.31	5.62	5.72	6.98
MELDR-11	7.56	8.31			8.38	8.17	9.08	8.16	8.67	9.3	9.7	9.21	7.34	7.52	7.87	9.08	7.22	7.8	7.51	7.59	7.64	7.65	8.24	8.42	7.43	7.64	6.26	6.82	7.32
MELDR-12	4.31	7.5			7.05	7.92	8.49		6.74	9.3	7.96		7.17	7.61	9.44	8.57	3.41	3.5	6.47	7.08	3.99	4.03	5.16	6.97	4.12	6.6	6.79	7.04	6.39

Site	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15	6.16	6.11	6.21	6.41	6.24	6.76	6.68	6.61	6.56	6.46	6.54	6.85	6.58	6.4	6.49	6.83	6.51	6.5	6.32	6.35	6.49	6.17	6.56	7.15	6.3	6.33	6.47	6.49
MELDR-05	6.25	6.17	6.43	6.33	6.15	6.55	6.55	6.24	6.33	6.4	6.22	6.53	6.46	6.32	6.39	6.52	6.45	6.36	6.4	6.27	6.28	6.33	6.35	6.24	6.13	6.25	6.35	6.45
MELDR-16	6.29	6.24	6.56	6.44	7.1	6.48	6.9	6.61	6.61	6.74		7.15	6.83	6.93	7.02		7.27	7.11	6.85	6.4	6.82	6.94	7.13	7.28	6.76	6.96	6.78	6.83
MELDR-02	6.21	6.17	6.22	6.11	6.04	6.16	6.16	6.26	6.22	6.16	6.23	6.24	6.24	6.21	6.25	6.59	6.45	6.35	6.3	6.19	6.39	6.39	6.36	6.21	6.31	6.15	6.29	6.27
MELDR-01	6.73	6.67	6.76	6.66	6.51	6.68	6.66	6.77	6.73	6.77	6.8	6.68	6.84	6.78	6.74	7.38	6.97	6.79	6.84	6.74	6.74	7.07	7.01	6.57	6.73	6.76	6.74	6.8
MELDR-13	6.69	6.66	6.74	6.5	6.31	6.57	6.41	6.77	6.67	6.81	6.69	6.61	6.75	6.64	6.71	7.27	7.41	6.67	6.69	6.66	6.68	6.83	6.74	6.42	6.55	6.5	6.49	6.67
MELDR-14	7.14	7.11	7.12	7.01	6.8	6.89	6.86	7.04	7.03	7.06	7.09	7.11	7.24	7.15	7.18	7.45	6.75	7.07	7.21	7.03	7.24	7.42	7.24	6.83	7.07	6.57	7	7.065
MELDR-06	6.8	6.78	6.87	6.83	6.74	6.74	6.56	7.25	7.13	7.48	6.91	6.79	7.18	6.82	6.98	7.47	7.23	6.91	6.83	6.84	6.87	7.28	6.85	6.63	6.69	7.33	6.92	6.87
MELDR-07	6.26	6.76	6.83	3.34	3.24	6.19	6.58	4.35	3.55	3.83	6.55		6.79	6.85	6.67	7.05	6.93	6.81	6.87	7.06	7.09	7.11	7	6.55	6.5	6.33	6.54	6.545
MELDR-08	5.34	5.43	5.4	5.45	5.31	6.55	6.49	5.48	5.54	5.57	6.33	5.61	5.9	6.18	6.06	6.08	5.92	6.78	6.56	5.98	5.98	6.32	6.31	4.94	5.31	5.78	6.4	5.675
MELDR-09	6.31	6.26	6.85	6.41	6.27	6.92	6.8	6.37	6.38	5.66	6.73	6.39	6.37	6.72	6.76	7.56	6.51	6.64	6.57	6.45	6.9	6.92	7.09	7.49	6.65	6.69	6.94	6.875
MELDR-10	7.37	7.61	6.73	6.77	6.94	6.63	8.31	6.8	7.01	6.9	6.56	6.95	7.19	7.37	6.96	7.84	7.2	6.68	7.31	7.13	7.19	7.4	7.17	6.94	6.9	7.71	6.06	7.19
MELDR-11	7.09	7.81	8.3	8.08	7.9	9.92	9.99	7.4	7.46	7.96	10.02	9.12	9.82	9.51	9.21	8.18	7.15	8.28	7.99	9.4	8.15	9.06	8.79	8.96	9.94	9.11	9.99	8.175
MELDR-12	6.58	6.9	7	6.48	6.43	6.95	6.97	3.74	4.57	5.91	6.98	6.8	6.6	6.79	6.92	7.36	6.82	6.81	6.86	6.91	6.92	6.93	7.37	7.24	7.25	6.92	7.72	6.915

SITES RECORDING pH ALWAYS/GENERALLY OUTSIDE ACCEPTABLE RANGE
SITES RECORDING 40-60% of pH values ABOVE ACCEPTABLE RANGE
SITES RECORDING pH ALWAYS/GENERALLY WITHIN ACCEPTABLE RANGE

Record BELOW acceptable range | Record WITHIN acceptable range
Record ABOVE acceptable range | NO sample taken

DO saturation % ANZECC acceptable range for lowland rivers: 80-120% for wetlands: 90-120% Max 206.5 Min 0.3

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14
MELDR-15																													
MELDR-05	13.1	21.9			29.9	8.8	2.7		42.8	65.4			74.3	26.2	14.6	12.7	60.2	11.4	76.3	7.7	9.4	60.9	2.3	21.1	27.8	22.5	88.9	71.7	31.6
MELDR-16																													
MELDR-02	51.8	53.7	46.7	44.5	53.1	50.1	46.9	44.9	53.4	49.7	41.5		54.8	47.2	40.2	41.1	46.1	48.2	49.7	44.1	45.6	47.1	43.2	41.1	45.1	45.9	70.5	72.9	52.3
MELDR-01	65.5	70.7	83.7	66.1	66.6	61.2	68.3	62.7	61.8	67.2	69.5		65.3	57.9	55	51.6	62.2	59.1	54.3	57.7	48.3	56.8	51.7	48.6	57.2	55.1	75.7	73.2	63.7
MELDR-13																											51.2	47.8	78.1
MELDR-14																											8.7	13.3	88.4
MELDR-06	76.4	84.3	63.2	76.5	76.4	82.9	86.5	80.7	76.4	84.7	84.8		75.7	74.9	72.3	79.8	74.5	75.7	80.2	80.5	56.9	76.8	74.8	83.1	59	73.4	41.3	40	72.4
MELDR-07	123.2	20.7			49.5	47.2	36.6		115.2	19			61.2	12.1	91.4	78.6		115.6	32.9	22.9			51.9	52.5		71.7	36.8	37.8	42.5
MELDR-08	122.8	37.5			65.9	43.4			66.1										54.1	49.8		41.5	39	88.7	20.1	27.1	72.9	63.9	32.7
MELDR-09	62.4	92.1			93.4	82.5	91	75.6	84.9	100.7	74.1		101.2	89.9	80.4		76.2	97.3	70	78.3	72.5	85	81.3	77.8	77.8	55	86.7	97.6	35
MELDR-10	59.2	113			143.8	81.9	125.6	41.8	116.5	156.1	37.5		82.8	67.5	23.7	45.8	57.3	63	57.3	82.4	55.2	71.2	84.6	27.9	52.1	72.6	32.9	30.2	54.2
MELDR-11	84.8	122.8			110.5	80	123.8		102	206.5	188.3	186.4	48.5	54.8	103.7	134.1	61	65	67.2	55	65.8	68	82	110.7	39.6	68.5	33.9	37.3	61.6
MELDR-12	121.9	79.7			48.8	88.8	123.4	83.5	41.2	134.2	88.4		90	95.6	160.4	125.5	107	78.6	17.7	47.7	107.3	118.4	95.2	81.1	8.8	17.9	26.3	15.3	21.1

Site	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15	41.1	39.3	47.7	56.9	53	48.4	56	45.8	44.1	43.7	42.9	49.7	44	39.7	37.9	60.6	42.6	54.2	53	41.5	45.1	38.9	34.8	82.9	33.4	40.6	22.7	44
MELDR-05	8.1	12.6	18.2	13.1	0.3	0.6	1.6	10.1	12	45.4	12.9	37.9	19.3	7.8	7.7	3.7	16.2	20.5	6.8	3.4	3	3.6	2	31.6	21	27.5	9.1	13.1
MELDR-16	79.4	97.9	82	65.1	71.1	63.7	70.2	68.1	80.8	87.1		71	61.7	65.2	79.5		91.2	89.8	92.6	84.9	93.5	90.5	92.6	93.1	82.1	92.6	88.7	82.1
MELDR-02	40.8	46	37	41.7	37.5	32.4	35.1	42	45.8	50.9	43.5	44.1	47.7	43.1	32	47.1	55.7	56.9	48.8	36.2	49.3	47.7	44.1	71.8	45.7	36	29.6	45.9
MELDR-01	53.6	53.6	52.5	56.4	53.7	45.9	51.5	50	56.9	64.4	55.1	52.2	42.6	50.1	47.1	55.7	57.8	62.1	56.4	56.9	56.3	62.5	57	57.2	60.2	61.7	58.3	57.2
MELDR-13	65.4	69.3	71.8	55.1	63.1	65.5	47.6	58.7	64.2	57.3	68.5	60.1	63.5	61.1	61.5	67.7	93.2	69.4	71.8	65	65.9	63.8	66.4	73.8	63.9	64.2	64.1	64.2
MELDR-14	77.7	82	80	91.6	75.7	50.7	69.5	78.5	85	87.5	82.4	69.9	75	81.1	75	90.2	68.8	91.3	88	87.3	91.8	91.5	82.4	87.7	86.3	38.6	73.9	81.55
MELDR-06	71.9	73.1	75.8	77	54.2	66.2	49.4	57.3	54.9	57.9	58.8	61.5	63.9	66.9	56	74.4	76.7	75.9	76.7	73	74.7	74.2	68.9	65.2	65.7	81.8	54.1	74.4
MELDR-07	0.6	136.6	19.9	79.6	61.4	1.7	2.2	37.5	56.4	52.9	8.9		23.9	30.3	1.2	18.8	12.8	12.3	15.9	7.5	23.4	37.7	16.2	29.2	17.7	12.1	17.8	31.6
MELDR-08	40.1	25.5	38.9	54.8	46.1	55.5	73.4	37.8	38.3	37.4	62.2	33.4	29.8	38.3	26.8	20.4	55.2	39.8	23.3	54.5	38.8	61.8	19.4	12.9	20.2	43.6	31.6	39.4
MELDR-09	3	0.8	29.6	33.4	32.4	60.2	36.8	36.2	40	22.3	31.7	19.8	33.4	33.4	21.8	64.1	22.7	35.3	5.8	21.8	57.8	54.1	59.1	96.5	59.1	68.5	109.4	63.25
MELDR-10	61.3	70.2	59.6	32.2	52	3.7	69	28.1	47.9	73.2	2.5	45.3	62.6	70.5	34.4	44.8	66.3	18	101.8	55.8	47.2	70	40	70.1	40.9	81.3	37	57.3
MELDR-11	15	64.6	67.6	76.2	80.5	121	96.1	65.4	68.1	75.1	132.3	75.1	83.1	63.6	88.4	105	54.2	131.4	135.5	118	105.2	122.4	150	108.3	128.8	105.2	129.5	83.1
MELDR-12		30.3	21.7	31.2	41.7	48.8	35.3	90	33	14.2	36.1	63.9	32.5	12.3	31.4	41.4	44.8	26.5	25.1	46.3	42.4	41.8	91.5	88.9	93.8	78.3	121.6	48.25

SITES RECORDING DO SATURATIONS ALWAYS/GENERALLY OUTSIDE ACCEPTABLE RANGE
SITES RECORDING 40-60% of DO saturations ABOVE ACCEPTABLE RANGE
SITES RECORDING DO saturations ALWAYS/GENERALLY WITHIN ACCEPTABLE RANGE

Record BELOW acceptable range | Record WITHIN acceptable range
Record ABOVE acceptable range | NO sample taken

DO concentration (mg/L) Max 16.35 Min 0.03

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14
MELDR-15																													
MELDR-05	1.4	2.03			2.9	0.8	0.24		4.11	5.42			7.35	2.6	1.33	1.16	6.15	1.11	7.28	0.69	1.01	6.23	0.22	1.96	2.7	2.1	8.26	6.33	3.01
MELDR-16																													
MELDR-02	4.77	4.91	4.12	3.92	4.87	4.52	4.16	3.95	4.93	4.46	3.65		5.13	4.31	3.64	3.69	4.18	4.39	4.5	3.96	4.1	4.32	3.92	3.7	4.17	4.19	6.39	6.42	4.91
MELDR-01	6.59	6.66	7.32	6.14	6.44	5.79	6.33	5.84	5.96	6.04	6.37		6.32	5.7	5.23	4.88	6.06	5.68	5.12	5.31	4.85	5.59	5.02	4.6	5.45	5.11	6.89	6.49	6.04
MELDR-13																											4.74	4.38	7.5
MELDR-14																											0.79	1.18	8.5
MELDR-06	7.37	7.8	5.83	6.71	7.25	7.5	7.45	7.03	7.29	7.22	7.24		7.25	7.27	6.66	7.32	7.01	7.1	7.43	7.21	4.87	7.63	7.12	7.65	5.56	6.75	3.74	3.56	6.93
MELDR-07	12.03	1.84			4.67	3.65	2.78		11.16	1.53			5.72	1.17	7.83	6.36		11.24	3.02	2.02			5.08	4.84		6.58	3.36	3.29	4.13
MELDR-08	11.6	3.32			6.71	3.53			6.49										5.17	4.5		4.53	3.88	7.79	1.96	2.48	6.46	5.15	3.24
MELDR-09	6.78	8.34			9.41	7.18	7.38	6.83	8.27	8.3	6.21		10.3	9	7.4		8.04	9.85	6.75	7.04	8.31	9.21	7.98	7.12	7.88	5.17	7.77	7.99	3.45
MELDR-10	5.9	9.85			13.46	6.9	10.16	3.76	11.03	12.36	3.1		7.84	6.55	2.17	4.28	5.78	6.13	5.21	7.25	5.94	7.26	7.77	2.61	4.97	6.71	2.93	2.54	5.19
MELDR-11	8.66	10.9			10.59	6.85	9.89	7.24	9.8	16.35	14.53	13.81	4.66	5.18	8.99	11.39	6.16	6.38	6.19	5.01	7.03	6.96	7.57	9.82	3.76	6.35	3.1	2.98	5.91
MELDR-12	11.8	6.9			4.51	7.08	9.5		3.93	10.65	6.66		8.12	8.81	13.57	9.79	10.3	7.34	1.61	4.05	11.2	11.86	8.38	6.82	0.86	1.57	2.17	1.2	1.96

Site	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15	3.92	3.61	4.27	5.56	5.1	4.42	5.06	4.58	4.34	4.38	3.99	4.86	4.29	3.73	3.56	6	4.1	5.13	4.9	4.05	4.44	3.84	3.17	8.16	3.23	3.87	2.1	4.29
MELDR-05	0.77	1.15	1.64	1.33	0.03	0.05	0.14	1.07	1.22	4.61	1.23	3.74	1.78	0.74	0.71	0.37	1.55	1.93	0.62	0.34	0.3	0.36	0.18	3.2	2.14	2.74	0.85	1.33
MELDR-16	7.52	9.06	7.39	6.05	6.58	5.78	6.36	6.39	7.67	8.57		6.75	5.83	6.01	7.44		8.97	8.44	8.41	7.79	8.67	8.59	8.51	9.03	7.65	8.58	8.16	7.67
MELDR-02	3.73	4.16	3.3	3.81	3.43	2.9	3.14	3.84	4.22	4.78	3.95	4.08	4.39	3.93	2.92	4.3	5.17	5.24	4.44	3.34	4.59	4.46	3.98	6.75	4.21	3.35	2.69	4.17
MELDR-01	5.1	4.96	4.89	5.54	5.32	4.22	4.76	5.01	5.58	6.4	5.28	4.97	4.07	4.76	4.5	5.5	5.51	5.9	5.25	5.58	5.53	6.18	5.29	5.51	5.91	5.97	5.52	5.53
MELDR-13	6.1	6.28	6.41	5.27	5.98	5.75	4.15	5.65	6.1	5.49	6.29	5.63	5.93	5.69	5.68	6.49	9.2	6.49	6.53	6.18	6.3	6.13	6.01	7.03	6.08	6	5.87	6.045
MELDR-14	7.45	7.52	7.28	9.33	7.62	4.57	6.21	8.18	8.71	8.83	7.78	6.94	7.39	7.65	7.22	9.26	6.43	8.96	8.18	8.81	9.37	9.23	7.53	8.88	8.83	3.72	7.02	7.635
MELDR-06	6.77	6.66	6.81	7.51	5.3	5.91	4.43	5.77	5.45	5.77	5.51	5.93	6.11	6.33	5.3	7.4	7.38	7.27	7.15	7.18	7.38	7.35	6.32	6.4	6.52	8.11	5.13	7.01
MELDR-07	0.05	11.53	1.64	8.25	6.06	0.15	0.19	4.15	5.89	5.29	0.77		2.22	2.61	0.12	2.05	1.33	1.22	1.46	0.77	2.42	3.74	1.46	2.98	1.79	1.17	1.59	2.88
MELDR-08	3.79	2.28	3.57	5.87	4.8	4.7	6.37	4.39	4.05	3.81	5.75	3.39	2.93	3.7	2.36	2.22	5.44	3.83	2.01	5.9	4.26	6.19	1.82	1.25	1.81	3.84	2.75	3.86
MELDR-09	0.29	0.07	2.66	3.52	3.35	5.14	3.2	3.98	4.23	2.27	3.04	2.04	3.43	3.33	2.16	7.03	2.38	3.59	0.57	2.35	6.3	5.64	5.45	9.68	6.25	6.79	10.24	6.525
MELDR-10	5.53	6.1	5.24	3.21	4.95	0.33	5.67	2.94	4.88	7.32	0.23	4.5	6.05	6.28	3.23	4.62	6.7	1.68	8.94	5.63	4.78	6.92	3.55	7.01	4.06	7.45	3.28	5.63
MELDR-11	1.41	5.68	5.78	7.58	7.7	9.76	7.75	6.81	6.94	7.43	11.51	7.46	8.03	5.9	8.14	10.7	5.45	12.52	12.04	11.9	10.61	12.1	13.01	10.89	12.91	9.9	11.73	7.73
MELDR-12		2.39	1.76	3.03	3.71	3.68	2.65	9.14	3.25	1.35	2.84	6.08	2.92	1.07	2.75	4.36	4.42	2.49	2.08	4.7	4.17	4.04	7.95	8.45	8.34	6.65	10.15	4.42

Anoxic 0 mg/L | Low oxygenated >2 - ≤4 mg/L | Well oxygenated >6 mg/L
Hypoxic >0 - ≤2 mg/L | Oxygenated >4 - ≤6 mg/L

Conductivity (mS/cm) ANZECC acceptable range for lowland rivers: 0.12 - 0.3 mS/cm and for wetlands: 0.3 - 1.5 mS/cm Max 33.2 Min 0.037

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14
MELDR-15																													
MELDR-05	0.096	0.798			1.038	0.796	1.23		0.761	0.877			0.289	0.9	1.036	0.738	0.037	1.061	0.839	1.182	0.768	0.124	1.211	1.026	0.437	0.608	0.679	0.729	0.49
MELDR-16																													
MELDR-02	0.79	0.769	0.814	0.809	0.814	0.788	0.822	0.806	0.742	0.806	0.848		0.568	0.79	0.805	0.809	0.762	0.754	0.832	0.773	0.832	0.689	0.842	0.82	0.701	0.767	0.608	0.655	0.504
MELDR-01	0.746	0.709	0.736	0.776	0.706	0.725	0.754	0.665	0.693	0.737	0.763		0.415	0.72	0.738	0.726	0.687	0.712	0.758	0.694	0.78	0.598	0.761	0.744	0.48	0.741	0.606	0.655	0.551
MELDR-13																											0.753	0.79	0.19
MELDR-14																											0.828	0.86	0.49
MELDR-06	0.769	0.711	0.734	0.989	0.724	0.705	0.769	0.713	0.603	0.644	0.661		0.415	0.604	0.624	0.632	0.616	0.614	0.638	0.597	33.2	0.45	0.675	0.658	0.597	0.644	1.18	0.856	0.256
MELDR-07	3.83	1.92			1.890	1.920	2.820		1.93	2.41			2.65	2.51	3.4	4.76		2.62	2.65	2.32			3.57	3.94		2.17	1.166	1.333	2.038
MELDR-08	0.951	0.79			0.666	0.685			0.781										1.278	0.984		1.038	1.164	1.026	1.504	1.358	0.282	0.458	0.984
MELDR-09	0.926	0.821			0.841	1.010	1.280	1.472	0.814	1.09	1.415		0.717	0.748	0.889		0.922	0.827	0.853	0.919	0.814	0.806	0.828	0.855	0.782	0.739	0.289	0.267	0.877
MELDR-10	0.212	0.24			0.342	0.328	0.590	0.558	0.351	0.418	0.7		0.181	0.23	0.452	0.547	0.087	0.114	0.19	0.212	0.168	0.113	0.156	0.316	0.138	0.092	0.982	0.98	0.158
MELDR-11	0.318	0.517			0.432	0.421	0.502	0.736	0.258	0.417	0.705	0.988	0.297	0.35	0.483	0.409	0.204	0.234	0.289	0.204	0.34	0.346	0.317	0.391	0.297	0.211	1.746	1.981	0.187
MELDR-12	1.014	0.706			0.687	0.888	1.006		0.667	0.936	1.411		0.714	0.809	1.003	1.196	0.834	0.732	0.652	0.832	1.385	1.177	0.812	1.021	0.574	0.542	0.609	0.887	0.531

Site	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15	0.61	0.617	0.712	0.505	0.557	0.808	0.792	0.68	0.477	0.344	0.621	0.234	0.481	0.626	0.649	0.5	0.566	0.663	0.665	0.45	0.426	0.557	0.64	0.083	0.692	0.777	2.599	0.617
MELDR-05	0.879	0.803	1.316	0.822	0.916	1.475	1.05	0.47	0.651	0.371	0.81	0.403	1.858	1.006	1.196	1.05	0.804	0.768	1.363	1.11	1.093	1.064	1.201	0.127	0.893	0.944	1.325	0.877
MELDR-16	0.517	0.641	0.741	0.617	0.76	0.725	0.845	0.39	0.432	0.219		0.143	0.484	0.604	0.424		0.351	0.6	0.629	1.85	0.438	0.325	0.473	0.102	0.382	0.727	0.604	0.517
MELDR-02	0.836	0.831	0.878	0.836	0.854	0.864	0.86	0.8	0.794	0.656	0.828	0.666	0.785	0.814	0.801	0.8	0.726	0.779	0.804	1.31	0.684	0.718	0.746	0.329	0.78	0.774	0.803	0.8
MELDR-01	0.782	0.766	0.802	0.769	0.773	0.77	0.779	0.75	0.734	0.519	0.779	0.575	0.726	0.764	0.744	0.77	0.674	0.733	0.757	0.81	0.609	0.64	0.679	0.686	0.747	0.767	0.753	0.737
MELDR-13	0.623	0.619	0.635	0.597	0.429	0.627	0.695	0.46	0.511	0.587	0.619	0.555	0.587	0.606	0.6	0.59	0.598	0.601	0.606	0.6	0.509	0.582	0.546	0.324	0.604	0.615	0.619	0.6
MELDR-14	0.459	0.634	0.736	0.502	0.539	0.701	0.607	0.48	0.445	0.545	0.665	0.51	0.605	0.695	0.685	0.61	0.577	0.652	0.692	0.64	0.442	0.571	0.63	0.346	0.502	0.631	0.719	0.60745
MELDR-06	0.53	0.533	0.572	0.517	0.611	0.641	0.635	0.59	0.561	0.56	0.646	0.439	0.602	0.631	0.624	0.61	0.596	0.627	0.63	0.62	0.485	0.581	0.566	0.527	0.579	0.683	0.646	0.624
MELDR-07	1.874	1.75	1.811	3.06	2.989	3.134	2.767	2.45	2.336	1.919	1.671		1.619	1.662	1.454	1.55	1.132	1.063	1.108	1.58	1.048	1.145	1.102	3.076	2.63	2.626	2.764	2.104
MELDR-08	1.012	0.967	0.863	1.105	1.089	0.815	0.972	1.14	1.329	1.198	0.833	1.13	1.162	0.996	0.921	1.4	1.583	1.239	1.477	1.11	0.68	1.488	0.883	1.398	1.136	1.544	0.944	1.032
MELDR-09	0.788	0.672	0.935	0.706	0.727	0.852	0.749	0.86	0.909	0.825	0.997	0.758	0.492	0.676	0.641	0.64	0.401	0.464	0.75	0.81	0.454	0.711	0.714	0.095	0.661	0.711	0.757	0.7965
MELDR-10	0.213	0.318	0.499	0.132	0.164	0.494	0.256	0.09	0.15	0.173	0.425	0.132	0.16	0.326	0.305	0.2	0.295	0.503	0.524	0.19	0.23	0.24	0.356	0.131	0.171	0.268	0.488	0.24
MELDR-11	0.235	0.248	0.242	0.24	0.287	0.281	0.234	0.17	0.21	0.286	0.295	0.214	0.129	0.195	0.213	0.35	0.546	0.494	0.533	0.15	0.151	0.197	0.296	0.191	0.162	0.208	0.222	0.288
MELDR-12	0.652	0.643	0.974	0.921	1.09	1.399	1.27	0.75	0.874	0.721	0.88	0.721	0.571	0.737	0.749	0.59	0.488	0.502	0.655	0.78	0.575	0.635	0.7	0.791	0.919	0.872	0.963	0.785

SITES RECORDING EC LEVELS ALWAYS/GENERALLY OUTSIDE ACCEPTABLE RANGE
SITES RECORDING 40-60% of EC levels ABOVE ACCEPTABLE RANGE
SITES RECORDING EC levels ALWAYS/GENERALLY WITHIN ACCEPTABLE RANGE

Record BELOW acceptable range | Record WITHIN the acceptable range
Record ABOVE acceptable range | NO sample taken

Total Suspended Solids (mg/L) DoW interim guideline: 6 mg/L Max 184 Min <1 LOR 1 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15																														13	4	3	12	13	10	8	1	8	2	1	10	12	13	8	8	5	4	15	10	19	6	10	52	3	4	15	8
MELDR-05	11	2			6	10	12		7	4			8	7	12	6	8	10	11	<1	9	2	4	3	7	5	5	5	6	4	3	11	3	4	4	5	8	2	2	2	4	5	7	2	15	4	3	4	11	7	5	6	2	12	14	6	5
MELDR-16																														18	10	9	8	13	20	14	13	2	1	1	<1	12	58	2		3	2	8	21	13	2	14	7	7	11	12	9.5
MELDR-02	1	3	2	3	4	1	2	1	2	2	2	54	1	2	1	3	2	1	3	1	3	1	1	<1	3	2	3	1	3	3	2	1	2	1	1	1	<1	1	1	1	2	3	4	3	3	3	3	3	3	3	2	3	7	3	5	8	2
MELDR-01	4	3	29	4	7	1	5	12	6	2	2	7	8	3	4	2	2	<1	2	4	4	3	5	5	12	4	6	5	15	5	4	3	2	2	2	1	1	3	3	5	4	3	4	2	3	2	3	4	4	4	2	3	2	2	6	4	4
MELDR-13																											21	12	17	13	17	8	7	6	5	5	10	11	10	1	8	10	11	8	10	9	9	16	8	8	6	7	33	6	6	7	8.5
MELDR-14																											<1	3	2	2	1	<1	<1	<1	1	1	<1	1	2	4	1	<1	2	<1	1	2	2	2	2	2	<1	2	2	2	6	6	2
MELDR-06	51	56	4	44	35	27	24	14	13	8	11	8	14	9	13	10	12	13	15	9	14	13	8	6	17	10	16	7	18	11	11	2	17	5	4	4	5	6	7	5	3	3	6	5	6	5	7	5	4	3	2	6	2	6	2	7	8
MELDR-07	17	59			42	5	58		37	11			32	11	11	184		19	5	3			10	2		8	29	2	7	7	17	2	<1	1	8	7	15	4	7	1		7	6	2	9	3	<1	1	9	2	1	4	5	7	14	6	7
MELDR-08	7	27			23	5			2										<1	<1		1	1	3	3	<1	<1	1	<1	1	4	<1	<1	<1	2	3	<1	1	<1	1	2	3	9	7	4	2	<1	54	8	2	4	14	4	11	10	13	2
MELDR-09	3	1			9	<1	2	3	1	5	<1		2	<1	1	1	3	3	<1	<1	1	1	<1	<1	1	<1	2	1	<1	1	1	<1	1	2	1	1	<1	<1	<1	5	1	2	4	<1	<1	<1	<1	3	<1	<1	<1	3	14	37	10	9	1
MELDR-10	1	1			3	1	6	11	1	1	8		1	1	4	3	1	<1	<1	1	1	2	5	3	2	1	<1	<1	2	<1	<1	<1	2	1	2	1	<1	2	2	2	2	1	5	<1	4	6	5	4	1	2	1	4	4	3	4	31	2
MELDR-11	7	3			5	2	3	12	2	2	14	15	1	3	3	50	2	<1	2	1	1	3	1	2	3	2	1	3	1	3	2	1	2	3	4	2	<1	1	1	4	3	<1	4	1	2	3	<1	2	0.5	4	0.5	4	2	<2	5	5	2
MELDR-12	27	2			4	1	6		2	<1	9		1	<1	<1	3	<1	1	21	4	15	57	63	24	6	15	22	20	11	8	24	23	3	5	17	3	62	10	16	4	8	16	6	2	2	4	1	12	12	3	2	20	2	4	5	14	6

SITES RECORDING TSS CONCENTRATIONS ALWAYS/GENERALLY ABOVE GUIDELINE	
SITES RECORDING 40-60% of TSS concentrations ABOVE ACCEPTABLE RANGE	
SITES RECORDING TSS concentrations ALWAYS/GENERALLY WITHIN ACCEPTABLE RANGE	

Concentration ABOVE guideline	Concentration < LOR
Concentration BELOW guideline	NO sample taken

Temperature (°C) Min 8.7 Max 31.03

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15																														17.5	19.4	20.7	16.4	17.1	19.7	20.2	15.2	16	15.2	18.7	16.4	16.6	18.2	18.2	15.7	17.1	17.9	19.1	16.5	16.06	15.9	19.8	16.2	16.9	17.6	18.7	17.3
MELDR-05	12.95	19.18			16.65	20.07	22.61		17.18	24.8			15.81	15.77	19.23	19.1	14.3	16.57	17.52	20.32	12.08	14.35	17.81	18.7	16.6	18.61	18.8	21.5	18.4	17.4	19.6	20.2	14.3	15	21.2	20.9	12.4	14.8	14.6	17.6	15.9	19.1	18.1	18.7	15.4	17.5	18.1	19.5	15	15.83	15.7	19.9	14.8	14.6	15.5	18.6	17.52
MELDR-16																														17.9	19	20.4	18.8	19	20	20.1	18.4	17.8	16.1		17.7	18	19.2	18.5		16.1	18.3	20	19.3	19	17.8	19.4	16.8	18.8	19	19.3	18.8
MELDR-02	19.96	19.76	21.27	21.57	19.53	20.56	21.27	21.64	19.4	20.65	21.59		18.46	19.65	20.13	20.47	20.1	19.92	20.01	20.44	20.39	19.34	19.94	20.44	19.1	19.82	20.1	21.5	18.4	19.6	20.2	20.7	19.5	19.6	20.6	20.8	19.6	19.3	18.3	19.9	19.1	19.3	19.8	19.7	19.7	18.8	19.3	19.9	19	18.78	18.6	20.2	18.3	19.3	18.7	19.8	19.8
PSDTBCMD	15.69	18.29	21.81	19	17.04	18.3	19.07	18.82	17.25	20.6	19.6		16.88	16.05	17.62	17.96	16.5	17.22	18.13	19.28	15.03	16.04	16.77	17.8	17.6	18.79	19.9	21.2	17.9	17.6	19.1	18.6	16.1	15.7	19.3	19	15.2	16.2	15.6	17.3	17.7	17.4	17.6	17.4	15.8	17.6	17.7	18.7	16.2	16.11	15.9	18.8	17.1	16.2	16.8	17.9	17.6
MELDR-13																											19	19.5	17.3	18.6	20	20.9	17.4	17.9	21.7	22	17.1	17.7	17.3	19.5	18.4	18.6	18.7	19.1	17.3	15.9	18.5	19.9	17.7	17.5	17.3	20.2	17.7	17.7	18.6	19.5	18.55
MELDR-14																											19.9	21.3	17.2	17.3	19.5	19.8	14.5	15.1	20.4	20.8	13.4	14.2	14.9	18	15.6	16	18.1	17.1	14.1	18.6	16.2	18.8	14.9	14.39	14.9	19.7	14.8	14.3	17	17.8	17.05
MELDR-06	17.63	19.15	19.07	21.73	17.87	20.38	22.87	22.2	17.7	23.34	23.29		17.39	16.73	19.22	19.49	18.1	18.37	18.96	20.57	16.57	15.59	17.67	19.3	18.1	19.3	20	21	17.4	18.2	19.8	20.6	16.5	16.4	20.8	20.6	15	15.7	15.5	18.4	17.1	17.4	17.9	18	15.6	17.1	17.4	18.7	16.1	15.89	15.8	19.5	16.2	15.6	15.7	17.8	18
MELDR-07	16.54	21.04			18.03	28.58	29.34		16.83	25.94			18.15	16.48	22.42	25.12		16.26	19.34	20.99			15.9	18.63		19.14	19.6	22.1	16.4	19	23.6	24.7	13.3	15.5	21.6	22.5	10.5	13.1	15.1	21.9		18.7	22.5	17	11.3	13.4	15.8	19.3	13.9	13.78	15.5	20.4	13.9	14.3	16.6	20.4	18.39
MELDR-08	18.62	21.42			14.66	26.12			16.36										17.29	20.13		11.31	15.42	21.63	16.5	19.35	21.3	26.3	15.6	17.9	20.8	19.4	12.1	13.5	23.6	22.3	8.7	12.7	14.4	19.1	14.5	16	16.9	21.5	11.4	15.8	17.1	22.5	11.7	11.06	15.1	18.2	16.8	20.7	21.4	22	17.195
MELDR-09	12.14	20.25			15	22.29	25.98	20.21	16.8	25.07	24.03		14.49	15.25	19.59		12.8	14.7	16.9	20.37	9.25	11.66	16.04	19.54	14.7	18.25	20.7	25.5	16	16.6	18.2	20.5	12.8	13.7	23.2	22.1	11	12.7	14.5	17.2	14	14.2	15.5	15.6	11.2	13.2	14.5	15.9	11.8	11.39	13.4	19.3	15.2	12.7	15.7	18.4	15.65
MELDR-10	16.14	22.26			18.65	24.15	26.07	20.84	18.2	27.42	24.98		18	16.78	19.6	18.54	15	16.61	19.97	21.65	12.02	14.36	19.52	18.65	17.6	19.22	20.9	24	17.4	20.4	22.3	21.7	15.5	17.7	21.1	25.3	13.3	14.6	15.4	19.6	15.7	17	21	18.4	14	14.9	18.6	21.7	15	14.83	15.9	21.2	15.4	15.7	19.6	21.1	18.6
MELDR-11	15.07	21.32			17.46	23.35	27.06	22.39	17.5	27.41	28.81	31.03	17.39	18.06	22.35	23.45	15	16.21	19.34	19.9	12.41	14.29	19.11	21.22	17.8	19.03	19.5	26.4	17.3	18.6	21.7	23.1	15.6	17.4	26.3	26.3	13.5	14.5	15.8	22.2	15.7	17	19	19.3	14.1	15.1	17.6	21.1	15	15	15.9	22.4	15.1	15.3	18.2	20.1	18.4
MELDR-12	17.47	22.59			19.28	27.03	28.96		17.86	27.13	29.99		20.24	19.23	23.47	27.91	17.3	18.57	19.71	23.34	13.17	15.11	21.55	23.94	16.5	22.15	24.9	27.8	19.1	18	27.4	25.7	16.7	21	30	30.3	14.6	16	18	27.6	17.7	20.5	22.3	21.9	13	16	18.3	24.9	14.5	16	17	22.2	17.7	21	23.4	24.3	20.75

SITES RECORDING VALUES ALWAYS/GENERALLY ABOVE TV/OUTSIDE ACCEPTABLE RANGE	
SITES RECORDING 40-60% VALUES ABOVE TV/OUTSIDE ACCEPTABLE RANGE	
SITES RECORDING VALUES ALWAYS/GENERALLY BELOW TV/WITHIN ACCEPTABLE RANGE	

Concentration ABOVE trigger value/acceptable range	Concentration < LOR	Highest concentration of the year
Concentration BELOW trigger value/within acceptable range	NO sample taken	Lowest concentration of the year
Record BELOW acceptable range		

Table G-2: Total nitrogen (TN), total oxidised nitrogen (NOx-N), nitrogen as ammonia/ammonium (NH3/NH4+-N), total organic nitrogen (TON) and dissolved organic oxygen (DON) concentrations recorded in Melville Bull Creek catchment sites from 2007 to 2020

	Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
	MELDR-15																														0.77	0.75	0.67	1	0.82	1	1.1	1.1	0.76	0.48	0.69	0.58	0.96	0.86	0.8	0.98	0.96	0.93	0.74	1.1	0.99	0.68	1.3	0.41	1.1	0.91	1.1	0.91
Total Nitrogen (TN) (mg/L)	MELDR-05	0.89	1			1.5	1.9	2.4		1.3	1.1			1.4	1.3	2.1	2.5	0.45	1	1.4	1.4	1.5	0.27	1.3	1.4	0.87	0.94	0.83	1.1	0.91	1.1	0.88	1.4	1.3	1.3	1.6	1.6	0.91	0.87	0.32	0.82	0.79	1.2	0.9	0.92	1.5	1.1	0.94	0.85	1.6	1.1	0.91	1.3	0.39	1.4	2.2	1.8	1.1
	MELDR-16																														0.7	0.63	0.81	0.82	11	1.4	2.9	0.64	0.37	0.37			2	2.1	1.2		0.94	1.5	1.4	1.3	1	1.1	1.3	0.4	0.55	1.1	1	1.05
	MELDR-02	5.3	3.8	5.8	6.1	4.4	5.5	7.2	6.8	4.5	5.8	6.9	6.8	3.9	6	6.8	7.8	6.5	6	6.4	5.8	8.3	6.5	7.2	8.2	5.2	5	4.8	6.3	2.7	5.4	5.2	7	6.6	7	9.1	9.6	6.9	5.9	4.8	6.8	5.1	5.2	5.7	5.8	6.2	4	4.6	5.1	6.8	6.1	5	6.5	3.1	7.8	7.4	8.6	6.05
	MELDR-01	2.7	2.4	0.63	3.5	2.6	2.9	4	2.9	2.8	3.1	3.8	4.1	1.7	3	3.9	3.9	3	3	3.1	3	4.4	2.9	4	4.4	2.1	3	3.3	3.7	2.6	3.3	3.2	4.2	3.8	3.8	4.5	4.5	3.5	3.2	2	3.5	3	4.3	3.5	3.4	3.7	2.7	3	3.3	3.7	3.5	2.3	3.7	3.7	4.3	4.2	4.5	3.35
ANZECC trigger value for lowland rivers: 1.2 mg/L for wetlands: 1.5 mg/L	MELDR-13																											0.64	0.6	0.47	0.66	0.62	0.53	0.51	0.51	0.55	0.52	0.69	0.63	0.66	0.67	0.65	0.9	0.58	0.64	0.73	0.69	0.66	0.72	0.56	0.62	0.55	0.51	0.62	0.47	0.49	0.51	0.62
	MELDR-14																											0.75	0.69	0.71	0.96	0.73	0.59	0.49	0.49	0.59	0.59	0.68	0.63	0.62	0.55	0.58	1.2	0.73	0.64	0.77	0.98	0.67	0.64	0.76	0.73	0.58	0.51	0.38	0.38	0.48	0.59	0.635
	MELDR-06	1	0.87	3.3	0.63	0.77	0.7	0.56	0.61	0.95	0.62	0.58	0.54	0.75	0.6	0.6	0.64	0.74	0.81	0.85	0.58	0.57	0.43	0.53	0.51	0.64	0.79	0.65	0.6	0.51	0.62	0.63	0.53	0.6	0.53	0.59	0.49	0.78	0.63	0.66	0.64	0.55	0.89	0.62	0.61	0.68	0.8	0.69	0.65	0.61	0.69	0.56	0.53	0.42	0.46	0.51	0.53	0.62
	MELDR-07	1.1	10			6.3	11	11		3	7.6			2.7	6.1	16	20		2.5	6.4	10			0.52	0.45		0.55	2.8	3.3	0.76	1.6	2.2	3.5	0.37	0.31	3.5	3	1.2	0.5	0.44	3		7.9	5.2	3.5	3.6	4	3.9	2.9	4.6	4.8	3.4	3.4	6.8	11	10	10	3.5
	MELDR-08	1.1	1.7			2.3	0.62			0.78										0.61	0.65		0.62	0.76	0.62	1.6	1.4	0.79	0.71	1.2	0.95	1.3	0.78	0.73	0.58	0.66	0.65	0.76	0.85	1.1	0.83	0.82	1	0.92	1.2	1.4	2.2	3	3.9	1.9	0.95	1.4	1.6	0.57	0.56	1	1	0.935
	MELDR-09	0.81	0.81			0.61	0.79	1.3	1.2	0.71	0.74	0.85		0.49	0.54	0.6	0.95	1.1	0.73	0.85	0.75	0.4	0.4	0.48	0.5	0.4	0.62	1.2	1.4	1.3	1.2	1.3	1.5	0.77	0.89	0.98	1	0.67	0.68	1	1.2	0.72	1	1.3	1.4	0.63	1.1	1.2	2.4	0.74	0.75	0.76	0.89	0.73	0.6	0.71	0.8	0.8
	MELDR-10	0.67	0.31			0.37	0.46	1	1.3	0.32	0.55	1.1		0.33	0.29	0.65	0.77	0.38	0.28	0.46	0.34	0.32	0.41	0.32	0.52	0.3	0.25	0.29	0.44	0.67	0.34	0.32	0.56	0.24	0.33	0.63	0.49	0.31	0.27	0.28	0.48	0.37	0.22	0.88	0.26	0.52	0.35	0.6	0.39	0.54	0.41	0.25	0.46	0.33	0.44	0.69	3.3	0.39
Min 0.22	MELDR-11	0.8	0.56			0.45	0.49	0.66	1.2	0.53	0.52	1.3	1.9	1	0.6	0.63	1.2	0.55	0.44	0.61	0.39	0.4	0.42	0.34	0.46	0.65	0.38	0.31	0.44	0.43	0.43	0.42	0.44	0.32	0.35	0.73	0.72	0.35	0.26	0.32	0.47	0.45	0.26	0.51	0.47	0.34	0.84	0.32	0.44	0.28	0.41	0.38	0.49	0.48	0.49	0.67	0.85	0.465
Max 20	MELDR-12	2.6	2			1.3	1.4	1.7		1.4	1.2	2.4		1.3	1	1.2	1.7	0.78	0.22	1.2	3.3	3.9	7.1	3.7	3	1.5	2.3	2.6	3.2	2.2	2.1	2.4	5.4	3.9	3.5	2.4	3	0.86	0.63	2.2	2.6	2.7	2.5	3.5	2.1	1.6	1.6	1.8	2	2.3	1.6	1.7	5.9	2.7	2.4	2	1.9	2.15

	Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
	MELDR-15																														0.094	0.14	0.098	0.062	0.079	0.058	0.074	0.068	0.047	0.039	0.091	0.016	0.081	0.1	0.11	0.096	0.18	0.2	0.14	0.044	0.18	0.15	0.17	0.041	0.066	0.083	0.14	0.0925
Nitrogen as ammonia/ ammonium (NH_3-N/NH_4^+-N) (mg/L)	MELDR-05	0.014	0.24			0.53	0.73	0.049		0.2	0.076			0.15	0.44	0.1	1.3	0.01	0.086	0.052	0.044	0.45	0.044	0.31	0.43	0.15	0.19	0.14	0.25	0.27	0.45	0.28	0.13	0.51	0.52	0.32	0.1	0.4	0.22	0.048	0.16	0.063	0.33	0.23	0.22	0.62	0.27	0.32	0.29	0.62	0.42	0.2	0.43	0.059	0.51	0.08	0.31	0.24
	MELDR-16																														0.037	0.035	0.093	0.057	9.7	0.073	0.41	0.061	0.014	0.043		0.015	0.049	0.022	0.039		0.034	0.096	0.071	0.068	0.056	0.053	0.17	0.041	0.031	0.11	0.043	0.053
	MELDR-02	4.8	2.9	4.9	5.4	4	4.4	5.8	6.3	3.3	4.7	6.8	6.5	3.3	5.6	6.2	7	5.6	4.9	4.9	4.9	7.6	6	5.8	6.8	4	4	3.8	5.5	2	4.7	4.6	5.9	6.1	6.2	7.6	7.8	6.2	5.1	4	5.7	4.2	4.2	4.8	4.6	5.7	3.2	4	4.7	6.4	5.4	4.6	6.3	2.7	7.4	7.3	8.3	5.25
	MELDR-01	0.5	0.39	0.27	0.1	1.2	0.47	0.7	0.12	0.25	0.13	0.21	0.039	0.27	0.48	0.54	0.26	0.3	0.53	0.43	0.39	1.6	0.85	1.3	1.3	0.35	0.46	0.54	0.75	0.88	0.72	0.55	1	0.63	0.76	0.37	0.34	0.6	0.55	0.23	0.48	0.59	0.62	0.79	0.55	0.98	0.51	0.88	0.88	1.1	1.1	0.63	1	0.5	1.3	1.4	1.3	0.55
	MELDR-13																											0.12	0.15	0.075	0.16	0.14	0.19	0.16	0.16	0.14	0.15	0.16	0.15	0.13	0.16	0.14	0.14	0.12	0.14	0.16	0.14	0.13	0.14	0.15	0.14	0.13	0.12	0.081	0.12	0.11	0.1	0.14
ANZECC trigger value for lowland rivers: 0.08 mg/L for wetlands: 0.04 mg/L	MELDR-14																											0.023	0.045	0.047	0.066	0.066	0.098	0.05	0.05	0.047	0.041	0.059	0.035	0.019	0.043	0.055	0.062	0.061	0.044	0.092	0.082	0.056	0.074	0.09	0.066	0.059	0.052	0.047	0.035	0.099	0.052	0.0535
	MELDR-06	0.31	0.22	0.32	0.25	0.22	0.22	0.28	0.24	0.16	0.2	0.24	0.24	0.18	0.2	0.2	0.26	0.2	0.17	0.18	0.12	0.22	0.11	0.15	0.11	0.14	0.13	0.11	0.13	0.089	0.16	0.14	0.17	0.14	0.14	0.12	0.13	0.15	0.12	0.085	0.12	0.094	0.11	0.094	0.094	0.14	0.11	0.095	0.095	0.13	0.11	0.1	0.09	0.075	0.091	0.049	0.078	0.14
	MELDR-07	0.065	7.2			4.3	6.5	5		0.044	3.6			<0.01	3.4	12	14		<0.01	3.1	6.9			<0.01	0.022		<0.01	0.32	0.3	0.026	0.1	0.021	1.2	0.031	0.028	1.2	0.055	0.043	0.028	0.023	0.64		4.3	2.3	0.63	0.38	1.4	0.38	0.34	1.3	2.1	0.57	0.32	4.3	7.9	7	7	0.92
	MELDR-08	<0.01	0.038			0.014	0.023			0.013										<0.01	0.016		<0.01	<0.01	0.013	0.027	0.013	0.016	0.026	0.025	0.028	0.025	0.017	0.028	0.023	0.02	0.025	0.028	0.023	0.011	0.022	0.018	<0.01	0.013	0.033	0.037	0.051	0.045	0.078	0.03	0.025	0.031	0.024	0.018	0.018	0.022	0.022	0.023
	MELDR-09	0.017	0.015			0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	0.01	0.013	0.018	0.63	<0.01	0.076	0.046	<0.01	<0.01	<0.01	<0.01	<0.01	0.014	0.014	<0.01	<0.01	0.033	0.024	0.027	0.019	0.02	<0.01	<0.01	0.017	0.013	0.027	0.027	0.013	<0.01	0.012	0.019	0.005	0.013	0.012	0.04	<0.01	0.014	0.014	0.013	0.087	0.012	0.015	0.01	0.015
	MELDR-10	0.18	0.013			<0.01	<0.01	0.05	0.078	<0.01	0.017	0.36		0.041	0.013	0.21	0.26	0.05	<0.01	0.05	0.03	0.068	0.07	0.015	0.023	0.05	<0.01	<0.01	<0.01	0.034	0.033	0.017	0.059	0.031	0.021	0.018	0.035	0.055	0.04	<0.01	0.037	0.048	0.02	<0.01	0.015	0.2	0.051	0.12	0.015	0.17	0.05	0.016	0.024	0.071	0.02	0.026	0.011	0.0385
Min <0.01	MELDR-11	0.024	<0.01			<0.01	0.018	<0.01	0.017	<0.01	0.013	<0.01	0.011	0.54	0.15	0.026	<0.01	0.12	0.016	0.016	<0.01	0.015	<0.01	<0.01	<0.01	0.15	0.026	<0.01	<0.01	0.01	0.013	0.013	0.028	0.021	0.023	0.015	0.02	0.049	0.017	<0.01	0.01	0.005	0.005	<0.01	0.014	0.02	0.42	<0.01	0.014	<0.01	<0.01	0.012	0.011	0.017	<0.01	0.017	0.013	0.017
Max 14	MELDR-12	0.37	0.31			0.087	0.089	<0.01		0.18	0.021	0.023		0.051	0.056	0.031	0.043	0.56	<0.01	<0.01	1.4	1.6	1	0.021	0.026	0.85	0.083	<0.01	0.027	0.027	0.043	0.07	0.034	2.1	1.4	0.021	0.9	0.028	0.05	0.11	0.34	1.1	0.39	0.53	0.33	0.38	0.36	0.23	0.11	0.16	0.31	0.43	0.025	1.4	1.1	0.047	0.23	0.17

	Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
	MELDR-15																														0.071	0.1	0.1	0.22	0.14	0.17	0.15	0.37	0.21	0.14	0.13	0.12	0.13	0.11	0.12	0.15	0.28	0.36	0.15	1.1	0.99	0.68	1.3	0.078	0.33	0.22	0.19	0.150
Total Oxidised Nitrogen (NOx-N) (mg/L)	MELDR-05	<0.01	0.075			0.056	0.019	<0.01		0.063	0.029			0.21	0.023	0.025	<0.01	0.05	0.073	0.029	0.068	<0.01	0.051	0.031	<0.01	0.099	0.12	0.074	0.051	0.079	0.057	0.077	0.019	0.062	0.015	0.005	0.01	0.036	0.082	0.059	0.038	0.12	0.11	0.035	0.049	<0.01	0.33	0.2	0.052	1.6	1.1	0.91	1.3	0.036	0.024	<0.01	<0.01	0.057
	MELDR-16																														0.17	0.16	0.14	0.2	0.67	0.8	1.7	0.15	0.16	0.15		0.1	0.92	0.92	0.46		0.58	0.7	0.76	1.3	1	1.1	1.3	0.11	0.21	0.49	0.46	0.490
	MELDR-02	0.078	0.13	0.089	0.065	0.13	0.098	0.055	0.04	0.12	0.1	0.074	0.083	0.18	0.082	0.068	0.16	0.13	0.14	0.14	0.15	0.057	0.087	0.06	0.076	0.12	0.23	0.22	0.13	0.097	0.14	0.13	0.089	0.13	0.45	0.099	0.1	0.16	0.19	0.22	0.16	0.12	0.24	0.16	0.16	0.14	0.48	0.36	0.2	6.8	6.1	5	6.5	0.24	0.11	0.089	0.078	0.130
	MELDR-01	1.9	1.2	0.078	2.3	1.2	1.6	2.2	2	1.5	2.3	3.2	3.7	0.95	2.3	2.8	2.7	1.8	1.8	2.2	1.9	2.5	1.6	2.1	2.4	1.2	2.1	1.8	2.8	1.1	1.9	2.1	2.8	2.5	2.3	3.4	3.7	2.4	2.1	1.3	2.6	1.6	1.9	2.1	2.2	2.3	1.7	1.5	1.8	3.7	3.5	2.3	3.7	3.1	2.4	2.5	3.1	2.200
	MELDR-13																											0.2	0.19	0.12	0.22	0.19	0.16	0.13	0.11	0.089	0.11	0.3	0.32	0.34	0.26	0.19	0.29	0.2	0.23	0.24	0.32	0.4	0.32	0.56	0.62	0.55	0.51	0.1	0.15	0.19	0.15	0.210
ANZECC trigger value for lowland rivers: 0.15 mg/L for wetlands: 0.10 mg/L	MELDR-14																											0.23	0.077	0.23	0.43	0.21	0.06	0.12	0.071	0.038	0.029	0.31	0.25	0.24	0.066	0.12	0.4	0.16	0.11	0.26	0.56	0.25	0.1	0.76	0.73	0.58	0.51	0.041	0.039	0.15	0.055	0.185
	MELDR-06	0.32	0.35	2.1	0.068	0.24	0.08	0.051	0.086	0.31	0.12	0.062	0.049	0.22	0.15	0.11	0.093	0.2	0.25	0.23	0.14	0.19	0.15	0.12	0.11	0.23	0.35	0.23	0.16	0.14	0.21	0.18	0.14	0.15	0.13	0.078	0.097	0.34	0.26	0.31	0.21	0.16	0.34	0.2	0.2	0.23	0.41	0.34	0.26	0.61	0.69	0.56	0.53	0.055	0.11	0.036	0.12	0.195
	MELDR-07	<0.01	0.018			0.022	0.51	0.3		0.015	0.15			<0.01	0.01	0.11	0.19		<0.01	<0.01	0.26			<0.01	<0.01		<0.01	<0.01	0.014	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.082	<0.01	0.01	<0.01	0.015	<0.01		0.077	0.34	0.21	0.037	0.38	0.27	0.18	4.6	4.8	3.4	3.4	0.025	0.49	0.51	0.41	0.190
	MELDR-08	<0.01	<0.01			<0.01	<0.01			<0.01										<0.01	<0.01		<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.011	<0.01	0.016	<0.01	<0.01	<0.01	<0.01	0.018	0.035	0.031	1.9	0.95	1.4	1.6	<0.01	<0.01	0.011	<0.01	0.025
	MELDR-09	<0.01	0.011			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.014	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.012	<0.01	0.015	<0.01	<0.01	<0.01	<0.01	<0.01	0.018	0.02	0.74	0.75	0.76	0.89	0.19	<0.01	<0.01	0.015	0.018
	MELDR-10	0.036	0.011			<0.01	0.018	0.026	0.43	0.01	<0.01	<0.01		0.016	<0.01	<0.01	0.019	0.037	<0.01	0.011	<0.01	0.018	0.11	<0.01	<0.01	0.021	<0.01	0.021	<0.01	0.036	0.014	<0.01	0.15	0.017	<0.01	<0.01	<0.01	0.022	0.019	0.018	<0.01	0.037	<0.01	<0.01	<0.01	0.053	0.15	0.31	0.014	0.54	0.41	0.25	0.46	0.044	0.046	<0.01	0.015	0.026
Min <0.01	MELDR-11	<0.01	<0.01			0.01	<0.01	<0.01	0.14	0.011	0.01	0.013	0.01	0.16	0.086	0.017	<0.01	0.034	0.034	<0.01	<0.01	<0.01	0.014	<0.01	<0.01	0.071	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.056	0.019	0.013	<0.01	0.016	<0.01	<0.01	<0.01	<0.01	0.13	0.015	<0.01	0.28	0.41	0.38	0.49	0.02	0.005	<0.01	<0.01	0.020
Max 6.8	MELDR-12	<0.01	0.012			0.01	<0.01	<0.01		0.052	0.013	<0.01		<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.017	0.011	0.01	0.013	<0.01	<0.01	0.013	<0.01	<0.01	<0.01	<0.01	0.11	0.2	0.005	0.14	0.012	0.011	0.03	0.011	0.095	0.065	0.045	0.022	0.071	0.075	0.047	0.024	2.3	1.6	1.7	5.9	0.3	0.45	0.26	0.14	0.046

	Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
Total Organic Nitrogen (TON) (mg/L)	MELDR-15																														0.61	0.51	0.47	0.73	0.61	0.81	0.89	0.63	0.5	0.3	0.46	0.44	0.75	0.64	0.57	0.74	0.5	0.37	0.45	0.85	0.69	0.44	0.96	0.29	0.73	0.61	0.78	0.61
	MELDR-05																	0.39	0.86	1.4	1.3	1	0.18	0.96	1	0.62	0.62	0.61	0.77	0.56	0.59	0.52	1.3	0.74	0.8	1.3	1.5	0.47	0.58	0.22	0.62	0.6	0.8	0.64	0.65	0.88	0.54	0.42	0.51	0.93	0.73	0.67	0.81	0.3	0.85	2.1	1.5	0.7
	MELDR-16																														0.49	0.44	0.58	0.56	0.85	0.51	0.86	0.42	0.2	0.17		0.22	1	1.1	0.66		0.33	0.7	0.62	0.76	0.49	0.53	0.63	0.25	0.31	0.45	0.54	0.53
	MELDR-02																	0.83	0.88	1.3	0.77	0.62	0.41	1.4	1.3	1	0.81	0.79	0.63	0.64	0.46	0.47	0.96	0.47	0.29	1.4	1.7	0.51	0.58	0.56	0.94	0.82	0.76	0.68	1	0.37	0.37	0.29	0.12	0.22	0.65	0.27	0.12	0.13	0.29	<0.025	0.24	0.63
	PSDTBCMD																	0.98	0.76	0.48	0.77	0.35	0.48	0.6	0.79	0.6	0.53	1	0.15	0.65	0.66	0.6	0.33	0.61	0.72	0.75	0.38	0.56	0.58	0.47	0.44	0.8	1.8	0.63	0.63	0.4	0.56	0.63	0.67	0.9	0.47	0.38	0.39	0.062	0.57	0.3	0.23	0.59
	MELDR-13																											0.32	0.26	0.27	0.27	0.29	0.17	0.22	0.24	0.33	0.25	0.22	0.16	0.19	0.25	0.32	0.46	0.26	0.28	0.32	0.24	0.14	0.26	0.23	0.28	0.21	0.21	0.44	0.21	0.19	0.25	0.25
This parameter has no outlined Trigger Value	MELDR-14																											0.5	0.57	0.43	0.46	0.46	0.44	0.32	0.37	0.51	0.52	0.32	0.35	0.37	0.44	0.4	0.73	0.51	0.48	0.42	0.34	0.36	0.47	0.38	0.39	0.33	0.4	0.3	0.31	0.24	0.48	0.41
	MELDR-06																	0.34	0.39	0.44	0.32	0.16	0.17	0.26	0.29	0.27	0.31	0.31	0.32	0.28	0.24	0.31	0.21	0.31	0.27	0.39	0.27	0.29	0.25	0.27	0.31	0.3	0.43	0.32	0.32	0.31	0.28	0.26	0.29	0.28	0.36	0.25	0.3	0.29	0.25	0.43	0.33	0.295
Highest concentration of the year	MELDR-07																		2.5	3.3	3.2			0.51	0.42		0.55	2.5	3	0.73	1.4	2.2	2.4	0.33	0.28	2.3	2.9	1.1	0.47	0.4	2.3		3.5	2.6	2.7	3.2	2.3	3.3	2.4	3.2	2.4	2.4	2.7	2.5	2.4	2.5	2.8	2.4
	MELDR-08																			0.6	0.63		0.62	0.75	0.6	1.6	1.4	0.77	0.68	1.2	0.91	1.3	0.77	0.7	0.56	0.65	0.64	0.73	0.82	1.1	0.81	0.79	1	0.9	1.1	1.4	2.1	2.9	3.8	1.9	0.92	1.4	1.5	0.55	0.54	0.97	0.98	0.9
Lowest concentration of the year	MELDR-09																	0.42	0.72	0.77	0.7	0.39	0.39	0.47	0.48	0.4	0.61	1.1	1.4	1.3	1.1	1.3	1.4	0.75	0.87	0.97	1	0.65	0.66	1	1.2	0.69	1	1.3	1.4	0.62	1.1	1.2	2.4	0.73	0.71	0.74	0.86	0.45	0.59	0.7	0.77	0.76
	MELDR-10																	0.29	0.28	0.4	0.3	0.24	0.24	0.31	0.49	0.23	0.24	0.26	0.43	0.6	0.29	0.29	0.34	0.19	0.32	0.61	0.45	0.23	0.21	0.26	0.43	0.28	0.19	0.87	0.24	0.27	0.14	0.17	0.37	0.23	0.25	0.22	0.42	0.22	0.37	0.66	3.2	0.285
Min <0.025	MELDR-11																	0.4	0.39	0.59	0.39	0.38	0.41	0.33	0.45	0.43	0.35	0.31	0.43	0.42	0.41	0.4	0.41	0.29	0.33	0.72	0.7	0.24	0.23	0.31	0.46	0.43	0.25	0.5	0.45	0.32	0.29	0.3	0.42	0.26	0.4	0.36	0.47	0.45	0.49	0.65	0.84	0.405
Max 6	MELDR-12																	0.2	0.21	1.2	1.9	2.3	6	3.6	3	0.59	2.2	2.6	3.2	2.1	2.1	2.3	5.3	1.7	1.9	2.4	1.9	0.82	0.57	2.1	2.2	1.6	2	2.9	1.8	1.2	1.1	1.6	1.9	2.2	1.3	1.2	5.8	0.98	0.93	1.6	1.5	1.9

	Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
Dissolved Organic Nitrogen (DON) (mg/L)	MELDR-15																														0.4	0.39	0.46	0.59	0.6	0.65	0.79	0.62	0.41	0.28	0.39	0.32	0.56	0.46	0.45	0.61	0.38	0.3	0.34	0.6	0.54	0.37	0.51	0.23	0.59	0.57	0.6	0.46
	MELDR-05	<0.01	0.075			0.76	0.81	1.4		0.71	0.65			0.42	0.57	1.1	1	0.23	0.57	0.77	0.56	0.68	0.11	0.72	0.7	0.46	0.53	0.45	0.51	0.43	0.5	0.45	0.57	0.64	0.76	0.84	0.9	0.45	0.46	0.21	0.52	0.49	0.69	0.52	0.54	0.73	0.49	0.39	0.4	0.62	0.61	0.49	0.51	0.23	0.61	0.68	0.84	0.56
	MELDR-16																														0.37	0.43	0.48	0.41	0.75	0.35	0.6	0.3	0.15	0.16		0.18	0.69	0.77	0.59		0.28	0.62	0.53	0.35	0.39	0.33	0.46	0.2	0.25	0.27	0.37	0.37
	MELDR-02	0.078	0.13	0.089	0.065	0.25	1	1.1	0.3	1.1	0.93	0.44	0.23	<0.025	<0.025	<0.025	0.43	0.5	0.71	1.1	0.57	0.6	0.39	1.1	1.3	0.82	0.71	0.79	0.62	0.41	0.43	0.45	0.94	0.38	0.19	0.46	1.6	0.18	0.56	0.53	0.9	0.8	0.7	0.66	0.86	0.28	0.26	0.27	0.077	0.2	0.56	0.26	0.099	0.1	0.095	<0.025	<0.025	0.435
	MELDR-01	1.9	1.2	0.078	2.3	0.083	0.74	0.92	0.76	0.99	0.57	0.34	0.36	0.32	0.19	0.45	0.89	0.68	0.74	0.41	0.61	0.34	0.48	0.59	0.76	0.5	0.53	0.76	0.099	0.39	0.57	0.57	0.26	0.53	0.7	0.64	0.35	0.43	0.43	0.43	0.39	0.78	1.1	0.48	0.54	0.36	0.51	0.59	0.65	0.82	0.39	0.35	0.32	<0.025	0.27	0.17	0.1	0.505
	MELDR-13																											0.23	0.22	0.2	0.27	0.22	0.16	0.21	0.24	0.31	0.25	0.18	0.13	0.18	0.19	0.28	0.23	0.2	0.22	0.31	0.17	0.12	0.18	0.19	0.23	0.19	0.19	0.2	0.18	0.18	0.24	0.2
This parameter has no outlined Trigger Value	MELDR-14																											0.43	0.56	0.35	0.43	0.43	0.39	0.29	0.37	0.49	0.46	0.28	0.22	0.34	0.42	0.35	0.42	0.45	0.41	0.42	0.3	0.33	0.44	0.31	0.34	<0.025	0.33	0.25	0.28	0.2	0.44	0.36
	MELDR-06	0.32	0.35	2.1	0.068	0.3	0.28	0.15	0.18	0.45	0.26	0.2	0.24	0.24	0.22	0.22	0.28	0.29	0.32	0.4	0.28	0.16	0.17	0.23	0.26	0.21	0.28	0.23	0.28	0.19	0.24	0.25	0.18	0.24	0.24	0.37	0.26	0.2	0.18	0.26	0.28	0.28	0.3	0.27	0.28	0.3	0.23	0.2	0.24	0.23	0.29	0.25	0.23	0.26	0.22	0.37	0.26	0.255
Highest concentration of the year	MELDR-07	<0.01	0.018			0.92	3.5	5.3		0.64	3.3			1.5	2.7	3.5	1.2		1.1	3.1	2.9			0.32	0.29		0.28	1.7	2.8	0.58	1	1.4	2.2	0.3	0.24	1.6	2.6	0.64	0.27	0.28	2		2.4	2.5	2.5	2.4	2.2	2.4	2.4	2.8	2.2	2.3	2.5	2.5	1.7	2.3	2.8	2.2
	MELDR-08	<0.01	<0.01			0.64	0.5			0.69										0.6	0.6		0.54	0.72	0.57	1.5	1.2	0.76	0.63	1.1	0.88	1.3	0.69	0.65	0.56	0.48	0.55	0.73	0.82	0.99	0.77	0.78	1	0.9	1.1	1.2	2.1	2.8	2.4	1.1	0.84	1.3	0.85	0.48	0.38	0.85	0.8	0.775
Lowest concentration of the year	MELDR-09	<0.01	0.011			0.54	0.66	0.92	1.1	0.69	0.66	0.74		0.44	0.5	0.55	0.89	0.38	0.43	0.7	0.68	0.39	0.35	0.44	0.48	0.35	0.54	1.1	1.3	1.2	1.1	1.1	1.4	0.71	0.84	0.71	0.91	0.58	0.65	0.99	1.2	0.66	0.98	1.3	1.3	0.6	1	1.2	2.4	0.66	0.57	0.69	0.77	0.3	0.47	0.5	0.51	0.68
	MELDR-10	0.036	0.011			0.26	0.34	0.37	0.24	0.28	0.34	0.41		0.16	0.21	0.41	0.41	0.25	0.18	0.4	0.25	0.2	0.16	0.25	0.35	0.13	0.13	0.18	0.36	0.25	0.23	0.23	0.26	0.16	0.23	0.4	0.29	0.18	0.2	0.19	0.32	0.2	0.19	0.27	0.21	0.26	0.094	0.032	0.25	0.18	0.18	0.18	0.32	0.19	0.19	0.33	0.68	0.23
Min <0.01	MELDR-11	<0.01	<0.01			0.3	0.38	0.52	0.62	0.37	0.4	0.76	0.94	0.22	0.27	0.43	0.67	0.3	0.28	0.44	0.32	0.24	0.23	0.25	0.35	0.22	0.24	0.23	0.37	0.26	0.23	0.26	0.34	0.17	0.27	0.49	0.57	0.21	0.2	0.26	0.41	0.27	0.25	0.45	0.38	0.25	0.21	0.21	0.35	0.19	0.22	0.23	0.36	0.23	0.34	0.51	0.78	0.275
Max 5.3	MELDR-12	<0.01	0.012			1.1	1.2	1.2		1	1.1	1.4		0.82	0.89	1.1	1.4	0.18	0.13	0.92	1.9	1.2	0.69	0.75	2.1	0.35	1.4	1.9	1.9	1.6	1.6	1.6	1.5	1.4	1.5	1.6	1.9	0.29	0.29	1.6	2	1.5	1.5	1.8	1.7	1	1	1.4	1.6	0.89	0.97	1.1	1.3	0.87	0.71	1.5	1.3	1.25

SITES RECORDING CONCENTRATIONS ALWAYS/GENERALLY ABOVE ANZECC TRIGGER VALUE
SITES RECORDING 40-60% of concentrations ABOVE ACCEPTABLE RANGE
SITES RECORDING CONCENTRATIONS ALWAYS/GENERALLY BELOW ANZECC TRIGGER VALUE

Concentration ABOVE trigger value
Concentration BELOW trigger value

Concentration < LOR
NO sample taken

Table G-3: Total phosphorus (TP) and filterable reactive phosphorus (FRP) concentrations (mg/L) recorded in Melville Bull Creek catchment sites from 2007 to 2020.

Total Phosphorus (TP) (mg/L)

ANZECC trigger value for lowland rivers: 0.065 mg/L for wetlands: 0.06 mg/L

Min <0.005
Max 8.3

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10
MELDR-15																
MELDR-05	0.14	0.025			0.041	0.086	0.12		0.059	0.049			0.095	0.059	0.17	0.16
MELDR-16																
MELDR-02	0.01	0.009	0.008	0.014	0.01	0.01	0.008	0.014	0.015	0.013	0.013	0.072	0.028	0.01	0.011	0.017
MELDR-01	0.017	0.012	0.008	0.016	0.019	0.015	0.014	0.022	0.02	0.016	0.014	0.022	0.039	0.014	0.02	0.015
MELDR-13																
MELDR-14																
MELDR-06	0.013	0.008	0.027	0.016	0.012	0.023	0.008	0.013	0.013	0.01	0.01	0.012	0.03	0.012	0.016	0.021
MELDR-07	0.12	3.2			1.3	2.6	8.3		0.66	3.2			1	1.5	0.95	3.9
MELDR-08	0.077	0.11			0.15	0.024			0.021							
MELDR-09	0.02	0.018			0.014	0.014	0.017	0.02	0.012	0.012	0.013		0.012	0.015	0.02	0.028
MELDR-10	0.03	0.018			0.026	0.035	0.059	0.1	0.016	0.041	0.062		0.025	0.022	0.042	0.045
MELDR-11	0.036	0.032			0.03	0.039	0.042	0.077	0.033	0.038	0.11	0.16	0.042	0.034	0.049	0.089
MELDR-12	0.18	0.31			0.28	0.19	0.19		0.12	0.089	0.21		0.12	0.076	0.073	0.14

Site	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16
MELDR-15														0.048	0.044	0.014	0.047	0.041	0.025	0.027	0.015	0.028
MELDR-05	0.048	0.078	0.13	0.12	0.1	0.032	0.052	0.064	0.073	0.071	0.042	0.034	0.083	0.052	0.05	0.088	0.043	0.051	0.076	0.069	0.098	0.036
MELDR-16														0.059	0.043	0.037	0.042	0.051	0.063	0.12	0.057	0.02
MELDR-02	0.007	0.012	0.016	0.016	<0.005	<0.005	<0.005	<0.005	0.023	0.018	0.03	0.012	0.051	0.019	0.019	0.011	0.006	0.008	<0.005	0.006	0.006	0.007
MELDR-01	0.011	0.013	0.018	0.018	0.013	0.006	0.012	0.011	0.029	0.016	0.034	0.017	0.024	0.02	0.014	0.012	0.011	0.008	0.008	0.008	0.009	0.01
MELDR-13											0.016	0.005	0.026	0.011	0.013	<0.005	0.011	0.008	0.005	0.008	0.009	0.006
MELDR-14											0.009	0.017	0.013	0.014	0.012	0.011	0.014	0.012	0.016	0.02	0.011	0.012
MELDR-06	0.013	0.014	0.018	0.013	<0.005	0.012	0.008	0.006	0.014	0.011	0.01	0.007	0.019	0.008	0.011	<0.005	0.016	0.006	0.006	0.009	0.01	0.009
MELDR-07		0.81	1.2	2.9			0.45	0.081		0.21	0.91	1.5	0.33	1.1	0.77	2.3	0.02	0.025	0.73	0.64	0.22	0.12
MELDR-08			0.029	0.031		0.034	0.034	0.025	0.12	0.069	0.013	0.016	0.016	0.014	0.015	0.01	0.01	0.008	0.01	0.017	0.019	0.013
MELDR-09	0.025	0.03	0.025	0.017	<0.005	<0.005	<0.005	<0.005	0.005	0.007	0.013	0.016	0.007	0.013	0.021	0.017	0.009	0.013	0.009	0.012	0.008	<0.005
MELDR-10	0.024	0.025	0.024	0.025	0.031	0.028	0.023	0.039	0.027	0.022	0.017	0.025	0.054	0.024	0.023	0.02	0.022	0.023	0.031	0.031	0.025	0.025
MELDR-11	0.039	0.033	0.044	0.027	0.035	0.03	0.027	0.029	0.066	0.025	0.024	0.033	0.039	0.04	0.04	0.03	0.027	0.025	0.048	0.094	0.026	0.019
MELDR-12	0.008	0.017	0.26	1.1	0.15	0.65	0.73	0.54	0.036	0.36	0.67	0.55	0.59	0.72	0.51	0.85	0.44	0.58	0.3	0.7	0.14	0.077

Site	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15	0.015	0.035	0.046	0.075	0.067	0.045	0.065	0.054	0.042	0.046	0.094	0.056	0.04	0.052	0.037	0.018	0.012	0.041	0.042
MELDR-05	0.022	0.035	0.058	0.059	0.034	0.032	0.087	0.05	0.029	0.033	0.11	0.061	0.057	0.061	0.048	0.098	0.18	0.14	0.059
MELDR-16	0.016		0.029	0.069	0.21	0.087		0.015	0.047	0.074	0.086	0.029	0.036	0.06	0.036	0.03	0.075	0.09	0.051
MELDR-02	0.01	0.018	0.018	0.014	0.011	0.013	<0.005	0.013	0.018	0.011	0.015	<0.005	<0.005	<0.005	0.027	0.011	0.009	0.01	0.013
MELDR-01	0.012	0.009	0.015	0.012	0.015	0.013	0.005	0.008	0.018	0.011	0.011	0.005	0.012	<0.005	0.008	0.013	0.017	0.01	0.013
MELDR-13	0.007	0.008	0.013	0.01	0.009	0.012	<0.005	0.01	0.007	0.01	0.009	0.005	<0.005	<0.005	0.05	0.013	0.011	0.01	0.01
MELDR-14	0.01	0.009	0.019	0.012	0.015	0.012	0.006	0.009	0.014	0.016	0.014	0.008	0.006	<0.005	0.016	0.014	0.01	0.025	0.012
MELDR-06	0.011	0.01	0.014	0.012	0.011	0.013	<0.005	0.006	0.015	0.007	0.01	0.006	<0.005	<0.005	0.013	0.016	0.015	0.011	0.012
MELDR-07	0.11	1.2		1.6	3.6	4	3.1	3.8	4.5	5.5	4	4.9	3.7	5.4	0.2	0.53	0.7	0.78	1.15
MELDR-08	0.015	0.015	0.012	0.006	0.013	0.017	0.023	0.014	0.038	0.13	0.057	0.0025	0.018	0.032	0.018	0.017	0.033	0.037	0.018
MELDR-09	0.01	0.009	0.006	0.014	0.019	0.017	<0.005	0.01	0.018	0.018	0.016	0.012	0.013	<0.005	0.027	0.016	0.025	0.028	0.0145
MELDR-10	0.021	0.043	0.03	0.017	0.082	0.015	0.024	0.017	0.029	0.027	0.039	0.019	0.016	0.026	0.032	0.036	0.079	0.43	0.026
MELDR-11	0.021	0.054	0.05	0.041	0.074	0.048	0.028	0.053	0.027	0.034	0.041	0.037	0.054	0.057	0.047	0.056	0.084	0.099	0.039
MELDR-12	0.48	0.91	0.17	0.25	0.56	0.41	0.18	0.21	0.25	0.21	0.23	0.13	0.17	0.53	0.082	0.097	0.13	0.17	0.22

Filterable Reactive Phosphorus (FRP) (mg/L)

ANZECC trigger value for lowland rivers: 0.04 mg/L for wetlands: 0.03 mg/L

Min <0.005
Max 4.7

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10
MELDR-15																
MELDR-05	0.017	<0.005			<0.005	<0.005	<0.005		<0.005	<0.005			0.021	<0.005	<0.005	0.066
MELDR-16																
MELDR-02	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	<0.005	<0.005	0.008
MELDR-01	0.009	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	0.009	<0.005	0.009	<0.005	0.008	<0.005	<0.005	0.009
MELDR-13																
MELDR-14																
MELDR-06	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	0.009
MELDR-07	0.015	0.048			0.13	1	1.2		<0.005	0.67			0.056	0.46	0.21	0.083
MELDR-08	0.008	<0.005			<0.005	<0.005			<0.005							
MELDR-09	0.007	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	0.006	<0.005	0.01
MELDR-10	0.01	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	0.005
MELDR-11	0.007	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	<0.005	0.01
MELDR-12	0.008	0.16			0.18	0.078	0.048		0.064	0.021	0.022		0.042	0.033	0.018	0.081

Site	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16
MELDR-15														0.011	0.016	0.012	0.011	0.013	<0.005	0.006	0.011	0.006
MELDR-05	0.006	0.015	<0.005	0.01	0.081	0.01	<0.005	<0.005	0.026	0.03	<0.005	<0.005	0.032	0.005	0.016	<0.005	0.019	0.009	<0.005	0.005	0.061	0.015
MELDR-16														0.018	0.018	0.008	0.008	0.013	0.014	0.019	0.01	<0.005
MELDR-02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.007	0.014	<0.005	0.019	<0.005	0.006	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MELDR-01	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.006	<0.005	<0.005	<0.005	0.006	0.01	<0.005
MELDR-13											<0.005	<0.005	<0.005	<0.005	<0.005	<0.007	<0.005	<0.005	<0.005	0.007	0.006	<0.005
MELDR-14											<0.005	<0.005	<0.005	<0.005	<0.005	<0.008	0.005	<0.005	<0.005	0.008	0.006	<0.005
MELDR-06	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.009	0.005	<0.005	<0.005	0.008	0.007	<0.005
MELDR-07		0.059	0.27	1.6			0.043	0.022		0.011	0.37	1.1	0.13	0.87	0.23	1.7	0.008	0.009	0.53	0.3	0.018	0.006
MELDR-08			<0.005	0.01		0.007	0.008	<0.005	0.047	0.015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.007	<0.005
MELDR-09	<0.005	<0.005	<0.005	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MELDR-10	<0.005	<0.005	<0.005	0.014	0.008	0.006	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005
MELDR-11	0.009	0.005	<0.005	0.016	<0.005	<0.005	<0.005	<0.005	0.024	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	0.039	0.005	<0.005
MELDR-12	<0.005	<0.005	0.077	0.73	<0.005	<0.005	<0.005	0.09	<0.005	0.073	0.3	0.12	0.22	0.45	0.17	0.23	0.32	0.4	0.025	0.56	0.006	<0.005

Site	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15	<0.005	0.011	0.014	0.028	0.009	0.016	0.034	0.025	0.011	0.013	0.03	0.022	0.021	0.0025	0.011	<0.005	<0.005	<0.005	0.011
MELDR-05	0.006	<0.005	0.016	0.03	0.007	0.008	0.033	0.023	0.007	<0.005	0.047	0.031	0.009	0.0025	0.013	0.06	0.011	0.018	0.009
MELDR-16	<0.005		0.011	0.015	0.061	0.048		<0.005	0.017	0.038	0.006	0.005	0.013	0.01	0.014	0.008	0.02	0.019	0.013
MELDR-02	<0.005	0.005	0.01	0.007	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	<0.005	<0.005	<0.005
MELDR-01	<0.005	<0.005	0.007	0.007	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MELDR-13	<0.005	0.005	0.009	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005
MELDR-14	<0.005	<0.005	0.008	0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MELDR-06	<0.005	0.006	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005
MELDR-07	0.005	0.61		1.1	2.4	3.3	2.1	3.1	3.7	4.7	2.9	4.1	3.4	4.6	0.059	0.25	0.4	0.57	0.385
MELDR-08	<0.005	0.006	<0.005	0.006	<0.005	0.007	<0.005	<0.005	<0.005	0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	<0.005
MELDR-09	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
MELDR-10	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	0.01	<0.005	<0.005
MELDR-11	<0.005	0.015	0.008	0.016	0.02	0.011	0.008	0.01	<0.005	<0.005	0.008	<0.005	0.007	<0.005	0.009	0.012	0.02	0.023	<0.005
MELDR-12	0.16	0.62	0.1	0.15	0.43	0.31	0.081	0.13	0.15	0.089	0.03	0.074	0.11	0.056	0.043	0.053	0.057	0.083	0.0795

SITES RECORDING CONCENTRATIONS ALWAYS/GENERALLY ABOVE ANZECC TRIGGER VALUE
SITES RECORDING 40-60% of concentrations ABOVE ACCEPTABLE RANGE
SITES RECORDING CONCENTRATIONS ALWAYS/GENERALLY BELOW ANZECC TRIGGER VALUE

Concentration ABOVE trigger value
Concentration BELOW trigger value

Concentration < LOR
NO sample taken

Table G-4: Hardness, total and soluble aluminium (Al), and total and soluble chromium (Cr) concentrations (mg/L) recorded in Melville Bull Creek catchment sites from 2007 to 2020.

	Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
(mg/L)	MELDR-15																												
	MELDR-05	20	180			220	270	290		140	200			63	74	240	170	7	98	210	100	120	22	220	190	100	130	150	200
	MELDR-16																												
NO sample taken	MELDR-02	120	130	130	130	130	1,100	120	130	120	120	120	140	92	130	130	75	120	120	140	120	120	100	130	120	110	130	130	150
Soft 0-59 mg/L	MELDR-01	130	120	160	130	120	140	110	110	120	120	120	130	75	120	120	110	120	710	130	120	110	95	130	120	78	130	130	140
Moderate 60-119	MELDR-13																											130	160
Hard 120-179	MELDR-14																											130	160
Very Hard 180-240	MELDR-06	170	160	110	200	150	190	150	150	130	140	140	160	87	130	130	140	130	140	130	130	170	100	150	150	130	150	140	160
Extremely Hard > 240	MELDR-07	1,000	600			580	180	660		620	700			910	850	1,100	970		1,100	870	760			1,400	1,500		770	530	620
	MELDR-08	170	110			80	82			110										220	150		150	170	150	230	200	140	140
	MELDR-09	190	130			120	200	220	270	130	180	260		130	140	160	1,300	220	180	170	150	150	140	150	170	150	130	150	180
	MELDR-10	70	69			80	120	120	150	76	70	130		56	71	130	160	29	29	51	53	41	20	38	99	32	24	67	130
Min 7	MELDR-11	120	160			130	170	93	120	75	83	98	180	130	150	170	110	91	100	120	84	110	110	110	140	100	86	110	98
Max 1,500	MELDR-12	230	98			100	160	130		92	110	210		98	110	120	140	210	140	100	110	280	210	110	130	150	73	75	120

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15		110	130	140	100	100	150	150	130	98	65	99	25	89	110	120	100	110	120	120	86	99	110	110	15	150	150	150	110
MELDR-05	100	180	200	220	180	200	220	250	93	140	46	140	67	180	200	190	260	170	160	170	210	180	180	200	23	200	220	230	180
MELDR-16		76	110	120	110	130	130	150	68	69	33		24	85	110	82		62	120	120	190	89	61	84	18	63	85	100	85
MELDR-02	94	130	180	150	120	130	110	130	120	130	100	110	100	130	120	130	130	130	140	140	120	130	130	120	50	110	120	110	125
MELDR-01	99	130	170	140	120	130	110	130	130	120	91	110	96	130	120	120	130	120	130	140	140	130	140	120	110	120	120	110	120
MELDR-13	49	140	180	150	120	130	140	140	130	140	130	120	110	130	130	140	130	130	130	140	120	130	130	120	69	120	120	130	130
MELDR-14	100	140	170	150	93	100	130	130	94	100	110	110	94	130	130	140	120	130	130	140	130	110	120	110	62	92	130	130	130
MELDR-06	65	140	180	150	120	130	140	140	130	130	120	120	91	140	130	140	130	130	140	140	130	130	130	120	100	120	120	130	130
MELDR-07	640	620	650	530	880	900	130	850	890	800	650	410		440	410	360	350	240	220	230	310	270	230	220	860	700	650	650	650
MELDR-08	150	140	180	130	140	140	100	130	270	220	200	140	190	160	140	120	180	220	320	260	150	140	190	130	230	250	240	200	150
MELDR-09	110	100	120	140	110	120	130	130	150	140	110	130	130	71	97	99	110	67	80	130	140	110	140	150	24	120	130	140	140
MELDR-10	35	71	110	140	36	39	85	64	20	32	37	71	31	37	83	76	51	78	140	140	52	80	75	95	31	46	69	99	70
MELDR-11	74	90	130	76	82	91	50	55	58	77	110	66	61	40	67	79	110	160	170	160	44	66	75	100	55	53	68	72	95.5
MELDR-12	73	78	110	120	94	110	810	150	180	130	95	91	83	62	77	88	69	56	65	89	96	87	80	89	130	130	120	120	110

Total Al (mg/L) ANZECC trigger value: 0.055 mg/L when pH is >6.5 (or low reliability trigger value 0.0008 mg/L if pH<6.5) Max 3.9 Min 0.01 LOR 0.005 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05	0.065	0.24			0.18	0.13	0.084		0.22	0.095			0.19	0.14	0.12	0.14	0.14	0.31	0.38	0.21	0.16	0.16	0.15	0.1	0.23	0.23	0.18	0.16
MELDR-16																												
MELDR-02	0.31	0.39	0.32	0.31	0.32	0.9	0.3	0.3	0.34	0.31	0.36	2.1	0.3	0.31	0.37	0.35	0.36	0.36	0.34	0.39	0.37	0.31	0.28	0.3	0.31	0.36	0.26	0.3
MELDR-01	0.21	0.3	3.2	0.16	0.29	0.17	0.2	0.22	0.29	0.17	0.19	0.21	0.3	0.19	0.23	0.17	0.2	0.19	0.23	0.22	0.22	0.22	0.24	0.21	0.33	0.25	0.24	0.24
MELDR-13																											1.1	0.76
MELDR-14																											0.13	0.22
MELDR-06	3.6	3.2	0.3	2.6	2.2	1.5	1.4	1.3	1.2	1.1	0.97	0.87	0.58	0.76	0.85	0.73	0.66	0.89	0.96	0.71	0.77	0.64	0.6	0.54	0.94	0.77	0.9	0.69
MELDR-07	3.9	0.058			0.05	0.066	0.16		0.072	0.05			0.022	0.03	0.028	0.21		0.17	0.029	0.037			0.55	0.24		0.37	0.033	0.039
MELDR-08	0.3	0.29			0.3	0.13			0.25										0.37	0.24		0.2	0.2	0.14	0.35	0.35	0.29	0.25
MELDR-09	0.058	0.17			0.28	0.052	0.1	0.11	0.27	0.086	0.043		0.054	0.05	0.052	0.037	0.72	0.2	0.19	0.18	0.05	0.049	0.11	0.041	0.083	0.37	0.46	0.4
MELDR-10	0.079	0.065			0.053	0.029	0.031	0.056	0.055	0.051	0.053		0.048	0.06	0.097	0.072	0.084	0.035	0.041	0.044	0.039	0.17	0.079	0.053	0.049	0.032	0.035	0.032
MELDR-11	0.067	0.032			0.041	0.035	0.053	0.16	0.056	0.044	0.11	0.089	0.038	0.04	0.052	0.36	0.04	0.044	0.051	0.041	0.018	0.043	0.04	0.049	0.034	0.034	0.022	0.12
MELDR-12	0.22	0.062			0.058	0.039	0.036		0.059	0.035	0.2		0.052	0.06	0.062	0.16	1.8	0.61	0.074	0.11	0.32	0.18	0.052	0.038	0.12	0.072	0.097	0.083

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15		0.047	0.31	0.21	0.53	0.48	0.23	0.6	0.42	0.19	0.22	0.21	0.18				0.3				0.43				0.29				0.3
MELDR-05	0.21	0.2	0.22	0.14	0.22				0.16				0.25				0.18				0.28				0.084				0.2
MELDR-16		0.11	0.75	0.34	0.94	0.33	0.14	0.49	0.51	0.14	0.27		0.053					0.42			1				0.17				0.3
MELDR-02	0.15	0.29	0.34	0.27	0.3				0.29				0.32				0.31				0.35				0.31				0.3
MELDR-01	0.26	0.26	0.24	0.21	0.22				0.2				0.23				0.24				0.25				0.16				0.2
MELDR-13	0.43	0.83	0.79	0.48	0.48				0.54				0.55				0.57				0.29				0.73				0.6
MELDR-14	0.13	0.18	0.13	0.08	0.12				0.11				0.11				0.15				0.2				0.095				0.1
MELDR-06	0.49	0.77	0.62	0.42	0.71				0.42				0.33				0.44				0.26				0.17				0.8
MELDR-07	0.14	0.064	0.041	0.07	0.67				1					0.067			0.064				0.072				0.36				0.1
MELDR-08	0.37	0.37	0.57	0.3	0.37				0.29				0.33				0.57				0.38				0.13				0.3
MELDR-09	0.87	0.51	0.6	0.35	0.38				0.39				0.31				0.24				0.2				0.75				0.2
MELDR-10	0.045	0.036	0.03	0.018	0.03				0.03				0.029				0.04				0.035				0.15				0.0
MELDR-11	0.01	0.019	0.028	0.026	0.03				0.03				0.057				0.027				0.046				0.12				0.0
MELDR-12	0.054	0.12	0.16	0.15	0.12				0.9				0.096				0.081				0.069				0.047				0.1

SITES RECORDING >60% CONCENTRATIONS ABOVE TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE TRIGGER VALUE
Concentration ABOVE trigger value & pH > 6.5
Concentration ABOVE trigger value & pH <6.5
Concentration BELOW trigger value & pH < 6.5 (i.e. potential risk)
Concentration BELOW trigger value and pH > 6.5
NO sample taken
NO pH reading

Soluble Al (mg/L) ANZECC trigger value: 0.055 mg/L when pH >6.5 (or low reliability trigger value 0.0008 mg/L if pH<6.5) Max 1.8 Min <0.005 LOR 0.005 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05																	0.037	0.14	0.16	0.12	0.11	0.057	0.13		0.073	0.15	0.18	0.09
MELDR-16																												
MELDR-02																												
MELDR-01									0.16	0.87	0.085	0.071	0.098	0.13	0.12	0.11	0.15	0.16	0.15	0.15	0.13	0.14	0.13	0.12	0.09	0.16	0.15	0.12
MELDR-13																											0.12	0.093
MELDR-14																											0.094	0.079
MELDR-06									0.091	0.083	0.22	0.16	0.098	0.2	0.19	0.15	0.13	0.16	0.17	0.093	0.071	0.084	0.096	0.12	0.09	0.086	0.084	0.087
MELDR-07																		0.15	0.016	0.023			0.56	0.23		0.37	0.022	0.039
MELDR-08																												
MELDR-09																												
MELDR-10																	0.033	0.018	0.026	0.026	0.021	0.042	0.057	0.022	0.014	0.012	0.017	0.014
MELDR-11																	0.013	0.018	0.012	0.022	<0.005	0.0067	0.014	0.016	0.005	0.006	0.009	0.044
MELDR-12																	1.8	0.62	0.044	0.077	0.31	0.16	0.023	0.019	0.1	0.041	0.082	0.057

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15													0.077	0.24	0.15	0.19	0.22	0.23	0.23	0.19	0.3	0.24	0.22	0.18	0.041	0.31	0.31	0.25	0.225
MELDR-05	0.15	0.14	0.2	0.096	0.18	0.13	0.073	0.067	0.12	0.13	0.06	0.11	0.13	0.18	0.13	0.15	0.13	0.23	0.18	0.14	0.19	0.19	0.16	0.12	0.029	0.12	0.1	0.099	0.13
MELDR-16													0.03	0.54	0.34	0.36		0.3	0.42	0.5	0.49	0.47	0.25	0.21	0.035	0.14	0.08	0.11	0.3
MELDR-02					0.3	0.23	0.25	0.22	0.24	0.24	0.25	0.21	0.23	0.29	0.25	0.3	0.25	0.34	0.29	0.27	0.26	0.28	0.24	0.22	0.097	0.25	0.24	0.22	0.25
MELDR-01	0.13	0.14	0.17	0.12	0.15	0.12	0.11	0.087	0.14	0.15	0.18	0.12	0.15	0.23	0.17	0.17	0.16	0.23	0.19	0.15	0.17	0.19	0.15	0.12	0.096	0.13	0.13	0.12	0.14
MELDR-13	0.057	0.1	0.12	0.097	0.14	0.11	0.31	0.081	0.12	0.11	0.14	0.19	0.12	0.17	0.11	0.29	0.14	0.18	0.15	0.13	0.13	0.14	0.22	0.08	0.054	0.098	0.1	0.076	0.12
MELDR-14	0.095	0.09	0.099	0.054	0.082	0.061	0.068	0.039	0.059	0.065	0.078	0.059	0.068	0.13	0.09	0.1	0.087	0.13	0.095	0.08	0.11	0.099	0.17	0.062	0.037	0.055	0.085	0.042	0.081
MELDR-06	0.056	0.097	0.11	0.088	0.15	0.095	0.26	0.066	0.1	0.089	0.11	0.077	0.078	0.15	0.093	0.23	0.11	0.15	0.13	0.085	0.11	0.1	0.083	0.058	0.052	0.058	0.056	0.057	0.0955
MELDR-07	0.14	0.056	0.032	0.082	0.61	0.4	0.067	0.011	0.89	0.78	0.32	0.047		0.053	0.058	0.084	0.03	0.091	0.14	0.15	0.042	0.078	0.082	0.081	0.012	0.029	0.034	0.042	0.078
MELDR-08					0.36	0.24	0.16	0.16	0.24	0.36	0.46	0.29	0.31	0.45	0.41	0.32	0.49	1	0.79	0.8	0.31	0.25	0.4	0.2	0.26	0.22	0.14	0.19	0.31
MELDR-09					0.38	0.28	0.11	0.12	0.32	0.35	0.99	0.38	0.25	1	0.67	0.64	0.21	0.77	0.5	0.7	0.17	0.14	0.15	0.12	0.11	0.09	0.079	0.054	0.265
MELDR-10	0.045	0.022	0.022	0.011	0.019	0.019	0.054	0.029	0.013	0.021	0.029	0.016	0.015	0.021	0.023	0.017	0.019	0.037	0.013	0.01	0.019	0.017	0.017	0.019	0.021	0.023	0.12	0.028	0.021
MELDR-11	0.01	0.01	0.011	0.02	0.011	0.013	0.05	0.062	0.012	0.018	0.026	0.043	0.039	0.049	0.11	0.072	0.013	0.008	0.011	0.008	0.024	0.013	0.031	0.013	0.044	0.11	0.13	0.19	0.016
MELDR-12	0.054	0.11	0.11	0.089	0.072	0.065	0.006	0.05	0.86	0.15	0.12	0.14	0.071	0.13	0.19	0.22	0.072	0.1	0.17	0.17	0.048	0.064	0.091	0.096	0.023	0.035	0.04	0.048	0.0855

SITES RECORDING Al CONC. ALWAYS/GENERALLY ABOVE TRIGGER VALUE
SITES RECORDING Al CONC. ALWAYS/GENERALLY BELOW TRIGGER VALUE
Concentration ABOVE trigger value & pH > 6.5
Concentration ABOVE trigger value & pH < 6.5
Concentration BELOW trigger value & pH < 6.5 (i.e. potential risk)
Concentration BELOW trigger value and pH > 6.5
NO pH reading
NO sample taken

Total Chromium (Cr) (mg/L)
ANZECC unmodified TV Cr III for 95% protection 0.0033 mg/L; NHMRC guideline value for recreational use: 0.05 mg/L Max 0.0077 Min 0.0001 LOR 0.0001 mg/L to 0.001 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05	<0.001	0.002			0.002	0.002	0.0018		0.002	0.001			<0.001	0.002	0.002	<0.001	<0.001	0.001	0.0022	0.001	<0.001	<0.001	0.0014	0.0014	0.002	0.001	0.001	0.001
MELDR-16																												
MELDR-02	<0.001	0.001	<0.001	<0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.001	0.002	<0.001	0.001	0.001	<0.001	<0.001	<0.001	0.0014	0.001	<0.001	0.0016	0.0011	0.0012	<0.001	0.001	0.001	0.001
MELDR-01	<0.001	0.001	0.004	<0.001	0.001	0.001	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001	0.0014	0.001	<0.001	0.0013	0.0013	0.0013	0.002	0.001	0.001	0.001
MELDR-13																											0.004	0.002
MELDR-14																											0.001	0.002
MELDR-06	0.006	0.005	<0.001	0.003	0.004	0.003	0.003	0.003	0.003	0.002	0.002	0.002	<0.001	0.002	0.003	0.001	<0.001	0.002	0.0028	0.002	0.0015	0.0027	0.002	0.002	0.003	0.002	0.003	0.002
MELDR-07	0.001	0.001			<0.001	0.001	0.002		<0.001	<0.001			<0.001	<0.001	<0.001	0.002		<0.001	<0.001	<0.001			<0.001	<0.001		<0.001	0.001	0.002
MELDR-08	<0.001	0.002			0.002	0.001			<0.001										<0.001	<0.001		0.0011	<0.001	<0.001	0.001	0.002	0.001	0.001
MELDR-09	<0.001	<0.001			0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.0011	<0.001	<0.001	<0.001	0.001	0.002	0.002
MELDR-10	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-11	<0.001	0.002			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-12	0.001	0.003			0.002	0.002	0.001		0.002	<0.001	0.001		0.002	0.002	0.002	<0.001	<0.001	<0.001	0.0019	0.004	<0.001	0.0011	<0.001	<0.001	<0.001	0.004	0.006	0.005

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20
MELDR-15		<0.001	0.002	0.002	0.003	0.002	0.002	0.003	0.002	0.001	<0.001	0.002	0.0004				0.0023				0.0027				0.0011			
MELDR-05	<0.001	0.002	0.001	0.002	0.002				0.001				0.0008				0.0023				0.0026				0.0006			
MELDR-16		<0.001	0.001	0.001	0.003	0.001	<0.001	0.002	0.001	<0.001	<0.001		0.0003					0.001			0.0028				0.0008			
MELDR-02	<0.001	0.002	0.001	0.002	0.002				0.001				0.0009				0.0015				0.0017				0.0014			
MELDR-01	0.001	<0.001	0.001	0.001	0.002				<0.001				0.0008				0.0015				0.0016				0.0014			
MELDR-13	0.003	0.003	0.003	0.002	0.002				0.002				0.0016				0.0021				0.0024				0.0077			
MELDR-14	0.001	0.002	0.001	0.001	0.001				<0.001				0.0008				0.0014				0.0017				0.001			
MELDR-06	0.003	0.003	0.002	0.002	0.003				0.002				0.0011				0.0018				0.0021				0.0016			
MELDR-07	<0.001	<0.001	0.001	0.002	0.002				0.002					0.0006			0.0012				0.0015				0.0012			
MELDR-08	0.001	0.002	0.002	0.002	0.002				<0.001				0.0009				0.0026				0.0022				0.0005			
MELDR-09	0.003	0.004	0.003	0.003	0.003				0.001				0.0016				0.0021				0.0019				0.004			
MELDR-10	0.001	0.001	<0.001	<0.001	<0.001				<0.001				0.0001				0.0002				0.0002				0.0007			
MELDR-11	<0.001	0.001	<0.001	<0.001	<0.001				<0.001				0.0001				0.0002				0.0002				0.0005			
MELDR-12	0.003	0.004	0.004	0.004	0.003				0.001				0.0019				0.0024				0.0021				0.0012			

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Concentration < LOR
NO sample taken

Soluble Chromium (Cr) (mg/L)
ANZECC unmodified TV Cr III for 95% protection 0.0033 mg/L; NHMRC guideline value for recreational use: 0.05 mg/L Max 0.007 Min <0.0001 LOR 0.0001 - 0.001 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05																	<0.001	<0.001	0.0014	0.001	<0.001	<0.001	0.0012	0.0011	<0.001	0.001	0.001	0.001
MELDR-16																												
MELDR-02																												
MELDR-01									<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.001	<0.001	0.0013	<0.001	<0.001	<0.001	0.001	0.001	0.001
MELDR-13																											0.001	0.001
MELDR-14																											0.001	0.001
MELDR-06									<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.0011	<0.001	<0.001	0.001	0.001	0.001	0.001
MELDR-07																		<0.001	<0.001	<0.001			<0.001	<0.001		<0.001	<0.001	0.001
MELDR-08																												
MELDR-09																												
MELDR-10																	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-11																	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-12																	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.004	0.004

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15													0.0004	0.0013	0.0007	0.0013	0.002	0.0015	0.0014	0.0016	0.0026	0.002	0.0021	0.0023	0.0003	0.002	0.0022	0.0021	0.0018
MELDR-05	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	0.0007	0.0013	0.0004	0.0017	0.0019	0.0016	0.0014	0.0016	0.0023	0.002	0.0022	0.0024	0.0003	0.0014	0.0017	0.0015	0.001
MELDR-16													0.0003	0.001	0.0038	0.0012		0.0009	0.0012	0.0014	0.0016	0.0014	0.0011	0.0016	0.0003	0.0006	0.0006	0.0009	0.0011
MELDR-02					0.001	0.001	<0.001	0.007	<0.001	0.001	<0.001	<0.001	0.0009	0.0009	0.0003	0.001	0.0014	0.0013	0.0012	0.0014	0.0015	0.0014	0.0029	0.0017	0.0006	0.0011	0.0012	0.0011	0.00105
MELDR-01	0.001	<0.001	<0.001	0.001	0.0015	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.0008	0.001	0.0006	0.0011	0.0012	0.0012	0.0012	0.0013	0.0014	0.0013	0.0016	0.0016	0.0009	0.001	0.0011	0.001	<0.001
MELDR-13	0.001	<0.001	<0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	<0.001	0.001	0.0012	0.0012	0.0004	0.0013	0.0018	0.0014	0.0014	0.0015	0.0019	0.0017	0.0023	0.002	0.0008	0.0013	0.0016	0.0014	0.0011
MELDR-14	0.001	0.002	<0.001	0.001	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.0008	0.0011	0.0006	0.0012	0.0013	0.0012	0.0012	0.0013	0.0014	0.0013	0.0017	0.0016	0.0007	0.0008	0.0016	0.0011	0.001
MELDR-06	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.002	0.001	0.001	<0.001	<0.001	<0.001	0.0008	0.0011	0.0004	0.0013	0.0014	0.0014	0.0013	0.0014	0.0016	0.0016	0.0019	0.0019	0.001	0.0012	0.0013	0.0013	0.001
MELDR-07	<0.001	<0.001	<0.001	0.002	0.002	<0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001		0.0006	0.0006	0.0012	0.001	0.0011	0.0012	0.0017	0.0013	0.0015	0.0019	0.0019	0.0007	0.001	0.0011	0.0011	<0.001
MELDR-08					0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	0.0011	0.0008	0.0021	0.0023	0.0031	0.0031	0.0034	0.0021	0.0015	0.0035	0.002	0.0005	0.0005	0.0009	0.0009	0.001
MELDR-09					0.002	0.002	0.001	0.004	0.001	0.002	0.002	0.002	0.0016	0.0029	0.0007	0.0029	0.0018	0.0027	0.0022	0.0041	0.0018	0.0018	0.0033	0.0035	0.0012	0.0011	0.0012	0.001	0.002
MELDR-10	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.0001	<0.0001	0.0006	<0.0001	0.0002	0.0001	<0.0001	<0.0001	0.0001	0.0002	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	<0.001
MELDR-11	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001	0.0001	0.0006	0.0001	0.0001	0.0001	<0.0001	<0.0001	0.0001	0.0002	0.0002	<0.0001	0.0003	0.0002	0.0002	0.0002	<0.001
MELDR-12	0.003	0.004	0.003	0.003	0.002	0.003	<0.001	0.002	0.001	<0.001	<0.001	0.003	0.0018	0.0025	0.0008	0.0035	0.0022	0.0018	0.0019	0.0025	0.002	0.002	0.0035	0.003	0.0012	0.0018	0.002	0.0018	0.002

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Concentration < LOR
NO sample taken

Table G-5: Total and soluble copper (Cu) and total and soluble Iron (Fe) concentrations (mg/L) recorded in Melville Bull Creek catchment sites from 2007 to 2020

Total Copper (Cu) (mg/L)

ANZECC unmodified TV for 95% protection 0.0014 mg/L; NHMRC recreational use guideline for aesthetic: 1 mg/L and health: 2 mg/L   Max 0.031   Min 0.0004   LOR 0.0001 mg/L to 0.001 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05	0.003	<0.001			<0.001	0.001	0.002		0.003	<0.001			0.008	0.002	0.002	0.002	0.004	0.002	0.0015	0.002	0.0031	0.0035	<0.001	0.0028	0.004	0.002	<0.001	0.001
MELDR-16																												
MELDR-02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0018	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
MELDR-01	<0.001	0.002	<0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.001	<0.001	<0.001	0.004	0.001	0.001	0.001	0.0015	0.001	0.0011	0.001	<0.001	0.0021	0.001	0.001	0.003	0.002	0.001	0.001
MELDR-13																											0.001	<0.001
MELDR-14																											0.001	0.001
MELDR-06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.0011	<0.001	<0.001	<0.001	<0.001	0.0025	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
MELDR-07	0.006	0.001			0.002	0.002	<0.001		<0.001	<0.001			<0.001	<0.001	<0.001	0.003		<0.001	0.0027	0.001			0.0034	0.0014		0.003	<0.001	0.001
MELDR-08	0.003	0.001			0.001	<0.001			<0.001										0.0018	0.002		0.0015	<0.001	<0.001	0.001	<0.001	0.002	<0.001
MELDR-09	<0.001	<0.001			<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	0.0011	<0.001	0.0011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001
MELDR-10	0.001	0.001			0.001	0.001	<0.001	0.004	0.001	<0.001	<0.001		0.002	0.001	<0.001	0.001	0.003	0.002	0.001	0.002	0.0017	0.0045	0.0029	0.0024	0.001	0.002	<0.001	0.001
MELDR-11	<0.001	<0.001			<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
MELDR-12	0.002	<0.001			<0.001	<0.001	<0.001		<0.001	<0.001	<0.001		0.001	<0.001	<0.001	<0.001	0.01	0.004	<0.001	0.002	0.004	0.0032	0.0015	0.001	<0.001	0.002	<0.001	<0.001

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15		<0.001	<0.001	0.002	0.007	0.005	0.001	0.003	0.005	0.003	0.002	<0.001	0.0044				0.0049				0.0099				0.0094				0.003
MELDR-05	0.002	0.002	0.001	0.001	0.003				0.002				0.0037				0.0013				0.0041				0.0037				0.002
MELDR-16		<0.001	0.001	0.003	0.007	0.003	0.004	0.013	0.005	0.003	0.003		0.0024					0.0045			0.0074				0.0059				0.0035
MELDR-02	0.002	0.001	<0.001	<0.001	<0.001				<0.001				0.0011				0.0004				0.0007				0.0068				<0.001
MELDR-01	0.002	0.002	0.002	0.001	0.001				0.001				0.0012				0.0012				0.0013				0.0016				0.001
MELDR-13	0.005	<0.001	<0.001	<0.001	0.001				<0.001				0.0007				0.0007				0.0008				0.0095				<0.001
MELDR-14	0.001	0.001	0.001	<0.001	<0.001				0.001				0.0007				0.0019				0.0012				0.0017				0.001
MELDR-06	0.005	<0.001	<0.001	<0.001	0.001				<0.001				0.0015				0.0008				0.001				0.0029				<0.001
MELDR-07	<0.001	0.0015	0.002	0.002	0.025				0.013					0.0013			0.0017				0.0017				0.0013				0.0014
MELDR-08	<0.001	0.002	0.002	0.001	0.002				0.001				0.0007				0.0014				0.0013				0.0061				0.001
MELDR-09	0.001	0.002	0.001	<0.001	0.001				0.001				0.0004				0.0014				0.0008				0.031				<0.001
MELDR-10	0.002	0.001	0.001	<0.001	0.002				0.002				0.0015				0.0015				0.0013				0.0032				0.001
MELDR-11	<0.001	<0.001	<0.001	<0.001	0.001				0.001				0.0007				0.0009				0.0013				0.0016				<0.001
MELDR-12	<0.001	<0.001	0.001	0.001	<0.001				0.007				0.0012				0.0015				0.0013				0.0018				<0.001

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE

Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value

Concentration < LOR
NO sample taken

Soluble Copper (Cu) (mg/L)

ANZECC unmodified TV for 95% protection 0.0014 mg/L; NHMRC recreational use guideline for aesthetic: 1 mg/L and health: 2 mg/L   Max 0.021   Min 0.0002   LOR 0.0001 - 0.001 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05																	0.003	0.002	<0.001	0.002	0.002	0.0025	<0.001	0.0018	0.002	<0.001	<0.001	<0.001
MELDR-16																												
MELDR-02																												
MELDR-01									0.001	<0.001	<0.001	<0.001	0.003	0.001	0.001	0.002	0.0013	0.001	<0.001	0.001	<0.001	0.0018	0.001	0.001	0.001	<0.001	0.001	0.001
MELDR-13																											<0.001	<0.001
MELDR-14																											0.001	0.001
MELDR-06									0.002	<0.001	0.002	<0.001	0.002	0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-07																		<0.001	0.0022	0.001			0.0034	0.0014		<0.001	<0.001	<0.001
MELDR-08																												
MELDR-09																												
MELDR-10																	0.003	0.001	0.0013	0.002	0.0016	0.0033	0.0024	0.0012	0.001	<0.001	<0.001	<0.001
MELDR-11																	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-12																	0.011	0.004	<0.001	0.001	0.0023	0.0029	0.0015	<0.001	<0.001	<0.001	<0.001	<0.001

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15													0.0042	0.0013	0.0007	0.0012	0.0031	0.0013	0.0009	0.0007	0.0075	0.002	0.0008	0.0009	0.0049	0.0034	0.0019	0.003	0.0016
MELDR-05	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001	0.0033	0.0006	0.0004	0.0007	0.0008	0.0009	0.0007	0.0004	0.0021	0.0011	0.0005	0.0005	0.0027	0.0013	0.0005	0.001	<0.001
MELDR-16													0.0024	0.005	0.0038	0.0046		0.0037	0.0026	0.0018	0.0026	0.0032	0.0044	0.0027	0.0034	0.0021	0.0032	0.0035	0.0032
MELDR-02					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0008	0.0003	0.0003	0.0003	0.0003	0.0008	0.0007	0.0003	0.0005	0.0004	0.0004	0.0003	0.0028	0.001	0.0003	0.0018	<0.001
MELDR-01	0.001	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	0.0012	0.0009	0.0006	0.0007	0.001	0.0013	0.0009	0.0008	0.0012	0.0011	0.0013	0.0012	0.0016	0.0017	0.0014	0.0013	0.001
MELDR-13	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.0005	0.0011	0.0004	0.0002	0.0007	0.0004	0.0004	0.0006	0.0008	0.0006	0.0007	0.001	0.0055	0.003	0.0019	0.0029	<0.001
MELDR-14	0.001	0.001	<0.001	<0.000	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.0007	0.0009	0.0006	0.0005	0.0007	0.0008	0.0005	0.0015	0.001	0.0015	0.0011	0.001	0.0014	0.0022	0.003	0.0018	<0.001
MELDR-06	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0014	0.0006	0.0004	0.0004	0.0007	0.0006	0.0004	0.0005	0.0007	0.0017	0.0009	0.001	0.0058	0.0054	0.0026	0.0039	<0.001
MELDR-07	<0.001	0.0015	<0.001	0.002	0.021	0.009	<0.001	<0.001	0.013	0.009	0.002	<0.001		0.0005	0.0006	0.0007	0.0013	0.0011	0.0011	0.0011	0.0014	0.0014	0.0016	0.0012	0.0012	0.0016	0.001	0.0013	0.0012
MELDR-08					0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.0007	0.0008	0.0008	0.0008	0.001	0.0013	0.0011	0.0009	0.0013	0.001	0.0019	0.001	0.0008	0.0004	0.0012	0.0008	<0.001
MELDR-09					0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.0004	0.0011	0.0007	0.0007	0.0011	0.0016	0.0017	0.0012	0.0008	0.0014	0.0015	0.0007	0.0075	0.0006	0.0006	0.0007	<0.001
MELDR-10	0.002	0.001	0.001	<0.001	0.002	0.001	0.001	0.001	<0.001	0.002	0.002	<0.001	0.0014	0.001	0.0006	0.0008	0.0012	0.0009	0.0002	0.0006	0.001	0.0011	0.0012	0.0009	0.0015	0.0014	0.0014	0.0011	0.001
MELDR-11	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.001	<0.001	0.002	0.001	<0.001	0.0007	0.0008	0.0006	0.0007	0.0006	0.0004	0.0005	0.0003	0.0011	0.001	0.0012	0.0006	0.0012	0.0012	0.0011	0.0018	<0.001
MELDR-12	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.007	0.002	0.001	<0.001	0.0012	0.0019	0.0008	0.0007	0.0014	0.0012	0.0011	0.0009	0.0012	0.001	0.0013	0.0009	0.0013	0.0015	0.0015	0.0021	0.001

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE

Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value

Concentration < LOR
NO sample taken

Total Fe (mg/L)

ANZECC interim guideline 0.3 mg/L; NHMRC recretional use guideline value 0.3 mg/L   Max 19.0   Min 0.1   LOR 0.005 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05	1.2	2.7			1.9	1.3	0.51		1.8	0.93			0.71	2.0	1.0	1.1	0.25	4.3	2.2	1.5	4.3	0.33	1.2	0.92	1.2	2.3	2.5	2.1
MELDR-16																												
MELDR-02	1.1	2.0	1.2	1.1	1.6	1.2	1.2	1.2	1.4	1.2	1.5	15.0	1.1	1.3	1.1	1.3	1.2	1.5	1.4	1.4	1.9	1.2	1.0	1.2	1.3	1.5	1.7	1.4
MELDR-01	0.76	1.0	13.0	0.68	1.6	0.6	0.88	0.97	0.79	0.64	0.85	0.88	1.2	0.68	0.78	0.58	0.58	0.82	0.88	0.65	0.9	0.59	0.78	0.75	1.2	0.9	1.2	1.1
MELDR-13																											4.4	4.1
MELDR-14																											0.9	1.5
MELDR-06	16.0	12.0	1.4	12.0	8.3	6.6	7.0	6.4	4.3	4.9	6.2	5.6	2.8	4.5	4.5	5.1	4.1	4.6	4.6	3.4	7.0	3.7	4.0	3.1	4.7	3.9	3.8	3.4
MELDR-07	3.9	15.0			9.5	7.3	16.0		5.4	6.9			4.8	6.3	4.5	19.0		3.3	4.5	3.3			5.4	1.3		4.7	5.8	2.8
MELDR-08	0.95	5.6			0.99	0.41			0.63										0.91	1.3		0.59	1.2	0.63	3.5	2.6	0.91	0.91
MELDR-09	0.82	0.61			0.45	0.11	0.13	0.08	0.26	0.06	0.12		0.07	0.05	0.06	0.1	0.7	1.0	1.6	1.9	0.15	0.13	0.22	0.14	0.1	0.22	0.93	0.72
MELDR-10	0.39	0.34			0.7	0.31	1.1	1.8	0.14	0.34	2.7		0.22	0.29	0.9	1.1	0.24	0.19	0.49	0.41	0.46	0.41	0.7	0.53	0.32	0.23	0.5	0.70
MELDR-11	0.39	0.59			0.53	0.7	0.91	1.6	0.32	0.99	1.7	1.8	0.43	0.37	0.4	2.0	0.26	0.33	0.36	0.32	0.53	0.62	0.47	0.69	0.34	0.13	0.18	0.4
MELDR-12	1.4	3.7			2.5	1.1	0.61		1.6	0.58	0.68		1.4	1.2	0.69	0.55	1.6	2.2	7.6	6.0	1.9	4.8	4.3	5.6	1.4	3.6	5.3	3.2

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15		5.1	3.8	2.3	2.5	5.7	0.46	2.4	0.24	0.63	0.64	1.6	0.19				3.5				3				0.31				2.3
MELDR-05	2.8	2.4	2.1	1.6	1.3				6.3				0.43				4.4				4.5				0.45				1.6
MELDR-16		6.5	7.5	3.3	1.4	1.5	0.68	2.7	1.1	0.33	0.55		0.053					0.4			1.6				0.2				1.3
MELDR-02	1.5	1.7	1.6	1.3	1.1				1.5				0.59				1.3				1.5				0.71				1.3
MELDR-01	1.1	1.2	0.8	0.86	0.53				0.54				0.34				0.55				0.73				0.44				0.8
MELDR-13	1.9	4.1	4.3	3.2	3.2				2.3				1.5				2.9				2.6				5				3.2
MELDR-14	0.6	0.9	0.9	0.86	0.56				0.45				0.42				0.56				0.67				0.35				0.6
MELDR-06	2.2	3.6	3.3	2.8	2.7				2.1				0.81				2				1.8				1.2				4.1
MELDR-07	2.0	5.9	5.0	2.8	6.9				5.2					6.8			2.7				2.7				3				5.0
MELDR-08	1.3	1.0	1.30	0.68	0.68				1.3				0.99				2.2				2.1				0.084				1.0
MELDR-09	0.9	1.00	0.59	0.58	0.58				0.44				0.22				0.19				0.33				0.63				0.3
MELDR-10	0.35	0.52	0.3	0.34	0.37				0.23				0.18				0.49				0.52				0.33				0.4
MELDR-11	0.12	0.13	0.09	0.23	0.082				0.091				0.16				0.56				0.19				0.24				0.4
MELDR-12	2.7	4.0	1.9	1.7	5.3				2.4				3.4				1.3				0.85				0.57				1.9

SITES RECORDING >60% CONCENTRATIONS ABOVE TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE TRIGGER VALUE

Concentration ABOVE guideline
Concentration BELOW guideline

Concentration < LOR
NO sample taken

Soluble Iron (Fe) (mg/L)

ANZECC interim guideline 0.3 mg/L; NHMRC recretional use guideline value 0.3 mg/L   Max 14.00   Min 0.025   LOR 0.005 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05																	0.1	2.9	1	0.73		0.22	0.77	0.57	0.66	1.6	1.2	0.64
MELDR-16																												
MELDR-02																												
MELDR-01									0.35	0.25	0.24	0.2	0.3	0.29	0.25	0.25	0.35	0.48	0.36	0.3	0.34	0.27	0.31	0.32	0.24	0.42	0.5	0.37
MELDR-13																											2.7	2.3
MELDR-14																											0.68	0.56
MELDR-06									3.4	2.8	3.7	2.6	1.3	3.1	2.6	3.1	2.7	2.7	3.1	1.8	5.2	2.2	2.7	1.7	2.6	2.9	2.6	1.8
MELDR-07																		0.99	1.3	1.1			3.9	1.2		4.1	2.5	2.2
MELDR-08																												
MELDR-09																												
MELDR-10																	0.21	0.16	0.37	0.26	0.37	0.19	0.51	0.24	0.19	0.14	0.32	0.28
MELDR-11																	0.19	0.2	0.081	0.081	0.21	0.11	0.085	0.11	0.16	0.05	0.066	0.14
MELDR-12																	1.6	1.9	5.3	4.1	0.81	1.8	0.34	1.9	0.72	1.3	3.2	1.3

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15													0.12	2.20	1.60	1.80	2.3	2.40	1.50	1.30	2.1	2.20	2.70	0.92	0.05	0.38	0.55	0.49	1.6
MELDR-05	2.7	1.2	1.8	0.7	1	0.96	0.44	0.35	6	1.40	0.34	1.10	0.36	2.00	1.60	1.40	3	2.00	1.30	1.50	3.3	1.50	1.80	1.60	0.25	14.00	2.30	1.70	1.3
MELDR-16													0.039	0.75	2.20	2.20		0.32	0.97	1.80	0.37	0.64	0.69	0.72	0.03	0.24	0.25	0.49	0.6
MELDR-02					1	1.1	0.93	0.88	1	1.3	1.00	0.99	0.59	1.1	1.10	1.20	1	1.1	1.10	1.20	1.1	1.1	1.00	0.92	0.36	1.10	0.95	0.94	1.1
MELDR-01	0.3	0.46	0.37	0.33	0.26	0.34	0.34	0.14	0.30	0.34	0.32	0.33	0.25	0.46	0.42	0.40	0.32	0.35	0.41	0.41	0.38	0.34	0.23	0.31	0.22	0.26	0.27	0.25	0.3
MELDR-13	0.6	2.0	1.7	1.1	1.7	1.3	2.6	0.87	1.9	2.3	1.7	1.30	1.3	1.4	1.0	2.50	1.5	1.3	1.1	1.00	1.1	1.2	2.1	0.84	0.32	0.78	0.83	0.86	1.3
MELDR-14	0.4	0.6	0.57	0.5	0.42	0.55	0.77	0.39	0.30	0.40	0.26	0.36	0.28	0.46	0.49	0.53	0.34	0.38	0.46	0.54	0.38	0.35	0.57	0.39	0.17	0.23	0.71	0.35	0.4
MELDR-06	0.55	1.7	1.4	0.96	1.2	1.4	2	0.47	1.2	1.2	1	0.59	0.5	0.9	1	1.70	0.79	0.7	1	0.52	0.72	0.6	1	0.49	0.45	0.50	0.29	0.65	1.4
MELDR-07	1.7	5.6	2.3	2.1	5.7	2.4	2.3	1.7	3.9	3.7	2.7	3.0		6.0	3.9	4.3	1.1	3.3	4.3	3.7	1.2	2.9	2.5	2.3	0.9	2.3	3.4	4.0	2.5
MELDR-08					0.66	0.44	0.49	0.59	1.10	1.40	1.20	0.81	0.91	0.99	0.88	3.80	1.9	2.50	2.50	2.70	1.6	0.95	1.80	0.89	0.05	0.89	3.30	2.10	1.0
MELDR-09					0.41	0.45	0.37	0.3	0.38	0.36	0.34	0.5	0.18	0.29	0.76	0.6	0.16	0.35	0.59	0.9	0.27	0.17	0.19	0.2	0.06	0.08	0.13	0.07	0.3
MELDR-10	0.24	0.38	0.19	0.077	0.24	0.12	0.41	0.11	0.17	0.37	0.21	0.33	0.11	0.23	0.35	0.14	0.35	0.30	0.55	0.15	0.34	0.26	0.30	0.25	0.12	0.17	0.51	0.53	0.2
MELDR-11	0.12	0.037	0.026	0.096	0.04	0.03	0.19	0.22	0.06	0.11	0.18	0.48	0.078	0.10	0.63	0.44	0.21	0.49	0.03	0.04	0.077	0.06	0.21	0.23	0.10	0.20	0.41	0.52	0.1
MELDR-12	1.8	3.4	1.1	1.1	3.9	2.9	1.6	1.7	2.1	1.2	5.1	3.1	2.9	3.0	3.7	2.9	1.2	1.3	1.3	1.0	0.61	0.6	0.7	0.7	0.45	0.84	0.99	0.91	1.5

SITES RECORDING Fe CONCENTRATIONS ALWAYS/GENERALLY ABOVE GUIDELINE
SITES RECORDING Fe CONCENTRATIONS ALWAYS/GENERALLY BELOW GUIDELINE

Concentration ABOVE guideline
Highest concentration of the year
Concentration BELOW guideline

Concentration < LOR
NO sample taken

Table G-6: Total and soluble lead (Pb), total and soluble mercury (hg) and total and soluble zinc (Zn) concentrations (mg/L) recorded in Melville Bull Creek catchment sites from 2007 to 2020

Total Lead (Pb) (mg/L) LOR 0.001 mg/L; LOR 0.0001 mg/L to 0.001 mg/L

ANZECC unmodified TV for 95% protection 0.0034 mg/L ; NHMRC recreational guideline value 0.01 mg/L Max 0.095 Min <0.00001

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05	0.004	0.003			0.002	0.002	0.003		0.003	0.002			0.005	0.002	0.005	0.006	0.003	0.005	0.002	0.002	0.0068	0.0022	<0.001	<0.001	0.003	0.002	<0.001	0.001
MELDR-16																												
MELDR-02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
MELDR-01	0.002	0.004	0.003	0.003	0.004	0.001	0.003	0.004	0.002	0.003	0.003	0.004	0.006	0.002	0.003	0.002	0.002	0.001	0.0022	0.002	0.0034	0.0028	0.0027	0.0029	0.006	0.003	0.004	0.004
MELDR-13																											0.002	0.001
MELDR-14																											0.001	0.002
MELDR-06	0.003	0.004	0.006	0.002	0.002	<0.001	0.001	0.001	0.002	0.002	0.001	<0.001	0.003	0.001	0.002	0.001	0.0015	0.001	0.0014	<0.001	0.0025	0.0028	0.0012	<0.001	0.002	0.001	0.002	0.001
MELDR-07	0.032	0.001			0.001	0.001	0.008		<0.001	0.002			0.002	<0.001	<0.001	0.012		0.002	<0.001	<0.001			0.004	0.003		0.002	<0.001	<0.001
MELDR-08	0.002	0.003			0.002	<0.001			<0.001										0.0014	0.001		<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
MELDR-09	<0.001	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	0.0014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-10	0.002	0.003			0.002	<0.001	0.001	0.009	<0.001	0.001	0.003		0.002	0.002	0.005	<0.001	0.003	0.001	0.0024	0.002	0.0023	0.0039	0.006	0.0028	0.002	0.001	0.002	0.002
MELDR-11	0.004	0.003			0.001	0.001	0.002	0.008	0.0013	0.002	0.005	0.003	0.001	0.002	0.003	0.014	0.002	0.002	0.0025	0.001	<0.001	0.0015	0.0021	0.0021	0.001	0.001	0.001	0.005
MELDR-12	0.029	0.009			0.003	0.005	0.003		0.0056	0.005	0.019		0.011	0.01	0.011	0.014	0.065	0.026	0.0012	0.003	0.051	0.036	0.0065	0.008	0.019	0.003	0.001	<0.001

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15		<0.001	<0.001	<0.001	0.009	0.006	0.001	0.009	0.007	0.003	0.001	<0.001	0.0005				0.003				0.0093				0.0047				0.003
MELDR-05	0.002	0.001	<0.001	0.001	0.002				0.002				0.0011				0.001				0.0034				0.0012				0.002
MELDR-16		<0.001	0.002	<0.001	0.011	0.003	<0.001	0.01	0.01	<0.001	<0.001		0.0008					0.0019			0.016				0.0018				0.00185
MELDR-02	0.001	<0.001	<0.001	<0.001	<0.001				<0.001				0.0003				0.0003				0.0006				0.0021				<0.001
MELDR-01	0.007	<0.001	0.003	0.003	0.002				0.002				0.0006				0.0014				0.0016				0.0016				0.00295
MELDR-13	0.003	<0.001	0.001	<0.001	<0.001				<0.001				0.0001				0.0007				0.0006				0.0053				<0.001
MELDR-14	<0.001	0.001	<0.001	<0.001	<0.001				<0.001				0.0003				0.0006				0.0007				0.0011				<0.001
MELDR-06	0.003	<0.001	<0.001	<0.001	0.002				<0.001				0.0001				0.0007				0.0007				0.0006				0.001
MELDR-07	<0.001	<0.001	<0.001	<0.001	0.005				0.002					0.0007			0.0015				0.0027				0.006				0.001
MELDR-08	0.001	0.001	0.002	<0.001	0.001				0.001				0.0004				0.0027				0.002				0.0034				0.001
MELDR-09	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001				0.0002				0.0033				0.0003				0.0028				<0.001
MELDR-10	0.002	0.001	<0.001	<0.001	<0.001				0.001				0.0002				0.0012				0.001				0.0075				0.002
MELDR-11	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001				<0.00001				0.001				0.0011				0.0021				0.0014
MELDR-12	0.003	0.001	0.002	0.003	0.008				0.095				0.0073				0.0038				0.0033				0.0016				0.00605

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Concentration < LOR
NO sample taken

Soluble Lead (Pb) (mg/L) LOR 0.0001 - 0.001 mg/L

ANZECC unmodified TV for 95% protection 0.0034 mg/L ; NHMRC recreational guideline value 0.01 mg/L Max 0.092 Min <0.0001

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05																	<0.001	0.002	<0.001	<0.001	0.0015	0.0011	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
MELDR-16																												
MELDR-02									<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0016	0.0011	0.001	<0.001	0.001	<0.001	0.001	0.001
MELDR-01																												
MELDR-13																											<0.001	<0.001
MELDR-14																											<0.001	0.001
MELDR-06									<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-07																		<0.001	<0.001	<0.001			0.004	0.003		0.002	<0.001	<0.001
MELDR-08																												
MELDR-09																												
MELDR-10																	0.002	<0.001	0.0016	<0.001	0.002	0.0019	0.0038	<0.001	0.001	<0.001	0.001	0.001
MELDR-11																	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
MELDR-12																	0.066	0.024	<0.001	0.002	0.046	0.026	<0.001	0.0031	0.018	<0.001	<0.001	<0.001

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15													0.0005	0.001	0.0003	0.0006	0.0017	0.0008	0.0006	0.0004	0.0044	0.0014	0.0005	0.0004	0.0008	0.0042	0.0021	0.0015	<0.001
MELDR-05	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.001	0.0005	0.0002	0.0004	0.0004	0.0006	0.0004	0.0003	0.0013	0.0007	0.0003	0.0002	0.0005	0.0005	0.0003	0.0005	<0.001
MELDR-16													0.0002	0.0017	0.0013	0.0025		0.0012	0.0012	0.0011	0.0012	0.0009	0.0011	0.0004	0.0004	0.0004	0.0008	0.0009	0.0011
MELDR-02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0003	0.0003	0.0001	0.0002	0.0002	0.0005	0.0004	0.0002	0.0003	0.0003	0.0002	0.0001	0.0005	0.0002	0.0001	0.0002	<0.001
MELDR-01					0.002	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.0005	0.0007	0.0004	0.0007	0.0006	0.0008	0.0007	0.0007	0.0006	0.0007	0.0004	0.0005	0.0007	0.0006	0.0006	0.0007	<0.001
MELDR-13	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0004	<0.0001	0.0002	0.0001	<0.0001	<0.0001	<0.001
MELDR-14	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0002	0.0003	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0005	0.0002	0.0003	0.0002	<0.0001	0.0002	<0.001
MELDR-06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001	0.0002	<0.0001	0.0001	0.0002	0.0002	0.0002	0.0001	0.0002	0.0002	0.0001	<0.0001	0.0002	0.0001	0.0002	0.0001	<0.001
MELDR-07	<0.001	<0.001	<0.001	<0.001	0.005	0.005	0.008	<0.001	0.002	0.006	0.003	<0.001		0.0007	0.0005	0.0009	0.0007	0.0032	0.0039	0.0024	0.0012	0.0026	0.002	0.0011	0.0004	0.0013	0.0012	0.0015	0.0012
MELDR-08					0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.0004	0.0007	0.0006	0.0012	0.0015	0.0058	0.0033	0.0025	0.0016	0.0006	0.0016	0.0004	0.0004	0.0003	0.0006	0.0004	<0.001
MELDR-09					<0.001	<0.001	<0.001	0.001	<0.001	0.001	0.001	<0.001	0.0002	0.0011	0.0004	0.0006	0.0003	0.0016	0.0009	0.0008	0.0002	0.0003	0.0003	<0.0001	0.0003	<0.0001	0.0001	<0.0001	<0.001
MELDR-10	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.0002	0.0004	0.0002	0.0001	0.0005	0.0003	<0.0001	<0.0001	0.0006	0.0003	0.0003	0.0003	0.0021	0.0016	0.0025	0.0009	<0.001
MELDR-11	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.002	<0.0001	0.0004	0.0013	0.0018	0.0002	0.0002	<0.0001	<0.0001	0.0002	0.0001	0.0004	0.0002	0.0008	0.0014	0.0028	0.0043	<0.001
MELDR-12	0.001	0.001	<0.001	<0.001	0.006	0.006	<0.001	0.006	0.092	0.011	0.006	0.002	0.0067	0.0061	0.0018	0.0017	0.0036	0.0028	0.0014	0.0009	0.0022	0.0014	0.0015	0.0007	0.0087	0.01	0.0084	0.013	0.0025

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Concentration < LOR
NO sample taken

Total Mercury (Hg) (mg/L) ANZECC trigger value: 0.0006 mg/L; NHMRC recretional guideline value: 0.001 mg/L Max 0.0003 Min <0.00005 LOR 0.0001 mg/L and 0.00005 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-16																												
MELDR-13																												
MELDR-14																												
MELDR-06																												
MELDR-07																												

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20
MELDR-15	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001																
MELDR-16	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002																	
MELDR-13	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	<0.00005	<0.00005	<0.00005
MELDR-14	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	<0.00005	<0.00005	<0.00005
MELDR-06	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.0005	<0.00005	<0.00005	<0.00005
MELDR-07																					<0.0001				<0.0005			

Concentration ABOVE guideline
Highest concentration of the year
Concentration BELOW trigger value
Concentration <LOR
NO sample taken

Soluble Mercury (Hg) (mg/L) ANZECC trigger value: 0.0006 mg/L; NHMRC recretional guideline value: 0.001 mg/L Max 0.0002 Min <0.0001 LOR 0.0001 mg/L and 0.00005 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-16																												
MELDR-13																												
MELDR-14																												
MELDR-06																												
MELDR-07																												
MELDR-08																												

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20
MELDR-15	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001																				
MELDR-16	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001																				
MELDR-13	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
MELDR-14	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
MELDR-06	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
MELDR-07																					<0.0001		<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
MELDR-08																						<0.0001						

Concentration ABOVE guideline
Highest concentration of the year
Concentration BELOW trigger value
Concentration <LOR
NO sample taken

Total Zinc (Zn) (mg/L) LOR 0.001 mg/L

ANZECC unadjusted TV for 95% protection 0.008 mg/L; NHMRC recreational guideline value 3 mg/L Max 1.2 Min <0.001

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05	0.006	0.011			0.005	0.006	0.003		0.021	0.008			0.054	0.004	0.005	0.008	0.024	0.05	0.018	0.017	0.014	0.027	0.0084	0.012	0.03	0.03	0.028	0.014
MELDR-16																												
MELDR-02	0.002	0.003	<0.001	<0.001	0.003	0.004	0.004	0.004	0.01	0.004	0.003	0.009	0.015	0.002	0.005	0.004	0.008	0.012	0.007	0.009	<0.001	0.011	0.0037	0.0019	0.021	0.019	0.03	0.035
MELDR-01	0.006	0.007	0.011	0.012	0.006	0.009	0.005	0.009	0.015	0.008	0.002	0.005	0.02	0.006	0.008	0.006	0.017	0.014	0.011	0.01	0.0092	0.016	0.01	0.009	0.02	0.02	0.012	0.011
MELDR-13																											0.019	0.008
MELDR-14																											0.008	0.005
MELDR-06	0.01	0.01	0.009	0.011	0.007	0.006	0.004	0.008	0.011	0.008	0.002	0.004	0.021	0.005	0.006	0.006	0.02	0.014	0.011	0.008	0.009	0.017	0.01	0.0053	0.02	0.01	0.015	0.0081
MELDR-07	1.2	0.02			0.016	0.002	<0.001		0.058	0.002			0.009	0.002	<0.001	0.018		0.092	0.005	0.002			0.14	0.05		0.12	0.002	0.001
MELDR-08	0.13	0.026			0.024	0.009			0.031										0.07	0.026		0.05	0.011	0.0031	0.1	0.023	0.02	0.012
MELDR-09	0.004	0.003			0.006	0.004	0.003	0.002	0.007	0.001	<0.001		<0.001	<0.001	0.002	0.002	0.22	0.091	0.033	0.01	0.014	0.014	0.012	0.0044	0.007	0.013	0.011	0.004
MELDR-10	0.006	0.004			0.003	0.003	0.003	0.012	0.003	0.003	<0.001		0.004	0.002	0.004	0.007	0.02	0.041	0.009	0.007	0.011	0.023	0.014	0.0058	0.02	0.013	0.007	0.003
MELDR-11	0.007	0.003			0.001	0.001	<0.001	0.008	0.0023	0.002	0.001	0.002	0.004	0.003	0.002	0.017	0.006	0.003	0.005	0.002	0.002	0.0058	0.0024	0.002	0.003	0.004	0.001	0.003
MELDR-12	0.19	0.001			0.001	0.002	<0.001		0.003	<0.001	0.004		0.003	0.002	0.003	0.002	0.65	0.22	0.013	0.003	0.16	0.11	0.016	<0.001	0.1	0.002	0.003	0.002

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15		0.029	0.041	0.041	0.09	0.094	0.057	0.055	0.041	0.092	0.044	0.09	0.14				0.11				0.23				0.071				0.071
MELDR-05	0.031	0.021	0.018	0.007	0.023				0.016				0.042				0.024				0.038				0.032				0.018
MELDR-16		0.024	0.039	0.023	0.18	0.074	0.051	0.072	0.12	0.084	0.032		0.1					0.085			0.38				0.042				0.073
MELDR-02	0.021	0.012	0.01	0.005	0.009				0.005				0.015				0.007				0.014				0.05				0.007
MELDR-01	0.021	0.012	0.01	0.008	0.014				0.013				0.018				0.013				0.018				0.019				0.011
MELDR-13	0.033	0.011	0.012	0.008	0.01				0.007				0.01				0.008				0.012				0.052				0.0105
MELDR-14	0.046	0.01	0.005	0.004	0.008				0.008				0.016				0.011				0.026				0.016				0.009
MELDR-06	0.032	0.011	0.01	0.008	0.011				0.008				0.017				0.011				0.013				0.015				0.01
MELDR-07	0.048	0.013	0.004	0.003	0.21				0.2					0.007			0.007				0.013				0.021				0.013
MELDR-08	0.024	0.031	0.037	0.021	0.041				0.043				0.027				0.04				0.024				0.015				0.026
MELDR-09	0.006	0.008	0.005	0.003	0.011				0.009				0.01				0.009				0.013				0.084				0.007
MELDR-10	0.03	0.009	0.006	0.007	0.016				0.019				0.019				0.019				0.02				0.028				0.007
MELDR-11	0.003	0.003	0.003	0.002	0.004				0.008				0.0025				0.007				0.005				0.014				0.003
MELDR-12	0.002	0.003	0.005	0.008	0.003				0.24				0.009				0.007				0.017				0.016				0.003

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Highest concentration of the year
Concentration < LOR
NO sample taken

Soluble Zinc (Zn) (mg/L) LOR 0.001 mg/L

ANZECC unmodified TV for 95% protection 0.008 mg/L; NHMRC recreational guideline value 3 mg/L Max 0.58 Min <0.001

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13
MELDR-15																												
MELDR-05																	0.025	0.05	0.016	0.026	0.0064	0.027	0.011	0.012	0.03	0.02	0.028	0.014
MELDR-16																												
MELDR-02									0.015	0.01	0.011	0.009	0.02	0.015	0.01	0.013	0.019	0.014	0.01	0.017	0.007	0.016	0.01	0.009	0.02	0.02	0.012	0.011
MELDR-01																												
MELDR-13																											0.019	0.008
MELDR-14																											0.008	0.005
MELDR-06									0.015	0.015	0.015	0.012	0.02	0.016	0.018	0.02	0.02	0.014	0.013	0.022	0.009	0.017	0.01	0.0053	0.02	0.01	0.015	0.0081
MELDR-07																		0.092	0.006	0.012			0.14	0.05		0.12	0.002	0.001
MELDR-08																												
MELDR-09																												
MELDR-10																	0.022	0.039	0.012	0.01	0.011	0.021	0.015	0.0055	0.02	0.013	0.007	0.003
MELDR-11																	0.006	0.003	0.005	0.002	0.002	0.0055	0.0024	0.002	0.003	0.004	0.001	0.001
MELDR-12																	0.58	0.0024	0.018	0.013	0.16	0.11	0.016	<0.001	0.1	0.002	0.003	0.002

Site	Aug-14	Sep-14	Oct-14	Nov-14	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15													0.097	0.049	0.071	0.052	0.094	0.17	0.037	0.048	0.18	0.099	0.027	0.11	0.053	0.072	0.14	0.1	0.083
MELDR-05	0.028	0.021	0.018	0.03	0.02	0.015	0.01	0.011	0.016	0.029	0.04	0.028	0.04	0.017	0.016	0.022	0.011	0.03	0.022	0.02	0.02	0.016	0.02	0.032	0.029	0.011	0.034	0.008	0.02
MELDR-16													0.044	0.089	0.052	0.054		0.068	0.088	0.1	0.2	0.15	0.035	0.11	0.029	0.11	0.046	0.073	0.073
MELDR-02	0.021	0.012	0.01	0.008	0.009	0.016	0.012	0.015	0.005	0.028	0.021	0.019	0.013	0.015	0.011	0.013	0.007	0.031	0.015	0.018	0.008	0.018	0.018	0.029	0.037	0.016	0.017	0.016	0.015
MELDR-01					0.014	0.019	0.015	0.013	0.013	0.025	0.025	0.02	0.011	0.019	0.01	0.013	0.013	0.023	0.015	0.014	0.012	0.023	0.021	0.017	0.019	0.01	0.008	0.015	0.015
MELDR-13	0.028	0.011	0.012	0.008	0.01	0.017	0.007	0.015	0.007	0.025	0.021	0.022	0.007	0.014	0.014	0.012	0.008	0.013	0.01	0.012	0.007	0.018	0.009	0.019	0.025	0.027	0.021	0.021	0.0135
MELDR-14	0.02	0.01	0.005	0.004	0.008	0.014	0.005	0.014	0.008	0.03	0.019	0.013	0.008	0.014	0.009	0.008	0.011	0.012	0.012	0.017	0.017	0.032	0.014	0.017	0.016	0.024	0.02	0.021	0.0135
MELDR-06	0.032	0.011	0.01	0.008	0.011	0.015	0.006	0.014	0.008	0.066	0.022	0.015	0.012	0.015	0.012	0.01	0.011	0.013	0.012	0.011	0.008	0.018	0.018	0.017	0.015	0.025	0.015	0.019	0.015
MELDR-07	0.048	0.013	0.004	0.003	0.18	0.13	0.01	0.014	0.2	0.17	0.099	0.019		0.0025	0.008	0.009	0.007	0.013	0.009	0.012	0.007	0.021	0.011	0.012	0.011	0.032	0.012	0.018	0.012
MELDR-08					0.038	0.029	0.023	0.021	0.043	0.042	0.038	0.034	0.022	0.035	0.025	0.019	0.04	0.03	0.026	0.025	0.013	0.031	0.029	0.023	0.015	0.012	0.019	0.029	0.0275
MELDR-09					0.011	0.015	0.012	0.011	0.009	0.026	0.019	0.018	0.006	0.018	0.011	0.014	0.009	0.017	0.013	0.016	0.006	0.014	0.016	0.011	0.03	0.007	0.017	0.01	0.0135
MELDR-10	0.03	0.009	0.006	0.007	0.016	0.02	0.006	0.008	0.019	0.026	0.021	0.021	0.013	0.02	0.01	0.012	0.019	0.035	0.019	0.015	0.017	0.023	0.018	0.014	0.024	0.009	0.008	0.039	0.0155
MELDR-11	0.003	0.003	0.003	0.002	0.004	0.008	0.002	0.003	0.008	0.017	0.009	0.003	0.0025	0.0025	0.004	0.01	0.007	0.011	0.004	0.01	0.004	0.013	0.006	0.002	0.01	0.002	0.006	0.005	0.004
MELDR-12	0.002	0.003	0.005	0.008	0.003	0.011	0.018	0.009	0.24	0.11	0.029	0.013	0.0025	0.014	0.007	0.01	0.007	0.013	0.012	0.02	0.006	0.018	0.012	0.01	0.012	0.004	0.011	0.014	0.0115

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Concentration < LOR
NO sample taken

Table G-7: total and soluble arsenic (As) and total and soluble nickel (Ni) concentrations (mg/L) recorded in Melville Bull Creek catchment sites from 2007 to 2020.

Total As (mg/L) ANZECC TV: 0.024 mg/L; NHMRC recreational guideline value: 0.007 mg/L Max 0.013 Min <0.001 LOR 0.001 or 0.0001 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10
MELDR-15																
MELDR-05	<0.001	0.002			<0.001	<0.001	0.002		0.001	<0.001			<0.001	<0.001	0.001	0.001
MELDR-16																
MELDR-02	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
MELDR-01	<0.001	0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-13																
MELDR-14																
MELDR-06	0.004	0.005	<0.001	0.004	0.003	0.003	0.004	0.004	0.004	0.003	0.004	0.004	0.001	0.003	0.003	0.003
MELDR-07	0.002	0.004			0.002	0.003	0.006		0.002	0.002			0.001	0.002	0.003	0.004
MELDR-08	0.001	0.002			<0.001	<0.001			<0.001							
MELDR-09	0.001	0.001			<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
MELDR-10	0.004	0.005			0.004	0.003	0.005	0.01	0.004	0.003	0.01		0.002	0.003	0.007	0.007
MELDR-11	0.002	0.004			0.002	0.004	0.007	0.007	0.003	0.004	0.011	0.013	0.003	0.003	0.004	0.01
MELDR-12	0.002	0.003			0.003	0.003	0.003		0.002	<0.001	0.004		0.002	0.002	0.003	0.003

Site	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14
MELDR-15														<0.001	<0.001	<0.001
MELDR-05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.001	0.001
MELDR-16														<0.001	<0.001	0.001
MELDR-02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	<0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001
MELDR-01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001
MELDR-13											0.003	0.003	0.001	0.001	0.003	0.002
MELDR-14											0.001	0.002	0.001	0.002	0.002	0.001
MELDR-06	0.002	0.002	0.0023	0.002	0.0025	0.0022	0.0028	0.0019	0.003	0.002	0.003	0.003	0.001	<0.001	0.003	0.002
MELDR-07		<0.001	0.0019	0.003			0.0011	<0.001		0.001	0.002	0.004	<0.001	<0.001	0.002	0.002
MELDR-08			<0.001	<0.001		<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	0.002	<0.001
MELDR-09	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	0.001
MELDR-10	0.0015	0.001	0.003	0.003	0.0016	0.0013	0.0036	0.0042	0.002	0.002	0.003	0.004	0.002	0.001	0.003	0.002
MELDR-11	0.0013	0.002	0.0024	0.002	0.0018	0.002	0.0037	0.0047	0.002	0.002	0.002	0.003	0.002	<0.001	0.002	0.003
MELDR-12	<0.001	<0.001	0.0021	0.005	<0.001	0.0012	0.0012	0.0025	<0.001	0.003	0.004	0.006	0.003	0.002	0.004	0.004

Site	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15	0.002	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001													0.0005
MELDR-05																									0.0005
MELDR-16	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001														0.0005
MELDR-02																									0.0005
MELDR-01																									0.0005
MELDR-13																									0.0025
MELDR-14																									0.0015
MELDR-06																									0.003
MELDR-07																	0.0036				0.0011				0.002
MELDR-08																									0.0005
MELDR-09																									0.0005
MELDR-10																									0.003
MELDR-11																									0.003
MELDR-12																									0.00275

SITES RECORDING As CONC. ALWAYS/GENERALLY ABOVE TRIGGER VALUE
SITES RECORDING As CONC. ALWAYS/GENERALLY BELOW TRIGGER VALUE
Concentration BELOW trigger value
Concentration ABOVE guideline
Highest concentration of the year
Concentration <LOR
NO sample taken

Soluble As (mg/L) ANZECC TV: 0.024 mg/L; NHMRC recreational guideline value: 0.007 mg/L Max 0.0031 Min <0.001 LOR 0.001 or <0.0001 mg/L

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10
MELDR-15																
MELDR-05																
MELDR-16																
MELDR-02																
MELDR-01																
MELDR-13																
MELDR-14																
MELDR-06																
MELDR-07																
MELDR-08																
MELDR-09																
MELDR-10																
MELDR-11																
MELDR-12																

Site	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14
MELDR-15																
MELDR-05																
MELDR-16																
MELDR-02																
MELDR-01																
MELDR-13																
MELDR-14																
MELDR-06																
MELDR-07																
MELDR-08																
MELDR-09																
MELDR-10																
MELDR-11																
MELDR-12																

Site	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-15																									
MELDR-05																									
MELDR-16																									
MELDR-02																									
MELDR-01																									
MELDR-13																									
MELDR-14																									
MELDR-06																									
MELDR-07																	0.0031		0.0026	0.0023	0.0011	0.002	0.0021	0.0025	0.0023
MELDR-08																		0.0009							0.0009
MELDR-09																									
MELDR-10																									
MELDR-11																									
MELDR-12																									

SITES RECORDING As CONC. ALWAYS/GENERALLY ABOVE TRIGGER VALUE
SITES RECORDING As CONC. ALWAYS/GENERALLY BELOW TRIGGER VALUE
Concentration BELOW trigger value
Concentration ABOVE guideline
Highest concentration of the year
Concentration <LOR
NO sample taken

Total Nickel (Ni) (mg/L) LOR 0.001 mg/L
ANZECC unmodified TV for 95% protection 0.0011 mg/L; NHMRC recreational guideline value 0.002 mg/L Max 0.021 Min <0.001

Site	Jul-07	Oct-07	Jan-08	Apr-08	Sep-08	Nov-08	Jan-09	Mar-09	Sep-09	Nov-09	Jan-10	Mar-10	Aug-10	Sep-10	Oct-10	Nov-10
MELDR-04																
MELDR-05	0.001	0.001			<0.001	<0.001	0.002		0.002	<0.001			<0.001	0.001	0.002	<0.001
MELDR-06																
MELDR-07	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-08	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
MELDR-09																
MELDR-10																
MELDR-11	0.008	0.007	<0.001	0.006	0.004	0.004	0.004	0.003	0.004	0.003	0.002	0.002	0.001	0.002	0.002	0.002
MELDR-07	0.021	0.003			0.002	0.002	0.002		0.002	0.002			0.001	0.001	0.001	0.001
MELDR-08	0.004	0.002			<0.001	<0.001			0.003							
MELDR-09	0.001	<0.001			<0.001	0.001	0.002	<0.001	0.002	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001
MELDR-10	<0.001	<0.001			<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001
MELDR-11	<0.001	0.001			<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
MELDR-12	0.003	<0.001			<0.001	0.005	0.001		0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001

Site	Jul-11	Aug-11	Sep-11	Oct-11	Jul-12	Aug-12	Sep-12	Oct-12	Aug-13	Sep-13	Oct-13	Nov-13	Aug-14	Sep-14	Oct-14	Nov-14
MELDR-04														<0.001	0.002	0.001
MELDR-05	0.001	0.004	0.0018	0.001	0.0015	<0.001	<0.001	0.0012	0.001	0.002	0.001	0.001	<0.001	0.001	0.002	<0.001
MELDR-06														<0.001	0.003	0.003
MELDR-07	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	<0.001	0.001	0.001	<0.001
MELDR-08	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
MELDR-09											0.002	0.002	<0.001	0.002	0.002	0.001
MELDR-10											<0.001	0.001	<0.001	0.001	<0.001	<0.001
MELDR-11	0.0015	0.003	0.002	0.002	0.0035	0.0022	0.0014	0.0017	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001
MELDR-07		0.01	0.0021	0.002			0.0031	0.002		0.003	<0.001	0.001	0.001	0.002	0.001	0.002
MELDR-08			0.003	0.002		0.0014	<0.001	<0.001	0.003	0.002	0.001	0.001	0.001	0.002	0.002	0.002
MELDR-09	0.009	0.011	0.0022	0.002	0.0017	0.0014	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	0.001	0.001
MELDR-10	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-11	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MELDR-12	0.011	0.008	<0.001	0.002	0.0033	0.003	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Site	Aug-15	Sep-15	Oct-15	Nov-15	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-04	0.002	0.002	<0.001	0.001	<0.001	<0.001	<0.001	0.002																	0.001
MELDR-05																									0.001
MELDR-06	0.003	0.002	0.001	0.002	0.002	<0.001	<0.001																		0.002
MELDR-07																									0.0005
MELDR-08																									0.0005
MELDR-09																									0.002
MELDR-10																									0.0005
MELDR-11																									0.002
MELDR-07																					0.0014				0.002
MELDR-08																									0.0017
MELDR-09																									0.001
MELDR-10																									0.0005
MELDR-11																									0.0005
MELDR-12																									0.0005

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Highest concentration of the year
Concentration < LOR
NO sample taken

Soluble Nickel (Ni) (mg/L) LOR 0.001 mg/L
ANZECC unmodified TV for 95% protection 0.0011 mg/L; NHMRC recreational guideline value 0.002 mg/L Max 0.001 Min <0.001

Soluble Nickel (Ni) (mg/L)

ANZECC trigger value (unmodified): 0.011 mg/L

Min <0.001
Max 0.001

Site	Jul-16	Aug-16	Sep-16	Oct-16	Jul-17	Aug-17	Sep-17	Oct-17	Jul-18	Aug-18	Sep-18	Oct-18	Jul-19	Aug-19	Sep-19	Oct-19	Jul-20	Aug-20	Sep-20	Oct-20	Median
MELDR-04																					0
MELDR-05																					0
MELDR-06																					0
MELDR-07																	0.0013	0.001	0.001	0.0008	0.001
MELDR-08																					0
MELDR-09																					0
MELDR-10																					0
MELDR-11																					0
MELDR-07																					0
MELDR-08																					0
MELDR-09																					0
MELDR-10																					0
MELDR-11																					0
MELDR-12																					0

SITES RECORDING >60% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING 40-60% OF CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
SITES RECORDING <40% CONCENTRATIONS ABOVE ADJUSTED TRIGGER VALUE
Concentration ABOVE ADJUSTED trigger value
Concentration BELOW ADJUSTED trigger value
Highest concentration of the year
Concentration < LOR
NO sample taken

Appendix H Compilation data tables of sediment parameters tested at each sample site from 2013 - 2020

Table H-1: Metal aluminium (Al), arsenic (As), chromium (Cr), copper (Cu) concentrations (mg/kg) recorded in Melville Bull Creek catchment sites from 2013 to 2020

Aluminium (Al) (total sediment) (mg/kg) LOR 1.0 or 10 mg/Kg

ANZECC trigger value: ND

Max (red) 30,000 Min (blue) 192

Site name	Nov-13	Sep-14	Oct-15	Oct-16	Oct-17	Oct-18	Oct-19	Oct-20
MELDR-05	2,300	1,300	630	5100	3270	6770		11000
MELDR-02	1,400	1,500	2,100	1200	1470	3170	711	1250
MELDR-01	500	1,300	8,200	8100	1300	534	242	527
MELDR-13	360	470	760	30000	1460	3880	426	
MELDR-14	560	460	470	1000	1260	1140	438	
MELDR-06	620	500	640	510	485	540	192	1050
MELDR-07	6,500		2,300	7000	5290	3440	4480	1270
MELDR-08	3,200	2,900	5,000	4600	383	3400	1000	
MELDR-09	1,000	1,000	720	1100	774	692	244	537
MELDR-10	1,100	1,500	2,200	6500				1140
MELDR-11	1,100		2,900	1900	2420	2860	2910	3580
MELDR-12	2,200	820	1,000	720	938	537	1790	1080

Highest concentration of the year
Lowest concentration of the year

Arsenic (As) (total sediment) (mg/kg) LORs 0.1, 0.2 or 0.5 mg/kg

ANZECC low TV: 20 mg/kg, high TV: 70 mg/Kg

Max (red) 20 Min (blue) <0.2

Site name	Nov-13	Sep-14	Oct-15	Oct-16	Oct-17	Oct-18	Oct-19	Oct-20
MELDR-05	0.8	<0.5	<0.5	1.9	0.8	4.4		4.3
MELDR-02	<0.5	<0.5	0.6	<0.5	0.4	0.7	0.4	0.5
MELDR-01	<0.5	0.8	2.6	4.1	0.6	0.4	0.2	0.3
MELDR-13	0.7	0.8	<0.5	0.7	0.6	2.2	0.9	
MELDR-14	<0.5	<0.5	<0.5	0.6	0.6	0.7	0.7	
MELDR-06	1.4	0.7	<0.5	<0.5	0.4	0.7	0.6	3.5
MELDR-07	18		20	7.1	4.9	2.6	9	0.3
MELDR-08	1.4	0.8	1.4	1.5	0.1	1.2	0.4	
MELDR-09	<0.5	<0.5	<0.5	<0.5	0.1	0.2	<0.2	0.2
MELDR-10	1.1	1.3	1.4	5.1		2.5		1.4
MELDR-11	1		2.8	2.5	1.4	2.5	3.1	2.5
MELDR-12	1.4	<0.5	0.7	<0.5	1.7	0.6	0.8	0.7

Record >LOW Trigger Talue	Concentration < LOR
Record >HIGH Trigger Value	NO sample taken
Record <LOW Trigger Value	

Chromium (Cr) (total sediment) (mg/kg)					LOR 0.05 or 0.5 mg/kg			
ANZECC lower TV: 80 mg/kg, higher TV: 370 mg/kg					Max (red) 180		Min (blue) 0.36	
Site name	**Nov-13**	**Sep-14**	**Oct-15**	**Oct-16**	**Oct-17**	**Oct-18**	**Oct-19**	**Oct-20**
MELDR-05	12	4.3	2	18	8	16		29
MELDR-02	3.3	3.4	4.2	11.0	2.2	4.8	2.3	2.6
MELDR-01	0.9	3.1	12	11	1.9	0.72	0.36	0.9
MELDR-13	1	1.5	1.7	180.0	2.4	7.2	1.5	
MELDR-14	1.7	1.3	1.3	1.2	2.3	2.6	1.4	
MELDR-06	2.1	2.5	1.6	1.2	0.88	1	0.86	3.6
MELDR-07	64		72	35	26	15	19	2.5
MELDR-08	9.4	6.5	12	10	1	5.2	1.9	
MELDR-09	2.8	1.7	1.5	1.6	0.96	1.2	0.94	1.7
MELDR-10	3.6	3.9	4.6	23.0				3.3
MELDR-11	4.4		5	3	4.2	4.2	5.4	6.1
MELDR-12	11	2.1	4.7	2.0	5.9	2.4	4.4	3.4

Record >LOW Trigger Talue	Concentration < LOR
Record >HIGH Trigger Value	NO sample taken
Record <LOW Trigger Value	

Copper (Cu) (total sediment) (mg/kg)				Max (red) 250		Min (blue) <0.5		
ANZECC lower TV: 65 mg/kg, higher TV: 270 mg/kg					All data in blue were <0.5 (LOR)			
Site name	**Nov-13**	**Sep-14**	**Oct-15**	**Oct-16**	**Oct-17**	**Oct-18**	**Oct-19**	**Oct-20**
MELDR-05	20	11	4.3	50.0	16.0	33.0		61.0
MELDR-02	7.9	3.6	7.0	16.0	3.3	4.8	2.1	3.3
MELDR-01	<0.5	4.2	1.3	2.4	0.8	0.6	<0.5	0.7
MELDR-13	<0.5	0.7	<0.5	95.0	0.9	4.3	1.6	
MELDR-14	<0.5	0.8	0.8	<0.5	<0.5	1.6	1.1	
MELDR-06	0.9	2.1	0.5	<0.5	<0.5	<0.5	0.7	2.5
MELDR-07	38		250.0	28.0	12.0	12.0	30.0	0.5
MELDR-08	13	10	16.0	14.0	<0.5	3.3	1.8	
MELDR-09	<0.5	0.7	1.2	1.2	<0.5	1.1	0.8	1.7
MELDR-10	4.9	8	7.3	72.0				2.7
MELDR-11	2.6		1.3	1.0	3.9	6.3	11.0	2.3
MELDR-12	11	3.2	4.2	1.2	6.0	2.1	6.5	3.0

Record >LOW Trigger Talue	Concentration < LOR
Record >HIGH Trigger Value	NO sample taken
Record <LOW Trigger Value	

Table H-2: Metal (iron (Fe), lead (Pb), mercury (Hg), nickel (Ni) concentrations (mg/kg) recorded in Melville Bull Creek catchment sites from 2013 to 2020

Iron (Fe) (total sediment) (mg/kg)						LOR 1.0 or 5.0 mg/Kg		
ANZECC trigger value: ND					Max (red) 57,000		Min (blue) 85	
Site name	**Nov-13**	**Sep-14**	**Oct-15**	**Oct-16**	**Oct-17**	**Oct-18**	**Oct-19**	**Oct-20**
MELDR-05	6,200	3,400	1,700	7,000	3,500	24,000		21,000
MELDR-02	3,000	3,500	4,000	1,400	2,700	4,200	1,300	1,900
MELDR-01	810	3,700	56,000	57,000	1,700	710	400	550
MELDR-13	1,800	2,700	760	54,000	1,400	6,300	1,100	
MELDR-14	650	560	620	1,700	800	1,300	900	
MELDR-06	3,400	2,500	1,200	730	590	720	690	4,600
MELDR-07	17,000		17,000	13,000	8,200	10,000	13,000	910
MELDR-08	2,100	1,500	2,100	1,800	310	1,400	340	
MELDR-09	85	170	350	180	180	230	130	250
MELDR-10	3,300	3,900	3,600	11,000				1,800
MELDR-11	1,100		3,000	1,700	1,500	1,800	2,600	2,100
MELDR-12	3,700	880	1,400	850	1,400	2,500	1,300	940

Highest concentration of the year		Concentration < LOR
Lowest concentration of the year		NO sample taken

Lead (Pb)(total sediment) (mg/kg) Max (red) 220 Min (blue) 1.1

ANZECC low TV: 50 mg/kg, high TV: 220 mg/kg LOR 0.05

Site number	Nov-13	Sep-14	Oct-15	Oct-16	Oct-17	Oct-18	Oct-19	Oct-20
MELDR-05	220	80	14	130	52	60		91
MELDR-02	8.6	4.5	20	8.5	5.5	6.3	4	5.8
MELDR-01	4.2	29	9.6	14	6.8	4.6	1.9	3.8
MELDR-13	2.3	21	2.1	170	4.3	21	3.9	
MELDR-14	7.4	8.3	9.2	3.5	4.5	9.3	10	
MELDR-06	6.5	5.5	2.2	1.2	1.1	1.3	1.2	4.5
MELDR-07	120		50	56	66	80	170	2
MELDR-08	44	36	66	50	4.4	26	8.6	
MELDR-09	1.7	2.9	7.7	3.5	1.8	7.1	2.9	5.4
MELDR-10	48	54	54	200				17
MELDR-11	19		8.6	5.7	33	23	44	9
MELDR-12	150	12	59	15	19	13	20	20

Record >LOW Trigger Talue	Concentration < LOR
Record >HIGH Trigger Value	NO sample taken
Record <LOW Trigger Value	

Mercury (Hg) (total sediment) (mg/kg) Max (red) 0.2 Min (blue) <0.02

ANZECC low TV: 0.15 mg/kg, high TV: 1.0 mg/kg data in blue were <0.02 or <0.1 (LORs)

Site name	Nov-13	Sep-14	Oct-15	Oct-16	Oct-17	Oct-18	Oct-19	Oct-20
MELDR-05	<0.1	<0.1	<0.1	0.1	<0.02	<0.02		0.1
MELDR-02	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.02	<0.02
MELDR-01	<0.1	<0.1	<0.1	0.1	<0.02	<0.02	<0.02	<0.02
MELDR-13	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.02	
MELDR-14	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.02	
MELDR-06	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.02	<0.02
MELDR-07	<0.1		0.1	0.2	0.03	0.05	0.05	<0.02
MELDR-08	<0.1	<0.1	0.1	0.1	<0.02	0.04	<0.02	
MELDR-09	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.02	<0.02
MELDR-10	<0.1	<0.1	<0.1	0.1				<0.02
MELDR-11	<0.1		<0.1	<0.1	<0.02	<0.02	<0.02	<0.02
MELDR-12	<0.1	<0.1	<0.1	<0.1	<0.02	<0.02	<0.02	<0.02

Record >LOW Trigger Talue	Concentration < LOR
Record >HIGH Trigger Value	NO sample taken
Record <LOW Trigger Value	

Nickel (Ni) (total sediment) (mg/kg) All data in blue were <0.1 or <1.0 (LORs)

ANZECC low TV:21 mg/kg, high TV: 52 mg/kg Max (red) 31.0 Min (blue) <0.1

Site number	Nov-13	Sep-14	Oct-15	Oct-16	Oct-17	Oct-18	Oct-19	Oct-20
MELDR-05	2.9	1.4	<1.0	5.5	2.4	4.1		9.9
MELDR-02	1.2	1.8	2.1	<1.0	0.7	1.3	0.8	1.4
MELDR-01	<1.0	1.3	1.8	1.6	0.5	<0.1	0.2	0.4
MELDR-13	<1.0	<1.0	<1.0	21	1	5	0.7	
MELDR-14	<1.0	<1.0	<1.0	<1.0	0.4	0.4	0.4	
MELDR-06	<1.0	<1.0	<1.0	<1.0	0.2	<0.1	0.2	1
MELDR-07	8.2		31	7.6	4.2	2.9	6	0.5
MELDR-08	4.8	2.7	5.5	5.1	0.5	1.7	0.9	
MELDR-09	<1.0	<1.0	<1.0	<1.0	<0.1	0.2	0.5	0.8
MELDR-10	1.6	1.8	2.2	8.2				0.9
MELDR-11	1.3		1.2	<1.0	1.2	1.5	2.3	1.5
MELDR-12	2.3	<1.0	<1.0	<1.0	0.8	0.4	1.5	0.9

Record >LOW Trigger Talue	Concentration < LOR
Record >HIGH Trigger Value	NO sample taken
Record <LOW Trigger Value	

Table H-3: Metal (selenium (Se) and zinc (Zn)) concentrations (mg/kg) recorded in Melville Bull Creek catchment sites from 2013 to 2020

Selenium (Se) (total sediment) (mg/kg) All data in blue <0.05 or <1.0 mg/Kg (LORs)

ANZECC trigger value: ND Max (red) 2.9 Min (blue) <0.05

Site name	Nov-13	Sep-14	Oct-15	Oct-16	Oct-17	Oct-18	Oct-19	Oct-20
MELDR-05	<1.0	<1.0	<1.0	<1.0	0.14	0.31		1
MELDR-02	<1.0	<1.0	<1.0	<1.0	<0.05	<0.05	<0.05	<0.05
MELDR-01	<1.0	<1.0	<1.0	1.1	<0.05	<0.05	<0.05	<0.05
MELDR-13	<1.0	<1.0	<1.0	<1.0	<0.05	0.07	<0.05	
MELDR-14	<1.0	<1.0	<1.0	<1.0	<0.05	<0.05	<0.05	
MELDR-06	<1.0	<1.0	<1.0	<1.0	<0.05	<0.05	<0.05	0.14
MELDR-07	2.8		1.3	2.9	1.3	0.98	0.48	<0.05
MELDR-08	<1.0	<1.0	<1.0	<1.0	<0.05	0.23	0.1	
MELDR-09	<1.0	<1.0	<1.0	<1.0	<0.05	<0.05	<0.05	0.09
MELDR-10	<1.0	<1.0	<1.0	<1.0				<0.05
MELDR-11	<1.0		<1.0	<1.0	0.1	0.09	0.12	0.17
MELDR-12	<1.0	<1.0	<1.0	<1.0	<0.05	<0.05	0.1	0.06

Highest concentration of the year
Lowest concentration of the year

Zinc (Zn) (total sediment) (mg/kg) All data in blue <0.25 or <1.0 mg/Kg (LORs)

ANZECC low TV:200 mg/kg, high TV: 410 mg/kg Max (red) 390 Min (blue) <0.25

Site number	Nov-13	Sep-14	Oct-15	Oct-16	Oct-17	Oct-18	Oct-19	Oct-20
MELDR-05	49	24	20	120	58	150		180
MELDR-02	26	15	49	19	7.2	22	15	30
MELDR-01	3.7	22	18	35	5.6	4.5	2.7	5.5
MELDR-13	13	27	6.8	390	5.7	26	12	
MELDR-14	6.1	6.4	9.4	5.5	3.9	11	18	
MELDR-06	14	22	4.4	4.2	3.1	4.7	6.5	33
MELDR-07	95		120	57	42	51	29	2.5
MELDR-08	34	25	39	49	<0.25	11	4.8	
MELDR-09	1.0	<1.0	3.7	1.4	<0.25	3.6	3.7	7.2
MELDR-10	30	39	48	320				26
MELDR-11	17		13	16	23	44	78	16
MELDR-12	37	9.9	13	5.6	21	12	19	10

Record >LOW Trigger Value
Record >HIGH Trigger Value
Record <LOW Trigger Value
Concentration < LOR
NO sample taken