



EPL298 Monitoring Report

Katherine Waste Management Facility

Reporting period 1 July 2021 – 30 June 2022

Prepared for: Katherine Town Council



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Appendices

Appendix A	Historical data
Appendix B	Monthly operational checklist (September to December 2021)

ACRONYMS

AHD	Australian Height Datum
Al	Aluminium
BOD	Biological Oxygen Demand
BOM	Bureau Of Meteorology
BTEXN	Benzene, Toluene, Ethylbenzene, Xylene, Naphthalene
Ca	Calcium
CaCO₃	Alkalinity
Cd	Cadmium
Cl	Chloride
COD	Chemical Oxygen Demand
Cr III	Trivalent chromium
Cr VI	Hexavalent chromium
Cu	Copper
EMP	Environmental Management Plan
EPL	Environment Protection Licence
Fe	Iron
HSL	Health Screening Levels for Petroleum Hydrocarbons
K	Potassium
KTC	Katherine Town Council
KWMF	Katherine Waste Management Facility
Mg	Magnesium
Mn	Manganese
MTBE	Methyl Tert-Butyl Ether
NO₃	Nitrate (as N)
Na	Sodium
NATA	National Association of Testing Authorities
NEMP	National Environmental Management Plan (PFAS)
NEPM	National Environment (Assessment of Site Contamination) Protection Measure
NH₄	Ammonium
Ni	Nickel
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
Pb	Lead
PFAS	Per- And Polyfluoroalkyl Substances
Se	Selenium
SO₄	Sulfate
SWL	Standing Water Level
TDS	Total Dissolved Solids
TN	Total Nitrogen
TOC	Total Organic Carbon / Top of Casing
TP	Total Phosphorus

TRH/TPH	Total Recoverable Hydrocarbons / Total Petroleum Hydrocarbons
VFA	Volatile Acids as Acetic Acid
VOC	Volatile Organic Compounds
WMPC Act	<i>Waste Management and Pollution Control Act</i>
Zn	Zinc

1 INTRODUCTION

The Katherine Waste Management Facility (KWMF) is a municipal waste resource recovery and disposal site operated by Katherine Town Council (KTC). The facility is located approximately 7 km south of Katherine town centre within NT Portion 5043, on Novis Quarry Road (Figure 1-1). KWMF provides services to domestic and commercial customers in the Katherine area.

The current Environment Protection Licence (EPL) covering the KWMF (i.e. EPL298), was issued by the Northern Territory Environment Protection Authority (NT EPA) to KTC on 4 March 2020 (expires 3 August 2022). EPL298 licences KTC to store, treat and dispose of materials at the KWMF, which are classified as 'listed wastes' under the Northern Territory *Waste Management and Pollution Control Act*.

1.1 Purpose and scope

This Monitoring Report is required as per EPL298 conditions 64, 65 and 66, as reproduced below:

64. The licensee must complete and provide to the NT EPA a Monitoring Report, as prescribed by this licence, and in accordance with the timeframe and reporting period specified in Table 3 [in EPL298]

65. The licensee must ensure that each Monitoring Report is prepared in consultation with a qualified professional and:

65.1 is prepared in accordance with the requirements of the NT EPA 'Guideline for Reporting on Environmental Monitoring'

65.2 includes a tabulation of all monitoring data required as a condition of this licence;

65.3 includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the activity, including potential impacts on beneficial uses of groundwater, over a minimum period of three years (where the data is available);

65.4 includes an assessment of environmental impact from the activity;

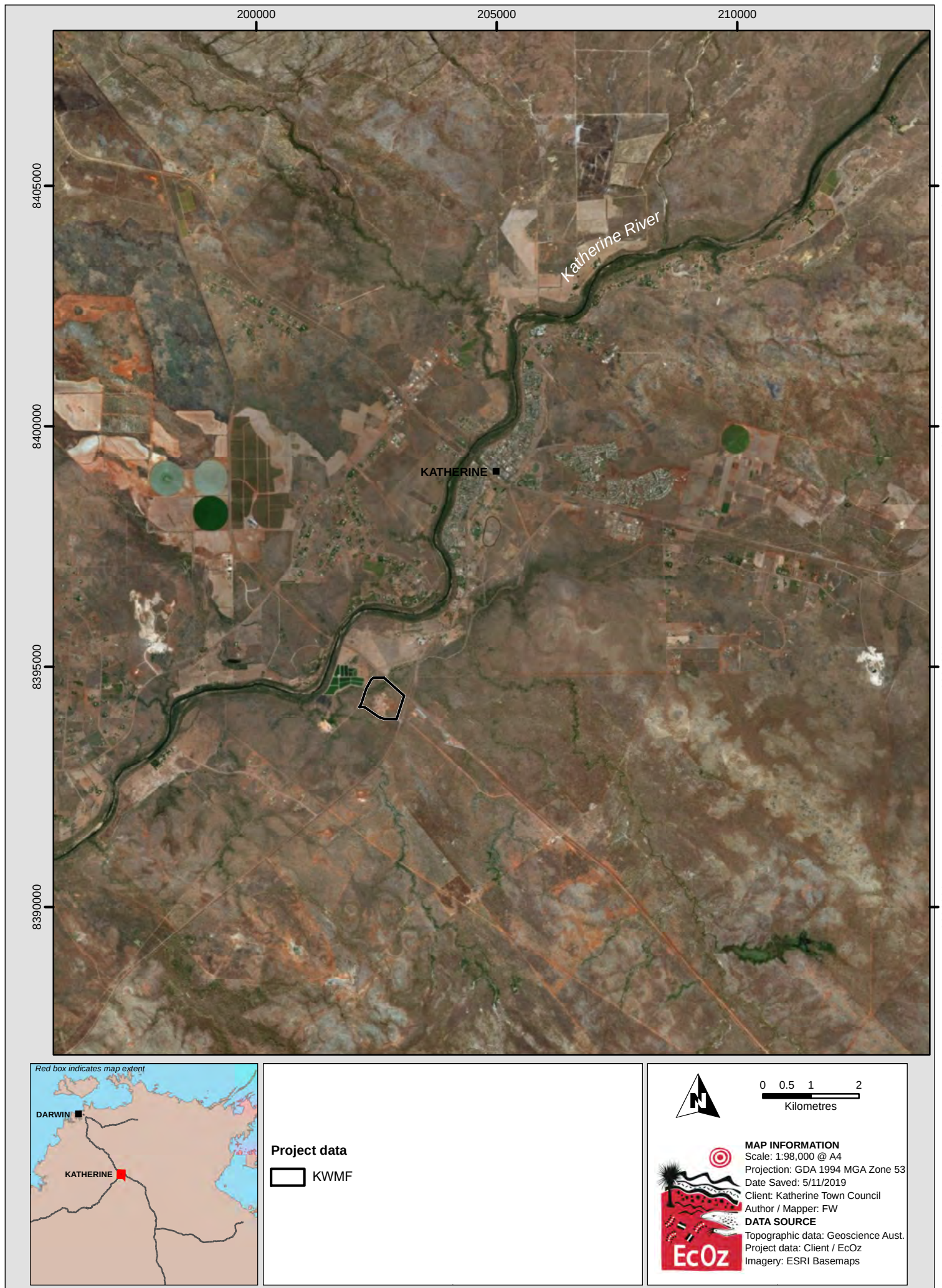
65.5 includes a review of performance against the measures specified in Document Number 1 of Table 2 [in EPL298];

65.6 incorporates a progress report, that includes implementation and completion dates, on all recommendations specified in Document Number 2 of Table 2 [in EPL298]; and

65.7 includes a copy of the qualified professional's endorsement.

66. The licensee must ensure that the Annual Return and the Monitoring Report are submitted to the NT EPA in accordance with the timeframes specified in Table 3 [in EPL298]

Table 3 in EPL298 specifies the Monitoring Report covering the reporting period starting 1 July 2021 and ending 30 June 2022 is due 30 July 2022. This Monitoring Report applies to this reporting period.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ19181 - KTC EPL Update and EMP\01 Project Files\Figure 2-1 Map showing site layout and infrastructure.mxd

Figure 1-1. KWMF location

2 LANDFILL OPERATIONS OVERVIEW

KTC manage operations at KWMF, and contractors manage kerbside collection.

The KWMF accepts and disposes of general waste from domestic and commercial users and is currently licenced to accept asbestos and tyres (listed wastes) for disposal.

The KWMF also accepts the following materials for landfill or subsequent resource recovery and disposal by contractors at external facilities:

- Chemical drums (only empty and triple washed containers accepted for DrumMuster)
- Tyres (whole or shredded)
- Metal
- Green waste
- Batteries
- Waste oil
- Empty gas bottles
- Animal carcasses
- E-waste

The KWMF layout is shown in Figure 2-1. The area method of landfilling (as depicted in Figure 2-2) is used at KWMF whereby, waste is disposed of at an active tip face and is then compacted in a mound above ground (as opposed to trench filling below ground). All landfilling activities occur over the existing landfill that has been in operation since the 1980's.

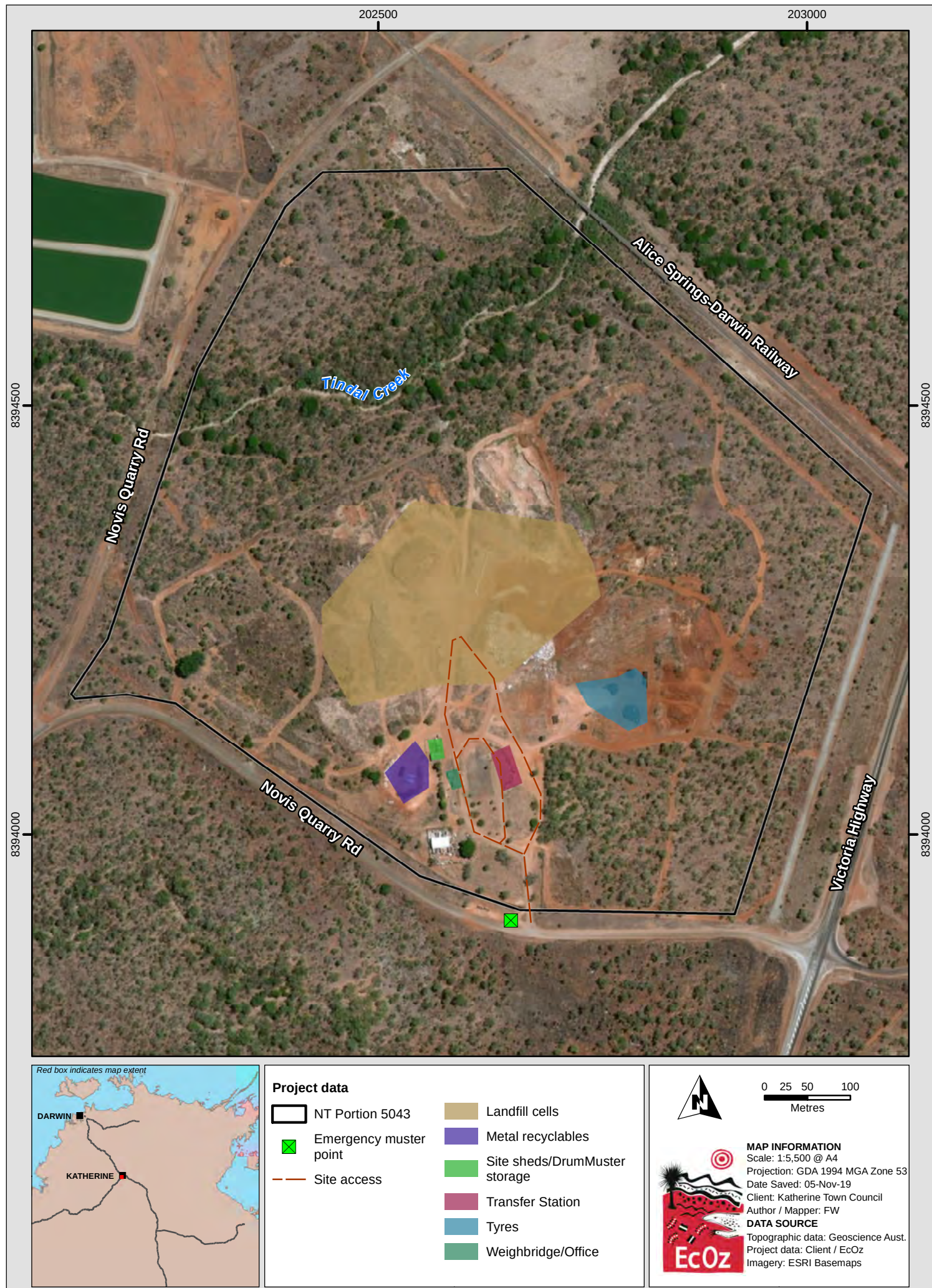
Each day, the waste is covered with daily cover, which is generally spoil material extracted from site or clean fill material accepted at the facility. Daily cover is applied at a minimum thickness of 150 mm, most of which can be retrieved on the following day prior to new waste disposal.

As the active tip area moves progressively along the existing landform (building up the height), the waste disposal areas are covered with a 300 mm intermediate layer of cover material to minimise rainfall infiltration. Final capping layers and rehabilitation are discussed in the GHD (2019) report *Katherine Town Council, Waste Management Facility Closure Plan, Stage 2 Report - Landfill Gas Risk Assessment and Hydrogeological Assessment*.

As landfill operations have been occurring on the site since the 1980's, it is unlikely an engineered liner has been installed beneath the landfill and there is currently no leachate recovery system.

In accordance with the *WMPC Act*, any lateral expansion of the landfill beyond the current footprint will require an Environment Protection Approval. The approval will factor in design considerations detailed in the *Guidelines for the Siting, Design and Management of Solid Waste Disposal Sites in the Northern Territory* (NT EPA 2013) and construction is required to undergo a rigorous quality assurance process. At the present time, there is no intention to expand the current landfill site and the site has been earmarked for closure and rehabilitation.

KTC is required to complete siting, approvals, design, and construction of a new landfill at an alternative site prior to closure of the existing KWMF. Discussions held in 2018 determined that the end of the 2025/2026 financial year may be an achievable timeframe to work towards.



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\EZ19181 - KTC EPL Update and EMP\01 Project Files\Figure 2-1 Map showing site layout and infrastructure.mxd

Figure 2-1. Map of KWMF layout and infrastructure

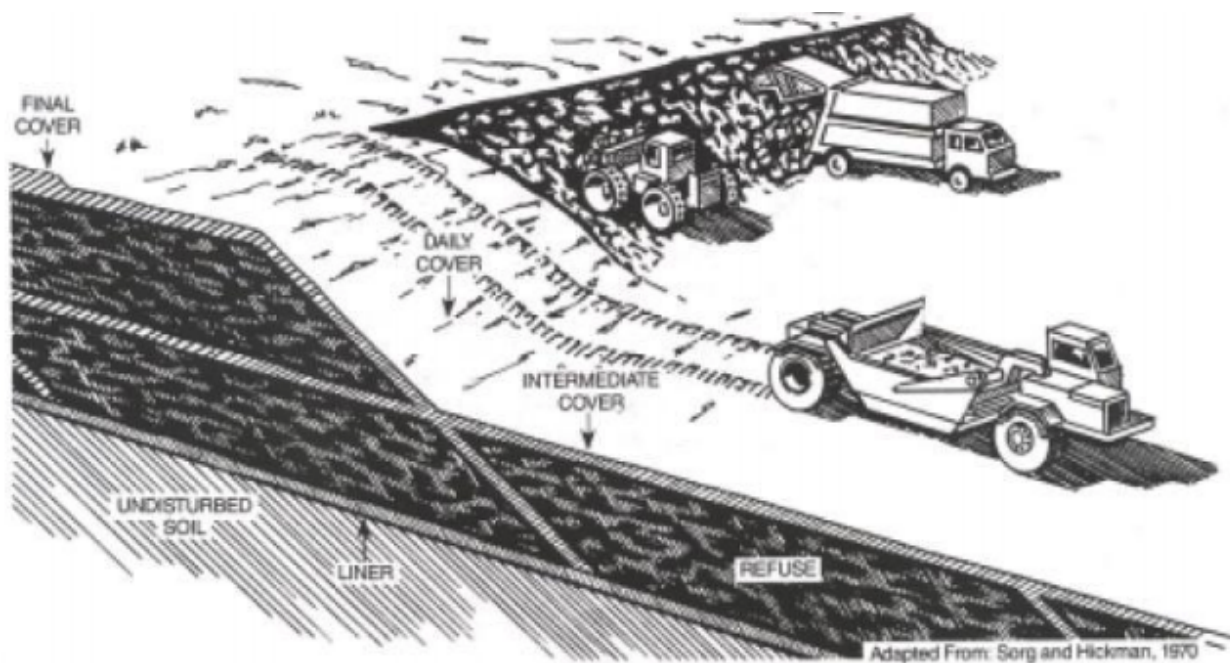


Figure 2-2. Area method of landfilling (taken from NT EPA 2013)

3 ENVIRONMENTAL SETTING

3.1 Climate

Katherine has a tropical savannah climate with distinct wet and dry seasons. The wet season typically occurs from November to April, and the dry season from May to October (see Figure 3-1). The average annual rainfall for Katherine is 967 mm (taken from Bureau of Meteorology Katherine Council station No. 014902). The driest months are June, July and August, which all have mean monthly rainfall totals of less than 2 mm. The wettest months are December, January and February, with mean monthly rainfall totals of between 198 mm and 237 mm.

The hottest months are September, October, November and December, with mean maximum temperatures between 36°C and 38°C. The coolest months are June, July and August, with mean minimum temperatures between 14°C and 15°C.

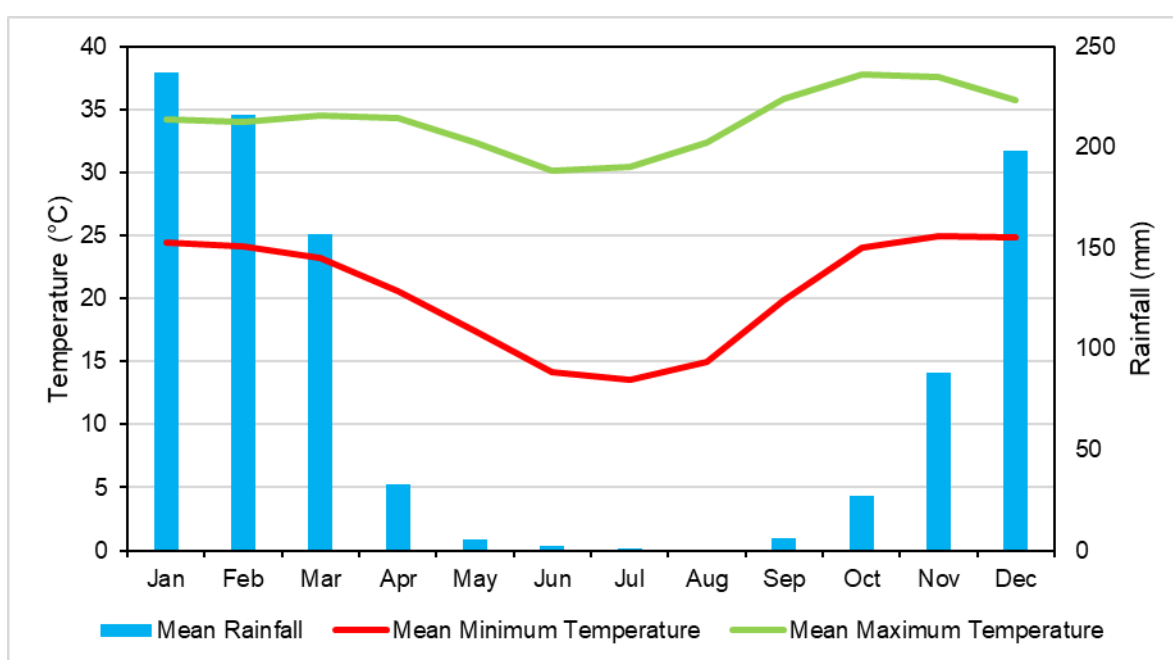


Figure 3-1. Average climate data for Katherine (taken from BoM station ID 014902)

3.1.1 Rainfall during the reporting period

During the reporting period (July 2021 and June 2022), rainfall was well below the annual average (967 mm), with a total of 686 mm. Annual rainfall during the reporting period was also much lower than that recorded between July 2020 to June 2021 (1,207 mm).

As shown in Figure 3-2, most of the rain occurred during the wet season months November to March. January and June were particularly wet; January recorded 337 mm (compared to the average 237 mm) and June recorded 35 mm (compared to the average 2 mm). Rainfall between December, February and March was particularly below the average for these months (above 157 mm), with monthly records below 56 mm.

No rain occurred between July and September 2021 and April and May 2022.

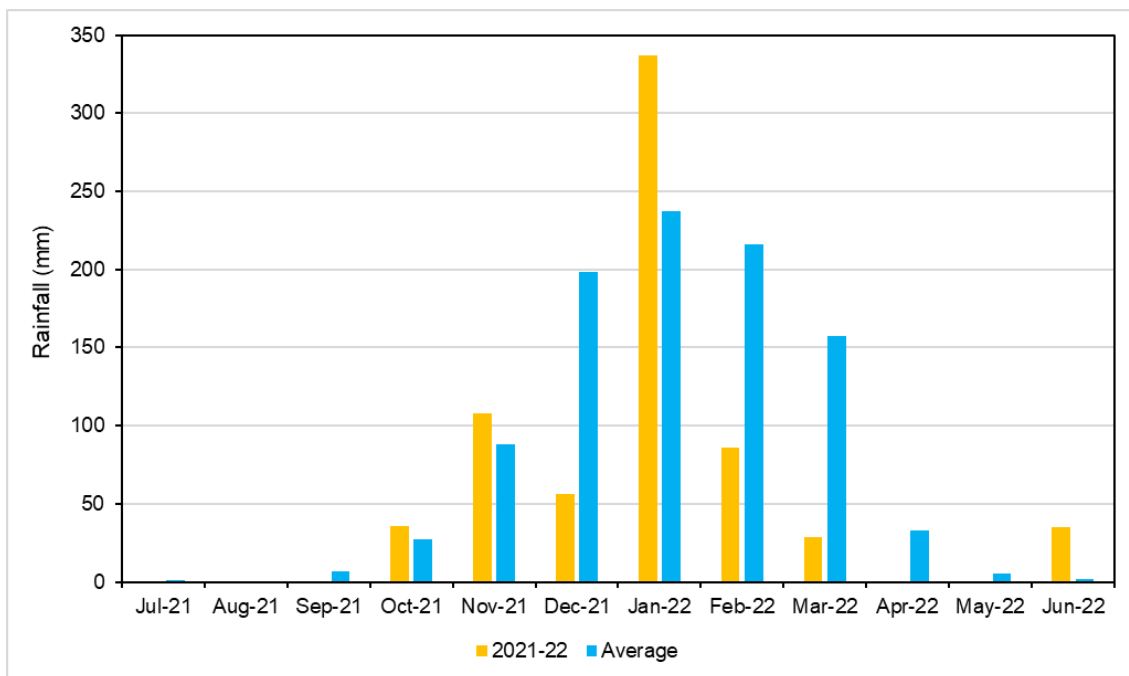


Figure 3-2. Monthly and average rainfall during the reporting period (taken from BoM station ID 014902)

3.2 Topography and landform

The KWMF is on almost-level terrain; very gently sloping towards the northwest. The elevation change is only six metres (not including landfill mounds) starting at 108 mAHD in the south-east, falling to 102 mAHD in the north-west.

Land unit mapping by Howe (2006) indicates that there are three land units within the site (3a, 3b and 7e), and two landforms. The landform is mostly plains, with a small area of drainage system.

Land unit 3b covers most of the site, and is described as very gentle undulating terrain; slopes less than 2%; scattered limestone pavement or rock outcrop.

Land unit 3a is present on the eastern side of the site, and is described as gentle slopes or undulating and dissected terrain; slopes to 2%; severe limestone and sandstone pavement and outcrop.

Land unit 7e is only present along the north-western side of the site associated with Tindal Creek, and is described as major creeks and severely gullied tributaries; includes permanent and ephemeral waters, with poorly drained soils.

3.3 Surface water

The KWMF is approximately 1 km east of the Katherine River and lies within the Katherine River flood plain. Tindal Creek flows in a northeast to southwest direction across the northern part of the site (see Figure 2-1) and surface water runoff from most of the KWMF area flows in a north-westerly direction, towards this creek.

Tindal Creek has a catchment area of 173 km², most of which is upstream of the KWMF. This catchment includes most of the township of Katherine, as well as wide mix of industries, and areas used for horticulture and cattle grazing. The RAAF Base Tindal is also within the catchment and is a known contamination source of per- and polyfluoroalkyl substances (PFAS); see the *Department of Defence, RAAF Base Tindal, Supplementary Detailed Site Investigation Report* (Coffey 2018).

Tindal Creek is ephemeral and typically only flows during the wet season. In its upper reaches, the creek is fed by surface water from bushland and scrubland, but becomes groundwater-fed in the wet season from Uralla through to the southern edge of Katherine.

South of the KWMF, a tributary of Tindal Creek flows from east to west and joins Tindal Creek approximately 650 m south-west of the site, which then flows into the Katherine River approximately 2 km downstream from KWMF (following the bends of the creek channel).

Flood modelling of the Katherine region (see NRETA 2006) indicates that during a 1 in 20-year flood event, the northern third of the KWMF, along Tindal Creek, would be flooded i.e under at least 2 m of water. During a 1 in 50-year event, the northern half of the site would be flooded, and during a 1 in 100-year event, most of the site would be flooded.

3.4 Geology and groundwater

The KWMF is underlain by rocks of the Daly River Group; namely the middle Cambrian-age Jinduckin Formation, which is predominantly dolomitic siltstone, with interbeds of dolostone and sandstone. Simplified geological sequences recorded at or close to the site (GHD 2019) generally comprise:

- Clay materials to depths up to 3 m
- Limestone (dolomitic) from 3 to 30 m
- Mudstone (siltstone) from 30 to 60 m
- Fractured limestone from 60 to 80 m

The Jinduckin Formation comprises the dolomitic limestone and mudstone/siltstone sequences to 60 m depth, and the fractured limestone at depths greater than 60 m is the Tindall Limestone.

The Tindall Limestone Aquifer is a highly productive and important water resource for the Katherine region (see the *Katherine Tindall Limestone Aquifer Water Allocation Plan 2019-2024*, DENR 2019). The Tindall Limestone Aquifer is used for the Katherine Township water supply, domestic supply for many rural properties, and supports the region's agricultural and other industries. The Tindall Limestone Aquifer also provides base flow to the Katherine River through springs and seepage along the riverbanks, and is responsible for the river maintaining steady flow throughout the dry season.

In the area of KWMF, and elsewhere where the Jinduckin Formation occurs, this Formation acts as a confining layer and prevents recharge to the Tindall Limestone Aquifer (see Figure 3-3). Recharge to the Tindall Aquifer only occurs in areas where it is in direct contact with the ground surface. These areas are described as 'unconfined' in Figure 3-3 and do not include the KWMF. Similarly, discharge to the Katherine River through springs and seepage from the Tindall Aquifer only occur where the river crosses the unconfined Tindall Aquifer. These sections of river occur upstream of the KWMF, but do not occur at the section nearest the KWMF (Figure 3-3).

Groundwater bores drilled into the Tindall Limestone Aquifer have yields of typically 50 L/s or more and good water quality. Whereas bores drilled into the Jinduckin Formation have yields of typically less than 5 L/s, sometimes up to 10 L/s, with poor water quality (excessive salinity).

Bore RN040476 located around 670 m north-east and up-gradient of the KWMF, was installed in 2017 as part of a network of bores to investigate the extent of PFAS contamination extending from RAAF Base Tindal; see Coffey (2018). This bore has a depth of 20 m and groundwater levels monitored in this bore vary seasonally by around 5.2 m, from 3.4 mBGL during the mid-wet season, to 8.6 mBGL at the end of the dry season.

PFAS concentrations measured by Coffey (2018) in this bore range from <0.01 µg/L up to 0.02 µg/L for PFOS+PFHxS. This is below the *PFAS National Environmental Management Plan* (NEMP) drinking water guideline of 0.07 µg/L (HEPA 2020). Given this shallow bore is in the Jinduckin Formation, and groundwater transport of PFAS from RAAF Base Tindal to the Katherine River is through the Tindall Aquifer, these PFAS concentrations are likely derived from surface water groundwater interaction, where the Katherine River is

recharging the Jinduckin aquifer. PFOS concentrations in the Katherine River can at times be above the PFAS NEMP freshwater ecosystem 95% species protection guideline value of 0.13 µg/L.

At a regional scale, groundwater hydraulic gradients fall towards the Katherine River. Standing water levels measured in bores within the KWMF are generally around 10 mBGL, and the differences in levels between these bores show that on-site groundwater gradients generally fall towards central landfilled areas from the northern, eastern and southern site boundaries, before discharging from the site in a northwest direction, towards Tindal Creek and the Katherine River (GHD 2019).

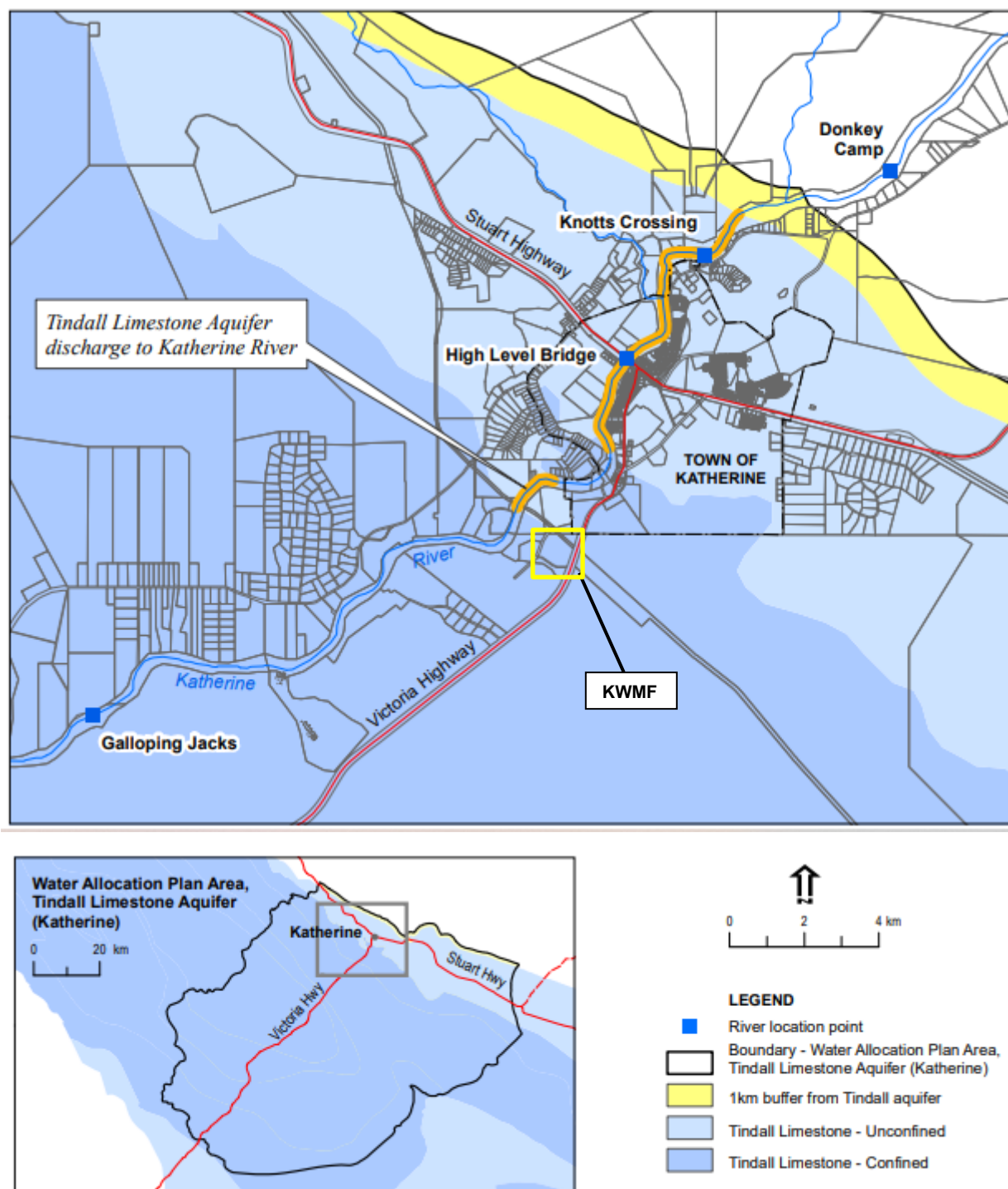


Figure 3-3. Discharge zones into the Katherine River, taken from NRETAS (2009)

4 MONITORING UNDERTAKEN

4.1 Monitoring sites

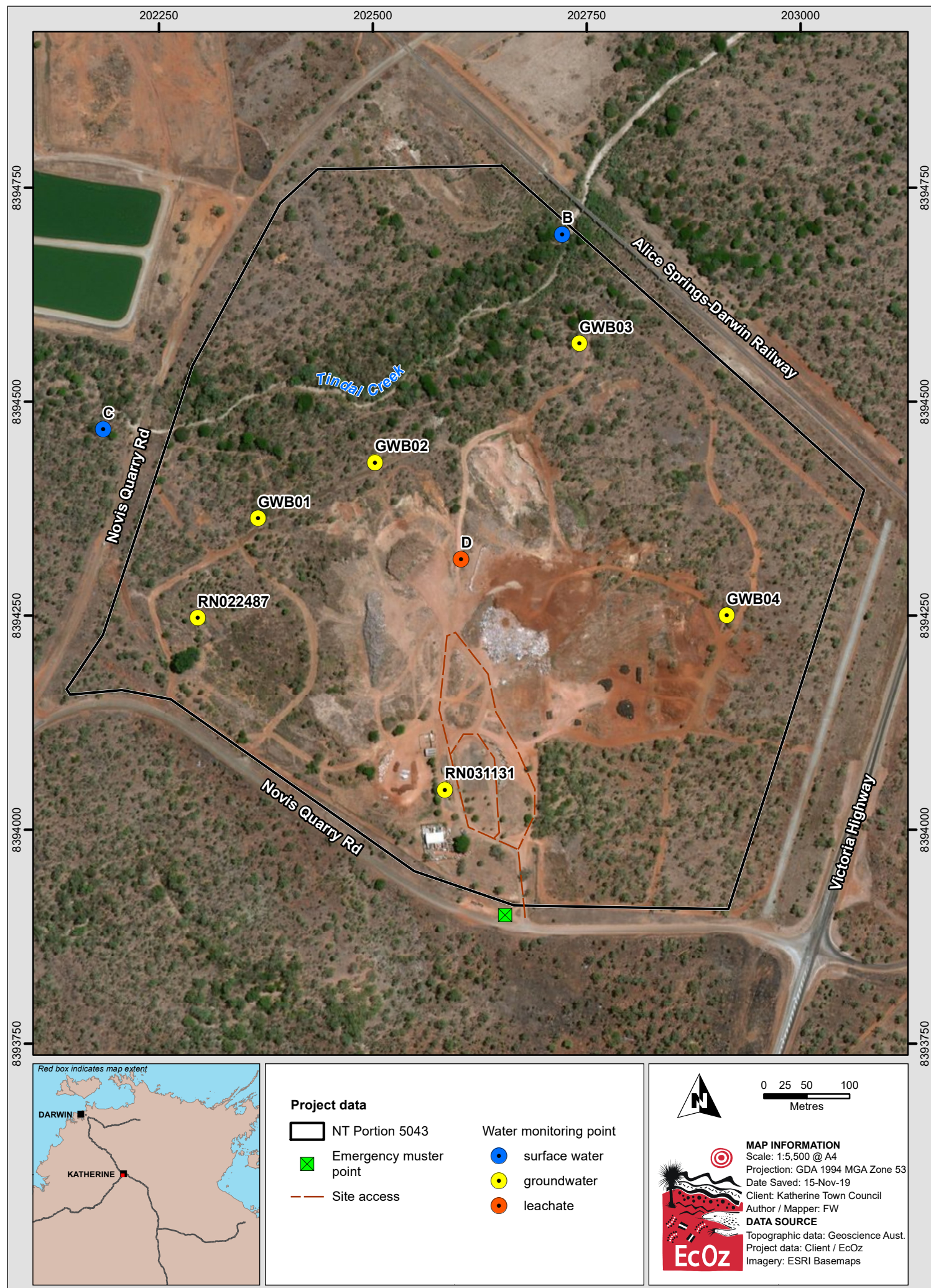
Surface water and groundwater monitoring sites are detailed in Table 4-1 and Table 4-2 respectively and shown in Figure 4-1.

Table 4-1. Surface water monitoring site details

Site Name	GPS Location	Purpose	Type
B	-14.5044°S, 132.242°E	Tindal Creek at railway crossing - upstream of the landfill and any leachate impacts	Surface water
C	-14.5064°S, 132.237°E	Tindal Creek - at Novis Quarry Rd bridge crossing – downstream of the landfill and any potential landfill impacts - this is the EPL298 compliance point where trigger values apply	Surface water
D	Active tip face	Determine quality of leachate source water	Leachate

Table 4-2. Groundwater monitoring bore details

Site Name	GPS Location	Purpose	Screened depth (mBGL)	General lithology
GWA (RN031131)	- 14.5103°S, 132.241°E	Water supply (and now also monitoring) installed in 1997 - located upgradient of the landfill	26.3 – 33 m in Jinduckin Formation	Clay, limestone
GWE (RN022487)	- 14.5084°S, 132.238°E	Water supply (and now monitoring) bore installed in 1983 – located upgradient of the landfill	Screened 16-23 m in Jinduckin Formation Open hole 28-80 m in Tindall Limestone from 57 m+	Siltstone, limestone, mudstone, limestone and fractures
GWB01	- 14.5057°S, 132.239°E	Monitoring bores installed by GHD in 2018 – located downgradient of the landfill	6.4-12.4 m in Jinduckin Formation	Clayey silt, silty clay, silty siltstone, silty sand, sand, sandy gravel
GWB02	- 14.5068°S, 132.240°E		8.0-17.0 m in Jinduckin Formation	Clay, clayey phyllite, sand, clayey phyllite, phyllite, siltstone
GWB03	- 14.5055°S, 132.242°E	Monitoring bore installed by GHD in 2018 – located upgradient of the landfill	5.6-10.1 m in Jinduckin Formation	Topsoil, silty clay, clay, clayey phyllite, phyllite, siltstone
GWB04	- 14.5084°S, 132.244°E		8.0-17.0 m in Jinduckin Formation	Silty clay, clayey phyllite, phyllite, siltstone, sandstone



Path: Z:\01 EcOz_Documents\04 EcOz Vantage GIS\IEZ19181 - KTC EPL Update and EMP\01 Project Files\Figure 8-1 Map of KWMF water monitoring locations.mxd

Figure 4-1 Map of monitoring site locations

4.2 Monitoring frequency, parameters, and trigger values

Monitoring frequency, parameters and trigger values, as required in EPL298, are provided in Table 4-3. Trigger values only apply to the downstream surface water monitoring site SWC.

Table 4-3. EPL298 required parameters, sampling frequency and trigger values

			Surface water		Leachate	Groundwater					
			SWB	SWC		GWA	GWE	GWB01	GWB02	GWB03	GWB04
Parameter	Unit	Trigger values (only apply to SWC)	Frequency								
Field Measurements											
pH	-	6.0-8.0	Quarterly			Monthly					
Temperature	°C	-									
Electrical Conductivity (EC)	µS/cm	20-250									
Dissolved Oxygen (DO)	% Sat	85-120									
REDOX (groundwater only)	mV	-	N/A								
Standing water level (groundwater only)	mAHD	-									
Major ions											
Potassium (K)	mg/L	400	Quarterly			Monthly					
Alkalinity (CaCO ₃)		-									
Calcium (Ca)		400									
Chloride (Cl)		-									
Sodium (Na)		300									
Sulfate (SO ₄)		500									
Magnesium (Mg)		-									
Nutrients											
Total Nitrogen (TN)	µg/L	200-300	Quarterly			Quarterly					
Total Phosphorus (TP)		-									
Nitrate (NO ₃ as N)		-									
Ammonium (NH ₄)		10				Monthly					
Metals											
Aluminium (Al)	mg/L	-	Quarterly			Quarterly					
Cadmium (Cd)		0.2									
Chromium (CrIII)		3.3									

			Surface water		Leachate	Groundwater					
			SWB	SWC		GWA	GWE	GWB01	GWB02	GWB03	GWB04
Parameter	Unit	Trigger values (only apply to SWC)	Frequency								
Metals continued											
Chromium (CrIV)		1.0	Quarterly	Quarterly							
Copper (Cu)		1.4									
Iron (Fe)		300									
Lead (Pb)		3.4									
Manganese (Mn)		1900									
Nickel (Ni)		13									
Selenium (Se)		-									
Zinc (Zn)		8.0									
Other Leachate Indicators											
Total Organic Carbon (TOC)	mg/L	-	Quarterly	Monthly							
Total Dissolved Solids (TDS)		-									
Chemical Oxygen Demand (COD)		-									
Biological Oxygen Demand (BOD)		-									
Volatile acids as acetic acid (VFA)		-			Quarterly						
Other											
Total Recoverable Hydrocarbons (TRH)	µg/L	-	Annually	Quarterly							
Polycyclic Aromatic Hydrocarbons (PAHs)		16									
Benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN)		950									
Polychlorinated biphenyls (PCB)		-									
PFOS/PFAS (in any form)		-									

4.3 Sampling procedures

All water sampling is undertaken in accordance with the below-listed accepted standards and guidelines for monitoring of water quality:

- *Australian/New Zealand Standard on Water Quality Sampling - Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS/NZS 5667.1:1998)*
- *Australian/New Zealand Standard on Water Quality Sampling – Part 6: Guidance on sampling of rivers and streams (AS/NZS 5667.6:1998).*
- *Australian/New Zealand Standard on Water Quality Sampling – Part 11: Guidance on sampling of groundwater (AS/NZS 5667.11:1998), Standards Australia, New South Wales.*
- ANZECC & AMRCANZ 2000, *Australian Guidelines for Water Quality Monitoring and Reporting*, National Water Quality Management Strategy Paper No 7, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.
- ANZECC & AMRCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, National Water Quality Management Strategy Paper No 4, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Water quality meters used for measuring in-situ surface water and groundwater physical parameters were calibrated in accordance with operating manuals prior to each sampling day and calibration results were recorded in a logbook.

All laboratory samples are analysed by a NATA-accredited laboratory (Envirolabs), which incorporates laboratory duplicates, blanks, and spikes to assess data accuracy.

Replicates and transport blanks were analysed during the reporting period in order to evaluate the precision of sampling results. The Relative Percentage Difference (RPD) was estimated, when possible. Differences between samples and replicated did not exceed 20% when concentrations were at least ten times the limit of reporting (LOR), meaning that the results are acceptable. Some of the replicates taken include:

- GWB04 – July 2021 to January 2022, April 2022
- GWE – July 2021, February to June 2022
- GWA – October 2021
- GWB01– April and May 2022

4.4 Monitoring undertaken during the reporting period

Table 4-4 lists the monitoring that was undertaken during the reporting period. Compliance against EPL298 monitoring requirements is outlined.

Table 4-4. Compliance with EPL298 monitoring requirements

Type	Site ID	Frequency required	Dates sampled	Compliance with sampling frequency	Compliance with parameters measured
Surface water	SWB	Quarterly (field measurements, major ions, nutrients, metals and metalloids, other leachate indicators)	Not sampled since April 2021	Non-compliant	Non-compliant
		Annually (TRH, PAH, BTEXN, PCB and PFAS/PFOS)			
	SWC	Quarterly (field measurements, major ions, nutrients, metals and metalloids, other leachate indicators)	Not sampled since April 2021		
		Annually (TRH, PAH, BTEXN, PCB and PFAS/PFOS)			
Leachate		Quarterly (field measurements, major ions, nutrients, metals and metalloids, other leachate indicators)	22/02/2022	Compliant – Sites attended quarterly but leachate ponding only once	Compliant except for: - TN, TP, NO ₃ (as N), metals, metalloids, and VFA not analysed
		Annually (TRH, PAH, BTEXN, PCB and PFAS/PFOS)	Not sampled for these parameters	Non compliant- site attended during the reporting period, but parameters to be measured annually were not analysed	Non compliant- None of the parameters were analysed
Groundwater	GWA	Monthly (field measurements, major ions, NH ₄ , TOC, TDS, COD, BOD)	27/07/2021 24/08/2021 21/09/2021 26/10/2021 24/11/2021 13/12/2021	Compliant	Compliant except for: - Redox measured only three times (April, May and June 2022) - NH ₄ not analysed in July, August and October 2021, and in January 2022 due to a miscommunication with laboratory. Ammonia (as N) was analysed instead.

Type	Site ID	Frequency required	Dates sampled	Compliance with sampling frequency	Compliance with parameters measured
			10/01/2022 22/02/2022 07/03/2022 11/04/2022 10/05/2022 14/06/2022		
		Quarterly (TN, TP, N, metals, VFA, TRH, PAH, BTEXN, PCB, PFOS/PFAS)	27/07/2021 26/10/2021 10/01/2022 11/04/2022	Compliant	Compliant except for: - Al and Se not measured in January 2022
	GWE	Monthly (field measurements, major ions, NH ₄ , TOC, TDS, COD, BOD)	27/07/2021 24/08/2021 21/09/2021 26/10/2021 24/11/2021 13/12/2021 10/01/2022 22/02/2022 07/03/2022 11/04/2022 10/05/2022 14/06/2022	Compliant	Compliant except for: - Redox measured only three times (April, May and June 2022) - NH ₄ not analysed in July, August and October 2021, and in January 2022 due to a miscommunication with laboratory. Ammonia (as N) was analysed instead.
	GWB01	Monthly (field measurements, major ions, NH ₄ , TOC, TDS, COD, BOD)	27/07/2021 24/08/2021 21/09/2021 24/11/2021 13/12/2021 10/01/2022	Compliant Bore was dry the day of monitoring in October	Compliant except for: - Redox measured only three times (April, May and June 2022) - NH ₄ not analysed in July, August and October 2021, and in January 2022 due to a miscommunication with laboratory. Ammonia (as N) was analysed instead.

Type	Site ID	Frequency required	Dates sampled	Compliance with sampling frequency	Compliance with parameters measured
			22/02/2022 07/03/2022 11/04/2022 10/05/2022 14/06/2022		
		Quarterly (TN, TP, N, metals, VFA, TRH, PAH, BTEXN, PCB, PFOS/PFAS)	27/07/2021 10/01/2022 11/04/2022	Compliant Bore was dry the day of monitoring in October 2021 and as such, these parameters were analysed only three of the four times	Compliant except for: - Al and Se not measured in January 2022
	GWB02	Monthly (field measurements, major ions, NH ₄ , TOC, TDS, COD, BOD)	27/07/2021 24/08/2021 21/09/2021 26/10/2021 24/11/2021 13/12/2021 10/01/2022 22/02/2022 07/03/2022 11/04/2022 10/05/2022 14/06/2022	Compliant	Compliant except for: - Redox measured only three times (April, May and June 2022) - NH ₄ not analysed in July, August and October 2021, and in January 2022 due to a miscommunication with laboratory. Ammonia (as N) was analysed instead.
		Quarterly (TN, TP, N, metals, VFA, TRH, PAH, BTEXN, PCB, PFOS/PFAS)	27/07/2021 26/10/2021 10/01/2022 11/04/2022	Compliant	Compliant except for: - Al and Se not measured in January 2022
	GWB03	Monthly (field measurements, major	27/07/2021 24/08/2021	Compliant	Compliant except for: - Redox measured only three times (April, May and June 2022)

Type	Site ID	Frequency required	Dates sampled	Compliance with sampling frequency	Compliance with parameters measured
		ions, NH ₄ , TOC, TDS, COD, BOD)	21/09/2021 26/10/2021 24/11/2021 13/12/2021 10/01/2022 22/02/2022 07/03/2022 11/04/2022 10/05/2022 14/06/2022		- NH ₄ not analysed in July, August and October 2021, and in January 2022 due to a miscommunication with laboratory. Ammonia (as N) was analysed instead.
		Quarterly (TN, TP, N, metals, VFA, TRH, PAH, BTEXN, PCB, PFOS/PFAS)	27/07/2021 26/10/2021 10/01/2022 11/04/2022	Compliant	Compliant except for: - Al and Se not measured in January 2022
	GWB04	Monthly (field measurements, major ions, NH ₄ , TOC, TDS, COD, BOD)	27/07/2021 24/08/2021 21/09/2021 26/10/2021 24/11/2021 13/12/2021 10/01/2022 22/02/2022 07/03/2022 11/04/2022 10/05/2022 14/06/2022	Compliant	Compliant except for: - Redox measured only three times (April, May and June 2022) - NH ₄ not analysed in July, August and October 2021, and in January 2022 due to a miscommunication with laboratory. Ammonia (as N) was analysed instead.
		Quarterly (TN, TP, N, metals, VFA, TRH, PAH, BTEXN, PCB, PFOS/PFAS)	27/07/2021 26/10/2021 10/01/2022 11/04/2022	Compliant	Compliant except for: - Al and Se not measured in January 2022

5 RESULTS AND DISCUSSION

5.1 Surface water quality

As mentioned in Section 3.1.1, rainfall during the reporting period was lower than the average, which limited the collection of samples from sites SWB and SWC, as Tindal Creek was always dry when monitoring was undertaken.

5.2 Leachate

Leachate was sampled in February 2022, this being the first time that the trench has been sampled since monitoring started, given that the trench is usually dry. The concentrations of parameters measured in February 2022 are presented in Table 5-1.

Table 5-1. Field measurements, major ions, nutrients and other leachate indicators measured in February 2022 in Leachate.

PARAMETER	UNIT	LOP	2022
			FEB
FIELD MEASUREMENTS			
pH	-	-	6.10
Temperature	°C	-	34.4
Electrical Conductivity (EC)	µs/cm	-	275
Dissolved Oxygen (DO)	% Sat	-	7.3
MAJOR IONS			
Potassium (K)	mg/L	0.5	7.6
Alkalinity (CaCO3)		5	110
Calcium (Ca)		0.5	25
Chloride (Cl)		1	9
Sodium (Na)		0.5	5.1
Sulfate (SO4)		1	9
Magnesium (Mg)		0.5	7
NUTRIENTS			
Total Nitrogen (TN)	µg/L	100	-
Total Phosphorus (TP)		50	-
Nitrate (as N)		5	-
Ammonium (NH4)		7	250
OTHER LEACHATE INDICATORS			
Total Organic Carbon (TOC)	mg/L	1	14
Total Dissolved Solids (TDS)		5	470
Chemical Oxygen Demand (COD)		20	66
Biological Oxygen Demand (BOD)		5	5
Volatile acids as acetic acid (VFA)		5	-

5.3 Groundwater

5.3.1 Groundwater levels and flow

Standing water levels (SWLs) measured during the monitoring period at the six on-site bores (see Table 5-2) indicate that groundwater flows in a north-west direction across the site towards Tindal Creek. During the monitoring period, GWA01 and GWA02 (located on the north-western side of the site near Tindal Creek) usually recorded lower levels than those in GWA, GWE, GWA03 and GWA04 (located around the western, southern, and eastern sides of the site).

The effects of the wet and dry season on the SWLs are clearly seen during the monitoring period. SWLs decreased at all sites during the dry season months of July and October 2021 and increased between October 2021 and February 2022 (wet season). As mentioned in Section 3.1.1, rainfall during the monitoring period was below the annual average and particularly low rainfall was recorded between February and April 2022. The effect of these factors on the SWLs can be clearly seen in Figure 5-1. Although there was a rise in the SWL during the 2021-22 reporting period, it is not as high as that reported in the 2020-21 reporting period, when rainfall was above the average.

An abrupt decrease in SWL at GWA01 was recorded in October 2021 (the bore was dry). The causes leading to such change are not yet known, but it is likely an outlier or error in field sampling.

Table 5-2. Standing water levels measured in KWMF bores from September 2020 to June 2021

BORE ID	2021						2022					
	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
	mAHD	mAHD	mAHD	mAHD	mAHD	mAHD	mAHD	mAHD	mAHD	mAHD	mAHD	mAHD
GWA (RN031131)	90.6754	90.0754	89.7754	89.4754	89.4754	Dry	90.5754	92.4454	91.0754	89.9754	89.5754	89.3454
GWE (RN022487)	92.1464	91.6964	91.3464	90.9464	90.9864	90.9964	92.0864	93.8164	92.6764	91.6464	91.1464	90.8764
GWA01	89.2214	88.8214	88.5214	86.4014	88.1914	89.1414	88.9214	91.1914	89.7914	88.7214	88.3214	88.0414
GWA02	89.5951	89.0951	88.6951	88.3951	88.3151	88.2551	89.7351	91.5251	90.1251	88.9951	88.7951	88.1151
GWA03	91.3793	90.9093	90.5793	90.0793	89.7393	88.2693	89.6293	93.0493	91.6693	90.7793	90.3793	89.9793
GWA04	91.363	90.663	90.263	89.933	89.963	89.263	90.963	93.123	91.693	90.513	89.963	89.663

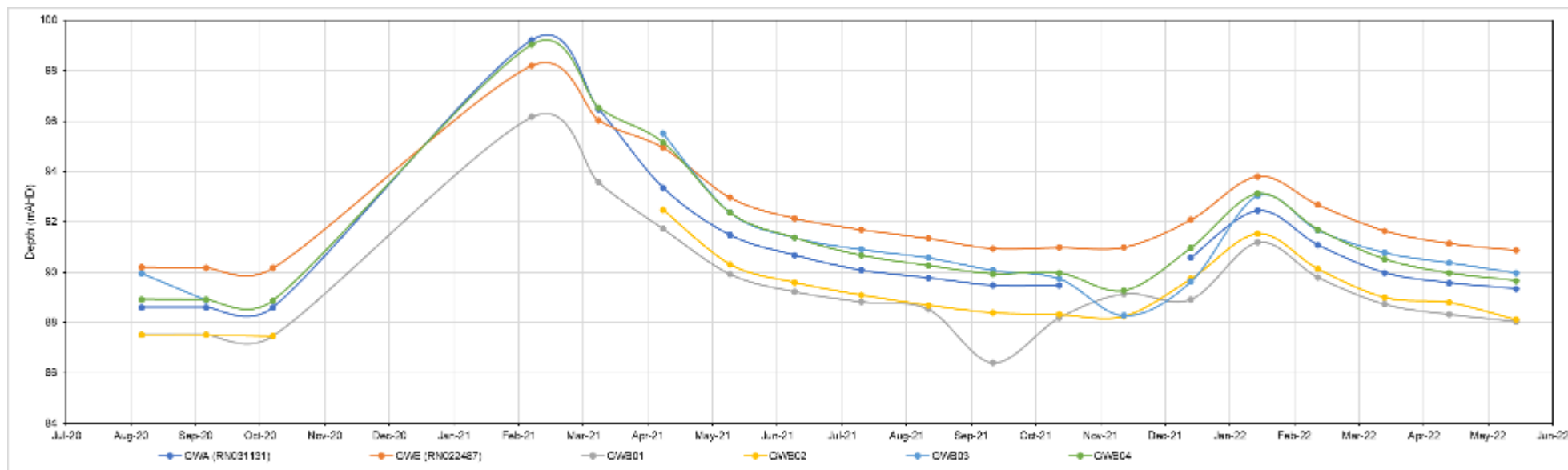


Figure 5-1. Groundwater depths, in m AHD, at each of the six bores monitored since monitoring started in August 2020 at the KWMF.

5.3.2 Groundwater quality

Groundwater quality monitoring results for the reporting period are presented below in Table 5-3 to Table 5-39. Trigger values are not defined for groundwater quality in EPL298, rather, concentrations in the two downgradient bores GWB01 and GWB02, are compared to the four up-gradient bores.

For comparison, all available groundwater quality data since monitoring started in August 2020 is also included in Figure 5-2 to Figure 5-37.

Appendix A also contains the tables with all the historic data available for the groundwater bores, including the results of single monitoring rounds undertaken in 2006, 2017 and 2018. Groundwater bores GWB01 to GWB04 were also only installed in 2018, and historic data for these bores is only available for a single monitoring round in 2018. A number of parameters were also not measured during the earlier monitoring rounds e.g., TN, VFA, and not all 28 PFAS currently analysed were analysed pre-2020.

Note that months when monitoring was not undertaken (variable for each parameter; see Table 4-4) were not included in the tables below.

Results tables are not provided below for parameters that recorded concentrations below the LOR for all bores, for all monitoring rounds.

Field parameters

During the monitoring period, pH was variable and ranged between 4.2 and 9.3 (see Table 5-3). Spikes in levels of pH were detected at most sites in the October 2021, January 2022 and March 2022, the latter having the highest values recorded since monitoring started in most sites. As shown in Figure 5-2, pH decreased considerably between May and June 2022, the lowest concentrations being reported in the downgradient bores GWB01 and GWB02. The cause of this drop is not yet known but it is not likely caused by the KWMF activities, given that (1) the pH of leachate sampled in February 2022 was higher than that recorded in groundwater, and (2) temperature also dropped at all monitoring bores in June 2022 (see Figure 5-3), possibly indicating changes in the characteristics of the recharge water.

EC ranged between 587 and 1701 $\mu\text{S}/\text{cm}$ during the monitoring period. Concentrations were mostly lower at the downgradient bores GWE and GWA. Spikes in concentration were recorded in October 2021 (GWB03) and March 2022 (GWB02) with no known reason causing it.

Table 5-3. pH measured in KWMF groundwater bores

pH	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	6.3	5.8	6.9	7.9	8.1	5.3	8.4	6.0	9.1	8.5	8.1	6.0
GWE	6.6	7.0	7.9	8.5	8.2	6.9	8.5	6.1	9.3	8.6	8.0	9.1
GWB01	6.5	6.0	7.0		7.5	7.1	7.9	6.7	9.0	7.8	8.8	4.2
GWB02	6.0	6.7	7.6	7.9	6.6	5.9	8.2	6.3	8.9	7.5	8.5	5.0
GWB03	5.8	7.1	7.8	8.1	7.5	5.9	8.7	6.0	8.7	6.6	7.0	6.7
GWB04	7.0	6.1	7.1	8.3	7.8	5.5	7.7	5.5	8.6	6.5	6.0	6.2

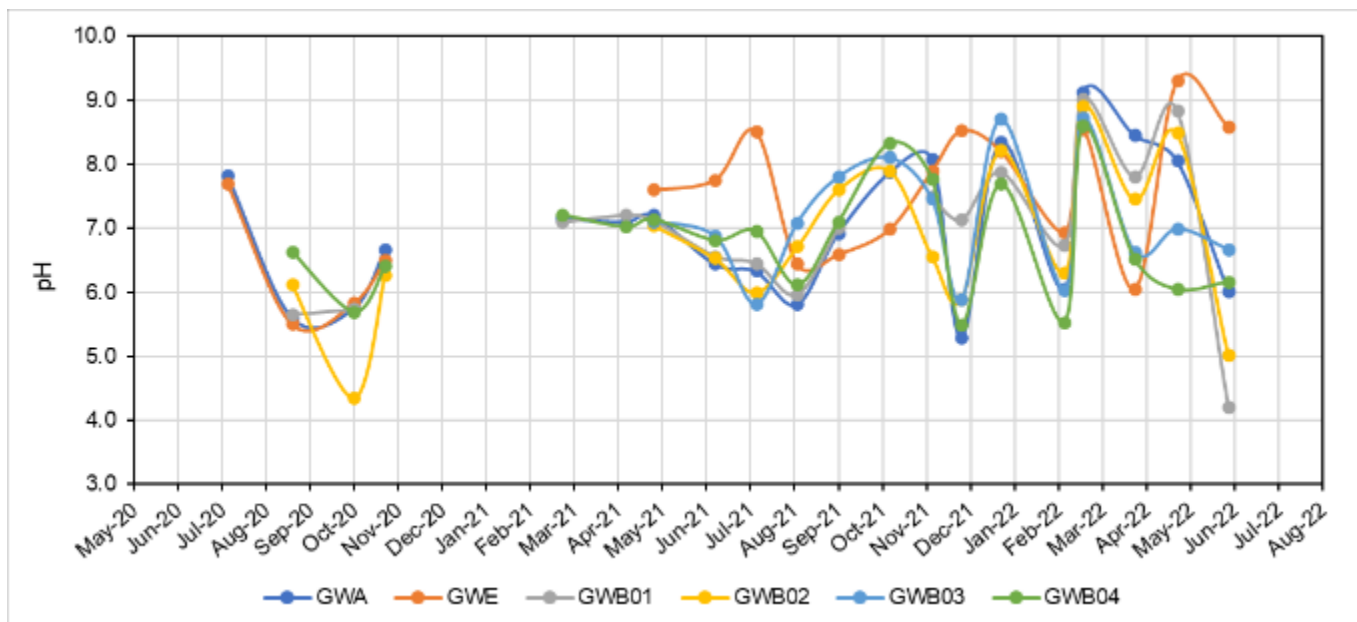


Figure 5-2. pH at each of the six of the bores monitored between August 2020 and June 2022

Table 5-4. pH measured in KWMF groundwater bores

T (°C)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	31.3	30.1	31.4	32.4	32.6	35.6	35.3	32.0	30.7	32.9	31.2	28.0
GWE	31.2	31.2	31.4	32.4	31.1	33.4	35.0	32.4	32.9	31.3	30.3	27.9
GWB01	31.3	30.0	30.1		30.9	33.0	32.2	31.8	31.9	31.5	30.7	28.6
GWB02	30.6	30.9	31.4	34.0	29.9	34.2	33.3	31.1	31.9	31.6	31.8	25.2
GWB03	27.7	29.7	31.1	31.8	27.4	32.2	36.4	28.8	31.0	29.3	29.8	24.5
GWB04	28.7	29.4	29.5	31.9	31.6	31.7	31.3	30.9	32.0	28.2	29.9	24.4

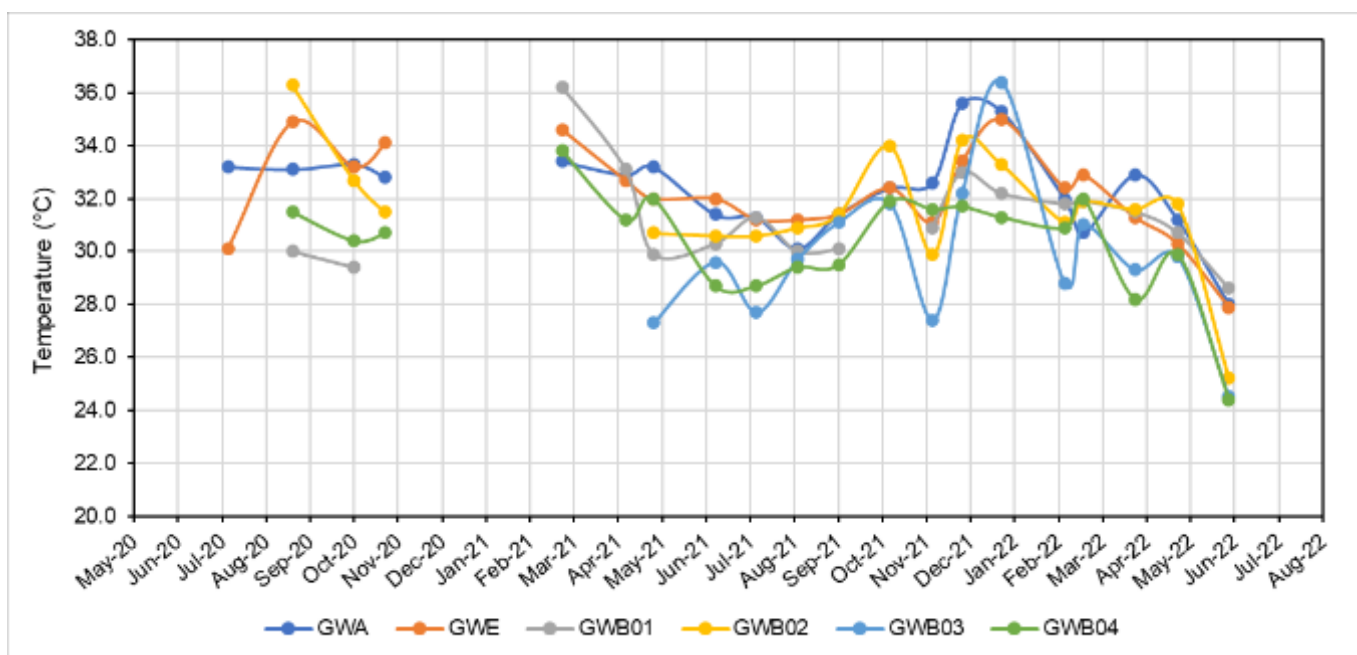


Figure 5-3. Temperature at each of the six of the bores monitored between August 2020 and June 2022

Table 5-5. EC measured in KWMF groundwater bores

EC (µS/cm)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	1120	766	835	759	737	619	735	700	710	730	729	730
GWE	587	611	513	579	448	598	459	630	626	622	605	570
GWB01	1120	1177	1073		1010	984	1020	1010	1020	1020	1045	1030
GWB02	1154	1063	1086	863	1000	955	1034	1100	1701	984	1005	1000
GWB03	1120	973	1050	1600	1049	1077	1192	892	998	966	1017	1060
GWB04	1016	1000	1030	894	910	887	975	982	930	1014	920	850

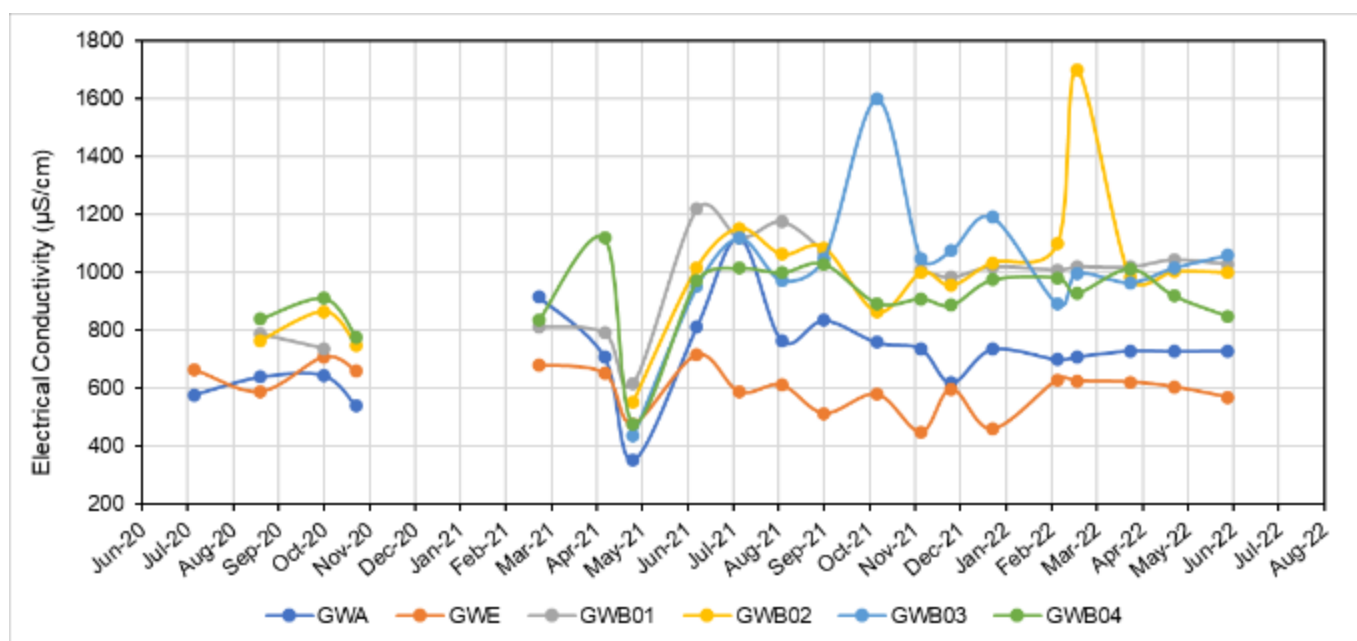


Figure 5-4. EC at each of the six of the bores monitored between August 2020 and June 2022

Major ions

During the monitoring period, K concentrations were always higher at GWB01 (downgradient bore) and GWB04 than in the other bores, a trend seen since monitoring started. Similarly, Cl concentrations were always higher at the downgradient bores, GWB01 and GWB02, than upgradient. The concentrations were also higher than those reported in previous monitoring rounds.

Concentrations of alkalinity, Ca and Mg during the monitoring period were always lower at two of the upgradient sites, GWA and GWE, a trend seen in historical data (see Figure 5-7, Figure 5-8 and Figure 5-9). Concentrations were variable during the monitoring period, but no increasing trend is seen since monitoring started.

Na and SO₄ were always higher in bores GWB01, GWB02 and GWB03 than in the most upgradient ones (Table 5-11 and Table 5-12). Between July 2021 and January 2022, Na and SO₄ had an increasing trend at GWB03. Concentrations decreased considerably in February but have been increasing since then. Further monitoring is necessary to determine the factors leading to the variations seen in Na and SO₄.

The higher concentration of some major ions in the downgradient compared to the upgradient bores, and the variations in SO₄ are not likely caused by the KWMF activities. The leachate sampled in February 2022 (see Table 5-1), had much lower concentrations of all major ions than those recorded at the groundwater bores. Therefore, the concentrations in these bores may be reflecting the characteristics of the aquifer. However, a possible effect of leachate infiltration cannot be discarded, given that the current leachate characterisation is limited and insufficient to estimate any impact.

Table 5-6. K measured in KWMF groundwater bores

K (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	5.0	5.2	4.5	3.9	5.1	5.3	4.7	4.8	4.8	4.7	5.2	5.1
GWE	5.5	5.4	5.0	4.8	6.5	5.7	6.0	5.5	5.4	6.3	5.2	5.4
GWB01	16.0	16.0	14.0		14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
GWB02	6.0	6.0	6.9	5.4	5.8	6.4	6.0	6.8	6.7	5.3	6.4	6.0
GWB03	4.6	4.9	4.5	4.7	5.4	6.5	5.9	4.8	4.8	4.9	5.2	5.7
GWB04	8.2	8.9	7.8	8.0	8.4	9.6	8.4	8.6	8.3	7.8	8.4	8.4

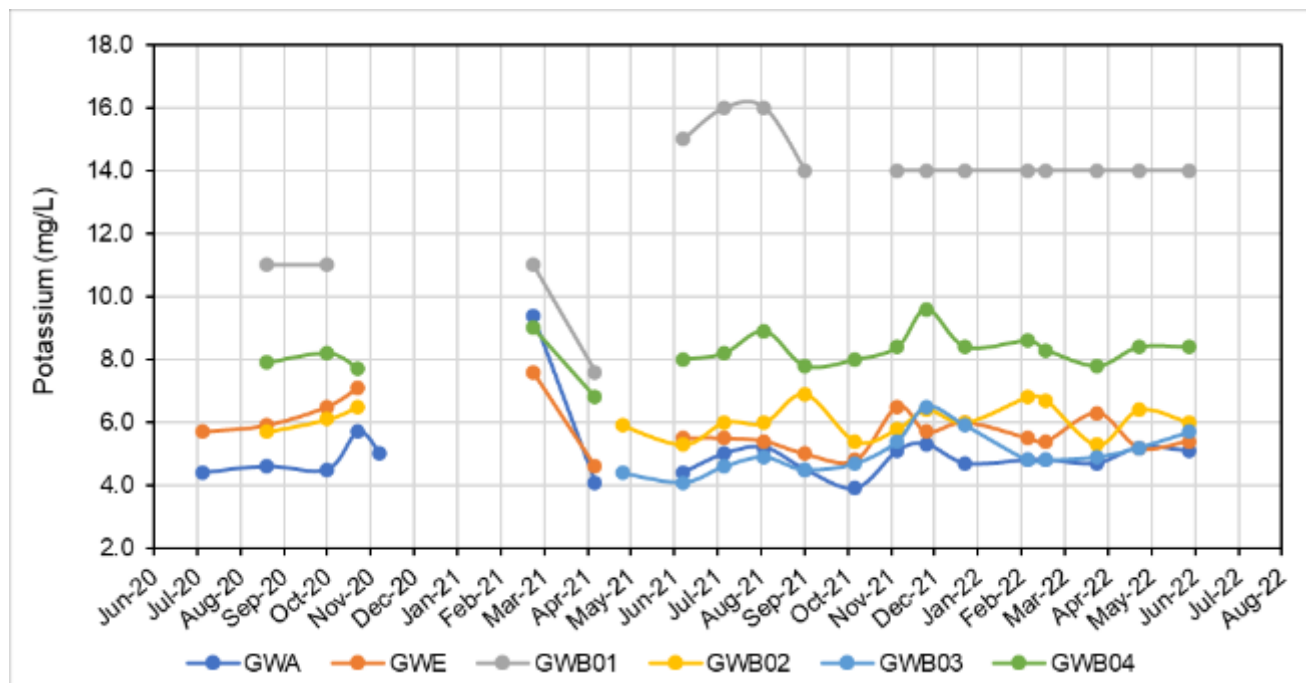


Figure 5-5. K at each of the six of the bores monitored between August 2020 and June 2022

Table 5-7. Cl measured in KWMF groundwater bores

Cl (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	5	4	5	6	5	5	5	5	5	5	5	5
GWE	7	6	7	8	5	8	6	9	10	10	10	10
GWB01	75	66	56		52	48	51	53	57	60	56	51
GWB02	42	37	51	38	27	25	39	48	48	43	37	27
GWB03	11	10	10	11	8	7	7	11	11	10	9	9
GWB04	7	6	7	7	6	6	6	5	6	10	7	7

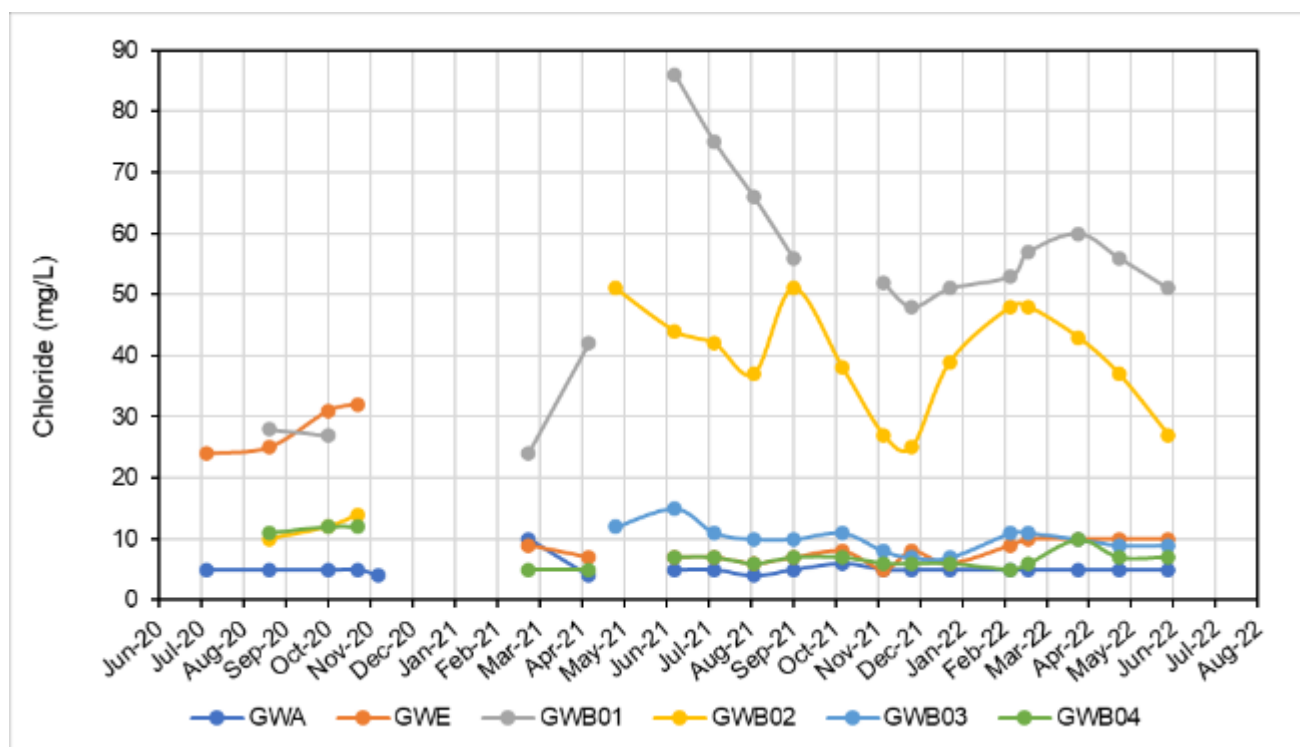


Figure 5-6. Cl at each of the six of the bores monitored between August 2020 and June 2022

Table 5-8. Alkalinity measured in KWMF groundwater bores

Alkalinity (mg/L)	2021						2021					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	360	370	350	340	340	350	340	340	340	360	350	350
GWE	280	300	280	280	200	300	250	320	300	290	280	250
GWA01	440	440	440		390	420	430	450	440	420	430	420
GWA02	450	460	460	460	450	460	450	460	450	450	470	460
GWA03	460	490	480	500	450	500	530	400	460	470	490	480
GWA04	460	490	480	470	450	470	480	470	470	480	470	490

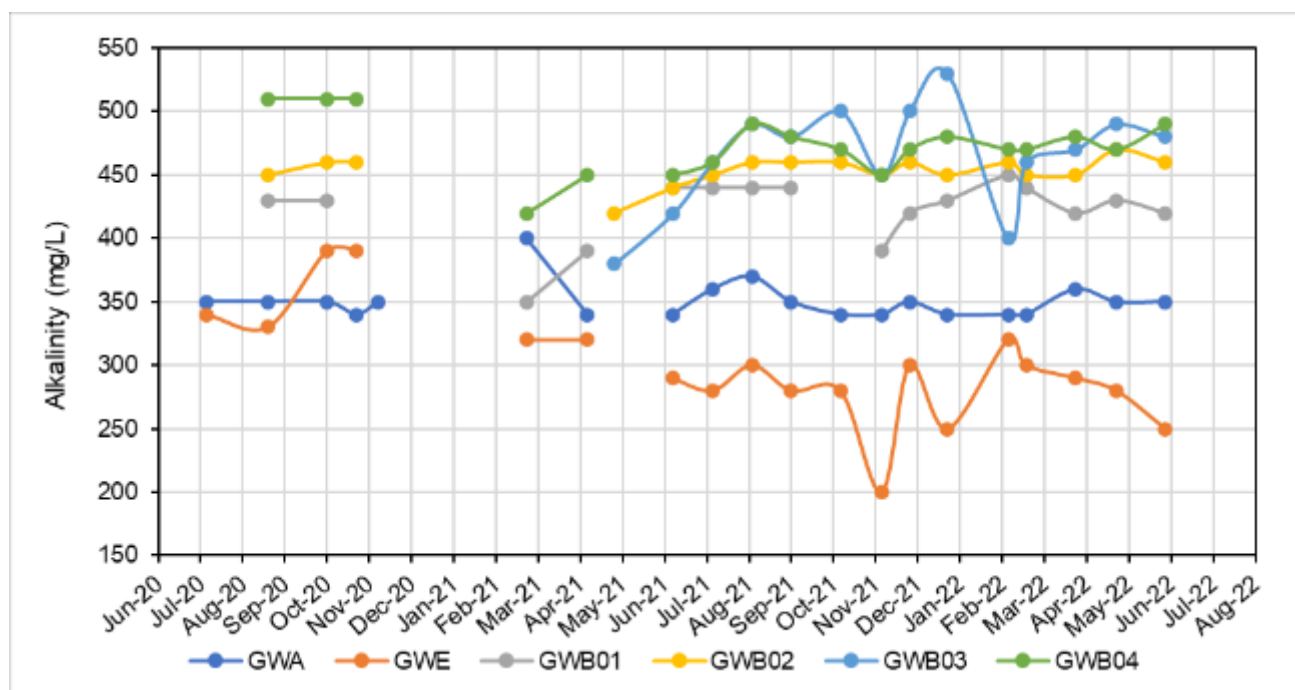


Figure 5-7. Alkalinity at each of the six of the bores monitored between August 2020 and June 2022

Table 5-9. Ca measured in KWMF groundwater bores

Ca (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	76	69	71	66	72	71	71	65	74	67	74	74
GWE	53	53	48	54	26	57	29	49	59	52	50	47
GWB01	95	86	87		84	94	92	88	100	92	96	91
GWB02	100	90	95	94	91	95	92	91	110	83	110	97
GWB03	98	84	89	93	84	95	95	77	98	86	89	92
GWB04	78	75	79	80	77	87	76	68	80	75	80	82

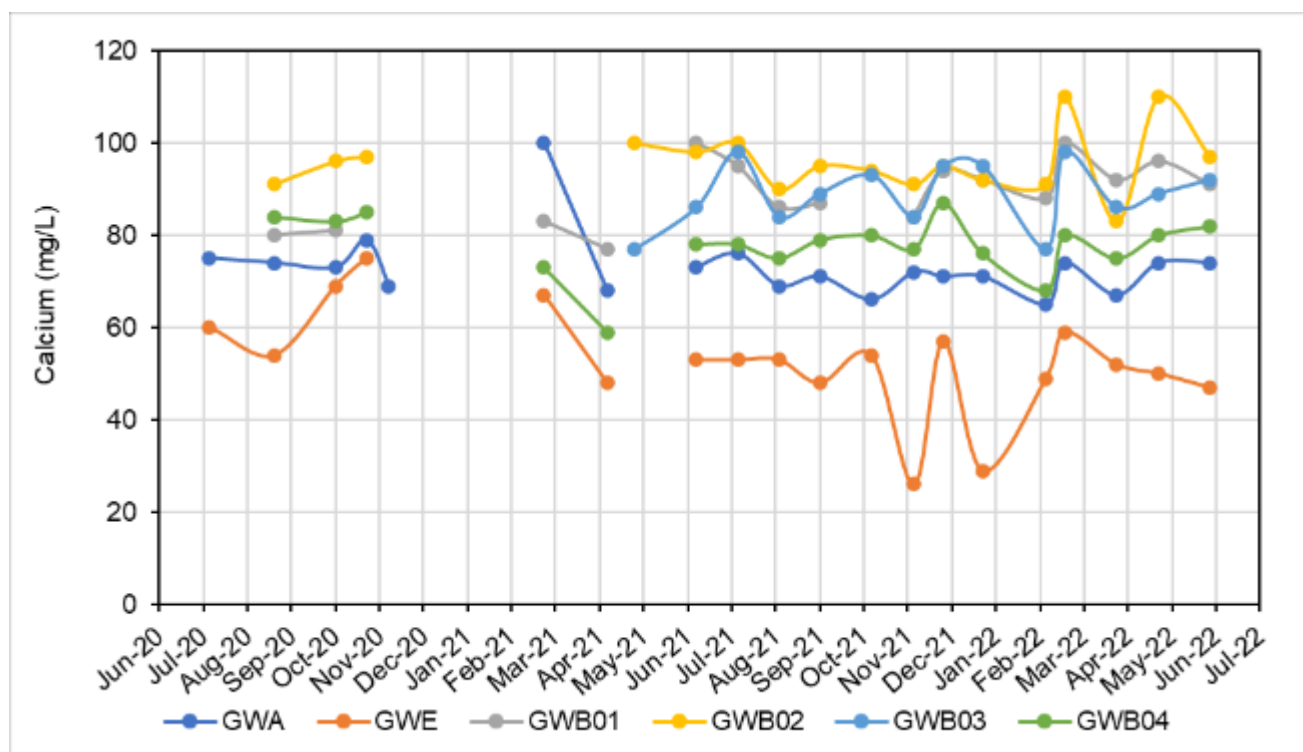


Figure 5-8. Ca at each of the six of the bores monitored between August 2020 and June 2022

Table 5-10. Mg measured in KWMF groundwater bores

Mg (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	34	34	34	28	33	32	33	31	33	32	36	36
GWE	29	31	29	31	26	31	28	30	34	33	32	31
GWB01	43	40	41		37	41	41	44	45	44	45	43
GWB02	53	51	51	52	52	52	49	48	55	49	59	54
GWB03	63	52	60	63	62	68	68	41	59	56	62	64
GWB04	57	54	57	57	56	61	55	52	60	54	58	58

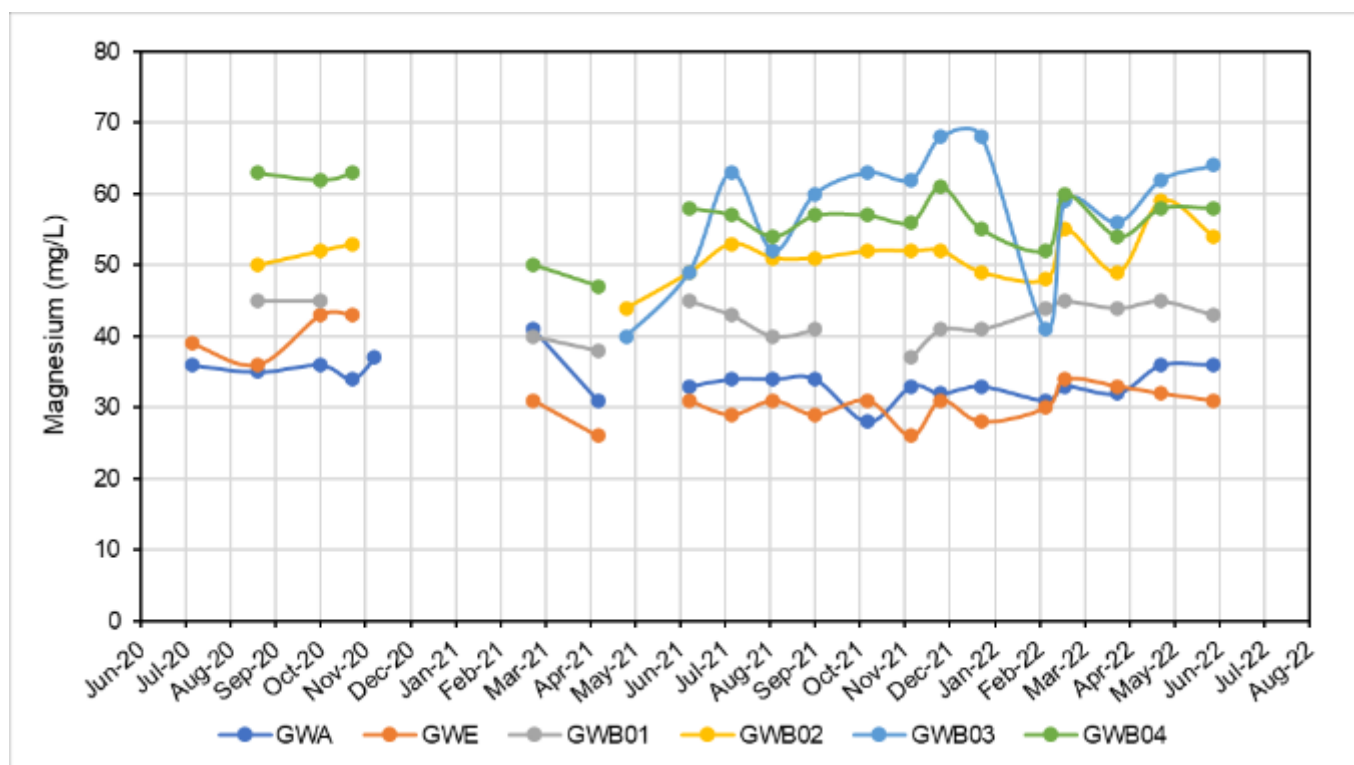


Figure 5-9. Mg at each of the six of the bores monitored between August 2020 and June 2022

Table 5-11. Na measured in KWMF groundwater bores

Na (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	6	6	6	5	6	7	6	6	6	6	7	6
GWE	8	8	8	9	9	8	10	9	10	12	11	10
GWB01	36	34	31		28	28	30	29	29	29	29	29
GWB02	20	18	24	16	14	15	18	25	26	18	20	16
GWB03	21	20	22	22	23	26	27	14	18	18	22	22
GWB04	9	9	10	9	9	10	10	10	9	9	10	10

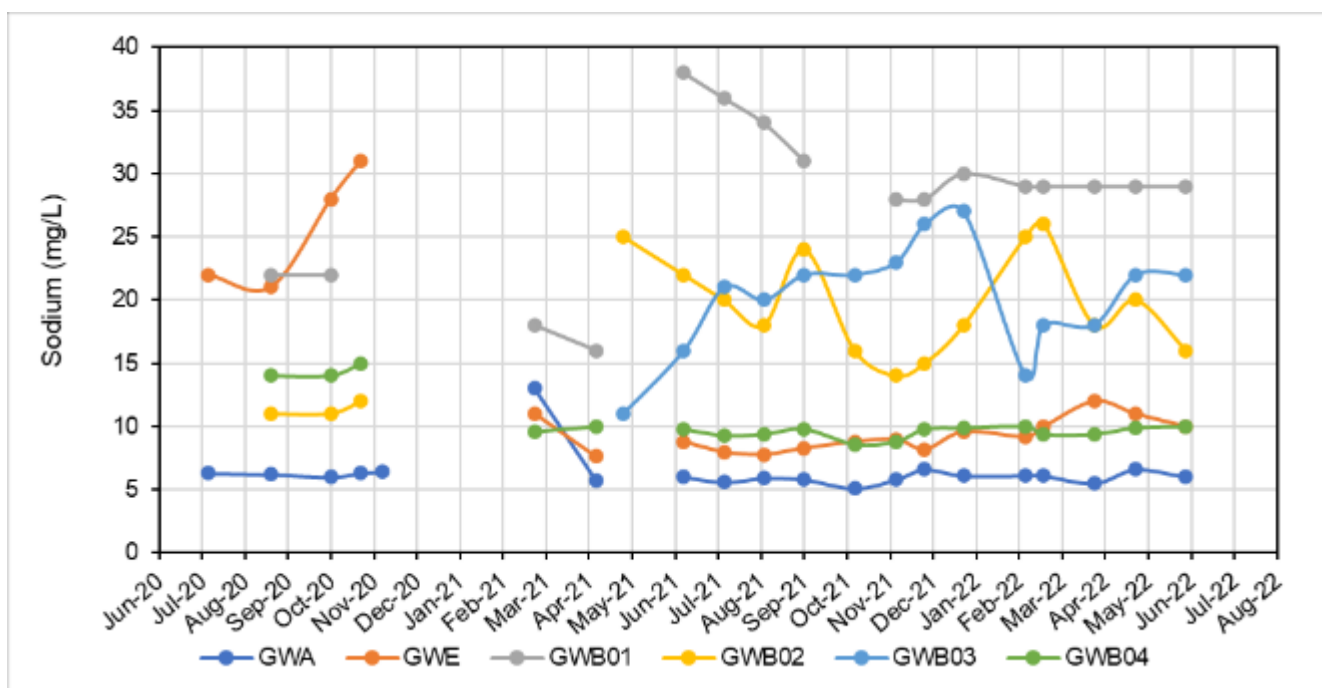


Figure 5-10. Na at each of the six of the bores monitored between August 2020 and June 2022

Table 5-12. SO₄ measured in KWMF groundwater bores

SO ₄ (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	6	7	6	6	5	5	6	5	2	7	6	6
GWE	6	7	6	5	5	<1	3	2	2	5	7	6
GWB01	25	25	21		19	21	23	29	30	25	23	20
GWB02	38	39	42	36	35	35	42	50	49	45	41	36
GWB03	68	51	75	76	99	110	150	11	26	32	62	67
GWB04	11	13	14	11	10	10	11	9	10	13	11	10

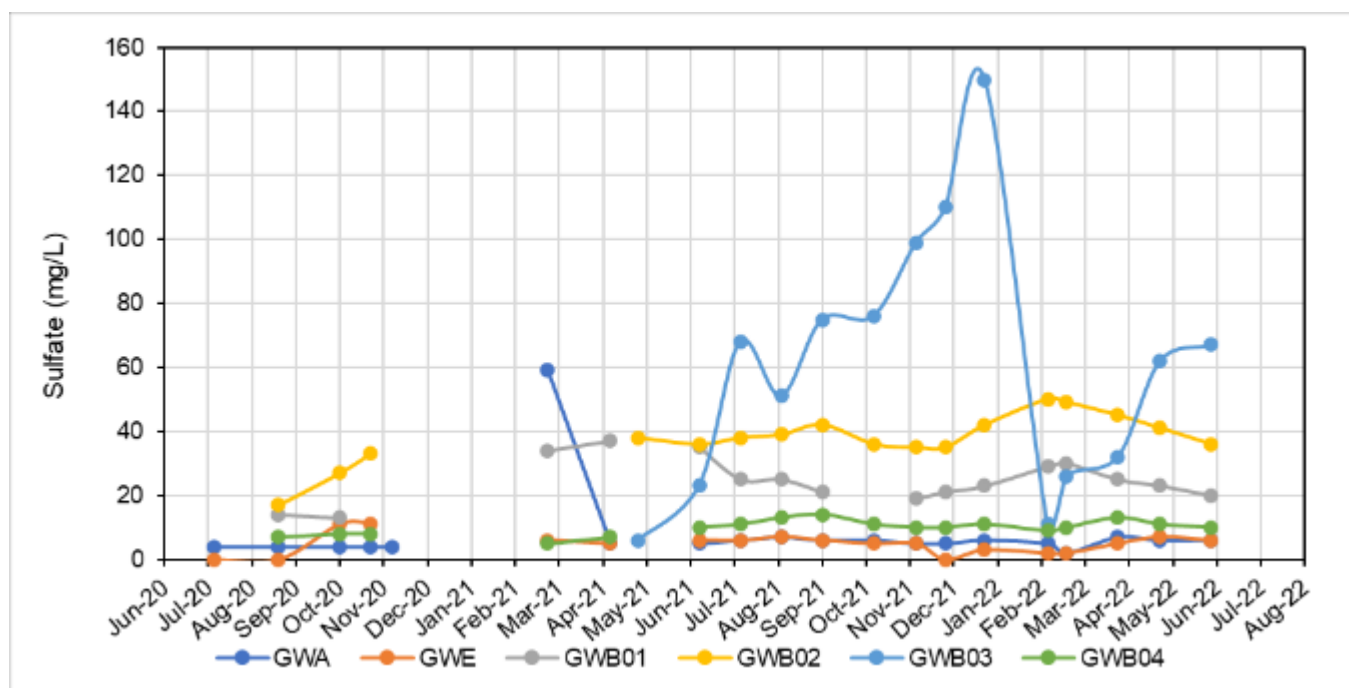


Figure 5-11. SO₄ at each of the six of the bores monitored between August 2020 and June 2022

Nutrients

TN and NO₃ (as N) were higher in bores GWB01, GWB02, GWB03 and GWB04, than in the upgradient bores GWA and GWE (Table 5-13 and Table 5-14). Since April 2021, TN and NO₃ (as N) have decreased at GWB04, while slightly increased at GWB02.

TP concentrations were mostly below LOR at all sites, although some spikes were recorded at GWB01, GWB02 and GWB03 (Table 5-15). The cause of the concentration spikes is not yet known.

NH₄ concentrations were much higher at the downgradient bore GWB01 than at any other bore (Table 5-16). Between September 2021 and March 2022, concentrations of NH₄ at this bore decreased to the lowest value recorded since monitoring started, but concentrations have increased since then.

Table 5-13. TN measured in KWMF groundwater bores

TN (µg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	600	500	600	700
GWE	300	300	1000	200
GWB01	4900		7500	1500
GWB02	600	600	600	1500
GWB03	7100	4100	1000	5300
GWB04	2800	2800	2300	1300

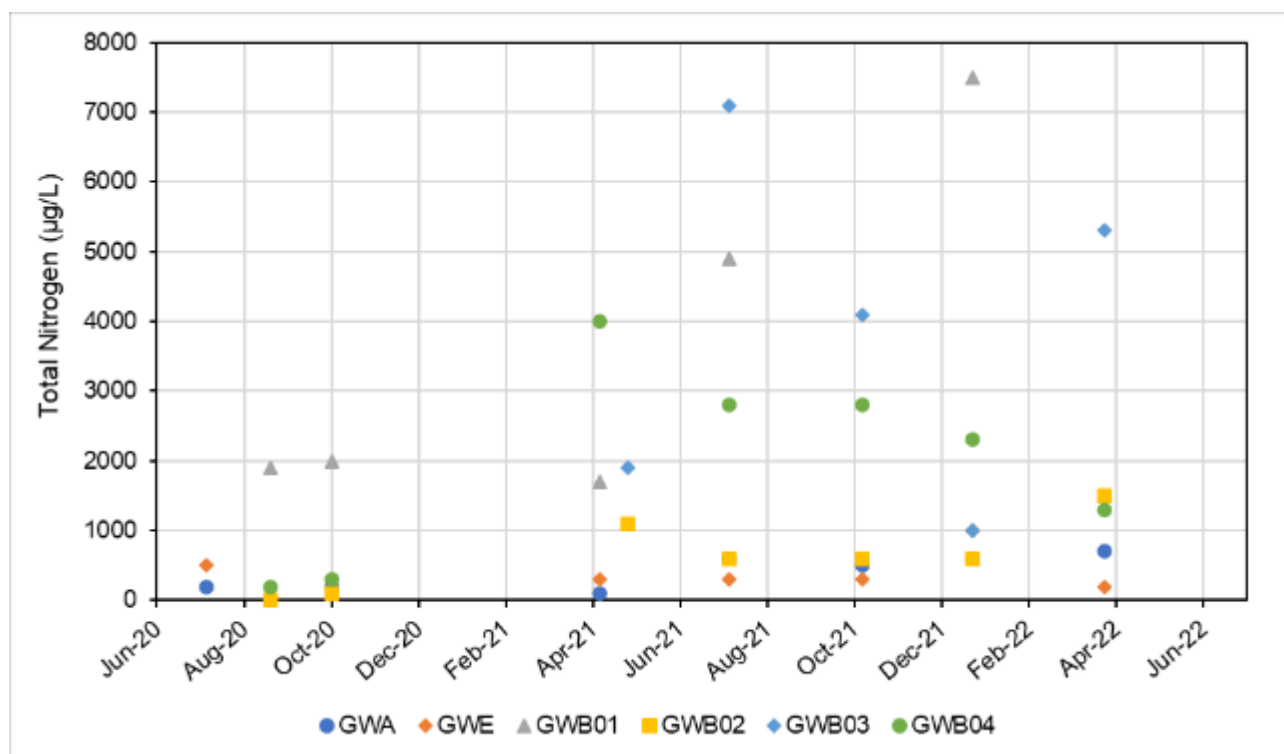


Figure 5-12. TN at each of the six of the bores monitored between August 2020 and June 2022

Table 5-14. NO₃ (as N) measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

NO ₃ -N (µg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	450	340	470	540
GWE	<5	9	9	<5
GWB01	170		5400	12
GWB02	150	32	320	1200
GWB03	6400	3600	300	5100
GWB04	2400	2600	2100	1200

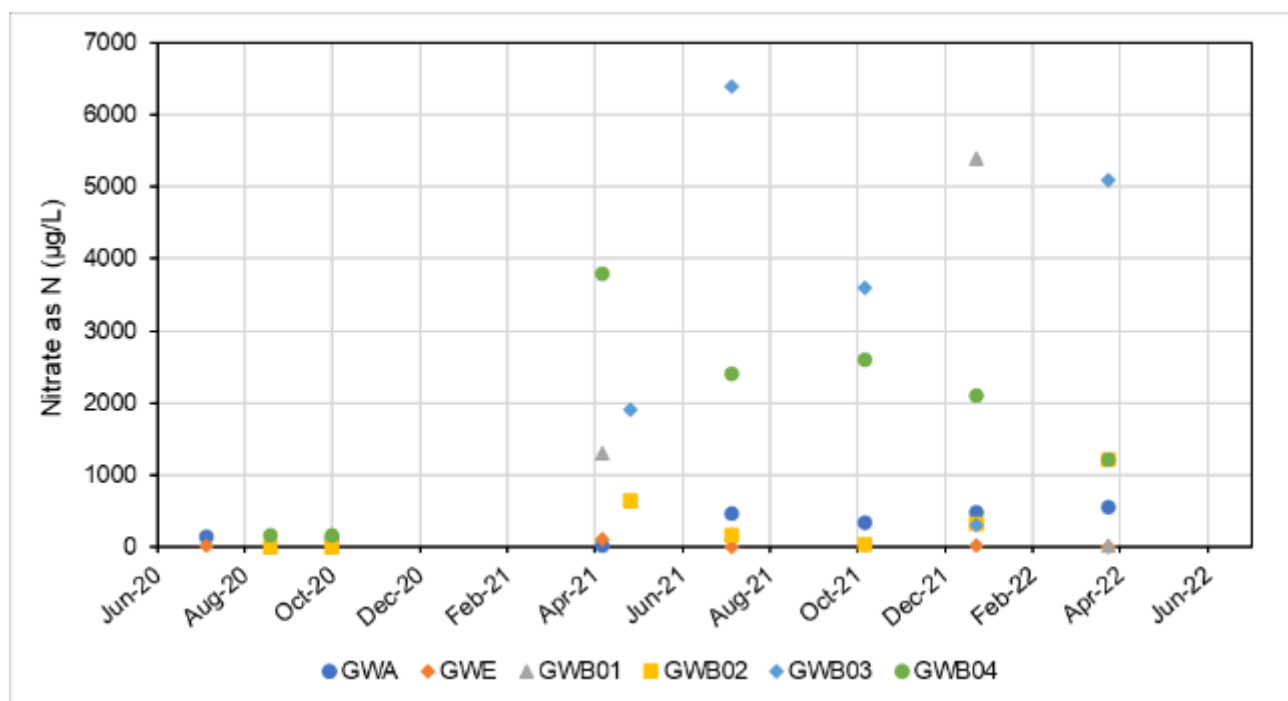


Figure 5-13. NO₃ (as N) at each of the six of the bores monitored between August 2020 and June 2022

Table 5-15. TP measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

TP (µg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<50	<50	<50	<50
GWE	<50	<50	<50	<50
GWB01	<50		<50	110
GWB02	<50	80	<50	<50
GWB03	<50	140	750	370
GWB04	<50	<50	<50	<50

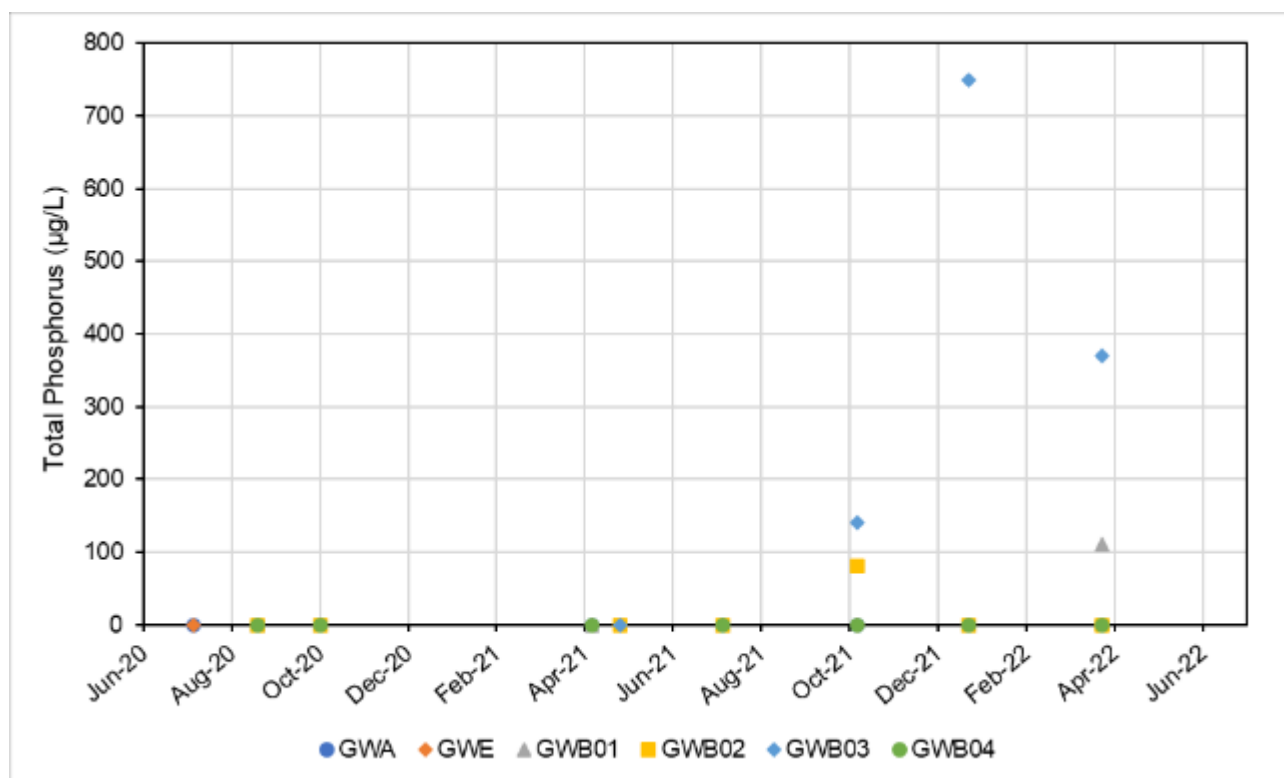


Figure 5-14. TP at each of the six of the bores monitored between August 2020 and June 2022

Table 5-16. NH₄ measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

NH ₄ (µg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			10		<7	63		55	17	<7	9	<7
GWE			110		11	150		83	42	120	120	150
GWB01			6100		5400	4000		740	380	1100	1200	1900
GWB02			800		<7	51		<7	<7	<7	<7	10
GWB03			13		26	42		<7	<7	8	35	34
GWB04			13		9	64		18	7	<7	12	13

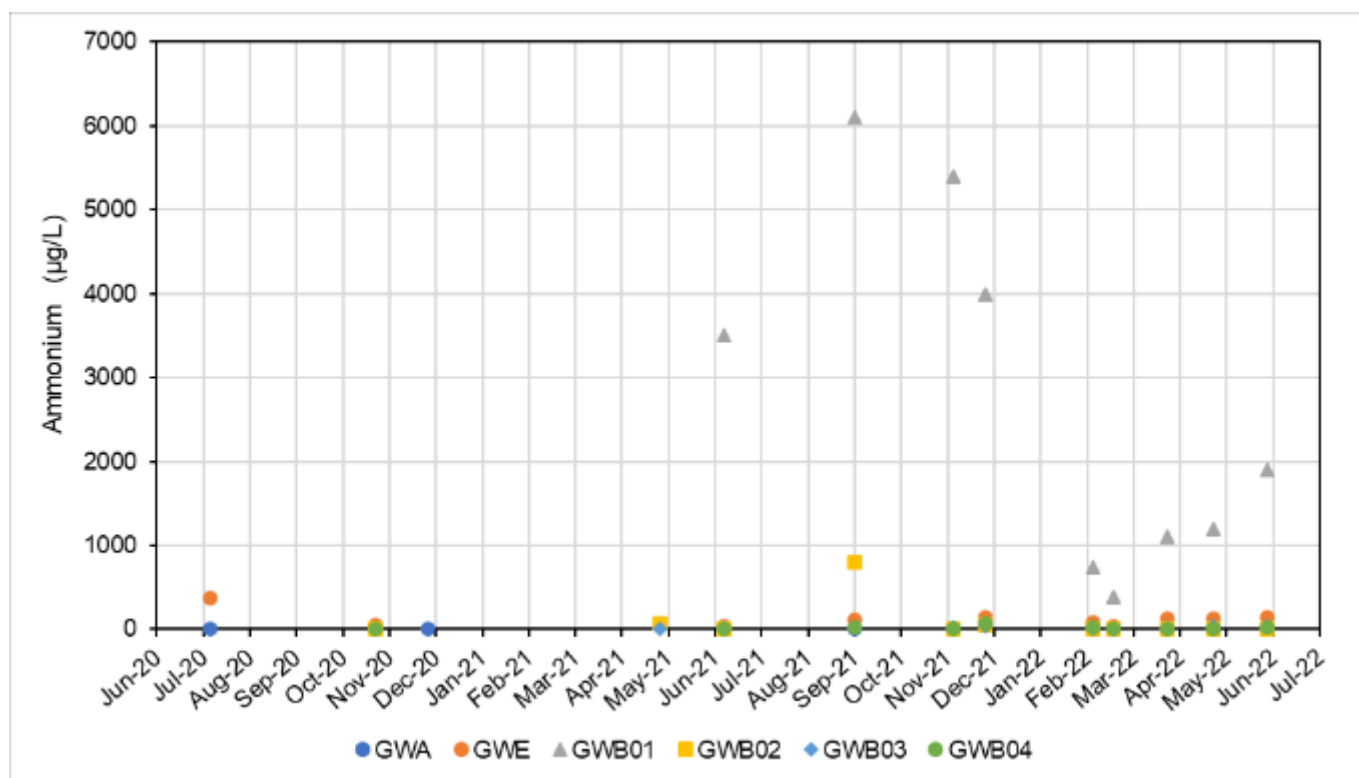


Figure 5-15. NH₄ at each of the six of the bores monitored between August 2020 and June 2022

Dissolved metals

Concentrations of Cd, CrIII, CrVI, Pb and Al were at or below the LOR during the monitoring period.

Cu concentrations were mostly between 0.001 mg/L (LOR) and 0.05 mg/L at all sites, except GWE where concentrations were always below LOR. The highest concentration recorded since monitoring started was reported in August 2021 at GWB04, with no clear cause leading to such concentration. As shown in Figure 5-16, concentrations of Cu have increased since October 2021 at GWA.

The variability of Fe seen in Figure 5-17 at GWE is most likely characteristic of the aquifer and not influenced by the activities at the KWMF. Similarly, no considerable differences in concentrations of Zn are seen between upgradient and downgradient bores. The increasing Zn concentration recorded at GWB04 (see Figure 5-18) is likely a characteristic of the aquifer.

Mn was always higher in bores GWB01 to GWB03 than at any other bore. There is an increasing trend in the concentration of this metal at GWB01 since May 2021.

Ni concentrations at the upgradient bores GWA and GWE was always below LOR, in comparison to bores GWB01 to GWB04, where concentrations ranged between 0.002 mg/L and 0.005 mg/L.

Se has always been detected at GWB04 since the parameter started to be analysed in July 2021 (Table 5-22)

Table 5-17. Cu measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

Cu (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.001	0.001	0.006	0.010
GWE	<0.001	<0.001	<0.001	<0.001
GWB01	0.005		0.007	0.005
GWB02	0.003	0.003	0.003	0.002
GWB03	0.002	<0.001	0.001	<0.001
GWB04	0.020	0.002	0.003	0.002

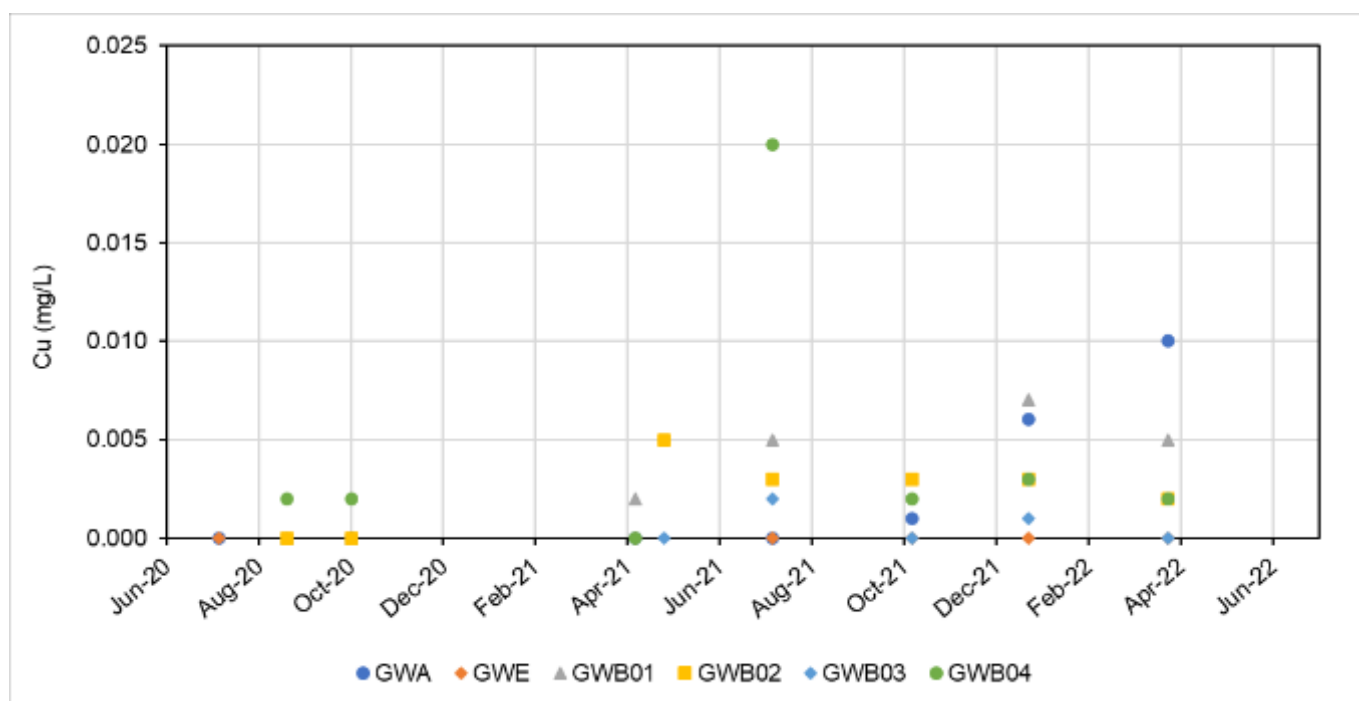


Figure 5-16. Cu at each of the six of the bores monitored between August 2020 and June 2022

Table 5-18. Fe measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

Fe (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.01	0.08	0.01	<0.01
GWE	0.11	1.10	<0.01	0.68
GWB01	<0.01		<0.01	0.01
GWB02	<0.01	<0.01	<0.01	<0.01
GWB03	<0.01	<0.01	<0.01	0.09
GWB04	<0.01	0.03	<0.01	<0.01

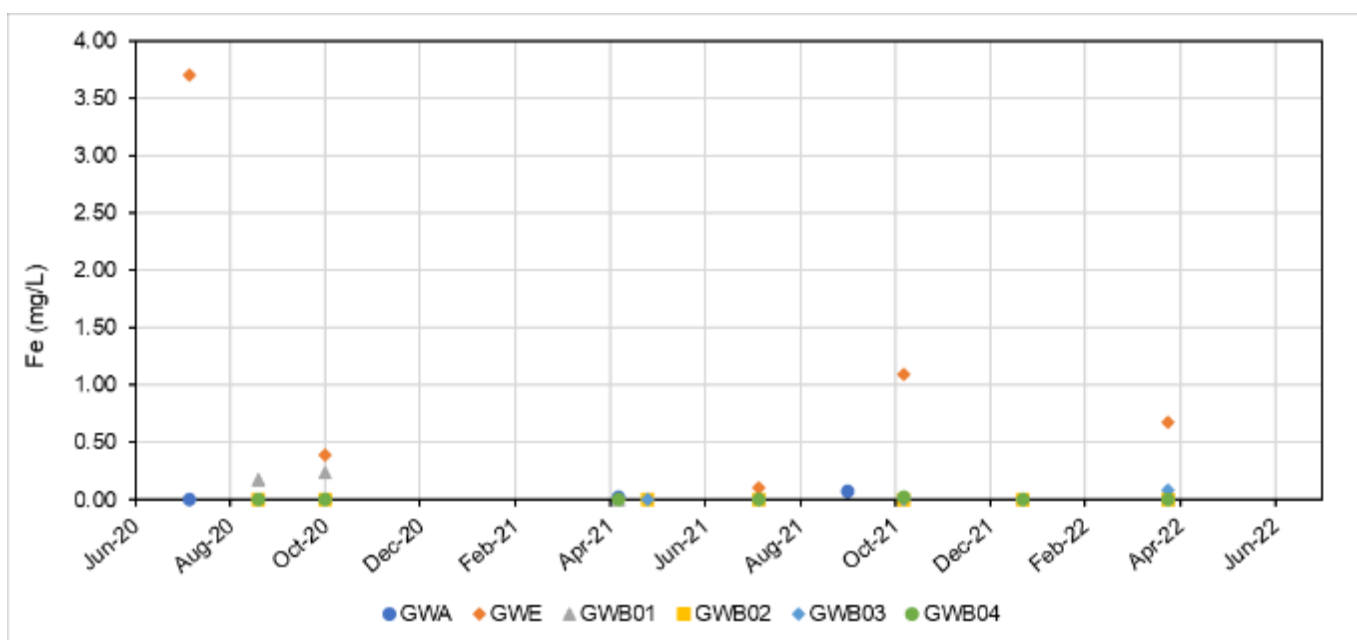


Figure 5-17. Fe at each of the six of the bores monitored between August 2020 and June 2022

Table 5-19. Zn measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

Zn (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.011	0.009	0.071	0.025
GWE	0.002	0.003	0.007	0.004
GWB01	0.004		0.009	0.008
GWB02	0.003	0.005	0.005	0.003
GWB03	0.007	0.005	0.007	0.008
GWB04	0.033	0.032	0.046	0.051

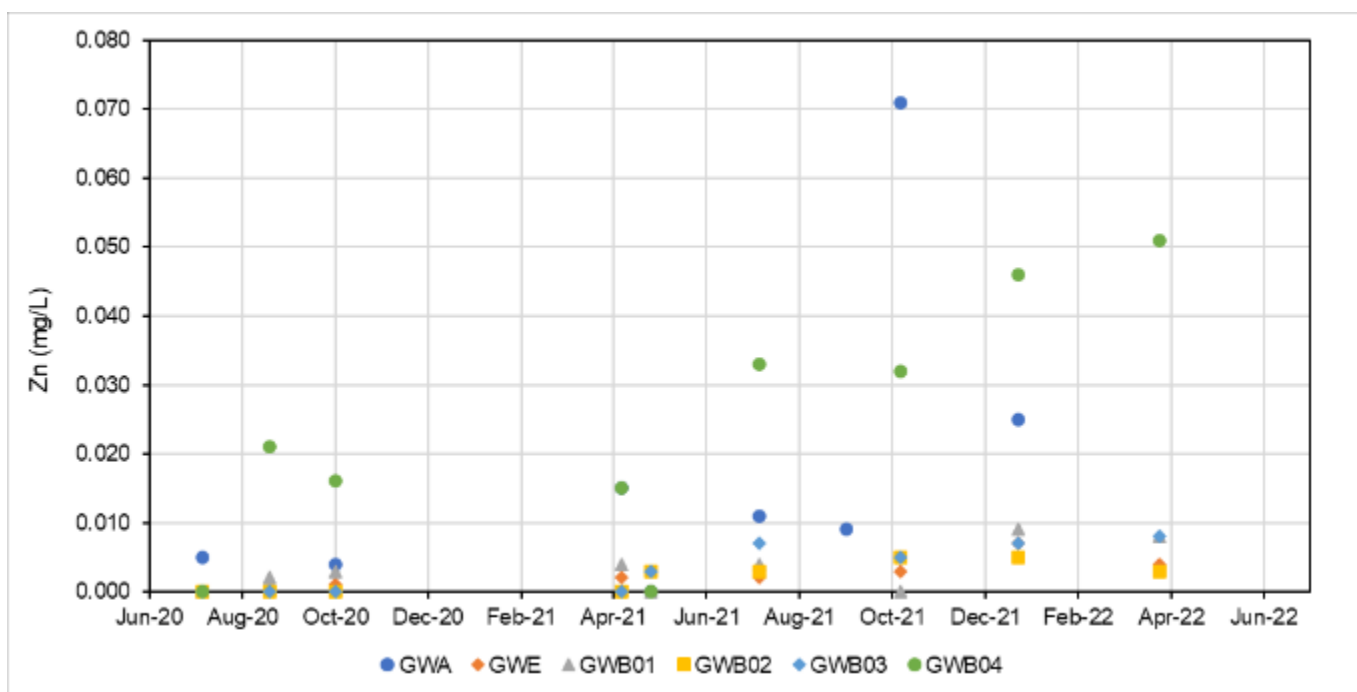


Figure 5-18. Zn at each of the six of the bores monitored between August 2020 and June 2022

Table 5-20. Mn measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

Mn (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.005	<0.005	<0.005	<0.005
GWE	0.008	0.019	<0.005	0.020
GWB01	0.380		0.015	0.140
GWB02	0.029	0.032	0.009	0.022
GWB03	0.054	0.097	0.110	0.100
GWB04	<0.005	<0.005	<0.005	<0.005

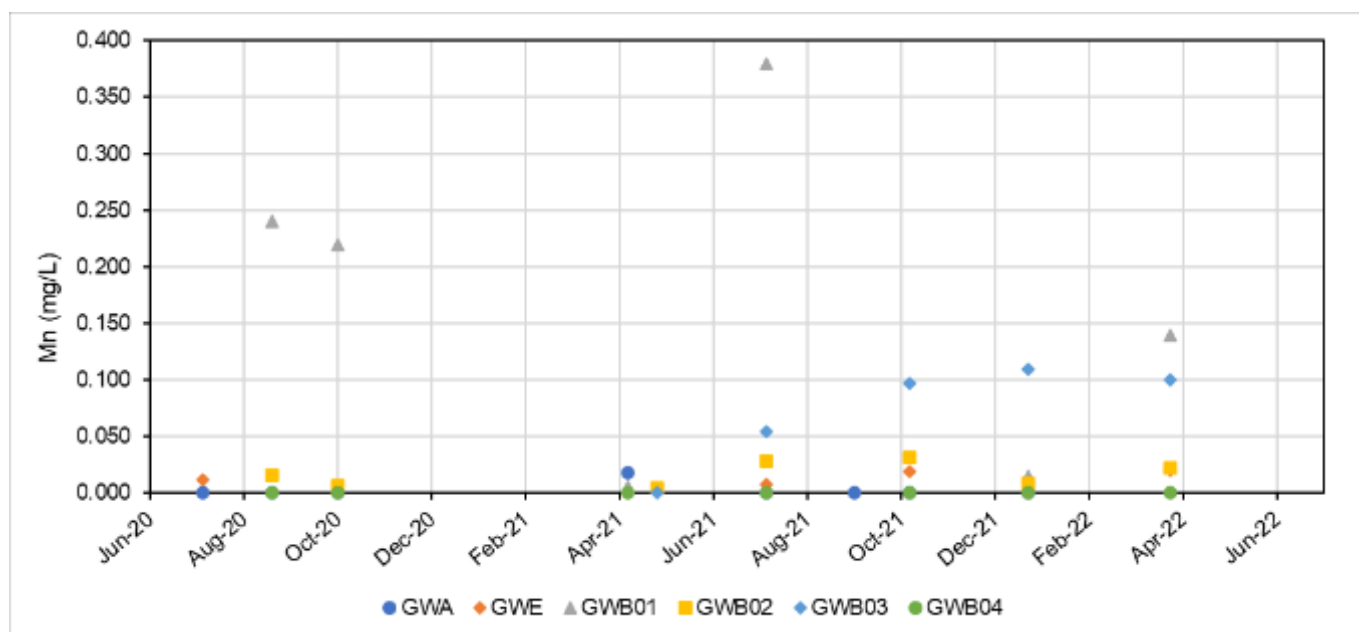


Figure 5-19. Mn at each of the six of the bores monitored between August 2020 and June 2022

Table 5-21. Ni measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

Ni (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.001	<0.001	<0.001	<0.001
GWE	<0.001	<0.001	<0.001	<0.001
GWB01	0.004		0.002	0.003
GWB02	0.003	0.004	0.003	0.003
GWB03	0.002	0.003	0.005	0.003
GWB04	0.004	<0.001	0.002	<0.001

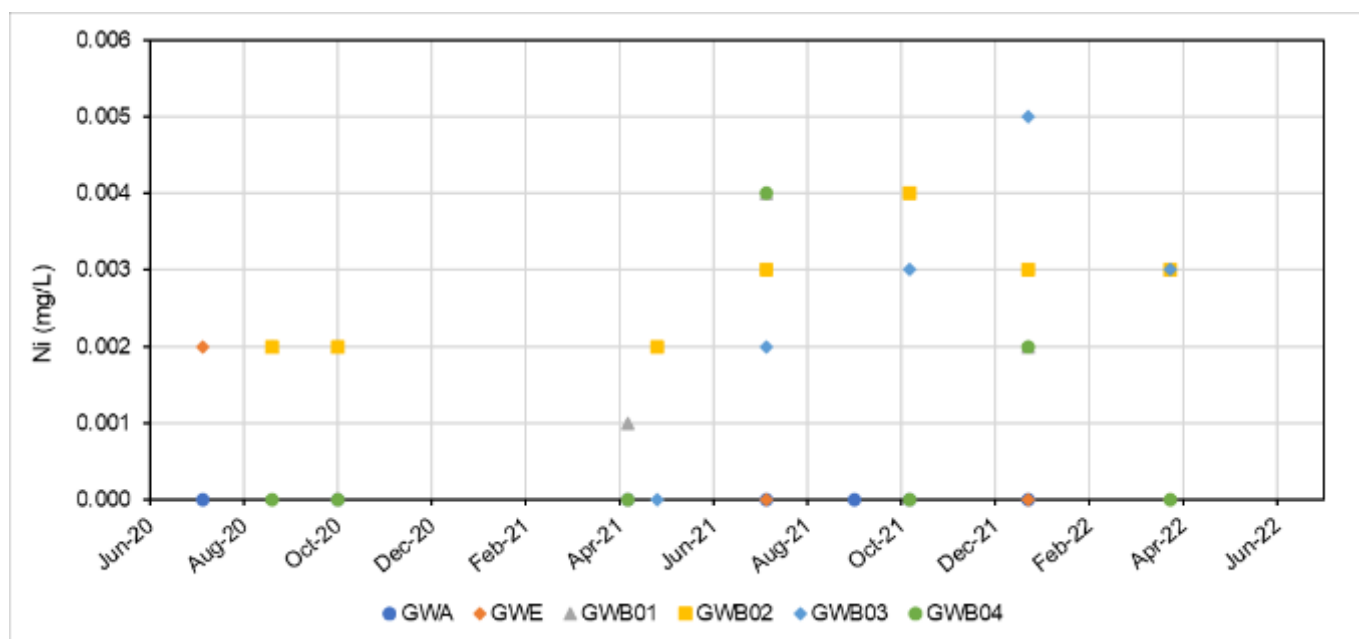


Figure 5-20. Ni at each of the six of the bores monitored between August 2020 and June 2022

Table 5-22. Se measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

Se (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.001	<0.001		<0.001
GWE	<0.001	<0.001		<0.001
GWB01	<0.001			<0.001
GWB02	<0.001	<0.001		<0.001
GWB03	<0.001	0.001		<0.001
GWB04	0.002	0.002		0.001

Other leachate indicators

TOC and TDS recorded higher concentrations at the downgradient bores (GWB01 to GWB04) than at the two most upgradient, GWA and GWE. The highest concentration of TOC, since monitoring started, was recorded at GWB03 in May 2022.

COD was also higher at the downgradient bores GWB01 to GWB03. Concentrations at GWE, GWA and GWB04 were always below LOR.

There was no significant difference in BOD and VFA concentrations between downgradient and upgradient bores.

Table 5-23. TOC measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

TOC (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	1
GWE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
GWB01	5	5	5		3	4	3	2	2	4	4	4
GWB02	2	2	3	2	<1	<1	3	2	2	2	2	2
GWB03	3	2	1	4	4	<1	4	2	<1	1	9	3
GWB04	3	<1	<1	<1	<1	<1	<1	<1	<1	5	<1	2

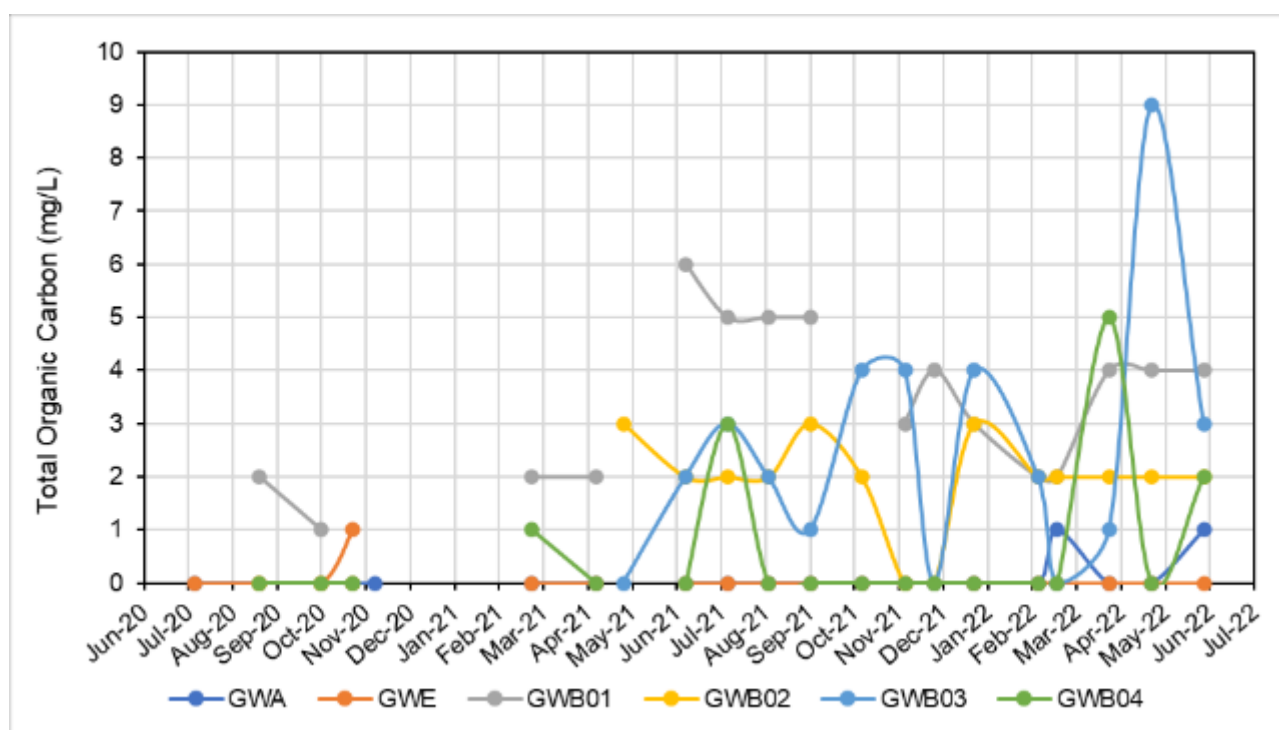


Figure 5-21. TOC at each of the six of the bores monitored between August 2020 and June 2022

Table 5-24. TDS measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

TDS (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	320	380	330	360	350	380	320	320	260	360	310	360
GWE	260	340	250	300	180	540	220	290	240	260	260	290
GWB01	640	520	520		530	490	550	560	530	500	510	540
GWB02	570	620	610	520	550	520	530	590	560	540	500	550
GWB03	540	630	520	580	590	670	580	450	450	490	530	610
GWB04	460	500	470	650	500	540	440	480	390	520	470	490

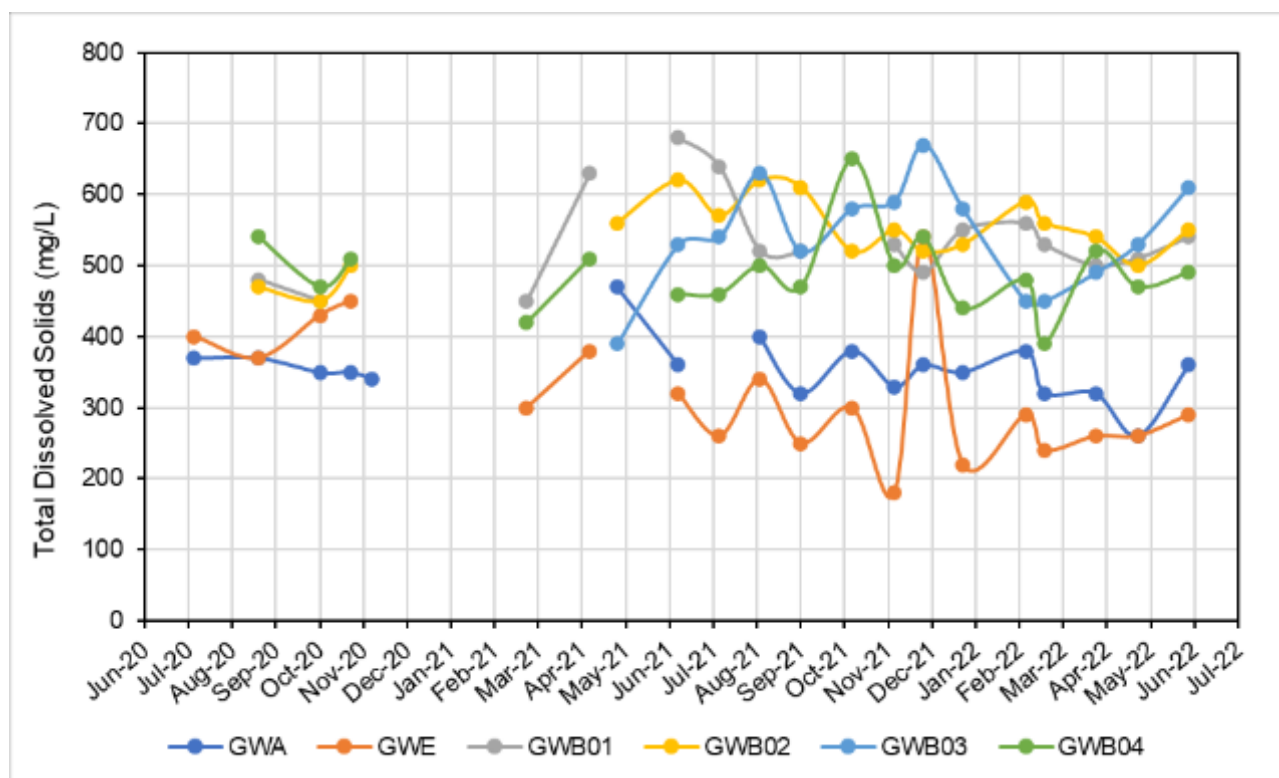


Figure 5-22. TDS at each of the six of the bores monitored between August 2020 and June 2022

Table 5-25. COD measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

COD (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
GWE	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
GWB01	<20	<20	220		<20	240	<20	<20	38	50	360	24
GWB02	<20	<20	<20	67	<20	<20	<20	21	<20	<20	<20	<20
GWB03	<20	<20	<20	100	220	<20	72	<20	<20	<20	<20	48
GWB04	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

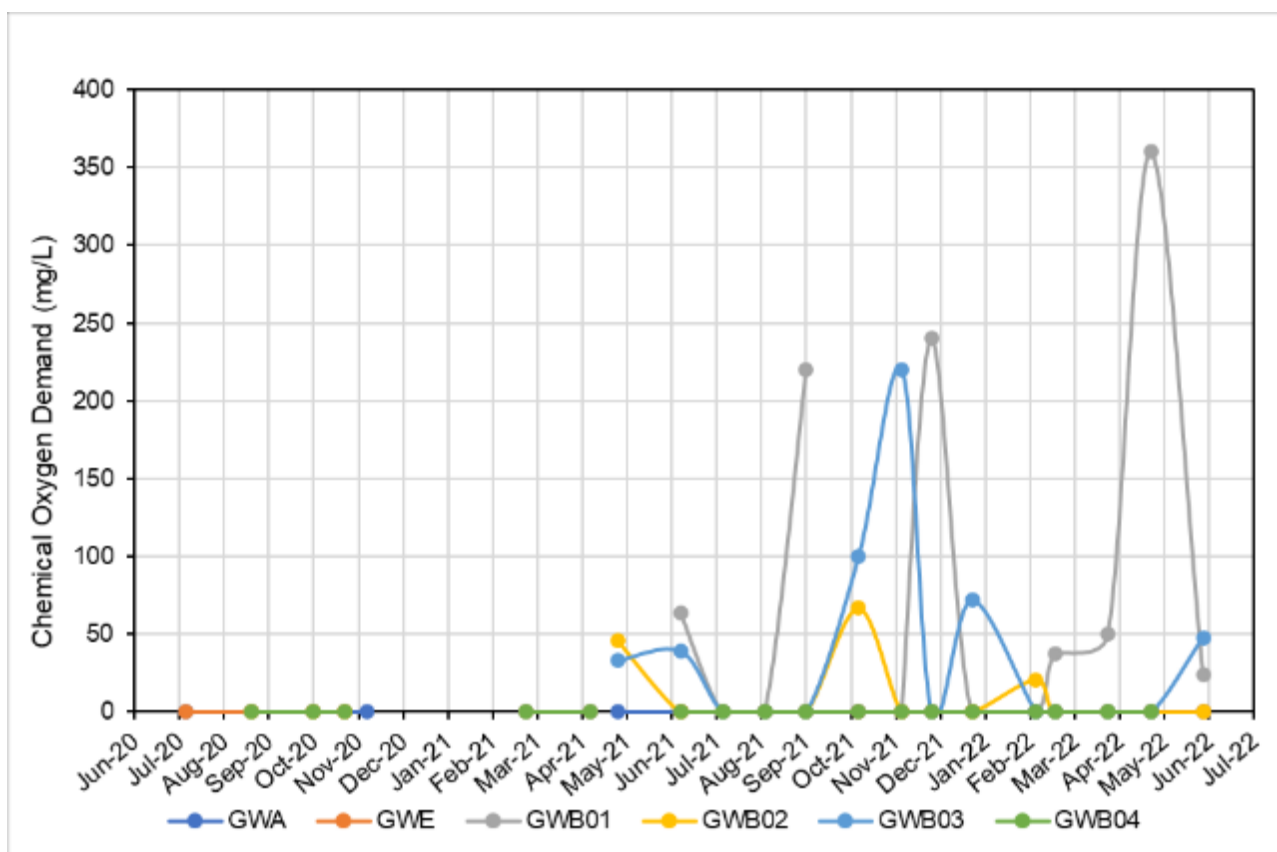


Figure 5-23. COD at each of the six of the bores monitored between August 2020 and June 2022

Table 5-26. BOD measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

BOD (mg/L)	2021						2022					
	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	<5	20	<5	19	14	<5	<5	5	<5	6	<5	<5
GWE	<5	19	<5	23	13	<5	<5	<5	<5	<5	<5	<5
GWB01	<5	22	6		20	<5	9	6	7	10	8	8
GWB02	<5	29	<5	29	17	<5	9	6	<5	6	<5	9
GWB03	<5	22	11	28	19	<5	15	14	<5	7	7	10
GWB04	<5	<5	6	6	18	<5	10	6	<5	13	6	8

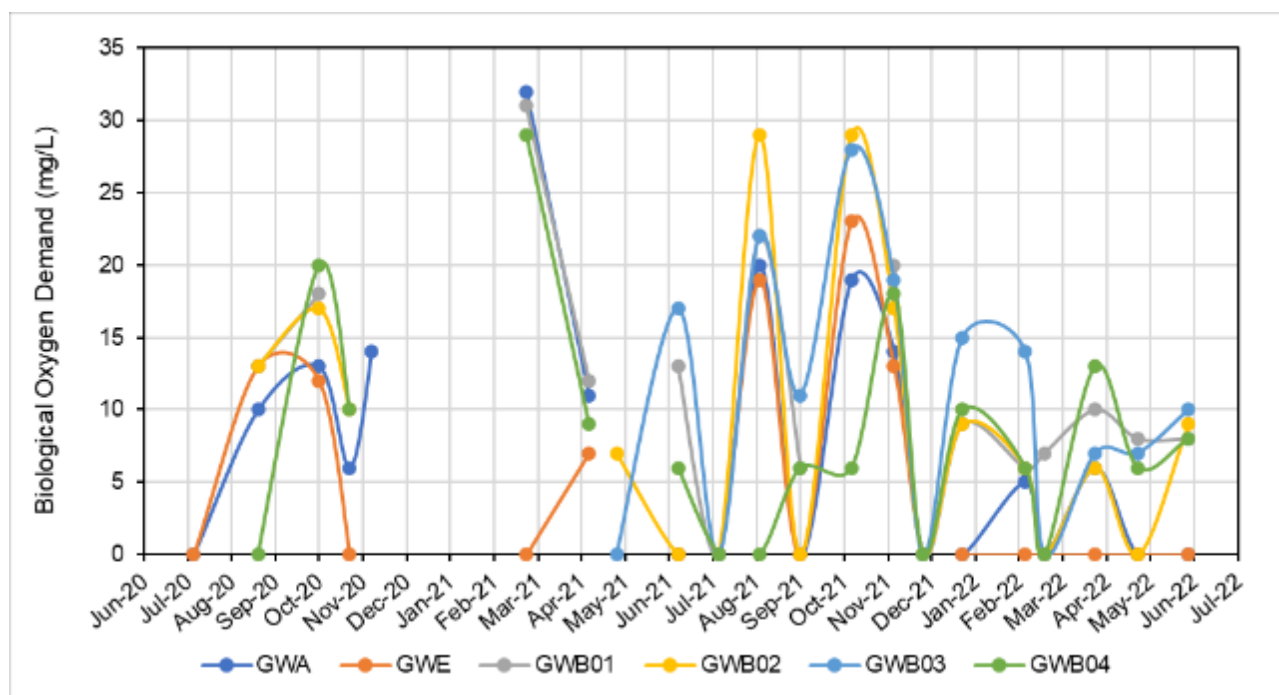


Figure 5-24. BOD at each of the six of the bores monitored between August 2020 and June 2022

Table 5-27. VFA measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

VFA (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	9	<5	33	<5
GWE	<5	<5	<5	9
GWB01	16		7	29
GWB02	12	<5	18	19
GWB03	22	11	7	18
GWB04	11	10	6	11

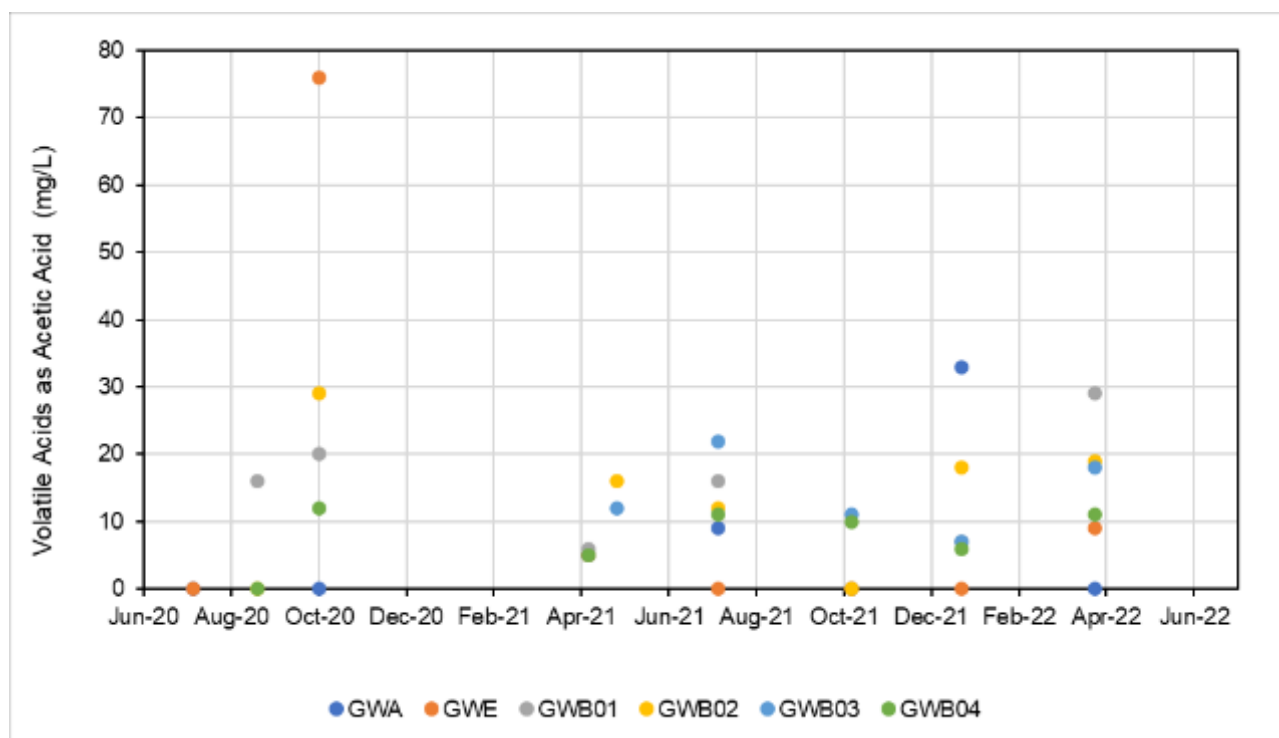


Figure 5-25. VFA at each of the six of the bores monitored between August 2020 and June 2022

PFAS

PFAS concentrations were usually higher in the downgradient bores GWB01 and GWB02 compared to the upgradient bores; see Table 5-28 to Table 5-39. The PFAS forms PFPeS and PFHpS were only detected in the downgradient bores. These two bores also recorded the highest concentrations of PFBS, PFHxS, PFOS, PFHxA, PFHpA and PFOA, particularly at GWB01. As shown in Figure 5-37, concentrations of PFAS since May 2021 have been mostly higher than in previous monitoring rounds.

During the monitoring period, concentrations of PFBA and PFPeA were at higher concentrations at the upgradient bore GWA than at GWB01 and GWB02. Although these species are commonly detected at GWA, the concentrations recorded since July 2021 have been higher than in previous months. No increasing trend is seen in these two PFAS species.

PFAS concentrations in the upgradient bores GWB03 and GWB04 were usually below LOR. These bores are screened in the shallower aquifer (Jinduckin Formation); as are GWB01 and GWB02 (see Section 3.4 above for more detail). The PFAS concentrations recorded in the upgradient bores GWA and GWE, which are drilled deeper into the underlying Tindal Limestone Aquifer, are likely derived from the regional-scale PFAS contamination from the RAAF Base Tindall, which is dominated by the fire-fighting foam PFAS ingredients PFOS, PFHxS and PFOA, or from other unidentified PFAS sources.

PFDS, PFNA, PFDA, PFUnDA, PFDoDA, PFTTrDA, PFTA, 4:2 FTS, 6:2 FTS, 8:2 FTS, 10:2 FTS and PFOSA were all below the LOR.

The wide mixture of different PFAS types detected in the downgradient bores is indicative of a landfill source.

Table 5-28. PFPeS measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFPeS (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.01	<0.01	<0.01	<0.01
GWE	<0.01	<0.01	<0.01	<0.01
GWB01	0.08		0.08	0.08
GWB02	0.10	0.07	0.09	0.08
GWB03	<0.01	<0.01	<0.01	<0.01
GWB04	<0.01	<0.01	<0.01	<0.01

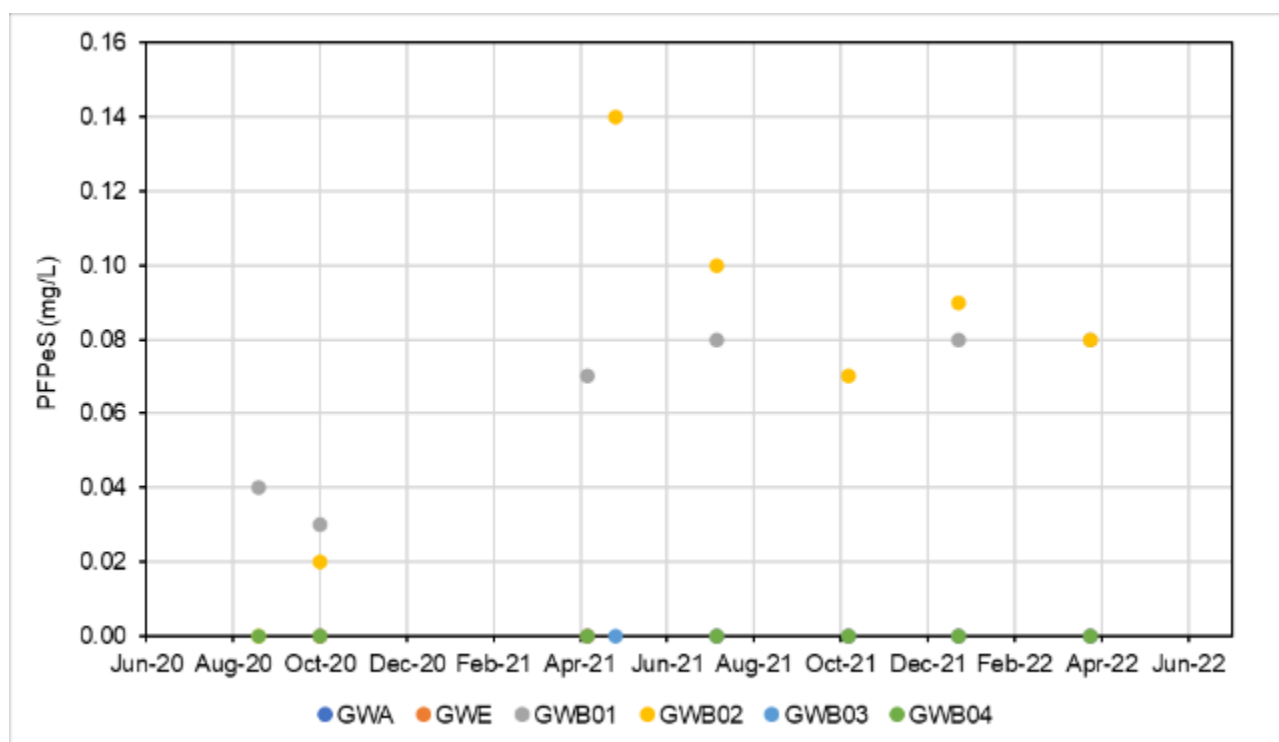


Figure 5-26. PFPeS at each of the six of the bores monitored between August 2020 and June 2022

Table 5-29. PFHpS measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFHpS (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.01	<0.01	<0.01	<0.01
GWE	<0.01	<0.01	<0.01	<0.01
GWB01	0.10		0.04	0.06
GWB02	0.06	0.05	0.06	0.06
GWB03	<0.01	<0.01	<0.01	<0.01
GWB04	<0.01	<0.01	<0.01	<0.01

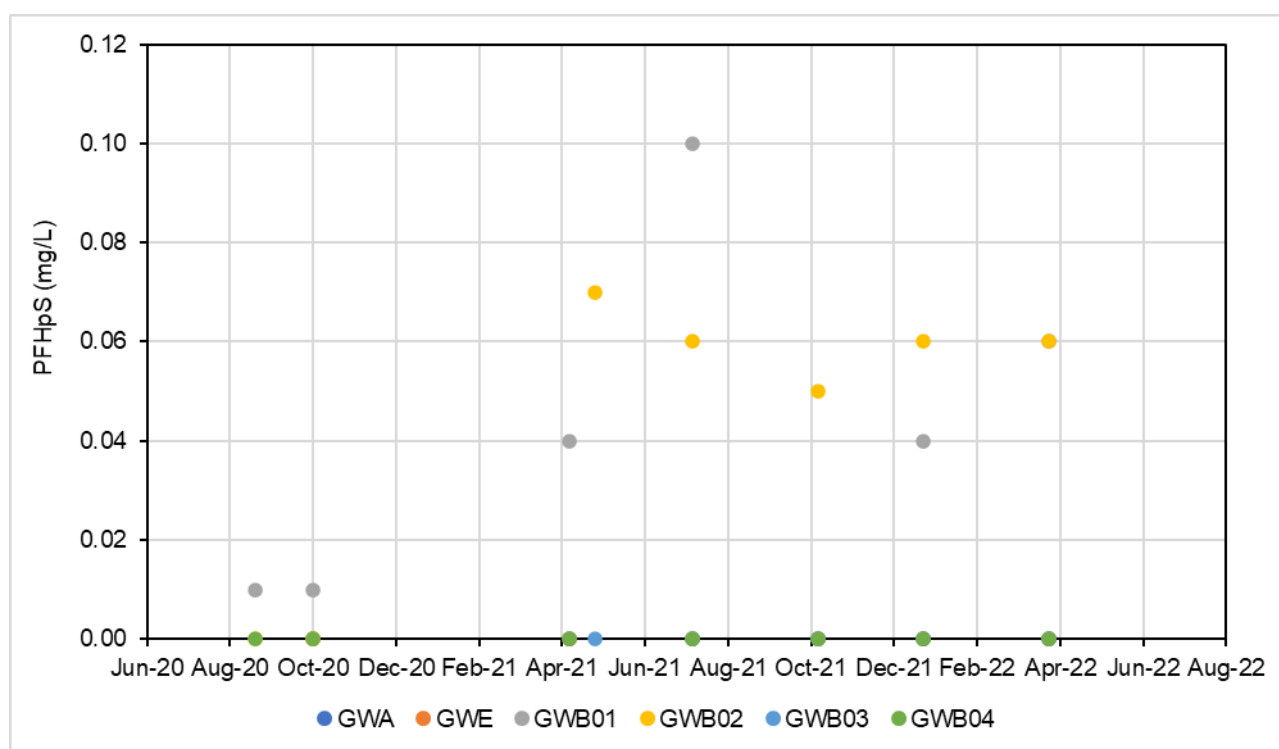


Figure 5-27. PFHpS at each of the six of the bores monitored between August 2020 and June 2022

Table 5-30. PFBS measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFBS (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.01	<0.01	<0.01	<0.01
GWE	<0.01	0.03	<0.01	<0.01
GWB01	0.10		0.10	0.10
GWB02	0.15	0.12	0.14	0.12
GWB03	<0.01	<0.01	<0.01	<0.01
GWB04	<0.01	<0.01	<0.01	<0.01

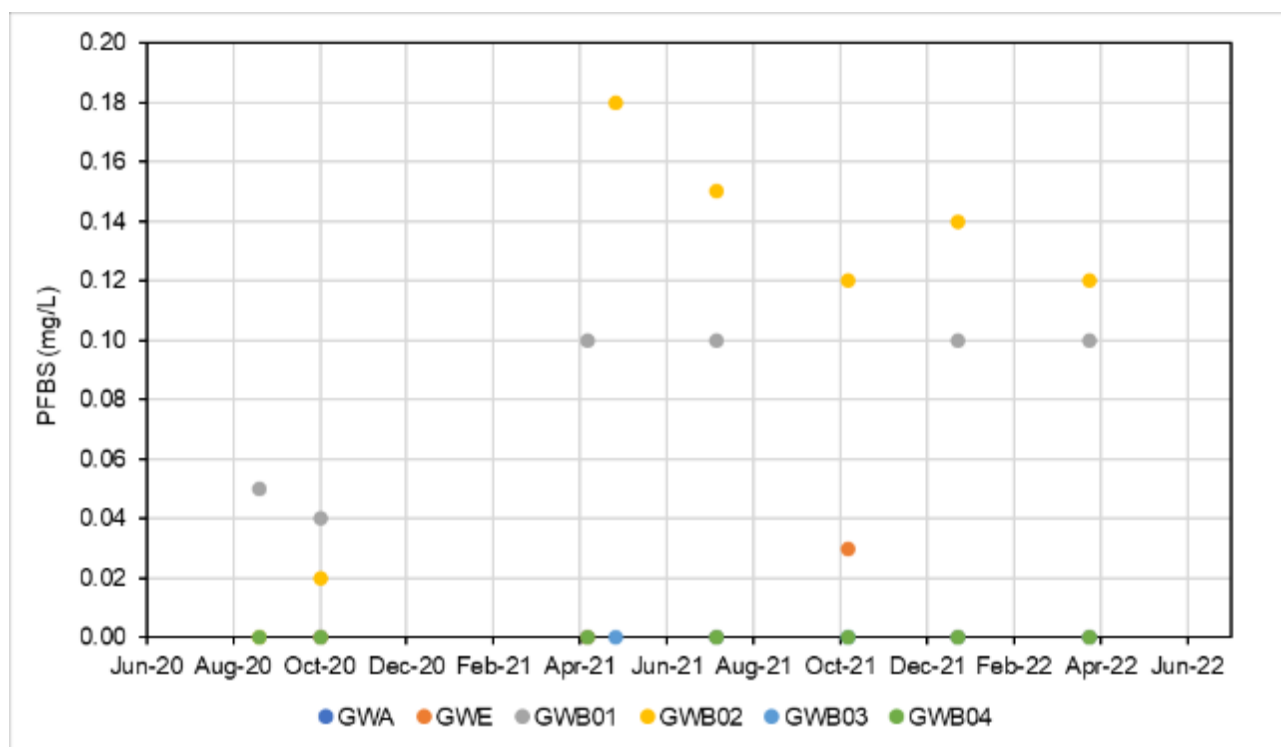


Figure 5-28. PFBS at each of the six of the bores monitored between August 2020 and June 2022

Table 5-31. PFHxS measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFHxS (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.03	<0.01	0.02	0.02
GWE	0.01	0.04	<0.01	<0.01
GWB01	1.10		0.62	0.83
GWB02	0.49	0.28	0.48	0.42
GWB03	<0.01	<0.01	<0.01	<0.01
GWB04	0.01	<0.01	<0.01	<0.01

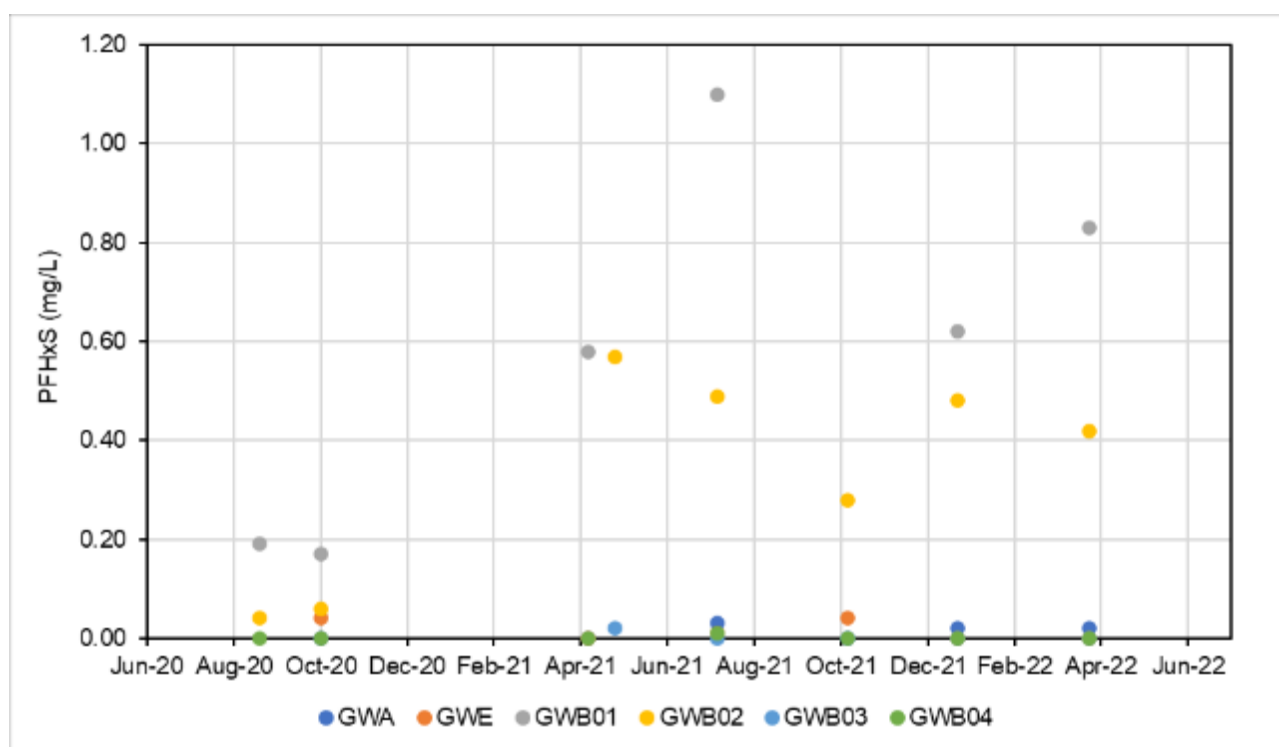


Figure 5-29. PFHxS at each of the six of the bores monitored between August 2020 and June 2022

Table 5-32. PFOS measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFOS (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.05	<0.01	<0.01	0.03
GWE	0.04	0.12	<0.01	0.02
GWB01	2.30		0.90	1.40
GWB02	0.45	0.51	0.69	0.59
GWB03	0.01	<0.01	<0.01	<0.01
GWB04	0.04	<0.01	<0.01	<0.01

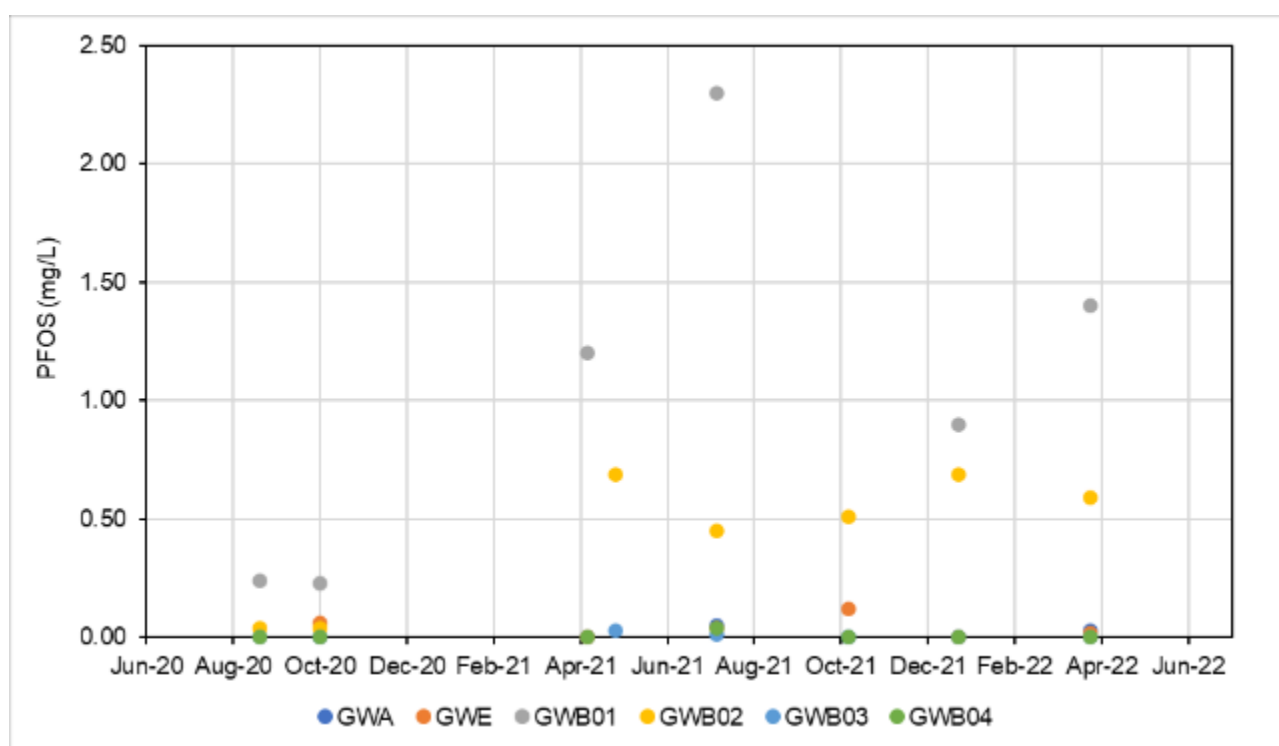


Figure 5-30. PFOS at each of the six of the bores monitored between August 2020 and June 2022

Table 5-33. PFHxA measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFHxA (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.14	0.01	0.15	0.16
GWE	<0.01	0.03	<0.01	<0.01
GWB01	0.23		0.11	0.14
GWB02	0.34	0.25	0.29	0.26
GWB03	<0.01	<0.01	<0.01	<0.01
GWB04	<0.01	<0.01	<0.01	<0.01

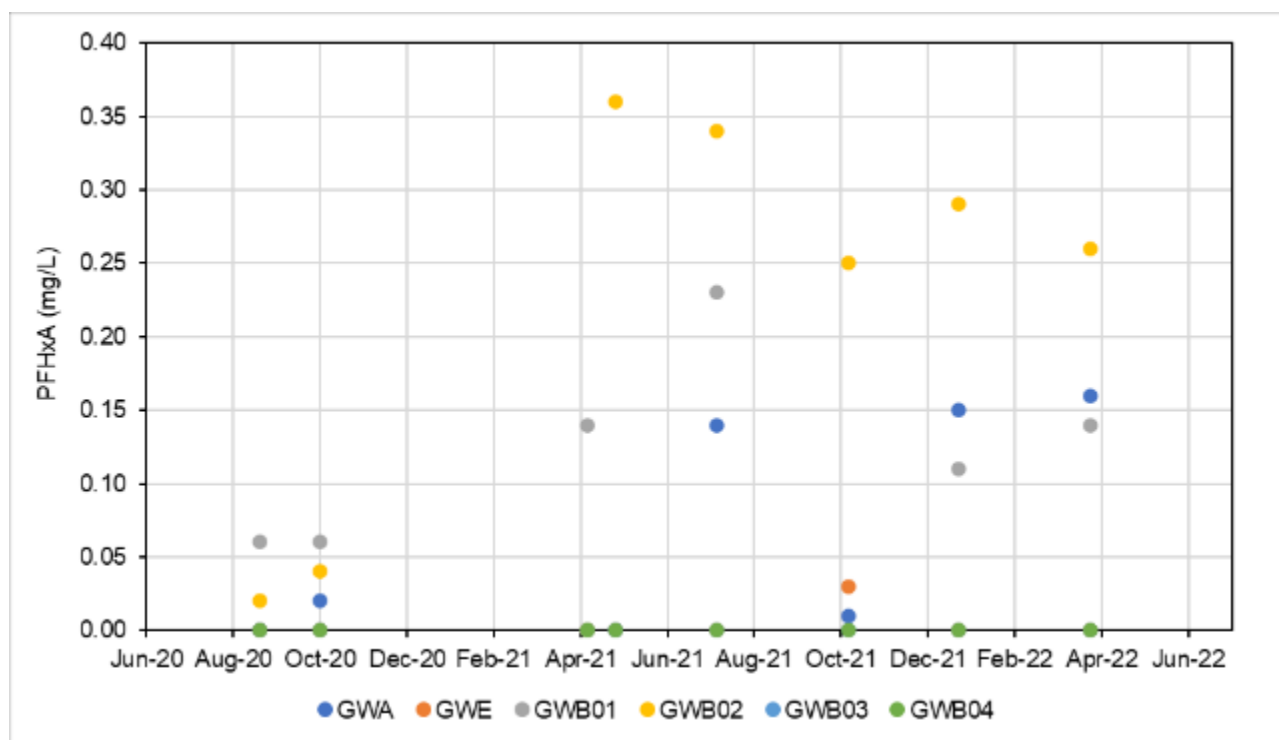


Figure 5-31. PFHxA at each of the six of the bores monitored between August 2020 and June 2022

Table 5-34. PFHpA measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFHpA (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.09	<0.01	0.08	0.10
GWE	<0.01	0.01	<0.01	<0.01
GWB01	0.09		0.05	0.05
GWB02	0.11	0.09	0.09	0.09
GWB03	<0.01	<0.01	<0.01	<0.01
GWB04	<0.01	<0.01	<0.01	<0.01

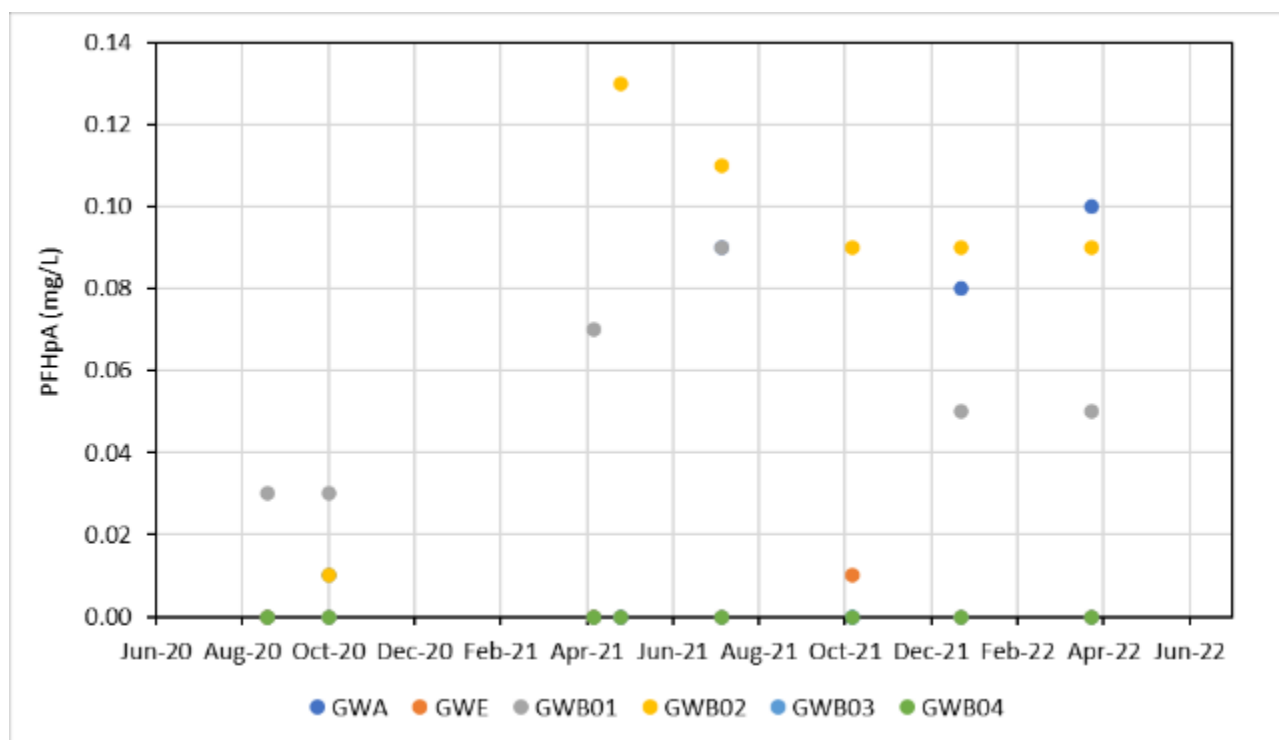


Figure 5-32. PFHpA at each of the six of the bores monitored between August 2020 and June 2022

Table 5-35. PFOA measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFOA (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.05	<0.01	0.03	0.05
GWE	<0.01	0.02	<0.01	<0.01
GWB01	0.21		0.12	0.15
GWB02	0.16	0.12	0.18	0.16
GWB03	<0.01	<0.01	<0.01	<0.01
GWB04	<0.01	<0.01	<0.01	<0.01

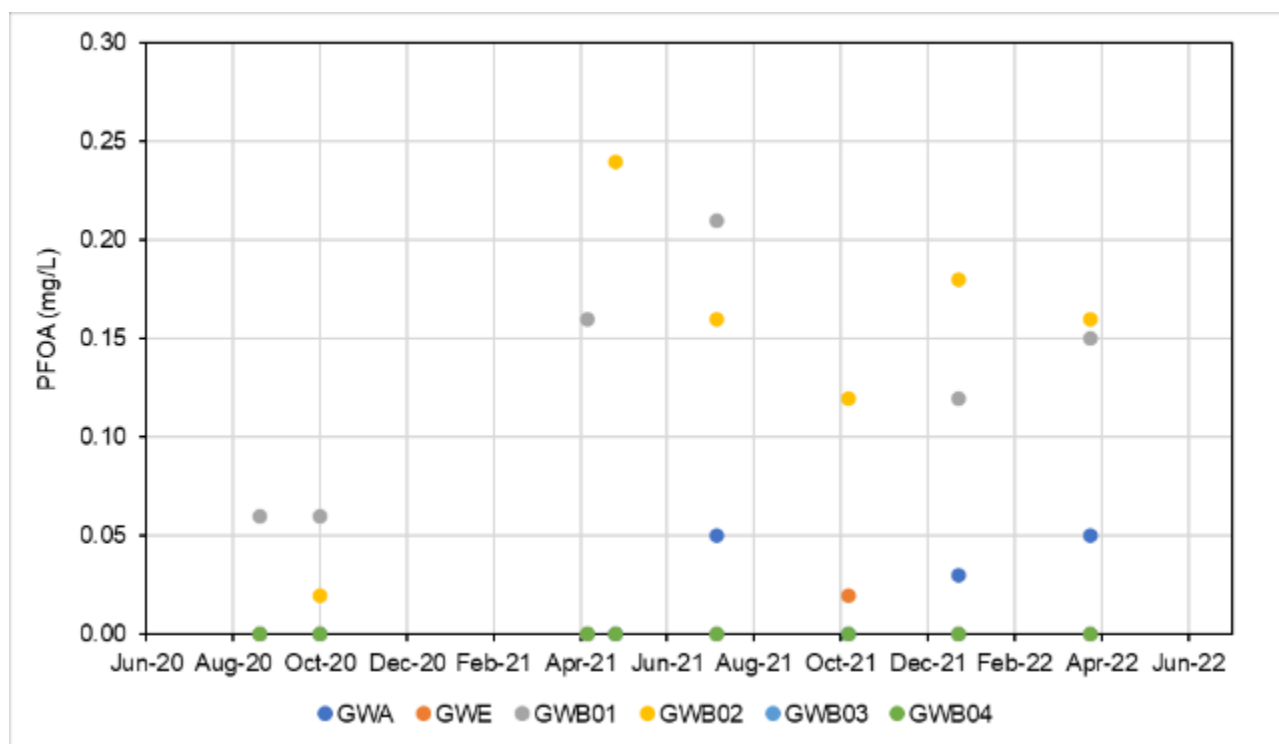


Figure 5-33. PFOA at each of the six of the bores monitored between August 2020 and June 2022

Table 5-36. PFBA measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFBA (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.20	<0.02	0.20	0.20
GWE	<0.02	<0.02	<0.02	<0.02
GWB01	0.10		0.08	0.10
GWB02	0.10	0.10	0.10	0.10
GWB03	<0.02	<0.02	<0.02	<0.02
GWB04	<0.02	<0.02	<0.02	<0.02

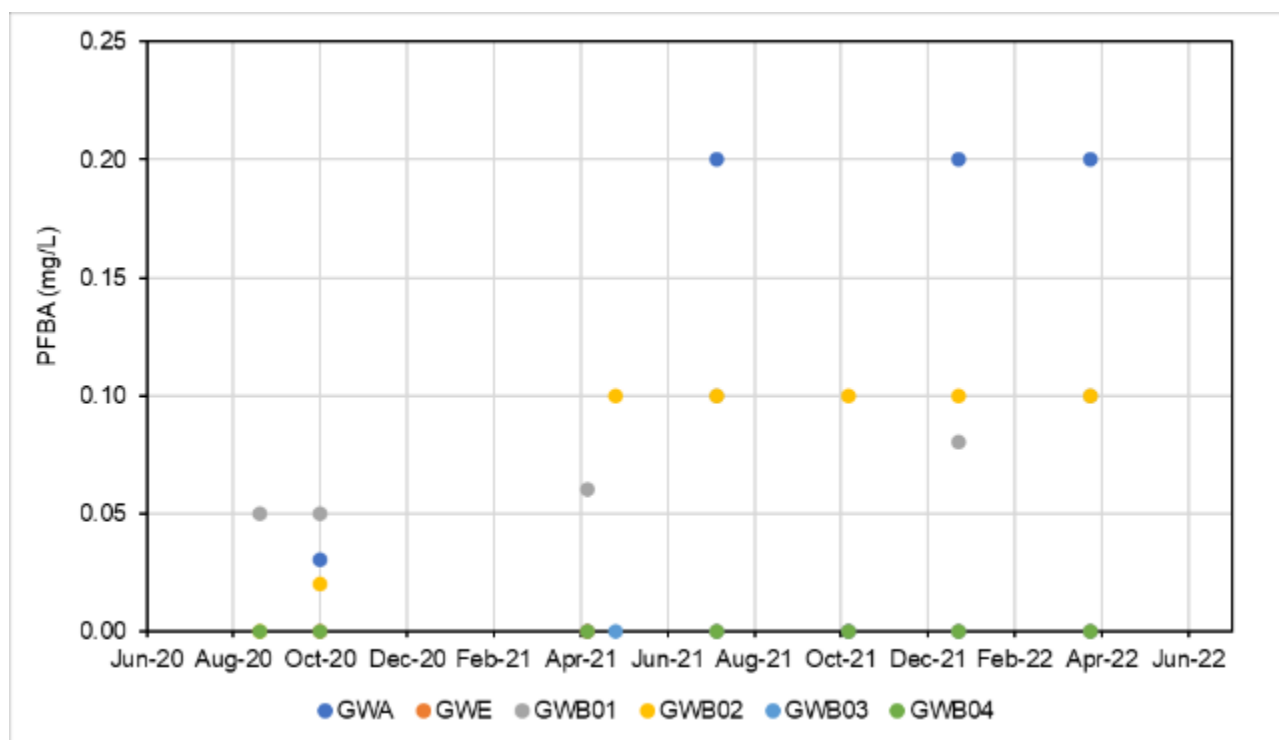


Figure 5-34. PFBA at each of the six of the bores monitored between August 2020 and June 2022

Table 5-37. PFPeA measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

PFPeA (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.31	0.03	0.32	0.35
GWE	<0.02	<0.02	<0.02	<0.02
GWB01	0.09		0.05	0.06
GWB02	0.10	0.10	0.10	0.10
GWB03	<0.02	<0.02	<0.02	<0.02
GWB04	<0.02	<0.02	<0.02	<0.02

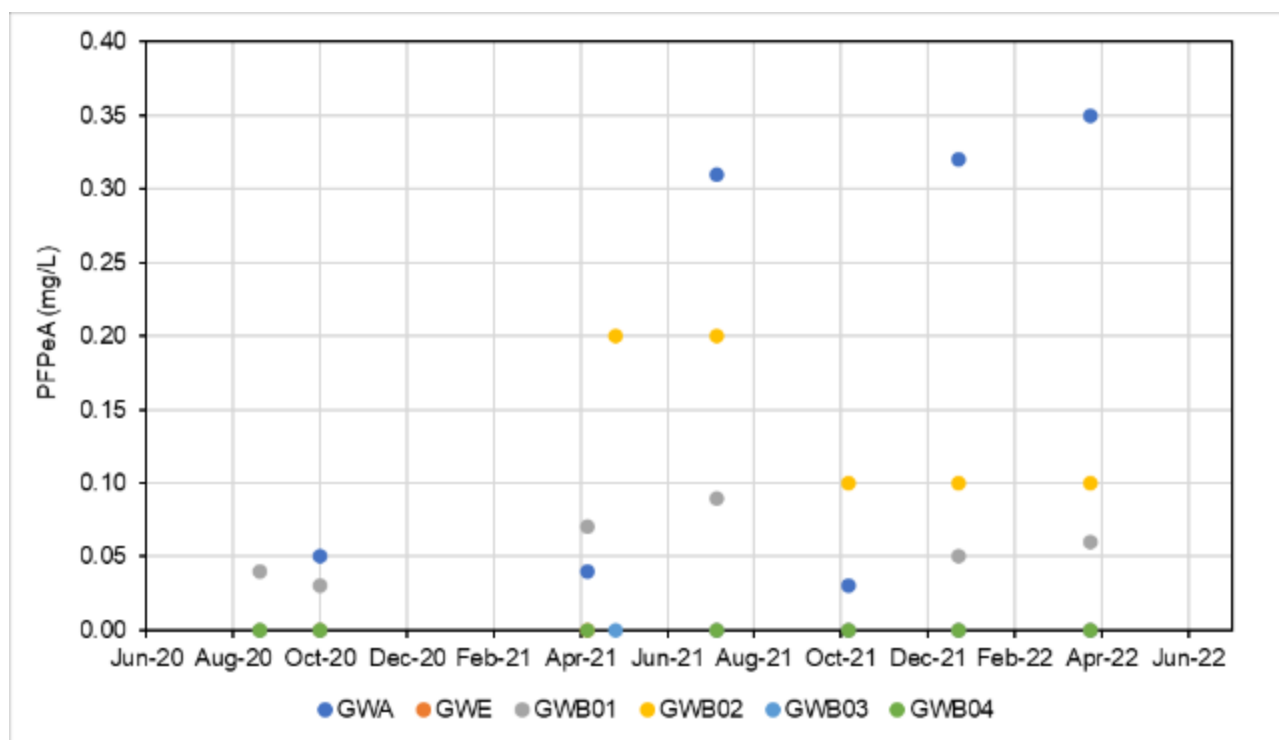


Figure 5-35. PFPeA at each of the six of the bores monitored between August 2020 and June 2022

Table 5-38. Total PFHxS + PFOS measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

TOTAL PFHxS + PFOS (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.08	<0.01	0.02	0.05
GWE	0.05	0.16	<0.01	0.02
GWB01	3.40		1.50	2.20
GWB02	0.94	0.79	1.20	1.00
GWB03	0.01	<0.01	<0.01	<0.01
GWB04	0.05	<0.1	<0.1	<0.1

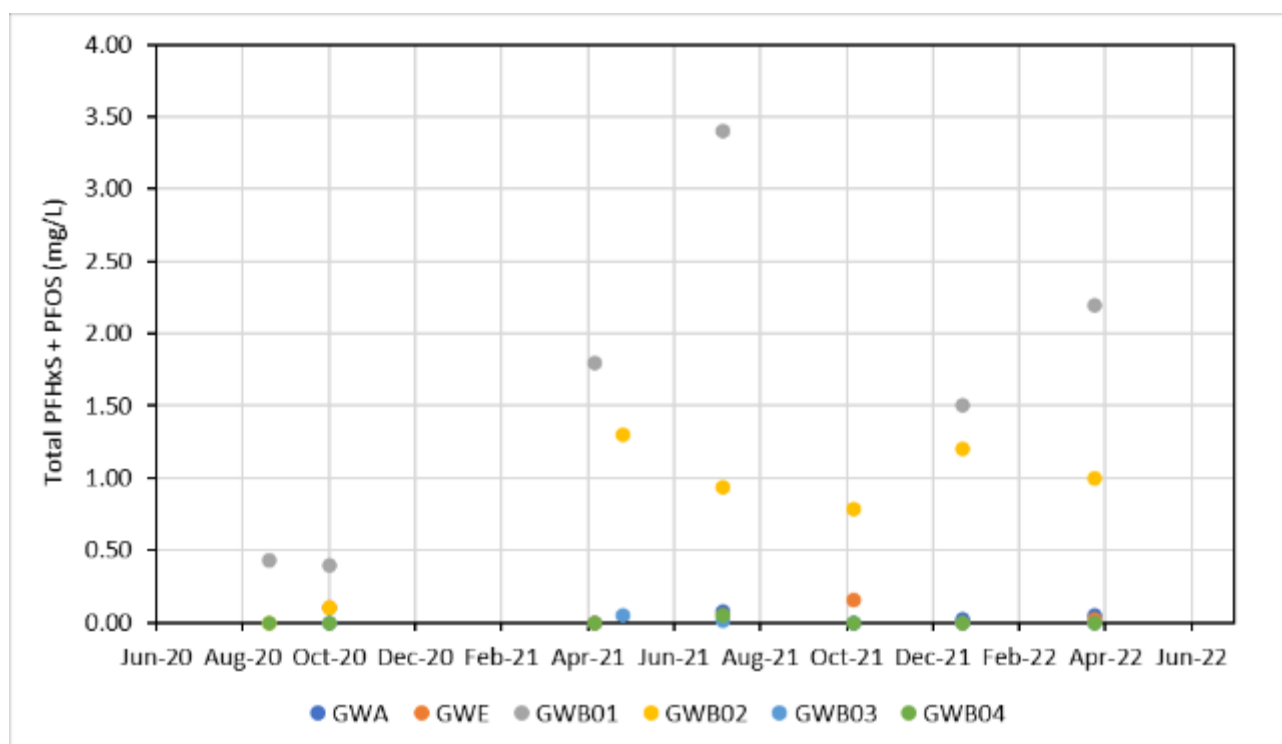


Figure 5-36. Total PFHxS + PFOS at each of the six of the bores monitored between August 2020 and June 2022

Table 5-39. Total PFAS (28 analytes) measured in KWMF groundwater bores
(Concentrations below the LOR are greyed out)

TOTAL PFAS (mg/L)	2021		2022	
	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.87	0.04	0.80	0.91
GWE	0.05	0.25	<0.01	0.02
GWB01	4.40		2.20	3.00
GWB02	2.10	1.70	2.20	2.00
GWB03	0.01	<0.01	<0.01	<0.01
GWB04	0.05	<0.1	<0.1	<0.1

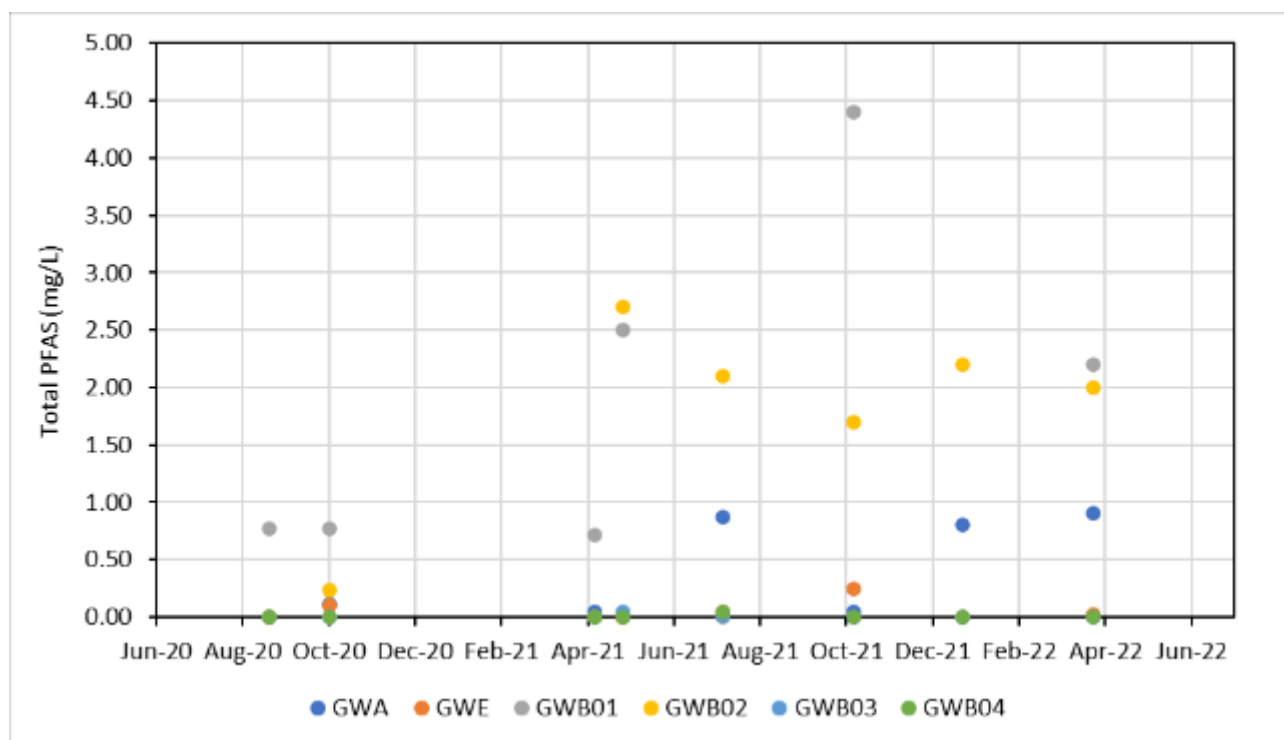


Figure 5-37. Total PFAS at each of the six of the bores monitored between August 2020 and June 2022

Other parameters

TRH, PAH, BTEXN and PCBs were all below LOR in all bores during the reporting period.

5.4 Discussion

Groundwater monitoring results indicate a likely impacts of landfill leachate on groundwater quality. Contaminants elevated in the two downgradient bores (GWB01 and GWB02), compared to the upgradient bores were metals (Mn, Ni, Cu), nutrients (TN, N, TP and NH₄), TOC, TDS, COD and a wide mixture of PFAS types.

PFAS concentrations were also recorded in the upgradient bores GWA and GWE, which are drilled deeper into the underlying Tindal Limestone Aquifer. These are likely derived from the regional-scale PFAS contamination from the RAAF Base Tindall, which is dominated by the fire-fighting foam PFAS ingredients PFOS, PFHxS and PFOA (see Figure 31a of the *Supplementary Detailed Site Investigation Report*, DoD 2018b). The wide mixture of PFAS types seen in the bores downgradient of the landfill are possibly indicating a landfill-source. However, the concentration of PFAS in leachate is not known, and as such, it is not possible to confirm the relationship between leachate and the PFAS detected in groundwater downgradient from the site.

6 POTENTIAL ENVIRONMENTAL IMPACTS

Based on the limited data available, it appears that landfill activities are impacting on groundwater quality, as seen in bores GWB01 and GWB02 with higher concentrations of some dissolved metals, nitrogen species and PFAS.

Potential receptors to contaminated groundwater downgradient of the KWMF are limited. There are no known bores used for any purpose downgradient of the KWMF i.e. no bores to the north west or west of the facility. The sewage ponds for Katherine are located in this area and as such, use of groundwater and/or surface water in this area would not generally be desirable anyway.

It is possible that groundwater from beneath the KWMF seeps into the Katherine River, although the Jinduckin Formation is a relatively poor aquifer in the region, and the Katherine River receives its most important groundwater inputs from springs located upstream that discharge groundwater from the Tindall Limestone Aquifer. The Tindall Limestone Aquifer is not readily recharged by surface water from the KWMF, where the Jinduckin Formation occurs.

Groundwater used at the KWMF is sourced from a bore upgradient of the landfill and as such, on-site workers are not at risk.

Impacts on surface water (Tindal Creek) were not evaluated given that no samples were collected during this monitoring period, as the creek was always dry when monitoring was undertaken.

7 REVIEW OF PERFORMANCE AGAINST EMP MEASURES

As required by Condition 65.5 of EPL298, Table 7-1 to Table 7-12 below, provide a review of performance against the measures specified in the *Environmental Management Plan- Katherine Waste Management Facility* (EcOz 2020).

Table 7-1. Measures for general environmental management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Ensure the implementation and compliance of this EMP	Ongoing
	Annual environmental audit of EPL conditions and EMP	EcOz engaged to prepare annual Monitoring Report (i.e. this report)
	Ensure all personnel working at KWMF are given an induction detailing environmental risks and mitigation measures in this EMP, as well as emergency response procedures	All operators are inducted with protocol they have to follow in an emergency situation and evacuation procedure.
Target / performance criteria	Impacts/risks to environment are reduced to acceptable levels	Impacts/risks to water quality are discussed in this Monitoring Report
Monitoring	Daily visual site inspection (general parameters)	Any loose rubbish is picked up every morning.
	Monthly environmental inspection against EPL conditions and this EMP, as per site inspection checklist	Implemented

Table 7-2. Measures for communication, consultation and heritage management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Seek and maintain required approvals from NT EPA regarding landfill design upgrades, monitoring and reporting in accordance with the EPL conditions	TAFT Engineering have developed Integrated Environmental Management Plan, and provided recommendations to optimise use of current facility and engage with the NT EPA to assist Council with approval processes.
	Develop and distribute newsletters or leaflets to inform users of KWMF of any updates or changes to the landfill operations or site. Have this information also on the KTC website.	KTC website and social media is used to update users about, accepted waste streams, alternative disposal and/or recycling options and cost benefits for separating waste streams.

EMP measure:		Current implementation progress:
	Place notices in the newspaper when any significant works or changes are being planned/undertaken	N/A
	In the event a sacred site or heritage artefact is uncovered, the KTC must inform the Heritage Branch as soon as possible and follow further advice	N/A
	All complaints shall be logged in the complaints register and appropriate action undertaken	One complain received and appropriate action taken.
Target / performance criteria	Minimal complaints from users of KWMF and surrounding landowners/users	Nil
	Minimal complaints from local community	Complain actioned as soon as possible
	Appropriate management of sacred sites or heritage items discoveries	Nil
	Any complaints have been addressed and responded to	One complain received and appropriate action taken.
Monitoring	Review of complaints register to ensure it is being used correctly	Implemented
	Annual audit to ensure that monitoring and reporting are being undertaken as per the EPL conditions and EMP	NT EPA site visit <i>See Katherine Landfill Environmental Audit of Sub-surface Fires Report (Golder Associates, 2021).</i>

Table 7-3. Measures for waste acceptance and disposal management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Relevant staff are to be trained on the types of waste accepted and pre-approvals required – this will be done through inductions and toolbox talks/staff meetings	Ongoing – On the job training provided to staff and discussed in regular staff meetings.
	Clear signage and communication to make landfill users aware of the types of waste accepted at KWMF	Clear signs are in place. Users are also instructed on the weighbridge as they drive in. Plans are in place to implement more signs.
	At the weighbridge – conduct visual inspections of waste loads and question driver regarding types of wastes within the load.	Manual and visual inspections are carried out for every load that comes in. Weighbridge staff go out and have a closer look at the waste pile. CCTV is also in place to monitor the incoming waste loads.

EMP measure:		Current implementation progress:
	If not general waste, seek compliance documentation to verify type of wastes and prior approval if applicable.	Any disposal of asbestos requires prior application before user bring it to the waste facility. Acceptance of any degassed white goods will require certificate, if not, users will be charged extra for KTC to organise onsite degassing.
	Any waste not listed in the EPL can only be accepted after special approval from NT EPA	Anything that is non-compliant with NT EPA is not accepted.
	Only clean fill can be accepted for disposal. Soil being brought to KWMMF from potentially contaminated sites will require validation sampling results to be assessed against the NSW EPA <i>Waste Classification Guidelines</i> .	Soil from potentially contaminated site is verified with NT EPA before accepting in the facility.
	Provide assistance and clear directions on correct waste disposal areas	Weighbridge staff provide clear directions to users as they drive in.
	Clearly labelled signs at transfer stations	Implemented
	Salvage of recyclable materials incorrectly disposed of	Implemented – When the waste from transfer station is transferred to the tip face, staff go through the waste and remove any recyclables or hazardous objects and are placed on respective pile.
	Regular clean-up of scattered and inappropriately disposed waste	Any loose rubbish is picked up every morning and disposed appropriately.
	Apply daily cover, temporary cover and capping as required	Implemented
	Only domestic users are permitted to use the transfer station unless directed by the weighbridge operator	Implemented
	Accepted wastes are only to be stored within approved areas and storage vessels	Implemented
	All liquid waste (toilets, ablutions etc.) will be disposed of directly into site septic tanks, which will be managed as required	Liquid waste is not accepted – not licenced
	All drivers will be instructed to remain on alert for evidence of hot loads (smoke/fire) and to alert KWMMF staff	Implemented – Staff are constantly alert for evidence of hot loads. Firefighting equipment is located at accessible area for use when required.
Target / performance	No acceptance of unapproved wastes	Nil
	No significant impacts or environmental harm	Nil

EMP measure:		Current implementation progress:
criteria	No breach of EPL conditions	Nil
	All wastes disposed of in accordance with EPL and industry standards	Implemented
Monitoring	Visual monitoring of loads to ensure appropriate acceptance of wastes	Visual monitoring of every waste load is carried out at the Weighbridge
	Water quality monitoring as per schedule	Minor breaches as outlined in this Monitoring Report. Unable to complete some sampling due to Tindal Creek not flowing.
	Visual inspections of waste transfer stations and active tip face shall occur at least daily in the dry season and at least twice daily in the wet season	Implemented

Table 7-4. Measures for storage and use of chemicals, oils and fuels management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Any spills or leaks of hazardous materials will be treated in accordance with the emergency response plan – spill response procedure	The facility does not accept hazardous materials. Battery storage is underneath the shade which keeps rain away. Spill kit is ready for use when required
	All chemicals, oils and fuels will be stored appropriately in locked areas that are bunded, impervious areas in accordance with their SDS	All chemicals and fuels are bunded and stored on a shed and are locked appropriately.
	SDS will be available in a folder where the chemicals, oils and fuels are stored	Implemented. The folder is kept in the office. All operators and tradesmen are made aware about the location of the folder.
	Storage of oils and fuels must be in accordance with Australian Standards (AS1940 – The storage and handling of flammable and combustible liquids)	Implemented
	Chemical use will be in accordance with the appropriate SDS	Implemented
	Volumes of stored chemicals, oils and fuels will be kept to a minimum where possible	Implemented
	Spill response kits to be stored and maintained in all storage areas	Implemented
	Site staff to be trained in spill response as part of the induction process	Implemented
Target / performance criteria	No spills or leaks of hazardous substances	Nil
	No breach of EPL	Nil in relation to this aspect
	Reporting of spills/leaks to NT EPA	Nil

Monitoring	Daily visual inspections of waste disposal areas to identify any hazards or spills	Daily inspection is carried out
	Monthly site inspection to check correct use and storage of hazardous materials and for signs of any spills or leaks	Implemented

Table 7-5. Measures for storm water, erosion and sediment control management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Install and maintain surface water diversion structures as required to ensure that clean and dirty water do not mix.	Ongoing – Implementation of drain and bunding
	Use appropriate cover and capping materials (temporary daily cover where required)	Implemented - Constant supply of capping material is delivered to site.
	Implement and maintain erosion and sediment control measures where necessary	Ongoing – Bunding upgrade when required.
	Prevent contamination of storm water from chemicals, oils and fuels stored and used on site by use of appropriate bunding and covers	Implemented
	Ensure appropriate management of spills	Implemented
	Ensure progressive rehabilitation of disturbed areas	Ongoing noxious weed management implemented.
	Monitor for signs of erosion and take corrective actions where required	Daily site inspection
Target / performance criteria	No sedimentation of the surrounding environment	Nil to date
	No impacts to surface water or groundwater within KWMF	Minor impacts detected, as outlined in Section 5 of this Monitoring Report
	Erosion and sediment control measures are implemented and maintained where necessary	Implemented
	Disturbed areas are rehabilitated as soon as possible	Implemented
Monitoring	Ensure water quality monitoring is undertaken in accordance with the monitoring plan	Minor breaches as outlined in this Monitoring Report. Unable to complete some sampling due to Tindal Creek been dry
	Inspection of waste disposal areas following heavy rainfall events	Implemented
	Site inspections to include checks for signs of erosion and monitoring of erosion and sediment control measures as well as surface water diversion structures, as per the site inspection schedule	Implemented

Table 7-6. Measures for leachate management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Ensure appropriate disposal of wastes into landfill cells	5:1batters around the edge of landfill and filling with waste and capping.

EMP measure:		Current implementation progress:
	Use of appropriate cover and capping for landfill cells	Use of 2 types of soil (lower grade soil and higher dry content) for cover and capping.
	Minimise exposed tip face area to reduce rainfall infiltration Monitor all active waste areas following high rainfall events for signs of discoloured runoff / leachate Where leachate contamination of surface run-off is visible, construct diversions to direct leachate back into landfill	Implemented – construction of drains where required.
	Minimise the surface area and volumes of green waste kept on site	Constant heaping of the mulch/green waste to reduce risk of fire.
Target / performance criteria	No incidents or monitoring results in breach of the EPL	Surface water sampling sites not sampled during reporting period
	No detectable leachate flowing from KWMF operations area	Likely infiltration into groundwater as seen in groundwater monitoring results presented in this Monitoring Report, but does not represent a potential risk for receptors, as discussed in Section 5.4
	No impacts to the surface water or groundwater at KWMF	Minor impacts, as described in Section 5 of this Monitoring Report
Monitoring	Ensure water quality monitoring is undertaken in accordance with the monitoring plan	Minor breaches as outlined in this Monitoring Report. Unable to sample any surface water site during the reporting period, and some parameters to be tested in leachate were not analysed.
	Inspection of waste disposal areas following heavy rainfall events	Implemented
	Conduct site inspections on water quality controls as per the site inspection schedule	Daily and monthly inspections

Table 7-7. Measures for dust, odour and aesthetics management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Dust suppression through the use of a water cart/truck will be undertaken when necessary	Implemented as required
	Speed limits on site will be enforced to reduce the amount of dust	Speed limit of 20km/hr implemented within the facility
	Progressive revegetation of disturbed areas will be undertaken to reduce generation of dust	Revegetation will be carried out after capping is implemented.
	Transfer station skip bins will be emptied when full and at least at the close of each working day	Implemented
	Skip bins used at the transfer station are to be cleaned at least monthly to prevent build-up of odours	Monthly clean
	Wastes that cause odour are to be covered immediately	Implemented

	Scattered rubbish will be cleaned up regularly	Implemented - daily
	Waste stations / storage areas are to be kept tidy	Implemented
Target / performance criteria	No complaints received from KWMF users, employees and surrounding land owners/users relating to dust, odour or aesthetics	Nil received
Monitoring	Daily site inspection to include visual checks of cleanliness and tidiness	Implemented
	Visual monitoring for excessive dust generation	Implemented

Table 7-8. Measures for noise management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Maintain all equipment and machinery to manufacturers standards	Implemented- daily check and regular service of machinery is carried out.
	Conduct all operations during standard work hours	Implemented
Target / performance criteria	No complaints received from KWMF users, employees and surrounding land owners/users relating to noise	Nil received
Monitoring	If noise outside of what is considered normal operational noise is to occur, notification and details will be given to the public and surrounding land owners via newspapers and letter drops	Work not carried out outside of normal operational hours.
	Noise monitoring will be undertaken in the event of a complaint	N/A

Table 7-9. Measures for litter management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Litter will be regularly cleaned up and disposed of appropriately by KWMF staff	Implemented daily
	The perimeter fence is designed to reduce wind-blown litter leaving the KWMF. This fence will be maintained.	Implemented – fence recently upgraded.
	Additional litter fencing should be installed near Tindal Creek if existing fencing is inadequate in preventing windblown litter from entering the waterway.	Implemented (temporary fencing around active tip face)
Target / performance criteria	No complaints received from KWMF users, employees and surrounding land owners/users relating to litter	Nil received
Monitoring	Daily site inspections to include a visual check for litter	Implemented
	Monthly formal site inspection including inspection of litter and litter controls	See Appendix B for <i>Monthly Operational Checklist</i> from September to December 2021

Table 7-10. Measures for flora and fauna management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	All clearing at KWMF will have the required approvals undertaken by KTC	Implemented
	Any sightings of threatened fauna species are to be reported to the Site Manager to determine whether the animal is at risk and requires relocation	Nil
	Report any injured fauna to the Site Manager	Nil
	No pets / domestic animals allowed to be brought onto KWMF	Implemented
	Speed limits will be enforced to minimise potential for fauna impact	Implemented - Speed limit of 20km/hr
	Disturbed areas will be progressively rehabilitated, and done so with species local to the surrounding environment	The rehabilitation of the site will be progressive as areas reach final levels (Taft Engineering, 2022). Species to be used are yet to be defined
	Perimeter fencing around the landfill site to prevent large fauna entering the site	Implemented
Target / performance criteria	No significant impacts to flora and fauna	Nil
	No injured fauna as a result of KWMF activities	Nil
	Disturbed areas progressively rehabilitated with local native species, and achieving a minimum 80% groundcover within the first year	The rehabilitation of the site will be progressive as areas reach final levels (Taft Engineering, 2022). Species to be used are yet to be defined
Monitoring	Monthly site inspections to check for signs of impacted flora and fauna	Implemented
	Monitoring of rehabilitation areas will be undertaken to ensure it is to an acceptable standard (i.e. a minimum 80% groundcover within the first year)	The rehabilitation of the site will be progressive as areas reach final levels (Taft Engineering, 2022). Species to be used are yet to be defined

Table 7-11. Measures for pests and weeds management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Declared weeds are not to be disposed of at KWMF without prior approval from KTC and the NT EPA	Declared weeds not accepted at the facility
	Weeds identified on site will be managed in accordance with the KTC WMP	Ongoing
	Regular pest control activities to be undertaken at KWMF, including use of bait stations etc.	Ongoing

EMP measure:		Current implementation progress:
	Where an infestation has been identified, a qualified, licensed pest control contractor will be called in to control the infestation	Implemented
	Boundary fence to be regularly inspected and maintained to prevent access to animals	Implemented
	The pooling of water will be prevented where possible, to decrease the breeding grounds for mosquitos	Implemented
Target / performance criteria	No declared weeds or introduction of noxious weeds at KWMF	Ongoing
	No spread of weeds from KWMF to surrounding environment	Bellyache bush (<i>Jatropha gossypifolia</i>) is growing within the facility and reported to weed management and dealt with appropriately.
	No introduction of feral / pest species at KWMF	Nil
	No feral / pest / vector infestations at KWMF	Nil
Monitoring	A weed survey is to be undertaken at least annually	Nil
	Monthly site inspection to check for presence of pests and weeds in operational areas	Implemented

Table 7-12. Measures for fire prevention management, specified in the Environmental Management Plan- Katherine Waste Management Facility (EcOz 2020).

EMP measure:		Current implementation progress:
Mitigation / Control	Appropriate management of waste disposal into landfill cells to ensure no hot loads or smoking loads	Implemented
	Ensure a clean and tidy operations area to minimise ignition sources	Implemented
	Appropriate hot works procedures – no hot works undertaken during fire bans or near flammable materials	Implemented
	Maintain fire-fighting equipment including extinguishers in date and accessible water cart.	Implemented
	Smoking only to occur in designated smoking areas	Implemented
	Maintain a 4 m wide fire break around the perimeter of the KWMF, around buildings and operational areas	Implemented
Target / performance criteria	Fire risk from and to the KWMF is reduced	Implemented
	No fires started at KWMF	Nil
Monitoring	Visual monitoring of loads going to landfill cells for evidence of smoking or hot loads	Implemented – frequent checks carried out

	Site inspections to include checks for fire fighting equipment and fire risks such as site tidiness, appropriate hot works permits etc.	Implemented
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8 PROGRESS ON RECOMMENDATIONS

As required by Condition 65.6 of EPL298, Table 8-1 provides a progress report, that includes implementation and completion dates, on all recommendations specified in *Katherine Town Council Waste Management Facility Closure Plan Stage 2 Report – Landfill Gas Risk Assessment and Hydrogeological Assessment* (GHD 2019).

Table 8-1. Progress report on recommendations specified in *Katherine Town Council Waste Management Facility Closure Plan Stage 2 Report – Landfill Gas Risk Assessment and Hydrogeological Assessment* (GHD 2019)

Recommendations		Implementation
1.(i) Adopt a passive venting system to allow LFG to vent safely from the landfill		On-going. The incorporation of a passive landfill gas collection system underneath the capping system will be explored for management of residual gas underneath the final system (Taft Engineering, 2022).
1.(ii) Monitoring inside the WMF office using a continuous monitor to detect methane for a period of one month		Not undertaken yet.
1.(iii) Update the LFGRA when conditions at, or near, the site change such that the LFG risk profile may change (conditions specified in Waste Management Facility Closure Plan)		No changes in the LFG risk profile have been identified so far.
2. Continue to implement existing leachate management practices around operational areas of the landfill, including:	Diversion of surface water away from active tipping areas to minimise leachate generation	On-going. According to the report developed by Taft Engineering (2022), a clean surface diversion is proposed to be established to prevent clean stormwater from entering within the site operating area.
	Keep size of tipping area as small as possible to reduce leachate generation	On-going. A track loader is currently used to place and compact the waste in order to guarantee that active or exposed tipping areas remain as small as possible (Taft Engineering, 2022).
	Use intermediate cover to close off a cell which will not receive additional lifts of waste or final cover for some time Spread at least 300 mm of soil over the waste, so it is not left exposed.	On-going. In areas not active or not expected to be active for greater than 3 months Interim Cover will be placed. Interim cover will be 500mm average depth. The Intermediate Cover must be constructed with appropriate material and compacted, graded and sloped towards surface water drains (Taft Engineering, 2022).
	Consider engineering lining and leachate collection systems for areas constructed beyond current landfill footprint.	To be considered.
2.(i) Placement of additional cover soils on landfill areas where intermediate cover is presently less than 300 mm		On-going.
2.(ii) Progressive construction of a final cap on areas filled to final surface contours		On-going. A conceptual layout of the proposed final landform is provided in the <i>Integrated Environmental Management Plan – Katherine</i>

Recommendations	Implementation
	<i>Town Council Waste Management Facility</i> by Taft Engineering (2022).
3. Incorporation of full lateral extent of wastes in the final cap designed during Stage 3	To be implemented. A conceptual layout of the proposed final landform is provided in the <i>Integrated Environmental Management Plan – Katherine Town Council Waste Management Facility</i> by Taft Engineering (2022).
4. Biannual surface water and groundwater monitoring, undertaken at the end of dry season and the end of the wet season.	On-going - all groundwater monitoring bores were sampled monthly, except GWB01 in October 2021, when the bore was dry. Monitoring of surface water sites was not undertaken during the 2021/22 monitoring period, given that Tindal Creek was always dry when sites were visited.
5. Installation of two leachate monitoring bores within closed landfill areas	None installed so far

9 CONCLUSIONS AND RECOMMENDATIONS

During the 2021-2022 reporting period, the impact of KWMF on groundwater quality were evident in the downgradient bores GWB01 and GWB02. Higher concentrations in some dissolved metals, nitrogen species and PFAS (including a higher concentration and number of PFAS types) were indicative of an impact of the landfill. The exposure of potential receptors to the contaminated groundwater downgradient of the landfill is low, given that no known bores are used for any purpose downgradient of the landfill. Also, seeping of groundwater from beneath the KWMF into the Katherine River is unlikely, given that this river receives most of its inputs from the Tindall Limestone Aquifer which is not recharged by surface water from the area where the KWMF is located.

The monitoring frequency and parameters analysed were not always compliant with the EPL298 requirements. Although the lower rainfall recorded in the 2021-2022 wet season influenced the non-compliances, it is essential to improve future monitoring, so it is compliant with EPL298 requirements. Of great importance is to keep the quarterly monitoring of surface water (or alternatively four times during the wet season depending on flows), as current data are too limited to assess water quality risks. Although a characterisation of the leachate composition was done for the first time during the monitoring period, it is essential such characterisation is compliant with all the parameters requested by the EPL298. Given the likely influence that the KWMF activities are having on PFAS concentrations in groundwater, more efforts should be put into monitoring PFAS in leachate.

Most of the measures specified in the *Environmental Management Plan- Katherine Waste Management Facility* have been implemented; however:

- Breaches reported in measures 'water quality monitoring as per schedule' mentioned in Table 7-3 and 'Ensure water quality monitoring is undertaken in accordance with the monitoring plan' mentioned in Table 7-5 and Table 7-6. Improvements in the water quality monitoring are recommended.
- Minor breaches reported in measures 'no impacts to surface water or groundwater within KWMF' mentioned in Table 7-5 and Table 7-6 and 'no detectable leachate flowing from KWMF operations area' in Table 7-6 as impacts were identified, as mentioned in Section 5.

The *Integrated Environmental Management Plan* prepared by Taft Engineering, addresses most of the recommendations specified in *Katherine Town Council Waste Management Facility Closure Plan Stage 2 Report – Landfill Gas Risk Assessment and Hydrogeological Assessment*. The implementation of most recommendations is on-going or have not been implemented yet; therefore, completion dates are not provided in this report.

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APPENDIX A HISTORICAL DATA

All historical data for surface water, groundwater and leachate are presented in the tables below.

Surface water

SWB MEASUREMENTS									
PARAMETER	UNIT	LOP	2017	2020	2021		2022		
			23/05/2017	DEC	MAR	APR	FEB	MAR	APR
FIELD MEASUREMENTS							Dry	Dry	Dry
pH	-	-	8.40	-	8.52	8.42	-	-	-
Temperature	°C	-	-	-	28.7	26.0	-	-	-
Electrical Conductivity (EC)	µs/cm	-	600	-	566	884	-	-	-
Dissolved Oxygen (DO)	% Sat	-	-	-	-	15.2	-	-	-
MAJOR IONS									
Potassium (K)	mg/L	0.5	-	4.2	5.7	3.8	-	-	-
Alkalinity (CaCO3)		5	-	77	280	370	-	-	-
Calcium (Ca)		0.5	-	19	54	55	-	-	-
Chloride (Cl)		1	9	1	8	9	-	-	-
Sodium (Na)		0.5	-	1.7	9	9.4	-	-	-
Sulfate (SO4)		1	-	<1	7	4	-	-	-
Magnesium (Mg)		0.5	-	-	5.5	31	40	-	-
NUTRIENTS									
Total Nitrogen (TN)	µg/L	100	-	600	-	400	-	-	-
Total Phosphorus (TP)		50	-	<50	-	<50	-	-	-
Nitrate (as N)		5	-	<5	-	<5	-	-	-
Ammonium (NH4)		7	-	38	-	-	-	-	-
Ammonia (as N)		5	-	<5	29	-	<5	-	-
METALS (TOTAL)									
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	-	<0.0001	-	-	-
Chromium (Cr(III))		0.005	-	<0.005	-	<0.005	-	-	-
Chromium (CrVI)		0.005	-	<0.005	-	<0.005	-	-	-
Copper (Cu)		0.001	<0.001	0.003	-	<0.001	-	-	-
Iron (Fe)		0.01	-	1.9	-	0.05	-	-	-
Lead (Pb)		0.001	<0.001	<0.001	-	<0.001	-	-	-
Manganese (Mn)		0.005	-	0.025	-	<0.005	-	-	-
Nickel (Ni)		0.001	<0.001	0.001	-	<0.001	-	-	-
Zinc (Zn)		0.001	0.002	0.007	-	0.001	-	-	-
Aluminium (Al)		0.01	-	-	-	-	-	-	-
Selenium (Se)		0.001	<0.001	-	-	-	-	-	-
METALS (DISSOLVED)									
Cadmium (Cd)	mg/L	0.0001	<0.0001	-	-	<0.0001	-	-	-
Chromium (Cr(III))		0.005	-	-	-	<0.005	-	-	-
Chromium (CrVI)		0.005	-	-	-	<0.005	-	-	-
Copper (Cu)		0.001	<0.001	-	-	<0.001	-	-	-
Iron (Fe)		0.01	-	-	-	<0.01	-	-	-
Lead (Pb)		0.001	<0.001	-	-	<0.001	-	-	-
Manganese (Mn)		0.005	-	-	-	<0.005	-	-	-
Nickel (Ni)		0.001	<0.001	-	-	<0.001	-	-	-
Zinc (Zn)		0.001	0.005	-	-	0.001	-	-	-
Aluminium (Al)		0.01	-	-	-	-	-	-	-
Selenium (Se)		0.001	<0.001	-	-	-	-	-	-
OTHER LEACHATE INDICATORS									
Total Organic Carbon (TOC)	mg/L	1	-	11	8	5	-	-	-
Total Dissolved Solids (TDS)		5	-	86	310	420	-	-	-
Chemical Oxygen Demand (COD)		20	35	<20	<40	<20	-	-	-
Biological Oxygen Demand (BOD)		5	-	28	20	<5	-	-	-
Volatile acids as acetic acid (VFA)		5	-	13	-	<5	-	-	-

SWB MEASUREMENTS										
PARAMETER	UNIT	LOP	TRIGGER VALUE	2017	2020	2021		2022		
				23/05/2017	DEC	MAR	APR	FEB	MAR	APR
OTHER										
TRH C6 - C9 Fraction	µg/L	10	-	-	-	-	<10	-	-	-
TRH C10-C14 Fraction		50	-	-	-	-	<50	-	-	-
TRH C15-C28 Fraction		100	-	-	-	-	<100	-	-	-
TRH C29-C36		100	-	-	-	-	<100	-	-	-
MTBE		1	-	-	-	-	<1	-	-	-
Benzene		1	950	-	-	-	<1	-	-	-
Toluene		1	950	-	-	-	<1	-	-	-
Ethylbenzene		1	950	-	-	-	<1	-	-	-
Xylene (m&p)		2	950	-	-	-	<2	-	-	-
Xylene (o)		1	200	-	-	-	<1	-	-	-
Naphthalene		1	950	-	-	-	<1	-	-	-
Aroclor 1016		2	-	-	-	-	<2	-	-	-
Aroclor 1221		2	-	-	-	-	<2	-	-	-
Aroclor 1232		2	-	-	-	-	<2	-	-	-
Aroclor 1242		2	-	-	-	-	<2	-	-	-
Aroclor 1248		2	-	-	-	-	<2	-	-	-
Aroclor 1254		2	-	-	-	-	<2	-	-	-
Aroclor 1260	2	-	-	-	-	<2	-	-	-	
PFOS/PFAS (in any form)										
Perfluorobutanesulfonic acid	µg/L	0.01	-	-	-	-	<0.01	-	-	-
Perfluoropentanesulfonic acid		0.01	-	-	-	-	<0.01	-	-	-
Perfluorohexanesulfonic acid		0.01	-	-	-	-	<0.01	-	-	-
Perfluoroheptanesulfonic acid		0.01	-	-	-	-	<0.01	-	-	-
Perfluorooctanesulfonate PFOS		0.01	-	-	-	-	<0.01	-	-	-
Perfluorodecanesulfonic acid		0.02	-	-	-	-	<0.02	-	-	-
Perfluorobutanoic acid		0.02	-	-	-	-	<0.02	-	-	-
Perfluoropentanoic acid		0.02	-	-	-	-	<0.02	-	-	-
Perfluorohexanoic acid		0.01	-	-	-	-	<0.01	-	-	-
Perfluoroheptanoic acid		0.01	-	-	-	-	<0.01	-	-	-
Perfluorooctanoic acid PFOA		0.01	-	-	-	-	<0.01	-	-	-
Perfluorononanoic acid		0.01	-	-	-	-	<0.01	-	-	-
Perfluorodecanoic acid		0.02	-	-	-	-	<0.02	-	-	-
Perfluoroundecanoic acid		0.02	-	-	-	-	<0.02	-	-	-
Perfluorododecanoic acid		0.05	-	-	-	-	<0.05	-	-	-
Perfluorotridecanoic acid		0.1	-	-	-	-	<0.1	-	-	-
Perfluorotetradecanoic acid		0.5	-	-	-	-	<0.5	-	-	-
4:2 FTS		0.01	-	-	-	-	<0.01	-	-	-
6:2 FTS		0.01	-	-	-	-	<0.01	-	-	-
8:2 FTS		0.02	-	-	-	-	<0.02	-	-	-
10:2 FTS		0.02	-	-	-	-	<0.02	-	-	-
Perfluorooctance sulfonamide		0.1	-	-	-	-	<0.1	-	-	-
Total Positive PFHxS & PFOS		0.01	-	-	-	-	<0.01	-	-	-
Total Positive PFOS & PFOA		0.01	-	-	-	-	<0.01	-	-	-
Total Positive PFAS		0.01	-	-	-	-	<0.01	-	-	-
PAHs										
Naphthalene	µg/L	0.1	16	-	-	-	<0.1	-	-	-
Acenaphthylene		0.1	16	-	-	-	<0.1	-	-	-
Acenaphthene		0.1	16	-	-	-	<0.1	-	-	-
Fluorene		0.1	16	-	-	-	<0.1	-	-	-
Phenanthrene		0.1	16	-	-	-	<0.1	-	-	-
Anthracene		0.1	16	-	-	-	<0.1	-	-	-
Fluoranthene		0.1	16	-	-	-	<0.1	-	-	-
Pyrene		0.1	16	-	-	-	<0.1	-	-	-
Benzo(a)anthracene		0.1	16	-	-	-	<0.1	-	-	-
Chrysene		0.1	16	-	-	-	<0.1	-	-	-
Benzo(b,j+k)fluoranthene		0.2	16	-	-	-	<0.2	-	-	-
Benzo(a)pyrene		0.1	16	-	-	-	<0.1	-	-	-
Indeno(1,2,3-c,d)pyrene		0.1	16	-	-	-	<0.1	-	-	-
Dibenzo(a,h)anthracene		0.1	16	-	-	-	<0.1	-	-	-
Benzo(g,h,i)perylene		0.1	16	-	-	-	<0.1	-	-	-
Benzo(a)pyrene TEQ		0.5	16	-	-	-	<0.5	-	-	-
Total positive PAHs		0.1	16	-	-	-	<0.1	-	-	-

SWC MEASUREMENTS									
PARAMETER	UNIT	LOP	2017	2020	2021		2022		
			23/05/2017	DEC	MAR	APR	FEB	MAR	APR
FIELD MEASUREMENTS							Dry	Dry	Dry
pH	-	-	8.60	-	8.84	8.23	-	-	-
Temperature	°C	-	-	-	28.2	26	-	-	-
Electrical Conductivity (EC)	µs/cm	-	580	-	561	884	-	-	-
Dissolved Oxygen (DO)	% Sat	-	-	-	14.1	15.2	-	-	-
MAJOR IONS									
Potassium (K)	mg/L	0.5	-	5.1	5.5	2.9	-	-	-
Alkalinity (CaCO3)		5	-	81	280	350	-	-	-
Calcium (Ca)		0.5	-	18	53	39	-	-	-
Chloride (Cl)		1	9	1	7	9	-	-	-
Sodium (Na)		0.5	-	1.3	8.4	7.6	-	-	-
Sulfate (SO4)		1	-	<1	6	4	-	-	-
Magnesium (Mg)		0.5	-	-	5.8	30	30	-	-
NUTRIENTS									
Total Nitrogen (TN)	µg/L	100	-	700	-	300	-	-	-
Total Phosphorus (TP)		50	-	60	-	<50	-	-	-
Nitrate (as N)		5	-	<5	-	<5	-	-	-
Ammonium (NH4)		7	-	82	-	-	-	-	-
Ammonia (as N)		5	<5	64	-	<5	-	-	-
METALS (TOTAL)									
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	-	<0.0001	-	-	-
Chromium (Cr(III))		0.005	-	<0.005	-	<0.005	-	-	-
Chromium (CrVI)		0.005	-	<0.005	-	<0.005	-	-	-
Copper (Cu)		0.001	<0.001	0.003	-	<0.001	-	-	-
Iron (Fe)		0.01	-	2.00	-	0.04	-	-	-
Lead (Pb)		0.001	<0.001	<0.001	-	<0.001	-	-	-
Manganese (Mn)		0.005	-	0.029	-	<0.005	-	-	-
Nickel (Ni)		0.001	<0.001	0.002	-	<0.001	-	-	-
Zinc (Zn)		0.001	0.001	0.005	-	0.002	-	-	-
Aluminium (Al)		0.01	-	-	-	-	-	-	-
Selenium (Se)		0.001	<0.001	-	-	-	-	-	-
METALS (DISSOLVED)									
Cadmium (Cd)	mg/L	0.0001	<0.0001	<0.0001	-	<0.0001	-	-	-
Chromium (Cr(III))		0.005	-	<0.005	-	<0.005	-	-	-
Chromium (CrVI)		0.005	-	<0.005	-	<0.005	-	-	-
Copper (Cu)		0.001	<0.001	0.002	-	<0.001	-	-	-
Iron (Fe)		0.01	-	0.03	-	<0.01	-	-	-
Lead (Pb)		0.001	<0.001	<0.001	-	<0.001	-	-	-
Manganese (Mn)		0.005	-	0.007	-	<0.005	-	-	-
Nickel (Ni)		0.001	<0.001	<0.001	-	<0.001	-	-	-
Zinc (Zn)		0.001	0.006	0.002	-	0.001	-	-	-
Aluminium (Al)		0.01	-	-	-	-	-	-	-
Selenium (Se)		0.001	<0.001	-	-	-	-	-	-
OTHER LEACHATE INDICATORS									
Total Organic Carbon (TOC)	mg/L	1	-	9	8	5	-	-	-
Total Dissolved Solids (TDS)		5	-	100	310	380	-	-	-
Chemical Oxygen Demand (COD)		20	45	<20	<40	<20	-	-	-
Biological Oxygen Demand (BOD)		5	-	28	26	10	-	-	-
Volatile acids as acetic acid (VFA)		5	-	13	-	<5	-	-	-

SWC MEASUREMENTS									
PARAMETER	UNIT	LOP	2017	2020	2021		2022		
			23/05/2017	DEC	MAR	APR	FEB	MAR	APR
OTHER									
TRH C6 - C9 Fraction	µg/L	10	-	-	-	<10	-	-	-
TRH C10-C14 Fraction		50	-	-	-	<50	-	-	-
TRH C15-C28 Fraction		100	-	-	-	<100	-	-	-
TRH C29-C36		100	-	-	-	<100	-	-	-
MTBE		1	-	-	-	<1	-	-	-
Benzene		1	-	-	-	<1	-	-	-
Toluene		1	-	-	-	<1	-	-	-
Ethylbenzene		1	-	-	-	<1	-	-	-
Xylene (m&p)		2	-	-	-	<2	-	-	-
Xylene (o)		1	-	-	-	<1	-	-	-
Naphthalene		1	-	-	-	<1	-	-	-
Aroclor 1016		2	-	-	-	<2	-	-	-
Aroclor 1221		2	-	-	-	<2	-	-	-
Aroclor 1232		2	-	-	-	<2	-	-	-
Aroclor 1242		2	-	-	-	<2	-	-	-
Aroclor 1248		2	-	-	-	<2	-	-	-
Aroclor 1254		2	-	-	-	<2	-	-	-
Aroclor 1260	2	-	-	-	<2	-	-	-	
PFOS/PFAS (in any form)									
Perfluorobutanesulfonic acid	µg/L	0.01	-	-	-	<0.01	-	-	-
Perfluoropentanesulfonic acid		0.01	-	-	-	<0.01	-	-	-
Perfluorohexanesulfonic acid		0.01	-	-	-	<0.01	-	-	-
Perfluoroheptanesulfonic acid		0.01	-	-	-	<0.01	-	-	-
Perfluorooctanesulfonate PFOS		0.01	-	-	-	<0.01	-	-	-
Perfluorodecanesulfonic acid		0.02	-	-	-	<0.02	-	-	-
Perfluorobutanoic acid		0.02	-	-	-	<0.02	-	-	-
Perfluoropentanoic acid		0.02	-	-	-	<0.02	-	-	-
Perfluorohexanoic acid		0.01	-	-	-	<0.01	-	-	-
Perfluoroheptanoic acid		0.01	-	-	-	<0.01	-	-	-
Perfluorooctanoic acid PFOA		0.01	-	-	-	<0.01	-	-	-
Perfluorononanoic acid		0.01	-	-	-	<0.01	-	-	-
Perfluorodecanoic acid		0.02	-	-	-	<0.02	-	-	-
Perfluoroundecanoic acid		0.02	-	-	-	<0.02	-	-	-
Perfluorododecanoic acid		0.05	-	-	-	<0.05	-	-	-
Perfluorotridecanoic acid		0.1	-	-	-	<0.1	-	-	-
Perfluorotetradecanoic acid		0.5	-	-	-	<0.5	-	-	-
4:2 FTS		0.01	-	-	-	<0.01	-	-	-
6:2 FTS		0.01	-	-	-	<0.01	-	-	-
8:2 FTS		0.02	-	-	-	<0.02	-	-	-
10:2 FTS		0.02	-	-	-	<0.02	-	-	-
Perfluorooctance sulfonamide		0.1	-	-	-	<0.1	-	-	-
Total Positive PFHxS & PFOS		0.01	-	-	-	<0.01	-	-	-
Total Positive PFOS & PFOA		0.01	-	-	-	<0.01	-	-	-
Total Positive PFAS		0.01	-	-	-	<0.01	-	-	-
PAHs									
Naphthalene	µg/L	0.1	-	-	-	<0.1	-	-	-
Acenaphthylene		0.1	-	-	-	<0.1	-	-	-
Acenaphthene		0.1	-	-	-	<0.1	-	-	-
Fluorene		0.1	-	-	-	<0.1	-	-	-
Phenanthrene		0.1	-	-	-	<0.1	-	-	-
Anthracene		0.1	-	-	-	<0.1	-	-	-
Fluoranthene		0.1	-	-	-	<0.1	-	-	-
Pyrene		0.1	-	-	-	<0.1	-	-	-
Benzo(a)anthracene		0.1	-	-	-	<0.1	-	-	-
Chrysene		0.1	-	-	-	<0.1	-	-	-
Benzo(b,j,k)fluoranthene		0.2	-	-	-	<0.2	-	-	-
Benzo(a)pyrene		0.1	-	-	-	<0.1	-	-	-
Indeno(1,2,3-c,d)pyrene		0.1	-	-	-	<0.1	-	-	-
Dibenzo(a,h)anthracene		0.1	-	-	-	<0.1	-	-	-
Benzo(g,h,i)perylene		0.1	-	-	-	<0.1	-	-	-
Benzo(a)pyrene TEQ		0.5	-	-	-	<0.5	-	-	-
Total positive PAHs		0.1	-	-	-	<0.1	-	-	-

Leachate

Only results for field measurements, major ions, nutrients and other leachate indicators are presented in the table below, as other parameters have not been measured.

LEACHATE MEASUREMENTS					
PARAMETER	UNIT	LOP	2022		
			FEB	MAR	APR
FIELD MEASUREMENTS			Dry		Dry
pH	-	-	6.10	-	-
Temperature	°C	-	34.4	-	-
Electrical Conductivity (EC)	µs/cm	-	275	-	-
Dissolved Oxygen (DO)	% Sat	-	7.3	-	-
MAJOR IONS					
Potassium (K)	mg/L	0.5	7.6	-	-
Alkalinity (CaCO3)		5	110	-	-
Calcium (Ca)		0.5	25	-	-
Chloride (Cl)		1	9	-	-
Sodium (Na)		0.5	5.1	-	-
Sulfate (SO4)		1	9	-	-
Magnesium (Mg)		0.5	7	-	-
NUTRIENTS					
Total Nitrogen (TN)	µg/L	100	-	-	-
Total Phosphorus (TP)		50	-	-	-
Nitrate (as N)		5	-	-	-
Ammonium (NH4)		7	250	-	-
Ammonia (as N)		5	190	-	-
OTHER LEACHATE INDICATORS					
Total Organic Carbon (TOC)	mg/L	1	14	-	-
Total Dissolved Solids (TDS)		5	470	-	-
Chemical Oxygen Demand (COD)		20	66	-	-
Biological Oxygen Demand (BOD)		5	5	-	-
Volatile acids as acetic acid (VFA)		5	-	-	-

Groundwater

Standing Water Levels

BORE ID	2018		2019		2020								2021							
	Jul-18		May-19		Sep-20		Oct-20		Nov-20		Dec-20		Mar-21		Apr-21		May-21		Jun-21	
	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD
GWA (RN031131)	-	-	12.621	90.0544	14.07	88.6054	14.072	88.6034	14.07	88.6054	-	-	3.45	99.2254	6.2	96.4754	9.32	93.3554	11.2	91.4754
GWE (RN022487)	-	-	10.361	91.7854	11.944	90.2024	11.964	90.1824	11.976	90.1704	-	-	3.94	98.2064	6.1	96.0464	7.2	94.9464	9.18	92.9664
GWB01	9.945	89.6764	10.913	88.7084	12.103	87.5184	12.106	87.5154	12.154	87.4674	-	-	3.45	96.1714	6.05	93.5714	7.9	91.7214	9.7	89.9214
GWB02	9.727	90.0681	10.853	88.9421	12.287	87.5081	12.283	87.5121	12.332	87.4631	-	-	-	-	-	-	7.32	92.4751	9.48	90.3151
GWB03	6.655	93.0243	8.819	90.8603	9.724	89.9553	10.795	88.8843	-	-	-	-	-	-	-	-	4.16	95.5193	7.3	92.3793
GWB04	10.379	92.484	12.257	90.606	13.943	88.9200	13.957	88.906	13.99	88.873	-	-	3.82	99.043	6.32	96.543	7.71	95.153	10.5	92.363

BORE ID	2021												2022											
	Jul-21		Aug-21		Sep-21		Oct-21		Nov-21		Dec-21		Jan-22		Feb-22		Mar-22		Apr-22		May-22		Jun-22	
	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD	mbTOC	mAHD
GWA (RN031131)	12	90.6754	12.6	90.0754	12.9	89.7754	13.2	89.4754	13.2	89.4754	Not measured		12.1	90.5754	10.23	92.4454	11.6	91.0754	12.7	89.9754	13.1	89.5754	13.33	89.3454
GWE (RN022487)	10	92.1464	10.45	91.6964	10.8	91.3464	11.2	90.9464	11.16	90.9864	11.15	90.9964	10.06	92.0864	8.33	93.8164	9.47	92.6764	10.5	91.6464	11	91.1464	11.27	90.8764
GWB01	10.4	89.2214	10.8	88.8214	11.1	88.5214	13.22	86.4014	11.43	88.1914	10.48	89.1414	10.7	88.9214	8.43	91.1914	9.83	89.7914	10.9	88.7214	11.3	88.3214	11.58	88.0414
GWB02	10.2	89.5951	10.7	89.0951	11.1	88.6951	11.4	88.3951	11.48	88.3151	11.54	88.2551	10.06	89.7351	8.27	91.5251	9.67	90.1251	10.8	88.9951	11	88.7951	11.68	88.1151
GWB03	8.3	91.3793	8.77	90.9093	9.1	90.5793	9.6	90.0793	9.94	89.7393	11.41	88.2693	10.05	89.6293	6.63	93.0493	8.01	91.6693	8.9	90.7793	9.3	90.3793	9.7	89.9793
GWB04	11.5	91.363	12.2	90.663	12.6	90.263	12.93	89.933	12.9	89.963	13.6	89.263	11.9	90.963	9.74	93.123	11.17	91.693	12.35	90.513	12.9	89.963	13.2	89.663

Field measurements

Redox only started to be measured in April 2022, as such, the table below only comprises the months since monitoring of this parameter started.

pH	2006	2017	2018	2020														2021								2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun								
GWA	7.1	7.2	6.9	7.8	5.6	5.8	6.7	7.2	7.1	7.2	6.4	6.3	5.8	6.9	7.9	8.1	5.3	8.4	6.0	9.1	8.5	8.1	6.0								
GWE				7.7	5.5	5.8	6.5	7.6	7.8	8.5	6.4	6.6	7.0	7.9	8.5	8.2	6.9	8.5	6.1	9.3	8.6	8.0	9.1								
GWB01			6.6		5.7	5.7		7.1	7.2	7.1	6.6	6.5	6.0	7.0		7.5	7.1	7.9	6.7	9.0	7.8	8.8	4.2								
GWB02			7.0		6.1	4.4	6.3			7.1	6.5	6.0	6.7	7.6	7.9	6.6	5.9	8.2	6.3	8.9	7.5	8.5	5.0								
GWB03			7.1							7.1	6.9	5.8	7.1	7.8	8.1	7.5	5.9	8.7	6.0	8.7	6.6	7.0	6.7								
GWB04			6.7		6.6	5.7	6.4	7.2	7.0	7.1	6.8	7.0	6.1	7.1	8.3	7.8	5.5	7.7	5.5	8.6	6.5	6.0	6.2								

T (°C)	2006	2017	2018	2020														2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			33.1	33.2	33.1	33.3	32.8	33.4	32.9	33.2	31.4	31.3	30.1	31.4	32.4	32.6	35.6	35.3	32.0	30.7	32.9	31.2	28.0
GWE				30.1	34.9	33.2	34.1	34.6	32.7	32.0	32.0	31.2	31.4	32.4	31.1	33.4	35.0	35.0	32.4	32.9	31.3	30.3	27.9
GWB01			31.2		30.0	29.4		36.2	33.1	29.9	30.3	31.3	30.0	30.1		30.9	33.0	32.2	31.8	31.9	31.5	30.7	28.6
GWB02			30.6		36.3	32.7	31.5			30.7	30.6	30.6	30.9	31.4	34.0	29.9	34.2	33.3	31.1	31.9	31.6	31.8	25.2
GWB03			27.1							27.3	29.6	27.7	29.7	31.1	31.8	27.4	32.2	36.4	28.8	31.0	29.3	29.8	24.5
GWB04			30.9		31.5	30.4	30.7	33.8	31.2	32.0	28.7	28.7	29.4	29.5	31.9	31.6	31.7	31.3	30.9	32.0	28.2	29.9	24.4

EC (µS/cm)	2006	2017	2018	2020														2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	727	700	770	578	640	645	540	915	710	352	811	1120	766	835	759	737	619	735	700	710	730	729	730
GWE				664	588	708	661	679	652	478	715	587	611	513	579	448	598	459	630	626	622	605	570
GWB01			1111		788	738		813	791	617	1220	1120	1177	1073		1010	984	1020	1010	1020	1020	1045	1030
GWB02			894		765	866	748			553	1018	1154	1063	1086	863	1000	955	1034	1100	1701	984	1005	1000
GWB03			684							435	952	1120	973	1050	1600	1049	1077	1192	892	998	966	1017	1060
GWB04			1043		839	911	776	838	1120	478	971	1016	1000	1030	894	910	887	975	982	930	1014	920	850

DO (%)	2006	2017	2018	2020					2021												2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			22.7	5.3	5.7	3.9	4.4				11.1	6.0	7.6	5.6	4.1	3.8	1.9	4.1	11.9	2.4	3.6	5.3	22.9	4.4	10.1	8.2
GWE				2.7	1.7	1.7	3.4				11.9	4.5	6.9	6.7	3.7	4.3	6.3	3.0	9.1	2.0	4.1	5.5	5.4	3.0	2.4	4.5
GWB01			3.9		1.9	0.8					12.7	4.1	5.9	3.7	4.1	4.2	2.0		5.8	2.4	4.4	5.6	20.6	3.3	2.9	2.4
GWB02			63.5		5.2	2.7	3.1						7.7	3.8	6.0	4.0	2.1	4.7	4.0	8.6	4.0	4.2	4.0	2.1	2.1	1.8
GWB03			44.2										9.5	3.5	4.9	3.2	1.4	7.3	4.9	2.0	3.8	3.7	12.6	3.5	1.7	2.1
GWB04			27.7		6.7	4.5	4.3				8.1	7.6	6.9	7.4	4.0	4.3	33.0	6.6	4.2	2.9	4.8	8.3	5.7	2.0	2.3	5.9

Redox	2022		
	11-Apr	10-May	14-Jun
GWA	369.0	400.0	418.0
GWE	85.0	124.0	162.0
GWB01	277.0	367.0	395.0
GWB02	299.0	382.0	335.0
GWB03	233.0	320.0	318.0
GWB04	338.0	220.0	333.0

Major ions

K (mg/L)	2006	2017	2018	2020					2021												2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			5.7	4.4	4.6	4.5	5.7	5.0			9.4	4.1		4.4	5.0	5.2	4.5	3.9	5.1	5.3	4.7	4.8	4.8	4.7	5.2	5.1
GWE				5.7	5.9	6.5	7.1				7.6	4.6		5.5	5.5	5.4	5.0	4.8	6.5	5.7	6.0	5.5	5.4	6.3	5.2	5.4
GWB01			15.0		11.0	11.0					11.0	7.6		15.0	16.0	16.0	14.0		14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
GWB02			7.7		5.7	6.1	6.5						5.9	5.3	6.0	6.0	6.9	5.4	5.8	6.4	6.0	6.8	6.7	5.3	6.4	6.0
GWB03			4.4										4.4	4.1	4.6	4.9	4.5	4.7	5.4	6.5	5.9	4.8	4.8	4.9	5.2	5.7
GWB04			8.8		7.9	8.2	7.7				9.0	6.8		8.0	8.2	8.9	7.8	8.0	8.4	9.6	8.4	8.6	8.3	7.8	8.4	8.4

Alkalinity (mg/L)	2006	2017	2018	2020					2021												2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			360	350	350	350	340	350			400	340		340	360	370	350	340	340	350	340	340	340	360	350	350
GWE				340	330	390	390				320	320		290	280	300	280	280	200	300	250	320	300	290	280	250
GWB01			440		430	430					350	390		440	440	440	440		390	420	430	450	440	420	430	420
GWB02			370		450	460	460						420	440	450	460	460	460	450	460	450	460	450	450	470	460
GWB03			300										380	420	460	490	480	500	450	500	530	400	460	470	490	480
GWB04			520		510	510	510				420	450		450	460	490	480	470	450	470	480	470	470	480	470	490

Ca (mg/L)	2006	2017	2018	2020					2021												2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			76	75	74	73	79	69			100	68		73	76	69	71	66	72	71	71	65	74	67	74	74
GWE				60	54	69	75				67	48		53	53	53	48	54	26	57	29	49	59	52	50	47
GWB01			95		80	81					83	77		100	95	86	87		84	94	92	88	100	92	96	91
GWB02			76		91	96	97						100	98	100	90	95	94	91	95	92	91	110	83	110	97
GWB03			53										77	86	98	84	89	93	84	95	95	77	98	86	89	92
GWB04			83		84	83	85				73	59		78	78	75	79	80	77	87	76	68	80	75	80	82

Cl (mg/L)	2006	2017	2018	2020					2021												2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	12	7	6	5	5	5	5	4			10	4		5	5	4	5	6	5	5	5	5	5	5	5	5
GWE				24	25	31	32				9	7		7	7	6	7	8	5	8	6	9	10	10	10	10
GWB01			56		28	27					24	42		86	75	66	56		52	48	51	53	57	60	56	51
GWB02			18		10	12	14						51	44	42	37	51	38	27	25	39	48	48	43	37	27
GWB03			10										12	15	11	10	10	11	8	7	7	11	11	10	9	9
GWB04			11		11	12	12				5	5		7	7	6	7	7	6	6	6	5	6	10	7	7

Na (mg/L)	2006	2017	2018	2020					2021												2022					
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			7	6	6	6	6	6			13	6		6	6	6	6	5	6	7	6	6	6	6	7	6
GWE				22	21	28	31				11	8		9	8	8	8	9	9	8	10	9	10	12	11	10
GWB01			38		22	22					18	16		38	36	34	31		28	28	30	29	29	29	29	29
GWB02			17		11	11	12						25	22	20	18	24	16	14	15	18	25	26	18	20	16
GWB03			18										11	16	21	20	22	22	23	26	27	14	18	18	22	22
GWB04			15		14	14	15				10	10		10	9	9	10	9	9	10	10	10	9	9	10	10

SO4 (mg/L)	2006	2017	2018	2020					2021											2022						
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			5	4	4	4	4	4			59	5		5	6	7	6	6	5	5	6	5	2	7	6	6
GWE				<1	<1	11	11				6	5		6	6	7	6	5	5	<1	3	2	2	5	7	6
GWB01			19		14	13					34	37		35	25	25	21	21	19	21	23	29	30	25	23	20
GWB02			28		17	27	33						38	36	38	39	42	36	35	35	42	50	49	45	41	36
GWB03			8										6	23	68	51	75	76	99	110	150	11	26	32	62	67
GWB04			8		7	8	8				5	7		10	11	13	14	11	10	10	11	9	10	13	11	10

Mg (mg/L)	2006	2017	2018	2020					2021											2022						
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA			39	36	35	36	34	37			41	31		33	34	34	34	28	33	32	33	31	33	32	36	36
GWE				39	36	43	43				31	26		31	29	31	29	31	26	31	28	30	34	33	32	31
GW801			44		45	45					40	38		45	43	40	41		37	41	41	44	45	44	45	43
GW802			44		50	52	53						44	49	53	51	51	52	52	52	49	48	55	49	59	54
GW803			36										40	49	63	52	60	63	62	68	68	41	59	56	62	64
GW804			66		63	62	63				50	47		58	57	54	57	57	56	61	55	52	60	54	58	58

Nutrients

TN (µg/L)	2006	2017	2018	2020			2021				2022	
	JUN	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA				200		200	100		600	500	600	700
GWE				500		300	300		300	300	1000	200
GWB01					1900	2000	1700		4900		7500	1500
GWB02					<100	100		1100	600	600	600	1500
GWB03								1900	7100	4100	1000	5300
GWB04							200	300	4000		2800	2800

TP (µg/L)	2006	2017	2018	2020			2021			2022		
	JUN	MAY	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA			<50	<50		<50	<50		<50	<50	<50	<50
GWE			<50		<50	<50		<50	<50	<50	<50	
GWB01			<50	<50	<50		<50		<50		<50	110
GWB02			<50	<50		<50	<50		<50	80	<50	<50
GWB03			60			<50		<50	<50	140	750	370
GWB04			<50	<50	<50		<50	<50	<50	<50	<50	<50

NO ₃ -N (µg/L)	2006	2017	2018	2020				2021			2022	
	JUN	MAY	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA			270	130		100	8		450	340	470	540
GWE				7		17	100		<5	9	9	<5
GWB01			220		18	13	1300		170		5400	12
GWB02			94		<5	<5		630	150	32	320	1200
GWB03			47					1900	6400	3600	300	5100
GWB04			150		160	160	3800		2400	2600	2100	1200

NH4 (µg/L)	2017	2018	2020					2021								2022							
	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA	<5	<5	<7			<7	<7				17			10		<7	63		55	17	<7	9	<7
GWE			370			49					29			110		11	150		83	42	120	120	150
GWB01		2900									3500			6100		5400	4000		740	380	1100	1200	1900
GWB02		1000				<7				71	8			800		<7	51		<7	<7	<7	<7	10
GWB03		360								<7	<7			13		26	42		<7	<7	8	35	34
GWB04		130				<7					<7			13		9	64		18	7	<7	12	13

Dissolved metals

Cd (mg/L)	2017	2018	2020				2021				2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
GWE			<0.0001		<0.0001	<0.0001		<0.0001		<0.0001	<0.0001	<0.0001
GWB01		<0.0001		<0.0001	<0.0001	<0.0001		<0.0001			<0.0001	<0.0001
GWB02		<0.0001		<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001	<0.0001
GWB03		<0.0001					<0.0001	<0.0001		<0.0001	<0.0001	<0.0001
GWB04		<0.0001		<0.0001	<0.0001	<0.0001		<0.0001		<0.0001	<0.0001	<0.0001

CrIII (mg/L)	2017	2018	2020				2021				2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA			<0.005		<0.005	<0.005		<0.005	<0.005	<0.005	<0.005	<0.005
GWE			<0.005		<0.005	<0.005		<0.005		<0.005	<0.005	<0.005
GWB01				<0.005	<0.005	<0.005		<0.005			<0.005	<0.005
GWB02				<0.005	<0.005		<0.005	<0.005		<0.005	<0.005	<0.005
GWB03							<0.005			<0.005	<0.005	<0.005
GWB04				<0.005	<0.005	<0.005		<0.005		<0.005	<0.005	<0.005

CrVI (mg/L)	2017	2018	2020			2021					2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA			<0.005		<0.005	<0.005		<0.005	<0.005	<0.005	<0.005	<0.005
GWE			<0.005		<0.005	<0.005		<0.005		<0.005	<0.005	<0.005
GWB01				<0.005	<0.005	<0.005		<0.005			<0.005	<0.005
GWB02				<0.005	<0.005		<0.005	<0.005		<0.005	<0.005	<0.005
GWB03							<0.005	<0.005		<0.005	<0.005	<0.005
GWB04				<0.005	<0.005	<0.005		<0.005		<0.005	<0.005	<0.005

Cu (mg/L)	2017	2018	2020			2021					2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA	<0.001	<0.001	<0.001		<0.001	<0.001		<0.001	0.002	0.001	0.006	0.010
GWE			<0.001		<0.001	<0.001		<0.001		<0.001	<0.001	<0.001
GWB01		0.018		<0.001	<0.001	0.002		0.005			0.007	0.005
GWB02		0.014		<0.001	<0.001		0.005	0.003		0.003	0.003	0.002
GWB03		0.023					<0.001	0.002		<0.001	0.001	<0.001
GWB04		0.008		0.002	0.002	<0.001		0.020		0.002	0.003	0.002

Fe (mg/L)	2017	2018	2020			2021					2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA		0.03	<0.1		<0.01	0.03		<0.01	0.03	0.08	0.01	<0.01
GWE			3.70		0.39	<0.01		0.11		1.10	<0.01	0.68
GWB01		0.01		0.18	0.24	<0.01		<0.01			<0.01	0.01
GWB02		0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01
GWB03		0.01					<0.01	<0.01		<0.01	<0.01	0.09
GWB04		0.01		<0.01	<0.01	<0.01		<0.01		0.03	<0.01	<0.01

Pb (mg/L)	2017	2018	2020			2021					2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA	<0.001	<0.001	<0.001		<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001
GWE			<0.001		<0.001	<0.001		<0.001		<0.001	<0.001	<0.001
GWB01		<0.001		<0.001	<0.001	<0.001		<0.001			<0.001	<0.001
GWB02		<0.001		<0.001	<0.001		<0.001	<0.001		<0.001	<0.001	<0.001
GWB03		0.001					<0.001	<0.001		<0.001	<0.001	<0.001
GWB04		<0.001		<0.001	<0.001	<0.001		<0.001		<0.001	<0.001	0.001

Mn (mg/L)	2017	2018	2020			2021					2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA		<0.005	<0.005		<0.005	0.018		<0.005	<0.005	<0.005	<0.005	<0.005
GWE			0.012		<0.005	<0.005		0.008		0.019	<0.005	0.020
GWB01		0.210		0.240	0.220	0.006		0.380			0.015	0.140
GWB02		<0.005		0.016	0.007		0.005	0.029		0.032	0.009	0.022
GWB03		0.007					<0.005	0.054		0.097	0.110	0.100
GWB04		0.029		<0.005	<0.005	<0.005		<0.005		<0.005	<0.005	<0.005

Ni (mg/L)	2017	2018	2020			2021					2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA	<0.001	<0.001	<0.001		<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001
GWE			0.002		<0.001	<0.001		<0.001		<0.001	<0.001	<0.001
GWB01		0.010		0.002	0.002	0.001		0.004			0.002	0.003
GWB02		0.007		0.002	0.002		0.002	0.003		0.004	0.003	0.003
GWB03		0.004					<0.001	0.002		0.003	0.005	0.003
GWB04		0.003		<0.001	<0.001	<0.001		0.004		<0.001	0.002	<0.001

Zn (mg/L)	2017	2018	2020			2021					2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA	0.005	0.008	0.005		0.004	0.015		0.011	0.032	0.009	0.071	0.025
GWE			<0.001		0.001	0.002		0.002		0.003	0.007	0.004
GWB01		0.015		0.002	0.003	0.004		0.004			0.009	0.008
GWB02		0.019		<0.001	<0.001		0.003	0.003		0.005	0.005	0.003
GWB03		0.025					0.003	0.007		0.005	0.007	0.008
GWB04		0.013		0.021	0.016	0.015		0.033		0.032	0.046	0.051

Se (mg/L)	2017	2018	2020					2021			2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA								<0.001		<0.001		<0.001
GWE								<0.001		<0.001		<0.001
GWB01								<0.001				<0.001
GWB02							<0.001	<0.001		<0.001		<0.001
GWB03							<0.001	<0.001		0.001		<0.001
GWB04								0.002		0.002		0.001

Al (mg/L)	2017	2018	2020					2021			2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	21-Sep	26-Oct	10-Jan	11-Apr
GWA								<0.01		<0.01		<0.01
GWE								<0.01		<0.01		<0.01
GWB01								<0.01				<0.01
GWB02							<0.01	<0.01		<0.01		<0.01
GWB03							<0.01	<0.01		<0.01		<0.01
GWB04								<0.01		<0.01		<0.01

Other leachate

TOC (mg/L)	2017	2018	2020					2021												2022					
	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA		<1	<1	<1	<1	<1	<1			<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	1
GWE			<1	<1	<1	1				<1	<1		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
GWB01		5		2	1					2	2		6	5	5	5		3	4	3	2	2	4	4	4
GWB02		<1		<1	<1	<1							2	2	2	3	2	<1	<1	3	2	2	2	2	2
GWB03		1										3	2	3	2	1	4	4	<1	4	2	<1	1	9	3
GWB04		<1		<1	<1	<1				1	<1		<1	3	<1	<1	<1	<1	<1	<1	<1	<1	5	<1	2

TDS (mg/L)	2017	2018	2020					2021												2022					
	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA		380	370	370	350	350	340			470	360		400	320	380	330	360	350	380	320	320	260	360	310	360
GWE			400	370	430	450				300	380		320	260	340	250	300	180	540	220	290	240	260	260	290
GWB01		590		480	450					450	630		680	640	520	520		530	490	550	560	530	500	510	540
GWB02		440		470	450	500						560	620	570	620	610	520	550	520	530	590	560	540	500	550
GWB03		340										390	530	540	630	520	580	590	670	580	450	450	490	530	610
GWB04		530		540	470	510				420	510		460	460	500	470	650	500	540	440	480	390	520	470	490

COD (mg/L)	2017	2018	2020					2021												2022							
	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun		
GWA	41		<20	<20	<20	<20	<20			<40	<20		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		
GWE			<20	<20	<20	<20	<20			<40	<20		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		
GWB01				<20	<20						<40	<20		64	<20	<20	220		<20	240	<20	<20	38	50	360	24	
GWB02				<20	<20	<20	<20						46	<20	<20	<20	<20		67	<20	<20	<20	21	<20	<20	<20	<20
GWB03						<20	<20	<20					33	39	<20	<20	<20	<20	100	220	<20	72	<20	<20	<20	<20	48
GWB04			<20	<20	<20	<20				<40	<20		<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20		

BOD (mg/L)	2017	2018	2020					2021												2022					
	MAY	JUL	1-Aug	14-Sep	26-Oct	16-Nov	1-Dec	1-Jan	1-Feb	17-Mar	29-Apr	18-May	29-Jun	27-Jul	24-Aug	21-Sep	26-Oct	24-Nov	14-Dec	10-Jan	22-Feb	7-Mar	11-Apr	10-May	14-Jun
GWA		<5	<5	10	13	6	14			32	11		<5	<5	20	<5	19	14	<5	<5	5	<5	6	<5	<5
GWE		<5	<5	13	12	<5	<5			7	<5		<5	19	<5	23	13	<5	<5	<5	<5				
GWB01		<5	<5	13	18	<5	<5			31	12		<5	22	6	<5	20	<5	9	6	7	10	8	8	
GWB02		<5	<5	13	17	10	<5			7	<5		29	<5	29	17	<5	9	6	<5	6	<5	9		
GWB03		<5	<5	<5	<5	<5	<5			<5	17		<5	22	11	28	19	<5	15	14	<5	7	7	10	
GWB04	<5	<5	<5	<5	20	10	<5	<5	<5	29	9	<5	6	<5	<5	6	6	18	<5	10	6	<5	13	6	8

VFA (mg/L)	2017	2018	2020			2021				2022	
	MAY	JUL	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA			<5		<5	5		9	<5	33	<5
GWE			<5		76	5		<5	<5	9	
GWB01				16	20	6		16	7	29	
GWB02			<5	29		16		12	<5	18	19
GWB03						12		22	11	7	18
GWB04			<5	12	5			11	10	6	11

TRH, PAH, BTEXN and PCB

TRH C10-C14 (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<50	<10		<10	<50		<50	<50	<50	<50
GWE		<10		<10	<50		<50	<50	<50	<50
GWB01	<10		<50	<50	<50		<50		<50	<50
GWB02	<10		<50	<50		<50	<50	<50	<50	<50
GWB03	<10					<50	<50	<50	<50	<50
GWB04	<10		<50	<50	<50		<50	<50	<50	<50

TRH C15-C28 (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<100	<100		<100	<100		<100	<100	<100	<100
GWE		<100		<100	<100		<100	<100	<100	<100
GWB01	<10		<100	<100	<100		<100		<100	<100
GWB02	<10		<100	<100		<100	<100	<100	<100	<100
GWB03	<10					<100	<100	<100	<100	<100
GWB04	<10		<100	<100	<100		<100	<100	<100	<100

TRH C29-C36 (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<100	<100		<100	<100		<100	<100	<100	<100
GWE		<100		<100	<100		<100	<100	<100	<100
GWB01	<100		<100	<100	<100		<100		<100	<100
GWB02	<100		<100	<100		<100	<100	<100	<100	<100
GWB03	<100					<100	<100	<100	<100	<100
GWB04	<100		<100	<100	<100		<100	<100	<100	<100

MTBE (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<1	<1		<1	<1		<1	<1	<1	<1
GWE		<1		<1	<1		<1	<1	<1	<1
GWB01			<1	<1	<1		<1		<1	<1
GWB02			<1	<1		<1	<1	<1	<1	<1
GWB03						<1	<1	<1	<1	<1
GWB04			<1	<1	<1		<1	<1	<1	<1

C6H6 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA	<1	<1		<1	<1		<1	<1	<1	<1	
GWE		<1		<1	<1		<1	<1	<1	<1	
GWB01	<1		<1	<1	<1		<1		<1	<1	
GWB02	<1		<1	<1		<1	<1	<1	<1	<1	
GWB03	<1					<1	<1	<1	<1	<1	
GWB04	<1		<1	<1	<1		<1	<1	<1	<1	

C7H8 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA	<1	<1		<1	<1		<1	<1	<1	<1	
GWE		<1		<1	<1		<1	<1	<1	<1	
GWB01	<1		<1	<1	<1		<1		<1	<1	
GWB02	<1		<1	<1		<1	<1	<1	<1	<1	
GWB03	<1					<1	<1	<1	<1	<1	
GWB04	<1		<1	<1	<1		<1	<1	<1	<1	

C8H10 (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<1	<1		<1	<1		<1	<1	<1	<1
GWE		<1		<1	<1		<1	<1	<1	<1
GWB01	<1		<1	<1	<1		<1		<1	<1
GWB02	<1		<1	<1		<1	<1	<1	<1	<1
GWB03	<1					<1	<1	<1	<1	<1
GWB04	<1		<1	<1	<1		<1	<1	<1	<1

C8H10 M+P (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<2	<2		<2	<2		<2	<2	<2	<2
GWE		<2		<2	<2		<2	<2	<2	<2
GWB01	<2		<2	<2	<2		<2		<2	<2
GWB02	<2		<2	<2		<2	<2	<2	<2	<2
GWB03	<2					<2	<2	<2	<2	<2
GWB04	<2		<2	<2	<2		<2	<2	<2	<2

C8H10 O (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<1	<1		<1	<1		<1	<1	<1	<1
GWE		<1		<1	<1		<1	<1	<1	<1
GWB01	<1		<1	<1	<1		<1		<1	<1
GWB02	<1		<1	<1		<1	<1	<1	<1	<1
GWB03	<1					<1	<1	<1	<1	<1
GWB04	<1		<1	<1	<1		<1	<1	<1	<1

C10H8 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA	<1	<1		<1	<1		<1	<1	<1	<1	
GWE		<1		<1	<1		<1	<1	<1	<1	
GWB01	<1		<1	<1	<1		<1		<1	<1	
GWB02	<1		<1	<1		<1	<1	<1	<1	<1	
GWB03	<1					<1	<1	<1	<1	<1	
GWB04	<1		<1	<1	<1		<1	<1	<1	<1	

AROCLOR 1016 (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<2		<2	<2		<2	<2	<2	<2
GWE		<2		<2	<2		<2	<2	<2	<2
GWB01			<2	<2	<2		<2		<2	<2
GWB02			<2	<2		<2	<2	<2	<2	<2
GWB03						<2	<2	<2	<2	<2
GWB04			<2	<2	<2		<2	<2	<2	<2

AROCLOR 1221 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<2		<2	<2		<2	<2	<2	<2	
GWE		<2		<2	<2		<2	<2	<2	<2	
GWB01			<2	<2	<2		<2		<2	<2	
GWB02			<2	<2		<2	<2	<2	<2	<2	
GWB03						<2	<2	<2	<2	<2	
GWB04			<2	<2	<2		<2	<2	<2	<2	

AROCLOR 1232 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<2		<2	<2		<2	<2	<2	<2	
GWE		<2		<2	<2		<2	<2	<2	<2	
GWB01			<2	<2	<2		<2		<2	<2	
GWB02			<2	<2		<2	<2	<2	<2	<2	
GWB03						<2	<2	<2	<2	<2	
GWB04			<2	<2	<2		<2	<2	<2	<2	

AROCOR 1242 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<2		<2	<2		<2	<2	<2	<2	
GWE		<2		<2	<2		<2	<2	<2	<2	
GWB01			<2	<2	<2		<2		<2	<2	
GWB02			<2	<2		<2	<2	<2	<2	<2	
GWB03						<2	<2	<2	<2	<2	
GWB04			<2	<2	<2		<2	<2	<2	<2	

AROCOR 1248 (µg/L)	2018	2020				2021			2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<2		<2	<2		<2	<2	<2	<2
GWE		<2		<2	<2		<2	<2	<2	<2
GWB01			<2	<2	<2		<2		<2	<2
GWB02			<2	<2		<2	<2	<2	<2	<2
GWB03						<2	<2	<2	<2	<2
GWB04			<2	<2	<2		<2	<2	<2	<2

AROCOR 1254 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<2		<2	<2		<2	<2	<2	<2	
GWE		<2		<2	<2		<2	<2	<2	<2	
GWB01			<2	<2	<2		<2		<2	<2	
GWB02			<2	<2		<2	<2	<2	<2	<2	
GWB03						<2	<2	<2	<2	<2	
GWB04			<2	<2	<2		<2	<2	<2	<2	

AROCLOR 1260 (µg/L)	2018	2020				2021				2022	
	JUL	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<2		<2	<2		<2	<2	<2	<2	
GWE		<2		<2	<2		<2		<2	<2	
GWB01			<2	<2	<2		<2		<2	<2	
GWB02			<2	<2		<2	<2	<2	<2	<2	
GWB03						<2	<2	<2	<2	<2	
GWB04			<2	<2	<2		<2	<2	<2	<2	

PFAS

PFBS (mg/L)	2017	2020				2021			2022	
	MAY	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWE		<0.01		<0.01	<0.01		<0.01	0.03	<0.01	<0.01
GWB01			0.05	0.04	0.10		0.10		0.10	0.10
GWB02			<0.01	0.02		0.18	0.15	0.12	0.14	0.12
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFPeS (mg/L)	2017	2020				2021			2022	
	MAY	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWE		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWB01			0.04	0.03	0.07		0.08		0.08	0.08
GWB02			<0.01	0.02		0.14	0.10	0.07	0.09	0.08
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFHxS (mg/L)	2017	2020				2021			2022	
	MAY	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.04	<0.01		<0.01	<0.01		0.03	<0.01	0.02	0.02
GWE		0.03		0.04	<0.01		0.01	0.04	<0.01	<0.01
GWB01			0.19	0.17	0.58		1.10		0.62	0.83
GWB02			0.04	0.06		0.57	0.49	0.28	0.48	0.42
GWB03						0.02	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		0.01	<0.01	<0.01	<0.01

PFHpS (mg/L)	2017	2020				2021			2022	
	MAY	1-Aug	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWE		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWB01			0.01	0.01	0.04		0.10		0.04	0.06
GWB02			<0.01	<0.01		0.07	0.06	0.05	0.06	0.06
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFOS (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.09	<0.01		<0.01	<0.01		0.05	<0.01	<0.01	0.03
GWE		0.06		0.06	<0.01		0.04	0.12	<0.01	0.02
GWB01			0.24	0.23	1.20		2.30		0.90	1.40
GWB02			0.04	0.04		0.69	0.45	0.51	0.69	0.59
GWB03						0.03	0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		0.04	<0.01	<0.01	<0.01

PFDS (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
GWE		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
GWB01			<0.02	<0.02	<0.02		<0.02		<0.02	<0.02
GWB02			<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02
GWB03						<0.02	<0.02	<0.02	<0.02	<0.02
GWB04			<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02

PFPeA (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		0.05		0.05	0.04		0.31	0.03	0.32	0.35
GWE		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWB01			0.04	0.03	0.07		0.09		0.05	0.06
GWB02			<0.01	<0.01		0.20	0.10	0.10	0.10	0.10
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFHxA (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		0.03		0.02	<0.01		0.14	0.01	0.15	0.16
GWE		<0.01		<0.01	<0.01		<0.01	0.03	<0.01	<0.01
GWB01			0.06	0.06	0.14		0.23		0.11	0.14
GWB02			0.02	0.04		0.36	0.34	0.25	0.29	0.26
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFHpA (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		0.01		0.01	<0.01		0.09	<0.01	0.08	0.10
GWE		<0.01		<0.01	<0.01		<0.01	0.01	<0.01	<0.01
GWB01			0.03	0.03	0.07		0.09		0.05	0.05
GWB02			<0.01	0.01		0.13	0.11	0.09	0.09	0.09
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFOA (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	0.06	<0.01		<0.01	<0.01		0.05	<0.01	0.03	0.05
GWE		0.01		<0.01	<0.01		<0.01	0.02	<0.01	<0.01
GWB01			0.06	0.06	0.16		0.21		0.12	0.15
GWB02			<0.01	0.02		0.24	0.16	0.12	0.18	0.16
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFNA (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWE		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWB01			<0.01	<0.01	<0.01		<0.01		<0.01	<0.01
GWB02			<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

PFDA (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
GWE		<0.02		<0.02	<0.02		<0.02	<0.01	<0.02	<0.02
GWB01			<0.02	<0.02	<0.02		<0.02		<0.02	<0.02
GWB02			<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02
GWB03						<0.02	<0.02	<0.02	<0.02	<0.02
GWB04			<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02

PFUnDA (mg/L)	2017	2020				2021				2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	
GWE		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	
GWB01			<0.02	<0.02	<0.02		<0.02		<0.02	<0.02	
GWB02			<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02	
GWB03						<0.02	<0.02	<0.02	<0.02	<0.02	
GWB04			<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	

PFD _o DA (mg/L)	2017	2020				2021				2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<0.05		<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	
GWE		<0.05		<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	
GWB01			<0.05	<0.05	<0.05		<0.05		<0.05	<0.05	
GWB02			<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	
GWB03						<0.05	<0.05	<0.05	<0.05	<0.05	
GWB04			<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	

PFTrDA (mg/L)	2017	2020				2021				2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<0.1		<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	
GWE		<0.1		<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	
GWB01			<0.1	<0.1	<0.1		<0.1		<0.1	<0.1	
GWB02			<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	
GWB03						<0.1	<0.1	<0.1	<0.1	<0.1	
GWB04				<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1

PFTA (mg/L)	2017	2020			2021				2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.5		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
GWE		<0.5		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
GWB01			<0.5	<0.5	<0.5		<0.5		<0.5	<0.5
GWB02			<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	
GWB03					<0.5	<0.5	<0.5	<0.5	<0.5	
GWB04			<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	

4:2 FTS (mg/L)	2017	2020				2021				2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	
GWE		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	
GWB01			<0.01	<0.01	<0.01		<0.01		<0.01	<0.01	
GWB02			<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01	
GWB04				<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	

6:2 FTS (mg/L)	2017	2020		2021				2022		
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWE		<0.01		<0.01	<0.01		<0.01	<0.01	<0.01	<0.01
GWB01			<0.01	<0.01	<0.01		<0.01		<0.01	<0.01
GWB02			<0.01	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01
GWB03						<0.01	<0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		<0.01	<0.01	<0.01	<0.01

8:2 FTS (mg/L)	2017	2020				2021				2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA	<0.01	<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	
GWE		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	
GWB01			<0.02	<0.02	<0.02		<0.02		<0.02	<0.02	
GWB02			<0.02	<0.02		<0.01	<0.01	<0.02	<0.02	<0.02	
GWB03						<0.01	<0.01	<0.02	<0.02	<0.02	
GWB04			<0.02	<0.02	<0.02		<0.01	<0.02	<0.02	<0.02	

10:2 FTS (mg/L)	2017	2020		2021				2022		
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
GWE		<0.02		<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
GWB01			<0.02	<0.02	<0.02		<0.02		<0.02	<0.02
GWB02			<0.02	<0.02		<0.01	<0.01	<0.02	<0.02	<0.02
GWB03						<0.01	<0.01	<0.02	<0.02	<0.02
GWB04			<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02

PFOSA (mg/L)	2017	2020				2021				2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr	
GWA		<0.1		<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	
GWE		<0.1		<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	
GWB01			<0.1	<0.1	<0.1		<0.1		<0.1	<0.1	
GWB02			<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	
GWB03						<0.1	<0.1	<0.1	<0.1	<0.1	
GWB04				<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1

TOTAL PFHxS + PFOS (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.01		<0.01	<0.01		0.08	<0.01	0.02	0.05
GWE		0.09		0.10	<0.01		0.05	0.16	<0.01	0.02
GWB01			0.43	0.40	1.80		3.40		1.50	2.20
GWB02			<0.01	0.10		1.30	0.94	0.79	1.20	1.00
GWB03						0.05	0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		0.05	<0.1	<0.1	<0.1

TOTAL PFOS+PFOA (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		<0.01		<0.01	<0.01		0.10	<0.01	0.03	0.08
GWE		0.07		0.06	<0.01		0.04	0.14	<0.01	0.02
GWB01			0.30	0.29	1.40		2.50		1.00	1.60
GWB02			<0.01	0.06		0.93	0.61	0.63	0.87	0.75
GWB03						0.03	0.01	<0.01	<0.01	<0.01
GWB04			<0.01	<0.01	<0.01		0.04	<0.1	<0.1	<0.1

TOTAL PFAS (mg/L)	2017	2020				2021			2022	
	MAY	AUG	14-Sep	26-Oct	29-Apr	18-May	27-Jul	26-Oct	10-Jan	11-Apr
GWA		0.12		0.11	0.04		0.87	0.04	0.80	0.91
GWE		0.10		0.10	<0.01		0.05	0.25	<0.01	0.02
GWB01			0.77	0.71	2.50		4.40		2.20	3.00
GWB02			<0.01	0.23		2.70	2.10	1.70	2.20	2.00
GWB03						0.05	0.01	<0.01	<0.01	<0.01
GWB04				<0.01	<0.01	<0.01		0.05	<0.1	<0.1

APPENDIX B MONTHLY OPERATIONAL CHECKLIST (SEPTEMBER TO DECEMBER 2021)

Katherine Town Council Waste Management Facility Operational Checklist

Work Area / Location: WMF.

Date and Time: 14/9/2021 2.00pm.

Inspected by: (include all involved in the inspection) Name(s): CRAIG WALKER
Position(s):
Signature(s):

#	Inspection Items	Yes	No	N/A	Comments
General Site Management					
1.	Have all actions raised in the previous inspections been closed out?	☒	☐	☐	
2.	Have all actions from any recent environmental incidents been adequately investigated and appropriately addressed?	☒	☐	☐	
3.	Is the work area free from visible incidents (i.e. chemical spills, hydrocarbon spills, leachate pooling, etc.)?	☒	☐	☐	
4.	Have all incidents been reported?	☒	☐	☐	
5.	Is the boundary fence in good working order?	☐	☒	☐	Quotes underway
6.	Is the induction register up to date? Are all staff and contractors working on site being inducted?	☒	☐	☐	
7.	Is the complaints register being used correctly? Are complaints being addressed?	☒	☐	☐	
8.	Are the weighbridge operators following waste acceptance criteria guidelines in the EMP?	☒	☐	☐	
Water Quality Management					
9.	Is water quality monitoring being undertaken as per the program in the EMP / EPL?	☒	☐	☐	
10.	Are all surface water courses unobstructed?	☒	☐	☐	
11.	Are erosion and sediment control structures intact and maintained (in good working order)?	☒	☐	☐	
12.	Are surface water structures free from erosion or scour?	☒	☐	☐	
13.	Is potentially contaminated storm water prevented from being discharged into the environment?	☒	☐	☐	New Blocker / crossing created.
14.	Is there any evidence of leachate breakout or runoff from the landfill cells?	☐	☒	☐	
Dust, Odour and Aesthetics Management					
15.	Is the work area free from excessive visible dust?	☐	☒	☐	CONSTANT Battle water truck daily. limit where
16.	Are activities in the area creating minimal dust?	☒	☐	☐	TRACK equip go.

Fire Prevention

- | | | | | |
|-----|--|-------------------------------------|--------------------------|--------------------------|
| 36. | Are staff undertaking visual monitoring of loads going to landfill cells for evidence of smoking or hot loads? | ☒ | ☐ | ☐ |
| 37. | Are appropriate hot works procedures being followed? | ☒ | ☐ | ☐ |
| 38. | Is all fire-fighting equipment up-to-date and accessible. | ☒ | ☐ | ☐ |
| 39. | Is there a designated smoking area? Is it being used? | ☒ | ☐ | ☐ |
| 40. | Is the 4m wide fire break (around perimeter of KWMP, buildings, & operational areas) being maintained? | ☒ | ☐ | ☐ |

Chemical containers (DrumMuster)

- | | | | | |
|----|----------------------------------|-------------------------------------|--------------------------|--------------------------|
| 41 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 42 | All containers are contained? | ☒ | ☐ | ☐ |
| 43 | All containers are empty? | ☒ | ☐ | ☐ |
| 44 | Signage is erected? Not faded? | ☒ | ☐ | ☐ |

Tyres

- | | | | | |
|----|--|-------------------------------------|--------------------------|--------------------------|
| 45 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 46 | All waste is contained? | ☒ | ☐ | ☐ |
| 47 | Signage is erected? Not faded? | ☒ | ☐ | ☐ |
| 48 | Are tyres stacked in accordance with the CEMP? | ☒ | ☐ | ☐ |
| 49 | Is separation between stockpiles sufficient for fire access? | ☒ | ☐ | ☐ |

Metal

- | | | | | |
|----|----------------------------------|-------------------------------------|--------------------------|--------------------------|
| 50 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 51 | All waste is contained? | ☒ | ☐ | ☐ |
| 52 | Signage is erected? Not faded? | ☒ | ☐ | ☐ |

Green waste

- | | | | | |
|----|--|-------------------------------------|-------------------------------------|--------------------------|
| 53 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 54 | Is all green waste contained within the area? | ☒ | ☐ | ☐ |
| 55 | Are there any contaminants e.g. stone, plastic, steel? | ☐ | ☒ | ☐ |

WORKING extra hard
ON Teaching clients.

Issues Raised During Inspection				
Item	Identified Hazard	Actions Required	Due Date	Responsible Person
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Note: Actions are to be entered into the Management System for tracking and closeout with adequate evidence.

Other Comments/ Notes

Katherine Town Council Waste Management Facility Operational Checklist

Work Area / Location: **WME**

Date and Time: **1:02pm 21/10/21**

Inspected by:
(include all
involved in the
inspection)

Name(s): **CRAIG**
Position(s):
Signature(s):

[Signature]

#	Inspection Items	Yes	No	N/A	Comments
General Site Management					
1.	Have all actions raised in the previous inspections been closed out?	☒	☐	☐	
2.	Have all actions from any recent environmental incidents been adequately investigated and appropriately addressed?	☐	☐	☒	
3.	Is the work area free from visible incidents (i.e. chemical spills, hydrocarbon spills, leachate pooling, etc.)?	☒	☐	☐	
4.	Have all incidents been reported?	☒	☐	☐	
5.	Is the boundary fence in good working order?	☐	☒	☐	waiting on fencing contractor.
6.	Is the induction register up to date? Are all staff and contractors working on site being inducted?	☒	☐	☐	
7.	Is the complaints register being used correctly? Are complaints being addressed?	☒	☐	☐	
8.	Are the weighbridge operators following waste acceptance criteria guidelines in the EMP?	☒	☐	☐	
Water Quality Management					
9.	Is water quality monitoring being undertaken as per the program in the EMP / EPL?	☒	☐	☐	
10.	Are all surface water courses unobstructed?	☒	☐	☐	
11.	Are erosion and sediment control structures intact and maintained (in good working order)?	☒	☐	☐	
12.	Are surface water structures free from erosion or scour?	☒	☐	☐	
13.	Is potentially contaminated storm water prevented from being discharged into the environment?	☒	☐	☐	
14.	Is there any evidence of leachate breakout or runoff from the landfill cells?	☐	☒	☐	
Dust, Odour and Aesthetics Management					
15.	Is the work area free from excessive visible dust?	☒	☐	☐	
16.	Are activities in the area creating minimal dust?	☒	☐	☐	

17. Is dust suppression of dirt roads and other cleared areas being undertaken where excessive dust is visible? ☒ ☐ ☐

19. Are speed limits being enforced at site to reduce dust? ☒ ☐ ☐

23. Is there scattered rubbish around the site? ☐ ☒ ☐

20. Are there controls in place to catch wind-blown litter? Do these require maintenance? ☒ ☐ ☐

Noise Management

21. Are all equipment and machinery being maintained to manufacturers standards to prevent noise issues? ☒ ☐ ☐

22. Are any operations occurring outside standard work hours? Have the public, users and surrounding land owners been notified of works? ☐ ☒ ☐

Chemical, Oil and Fuel Management

23. Are all chemicals, oils and fuels will be stored appropriately in locked areas that are bunded, impervious areas in accordance with their MSDS? ☒ ☐ ☐

24. Is bunding in good condition? ☒ ☐ ☐

25. Are MSDS available in a folder where the chemicals, oils and fuels are stored? ☒ ☐ ☐

26. Is equipment containing hazardous materials (including hydrocarbons, and hoses/pipes) free of spills/leaks? ☒ ☐ ☐

27. Are adequate spills kits available and fully stocked? ☒ ☐ ☐

Flora and Fauna Management

28. Do clearing works have the required approvals? ☐ ☐ ☒

29. Have any significant fauna sightings been reported to the Site Manager? ☒ ☐ ☐

30. Have any injured fauna been reported to the Site Manager? ☒ ☐ ☐

34. Are speed limits being enforced to minimise potential for fauna impact? ☒ ☐ ☐

32. Are disturbed areas being progressively rehabilitated, and done so with species local to the surrounding environment? ☐ ☒ ☐

NO AREAS Ready yet

Pest and Weed Management

33. Are there any pests and weeds in operational areas? ☒ ☐ ☐

34. Are pests and weeds being managed/controlled on site? ☒ ☐ ☐

35. Are there any signs of pooled water that could provide a breeding ground for mosquitos? ☐ ☒ ☐

continually Removing

Fire Prevention

- | | | | | |
|-----|--|-------------------------------------|--------------------------|--------------------------|
| 36. | Are staff undertaking visual monitoring of loads going to landfill cells for evidence of smoking or hot loads? | ☒ | ☐ | ☐ |
| 37. | Are appropriate hot works procedures being followed? | ☒ | ☐ | ☐ |
| 38. | Is all fire-fighting equipment up-to-date and accessible. | ☒ | ☐ | ☐ |
| 39. | Is there a designated smoking area? Is it being used? | ☒ | ☐ | ☐ |
| 40. | Is the 4m wide fire break (around perimeter of KWMF, buildings, & operational areas) being maintained? | ☒ | ☐ | ☐ |

Chemical containers (DrumMuster)

- | | | | | |
|----|----------------------------------|-------------------------------------|--------------------------|--------------------------|
| 41 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 42 | All containers are contained? | ☒ | ☐ | ☐ |
| 43 | All containers are empty? | ☒ | ☐ | ☐ |
| 44 | Signage is erected? Not faded? | ☒ | ☐ | ☐ |

Tyres

- | | | | | |
|----|--|-------------------------------------|-------------------------------------|--------------------------|
| 45 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 46 | All waste is contained? | ☒ | ☐ | ☐ |
| 47 | Signage is erected? Not faded? | ☒ | ☐ | ☐ |
| 48 | Are tyres stacked in accordance with the CEMP? | ☐ | ☒ | ☐ |
| 49 | Is separation between stockpiles sufficient for fire access? | ☒ | ☐ | ☐ |

Metal

- | | | | | |
|----|----------------------------------|-------------------------------------|--------------------------|--------------------------|
| 50 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 51 | All waste is contained? | ☒ | ☐ | ☐ |
| 52 | Signage is erected? Not faded? | ☒ | ☐ | ☐ |

Green waste

- | | | | | |
|----|--|-------------------------------------|-------------------------------------|--------------------------|
| 53 | Is the area kept clean and tidy? | ☒ | ☐ | ☐ |
| 54 | Is all green waste contained within the area? | ☒ | ☐ | ☐ |
| 55 | Are there any contaminants e.g. stone, plastic, steel? | ☐ | ☒ | ☐ |

checked Daily

56	Signage is erected? Not faded?	☒	☐	☐
57	Does the green waste require shredding/composting?	☐	☒	☐
58	Is there any leachate or discoloured water flowing from the green waste area?	☐	☒	☐
Transfer Station – batteries, waste oil, gas bottles, skip bins				
59	Is the area kept clean and tidy?	☒	☐	☐
60	All waste is contained?	☒	☐	☐
61	Are transfer station skip bins being emptied when full and at least at the close of each working day?	☒	☐	☐
62	Are skip bins at the transfer station being cleaned at least monthly to prevent build-up of odours? Do they have a strong odour?	☒	☐	☐
63	Signage is erected? Not faded?	☒	☐	☐
64	No cross contamination of wastes?	☒	☐	☐
65	All waste liquids are contained within the bunds?	☒	☐	☐
66	Empty containers are kept within the wheelie bins?	☒	☐	☐
Landfill Cell:				
67	Is cover material being placed as required?	☒	☐	☐
68	Is there acceptable plant and people separation at the tip face?	☒	☐	☐
69	Is there any evidence of prohibited waste disposal?	☐	☒	☐
70	Signage is erected? Not faded?	☒	☐	☐
Asbestos Cell				
71	Is the area kept clean and tidy?	☒	☐	☐
72	All asbestos covered as per Regulations?	☒	☐	☐
73	Is there sufficient space for more deposits into the cell?	☒	☐	☐
74	Signage is erected? Not faded?	☒	☐	☐
Incidents & Reporting				
75	Have any incidents occurred or been identified that require NT EPA notification?	☐	☐	☒
76	Has the appropriate incident response been initiated?	☐	☐	☒

KWMF Site Inspection Checklist



Work Area / Location:

W MF

Date and Time:

1.36pm 22/11/21

Inspected by Name(s):

CRAIG WALKER

(include all personnel who took part in the inspection) Position(s):

Signature(s):

#	Inspection items	Yes	No	N/A	Comments
---	------------------	-----	----	-----	----------

General site management

- | | | | | | |
|----|--|-------------------------------------|-------------------------------------|--------------------------|---|
| 1. | Have all actions raised in the previous inspections been closed out? | ☒ | ☐ | ☐ | |
| 2. | Have all actions from any recent environmental incidents been adequately investigated and appropriately addressed? | ☒ | ☐ | ☐ | |
| 3. | Is the work area free from visible incidents (i.e. chemical / hydrocarbon spills, leachate pools etc.)? | ☒ | ☐ | ☐ | |
| 4. | Have all incidents been reported? | ☒ | ☐ | ☐ | |
| 5. | Is the boundary fence in good working order? | ☐ | ☒ | ☐ | fencing on hold until could restrictions lift |
| 6. | Is the induction register up to date? Are all staff and contractors working on site being inducted? | ☒ | ☐ | ☐ | |
| 7. | Is the complaints register being used correctly? Are complaints being addressed? | ☒ | ☐ | ☐ | |
| 8. | Are the weighbridge operators following waste acceptance criteria guidelines in the EMP? | ☒ | ☐ | ☐ | |

Water quality management

- | | | | | | |
|-----|---|-------------------------------------|-------------------------------------|--------------------------|--|
| 9. | Is water quality monitoring being undertaken as per the program in the EMP / EPL? | ☒ | ☐ | ☐ | |
| 10. | Are all surface water courses unobstructed? | ☒ | ☐ | ☐ | |
| 11. | Are erosion and sediment control structures intact and maintained (in good working order)? | ☐ | ☒ | ☐ | Still working on these. But progressing well |
| 12. | Are surface water structures free from erosion or scour? | ☒ | ☐ | ☐ | |
| 13. | Is potentially contaminated storm water prevented from being discharged into the environment? | ☒ | ☐ | ☐ | |
| 14. | Is there any evidence of leachate breakout or runoff from the landfill cells? | ☒ | ☐ | ☐ | |

Dust and aesthetics management

- | | | | | | |
|-----|---|-------------------------------------|-------------------------------------|--------------------------|--|
| 15. | Is the work area free from excessive visible dust? | ☒ | ☐ | ☐ | |
| 16. | Are activities in the area creating minimal dust? | ☒ | ☐ | ☐ | |
| 17. | Is dust suppression of dirt roads and other cleared areas being undertaken where excessive dust is visible? | ☒ | ☐ | ☐ | |
| 18. | Are speed limits being enforced at site to reduce dust? | ☒ | ☐ | ☐ | |
| 19. | Is there scattered rubbish around the site? | ☐ | ☒ | ☐ | |
| 20. | Are there controls in place to catch wind-blown litter? Do these require maintenance? | ☒ | ☐ | ☐ | |

KWMF Site Inspection Checklist



#	Inspection items	Yes	No	N/A	Comments
Noise management					
21.	Are all equipment and machinery being maintained to manufacturers standards to prevent noise issues?	☒	☐	☐	
22.	Are any operations occurring outside standard work hours? Have the public, users and surrounding land owners been notified of works?	☐	☒	☐	
Chemical, oil and fuel management					
23.	Are all chemicals, oils and fuels will be stored appropriately in locked areas that are bunded, impervious areas in accordance with their MSDS?	☒	☐	☐	
24.	Is bunding in good condition?	☒	☐	☐	
25.	Are MSDS available in a folder where the chemicals, oils and fuels are stored?	☒	☐	☐	
26.	Is equipment containing hazardous materials (including hydrocarbons, and hoses/pipes) free of spills/leaks?	☒	☐	☐	
27.	Are adequate spills kits available and fully stocked?	☒	☐	☐	
Flora and fauna management					
28.	Do clearing works have the required approvals?	☒	☐	☐	
29.	Have any significant fauna sightings been reported to the Site Manager?	☒	☐	☐	
30.	Have any injured fauna been reported to the Site Manager?	☒	☐	☐	
31.	Are speed limits being enforced to minimise potential for fauna impact?	☒	☐	☐	
32.	Are disturbed areas being progressively rehabilitated, and done so with species local to the surrounding environment?	☒	☐	☐	
Pest and weed management					
33.	Are there any pests and weeds in operational areas?	☒	☐	☐	Still a lot of weem + trees to remove.
34.	Are pests and weeds being managed/controlled on site?	☒	☐	☐	
35.	Are there any signs of pooled water that could provide a breeding ground for mosquitos?	☐	☒	☐	
Fire prevention					
36.	Are staff undertaking visual monitoring of loads going to landfill cells for evidence of smoking or hot loads?	☒	☐	☐	
37.	Are appropriate hot works procedures being followed?	☒	☐	☐	
38.	Is all fire-fighting equipment in date and accessible?	☒	☐	☐	
39.	Is there a designated smoking area? Is it being used?	☒	☐	☐	
40.	Is the 4m wide fire break (around the perimeter of the KWMF, around buildings and around operational areas) being maintained?	☒	☐	☐	
Chemical containers (DrumMuster)					
41.	Is the area kept clean and tidy?	☒	☐	☐	
42.	All containers are contained?	☒	☐	☐	
43.	All containers are empty?	☒	☐	☐	
44.	Signage is erected? Not faded?	☒	☐	☐	

Katherine Town Council Waste Management Facility Operational Checklist

Work Area / Location: WMF.		Date and Time: 10.55am 23/12/2021
Inspected by: (include all involved in the inspection)	Name(s): CRAIG WALKER Position(s): COORDINATOR Signature(s): 	

#	Inspection Items	Yes	No	N/A	Comments
General Site Management					
1.	Have all actions raised in the previous inspections been closed out?	☒	☐	☐	
2.	Have all actions from any recent environmental incidents been adequately investigated and appropriately addressed?	☐	☐	☒	
3.	Is the work area free from visible incidents (i.e. chemical spills, hydrocarbon spills, leachate pooling, etc.)?	☒	☐	☐	Small amount of RAIN water pooling. will EVAPORATE.
4.	Have all incidents been reported?	☒	☐	☐	
5.	Is the boundary fence in good working order?	☒	☐	☐	
6.	Is the induction register up to date? Are all staff and contractors working on site being inducted?	☒	☐	☐	
7.	Is the complaints register being used correctly? Are complaints being addressed?	☒	☐	☐	
8.	Are the weighbridge operators following waste acceptance criteria guidelines in the EMP?	☒	☐	☐	
Water Quality Management					
9.	Is water quality monitoring being undertaken as per the program in the EMP / EPL?	☒	☐	☐	
10.	Are all surface water courses unobstructed?	☒	☐	☐	
11.	Are erosion and sediment control structures intact and maintained (in good working order)?	☒	☐	☐	
12.	Are surface water structures free from erosion or scour?	☒	☐	☐	
13.	Is potentially contaminated storm water prevented from being discharged into the environment?	☒	☐	☐	
14.	Is there any evidence of leachate breakout or runoff from the landfill cells?	☐	☒	☐	
Dust, Odour and Aesthetics Management					
15.	Is the work area free from excessive visible dust?	☒	☐	☐	water truck used when needed.
16.	Are activities in the area creating minimal dust?	☒	☐	☐	

17.	Is dust suppression of dirt roads and other cleared areas being undertaken where excessive dust is visible?	☒	☐	☐	
19.	Are speed limits being enforced at site to reduce dust?	☒	☐	☐	
23.	Is there scattered rubbish around the site?	☐	☒	☐	
20.	Are there controls in place to catch wind-blown litter? Do these require maintenance?	☒	☐	☐	
Noise Management					
21.	Are all equipment and machinery being maintained to manufacturers standards to prevent noise issues?	☒	☐	☐	
22.	Are any operations occurring outside standard work hours? Have the public, users and surrounding land owners been notified of works?	☐	☒	☐	
Chemical, Oil and Fuel Management					
23.	Are all chemicals, oils and fuels will be stored appropriately in locked areas that are bunded, impervious areas in accordance with their MSDS?	☒	☐	☐	
24.	Is bunding in good condition?	☒	☐	☐	
25.	Are MSDS available in a folder where the chemicals, oils and fuels are stored?	☒	☐	☐	
26.	Is equipment containing hazardous materials (including hydrocarbons, and hoses/pipes) free of spills/leaks?	☒	☐	☐	
27.	Are adequate spills kits available and fully stocked?	☒	☐	☐	
Flora and Fauna Management					
28.	Do clearing works have the required approvals?	☒	☐	☐	
29.	Have any significant fauna sightings been reported to the Site Manager?	☐	☒	☐	
30.	Have any injured fauna been reported to the Site Manager?	☐	☐	☒	
34.	Are speed limits being enforced to minimise potential for fauna impact?	☒	☐	☐	
32.	Are disturbed areas being progressively rehabilitated, and done so with species local to the surrounding environment?	☐	☒	☐	not yet.
Pest and Weed Management					
33.	Are there any pests and weeds in operational areas?	☒	☐	☐	continuously working on these.
34.	Are pests and weeds being managed/controlled on site?	☒	☐	☐	
35.	Are there any signs of pooled water that could provide a breeding ground for mosquitos?	☐	☒	☐	

Fire Prevention

36.	Are staff undertaking visual monitoring of loads going to landfill cells for evidence of smoking or hot loads?	☒	☐	☐
37.	Are appropriate hot works procedures being followed?	☒	☐	☐
38.	Is all fire-fighting equipment up-to-date and accessible.	☒	☐	☐
39.	Is there a designated smoking area? Is it being used?	☒	☐	☐
40.	Is the 4m wide fire break (around perimeter of KWMF, buildings, & operational areas) being maintained?	☒	☐	☐

Chemical containers (DrumMuster)

41	Is the area kept clean and tidy?	☒	☐	☐
42	All containers are contained?	☒	☐	☐
43	All containers are empty?	☒	☐	☐
44	Signage is erected? Not faded?	☒	☐	☐

Tyres

45	Is the area kept clean and tidy?	☒	☐	☐
46	All waste is contained?	☒	☐	☐
47	Signage is erected? Not faded?	☒	☐	☐
48	Are tyres stacked in accordance with the CEMP?	☒	☐	☐
49	Is separation between stockpiles sufficient for fire access?	☒	☐	☐

Metal

50	Is the area kept clean and tidy?	☒	☐	☐
51	All waste is contained?	☒	☐	☐
52	Signage is erected? Not faded?	☒	☐	☐

Green waste

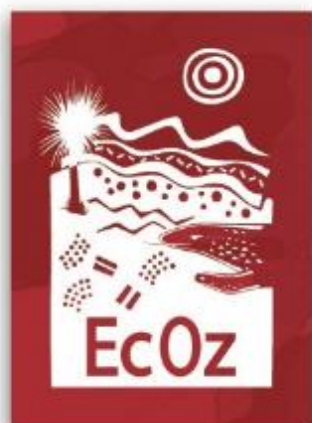
53	Is the area kept clean and tidy?	☒	☐	☐
54	Is all green waste contained within the area?	☒	☐	☐
55	Are there any contaminants e.g. stone, plastic, steel?	☐	☒	☐

56	Signage is erected? Not faded?	☒	☐	☐
57	Does the green waste require shredding/composting?	☐	☒	☐
58	Is there any leachate or discoloured water flowing from the green waste area?	☐	☒	☐
Transfer Station – batteries, waste oil, gas bottles, skip bins				
59	Is the area kept clean and tidy?	☒	☐	☐
60	All waste is contained?	☒	☐	☐
61	Are transfer station skip bins being emptied when full and at least at the close of each working day?	☒	☐	☐
62	Are skip bins at the transfer station being cleaned at least monthly to prevent build-up of odours? Do they have a strong odour?	☒	☐	☐
63	Signage is erected? Not faded?	☒	☐	☐
64	No cross contamination of wastes?	☒	☐	☐
65	All waste liquids are contained within the bunds?	☒	☐	☐
66	Empty containers are kept within the wheelie bins?	☐	☐	☒
Landfill Cell:				
67	Is cover material being placed as required?	☒	☐	☐
68	Is there acceptable plant and people separation at the tip face?	☒	☐	☐
69	Is there any evidence of prohibited waste disposal?	☐	☒	☐
70	Signage is erected? Not faded?	☒	☐	☐
Asbestos Cell				
71	Is the area kept clean and tidy?	☒	☐	☐
72	All asbestos covered as per Regulations?	☒	☐	☐
73	Is there sufficient space for more deposits into the cell?	☒	☐	☐
74	Signage is erected? Not faded?	☒	☐	☐
Incidents & Reporting				
75	Have any incidents occurred or been identified that require NT EPA notification?	☐	☐	☒
76	Has the appropriate incident response been initiated?	☐	☐	☒

Issues Raised During Inspection				
Item	Identified Hazard	Actions Required	Due Date	Responsible Person
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Note: Actions are to be entered into the Management System for tracking and closeout with adequate evidence.

Other Comments/ Notes



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