EPL233 Monitoring Report
Archer Waste Transfer Station

For annual reporting period ending 31 May 2022

City of Palmerston

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ACRONYMS

ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
BoM	Bureau of Meteorology
CoP	City of Palmerston
DO	dissolved oxygen
EC	electrical conductivity
EPL	Environment Protection Licence
LOR	limit of reporting
NATA	National Association of Testing Authorities
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
TBA	To be advised
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
WTS	Waste transfer station

1 INTRODUCTION

City of Palmerston (CoP) operate the Archer Waste Transfer Station (WTS) situated on Lot 11497, Town of Palmerston, Elrundie Avenue, Archer. CoP are authorised to 'store' waste at this facility under the NT *Waste Management and Pollution Control Act* in accordance with Environment Protection Licence (EPL233-02). Wastes stored at the facility prior to transport and disposal at the Shoal Bay Waste Management Facility comprise the following:

- Paper and cardboard
- Plastics
- Glass and aluminium
- General household waste
- Oil and grease
- Steel and metal
- Batteries
- Paint
- White goods and gas bottles.

Green waste is accepted and mulched onsite for sale to the general public. Refer to site layout in Figure 1-1.

Surface water monitoring is undertaken at the Archer WTS in accordance with Attachment 1 of EPL233-02 to ensure that operations do not impact any waterways downstream. Monitoring Reports are required annually, as per Condition 43 of EPL233-02. These must be prepared in accordance with the NT EPA 'Guideline for Reporting on Environmental Monitoring'. Each report must include all requirements as set out in EPL233-02 Condition 44.

This particular Monitoring Report covers all surface water quality monitoring undertaken for the reporting period 1 June 2021 to 31 May 2022 (herein referred to as the 'reporting period'). This is the second Monitoring Report since commencement of EPL233 on 19 December 2020.

1.1 Purpose and scope

This Monitoring Report is prepared in accordance with the following EPL233-02 conditions:

Condition 43

The licensee must complete and provide to the NT EPA a Monitoring Report, as prescribed by this licence, by 31 May each year.

Condition 44

The licensee must ensure that each Monitoring Report:

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

44.2 includes a tabulation of all monitoring data required as a condition of this licence. Data must be provided electronically in Microsoft Excel format;

44.3 includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the activity over a minimum period of three years (where the data is available). Data used in the analysis must be provided electronically in Microsoft Excel format; and

44.4 includes an assessment of environmental impact from the activity

Figure 1-1. Map of Archer WTS layout, surface water drainage and sample site locations

2 ENVIRONMENTAL SETTING

Palmerston has a tropical climate with a distinct dry season (May to October) and wet season (November to April). Typically, for this region, humidity, maximum and minimum temperatures are highest in the wet season, and annual evaporation far exceeds annual rainfall.

Climate data is sourced from the Bureau of Meteorology (BoM) weather monitoring station at Darwin Airport (station number 014015). Average annual rainfall at Darwin Airport (16 km northwest of the site) is 1,723.8 mm, with the highest rainfall occurring in January and the lowest in July.

Table 2-1. Average rainfall (taken from BoM Station No. 014015)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)	431.3	369.0	310.8	101.7	20.4	1.8	1.1	4.6	16.5	70.2	141.8	252.0	1723.8

The site is located on a relatively flat area, with a gradient of <3%. The area is well-drained with a combination of bitumen, compacted gravel/dirt, and grassed areas allowing for some infiltration but mostly surface water runoff. Existing constructed drains located on site collect and direct overland flows towards the eastern property boundary, where they enter an ephemeral stream (see Figure 1-1).

The stream captures stormwater from the neighbouring suburb of Bellamack before passing under Elrundie Avenue. It then passes the eastern boundary of the site and continues for approximately 1.5 km before entering a mangrove-lined creek in the Elizabeth River. Downstream of the site there is partially cleared land, a power transmission corridor, and a railway track.

2.1 Rainfall during reporting period

Figure 2-1 shows monthly rainfall totals for the reporting period taken from the Darwin Airport BoM station No. 014015. Average monthly rainfall totals are also shown for comparison. Rainfall during February 2022 and April 2022 was above average. March 2022 was below average. For all other months during the reporting period, rainfall was close to average. Total rainfall for the reporting period was 6,606.2 mm, which is close to the annual average (1,723.8 mm)

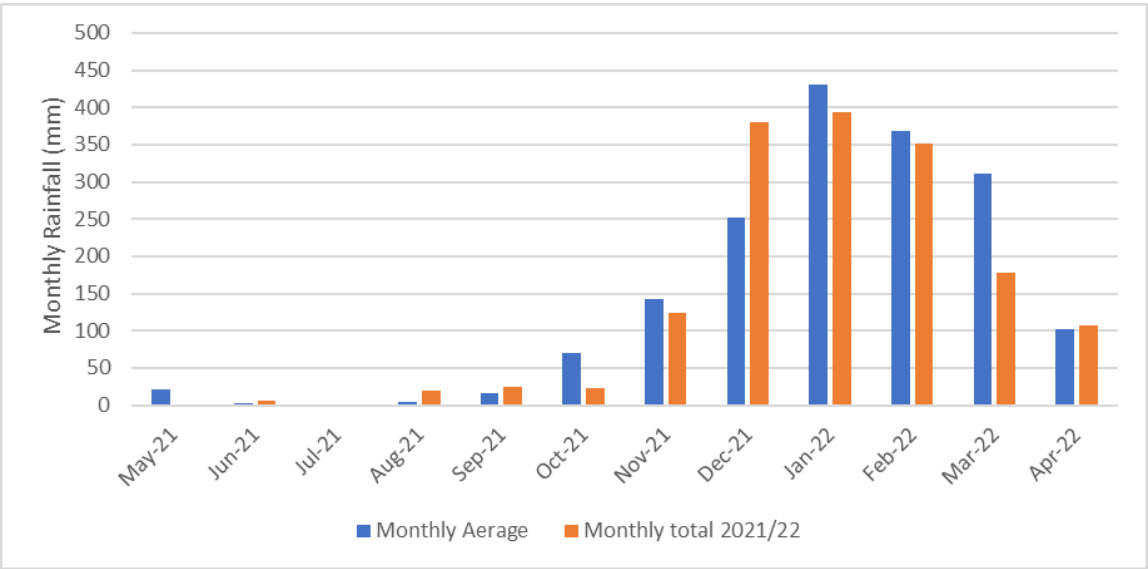


Figure 2-1. Monthly rainfall totals May 2021 to April 2022 (Darwin Airport BoM station No. 014015)

3 MONITORING UNDERTAKEN

During the reporting period, monitoring was undertaken as per EPL233-02 requirements as summarised below.

3.1 Monitoring sites

Details for surface water monitoring sites as listed in EPL233-02 Attachment 1 are shown in Table 3-1.

Table 3-1. Surface water monitoring site details

Site ID	Context and purpose	GPS Coordinates	
		Latitude	Longitude
Surface Water Sites			
SW01	Upstream of site. To capture water quality of stream before impact of runoff from site.	715054	8615118
SW04	Minor drainage line at the southern boundary of site.	714895	8614982
SW07	Downstream of confluence of ephemeral stream and runoff form site. To capture impact of runoff from site. The trigger values only apply to this site.	715031	8614965

3.2 Monitoring frequency, parameters, and trigger values

The parameters to be measured at each site, the sampling frequency, and trigger values currently specified in EPL233-02 Attachment 1 are shown in Table 3-2.

Table 3-2. Monitoring program and trigger values for surface water sites

Monitoring sites	Parameter	Units	Sampling frequency	Trigger value
SW01, SW04, SW07	Field measurement		4 times during the wet season (December, January, February, March, April)	-
	Flow	L/s		-
	pH	pH units		6 – 8.5[3]
	Electrical Conductivity (EC)	µS/cm		-
	Dissolved Oxygen (DO)	% saturation		80 – 100[3]
	Temperature	ºC		-
	Turbidity	NTU		-
	Metals/Metaloids	µg/L		-
	Cadmium (Cd)			5.5[7]
	Chromium (Cr)[5]			4.4[6,7]
	Copper (Cu)			1.3[7]
	Lead (Pb)			4.4[7]
	Mercury (Hg)			0.4[7]
	Nickel (Ni)			70[7]
	Zinc (Zn)			15[7]
	Other			
	Chemical Oxygen Demand (COD)	mg/L		-

	Total Suspended Solids (TSS)			10[3]
	Total Dissolved Solids (TDS)			-
	Nutrients	µg/L		
	Ammonia (NH3 as N)			20[3]
	Total Nitrogen (TN)			300[3]
	Total Phosphorous (TP)			30[3]
	Hydrocarbons	µg/L		
	Total Recoverable Hydrocarbons (TRH)			-
	Benzene			700[7]
	Toluene			-
	Ethylbenzene			-
	Xylene			-
	Naphthalene			70[7]

1 – Trigger values only apply to monitoring location SW07

2 – Only during months December to March

3 – Based on Darwin Harbour Water Quality Objectives (Marine and Estuarine Systems – Upper Estuary)

4 – Estimate the flow at the time of sampling

5 – Analyse for Trivalent and Hexavalent Chromium if total chromium exceeds trigger value

6 – Based on Hexavalent chromium 95% species protection ANZECC Water Quality Guidelines 2018 (ANZG 2018)

7 – Based on 95% species protection for marine waters ANZECC Water Quality Guidelines 2018 (ANZG 2018)

3.3 Sampling procedures

All sampling is undertaken in accordance with the Archer WTS *Water Quality Monitoring and Management Plan* (EcOz 2018) and Archer WTS *Sampling and Analysis Quality Plan* (EcOz) 2018) and the following standards and guidelines:

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), Standards Australia, New South Wales.

Australian/New Zealand Standard on Water Quality Sampling - *Part 6: Guidance on sampling of rivers and streams* (AS/NZS 5667.6:1998), Standards Australia, New South Wales.

Australian Standard/New Zealand Standard on Water Quality Sampling – *Part 10: Guidance on sampling of waste waters* (AN/NZS 5667.10:1998), Standards Australia, New South Wales.

All water sampling was carried out by an EcOz Environmental Consultant well-experienced in water quality monitoring. Field parameters were measured *in-situ* with water quality meters that were calibrated immediately prior to field mobilisaion. Laboratory samples were collected upstream of the location where *in-situ* field parameters were measured, to prevent contamination of samples.

All laboratory samples were collected into ALS Laboratory-supplied sample bottles/jars; some of which contain preservative where required. Once collected, these samples were kept cold in an esky with ice bricks until dispatched to the ALS shopfront on the same day as sampling in order to meet analytical holding time limits. The samples were analysed by a NATA accredited lab (ALS or Eurofins).

All surface water field parameters and observations were recorded on a dedicated *Field Data Sheet*. Information included who collected the sample, date and time, flow rate, field parameters measurements, and any items of interest such as presence of algae, animals or potential contaminants that may affect the water quality.

Field and laboratory results are stored in an Excel database updated and maintained by EcOz.

All field data sheets (scanned copies) and laboratory documentation are stored in an online filing system maintained by EcOz (M-Files). CoP also maintain copies of all laboratory documentation.

3.4 Monitoring undertaken during the reporting period

Table 3-3 outlines the monitoring undertaken during the reporting period and compliance against EPL233-02 monitoring requirements. The only non-compliance was SW04 not being sampled during the February monitoring event due to a lack of surface water flow at that site.

Table 3-3. Monitoring undertaken during the reporting period

Site ID	Frequency required	Dates sampled	Compliance with sampling frequency	Compliance with parameters measured
SW01	Monthly during reporting period (December, January, February, March)	20/12/21, 24/01/22, 24/02/22, 29/03/22	Compliant	Compliant
SW04	Monthly during reporting period (December, January, February, March)	20/12/21, 24/01/22, 29/03/22	Non-compliant – no surface water flow on 24/02/22 so not sampled	Compliant
SW07	Monthly during reporting period (December, January, February, March	20/12/21, 24/01/22, 24/02/22, 29/03/22	Compliant.	Compliant

4 RESULTS AND DISCUSSION

4.1 Reporting period trigger value exceedances

Field and laboratory results for the 2021-2022 wet season are presented in Table 4-1 and Table 4-2 compared against the EPL233-02 trigger values. Note that the trigger values only apply to the downstream compliance point SW07.

Trigger values exceedances occurred at SW07 during the reporting period for dissolved oxygen (DO), total suspended solids (TSS), dissolved copper, ammonia, total phosphorous (TP) and total nitrogen (TN). Only these parameters which exceeded the trigger values are discussed below.

DO was below the trigger value of 80% saturation at SW07 during the January and March sampling rounds. The DO concentrations measured (76 and 60%satuation) are relatively good for an urban stream receiving stormwater run-off. The 80% saturation trigger value comes from data collected in the open tidal waters of Darwin Harbour.

TSS exceeded the trigger value at SW07 in December, January, and February. TSS accounted for exceedances of the greatest magnitude, with the highest concentration recorded 984 mg/L in February. Notably, whenever SW07 exceeded the trigger value the upstream site SW01 did also, which shows the trigger value can be exceeded before any impact from the WTS. Such TSS concentrations are reasonably expected having regard to the catchment and the ephemeral characteristic of the waterway. TSS concentrations at SW07, however, may also be reflective of the extensive earthen hardstand area of the site utilised for green waste and mulch stockpiling. Having regard to this there is an opportunity to construct appropriately located mulch windrows to act as sediment filters. Additionally, retention of ground cover in site drains may also act as a natural filter to reduce TSS at SW07. Notwithstanding this, the thick, grassy vegetation present in the ephemeral stream is likely to attenuate TSS concentrations significantly and reduce the risk of sediment entering Darwin Harbour.

No TSS exceedances were recorded at SW07 in March.

Dissolved copper exceeded the trigger value at SW07 in December, January, and February. Notably, the results for the upstream site SW01 in December show there is a background dissolved copper concentration in the ephemeral stream before any contributions from WTS site. There was a trend towards lower concentrations at SW07 as the wet season progressed.

Ammonia exceeded the trigger value at SW07 during all sampling rounds. Notably, the results for SW01 show there is significant background ammonia before any contributions from WTS site.

TP and TN exceeded the trigger value at SW07 during the December, January and February monitoring rounds. These concentrations appear to correlate with the TSS concentrations, indicating the N and P is particulate and associated with sediment run-off from the site.

4.2 Trends since 2018

Trend analysis graphs for key parameters, displaying trends in data from 2018 to 2022 are provided in Appendix B. A complete summary of water quality data since monitoring started in 2018 is provided in Appendix A.

There is no obvious overall trend in TSS concentrations since 2018, but concentrations do appear to reduce towards the end of each wet season.

Dissolved copper, ammonia and TP concentrations appear to be declining since 2018, but further years of monitoring are required to confirm this.

The trend of the number of exceedances reducing towards the end of each wet season shows that there is a limited amount of contaminants on site available to mobilise into the receiving environment. The weak trend

of lowering concentrations of dissolved metals and nutrients since 2018 show that management measures implemented on site are improving runoff water quality.

Table 4-1. Water sampling results 2021-2022 - physical parameters and dissolved metals

Concentrations exceeding trigger values of EPL233 trigger values at the SW07 compliance point are highlighted

		Field parameters										Dissolved Metals							
Site ID	Date	Temp	Dissolved Oxygen	EC	TDS	Salinity	pH	ORP	Turbidity	TDS	TSS	Arsenic As V	Cadmium Cd	Chromium	Copper Cu	Lead Pb	Mercury (inorganic)	Nickel Ni	Zinc Zn
		°C	%	µS/cm	mg/L	ppt		mV	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EPL233-02 trigger values		-	80-100	-	-	-	6-8.5	-	-	-	10	-	0.0055	0.0044	0.0013	0.0044	0.0004	0.07	0.015
SW01	20-12-21	25.6	54	58	38	0.00	6.67	200	1000+	36	40	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.007
SW04	20-12-21	25.2	64	133	86	0.10	6.48	206	1000+	268	38	<0.001	<0.0001	<0.001	0.003	<0.001	<0.0001	0.001	0.007
SW07	20-12-21	25.6	101	347	226	0.20	7.00	206	1000+	260	229	0.001	<0.0001	<0.001	0.006	<0.001	<0.0001	0.001	0.006
SW01	24-01-22	27.3	90	52	34	0.02	7.48	131	24	38	16	<0.001	<0.0001	<0.001	0.001	<0.001	<0.0001	<0.001	0.008
SW04	24-01-22	27.4	86	185	120	0.09	7.29	132	297	362	97	<0.001	<0.0001	<0.001	0.001	<0.001	<0.0001	<0.001	0.025
SW07	24-01-22	27.3	76	574	373	0.28	6.31	74	64	197	188	0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.008
SW01	24-02-22	27.3	93	105	68	0.05	8.18	122	36.9	34	42	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005
SW07	24-02-22	26.3	97	306	199	0.14	7.73	119	1000+	262	984	0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	<0.005
SW01	29-03-22	30.9	81	91	59	0.04	6.53	-	3.25	66	6	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005
SW04	29-03-22	31.0	48	182	118	0.08	5.62	-	33.95	120	16	<0.001	<0.0001	<0.001	0.003	<0.001	<0.0001	0.001	0.019
SW07	29-03-22	30.9	60	253	165	0.12	6.50	-	4.37	126	<5	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	0.002	<0.005

Table 4-2. Water sampling results 2021-2022 – nutrients

Concentrations exceeding trigger values of EPL233 trigger values at the SW07 compliance point are highlighted

		Nutrients					
Site ID	Date	Ammonia mg/L	Total Phosphorus mg/L	Nitrite + Nitrate as N mg/L	Total Kjeldahl Nitrogen as N mg/L	Total Nitrogen as N mg/L	COD mg/L
EPL233-02 trigger values		0.02	0.03	-	-	0.3	-
SW01	20-12-21	0.09	0.11	0.23	0.7	0.9	12
SW04	20-12-21	0.04	0.09	0.18	0.9	1.1	28
SW07	20-12-21	0.25	0.71	0.94	2.4	3.3	103
SW01	24-01-22	0.06	0.09	0.06	0.3	0.4	15
SW04	24-01-22	0.08	0.12	0.01	1.0	1.0	36
SW07	24-01-22	0.11	0.42	0.50	1.4	1.9	90
SW01	24-02-22	0.08	0.08	0.01	0.8	0.8	<10
SW07	24-02-22	0.20	0.77	0.24	2.9	3.1	152
SW01	29-03-22	0.08	<0.01	0.02	0.2	0.2	10
SW04	29-03-22	0.05	0.05	<0.01	0.6	0.6	30
SW07	29-03-22	0.08	0.01	0.02	0.2	0.2	457

5 CONCLUSIONS

The monitoring schedule was undertaken as per EPL233-02 Attachment 1 – Surface Water Monitoring Program requirements, except for the non-compliance as listed in Table 3-3 (i.e. SW04 not sampled in February due to there being no surface water flows at the time).

Trigger value exceedances occurred at the compliance point (SW07) during the reporting period for DO, TSS, dissolved copper, ammonia, TP, and TN on one or more occasions and were reported at that time in accordance with Condition 42 of EPL 233-02. It is also noted that trigger value exceedances were also observed at the upstream site SW01, which shows the trigger value can be exceeded before any impact from the WTS. Having regard to TSS trigger value exceedances, there is an opportunity to use appropriately located mulch windrows as sediment filters to mitigate sediment movement from the green waste and mulch earthen hardstand.

The balance of water quality monitoring results conformed with trigger values.

6 REFERENCES

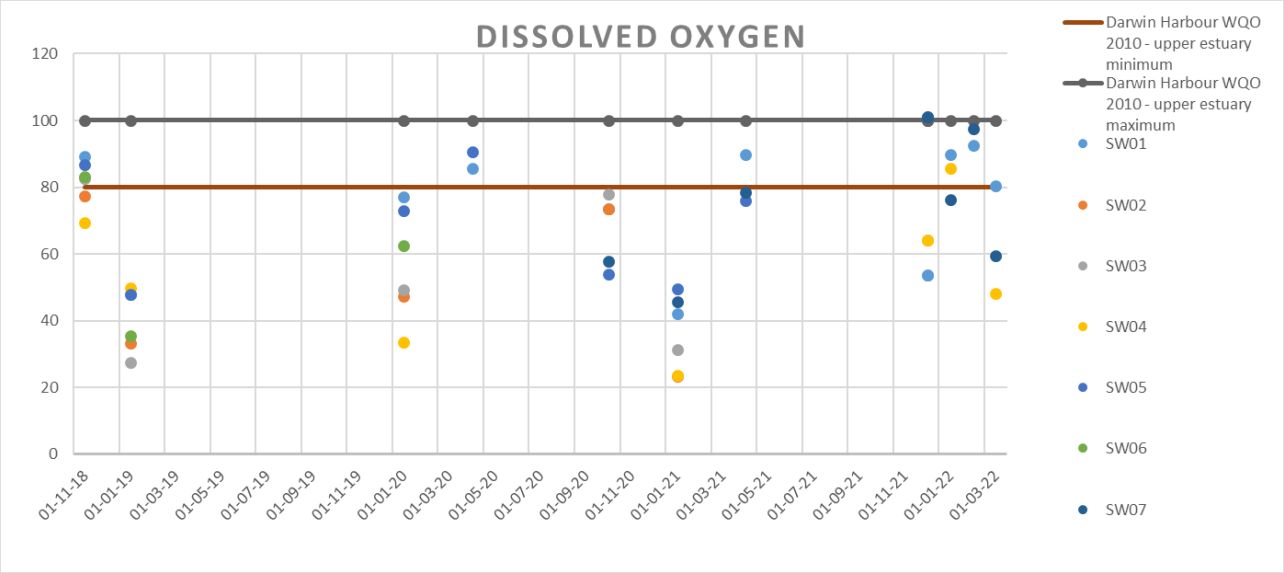
ANZG 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

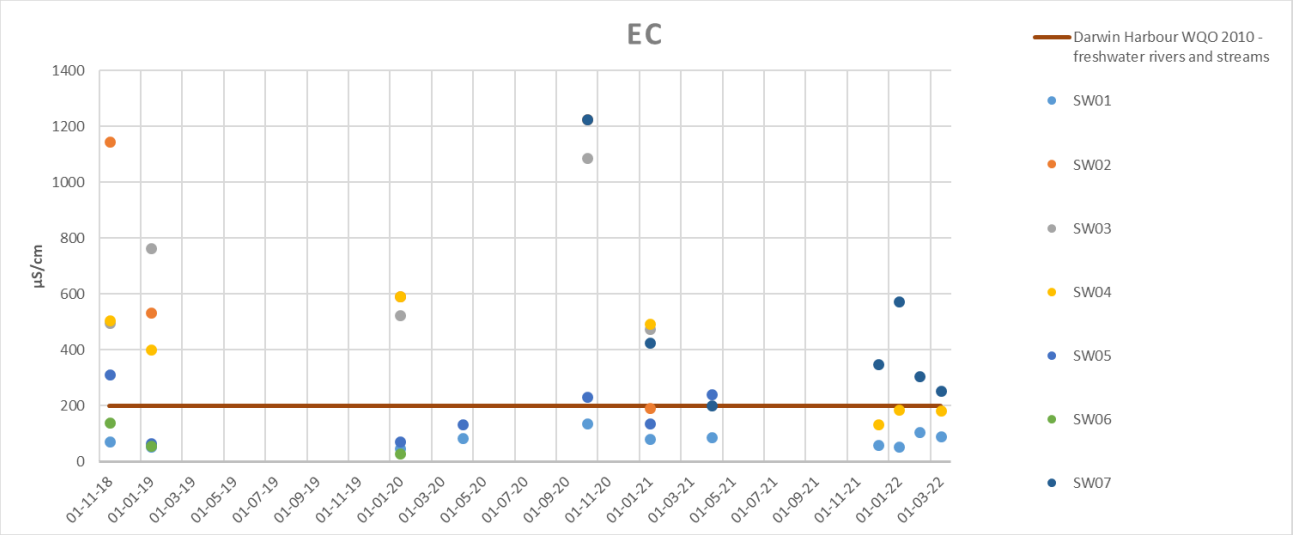
Northern Territory Government (2010) *Water Quality Objectives for the Darwin Harbour Region for marine and estuarine systems.*

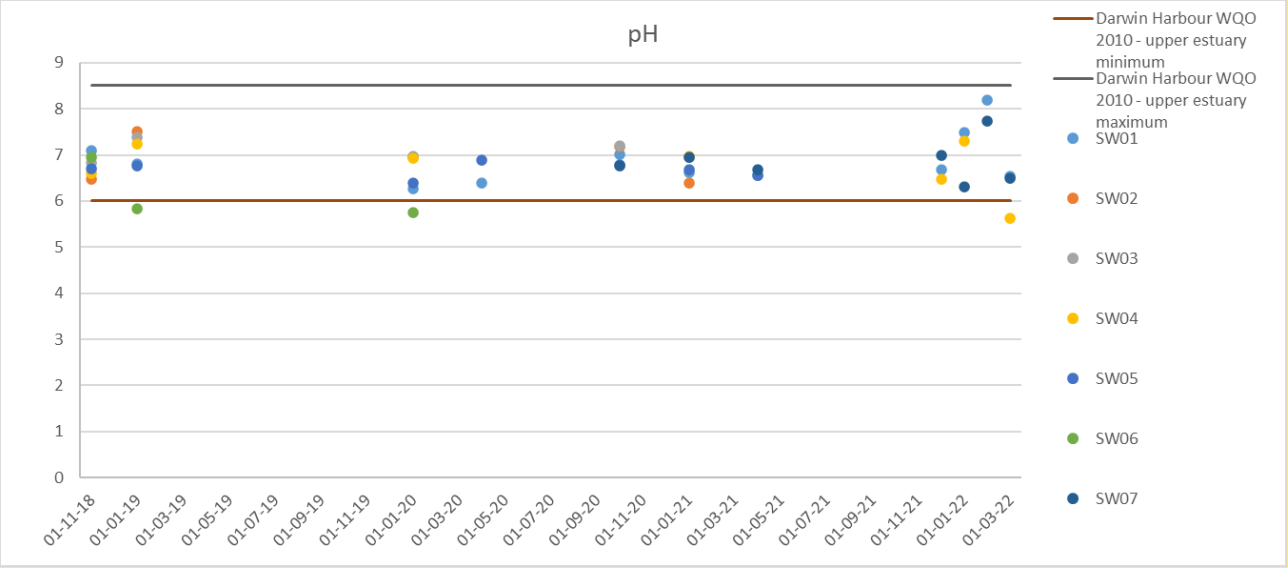
APPENDIX A COMPLETE WATER QUALITY DATASET

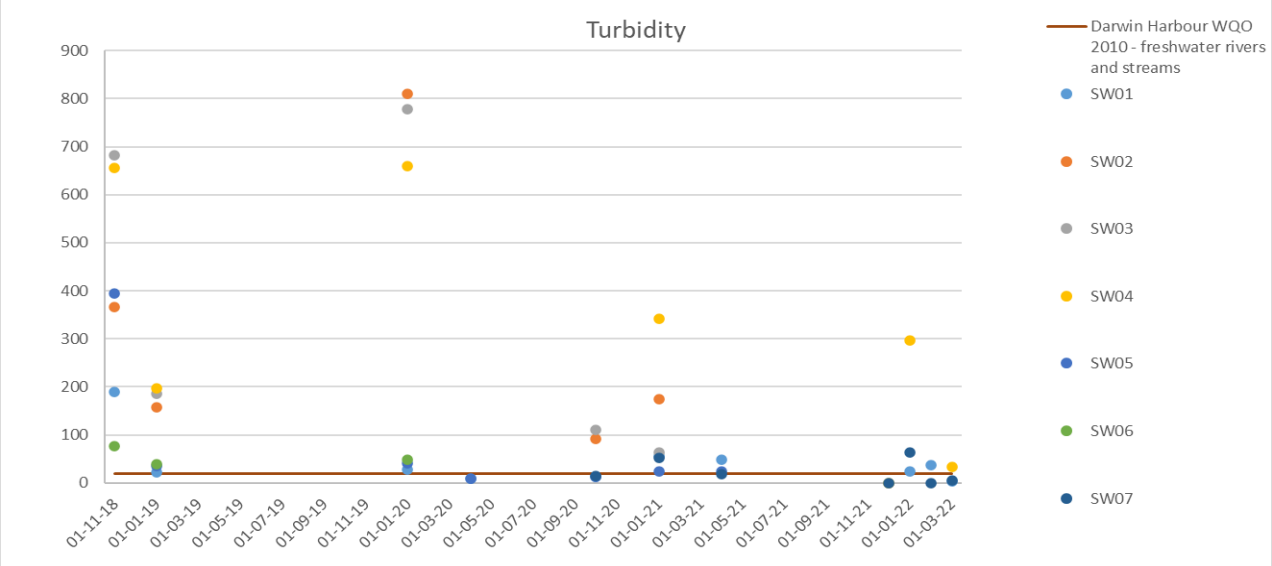
The water quality data collected by EcOz from 2018 to 2022 are provided in an Excel database forwarded as separate file titled Archer Waste Data 2018 to 2022.

APPENDIX B TREND ANALYSIS GRAPHS





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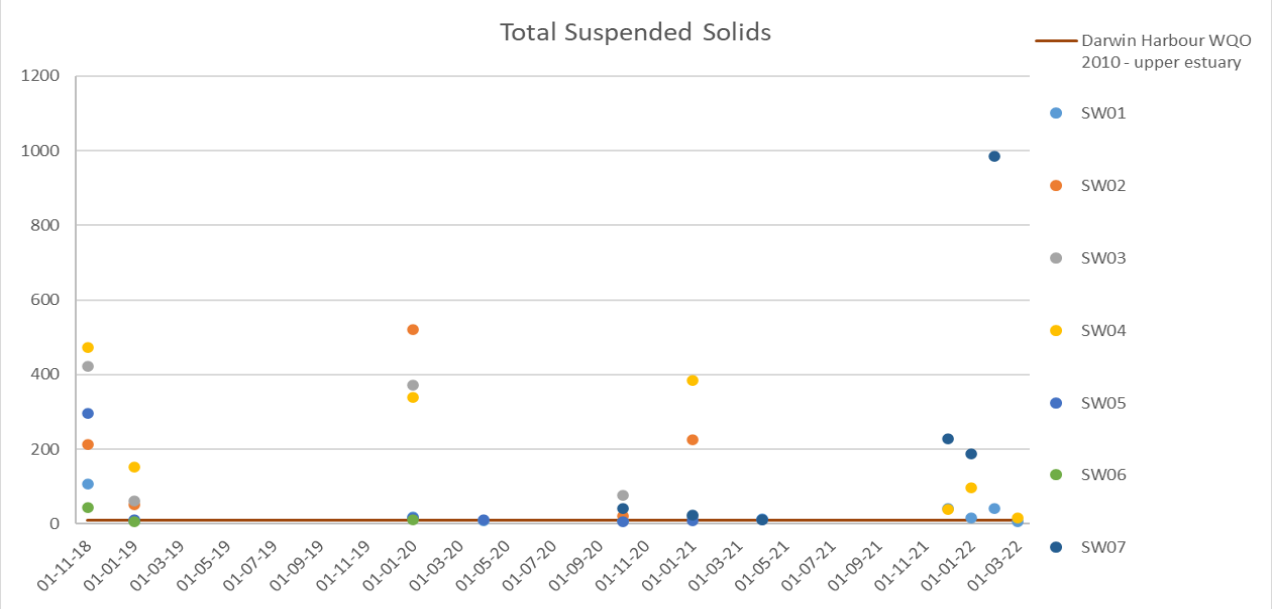
SW01
SW02
SW03
SW04
SW05
SW06
SW07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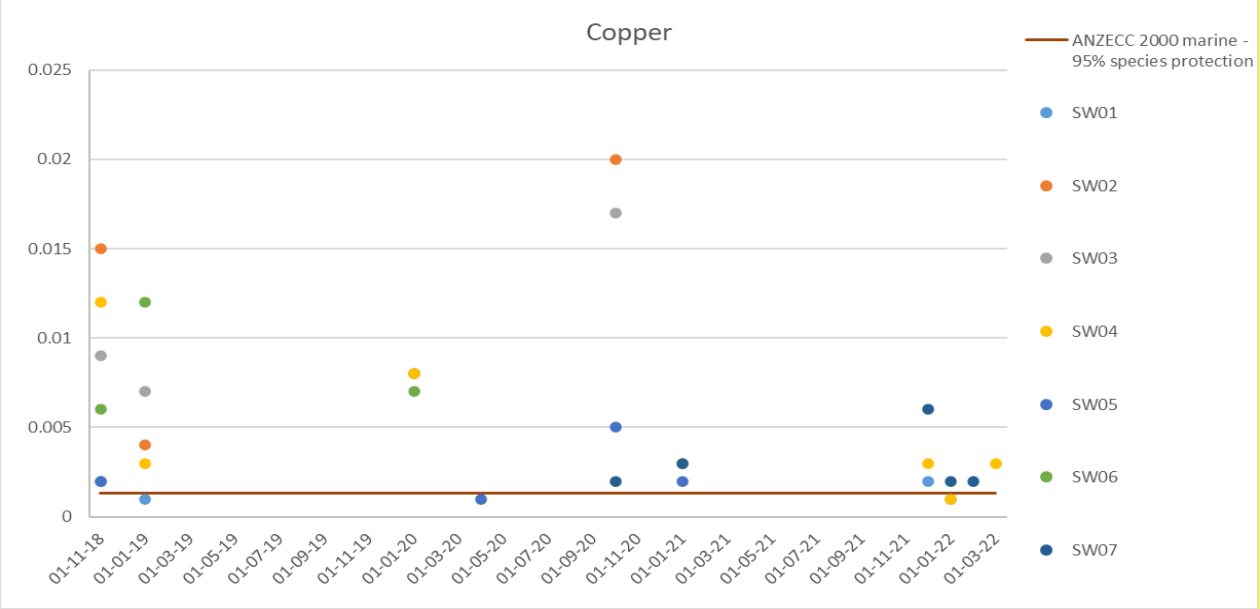
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ANZECC 2000 marine - 95% species protection
SW01
SW02
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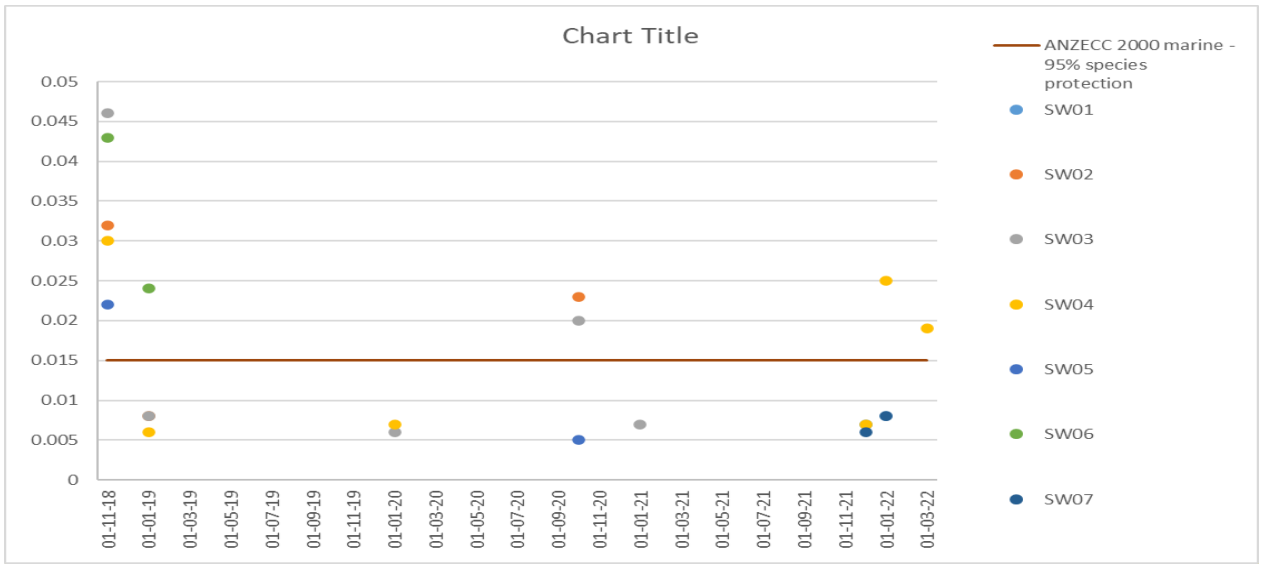
SW04
SW05
SW06
SW07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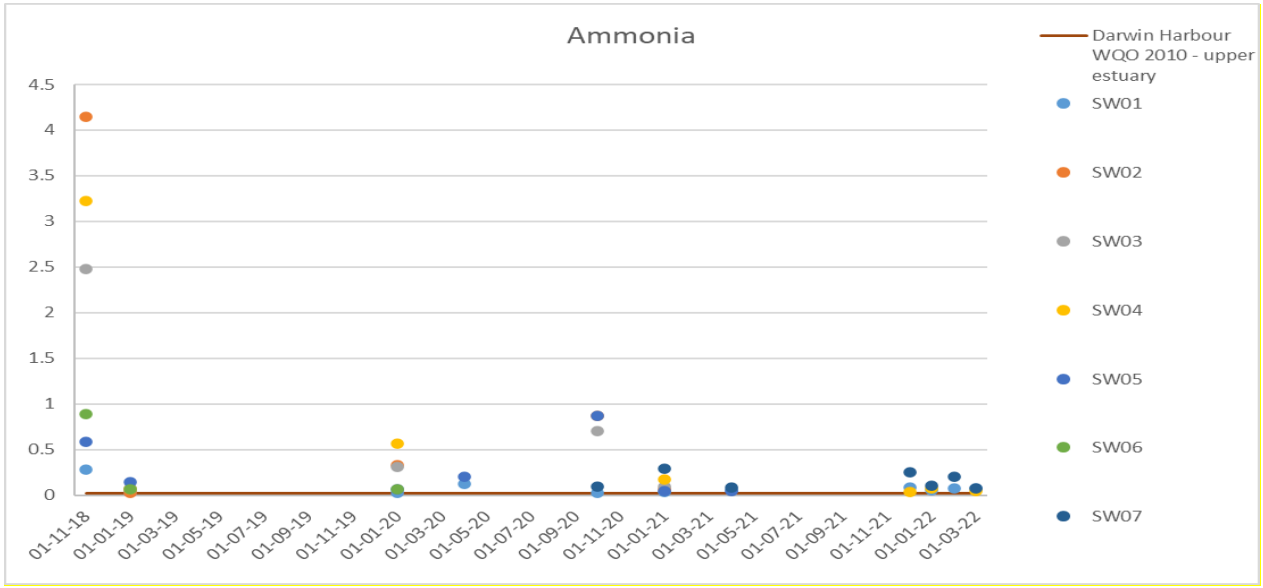
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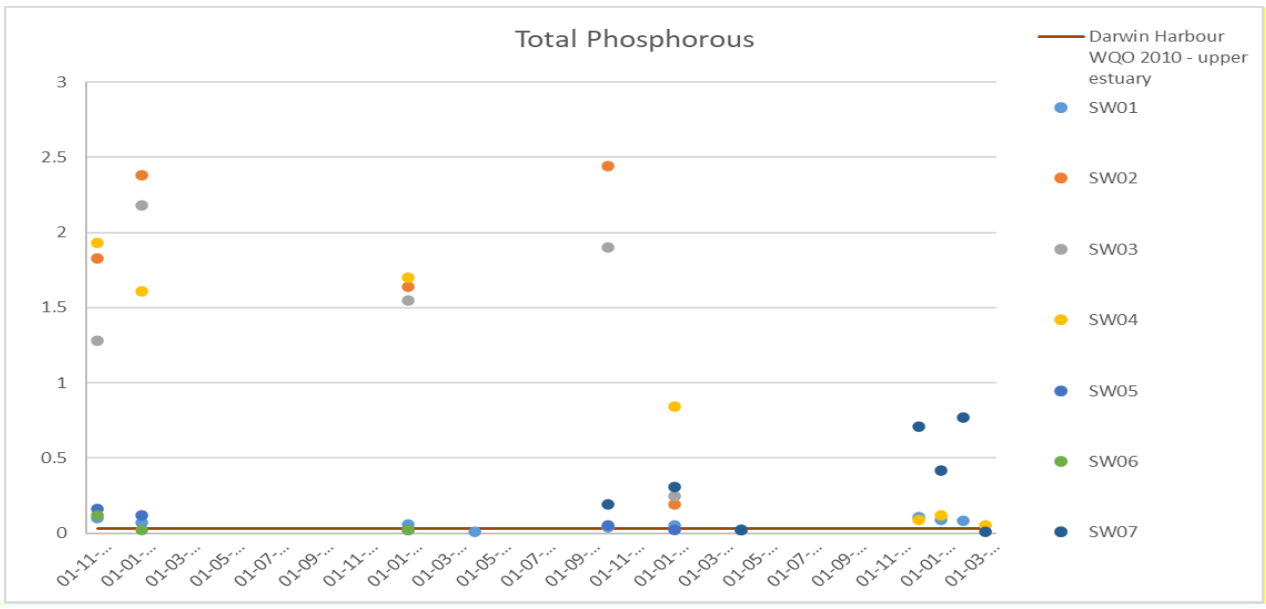
01-01-22
01-03-22


Total Phosphorous
Darwin Harbour WQO 2010 - upper estuary
SW01
SW02
SW03
SW04
SW05
SW06
SW07
3
2.5
2
1.5
1
0.5
0

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