EPL233-02 Monitoring Report
Archer Waste Transfer Station

For annual reporting period ending 31 May 2024

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
COD	Chemical Oxygen Demand
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
- Steel and metal
- Batteries
- Paint
- Waste oil
- 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 December 2023 to 31 March 2024 (herein referred to as the 'reporting period'). This is the fourth 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 act

Path: Z:\01 EcOz_Documents\05 EcOz M-Files GIS\2024\EZ24088 - Archer Waste EPL Reporting - 2023-24\1. Project Files\2. Report Maps\Archer Waste Management Sample Points.aprx

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 1,722.5 mm, with the highest rainfall occurring in January and the lowest in July.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave Rainfall (mm)	431.3	371.8	310.0	100.5	20.2	1.8	1.1	4.6	16.3	70.4	142.1	255.3	1722.5

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 January, February and March 2024 was above average. September, October, November 2023 recorded significantly lower rainfall than average, with all other months recording close to average rainfall. It is noted that December recorded little rainfall towards the end of the month, where during this time there was in-sufficient rainfall to maintain stream flow to support sampling.

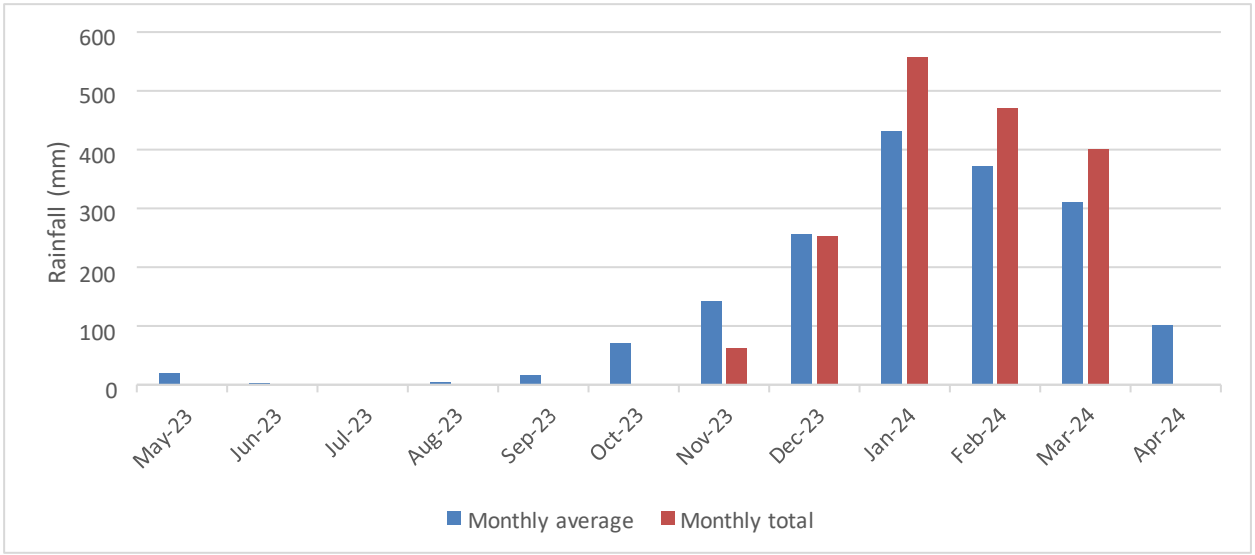


Figure 2-1. Monthly rainfall totals May 2023 to April 2024 (Darwin Airport BoM station No. 014015)

3 MONITORING UNDERTAKEN

During the reporting period, monitoring was undertaken as per EPL233-02, although the December sampling round did not take place until early January and the February round did not occur until early March. This was due to rainfall concentrated in the middle of the month experienced in both December and February, leading to a lack of stream flow and dry sampling locations while staff resources were available. EPL233-02 requirements are 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. Captures 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 from site. Captures impact of runoff from site. Trigger values apply only 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	Trigger value	Sampling frequency
SW01, SW04, SW07	*Field measurement*			4 times during the wet season (December, January, February, March)
	Flow	L/s	-	
	pH	pH units	6 -8.5[3]	
	Electrical Conductivity (EC)	µS/cm	-	
	Dissolved Oxygen (DO)	% saturation	80 -100[3]	
	Temperature	°C	-	
	Turbidity	NTU	-	
	Metals/Metaloids			
	Cadmium (Cd)	µg/mL	5.7[7]	
	Chromium (Cr)[5]		4.4[6,7]	
	Copper (Cu)		1.3[7]	
	Lead (Pb)		4.4[7]	
	Mercury (Hg)		0.4[7]	

Monitoring sites	Parameter	Units	Trigger value	Sampling frequency
	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			
	Ammonia (NH3as N)	µg/L	20[3]	
	Total Nitrogen (TN)		300[3]	
	Total Phosphorous (TP)		30[3]	
	Hydrocarbons			
	Total Recoverable Hydrocarbons (TRH)	µg/L	-	
	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 Estuary Systems – Upper Estuary)
4 – Estimate the flow at 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 water 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), 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 mobilisation. 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. There were non-compliances at all sites in both December and February, due to insufficient flow when field staff were present.

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)	11/01/2024 24/01/2024 01/03/2024 21/03/2024	Non-compliant in December 2023. To amend this, two samples were taken in early and late January 2024. Samples were not collected in February owing to insufficient flow. To amend, march had samples taken both early and late.	Non-compliant as discussed in section 4.1
SW04	Monthly during reporting period (December, January, February, March)	11/01/2024 24/01/2024 01/03/2024 21/03/2024	Non-compliant in December 2023. To amend this, two samples were taken in early and late January 2024. Samples were not collected in February owing to insufficient flow. To amend, march had samples taken both early and late.	Non-compliant as discussed in section 4.1
SW07	Monthly during reporting period (December, January, February, March)	11/01/2024 24/01/2024 01/03/2024 21/03/2024	Non-compliant in December. To amend this, two samples were taken in early and late January 2024. Samples were not collected in February owing to insufficient flow. To amend, march had samples taken both early and late.	Non-compliant as discussed in section 4.1

4 RESULTS AND DISCUSSION

4.1 Reporting period trigger value exceedances

Field and laboratory results for the 2023-2024 wet season are presented in Table 4-1 and Table 4-2 compared against the EPL233-02 trigger values. Note that the trigger values apply only to the downstream compliance point SW07.

Trigger value exceedances occurred at SW07 during the reporting period for DO, TSS, Copper, Ammonia, TP and TN. Therefore, only results for these parameters are discussed below. It is worth noting that this sampling site is immediately adjacent to the confluence of the stormwater drainage (where SW04 is located) into the ephemeral stream. As such, water originating from the site is unlikely to be well mixed throughout the stream. In further sampling, it is recommended that an additional sample site downstream from SW07 is included, to ensure mixing of the discharge is adequately considered. Should a new more representative sample point be elected downstream, elevated levels of parameters in exceedance are expected.

DO was below the trigger value of 80% saturation at SW07 during all but the late March sampling event where it recorded 80.3%. SW07 recorded the lowest DO% since monitoring began in early March, rainfall during this period was minimal indicating that the waterflow would have been insufficient for oxygen to properly dissolve within the stream. It is noted that the upstream site (SW01) only achieved a DO% greater than the trigger value on late March. This indicates that the background levels of DO in the ephemeral stream were consistently below the trigger value. The 80% saturation trigger value comes from data collected in the open tidal waters of Darwin Harbour. Darwin Harbour displays typical water quality for waters around the Darwin region, making it a good baseline for the establishment of water quality in the region.

TSS concentrations at SW7 exceeded trigger values twice, first in late January and then in early March. SW4 consistently recorded TSS concentrations above the SW7 trigger values, notably during the early January and late March sampling events, with the highest level of 114 mg/L occurring on 11/01/2024 in early January. As observed in the previous reporting period, TSS accounted for the greatest magnitude of exceedances among all analytes. However, the early March sampling event stands out as an outlier, with TSS reaching 108 mg/L, while turbidity and TDS were low at 26 NTU and 35.1 mg/L, respectively.

Early January, late January and late March all recorded Ammonia levels above the SSTV at SW07. The late January readings were highest at 0.48 mg/L Of note is that SW01 shows exceedances during the first 3 sampling events; however, they have not reached the high levels displayed at SW07. This demonstrate that although background conditions are already high in ammonia, the discharge at SW04 is likely elevating the levels at SW07.

TP exceeded the trigger values at all sites in all sampling events barring SW01 in the late January sampling. It is noted that SW01 recorded values far lesser than the SW04 and SW07 values, indicating that TP originating on site is likely discharged into the stream through runoff.

TN at SS7 was above the SSTV during every sampling round. During the reporting period, concentrations at this site were higher than or equal to those recorded at SW01 during each round of sampling. This shows that TN is leaching from the site and entering the ephemeral stream.

To address concerns regarding dissolved copper, total nitrogen, total phosphorus, and ammonia, implementing controls such as constructing appropriately located mulch windrows to act as sediment filters could be beneficial. This is especially relevant as most TSS concentrations at SW07 align with turbidity levels and may also reflect the extensive earthen hardstand area of the site used for green waste and mulch stockpiling. The low turbidity and TDS may be attributed to the low rainfall recorded, leading to relatively low particulates being dissolved into the waterway compared to other more rainfall-heavy monitoring periods. Furthermore, retaining ground cover in site drains could serve as a natural filter to reduce TSS at SW07. Despite these measures,

the thick, grassy vegetation present in the ephemeral stream is likely to significantly attenuate TSS concentrations and reduce the risk of sediment entering Darwin Harbour.

4.2 Trends since 2018

Trend analysis graphs for key parameters, displaying trends in data from 2018 to 2024 are provided in Appendix B. A complete summary of water quality data since monitoring started in 2018 is provided in Appendix A.

TSS at SW07 has consistently exceeded the set trigger values with highest concentrations being found in February and the lowest in January. Generally, TSS concentrations have been declining since 2018, with the exception of two February sampling events in 2022 and 2023 which displayed highly elevated TSS results of 558 and 984 mg/L respectively.

At SW04 dissolved copper, ammonia and TP concentrations appear to be declining since 2018. The 2024 round of sampling did however show a spike in these analytes at SW04. Further years of monitoring are required to confirm any potential trend. Both SW01 and SW07 do not show a clear trend with these analytes; however, they are often higher at SW07 than they are in SW01 during the same sampling event.

TN concentrations at SW07 have consistently been above the recommended guidelines during the first wet season flush since 2021. However, during this reporting period the December/January sample was the lowest it has been. Of note is that in the early January round, SW01 recorded a concentration of 0.09 mg/L indicating that site runoff has had minimal impact on TN downstream. This is further supported by the March readings at all 3 sites which show slight exceedances at SW01 and SW07, while the site water representation from SW04 is more than 60x over the Darwin Harbour WQO 2010 -upper estuary. In previous rounds of monitoring SW01 has displayed lower concentrations than SW07. Concentrations at SW04 have also been commonly below those recorded at SW07.

This round of monitoring shows a marked increase in the concentrations of analytes in exceedance of set guidelines over previous rounds of reporting. This could be as a result of additional rainfall inputs increasing the rate at which contaminants are deposited downstream. January, February and March all received higher average rainfall in total ultimately increasing the volume of water and therefore vector of transportation for contaminants. Future rounds of monitoring will be able to establish whether the increased detection of contaminants is from rainfall, or whether the sites control measures need revising.

Table 4-1. Water sampling results 2024 - physical parameters and dissolved metals

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

		Field parameters										Dissolved Metals							
		Temp	Dissolved Oxygen	EC	TDS	Salinity	pH	ORP	Turbidity	TDS	TSS	Arsenic Ar	Cadmium Cd	Chromium Cr	Copper Cu	Lead Pb	Mercury Hg (inorganic)	Nickel Ni	Zinc Zn
Site ID	Date	℃	%	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
Darwin Harbour WQO 2010 - up		-	80 -100	-	-	-	6-8.5	-	-	-	10	-	-	-	-	-		-	-
Darwin Harbour WQO 2010 - fre		-	50-100	200	-	-	6-7.5	-	20	-	5	-	-	-	-	-		-	-
ANZG 2018 freshwater - 95% sp		-	-	-	-	-	-	-	-	-	-	0.013	0.0002	0.0044	0.0014	0.0034	0.0006	0.011	0.008
EPL233-02 trigger values		-	80-100	-	-	-	6-8.5	-	-	-	10	-	0.0055	0.0044	0.0013	0.0044	0.0004	0.07	0.015
SW1	11/01/2024	28	39	63.3	41	0.03	6.05	251.6	11.07	-	<5	0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.006
SW4	11/01/2024	26.2	97	0.8	1	0	6.44	182	116.2	-	114	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.007
SW7	11/01/2024	27.5	43.5	112.4	73	0.05	6.32	220.6	16.67	-	5	0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005
SW1	24/01/2024	27.7	62.2	80.9	52	0.04	6.06	390.6	7.43	-	<5	<0.001	<0.0001	<0.001	0.003	<0.001	<0.0001	<0.001	<0.005
SW4	24/01/2024	27.3	27.6	211.3	135.4	0.1	5.74	119	85.7	-	30	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.007
SW7	24/01/2024	27.3	35.4	622	403	0.3	6.84	262	178	-	32	0.005	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	<0.005
SW1	1/03/2024	29.4	28.1	60.2	39.69	0.03	7.66	229.5	7.45	-	<5	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005
SW4	1/03/2024	28.8	61.9	1798	1170	0.9	7.15	245	35.9	-	39	0.016	<0.0001	0.005	0.001	0.002	<0.0001	0.005	0.011
SW7	1/03/2024	30.2	16.2	53.6	35.1	0.02	6.94	172.8	26	-	108	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005
SW1	21/03/2024	26.6	85.2	67.2	44	0.03	6.03	344.4	15.88	-	<5	<0.001	<0.0001	<0.001	0.001	<0.001	<0.0001	<0.001	<0.005
SW4	21/03/2024	30.6	45.5	1104.8	718	0.54	6.64	255.3	112.14	-	17	0.008	<0.0001	0.003	0.012	0.003	<0.0001	0.003	0.03
SW7	21/03/2024	28.5	80.3	221.7	144	0.1	6.93	226	49.4	-	<5	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.008

Table 4-2. Water sampling results 2024 – nutrients

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

Site ID	Date	Nutrients					
		Ammonia	Total Phosphorus	Nitrite + Nitrate as N	Total Kjeldahl Nitrogen	Total Nitrogen as N	COD
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Darwin Harbour WQO 2010 - upper estuary		0.02	0.03	-	-	-	-
Darwin Harbour WQO 2010 - freshwater rivers and streams		-	0.01	-	-	-	-
ANZG 2018 freshwater - 95% species protection		0.9	-	-	-	-	-
EPL233-02 trigger values		0.02	0.03	-	-	0.3	-
SW1	11/01/2024	0.12	0.09	<0.01	0.7	0.7	20
SW4	11/01/2024	0.12	0.3	0.73	<1.0	<1.0	58
SW7	11/01/2024	0.08	0.07	<0.01	0.7	0.7	17
SW1	24/01/2024	0.04	<0.01	<0.01	0.3	0.3	<10
SW4	24/01/2024	0.12	0.03	0.01	0.8	0.8	38
SW7	24/01/2024	0.48	0.76	0.23	4.8	5	144
SW1	1/03/2024	0.03	0.02	0.02	0.2	0.2	<10
SW4	1/03/2024	8.35	2.39	<0.01	22.4	22.4	428
SW7	1/03/2024	<0.01	0.09	0.02	0.6	0.6	11
SW1	21/03/2024	<0.01	0.04	0.09	0.3	0.4	<10
SW4	21/03/2024	3.64	2.4	2.95	17.3	20.2	383
SW7	21/03/2024	0.22	0.2	0.33	1.5	1.8	47

5 CONCLUSIONS

The monitoring schedule was undertaken as per EPL233-02 Attachment 1 – Surface Water Monitoring Program requirements, except for the non-compliance listed in Table 3-3 (i.e. December round occurring in early January, and February round in early March). This was due to there being sporadic rainfall in early December with all other high rainfall days occurring in conjunction with the Christmas shutdown period. Similarly, February recorded sporadic rainfall with the greatest amount falling in the middle of the month.

Prior experience with sampling at Archer Waste has demonstrated a minimum of 20mm of rainfall to collect samples at the beginning of the wet season, as water will rapidly infiltrate in the soil until saturated. As the wet season progresses, and the soil saturated, less rainfall is required prior to sampling.

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. However, no increasing trends are observed in any of the parameters monitored.

Overall, SW04 received exceedances in the highest concentrations of turbidity, TN and TP; therefore, as SW04 joins with SW07, it can be expected that some of the analytes are deposited downstream. It is also noted that trigger value exceedances in parameters such as DO, Ammonia, TP and TN were also observed at the upstream site SW01, which shows that background conditions in the ephemeral creek are already in exceedance of the trigger values adopted.

Considering that TSS are frequently above the trigger value at SW04, 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. In addition, it is recommended that an additional site approximately 100 m downstream from the point of confluence of SW4 into the stream is included in the monitoring program. This will allow adequate mixing with the main flow of the stream, and therefore, a better representation of the concentration of the parameters monitored in the water body.

6 REFERENCES

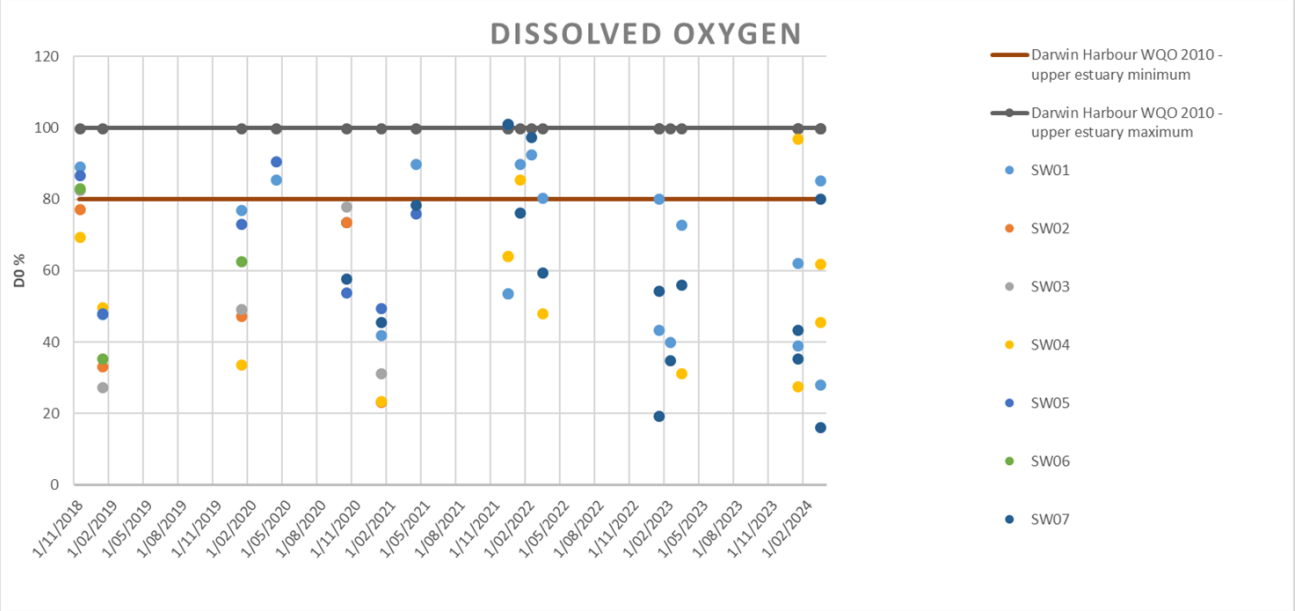
ANZG 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

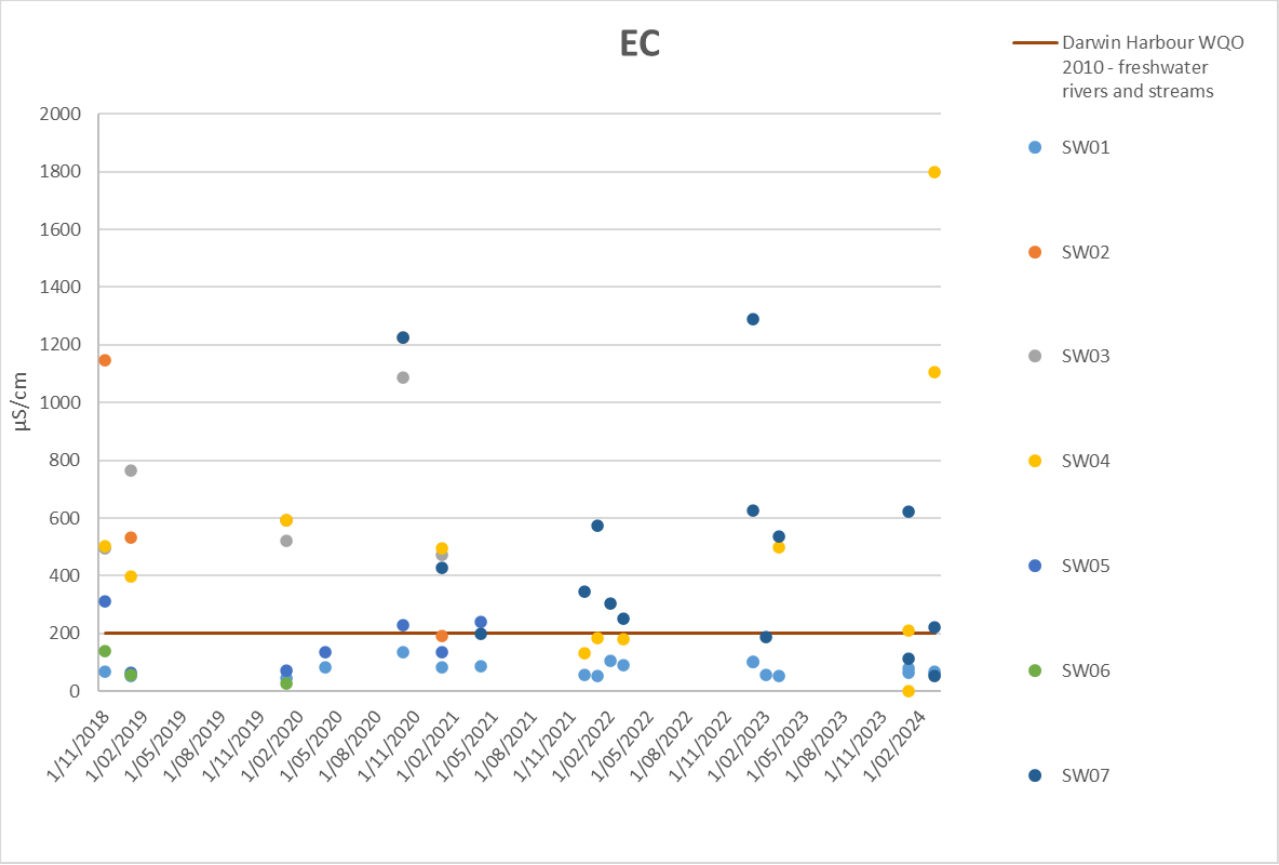
Northern Territory Government (2010) *Water Quality Objectives for the Darwin Harbour Region for marine and estuarine systems.*

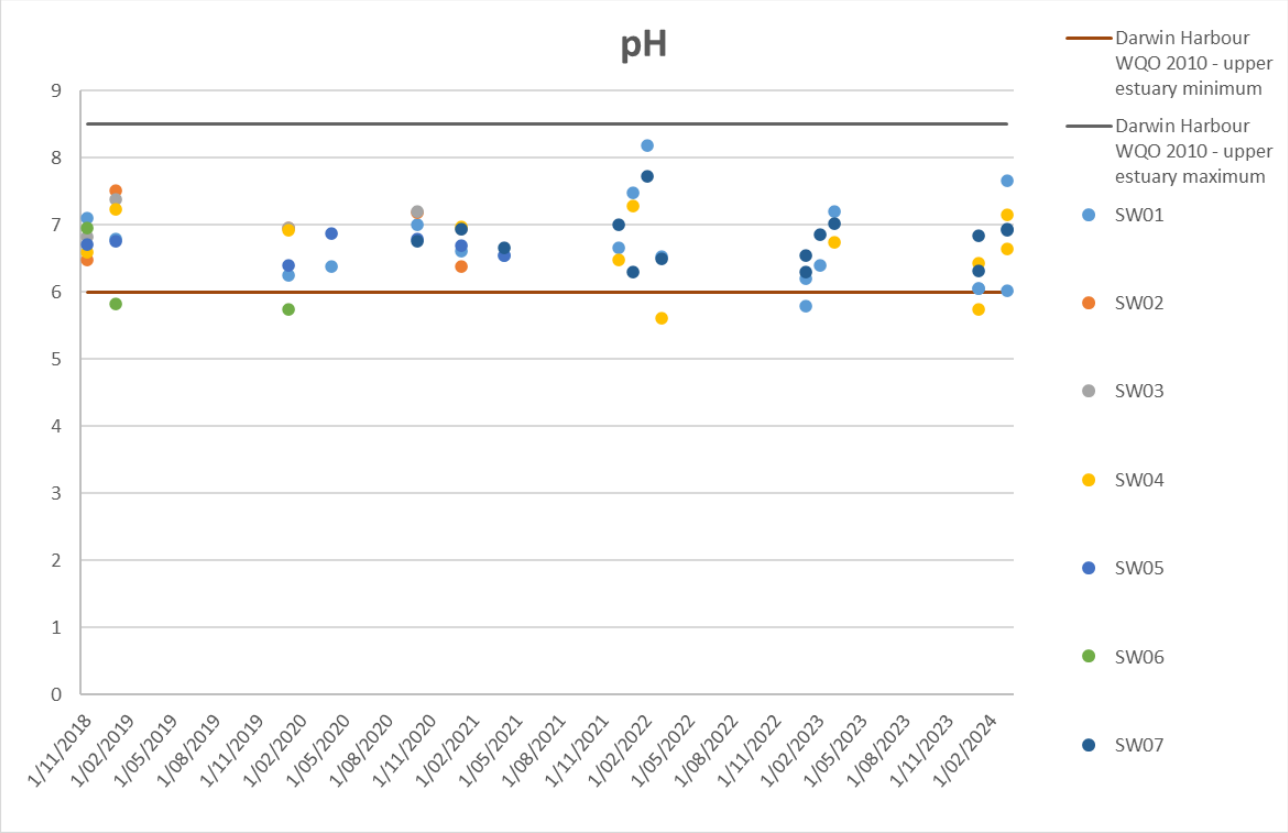
APPENDIX A COMPLETE WATER QUALITY DATASET

The water quality data collected by EcOz from 2018 to 2024 are provided in an Excel database forwarded as separate file titled Archer Waste Data 2018 to 2024

APPENDIX B TREND ANALYSIS GRAPHS



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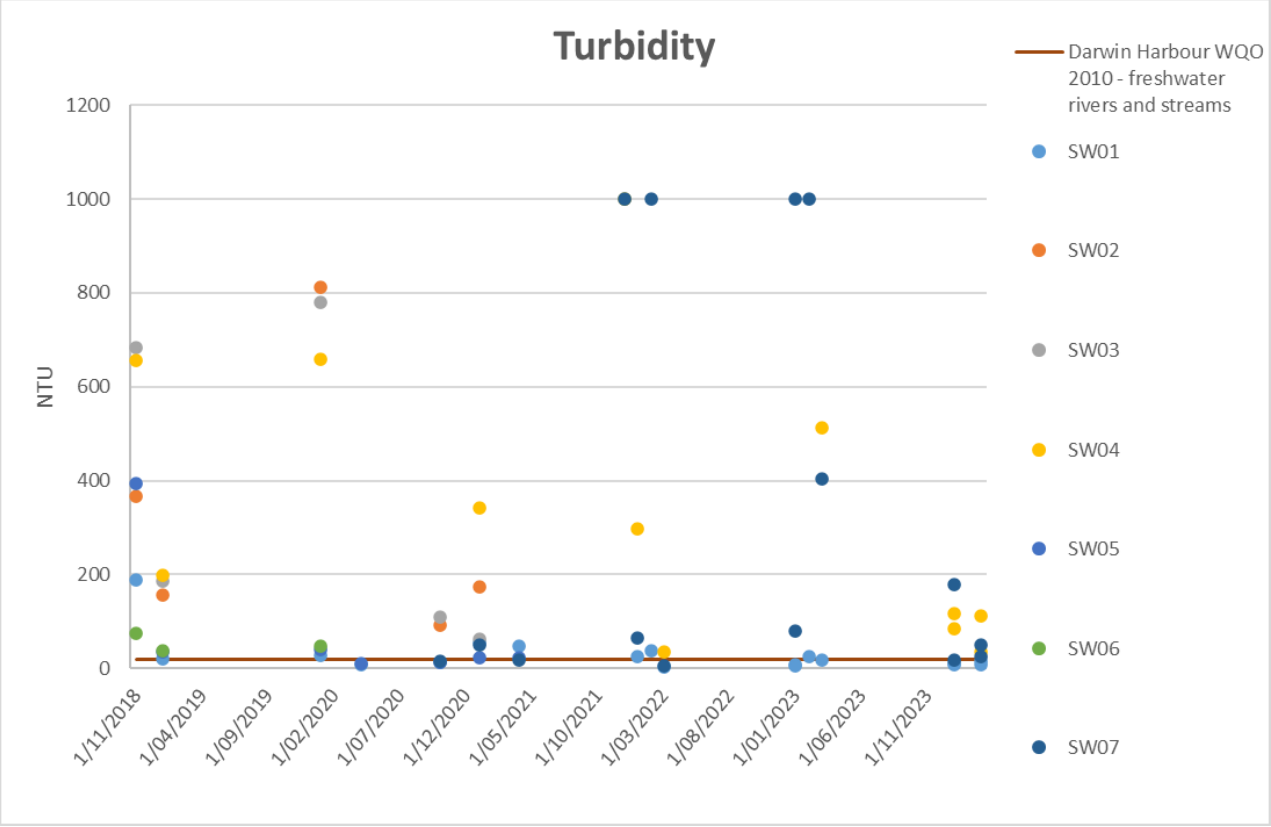
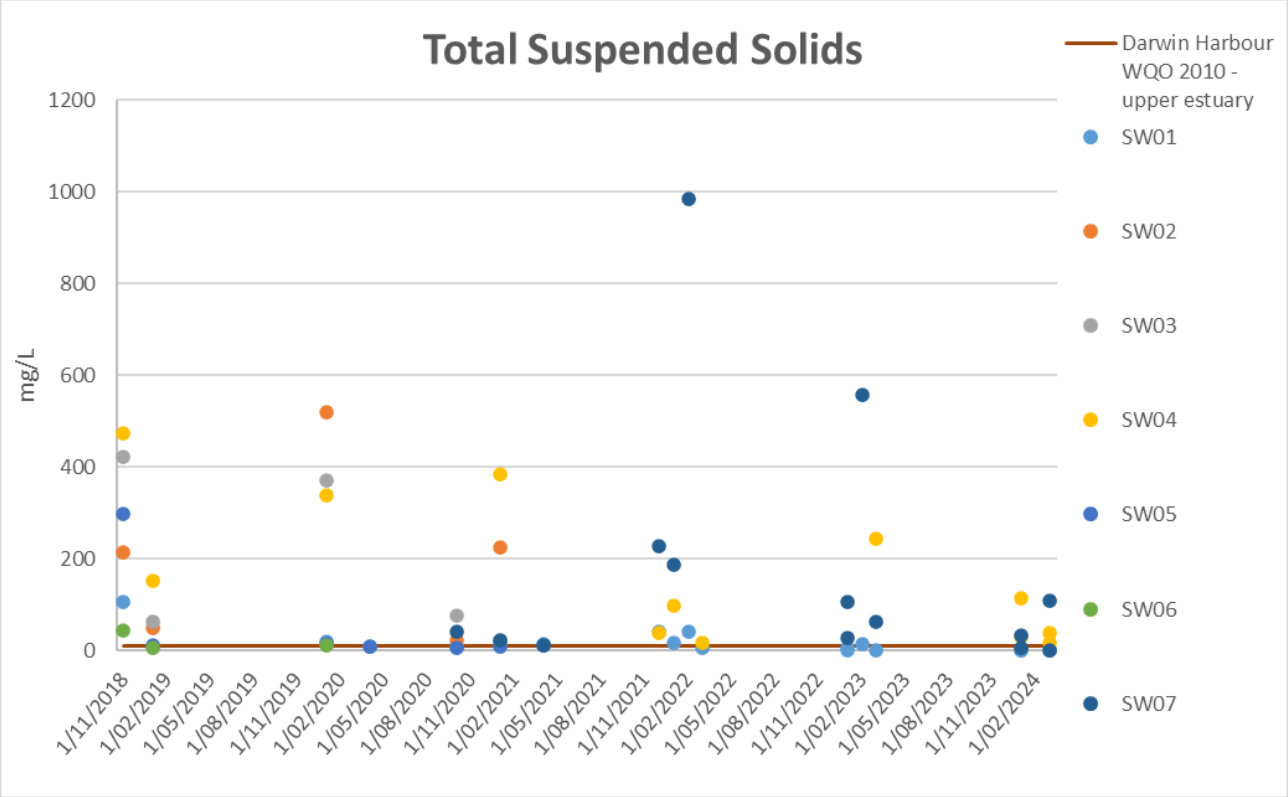
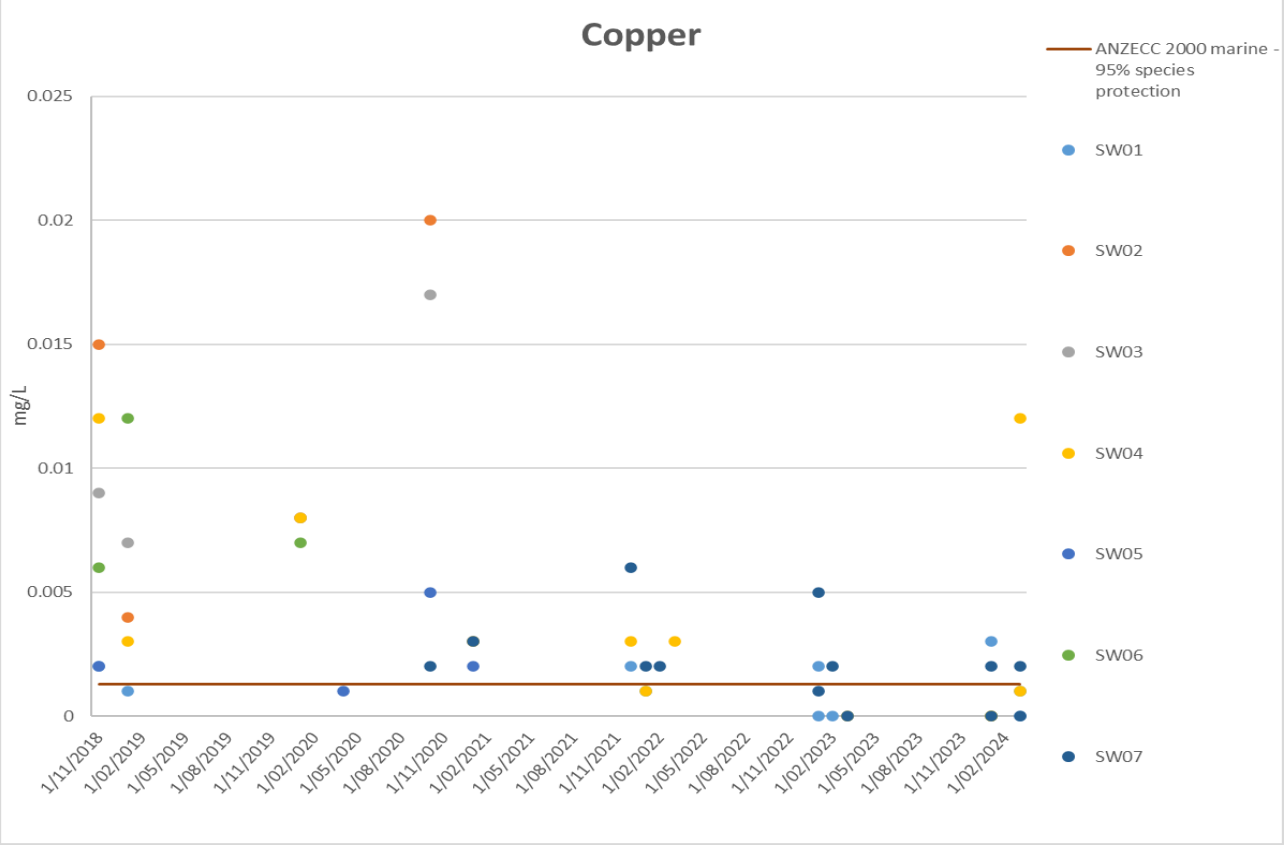
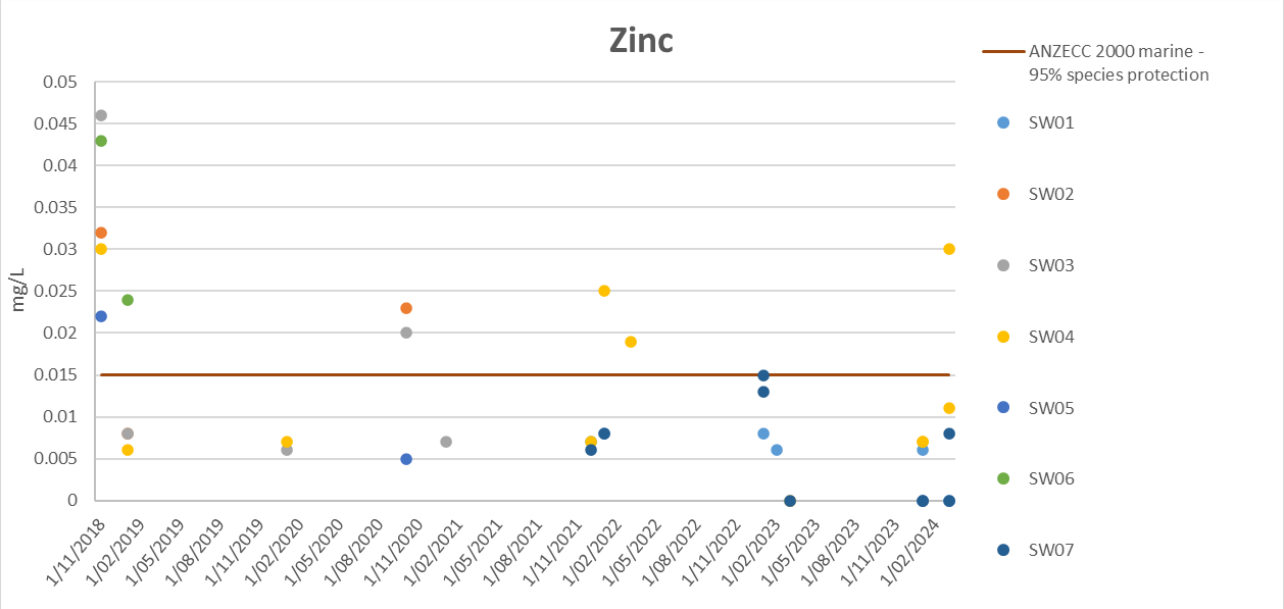
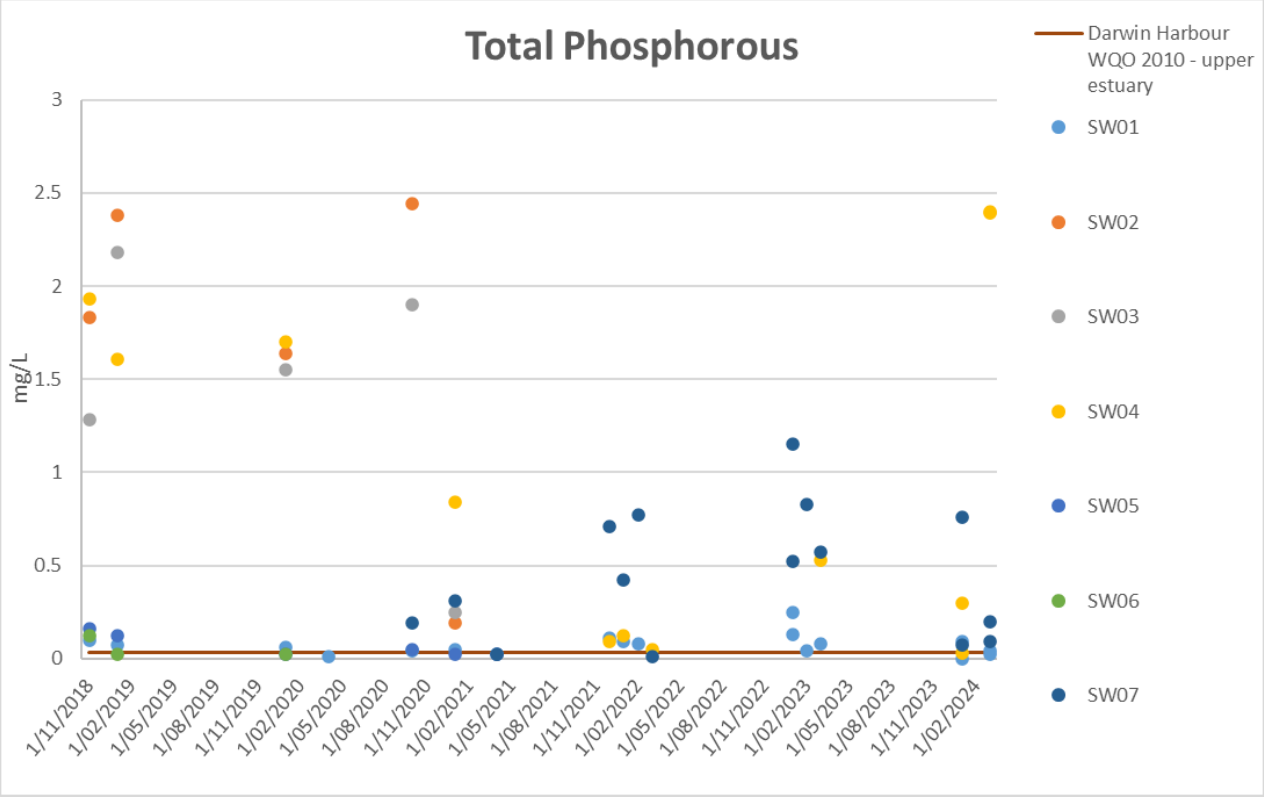
Darwin Harbour WQO 2010 - upper estuary minimum
Darwin Harbour WQO 2010 - upper estuary maximum
SW01
SW02
SW03
SW04
SW05
SW06
SW07

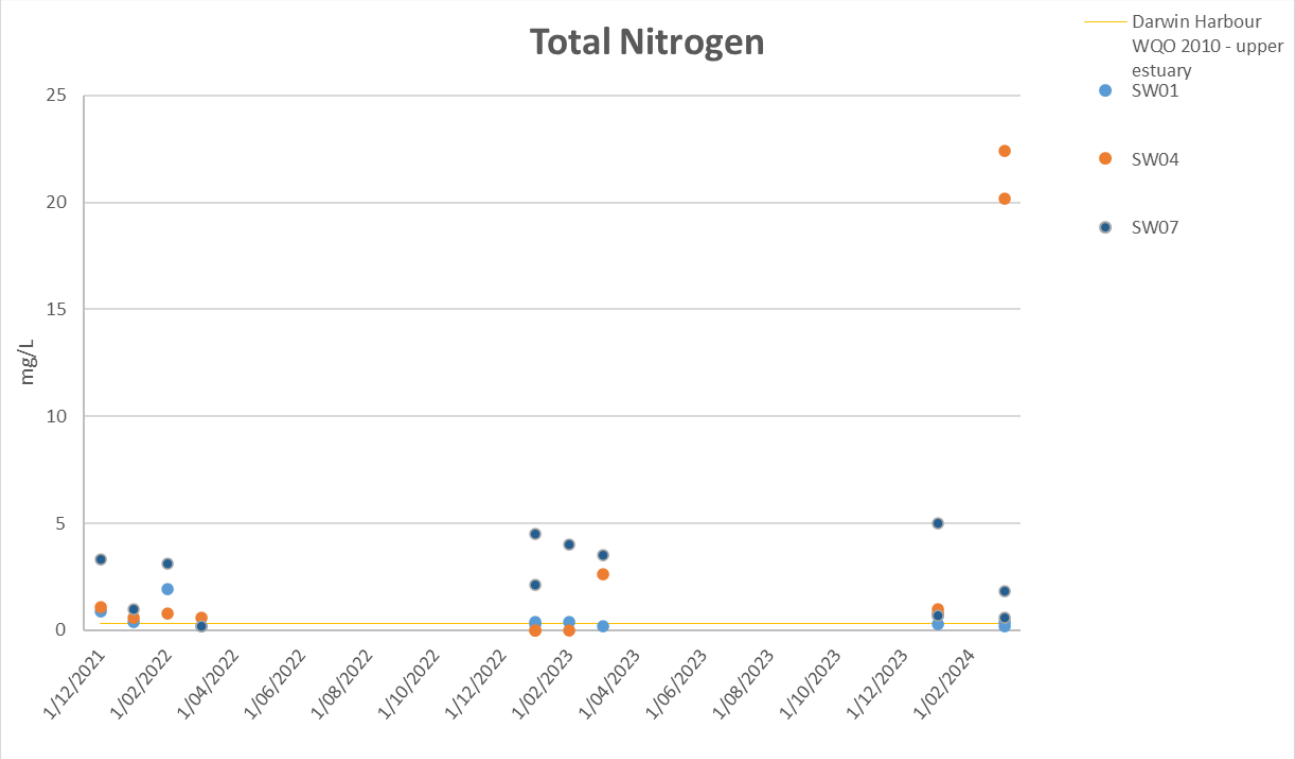

Turbidity
NTU
1200
1000
800
600
400
200
0
1/11/2018
1/04/2019
1/09/2019
1/02/2020
1/07/2020
1/12/2020
1/05/2021
1/10/2021
1/03/2022
1/08/2022
1/01/2023
1/06/2023
1/11/2023
Darwin Harbour WQO 2010 - freshwater rivers and streams
SW01
SW02
SW03
SW04
SW05
SW06
SW07

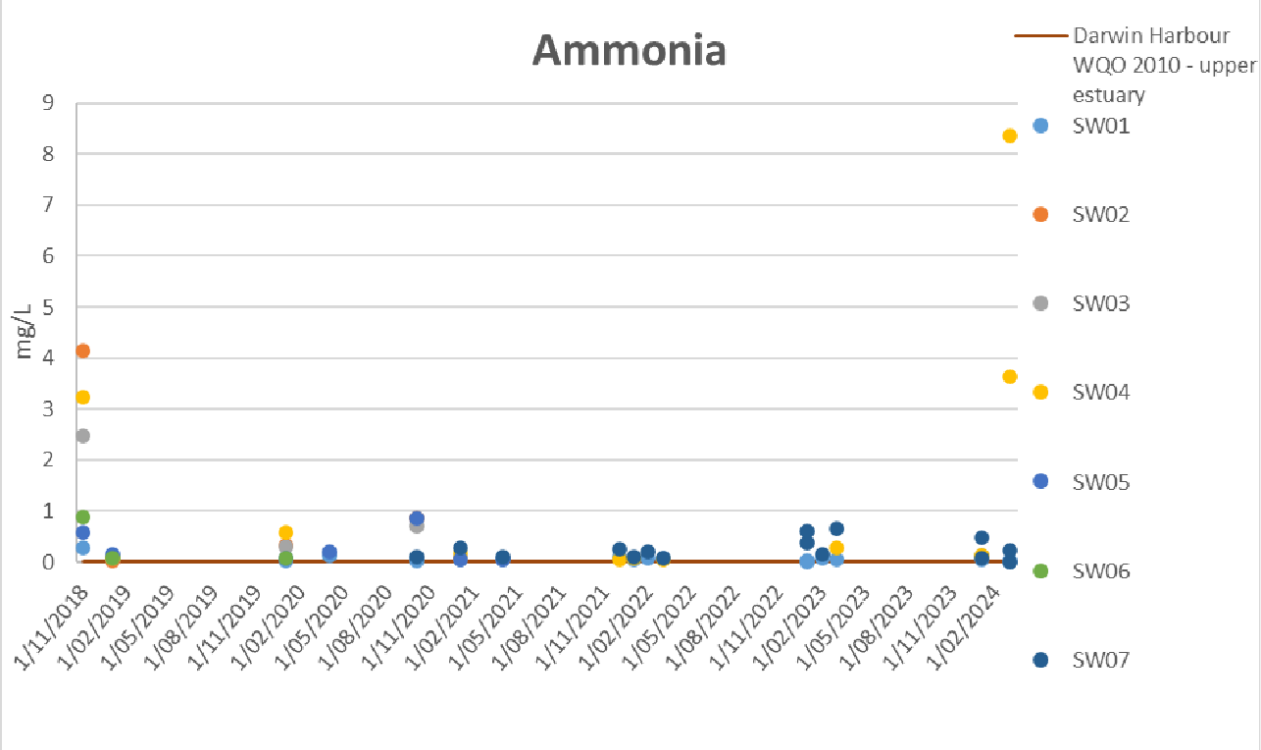

Total Suspended Solids
mg/L
1200
1000
800
600
400
200
0
1/11/2018
1/02/2019
1/05/2019
1/08/2019
1/11/2019
1/02/2020
1/05/2020
1/08/2020
1/11/2020
1/02/2021
1/05/2021
1/08/2021
1/11/2021
1/02/2022
1/05/2022
1/08/2022
1/11/2022
1/02/2023
1/05/2023
1/08/2023
1/11/2023
1/02/2024
Darwin Harbour WQO 2010 - upper estuary
SW01
SW02
SW03
SW04
SW05
SW06
SW07


Copper
mg/L
0.025
0.02
0.015
0.01
0.005
0
1/11/2018
1/02/2019
1/05/2019
1/08/2019
1/11/2019
1/02/2020
1/05/2020
1/08/2020
1/11/2020
1/02/2021
1/05/2021
1/08/2021
1/11/2021
1/02/2022
1/05/2022
1/08/2022
1/11/2022
1/02/2023
1/05/2023
1/08/2023
1/11/2023
1/02/2024
ANZECC 2000 marine - 95% species protection
SW01
SW02
SW03
SW04
SW05
SW06
SW07


Zinc
ANZECC 2000 marine - 95% species protection
SW01
SW02
SW03
SW04
SW05
SW06
SW07
mg/L
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
1/11/2018
1/02/2019
1/05/2019
1/08/2019
1/11/2019
1/02/2020
1/05/2020
1/08/2020
1/11/2020
1/02/2021
1/05/2021
1/08/2021
1/11/2021
1/02/2022
1/05/2022
1/08/2022
1/11/2022
1/02/2023
1/05/2023
1/08/2023
1/11/2023
1/02/2024


Total Phosphorous
Darwin Harbour WQO 2010 - upper estuary
SW01
SW02
SW03
SW04
SW05
SW06
SW07
mg/L
3
2.5
2
1.5
1
0.5
0
1/11/2018
1/02/2019
1/05/2019
1/08/2019
1/11/2019
1/02/2020
1/05/2020
1/08/2020
1/11/2020
1/02/2021
1/05/2021
1/08/2021
1/11/2021
1/02/2022
1/05/2022
1/08/2022
1/11/2022
1/02/2023
1/05/2023
1/08/2023
1/11/2023
1/02/2024


Total Nitrogen
Darwin Harbour WQO 2010 - upper estuary
SW01
SW04
SW07
mg/L
25
20
15
10
5
0
1/12/2021
1/02/2022
1/04/2022
1/06/2022
1/08/2022
1/10/2022
1/12/2022
1/02/2023
1/04/2023
1/06/2023
1/08/2023
1/10/2023
1/12/2023
1/02/2024


Ammonia
Darwin Harbour WQO 2010 - upper estuary
SW01
SW02
SW03
SW04
SW05
SW06
SW07
mg/L
9
8
7
6
5
4
3
2
1
0
1/11/2018
1/02/2019
1/05/2019
1/08/2019
1/11/2019
1/02/2020
1/05/2020
1/08/2020
1/11/2020
1/02/2021
1/05/2021
1/08/2021
1/11/2021
1/02/2022
1/05/2022
1/08/2022
1/11/2022
1/02/2023
1/05/2023
1/08/2023
1/11/2023
1/02/2024

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