

2024/25 Monitoring Report for Katherine Wastewater Treatment Plant WDL 151-08

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Abbreviations and Glossary

Abbreviation	Definition
Al	Aluminium
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BOD	Biochemical oxygen demand
Cfu	Colony forming units (expressed per unit of a specified volume of sample)
Chl-a	Chlorophyll-a, a photosynthetic pigment present in plants, algae and cyanobacteria that is used in oxygenic photosynthesis. It can be used as a measure of algal biomass and subsequently primary production
Cu	Copper
Cu-B	Bioavailable copper in sediment (estimated by dilute acid extraction)
Cu-F	Copper filtered (dissolved fraction)
Cu:Al	Total copper in sediment normalised to total aluminium content of the sediment
Cu-T	Total copper in sediment
DHWQO(s)	Darwin Harbour water quality objective(s)
DO	Dissolved oxygen
EC	Electrical conductivity
<i>E. coli</i>	<i>Escherichia coli</i>
EP	Equivalent population
ERA	Environmental risk assessment
FRP	Filterable reactive phosphorous (orthophosphate)
HEPA	Heads of EPAs Australia and New Zealand

ISQG	Interim sediment quality guidelines
Kg	Kilograms
kL	Kilolitres
L	Litres
LOP	Level of species protection (%)
LOR	Limit of reporting for chemical analysis
µg	Micrograms
mg	Milligrams
ML	Mega-litres
N	Nitrogen
NATA	National Association of Testing Authorities in Australia
NH₃-N	Total ammonia as N (NH ₃ and NH ₄ ⁺ as N) as per ANZECC and ARMCANZ (2000) and ANZG (2018)
NHMRC	National Health and Medical Research Council
NO_x-N	Oxidised of nitrogen as N – the sum of nitrate and nitrite
NRETAS	Department of Natural Resources, Environment, The Arts and Sports, Northern Territory
NT	Northern Territory
NT DOH	Northern Territory Department of Health
NT EPA	Northern Territory Environment Protection Authority
NTU	Nephelometric turbidity units
Phaeo-a	Phaeophytin-a, a degradation product of chlorophyll-a
PWC	Power and Water Corporation
QA/QC	Quality assurance and quality control
SMD	A slightly-moderately disturbed aquatic ecosystem. This reflects both the management intent and subsequently the level of protection (ANZECC 95% Species Protection).

SMDZ	Slightly to moderately disturbed zone
SSTV(s)	Site specific trigger value(s)
TN	Total nitrogen
TN:TOC	Total nitrogen to total organic carbon ratio in sediment
TOC	Total organic carbon
TP	Total phosphorous
TSS	Total suspended solids
TV(s)	Trigger value(s)
WDL(s)	Waste discharge licence(s)
WQO(s)	Water quality objective(s)
WSP(s)	Waste stabilisation pond(s)
Zn	Zinc
Zn-B	Bioavailable zinc in sediment (estimated by dilute acid extraction)
Zn-F	Zinc filtered (dissolved fraction)
Zn:Al	Total zinc in sediment normalised to total aluminium content in sediment
Zn-T	Total zinc in sediment
ZOI	Zone of influence of the discharge (disturbed zone 90% species protection level or less)

Executive Summary

This report presents the 2024/25 monitoring data collected from Katherine Wastewater Treatment Plant (KWwTP) in accordance with its relevant waste discharge licence WDL 151-08 issued under the 1992 Water Act. The monitoring program assessed discharge volumes, effluent water quality, and potential environmental impacts associated with discharges from the authorised discharge point (SKa100) into the Katherine River.

As required by condition 21.3 in WDL151-08, all discharges must occur when the receiving environment in Katherine River is flowing at 66.78 kL/s and above (equivalent to 1.67 m river height). Three discharge events occurred during the 2024/25 monitoring period, two compliant with condition 21.3, and another (commencing on 27 November 2024) which was found to be non-compliant. This discharge was undertaken to prevent uncontrolled discharge into the environment following a period of high rainfall. The non-compliant discharge event was investigated in accordance with conditions 24, 25, and 26 of WDL151-08 and was deemed to have a low/negligible risk of environmental harm.

Key findings include:

- **Discharge volumes:** Annual discharge volumes (193,496 kL) were higher than the previous reporting year, reflecting increased rainfall and associated inflows.
- **Effluent quality:** Median values for nutrients, metals, and bacteriological indicators were generally consistent with long-term data, with minor increases attributed to high inflows. Post-dilution concentrations remained below relevant ANZECC and HEPA guideline values.
- **Environmental indicators:** Slight increases in biochemical oxygen demand, suspended solids, and bacterial load were observed; however, no exceedances of environmental thresholds occurred, and impacts to receiving waters were assessed as negligible.
- **PFAS:** Concentrations of PFOA and PFOS+PFHxS remained well below national guideline thresholds, indicating negligible risk of environmental accumulation.
- **Environmental risk:** The Katherine River's high dilution capacity continues to provide effective mitigation, and the overall risk of adverse ecological impact from KWwTP discharges remains low.

The facility continues to operate within the intent of its licence conditions, demonstrating effective wastewater treatment performance. Ongoing monitoring of nutrient, microbial, and environmental indicator trends is recommended, particularly during high inflow periods, to ensure proactive management of potential risks associated with high rainfall events.

Table of Contents

List of Figures	Error! Bookmark not defined.
List of Tables	Error! Bookmark not defined.
1. Introduction	9
2. Monitoring Objective	10
3. Monitoring Method	11
3.1 Monitoring sites	13
3.2 Monitoring frequency, parameters and trigger values	13
3.3 Sampling and analysis method	14
4 Monitoring Results	15
4.1 Discharge volumes	15
4.1.1 Mass loads	16
4.2 Long term discharge quality	18
4.3 Discharge quality trends	18
4.3.1 Field measurements	19
4.3.2 Nutrients	20
4.3.3 Bacteriological	21
4.3.4 Metals and metalloids	22
4.3.5 Environmental indicators	23
4.3.6 PFAS	24
5 Monitoring Results – quality assurance/ quality control (QA/QC) evaluation	24
6 Discussion and interpretation of results	24
6.1 Assessment of Environmental Impact	24
7 Conclusion and proposed actions	26
8 Certification	27
References	28

Appendices	29
Appendix I - Analysis of mass loads	30
Appendix II - Risk characterisation by analyte	32
Appendix III - Calculation of 27 Nov 2024 Discharge Ratio	33

List of Figures

Figure 1: Katherine Wastewater Treatment Plant (Google Earth, 2024).....	9
Figure 2: Katherine Wastewater Treatment Plant and flow direction.....	10
Figure 3: SKa100 - authorised monitoring location/sampling point.	13
Figure 4: Katherine River Flow against KWSP discharge	16
Figure 5: Mass loads (Nutrients and Environmental Indicators) and Discharge Tonnes/Year.....	17
Figure 6: Mass loads (Metals) and Discharge Kg/Year	17
Figure 7: Mass Loads Percent Removal/Year	18
Figure 8: Katherine WwTP Discharge Conceptual Site Model.....	25

List of Tables

Table 1: Discharge monitoring frequencies and parameters.....	14
Table 2: KWwTP Financial year inflow, outflow and rainfall 2021 to present.	15
Table 3: Long term field parameter results.....	19
Table 4: Long term nutrient indicator results	20
Table 5: Long term bacteriological results	21
Table 6: Long term metals and metalloid results.....	22
Table 7: Long term environmental indicator results	23
Table 8: Long term PFAS results	24
Table 9: Analysis of mass loads in inflow and discharge	29
Table 10: Analysis of metals mass loads in discharge	30
Table 11 Risk Characterisation for KWwTP 2024/2025.....	31
Table 12 Dilution ratio calculations for 27 Nov 2024 Discharge	33
Table 13 Waste constituent contribution of 27 Nov 2024 discharge post-dilution using 1:375 discharge ratio	34

1. Introduction

Power and Water Corporation operate the Katherine Wastewater Treatment Plant (KWwTP) to treat and evaporate wastewater created by the Katherine Community. KWwTP is situated approximately 8 km from Katherine town, adjacent to the conservation (CN) zone of Katherine River. The configuration of KWwTP includes three facultative, two maturation, and seven evaporation ponds. As the evaporation ponds have capacity to manage standard operating inflows, discharge into Katherine River is only required during high inflow monsoonal events. The Katherine River is part of the Daly River catchment which is a region of high ecological value. It also possesses wide societal attachment due to its pristine beauty and conservation value (van Dam et al. 2008). An annotated map of the ponds with flow directions is displayed in Figure 2.



Figure 1: Katherine Wastewater Treatment Plant (Google Earth, 2024)

Discharges from KWwTP are regulated under conditions specified in WDL151-08, granted under provisions of the Water Act 1992. Condition 21.3 of WDL 151-08 states:

- “Discharges from each authorised discharge point must comply with the limitations specified in Item 9”.

Item 9 States:

- “Any authorised discharge must occur only when Katherine River Gauging Station, G8140001, is at a minimum flow of 66.78 kL/s”.

A monitoring report is required to be submitted to the Administering Agency by October 31 of each year pursuant to condition 39 of the WDL.

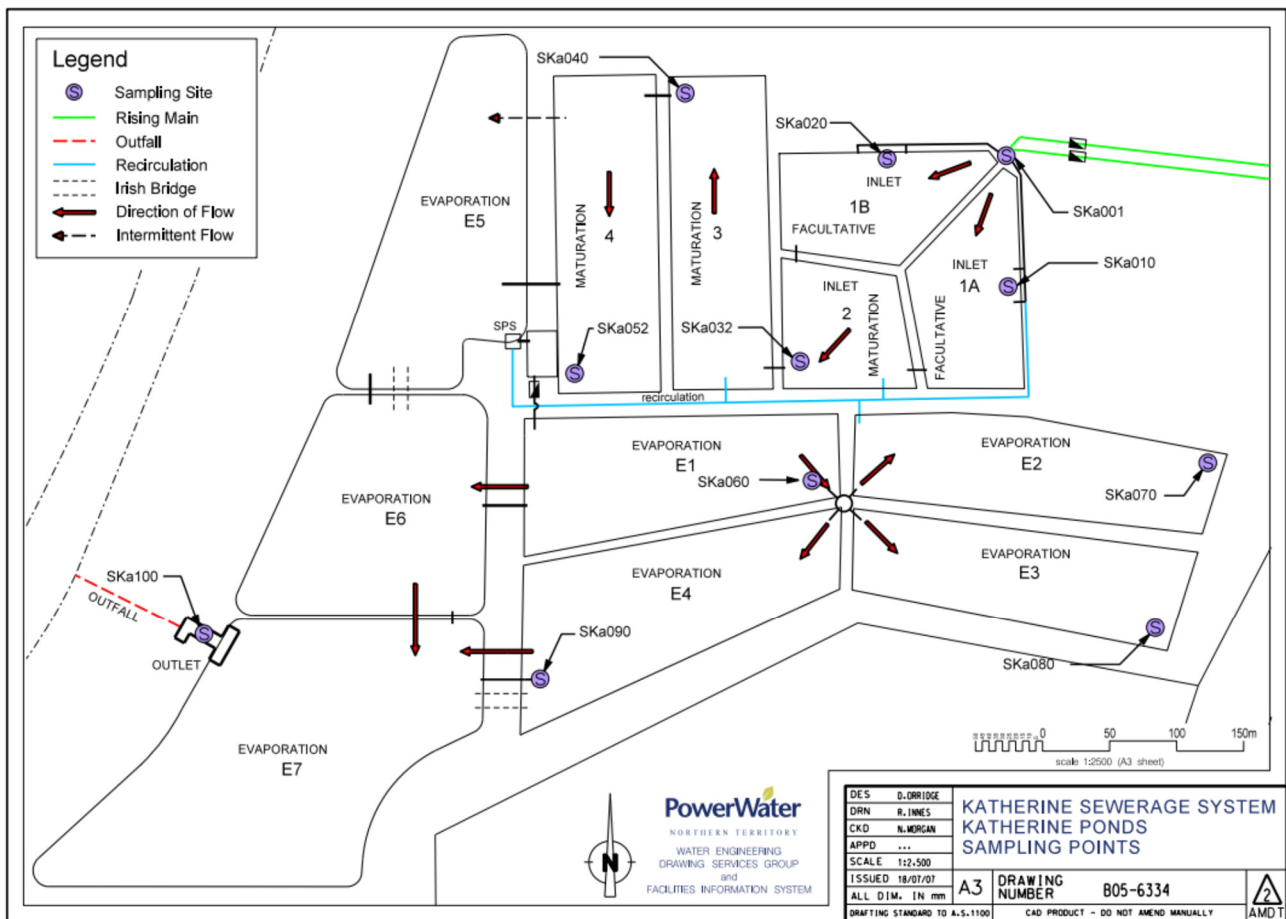


Figure 2: Katherine Wastewater Treatment Plants Sampling Points and flow direction

2. Monitoring Objective

This report presents the results of the 2024/2025 data collection and assessments required for WDL151-08 for discharge quality monitoring.

This report is prepared in accordance with conditions in WDL 151-08, issued to Power and Water Corporation pursuant to section 74 of the Water Act 1992. WDL 151-08 commenced on 8 August 2023 and the licence can be accessed via the NT EPA website via the following link;

<https://ntepa.nt.gov.au/your-business/public-registers/licences-and-approvals-register/waste-discharge-licences/sewerage/power-and-water-katherine>

This report has been prepared as per the following conditions in WDL151-08:

39. The Licensee must complete and provide to the Administering Agency a report of data and information obtained through the implementation and performance of the Monitoring Program (the Monitoring Report), as prescribed by this licence, on the dates specified in Item 13.
40. The Licensee must ensure that each Monitoring Report:
 - 40.1. is prepared in accordance with the requirements of the Administering Agency 'Guideline for Reporting on Environmental Monitoring' (or any other guideline as adopted by the Administering Agency from time to time);

- 40.2. *includes a tabulation, in Microsoft® Excel® format or another format requested by the Administering Agency, of all monitoring data required to be collected in accordance with this licence for the preceding 12 month period, including river height and flow telemetry at G8140001;*
- 40.3. *includes a tabulation of monthly and annual contaminant loads discharged from the authorised discharge point specified in Item 5 for the preceding 12 month period. Contaminant loads must be calculated for metals, metalloids, nutrients and other parameters (excluding field parameters) listed in the monitoring program specified in Item 11. The calculations must be based on the daily discharge volume and the concentration of contaminant present in the discharge on that day. On the days when a sample was not taken then the concentration of the contaminant must be estimated using Linear Interpolation methodology;*
- 40.4. *includes long term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licensed Action over a minimum period of three years (of part thereof);*
- 40.5. *includes a summary of any investigations undertaken by the Licensee in accordance with this licence for the preceding 12 month period; and*
- 40.6. *includes an assessment of environmental impact from the Licensed Action.*

3. Monitoring Method

As per WDL 151-08 requirements, monitoring of the KWWTP effluent is limited to sampling at the discharge point during discharge events (Condition 27). Licenced discharge is only allowed to occur at times when the Katherine River flow exceeds 66.78 kL/s (Condition 21.3), thus, it is not safe to sample from any potential downstream sites. The high flow means the minimum dilution of the effluent when discharged into the Katherine River is 1:575 (SLR, 2022), greatly reducing the risk posed by any discharged contaminants.

The number of samples collected annually has reduced due to limited discharges caused by the flow rate restriction. This limits the quality of statistical comparison of data collected with guideline values and any long-term trend analysis. However, it is still important to analyse and identify any notable trends in the long-term sampling data (Section 4.3) and mass loads of key contaminants (Section 4.1.1).

Monitoring is conducted in accordance with the licence conditions and are as follows:

27. *From the Commencement Date of this licence, the Licensee must implement and comply with the Monitoring Program specified in Item 11.*
28. *The Licensee must to the extent practicable collect samples that are representative of discharge conditions that maximises the ability to detect potential impact from the Licenced Action, including collecting samples at sampling points.*
29. *In implementing the Monitoring Program the Licensee must to the extent practicable that samples collected at the sampling points are collected:*
 - 29.1 *on the same date as discharge event; and*
 - 29.2 *from the part of the waterway that provides representative (well mixed) samples.*
30. *If a sample is missed or cannot be collected at a sampling point at a frequency set in the Monitoring Program for any reason, the Licensee must revisit the sampling point to collect a sample as soon as possible after the missed collection.*
31. *The Licensee must ensure that all samples and field environmental data are collected in accordance with recognised Australian Standards and guidelines (such as AS/NZS 5667.1 1998, ANZG (2018), as updated from time to time).*

32. *For the parameters that require analysis at a laboratory, the Licensee must ensure that:*
 - 32.1 *all samples are analysed at a laboratory with current NATA accreditation or equivalent; and*
 - 32.2 *detection and reporting limits are appropriate to determine compliance with this licence.*
33. *The Licensee must ensure any samples collected in accordance with the Monitoring Program or in connection with the Licensed Action or this licence, are obtained by, or under the supervision of a qualified sampler.*
34. *The Licensee must ensure any plant and equipment used by the Licensee in conducting the Monitoring Program:*
 - 34.1 *is reasonably fit for the purpose and use to which it is put, including that it is properly calibrated;*
 - 34.2 *is maintained and operational; and*
 - 34.3 *is operated by a person trained to use the plant and equipment.*
35. *The Licensee must ensure that, for each sample collected in accordance with the Monitoring Program or the Licensed Action, the following information must be recorded and retained:*
 - 35.1 *the date on which the sample was collected;*
 - 35.2 *the time at which the sample was collected;*
 - 35.3 *the location at which the sample was collected;*
 - 35.4 *the name of the person who collected the sample;*
 - 35.5 *the chain of custody forms relating to the sample;*
 - 35.6 *the field measurements (if any) and analytical results (if any) relating to the sample; and*
 - 35.7 *laboratory quality assurance and quality control documentation.*
36. *The Licensee must for all land based monitoring points specified in the Monitoring Program:*
 - 36.1 *install and maintain appropriate identification signage so that they are reasonably identifiable at all times; and*
 - 36.2 *maintain safe access and egress, as is reasonably practicable.*

3.1 Monitoring sites

Samples are collected from the authorised monitoring location, SKa100 (Figure 3), as per Appendix I and II of the WDL.



Figure 3: SKa100 - authorised monitoring location/sampling point.

3.2 Monitoring frequency, parameters and trigger values

The discharge monitoring plan WDL 151-08 (Appendix I) is depicted in Table 1 which indicates the collection of samples during discharge events.

WDL 151-08 has no trigger values associated with discharge quality prior to entering the receiving environment during discharge events.

Table 1: Discharge monitoring frequencies and parameters.

Parameter	Units	Frequency
Field Measurements		
pH,	pH units	D
electrical conductivity (EC),	µs/cm	D
dissolved oxygen (DO),	% saturation	D
temperature	°C	D
Nutrient Indicators		
Filterable Reactive Phosphorus (FRP)	mg/L	D
Total Phosphorus (TP)	mg/L	D
Ammonia (NH ₃ -N)	mg/L	D
Total Nitrogen (as N)	mg/L	D
Nitrate (NO ₃ -N)	mg/L	D
Nitrite (as N)	mg/L	D
Nitrogen Oxides (as N)	mg/L	D
Bacteriological		
Escherichia coli (E. coli)	MPN/100ml	D
Enterococcus spp.	MPN/100ml	D
Metals and Metalloids		
Arsenic	µg/L	A
Cadmium	µg/L	A
Chromium	µg/L	A
Copper	µg/L	A
Nickel	µg/L	A
Lead	µg/L	A
Zinc	µg/L	A
Mercury	µg/L	A
Environmental Indicators		
Biochemical Oxygen Demand (BOD)	mg/L	D
Chemical Oxygen Demand	mg/L	D
Total Suspended Solids	mg/L	D
Volatile Suspended Solids	mg/L	D
Hardness (CaCO ₃)	mg/L	D
Other		
PFAS (in any form)	µg/L	A
<p>Key:</p> <p>D – Once per discharge and whenever a discharge event continues for 7 days or more. Additional sampling must be conducted at intervals no more than 7 days apart.</p> <p>A – Annual: at least once per year in which a discharge has occurred and during a discharge event.</p>		

3.3 Sampling and analysis method

Effluent samples were collected from the authorised monitoring location (SKa100) when accessible during discharge events. Field measurements (pH, electrical conductivity, dissolved oxygen, and temperature) were measured in-situ using a calibrated handheld multi-meter probe. Laboratory supplied sample bottles were

filled from source using a sample pole. All samples were chilled and stored before being delivered same-day to a NATA accredited laboratory for analysis.

4 Monitoring Results

4.1 Discharge volumes

Discharge from KWWTP to the Katherine River is restricted by conditions 20 – 23.8 of WDL 151-08. Annual discharge volumes from 2021 to 2025 are detailed in Table 2 and Figure 4.

Table 2 also provides a statistical assessment of the inflow and outflow of the KWWTP, and Bureau of Meteorology reported rainfall in the area, which indicates this year’s discharge volume and rainfall was below the median values of data from previous years.

Table 2: KWWTP Financial year inflow, outflow and rainfall 2021 to present.

Financial Year	Inflow to Katherine WSP (kL)	Discharge to Katherine River (kL)	Rainfall (mm)
2024/2025	836060	193496	910.8
2023/2024	837736	101068	1027.6
2022/2023	729832	144407	1118.8
2021/2022	751908	43600	686.5
Statistical Assessment			
10th percentile	736454.8	60840.4	752.89
Median	793984	122737.5	967.7
60th percentile	819229.6	135739.2	1003.64
75th percentile	836479.0942	156679.25	1050.4
80th percentile	836730.5507	164042.6	1064.08
90th percentile	837233.4637	178769.3	1091.44
95th percentile	837484.9202	186132.65	1105.12

Annual rainfall data recorded at Katherine Council meteorological station 014902 from the Bureau of Meteorology between November 2024 and October 2025 reports the following (Bureau of Meteorology, 2025):

- Total 2024/25 rainfall in the Katherine region was 910.8 mm.
- The three wettest months in the 2024/25 monitoring period was February, March, and May.
- In 2025, no data was available for June, July, August, September, and October.

Rainfall data from 29 May 2025 to 22 September 2025 was supplemented from the Katherine – Cragborn Road meteorological station 014323 (4.5 km away from the Katherine Council meteorological station).

Three discharge events occurred within the 2024/25 reporting period, which commenced on the following dates:

- 27 November 2024
- 08 February 2025, and
- 2 April 2025.

NTG gauge data (NT Water Data WebPortal, 2025) shows that the minimum discharge flow rate of 66.78 kL/S is achieved at G8140001 (gauge at Ska100) river heights of 1.67 m and above. Figure 4 illustrates a discharge event on the 27 November 2024 (to 16 December) that occurred when the Katherine River height was less than 1.67 m. This event, which breached condition 21.3 of WDL151-08 and was considered a non-compliance, was investigated in accordance with conditions 24, 25, and 26 and was deemed to pose a low/negligible risk of environmental harm (Power and Water Corporation, 2024). All other discharges in the 2024/25 reporting period were compliant with condition 21.3. All data plotted is until 18/09/2025 as no discharges were discovered for the rest of the monitoring period and so no further data was collected for the year.

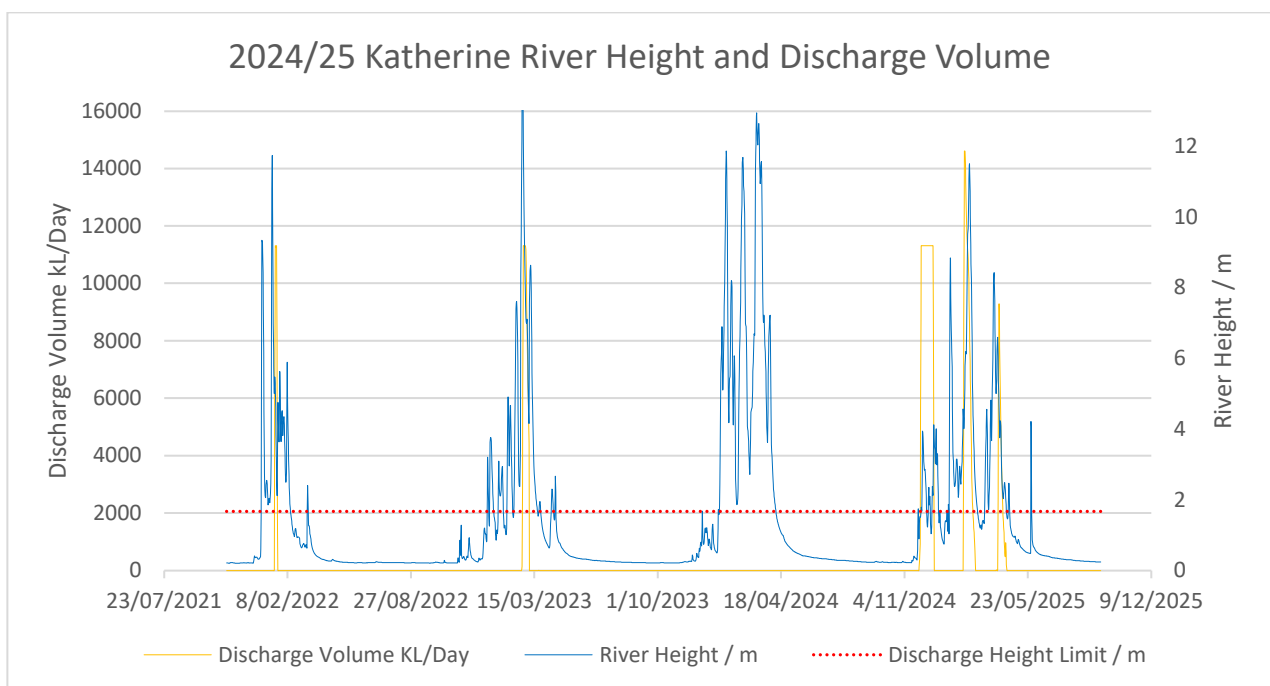


Figure 4: Katherine River Flow against KWSP discharge

4.1.1 Mass loads

Shown in Table 2, the 2024/25 KWwTP discharge volume almost doubled compared to last year. As a direct and proportional relationship exists between discharge volume and mass loads, this led to an overall increase in the mass loads for all waste constituents in the 2024/25 monitoring period (Figure 5; Figure 6).

Although, substantial dilution of the effluent is likely to occur upon being discharged to the Katherine River.

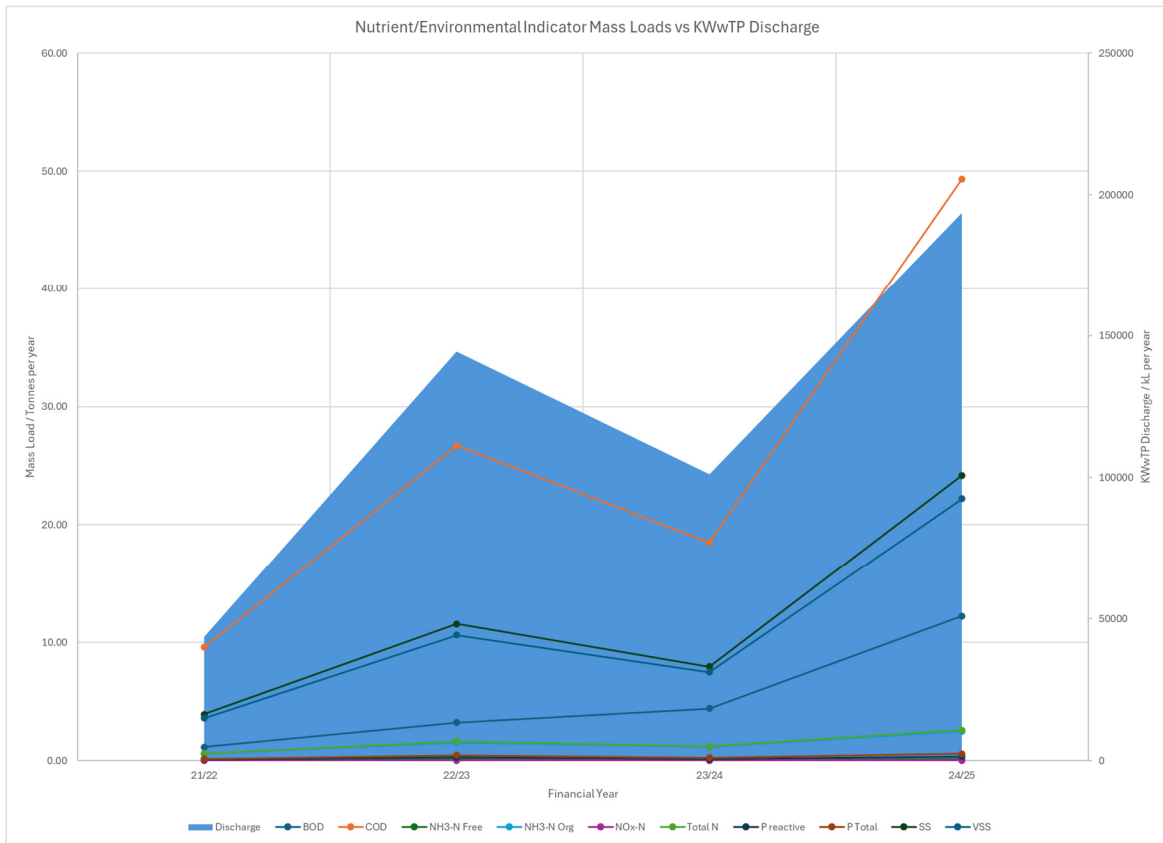


Figure 5: Mass loads (Nutrients and Environmental Indicators) and Discharge Tonnes/Year

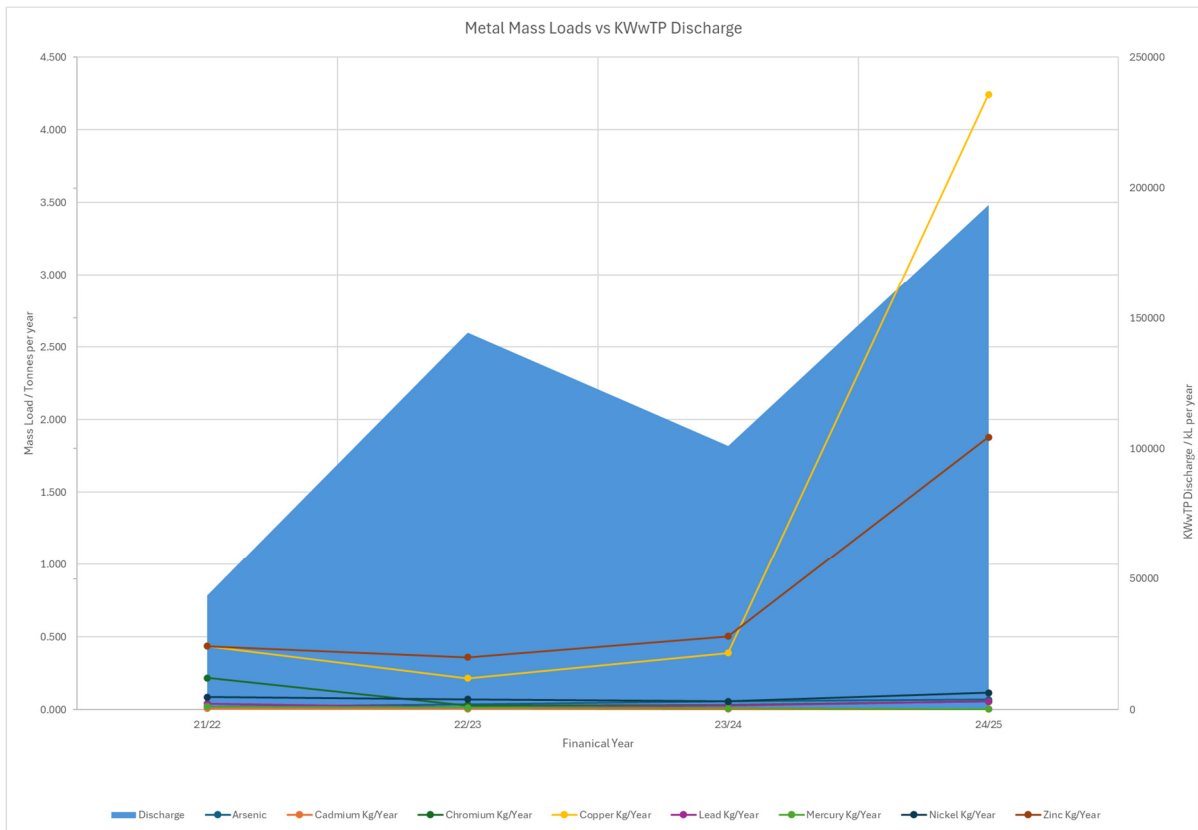


Figure 6: Mass loads (Metals) and Discharge Kg/Year

Percentage removal for this monitoring period decreased compared to last year. This may have been due to the increased discharge volumes and reduced retention times caused by the wet season rain events. However, KWwTP was still able to bring concentrations down to an appropriate level post-dilution despite the decrease in retention times.

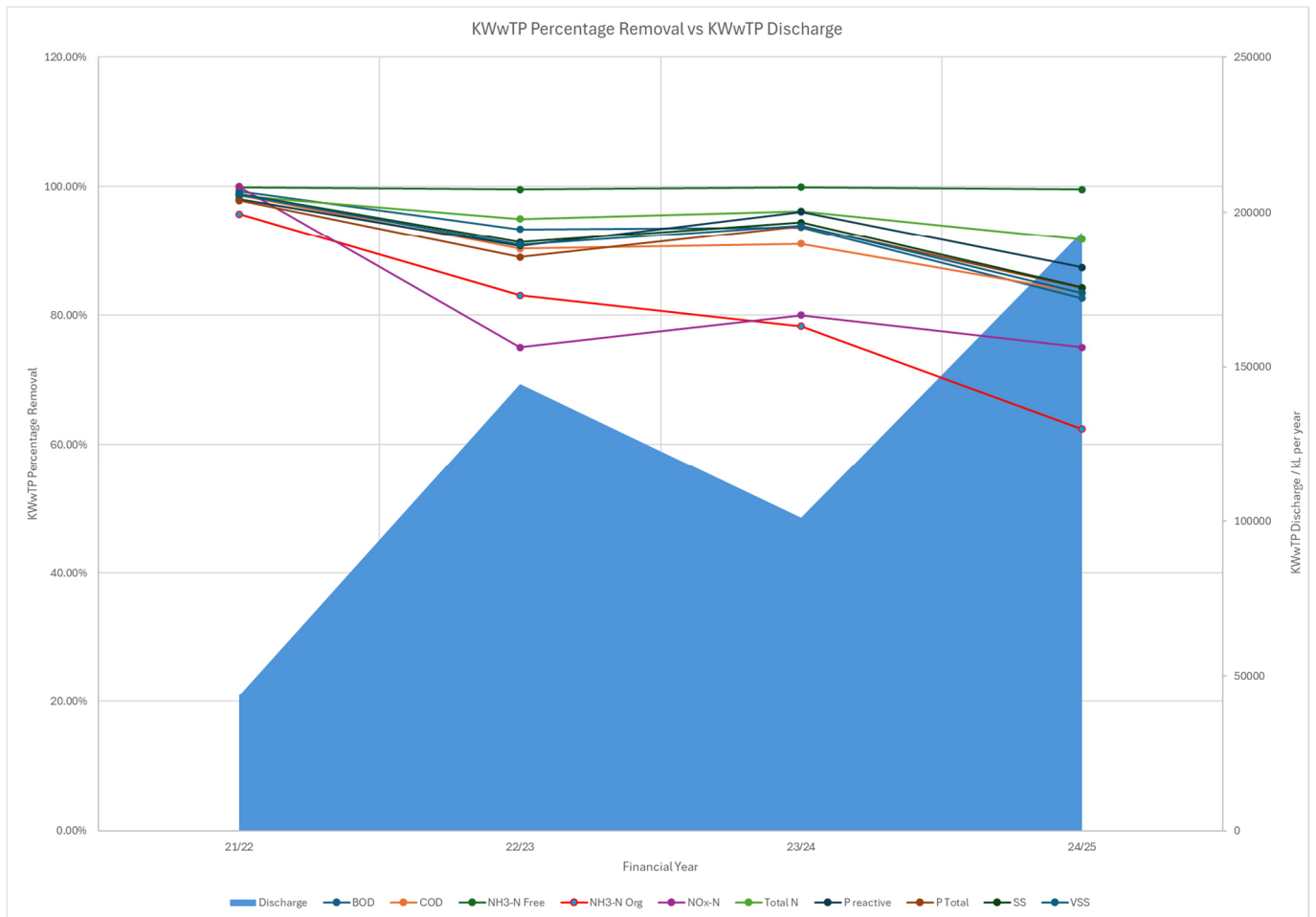


Figure 7: Mass Loads Percent Removal/Year

4.2 Long term discharge quality

The effluent discharge typically contains no gross pollutants, a moderately high nutrient content and a green colour. No odour is usually present at the discharge point as the biodegradable carbon has been stabilised and transformed into algae, contributing to the prevailing green colour.

4.3 Discharge quality trends

Since sampling data is collected during discrete events rather than regular intervals, it isn't appropriate to formulate a long-term trend and instead, the discharge quality (2024/25 median) will be compared to the long-term median (2021-2025). Statistical analysis of the monitoring data has been undertaken using an "over-estimation" method, which considers all values reported below the limit of reporting as equal to the limit of reporting itself.

The effluents contribution of chemical and biological waste constituents to the discharge environment has been estimated using the minimum dilution ratio of 1:575 calculated in the 2022 Katherine Environmental

Risk Assessment that occurs at river levels of 1.67 m (SLR 2022). These estimated values have been compared with the guideline values from the Australian and New Zealand Environment and Conservation Council (ANZECC) for assessment of environmental effect. However, these guidelines are not designed to be protective of the Katherine River water quality and only give a general estimate of environmental impact. No guidelines have been designed for this purpose at this time for the KWwTP. The discharge commencing on 27 Nov 2024 had a different dilution ratio thus has had a separate assessment calculation which has been presented in appendix III.

This report provides an analysis of the parameters relevant to WDL151-08 during discharge events between 2021-2025. Due to high levels in the south-east ponds, the road access to the sampling site was inaccessible, thus, samples were unable to be collected when the discharge event commenced on 08 February and 02 April 2025. As such, the verification of discharge quality and sampling took place when access was safe for personnel to proceed.

4.3.1 Field measurements

Table 3: Long term field parameter results

Parameter	Units	Detection Limits	ANZECC Guideline	2024/25 Median	Long term Median	1:575 Dilution	80th percentile	95 th percentile
pH	pH units	0.01	6.0-8.0	9.43	9.67	N/A	10.58	10.80
Electrical Conductivity (field)	(μ S/cm)	0.1	250	451	455.5	0.78	489	496.8
Dissolved Oxygen	% saturation	0.01	80-110	104.2	104.2	N/A	180.1	255.0
Temperature	$^{\circ}$ C	0.01	-	30.90	31.95	N/A	34.08	34.37

Dilution calculations were not calculated for pH, dissolved oxygen (DO), and temperature as their contribution is dependent on the properties of the receiving environment of which data is unavailable. Thus, assessment has been made solely using the historical statistical method. 2021-25 pH values range from 7.33 to 10.80. A drop in effluent pH was observed as 2024/25 median pH of 9.43 was less than the current long-term median pH of 9.67. Additionally, the historical 80th and 95th percentile values were found to be 10.58 and 10.8, respectively. This indicates that the effluent is generally of an alkaline nature.

Electrical conductivity (EC) data from 2021-2025 indicates that EC levels of the effluent are stable. This is demonstrated by long-term and 2024/25 median values being similar and a 2021-25 EC range of 382 to 501 μ S/cm.

2021-25 DO levels range from 24.01% to 280.2%. DO levels vary but are also observed to be stable overall. This is observed in a similar 2024/25 median DO value to the long-term median DO value. This means that the bulk of the data resides around the same point, indicating an unchanged behaviour between this year and the previous years. The DO presents to be on the higher end, however, is still within expected ranges and below the ANZECC guidelines.

Discharge temperature fluctuates between 28.02°C and 34.37°C. The 2024/25 median of 30.90°C indicates warm conditions during discharge events.

Field measurements are good indicators of environmental changes, stable data indicates a low likelihood that the environment is affected by the discharge (Dewangan, S. K et al, 2024).

4.3.2 Nutrients

Table 4: Long term nutrient indicator results

Parameter	Units	Detection Limits	ANZECC Guideline	2024/25 Median	Long term Median	1:575 Dilution	80th percentile	95 th percentile
Filterable Reactive Phosphorus (FRP)	mg/L	0.05	0.004	0.9	1.0	0.0016	1.64	2.62
Total Phosphorus (P)	mg/L	0.05	0.01	3.5	3.0	0.0061	3.5	4.54
Ammonia Nitrogen (NH3-N)	mg/L	0.1	0.01	0.6	0.6	0.0010	0.76	0.92
Total Nitrogen	mg/L	0.1	0.2	0.6	0.6	0.0010	0.76	0.92
Nitrate (NO3-N)	mg/L	0.1	-	0.1	0.1	0.00017	0.1	0.1
Nitrite as N (NO2-N)	mg/L	0.1	-	0.1	0.1	0.00017	0.1	0.1
Nitrate + Nitrite as N (NOx-N)	mg/L	0.1	0.005	0.1	0.1	0.00017	0.1	0.1

When analysing nutrient samples, it is important to note that the laboratory detection limit for filterable phosphorus, total phosphorus, ammonia nitrogen, and nitrite & nitrate nitrogen is higher than the ANZECC guideline values. The 2024/25 diluted effluent values for all nutrients were well below the ANZECC guidelines, meaning that nutrient contribution from the effluent is minor and unlikely to cause a significant spike in the discharging environment.

A slight increase in the 2024/25 median compared to the long-term median indicates a high 2024/25 total phosphorus period compared to previous years. All other analysed nutrients remained relatively stable throughout the monitoring period compared to previous years. This is indicated by all 2024/25 medians being similar to the long-term medians.

Stable nutrient concentrations forecast stable environments as when nutrient levels are unchanged, it is unlikely to disturb any ecological cycles which would likely lead to eutrophication and anoxia. The slight increase in total phosphorus is unlikely to cause any effect but should be monitored as phosphorus is often the limiting nutrient for eutrophication in some Australian rivers (Brett M. T. et al 2005).

4.3.3 Bacteriological

Table 5: Long term bacteriological results

Parameter	Units	Detection Limits	ANZECC Guideline	2024/25 Median	Long term Median	1:575 Dilution	80th percentile	95 th percentile
<i>E. coli</i>	MPN/100mL	10	200	520	100	0.90	621.4	2424.0
<i>Enterococci</i>	MPN/100mL	10	41-200	10112	1460	17.6	18562.4	93969.6

2024/25 median *E. coli* and *Enterococci* concentrations have increased compared to the long-term median values. The historical 80th and 95th percentiles are also high relative to the ANZECC guidelines. As the KWWTP inflow was similar to last year’s monitoring period (table 2), this increase in the microbiological activity was likely due to the hydraulic overloading during high rainfall events in the February-April period. Hydraulic overloading will reduce the retention time of the incoming wastewater, thus, decreasing pathogen die-off leading to a higher bacterial load.

Although *E. coli* and *Enterococci* numbers have increased in the 2024/25 period, after dilution, the numbers are still below the ANZECC guidelines. This means that the environmental impact of the effluent at discharge is unlikely to cause significant environmental impact and KWWTP is operating under licenced operating conditions.

The increased microbiological activity in the discharge water during high rainfall periods should continue to be monitored as the large inflows into the stabilisation ponds may lead to future environmental impacts with the discharging water.

4.3.4 Metals and metalloids

Table 6: Long term metals and metalloid results

Parameter	Units	Detection Limits	ANZECC Guideline	2024/25 Median	Long term Median	1:575 Dilution	80th percentile	95 th percentile
Arsenic	µg/L	0.5	13	0.35	0.4	0.0006	0.5	0.59
Cadmium	µg/L	0.2	0.2	0.02	0.035	0.00003	0.05	0.12
Chromium	µg/L	5	3.3	0.2	0.2	0.0003	0.46	2.64
Copper	µg/L	10	1.4	2.7	2.7	0.0047	9.4	60.41
Lead	µg/L	1	3.4	0.17	0.2	0.0003	0.55	0.84
Mercury	µg/L	0.1	0.06	0.008	0.093	0.00001	0.1	0.28
Nickel	µg/L	2	11	0.5	0.5	0.0009	0.68	1.62
Zinc	µg/L	10	8	7.8	5.5	0.014	9.9	16.84

When analysing metal samples, it is important to note that the laboratory detection limit for chromium, copper, mercury, and zinc is higher than the ANZECC guideline value. Although the ANZECC guideline values are not a specific part of the WDL conditions, it is important to know where the quality of the discharge sits in relation to the current environmental guidelines.

All metals either kept a stable 2024/25 median or were slightly lower compared to the long-term median except for zinc, which slightly increased from 5.5 µg/L to 7.8µg/L. This generally indicates orthodox discharge conditions compared to historical data.

The 2024/25 diluted effluent values for all metals were well below the ANZECC guidelines, indicating that the nutrient contribution from the effluent is minor and unlikely to cause a significant spike in the receiving environment. Overall, analysis of metals suggest that the effluent discharge is unlikely to cause significant environmental impact and KWWTP is operating under licenced operating conditions.

4.3.5 Environmental indicators

Table 7: Long term environmental indicator results

Parameter	Units	Detection Limits	ANZECC Guideline	2024/25 Median	Long term Median	1:575 Dilution	80th percentile	95 th percentile
Biological Oxygen Demand (BOD)	mg/L	2	-	62.0	51.0	0.1076	65.6	93.8
Chemical Oxygen Demand (COD)	mg/L	2	-	290.0	220.0	0.5035	314.0	342.0
Total Suspended Solids (TSS)	mg/L	1	15	130.0	116.0	0.2257	146.2	193.0
Volatile Suspended Solids (VSS)	mg/L	1	-	122.0	107.0	0.2118	141.8	171.4
Hardness (CaCO₃)	mg/L	1	-	117.0	89.3	0.2031	118.2	124.4

Overall, the 2024/25 median values for environmental indicators have increased compared to the long-term median values. This spike in environmental indicators is likely related to the increase in bacterial load discussed in section 4.3.3 as it has been observed that increases in bacterial presences like *E. coli* have increased the environmental indicators presented above (Goran Volf et al, 2024).

The Total Suspended Solids (TSS) of the effluent after dilution is much lower than the ANZECC guideline and is not likely to cause a significant spike in concentration into the receiving environment.

Overall, analysis of environmental indicators suggest that the sewage discharge is unlikely to cause significant environmental impact and KWwTP is operating under licenced operating conditions.

4.3.6 PFAS

Table 8: Long term PFAS results

Parameter	Units	Detection Limits	ANZECC Guideline	2024/25 Median	Long term Median	1:575 Dilution	80th percentile	95 th percentile
Perfluorooctanoic acid (PFOA) (ug/L)	ug/L	0.0016	220	0.001	0.0013	0.0000017	0.0018	0.0020
Sum (PFHxS + PFOS) (ug/L)	ug/L	0.0016	0.13	0.0008	0.0014	0.0000014	0.0026	0.0071
¹ HEPA (2020) Note: The PFOS guideline also applies to the PFOS+PFHxS concentration as there are no guidelines for PFHxS, it is assumed that both compounds have a similar toxicological effect.								

2024/25 median PFAS and PFOA concentrations for the undiluted discharge were well below the 95% species protection levels for receiving waters. Following dilution after discharging, the dilution concentration is well below the 99% level (HEPA 2020). This indicates that the PFAS/PFOA contribution from the effluent is negligible and unlikely to cause a significant effect in the receiving environment.

Overall, analysis of PFAS/PFOA suggest that the effluent discharge is unlikely to cause significant environmental impact and KWWTP is operating under licenced operating conditions.

5 Monitoring Results – quality assurance/ quality control (QA/QC) evaluation

Data was collected at the frequencies defined in the Discharge Monitoring Plan (Appendix I) of WDL151-08.

The following QA/QC practices for sample analysis were met by the relevant NATA accredited laboratories:

- Laboratory duplicates,
- Laboratory control samples and
- Method blanks.

6 Discussion and interpretation of results

6.1 Assessment of Environmental Impact

Environmental consultants SLR were approached to conduct an environmental risk assessment (ERA) to update the 2019 ERA. A 5-phase approach was utilised when conducting the 2022 ERA:

1. **Problem identification:** defines the objectives of the ERA, evaluates the available data and establishes a preliminary Conceptual Site Model (CSM).

2. **Receptor identification:** identifies the species that may be at risk of exposure and evaluates the level of acceptable risk in the context of the ecological values that need to be protected.
3. **Exposure assessment:** produces an estimate of the chemical exposure that may be experienced by the identified ecological receptors.
4. **Toxicity assessment:** estimates the concentration of identified contaminants of potential concern (CoPCs) that an ecosystem can be exposed to without adversely affecting the ecological values.
5. **Risk characterisation:** evaluates the lines of evidence gathered throughout the ERA to estimate the potential risks posed by CoPCs to the identified ecological receptors. Determines if the risk of harm is low and acceptable or higher.

The conceptual site model (Figure 8) gives an indication of the sensitive receptors in the catchment as well as many of the other inputs to Katherine River affecting water quality. (SLR, 2022).

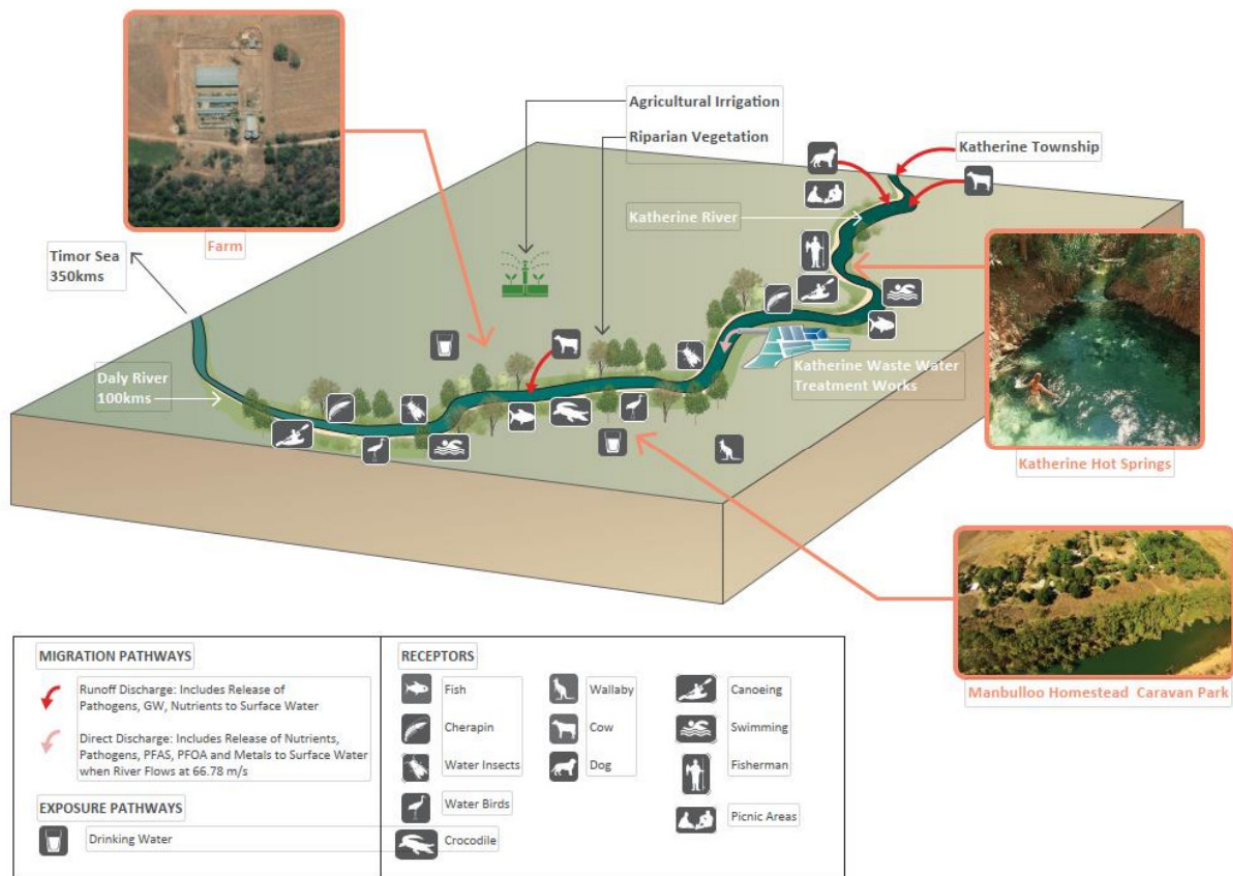


Figure 8: Katherine WwTP Discharge Conceptual Site Model

The environmental risk assessments conducted since 2011 have shown that the risk to the ecology and users of the Katherine River from the discharge from the KWwTP is low. The risk of exposure to pathogens for users drinking untreated water from the Katherine River during the Wet Season is high. However, this is mainly due to rainfall run-off and the risk does not increase with the addition of the KWwTP discharge. Further detail regarding risk rankings can be found in Appendix II.

7 Conclusion and proposed actions

The monitoring data presented above for KWwTP for the 2024/25 reporting period indicates that the facility continues to operate effectively and in accordance with WDL151-08 conditions. Post-dilution analysis confirms that discharge quality remains within acceptable ranges, with nutrient and metal concentrations well below ANZECC guideline values and PFAS concentrations consistently under the 95% species protection thresholds established by HEPA. The 2024/25 environmental indicators also suggest that treatment performance has remained functional throughout the monitoring period.

One discharge event (27 Nov 2025) in the 2024/25 period was in breach of the WDL151-08 conditions (condition 21.3 – river level too low for an authorised discharge). This event occurred due to high rainfall that led to pond overloading risking overflow, so a discharge was undertaken to prevent uncontrolled release into the environment. This discharge event was investigated in accordance with conditions 24, 25, and 26 of WDL151-08 and was deemed to have a low/negligible risk of environmental harm (Power and Water Corporation, 2024). This demonstrated that the facility was still able to produce effluent that had negligible environmental impact when discharged during a period of overloading as no significant increases in waste constituents occurred.

Overall, environmental risk associated with KWwTP discharges during the 2024/25 monitoring year was assessed to be low, with negligible potential for adverse impact to the Katherine River ecosystem or its identified environmental values.

In order to maintain and enhance compliance with WDL151-08, waste constituent trends should continue to be monitored to detect any further increases in concentrations allowing any problems to be handled proactively.

8 Certification

I, Tahlia Kemp, Manager Assurance Water Services, have reviewed this report and I confirm that to the best of my knowledge and ability all the information provided in the report is true and accurate.

(being a person authorised to legally represent the holder of the licence)



Signature: Date: 31 October 2025

Please note that:

- Significant penalties may apply where it is demonstrated that false or misleading information has been supplied to the NT EPA.

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Appendices

Number	Title
Appendix I	Analysis of mass loads
Appendix II	Risk characterisation by analyte
Appendix III	Calculation of 27 Nov 2024 Discharge Ratio

Appendix I - Analysis of mass loads

Table 9: Analysis of mass loads in inflow and discharge

Katherine WWTP	Biochemical Oxygen Demand BOD (tonnes/yr)	Chemical Oxygen Demand COD (tonnes/yr)	Nitrogen-ammonia Free NH3-N Free (tonnes/yr)	Nitrogen-ammonia Organic NH3-N Organic (tonnes/yr)	Nitrogen oxide NOX - N (tonnes/yr)	Total Nitrogen (tonnes/yr) Calculations	Phosphorus P_Reactive High (tonnes/yr)	Phosphorus P_Total High Level (tonnes/yr)	Suspended Solids SS (tonnes/yr)	Volatile Suspended Solids VSS (tonnes/yr)	Reporting Period
Inflow	70.21	298.49	24.8	6.57	0.04	31.41	2.69	3.66	153.54	133.86	24/25
Discharge to Katherine River	12.22	49.34	0.11	2.47	0.01	2.59	0.34	0.58	24.19	22.21	
Mass Removed Prior to Discharge	57.99	249.15	24.69	4.1	0.03	28.82	2.35	3.08	129.35	111.65	
Percentage removed prior to discharge	82.60%	83.47%	99.56%	62.40%	75.00%	91.75%	87.36%	84.15%	84.25%	83.41%	
Inflow	69.71	206.85	25.77	5.25	0.05	31.06	2.82	3.72	142	123.28	23/24
Discharge to Katherine River	4.4	18.51	0.03	1.14	0.01	1.18	0.11	0.23	7.94	7.48	
Mass Removed Prior to Discharge	65.31	188.34	25.74	4.11	0.04	29.88	2.71	3.49	134.06	115.8	
Percentage removed prior to discharge	93.69%	91.05%	99.88%	78.29%	80.00%	96.20%	96.10%	93.82%	94.41%	93.93%	
Inflow	48.22	276	23.29	8.96	0.04	32.29	2.92	4	132.86	116.97	22/23
Discharge to Katherine River	3.21	26.72	0.11	1.52	0.01	1.63	0.27	0.44	11.55	10.61	
Mass removed prior to discharge	45.01	249.28	23.18	7.44	0.03	30.66	2.65	3.56	121.31	106.36	
Percentage removed prior to discharge	93.34%	90.32%	99.53%	83.04%	75.00%	94.95%	90.75%	89.00%	91.31%	90.93%	
Inflow	164.84	732.4	27.82	13.34	0.05	41.21	4.08	6.49	343.46	290.57	21/22
Discharge to Katherine River	1.13	9.59	0.03	0.57	0	0.6	0.08	0.14	3.92	3.58	
Mass removed prior to discharge	163.71	722.81	27.79	12.77	0.05	40.61	4	6.35	339.54	286.99	
Percentage removed prior to discharge	99.31%	98.69%	99.89%	95.73%	100.00%	98.54%	98.04%	97.84%	98.86%	98.77%	

Table 10: Analysis of metals mass loads in discharge

Metals Mass Load - Kg/Year								
Year	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
	Kg/Year	Kg/Year	Kg/Year	Kg/Year	Kg/Year	Kg/Year	Kg/Year	Kg/Year
21/22	0.022	0.009	0.218	0.436	0.044	0.022	0.087	0.436
22/23	0.036	0.007	0.029	0.217	0.014	0.014	0.072	0.361
23/24	0.057	0.005	0.034	0.391	0.027	0.010	0.057	0.505
24/25	0.071	0.004	0.058	4.243	0.058	0.005	0.116	1.880

Appendix II - Risk characterisation by analyte

Table 11 Risk Characterisation for KWwTP 2024/2025

Analyte	Environmental Factors	Risk
Physico-chemistry	pH and EC were elevated in effluent relative to ANZECC guidelines. However, the minimum dilution ratio of 1:575 ensures that the discharges contribution to physico-chemistry is negligible.	Low/Negligible
BOD and DO	Expected conditions for NT rivers during wet season will contain approximately 5-7 mg/L of dissolved oxygen. Observed dissolved oxygen in the effluent was slight above this range. However, the minimum dilution ratio of 1:575 ensures that the discharges contribution to dissolved oxygen is negligible.	Low/Negligible
Suspended Solids	High suspended solids have been observed to obstruct sunlight, inhibiting plant growth. Robson et al. (2010) states that primary activity within the Katherine River is already light limited, thus, due to the minimum dilution ratio of 1:575, it is unlikely that the discharges contribution to suspended solids will be significant enough to cause environmental effects.	Low/Negligible
Aluminium Chromium Copper Mercury Zinc	All metals except copper were below the ANZECC guidelines pre-dilution. However, after being diluted at a minimum ration of 1:575, all metal contributions from the discharge and the associated risk of environmental impact is low.	Low/Negligible
PFOS PFOA	All pre-dilution results meet the 95% species protection levels (HEPA 2020), therefore, following a 1:575 dilution in the environment, the risk of PFAS in discharge causing an environmental impact is low.	Low/Negligible
Pathogens	<p>A risk assessment workshop was conducted in May 2013 with PWC and DoH to assess the level of risk that exists as a result of the KWwTP discharge containing pathogens to the Katherine River. Two Scenarios were assessed:</p> <ol style="list-style-type: none"> 1. The risk of a person becoming ill due to drinking water from the Katherine River when the height is greater than the minimum discharge level at G8140001 due to pathogen catchment sources only 2. The risk of a person becoming ill due to drinking water from the Katherine River when the height is greater than the minimum discharge level at G8140001 due to pathogen catchment sources and the KWwTP <p>As it was observed that the pathogen contribution from catchment runoff was already high enough to render the water unsafe to drink, the addition of pathogens from KWwTP discharges would not increase the likelihood of illness as a result from drinking from the Katherine River more than it already is.</p> <p>Power and Water has erected signs stating the untreated water should not be used for drinking.</p>	High
*DOH = Department of Health		

Appendix III – Calculation of 27 Nov 2024 Discharge Ratio

Table 12. Dilution ratio calculations for 27 Nov 2024 Discharge (* - ratio below standard 1:575 dilution ratio)

Date	Discharge Flow Rate L/s	River Flow Rate L/s	Discharge Ratio
27/11/2025	1	40618.3961	40618
28/11/2025	2	82468.16242	41234
29/11/2025	11	75071.30873	6825
30/11/2025	131	84042.52681	642
1/12/2025	131	90312.05052	689
2/12/2025	131	73191.19225	559*
3/12/2025	131	250318.6632	1911
4/12/2025	131	196687.104	1501
5/12/2025	131	148781.3682	1136
6/12/2025	131	148085.4959	1130
7/12/2025	131	149265.6517	1139
8/12/2025	131	116525.2147	890
9/12/2025	131	108015.8243	825
10/12/2025	131	68152.18787	520*
11/12/2025	131	49092.75063	375*
12/12/2025	131	154324.2152	1178
13/12/2025	131	153712.2201	1173
14/12/2025	131	101829.2382	777
15/12/2025	131	106688.9128	814
16/12/2025	131	62036.25993	474*

The dilution ratios for the non-compliant discharge that commenced on the 27th of November 2024 is shown in table 12. 4 out of the 20 days spent discharging had a ratio below the standard 1:575 discharge ratio outlined by the licence.

A worst-case calculation using the lowest ratio calculated (1:375) was used to assess the waste constituent contribution of the effluent to the receiving environment. All calculated concentrations post dilution with ratio 1:375 were found to be below ANZECC guidelines and conform to all conclusions made throughout the report despite the increase in concentration.

Table 13. Waste constituent contribution of 27 Nov 2024 discharge post-dilution using 1:375 discharge ratio

Parameter	Units	Median	1:375 Dilution	ANZECC Guidelines
Perfluorooctanoic acid (PFOA) (ug/L)	ug/L	0.001	0.0000027	220
Sum (PFHxS + PFOS) (ug/L)	ug/L	0.0008	0.0000021	0.13
Biological Oxygen Demand (BOD)	mg/L	62	0.164893617	-
Chemical Oxygen Demand (COD)	mg/L	290	0.771276596	-
Total Suspended Solids (TSS)	mg/L	130	0.345744681	15
Volatile Suspended Solids (VSS)	mg/L	122	0.324468085	-
Hardness (CaCO3)	mg/L	117	0.311170213	-
Arsenic	µg/L	0.35	0.000930851	13
Cadmium	µg/L	0.02	0.00005319	0.2
Chromium	µg/L	0.2	0.000531915	3.3
Copper	µg/L	2.7	0.007180851	1.4
Lead	µg/L	0.17	0.000452128	3.4
Mercury	µg/L	0.008	0.00002128	0.06
Nickel	µg/L	0.5	0.001329787	11
Zinc	µg/L	7.8	0.020744681	8
E. coli	MPN/100mL	520	1.382978723	200
Enterococci	MPN/100mL	10112	26.89361702	41-200
Filterable Reactive Phosphorus (FRP)	mg/L	0.9	0.002393617	0.004
Total Phosphorus (P)	mg/L	3.5	0.009308511	0.01
Ammonia Nitrogen (NH3-N)	mg/L	0.6	0.001595745	0.01
Total Nitrogen	mg/L	0.6	0.001595745	0.2
Nitrate (NO3-N)	mg/L	0.1	0.000265957	-
Nitrite as N (NO2-N)	mg/L	0.1	0.000265957	-
Nitrate + Nitrite as N (NOx-N)	mg/L	0.1	0.000265957	0.005
Electrical Conductivity (field)	(µS/cm)	451	1.199468085	250

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