Palmerston WwTP WDL 148 Monitoring Report

2022 - 2023

PowerWater

Contents

List of Tables

List of Figures

Executive Summary

This monitoring report, provides an overview of a comprehensive study on influent and effluent flow management at the Palmerston Wastewater Treatment Plant (WwTP) and its impact on Myrmidon Creek. The report presents monthly inflow volumes and corresponding discharges within the reporting period, with figures offering a visual representation of these flow patterns. Mass load estimation, despite laboratory reporting limits, is detailed, illustrating mass loads for select parameters during the 2022-2023 financial year.

Data collection adhered to prescribed schedules and stringent Quality Assurance/Quality Control (QA/QC) criteria, ensuring the accuracy and reliability of water quality monitoring data. The report offers a comprehensive summary of monitoring data and assessments, emphasising the importance of trigger values in the assessment framework.

The categorisation of Myrmidon Creek monitoring sites is discussed in relation to health risks, fulfilling regulatory requirements. Nutrient analysis results, including instances of nutrient levels exceeding Site-Specific Trigger Values (SSTVs) at certain monitoring points, are detailed, along with observations on Chlorophyll-a levels.

Physicochemical analysis, including dissolved oxygen and pH levels, are within SSTVs, with one exception likely due to environmental factors.

In October 2022 Power and Water Corporation entered into a new contract with a new laboratory service provider, encompassing consumables for environmental sample collection and laboratory services, in compliance with stringent Waste Discharge License (WDL) monitoring. However, an unexpected anomaly disrupted data integrity, notably elevated filtered zinc levels surpassing total zinc levels, prompting a thorough investigation. This investigation, lasting five months, successfully identified the contamination source, detailed in the accompanying report for the Administering Regulatory Agency. Importantly, contamination events were isolated incidents, with filtered zinc levels consistently below detection limits and SSTV when excluding these anomalies. Additionally, copper levels remained consistently low, affirming the environmental health.

Toxicant parameters are generally within limits, with isolated events requiring consideration of tidal cycles. Wastewater discharge assessments are compliant with regulatory conditions.

Sediment data collection adheres to prescribed schedules and QA/QC criteria, with observations on elevated Aluminium-normalized copper levels, albeit just above guideline values. Porewater parameters align with guideline values, with minor elevations at specific sites. This study offers valuable insights into water management trends, environmental risks, and the impact of wastewater discharge on Myrmidon Creek.

Report Scope

This report provides an overview of the findings from the data collection and assessment encompassing surface water, sediment, and biological monitoring activities conducted between July 2022 and June 2023.

This monitoring report is meeting compliance with the below conditions from WDL 148-08, which was granted to the Power and Water Corporation in accordance with section 74 of the Water Act 1992 and became effective on 1st November 2021.

For detailed information regarding WDL 148-08 and to access the license document, please visit the NT EPA website through the following link; https://ntepa.nt.gov.au/your-business/public-registers/licences-and-approvals-register/waste-discharge-licences/sewerage/power-and-water-ludmilla

39 The licensee must complete and provide to the Administering Agency a Monitoring Report, not less than 30 business days prior to the anniversary date of this licence, for each year of this licence, by emailing waste@nt.gov.com.

40 The licensee must ensure that each Monitoring Report:

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

40.2. includes a tabulation of all monitoring data required as a condition of this licence and any additional data used as part of the analysis undertaken in the report, to be submitted in electronic Microsoft Excel format.

40.3. includes long-term trend analysis of monitoring data to demonstrate any environmental impact associated with the Licenced activity over a minimum period of six years (where the data is available);

40.4. Includes an assessment of Surface Water Quality in accordance with Appendix 1, Table 1-3 and sediment quality in accordance with Appendix 2, Table 2-1.

40.5 Reports on the progress of the Palmerston Waste Stabilisation Pond Improvement Plan

40.6 Includes and assessment of environmental impacts from the Activity

40.7 Reports on the following parameters associated with wastewater discharge:

Total discharge (ML/year)

Total biochemical oxygen demand (tonnes/year)

Total Phosphorus (tonnes/year)

Total Nitrogen (tonnes/year)

Monitoring Objectives and Methods

The monitoring activities carried out during the reporting period encompass License Limits, SSTVs, and respective site locations, have been detailed in the approved monitoring plans. These plans are integral components of WDL 148-08 and are provided in the appendices labelled 1, 2, 3, and 4 within the license document.

For a comprehensive understanding of the site layouts and any additional relevant data, all pertinent information, including site maps and other critical details, can be readily accessed within the license document.

Furthermore, it is essential to highlight specific license conditions pertaining to monitoring activities as outlined in WDL 148-08. These conditions encompass:

25 The Licensee must conduct water monitoring in accordance with Appendix 1 table 1.1

26 The Licensee must conduct sediment monitoring in accordance with Appendix 2, table 2.1

27 The licensee must ensure that all samples and field environmental data are representative of the conditions at the time of sampling.

28 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, ANZG 2018).

29 The licensee must ensure that all monitoring samples are analysed at a laboratory with current NATA accreditation or equivalent, for the parameters to be measured.

30 The licensee must for all land based monitoring points specified in this licence

30.1 Install, maintain and provide appropriate identification signage so that they are easily identifiable at all times; and

30.2 Maintain safe access and egress, as is reasonably practicable

31 The licensee must ensure any samples collected in accordance with Appendix 1, 2 and 3 of this licence or in connection with the Licenced activity or this licence, are obtained by, or under the supervision of, a qualified sampler

32 The licensee must ensure that, for each sample collected in accordance with this licence or in connection with the activity or this licence, the following information must be recorded and retained:

32.1 the date on which the sample was collected;

32.2 the time at which the sample was collected;

32.3 the location at which the sample was collected;

32.4 the name of the person who collected the sample;

32.5 the chain of custody forms relating to the sample;

32.6 the field measurements (if any) and analytical results relating to the sample; and

32.7 laboratory quality assurance and quality control documentation.

Overview of Assessed data

The entirety of the data pertaining to WDL 148-08, which is referenced throughout this report, has been systematically catalogued within the Power and Water Corporation's EnviroSys data management system. This system houses all the relevant information and allows for seamless extraction and presentation of the data. This document contains analysis and presentation of all relevant data and is available on request.

Assessment criteria

The compliance monitoring for WDL 148 involved a rigorous evaluation of the results in relation to SSTVs that are directly aligned with safeguarding the officially declared Beneficial Uses under the Water Act (NT) and the Darwin Harbour Water Quality Objectives (DHWQO) as outlined in NRTEAS 2010. These SSTV values represent a culmination of collaborative efforts between the NT EPA and the Power and Water Corporation, having undergone iterative development and refinement across different iterations of WDL 148. This partnership-driven approach ensures the continual enhancement of environmental protection measures and regulatory standards.

Surface Water

During the reporting period, each parameter's assessment was conducted in accordance with either a guideline standard or a SSTV as mandated in Appendixes 1, 2, and 3 of WDL 148-08. The dataset collected between 2022 and 2023 was subjected to a thorough evaluation against specific standards and guidelines: Data pertaining to the Outer or Mid Estuary areas were evaluated against the Darwin Harbour Water Quality Objectives (DHWQO) guidelines, while the ANZG 95% level of species protection served as a benchmark for biodiversity preservation. Additionally, to ensure recreational water safety, guidelines specified in the NHMRC (2008) Guidelines for Recreational Water were employed for assessing enterococci levels.

In cases where percentiles were the designated reporting statistic, the most recent 24 monthly results were utilized to calculate the percentile value. For parameters where percentiles were not the specified reporting statistic, medians derived from the most recent 24 monthly samples were employed for assessment purposes.

For reporting instances of exceedance, individual spot values were compared against the guideline values. Specifically, for parameters where a percentile was required for reporting, compliance was assessed using rolling 24 monthly percentiles, or six monthly percentiles when specified in WDL, to ensure adherence to regulatory standards. This comprehensive approach to assessment ensures the accurate evaluation of environmental conditions and compliance with established standards.

Sediment

In accordance with the Waste Discharge Licence (WDL) sediment monitoring plan, the evaluation of sediment quality was carried out by applying a multifaceted approach. This involved assessing sediment quality against the Sediment Quality Guideline (SQG) ANZG (2018) values, as well as employing water quality SSTVs tailored to the specific zone. Additionally, another benchmark for assessment involved comparing the sediment data against the 2 x 80th percentile of reference site data obtained from Short Creek. The choice of Short Creek as a reference site was deemed appropriate due to its status as an unaffected location by waste discharge, thereby providing a reliable baseline for comparative analysis. This comprehensive methodology ensured a thorough assessment of sediment quality in line with regulatory requirements.

Results and Assessment

Influent and Effluent (Flow)

Table 2 offers a concise overview of the monthly inflow volumes into the Palmerston Wastewater Treatment Plant (WwTP) and the corresponding discharges from the WwTP into Myrmidon Creek. To provide a visual representation of these flow patterns over the span of 2019 to 2023, Figure 1 presents a graphical depiction, offering a comprehensive and dynamic visualization of these important water management trends.

Month	Days	Inflow to Palmerston WwTP (KL)	Discharge to Myrmidon Creek (KL)
Jul-22	31	383198	309522
Aug-22	31	380737	306939
Sep-22	30	363426	295960
Oct-22	31	398980	366888
Nov-22	30	412383	387220
Dec-22	31	585520	584368
Jan-23	31	607617	659584
Feb-23	28	579845	573484
Mar-23	31	595439	660784
April-23	30	467594	473191
May-23	31	325107	348993
June-23	30	342079	319428
Totals	365	5441924	5286362

Table 1: 2022 – 2023 Palmerston WWTP Monthly flow volumes

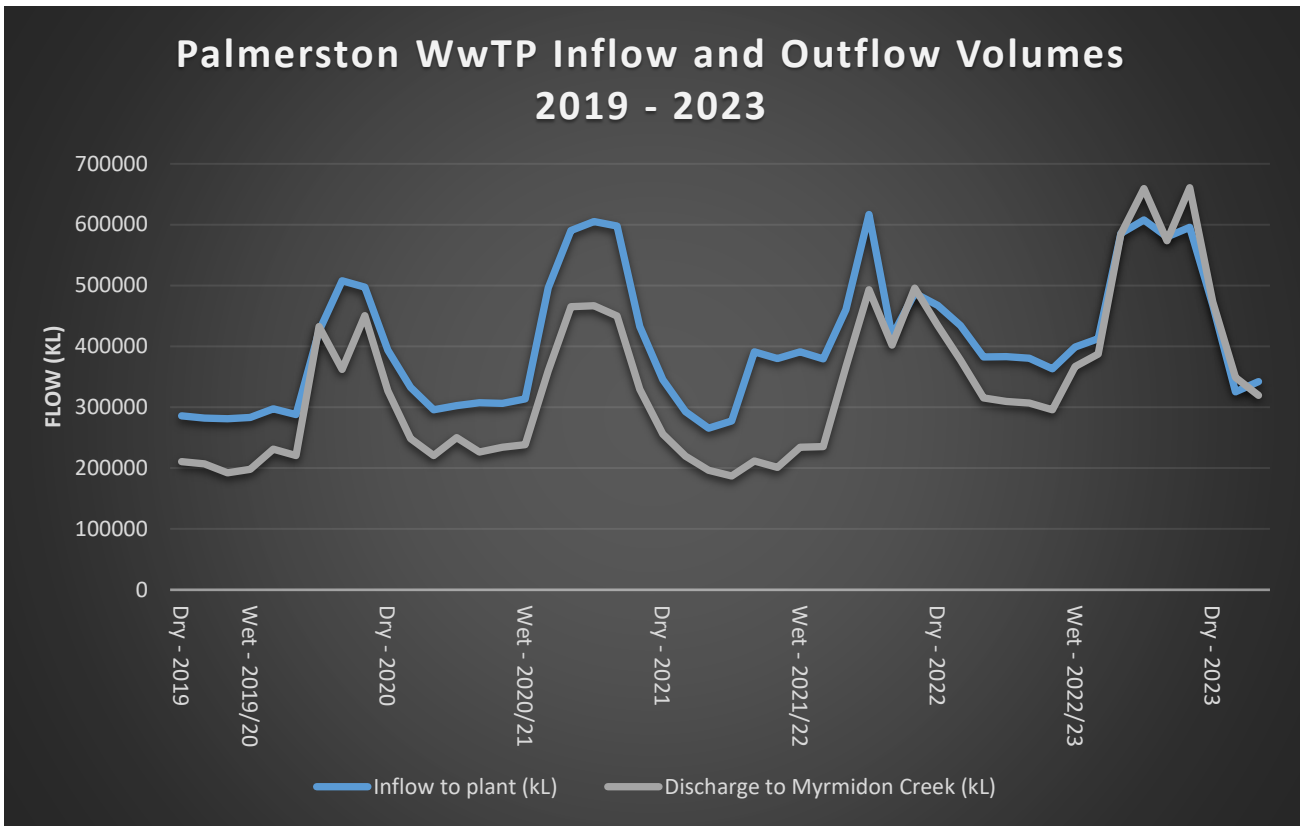

Figure 1: Palmerston WwTP Flow Volumes (2019-2023)

Mass Load Estimates

The estimation of mass loads is based on data collected at both inflow and discharge points, though it's important to acknowledge that the reported values may carry a degree of uncertainty attributed to laboratory analysis reporting limits. The methodology employed for calculating discharge loads entailed multiplying the analyte concentrations as reported by the laboratory by the corresponding inflow and discharge volumes. In cases where the reported analyte concentrations fell below the limits of reporting (LOR), half of the LOR value was used as a conservative approach for calculation. Figure 2, presented below, offers a visual trend presentation of mass loads for selected parameters throughout the 2022 – 2023 financial year, shedding light on the historic dynamics of these crucial data points.

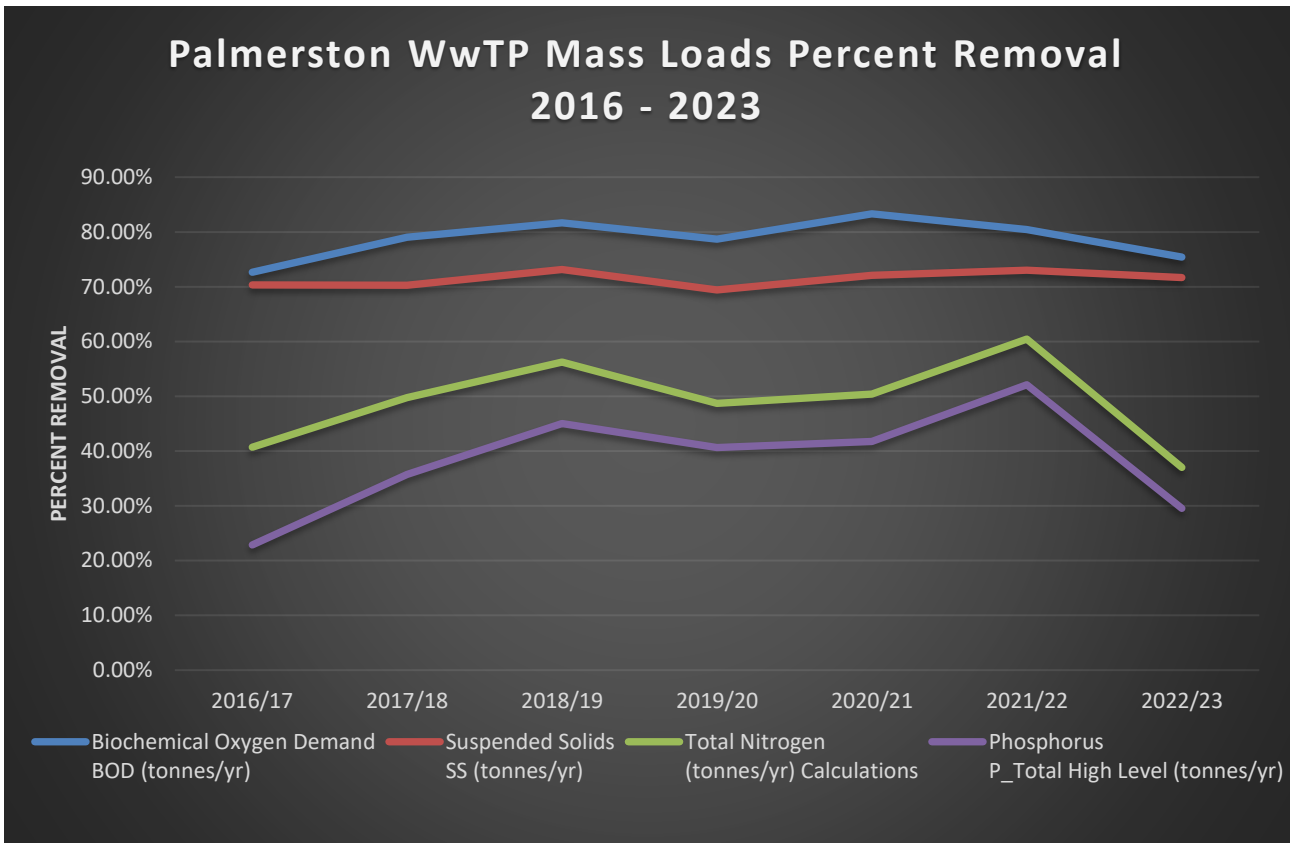

Figure 2: Palmerston WwTP Mass Loads Percent Removal (2016 – 2023)

Surface Water and Discharge

All data acquisition adhered meticulously to the prescribed frequencies as delineated within the Surface Water and Discharge Monitoring schedule as outlined in WDL 148-08. Furthermore, the QA/QC criteria for both sampling and data analysis, which encompassed the collection of blanks, duplicate samples, and triplicate samples were thoroughly met, thereby ensuring the integrity and reliability of the water quality monitoring data as per ANZG 2018 standards. This stringent approach underscores our commitment to maintaining the highest standards of accuracy and consistency in the dataset.

Contained within Appendix A – Data Assessment Graphs and Appendix B – Data Assessment Table are the comprehensive summary that encapsulates not only the monitoring data itself but also the assessment for each monitoring parameter. This evaluation is meticulously conducted by employing hazard ratios derived from pertinent trigger values tailored to the specific characteristics of each monitoring site. This integrated approach ensures a nuanced understanding of the potential environmental risks and reinforces the significance of trigger values as a critical benchmark in the assessment framework.

Pathogens Analysis

The categorization of Myrmidon Creek monitoring sites serves as a vital component in our assessment of potential health risks linked to water quality, fulfilling both NHMRC (National Health and Medical Research Council) Enterococci Category Table assessment and as an assessment requirement stipulated by WDL148-08 (**Error! Reference source not found.**). This systematic framework facilitates the evaluation of Enterococci levels within the water and their corresponding health implications.

Monitoring site SPAMY01 falls into Category C due to its Enterococci level. Within this category, there's a 5-10% risk of gastrointestinal (GI) illness and a 1.9-3.9% risk of AFRI (Acute Flaccid Respiratory Infection) per exposure. In practical terms, this translates to a significant likelihood, with 5 to 10 individuals experiencing gastroenteritis and approximately 2 to 4 individuals at risk of contracting AFRI for every 100 exposures.

Conversely, SPAMY03, SPAMY05, and SPAMY07 all fall into Category B, denoting a moderate risk of GI illness (1-5%) and a low AFRI risk (0.3-1.9%) per exposure. This category indicates that approximately 1 to 5 individuals out of every 100 exposures may experience gastroenteritis, with less than 2% at risk of AFRI.

On the other hand, SPAMY06 represents Category A, reflecting the lowest risk level as per the NHMRC Enterococci Category Table. The risk of GI illness is less than 1%, and the AFRI risk is less than 0.3% per exposure. Consequently, this site poses minimal health risks, with an average probability of less than one case of gastroenteritis in every 100 exposures and a negligible AFRI burden.

In the context of our environmental monitoring analysis, it's important to note that all the results from the Zone of Influence (ZOI) sites consistently demonstrate levels well below the established trigger (Figure 3). However, it's crucial to note an observation regarding SMDZ site SPAMY07, which recorded an exceedance (Figure 4). This site's unique upstream position in relation to all other monitoring sites plays a pivotal role in this exceedance. SPAMY07 receives drainage waters from a nearby suburban area, which can potentially introduce external factors and contaminants into its monitoring area especially during rain events. Consequently, this upstream location, influenced by suburban drainage, can lead to localized variations in water quality. As such, this exceedance should be interpreted in the context of its upstream position and the potential influence of external sources.

Monitoring Point	Enterococci Results - Long Term 95th Percentile (Hazen Method)	Category
SPAMY01	411.3	C
SPAMY03	75.0	B
SPAMY05	50.9	B
SPAMY06	19.5	A
SPAMY07	49.9	B

Table 2: NHMRC Enterococci Category Table

Nutrient Analysis

During our comprehensive analysis of nutrient levels within the estuarine creek, it is noteworthy that there were several instances where nutrient levels exceeded the SSTV at the SMDZ monitoring points although they did not breach the assessment guidelines and remained in compliance with the stipulated conditions within the WDL (Table 4). This suggests that while nutrient levels may have occasionally surpassed the established threshold, they generally fell within the acceptable range defined by regulatory guidelines.

One particularly interesting aspect of our assessment relates to the chlorophyll a levels in the creek. Despite instances of elevated nutrient levels, the chlorophyll a levels remained below the SSTV. This observation indicates that while there may have been occasional nutrient exceedances, the overall nutrient load in the creek was not sufficient to trigger eutrophication—a process characterised by excessive nutrient levels leading to harmful algal blooms and water quality degradation. Therefore, the presence of chlorophyll a levels below the SSTV suggests that the waterbody has not experienced the detrimental effects associated with nutrient-driven eutrophication.

Conversely, at the Zone of Influence (ZOI) site, nutrient levels consistently remained below the SSTV throughout the monitoring period. This is generally indicative of a favourable environmental condition within the ZOI area, with nutrient levels remaining within the established safe range. However, it's worth noting an exception during one specific event where the results notably deviated from historical and more recent available data.

The assessment of nutrient levels in the estuarine creek reveals a nuanced picture. While there were occasional exceedances of SSTV at SMDZ monitoring points, overall compliance with WDL conditions was maintained. The presence of chlorophyll a levels below the SSTV suggests that the creek has not experienced eutrophication despite intermittent nutrient elevations. The consistent adherence to SSTV at the ZOI site implies a generally favourable environmental condition, with the outlier event warranting additional scrutiny for a comprehensive understanding of its implications.

Physicochemical Analysis

During the monitoring period of 2022-2023, DO% consistently remained within the prescribed SSTV, reflecting a generally healthy dissolved oxygen concentration to support aquatic life.

However, an interesting deviation from this pattern occurred at SPAMY05, where DO% briefly ventured outside the SSTV range (Figure 6). This outlier event is most likely attributed to a specific set of environmental conditions, notably the initial rain events followed by runoff and an extended period of cloud cover. Rainfall can introduce various factors into the creek, such as organic matter and nutrients, potentially influencing dissolved oxygen levels. Runoff, especially after precipitation, can transport contaminants into the water, affecting its oxygen content. The extended cloud cover could have limited photosynthesis, further impacting oxygen production in the creek. Thus, this isolated event at SPAMY05 underscores the sensitivity of the creek's ecosystem to transient environmental changes.

In parallel, the pH levels within the estuarine creek remained consistently within SSTV values throughout the entire reporting period of 2022-2023 (Figure 7). This steadfast adherence to the established pH range indicates a stable pH environment, which is crucial for supporting aquatic organisms and maintaining overall water quality.

Metals

In October 2022, Power and Water Corporation entered into a contract with a new laboratory service provider. This contract covered laboratory services and the provision of materials used for collecting environmental samples as per the Waste Discharge License (WDL) monitoring requirements. However, as we received the results of our analysis, an unexpected irregularity emerged in the data concerning filtered zinc levels.

This surprising occurrence was particularly notable because of the significant increase in filtered zinc concentrations, along with the unusual situation where filtered zinc levels exceeded total zinc levels. Such an event, considering the specific sampling conditions and sample characteristics, was highly uncommon and raised immediate concerns.

Recognising the seriousness of the situation, the contractor responsible for collecting water samples in the field promptly initiated a thorough investigation. The primary goal was to uncover any potential sources of contamination that could explain the abnormal zinc levels. This investigation became a top priority as it had widespread implications for the accuracy of zinc analysis results within Water Quality monitoring programs.

This investigative effort continued until the contamination source was identified, which occurred approximately five months after the initial detection of the anomaly. A detailed report explaining the origins of the contamination has been submitted alongside this report. To ensure best practices and effective management, the responsibility for handling these complex details has been entrusted to the expertise of the Administering Regulatory Agency.

Importantly, it's crucial to note that the contamination events are distinct from the overall dataset. When these specific instances are excluded, the concentration of filtered zinc consistently remains well below both the detection limit and the SSTV. This pattern holds true not only after the contamination events but also throughout the preceding two years. Furthermore, the cumulative zinc levels remain below the established SSTV even during the contamination events (Figure 9).

Over the course of the reporting period, a consistent and reassuring trend became evident in our data analysis. This trend pertains to the levels of both filtered and total copper, which consistently registered values that were below not only the detection limit but also the SSTV.

This noteworthy pattern signifies that the copper levels in our monitored environment remained at exceptionally low concentrations. Such consistently low levels are a positive indicator, as they suggest that copper, a potentially harmful substance at elevated concentrations, posed no significant threat to the environmental quality and health of the ecosystem under scrutiny.

Toxicant Analysis

In the context of an intertidal estuarine creek, it's crucial to comprehensively assess the presence of toxicant parameters to ensure the health and integrity of the ecosystem. During the reporting period, an evaluation of toxicant parameters revealed that, overall, they remained within the established SSTV, aligning with the preservation of the creek's environmental quality.

However, an interesting observation arose during this assessment, primarily concerning SPAMY01. Here, there was an isolated event where Ammonia levels exceeded the toxicant guideline values. It's important to emphasize that this instance appears to be an outlier in the broader context of historical and recent data, which consistently align with the toxicant trigger values. This suggests that this specific event deviated from the norm and is not indicative of a sustained issue.

Furthermore, it's noteworthy that the timing of sample collection at SPAMY01 for this particular event occurred significantly later after the high tide. This temporal difference in sample collection, relative to tidal levels, is a crucial factor to consider, particularly given that SPAMY01 is situated within an intertidal zone. The timing of sample collection in relation to tidal cycles can significantly influence water quality parameters, including toxicants.

In essence, while the isolated exceedance of Ammonia at SPAMY01 is a notable event, it appears to be a temporary deviation, and the historical and recent data remain consistent with toxicant trigger values. This underscores the importance of understanding the context of data collection and its relationship with tidal cycles, particularly in intertidal zones. Overall, the assessment suggests that the estuarine creek maintains a generally healthy condition, with vigilant monitoring to capture transient variations and ensure the continued well-being of this ecosystem.

All Surface Water Parameters Compliance Summary

In the context of wastewater discharge into an estuarine creek, it's essential to scrutinize the exceedances of SSTV to ensure the adherence to environmental regulatory requirements. During our assessment, we did identify instances where SSTV exceedances occurred. However, it's crucial to note that despite these exceedances, the wastewater discharge remained compliant with the conditions stipulated in the WDL148-08.

These exceedances, while indicating variations from the prescribed threshold values, did not result in violations of the assessment conditions outlined in the WDL148-08. This suggests that the wastewater discharge, while occasionally deviating from the SSTV, remained within acceptable limits as per the specific regulations governing the estuarine creek.

These findings emphasize the importance of not only monitoring SSTV but also taking into account the broader regulatory framework established within the WDL148-08. The regulatory conditions encompass a comprehensive set of criteria and guidelines designed to ensure that wastewater discharge into the estuarine creek does not compromise environmental integrity. Consequently, the identification of exceedances within SSTV, which nonetheless fall within compliance with WDL conditions, signifies that the discharge is operating within the parameters established to safeguard the health and sustainability of the estuarine ecosystem.

Sediments

Sediment and Pore Water Summary Analysis

The collection and analysis of sediment and pore water data represent a critical aspect of ensuring the environmental health and compliance of any water system, particularly in the context of WDL148-08. It's noteworthy that all data collection activities were meticulously executed in strict accordance with the frequencies stipulated in the sediment monitoring schedule outlined in WDL 148-08.

Moreover, the data collection process adhered rigorously to QA/QC criteria, as per the guidelines set forth in the Australian and New Zealand Guidelines (ANZG) of 2018. This included the meticulous collection of duplicate samples, and triplicate samples, all of which are essential components of a robust QA/QC program. Such stringent adherence to these QA/QC criteria ensures the reliability and accuracy of the sediment data collected, bolstering the credibility of the assessments made.

To delve further into the specifics of the sediment data, Table 3 below provides a comprehensive overview of the sediment values acquired during the 2023 dry season. This dataset serves as a valuable resource for

understanding the sediment quality within the estuarine creek during this specific period, offering insights into potential changes or trends that may inform future environmental management strategies.

In essence, the meticulous collection and analysis of sediment data, in alignment with both the prescribed monitoring frequencies and ANZG (2018) QA/QC criteria, represent a robust foundation for effective environmental management and the preservation of the estuarine ecosystem's health. The insights derived from these data are invaluable in guiding decision-making processes aimed at ensuring the long-term sustainability of the water system.

2023	Sediments												Pore Water					
Indicator type	Nutrient Indicators						Toxicant Indicators						Nutrient Indicators			Toxicant Indicators		
Parameter	Chl-a	Chl-a : Phaeophytin	TP	TN	TOC	TN : TOC	Cu (D)	Bioavailable Cu	Al Normalised Cu	Zn (D)	Bioavailable Zn	Al Normalised Zn	TP	FRP	TN	NH3 unionised	Cu (D)	Zn (D)
Unit	mg/kg	none	mg/kg	mg/kg	mg/kg	none	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L
SQG Lower							65	65		210	210						65	210
SQG Upper							270	270		400	400						270	400
ANZG (2018) SMD							1.3			15							1.3	15
ANZG (2018) ZOI							3			15							3	15
Assessment criteria	> 2 x Reference site 80th Percentile	<1 OR >1	> 2 x Reference site 80th Percentile	> 2 x Reference site 80th Percentile		<1 OR >1	SQG	SQG	> 2 x Reference site 80th Percentile	SQG	SQG	> 2 x Reference site 80th Percentile	> 2 x Reference site 80th Percentile	> 2 x Reference site 80th Percentile	> 2 x Reference site 80th Percentile	> 2 x Reference site 80th Percentile	SQG	> 2 x Reference site 80th Percentile
> 2 x Reference site 80th Percentile	4.90825	1	896	3048	68320	1	270	270	6.615	400	400	22.464	0.224	0.02	6.88	3.764	2	10
Impact zone - ZOI																		
SPAMY01	3.90	0.26	760	2270	41200	0.06	17.7	10.6	13.3	37.2	18.5	28.0	0.34	0.02	6.3	5.71	1	5
SPAMY03	1.27	0.12	578	2110	33500	0.06	12.6	7.7	9.5	33.3	17.7	25.2	0.16	0.02	3.8	3.05	1	5
									5									
SPAMY05	1.65	0.21	605	2050	31600	0.06	10.1	4.2	7.9	31.3	14.9	22.0	0.18	0.01	3	2.59	1	5
SPAMY06	0.14	0.21	297	710	12700	0.06	10.6	1.6	10.9	16.3	5.9	26.3	0.05	0.01	1.1	1.03	1	5
SPAMY07	2.30	0.18	463	1900	47400	0.04	10.1	5.2	7.4	32.6	15.5	24.0	0.29	0.01	3.7	2.51	1	5
Short Creek reference siteS where site 01 is most upper estuary in series - Total concentration in sediment (mg/kg) or concentration in sediment porewater (mg/L)																		
SPASC01	1.43	0.13	322	970	22300	0.04	8.7	4.1	2.97	30.4	15.3	11.09	0.1	0.005	4.1	2.26	1	5
SPASC02	2.79	0.26	484	1650	36200	0.05	7.9	4.1	2.95	28.4	15.1	10.86	0.09	0.005	2	1.13	1	5
SPASC03	1.33	0.13	424	1440	32800	0.04	9.1	4.8	3.43	31.3	15.1	10.79	0.06	0.005	2.2	1.62	1	5
SPASC04	2.23	0.17	335	850	26000	0.03	6.7	2.9	3.23	24.9	12.3	11.45	0.13	0.005	3	1.63	1	5

Table 3: 2023 Myrmidon Creek Sediments Assessment

All Sediment and Pore water Parameters Analysis

The comparison of sediment data between Myrmidon Creek and the reference sites in Short Creek has revealed some noteworthy findings. Specifically, there were elevated concentrations of Aluminium-normalized copper observed at all sites within Myrmidon Creek. This observation raises questions about the potential accumulation of copper in the sediment near the discharge point, although it's essential to emphasize that these levels remain low and fall below the established Sediment Quality Guidelines (SQG). These findings suggest that, despite the elevated concentrations, the risk associated with copper accumulation in the sediment is considered low.

Furthermore, when we focus on specific sites, namely SPAMY01, SPAMY03, SPAMY06, and SPAMY07, we observe similar patterns of elevated Aluminium-normalized copper levels in comparison with the reference creek. Again, it's crucial to stress that majority of the other sites remain below SQG values, indicating that the sediment quality within these sites is within acceptable limits. This observation also suggests that there is no apparent evidence of eutrophication caused by the discharge within the sediments. This is further supported by the chlorophyll-a values, which consistently remain below the reference creek values, signifying a lack of excessive algal growth linked to nutrient enrichment.

Examining pore water parameters, we find that they generally conform to SQG values or align with reference creek comparator values. Minor elevations in pore water parameters were observed at SPAMY07 and at both sites within the Zone of Influence (ZOI). However, these minor elevations, while notable, remain just above the acceptable ranges.

References

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Appendix A – Data Assessment Graphs

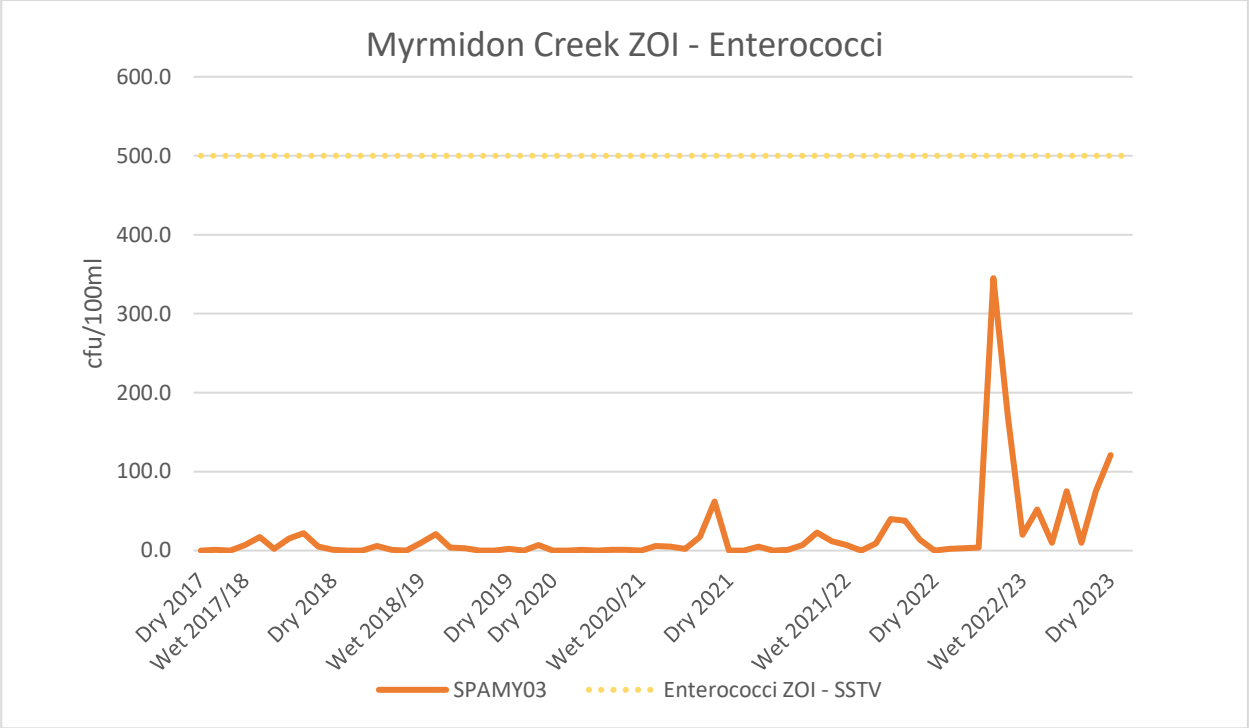

Figure 3: Myrmidon Creek ZOI – Enterococci 2017 - 2023

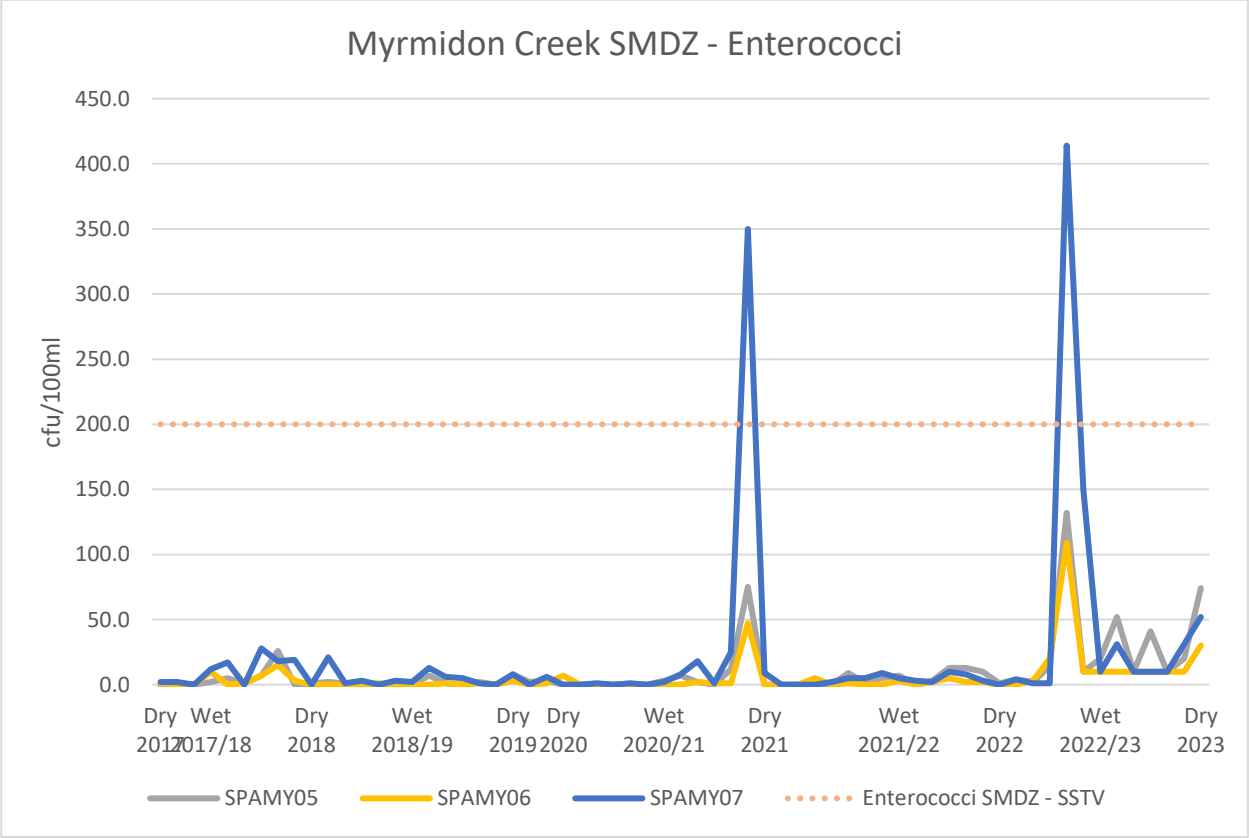

Figure 4: Myrmidon Creek SMDZ – Enterococci 2017 - 2023

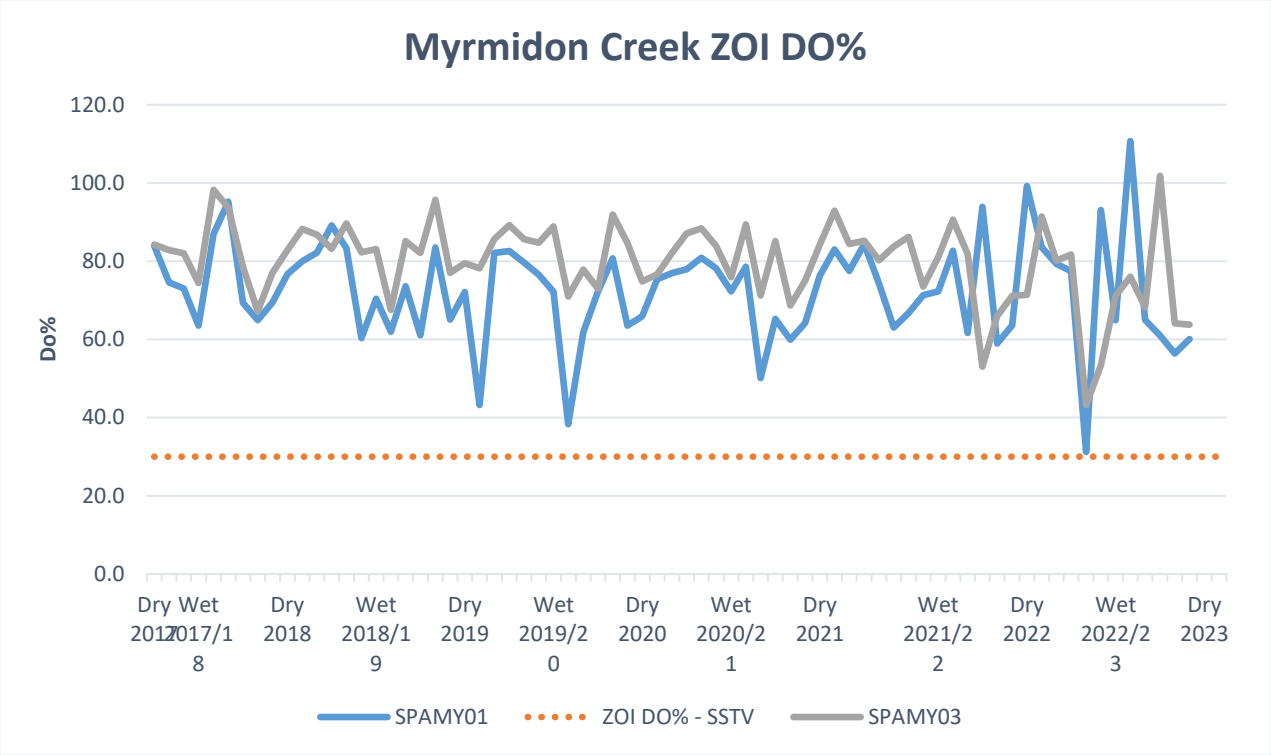

Figure 5: Myrmidon Creek ZOI – DO% 2017 – 2023

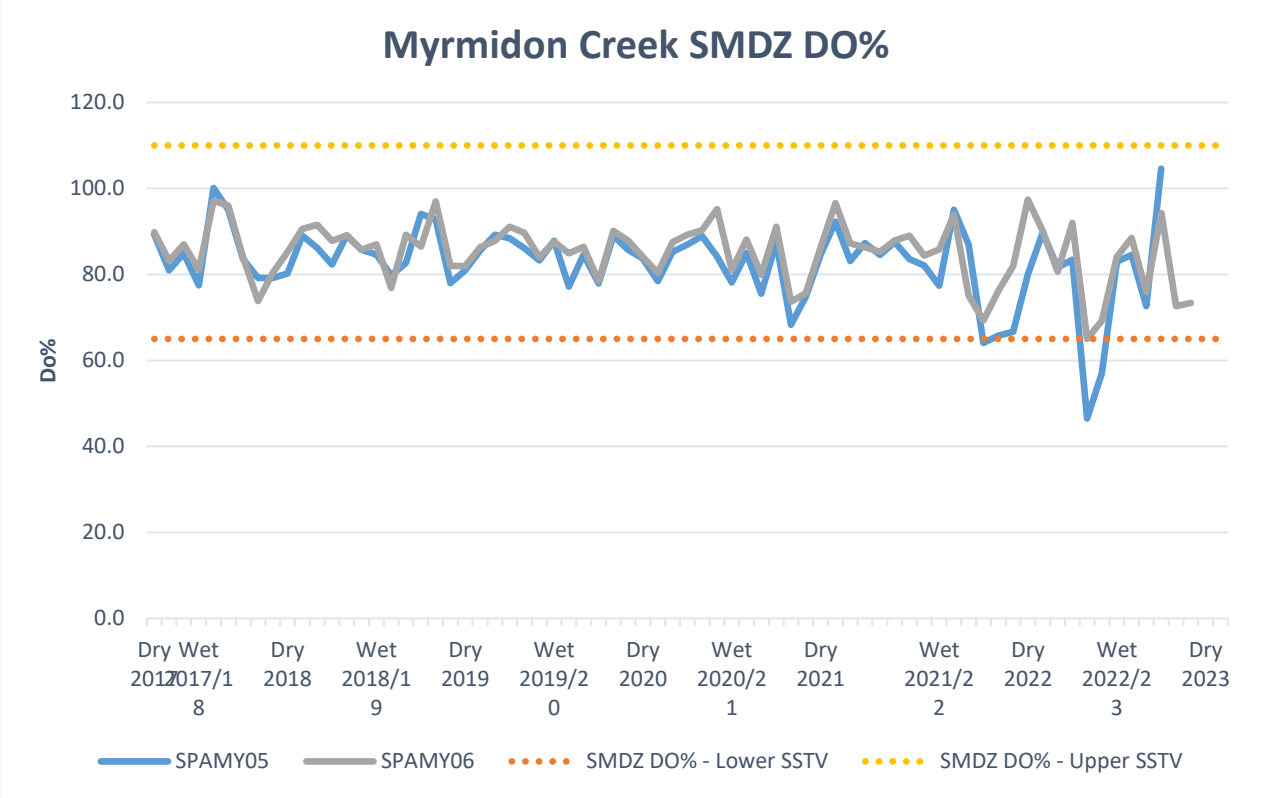

Figure 6: Myrmidon Creek SMDZ – DO% 2017 – 2023

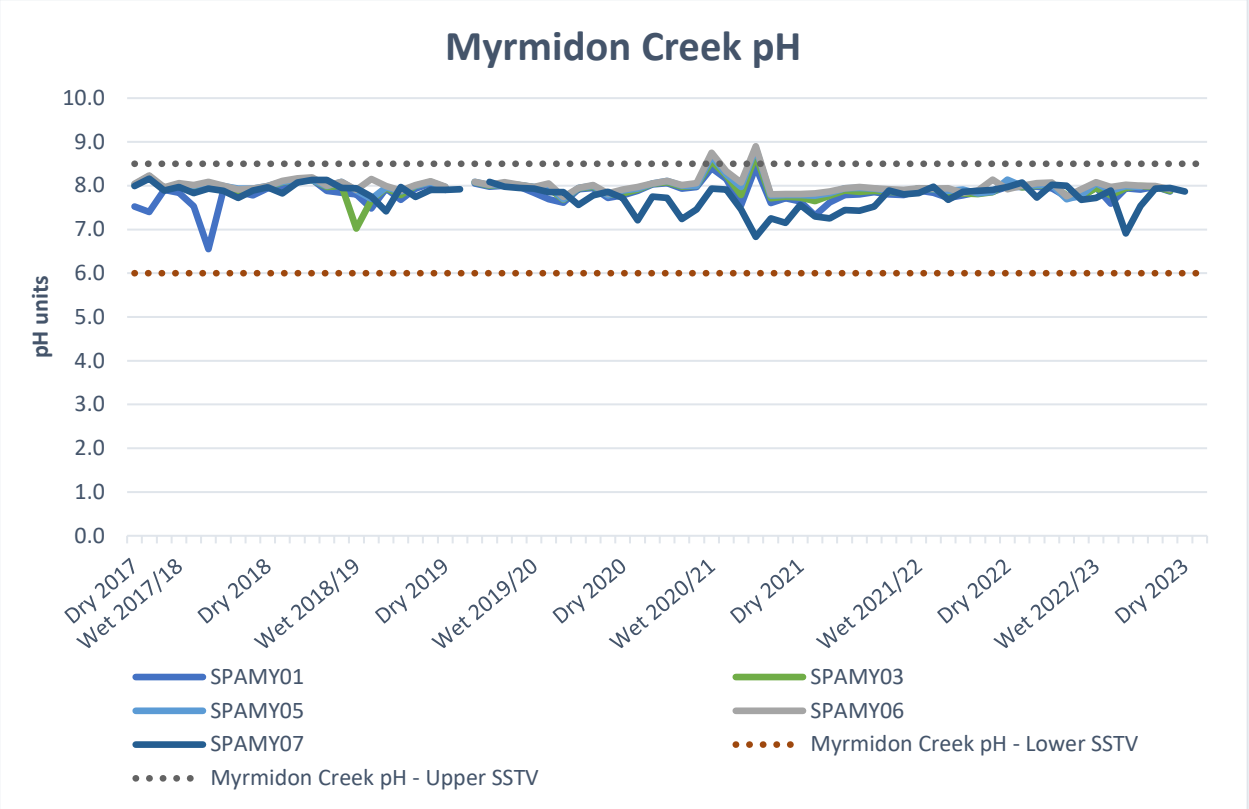

Figure 7: Myrmidon Creek pH trend 2017 to 2023

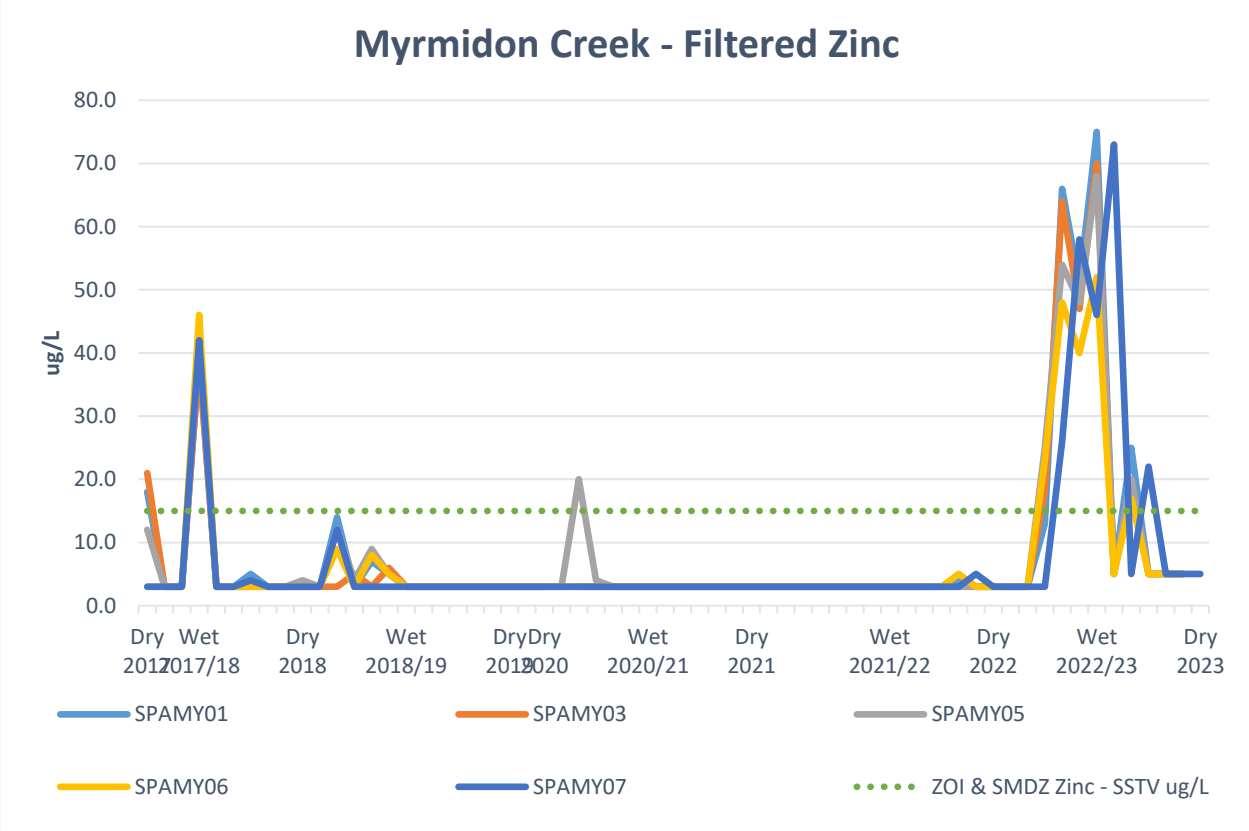

Figure 8: Myrmidon Creek – Filtered Zinc 2017 - 2023

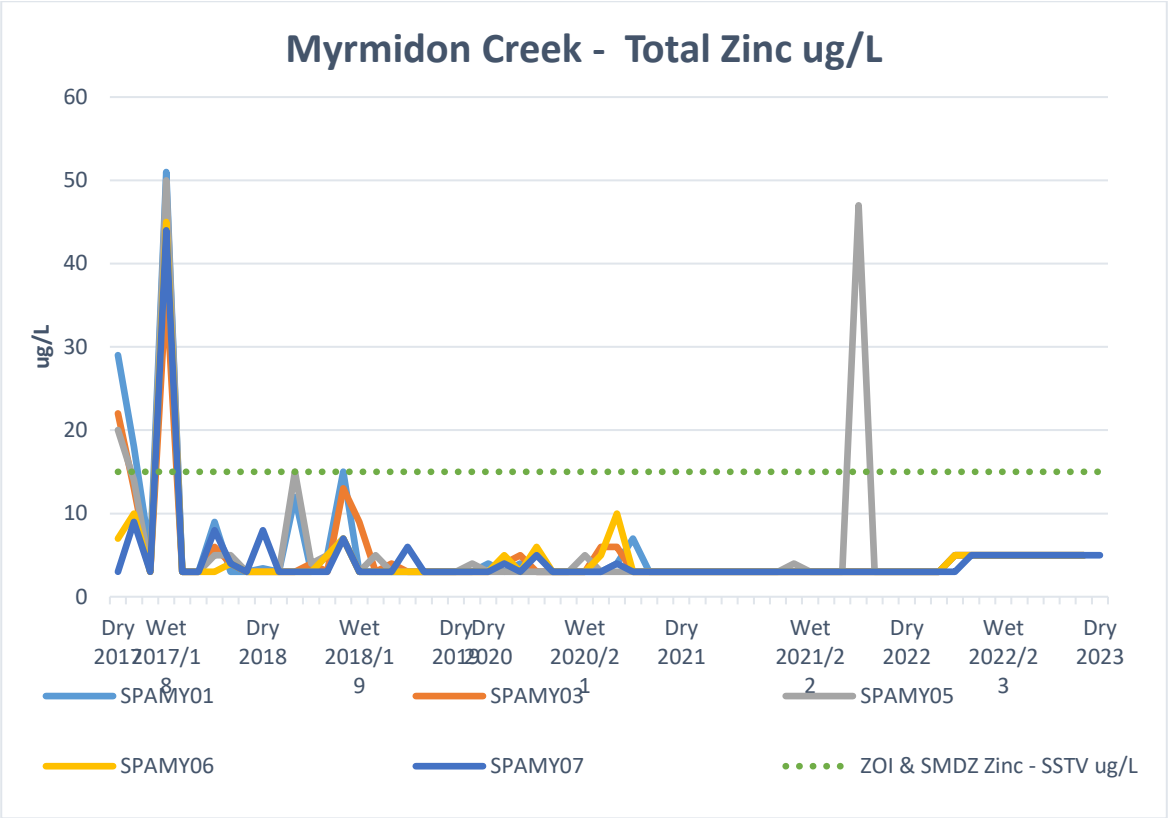

Figure 9: Myrmidon Creek – Total Zinc 2017 – 2023

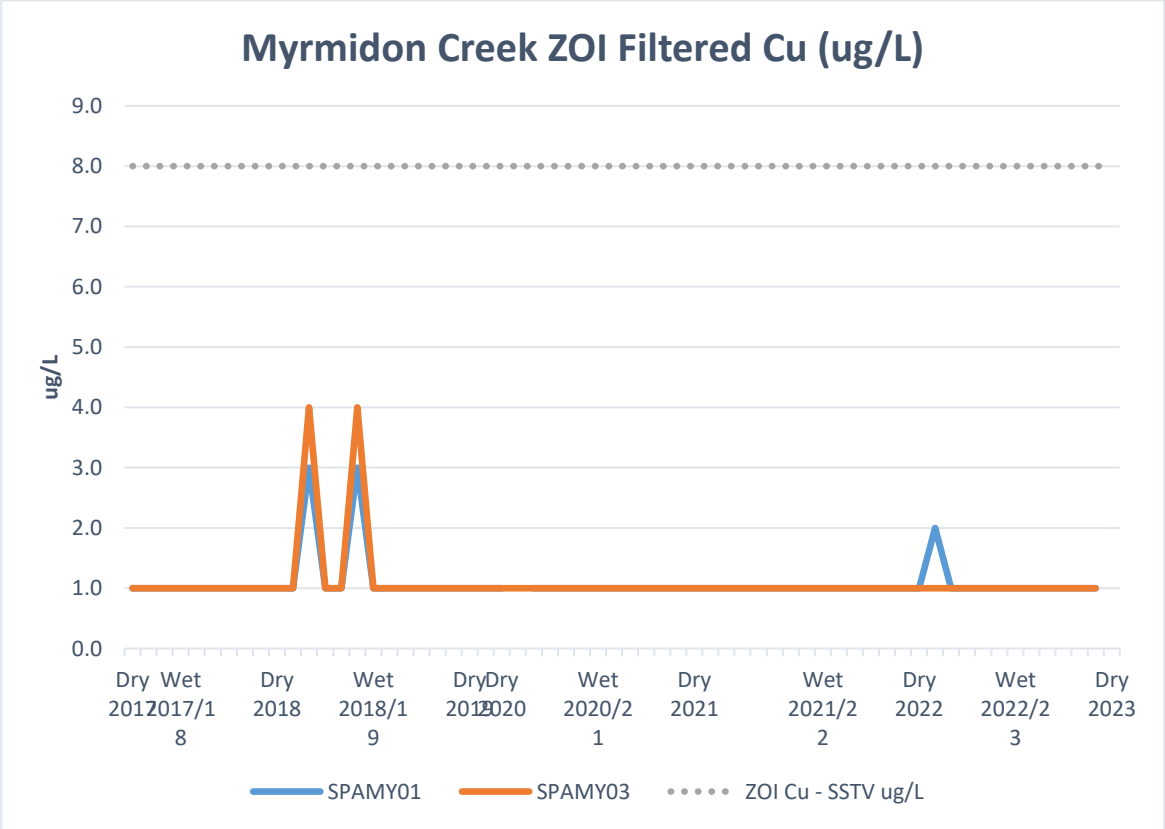

Figure 10: Myrmidon Creek ZOI – Filtered Copper 2017 – 2023

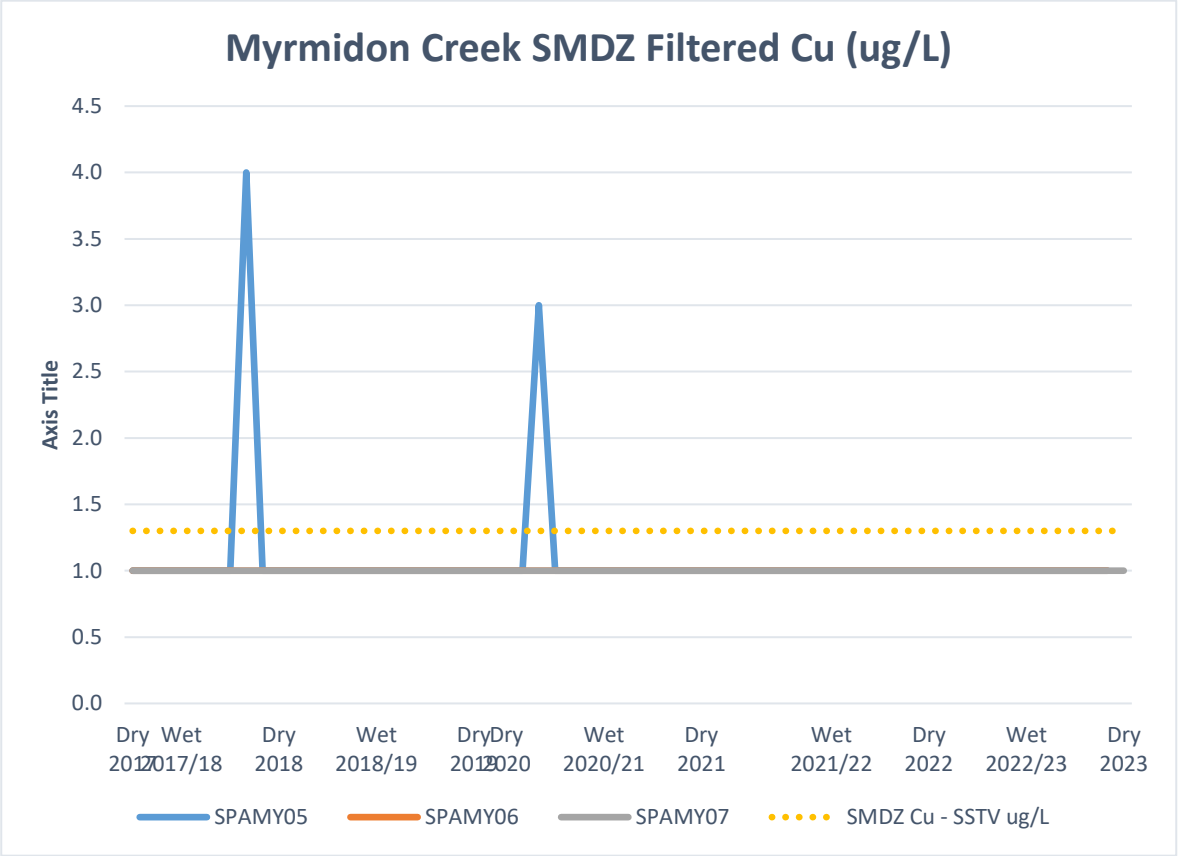

Figure 11: Myrmidon Creek SMDZ – Filtered Copper 2017 – 2023

Appendix B – Data Assessment Table

				Nutrients and Organics																					Chlorophyll			
				Ammonia					Nitrate + Nitrite as N (NOx)				Phosphorus - Filterable Reactive as P				Phosphorus - Total				Total Nitrogen				Chlorophyll			
Sample Date	Location	Description	Status		Ammonia Nitrogen (NH3-N) (mg/L)	Ammonia Nitrogen (NH3-N) (mg/L) - Median (6 months)	Ammonia Nitrogen (NH3-N) (mg/L) - Median (24 months)	Ammonia Nitrogen (NH3-N) (mg/L) - 95th Percentile (24 months)		Nitrate + Nitrite as N (NOx-N) (mg/L)	Nitrate + Nitrite as N (Nox-N) (mg/L) - Median (6 months)	Nitrate + Nitrite as N (Nox-N) (mg/L) - Median (24 months)		Phosphorus - Filterable Reactive as P (mg/L)	FRP (mg/L) - Median (6 months)	FRP (mg/L) - Median (24 months)		Phosphorus - Total (mg/L)	TP (mg/L) - Median (6 months)	TP (mg/L) - Median (24 months)		Total Nitrogen as N (mg/L)	TN (mg/L) - Median (6 months)	TN (mg/L) - Median (24 months)		Chlorophyll a (ug/L)	Chl-a (ug/L) - Median (6 months)	Chl-a (ug/L) - Median (24 months)
06/07/2022 11:57:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.149	N/A	0.008	0.2796		0.022	N/A	0.003	<	0.003	N/A	0.005		0.073	N/A	0.105		0.86	N/A	0.47		1.89	N/A	3.725
03/08/2022 11:02:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.087		0.009	0.2796		0.04		0.003	<	0.003		0.0045		0.069		0.105		0.16		0.47		1.69		3.725
01/09/2022 10:33:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.01		0.0095	0.2796		0.026		0.003		0.025		0.005		0.088		0.105		0.11		0.47		1.78		3.725
17/10/2022 13:30:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.386		0.011	0.37085		0.02		0.009		0.004		0.0045		0.019		0.105		0.74		0.58		7.35		4.345
16/11/2022 11:28:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.776		0.0205	0.7175		0.045		0.0175		0.072		0.0045	<	0.1		0.1025		1.48		0.58		15.8		4.78
15/12/2022 10:07:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		1.17		0.0205	1.1109		0.028		0.0175		0.204		0.005		0.258		0.1025		1.75		0.58		24.5		5.685
11/01/2023 09:46:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.433		0.039	1.1109		0.034		0.02		0.054		0.005		0.117		0.105		0.92		0.64		4.19		4.78
16/02/2023 12:24:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.28		0.068	1.1109		0.009		0.02		0.004		0.005		0.077		0.105		0.76		0.7		7.99		5.685
15/03/2023 13:30:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		1.44		0.118	1.3995		0.032		0.0205		0.188		0.005		0.182		0.108		1.96		0.75		30.1		6.79
12/04/2023 10:23:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid	<	0.005		0.118	1.3995		0.018		0.0205		0.001		0.005		0.009		0.108		0.12		0.75		2.3		6.79
24/05/2023 11:10:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.777		0.155	1.3995		0.047		0.021		0.029		0.005		0.164		0.114		1.81		0.81		17.6		7.265
21/06/2023 10:47:00	SPAMY01	SPAMY01 MYRMIDON CREEK OUTFALL 01	Valid		0.928		0.181	1.3995		0.04		0.024		0.024		0.0055		0.224		0.119		2.68		0.89		7.0		7.265
06/07/2022 12:09:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid	<	0.005	N/A	0.005	0.1129	<	0.003	N/A	0.003	<	0.003	N/A	0.003		0.032	N/A	0.0415		0.45	N/A	0.1		1.03	N/A	2.175
03/08/2022 11:09:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid	<	0.005		0.005	0.1129	<	0.003		0.003	<	0.003		0.003		0.018		0.0415		0.08		0.1		1.34		2.175
01/09/2022 10:54:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid	<	0.005		0.005	0.1129	<	0.003		0.003	<	0.003		0.003		0.038		0.04		0.08		0.09		1.23		2.175
17/10/2022 13:30:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid		0.337		0.005	0.25535		0.039		0.003		0.006		0.003		0.092		0.0425		1.05		0.1		5.91		2.175
16/11/2022 11:51:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid		0.827		0.005	0.32815		0.049		0.003		0.053		0.003	<	0.1		0.043		1.96		0.1		16.0		2.175
15/12/2022 10:31:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid		0.732		0.005	0.67275		0.024		0.003		0.123		0.0035		0.104		0.043		0.84		0.1		11.4		2.175
11/01/2023 09:57:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid		0.193		0.005	0.67275		0.028		0.003		0.001		0.0035		0.06		0.043		0.54		0.1		4.05		2.175
16/02/2023 12:40:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid	<	0.005		0.005	0.67275	<	0.002		0.003	<	0.001		0.0035		0.008		0.043		0.13		0.115		1.29		2.175
15/03/2023 13:30:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid		0.272		0.005	0.67275		0.02		0.003		0.042		0.0035		0.07		0.0435		0.56		0.165		9.32		2.255
12/04/2023 10:15:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid	<	0.005		0.005	0.67275		0.023		0.003		0.002		0.003		0.006		0.043		0.12		0.125		1.8		2.255
24/05/2023 11:28:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid		0.161		0.005	0.67275		0.019		0.003		0.009		0.0035		0.075		0.0435		0.62		0.125		7.15		2.255
21/06/2023 11:20:00	SPAMY03	SPAMY03 MYRMIDON CREEK OUTFALL 03	Valid		0.36		0.005	0.6762		0.026		0.003		0.018		0.004		0.105		0.0435		0.82		0.125		3.8		2.285
06/07/2022 12:13:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid	<	0.005	0.005	0.005	0.0148	<	0.003	0.003	0.003		0.005	0.004	0.0035		0.034	0.0375	0.0355		0.95	0.345	0.09		1.03	1.97	1.805
03/08/2022 11:14:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid	<	0.005	0.005	0.005	0.0077	<	0.003	0.003	0.003	<	0.003	0.0035	0.0035		0.022	0.0315	0.0355		0.08	0.12	0.085		1.4	1.735	1.805
01/09/2022 11:00:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.066	0.005	0.005	0.0522	<	0.003	0.003	0.003	<	0.003	0.0035	0.003		0.045	0.0375	0.0355		0.08	0.08	0.08		1.49	1.56	1.805
17/10/2022 13:30:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.088	0.0055	0.005	0.0651		0.018	0.003	0.003	<	0.001	0.0035	0.003		0.012	0.028	0.0355		0.51	0.08	0.085		13.6	1.56	1.805
16/11/2022 11:57:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.37	0.0355	0.005	0.0847		0.037	0.003	0.003		0.016	0.004	0.003		0.123	0.028	0.0355		0.91	0.295	0.09		7.03	1.56	1.805
15/12/2022 10:38:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.224	0.077	0.005	0.2036		0.012	0.0075	0.003		0.054	0.004	0.0035		0.101	0.0395	0.0355		0.78	0.645	0.09		5.1	3.295	1.805
11/01/2023 10:02:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.074	0.081	0.005	0.2036		0.023	0.015	0.003		0.004	0.0035	0.0035		0.039	0.042	0.0355		0.36	0.435	0.125		3.12	4.11	1.805
16/02/2023 12:49:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid	<	0.005	0.081	0.005	0.2036	<	0.002	0.015	0.003	<	0.001	0.0035	0.0035		0.007	0.042	0.0355		0.14	0.435	0.15		0.9	4.11	1.805
15/03/2023 13:30:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.146	0.117	0.005	0.2123		0.02	0.019	0.003		0.035	0.01	0.0035		0.046	0.0425	0.036		0.36	0.435	0.2		6.36	5.73	1.845
12/04/2023 10:30:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid	<	0.005	0.11	0.005	0.2123		0.022	0.021	0.003		0.001	0.01	0.003		0.005	0.0425	0.036		0.14	0.36	0.15		2.0	4.11	1.925
24/05/2023 11:39:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.04	0.057	0.005	0.2123		0.016	0.018	0.003		0.002	0.003	0.003	<	0.005	0.023	0.036		0.25	0.305	0.2		3.78	3.45	1.925
21/06/2023 11:28:00	SPAMY05	SPAMY05 MYRMIDON CREEK OUTFALL 05	Valid		0.241	0.057	0.005	0.23845		0.019	0.0195	0.003		0.015	0.003	0.003		0.068	0.023	0.036		0.62	0.305	0.205		2.9	3.01	2.05
06/07/2022 12:18:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.005	0.005	0.0097	<	0.003	0.003	0.003		0.004	0.004	0.004		0.05	0.0305	0.0325		0.45	0.205	0.14		0.72	1.795	1.545
03/08/2022 11:20:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.005	0.005	0.00785	<	0.003	0.003	0.003	<	0.003	0.004	0.004		0.022	0.0295	0.0315		0.08	0.08	0.14		0.52	1.315	1.545
01/09/2022 11:06:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.005	0.005	0.00785	<	0.003	0.003	0.003	<	0.003	0.004	0.004		0.035	0.0305	0.0315		0.08	0.08	0.11		1.1	1.105	1.545
17/10/2022 13:30:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid		0.069	0.0055	0.005	0.0097		0.01	0.003	0.003		0.002	0.0035	0.004		0.035	0.0325	0.0315		0.3	0.08	0.11		3.86	1.105	1.545
16/11/2022 12:02:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid		0.025	0.0055	0.005	0.02275		0.016	0.003	0.003	<	0.001	0.003	0.004		0.019	0.0285	0.0315		0.27	0.175	0.11		5.05	1.105	1.545
15/12/2022 10:45:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.005	0.005	0.02275	<	0.002	0.003	0.003		0.001	0.0025	0.0035		0.019	0.0285	0.0305		0.11	0.19	0.115		2.39	1.745	1.545
11/01/2023 10:07:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid		0.008	0.0065	0.005	0.02275		0.013	0.0065	0.003	<	0.001	0.0015	0.0035		0.01	0.0205	0.0295		0.19	0.15	0.155		4.0	3.125	1.545
16/02/2023 12:56:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.0065	0.005	0.02275		0.008	0.009	0.003	<	0.001	0.001	0.0035		0.006	0.019	0.0295		0.13	0.16	0.16		0.83	3.125	1.545
15/03/2023 13:30:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.0065	0.005	0.02275		0.011	0.0105	0.003		0.005	0.001	0.0035		0.011	0.015	0.0295		0.15	0.17	0.17		4.21	3.93	1.73
12/04/2023 10:46:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.005	0.005	0.02275		0.018	0.012	0.003	<	0.001	0.001	0.003		0.007	0.0105	0.028		0.12	0.14	0.14		2.1	3.195	1.955
24/05/2023 11:45:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid	<	0.005	0.005	0.005	0.02275		0.01	0.0105	0.003		0.002	0.001	0.003	<	0.005	0.0085	0.026		0.18	0.14	0.14		2.98	2.685	1.98
21/06/2023 11:38:00	SPAMY06	SPAMY06 MYRMIDON CREEK OUTFALL 06	Valid		0.009	0.005	0.005	0.02275		0.006	0.0105	0.003		0.006	0.0015	0.003		0.021	0.0085	0.0235		0.16	0.155	0.14		2.7	2.84	2.08
06/07/2022 11:46:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.005	0.005	0.005	0.04015	<	0.003	0.003	0.003	<	0.003	0.0035	0.004		0.036	0.036	0.0375		0.32	0.2	0.145		1.13	2.14	2.47
03/08/2022 10:52:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.005	0.005	0.005	0.04015	<	0.003	0.003	0.003	<	0.003	0.003	0.004		0.019	0.0315	0.0375		0.08	0.08	0.145		0.99	1.48	2.47
01/09/2022 10:44:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.005	0.005	0.005	0.04015	<	0.003	0.003	0.003	<	0.003	0.003	0.0035		0.031	0.0335	0.036		0.08	0.08	0.135		0.84	1.26	2.47
17/10/2022 13:30:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.01	0.0065	0.005	0.04015		0.027	0.003	0.003	<	0.001	0.003	0.003		0.043	0.0335	0.036		0.4	0.08	0.155		3.37	1.35	2.595
16/11/2022 11:37:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid		0.148	0.0075	0.005	0.06085		0.045	0.003	0.003		0.011	0.003	0.0035		0.091	0.0335	0.038		0.71	0.2	0.185		7.82	1.92	2.79
15/12/2022 10:08:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid		0.128	0.0075	0.005	0.1184		0.022	0.0125	0.003		0.035	0.003	0.0035		0.047	0.0395	0.038		0.42	0.36	0.185		2.05	1.59	2.535
11/01/2023 09:29:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.01	0.01	0.005	0.1184		0.012	0.017	0.003		0.002	0.003	0.0035		0.03	0.037	0.036		0.33	0.365	0.215		3.84	2.71	2.535
16/02/2023 12:05:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.005	0.01	0.005	0.1184	<	0.002	0.017	0.003	<	0.001	0.0025	0.0035		0.009	0.037	0.036		0.16	0.365	0.19		1.71	2.71	2.535
15/03/2023 13:30:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid		0.05	0.03	0.006	0.1184		0.021	0.0215	0.003		0.008	0.005	0.0035		0.011	0.0365	0.036		0.23	0.365	0.19		4.77	3.605	2.79
12/04/2023 10:05:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.005	0.03	0.005	0.1184		0.019	0.02	0.003		0.002	0.005	0.003		0.009	0.0205	0.0335		0.13	0.28	0.16		1.8	2.945	2.535
24/05/2023 11:19:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid		0.006	0.008	0.005	0.1184		0.011	0.0155	0.003		0.001	0.002	0.003	<	0.005	0.01	0.031		0.19	0.21	0.16		4.24	2.945	2.535
21/06/2023 11:00:00	SPAMY07	SPAMY07 MYRMIDON CREEK OUTFALL 07	Valid	<	0.005	0.0055	0.005	0.1184		0.014	0.013	0.003		0.003	0.002	0.003		0.035	0.01	0.033		0.25	0.21	0.175		2.7	3.27	2.705
06/07/2022 10:31:29	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		29.7	N/A				0.01	N/A			0.017	N/A			6.1	N/A			45.21	N/A			113.0	N/A	
03/08/2022 09:43:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		36.4				<	0.06				4.12				6.68				48.66				364.0		
01/09/2022 09:05:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		37.6					0.024				3.61				7.44				50.72				223.0		
17/10/2022 13:30:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		30.0				<	0.04				3.17				7.42				45.6				609.0		
16/11/2022 09:21:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		26.9					0.018				0.047				9.21				33.5				647.0		
15/12/2022 09:20:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		19.5					0.009				3.1				4.73				32.1				642.0		
10/01/2023 23:40:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		11.7					0.024				1.03				1.98				16.2				0.182		
16/02/2023 17:40:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		18.3					0.022				0.024				3.24				28.0				572.0		
15/03/2023 13:30:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		13.3					0.018				1.73				2.75				16.9				388.0		
12/04/2023 10:09:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		20.0					0.02				0.021				3.25				25.3				300.0		
24/05/2023 09:51:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		26.9					0.008				0.589				10.3				37.8				230.0		
21/06/2023 09:43:00	SPAMYDP	SPAMYDP FINAL OUTLET	Valid		23.7					0.03				0.43				6.01				40.2				260.0		

Table 4: Myrmidon Creek Nutrient and Chlorophyll-a assessment Table 2022 - 2023

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