Derwent Estuary Program Stormwater Monitoring

Final Report

Derwent Estuary Program

The Derwent Estuary Program pays respect to the traditional and original owners of this land and acknowledge today's Tasmanian Aboriginal people as the continuing custodians.

The Derwent Estuary Program (DEP) is a regional partnership between local governments, the Tasmanian State Government, businesses, scientists, and community-based groups to share science for the benefit of our estuary. The DEP was established in 1999 and has been nationally recognised for excellence in coordinating initiatives to reduce water pollution, conserve habitats and species, monitor river health and promote greater use and enjoyment of the foreshore.

Our major sponsors include Brighton, Clarence, Derwent Valley, Glenorchy, Hobart and Kingborough councils, the Tasmanian State Government, TasWater, Tasmanian Ports Corporation, Boyer, Nyrstar Hobart Smelter, Hydro Tasmania, EPA Tasmania and NRM South.

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1 EXECUTIVE SUMMARY

The Derwent Estuary Program (DEP), with funding by the Australian Government's Urban Rivers and Catchments Program, conducted a comprehensive stormwater monitoring initiative from June 2024 to May 2025. This study aimed to assess current contaminant levels across 35 sites in the Greater Derwent Estuary, building on previous monitoring efforts from 2002–2005 and 2010–2011.

Stormwater in Hobart's urban catchments often enters the River Derwent untreated, carrying pollutants that degrade water quality and aquatic habitats. The 2024 - 25 program focused on key indicators such as turbidity, total suspended solids (TSS), nutrients (nitrogen and phosphorus), and faecal bacteria (Enterococci and E. coli), aligning with both stormwater treatment guidelines and public health monitoring.

Key findings include:

- Urban catchments, particularly those under active development, showed the highest pollutant levels, especially sediment-related indicators like turbidity and TSS.
- Established urban areas (e.g., Hobart and Glenorchy CBDs) exhibited elevated nutrient and bacterial concentrations, likely linked to aging wastewater infrastructure.
- Natural or less disturbed sites had significantly lower pollutant loads, reinforcing the impact of land use on water quality.
- A Waterbug survey provided ecological context, revealing reduced biodiversity in areas with high sedimentation.
- A trial of ZiP Diagnostics' Bacteroides dorei rapid test confirmed human-specific faecal contamination in urban areas, offering a promising tool for source tracking.

The study highlights the urgent need for integrated planning that balances environmental protection with urban development.

Recommendations include:

- Strengthening sediment control practices in construction zones.
- Enhancing regulatory frameworks and compliance monitoring.
- Expanding community education and contractor training.
- Supporting further research into cost-effective pollutant monitoring, especially for metals and hydrocarbons.

This program delivers a critical update on stormwater quality in the Derwent Estuary and provides a robust foundation for future policy, planning, and environmental management efforts.

2 INTRODUCTION

Stormwater is the runoff that flows across land surfaces following precipitation, carrying with it a variety of pollutants such as pathogens, nutrients, hydrocarbons, and heavy metals. In most urban catchments around Hobart, this water enters the River Derwent untreated, traveling through a network of kerbs, gutters, and pipes. When stormwater discharges into urban streams, it can also contribute to downstream flooding and erosion. These pollutants can significantly degrade water quality and aquatic habitats in the Derwent Estuary.

The Derwent Estuary receives stormwater from 57 urban and suburban catchments via 13 major rivulets and numerous large outlet pipes. Pollution sources include construction sites, roads, industrial and commercial areas, eroding stream banks, and occasional sewer leaks. The Derwent Estuary Program (DEP) has previously conducted stormwater monitoring during base flow conditions, targeting pollutants such as sediment, faecal bacteria, nutrients, and metals. Building on earlier studies from 2002–2005 and 2010–2011 (Milne, 2005; DEP, 2011), the current monitoring program expands both the temporal scope and site coverage across the estuary.

Funded by the Australian Government's Urban Rivers and Catchment Program (URCP), the DEP's 2024-2025 stormwater monitoring initiative aims to assess contaminant concentrations in Hobart's stormwater systems while enhancing the existing legacy dataset. Over a 12-month period (June 2024 – May 2025), the program monitored 35 sites across the estuary, encompassing upper, lower, urban, and rural catchments, captured in Map 1 and Table 1. Local councils and the DEP collected monthly aseptic grab samples to evaluate the current state of stormwater pollution.

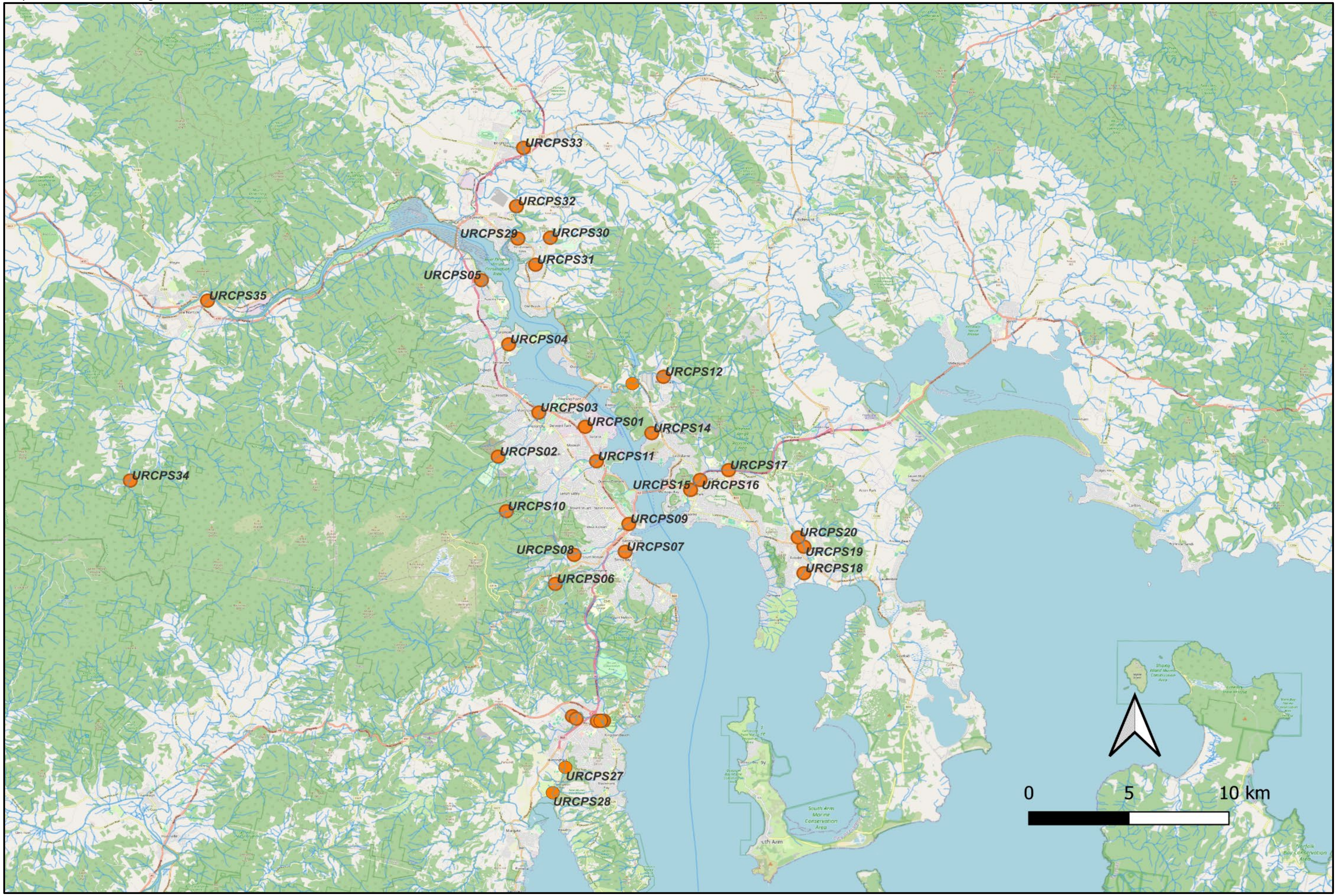
The selected analytes included turbidity, total suspended solids (TSS), total and dissolved nitrogen, total phosphorus, Enterococci, and E. coli. These were chosen due to their relevance to commonly used stormwater treatment devices in the region. The inclusion of Enterococci and E. coli also supports alignment with the DEP's Recreational Water Quality Program, which informs public health. Metals and hydrocarbons were excluded from this program due to the high cost of analysing samples across multiple sites. Additionally, the method used to collect water samples (grab sampling) may not be ideal for detecting metals, given their low concentrations in the water column and the limitations of laboratory detection. Contaminants, including metals, are often found at significantly higher concentrations in sediments due to their tendency to bind with particulate matter. Therefore, a dedicated study focusing on sediment analysis may be considered in the future.

Table 1 – Breakdown of Stormwater Monitoring sites sampled monthly between June 2024 and May 2025

Council	Site ID	Site Location
Glenorchy City Council	URCPS01	Prince of Wales Bay Outfall

	URCPS02	Humphreys Rivulet upper site
	URCPS03	Humphreys Rivulet lower site
	URCPS04	Faulkner's Rivulet lower site
	URCPS05	Goulds Lagoon
Hobart City Council	URCPS06	Sandy Bay Rivulet upper site
	URCPS07	Sandy Bay Rivulet lower site
	URCPS08	Hobart Rivulet 5m below tip SW outfall
	URCPS09	Hobart Rivulet lower site
	URCPS10	New Town Rivulet upper site
	URCPS11	New Town Rivulet lower site
Clarence City Council	URCPS12	Risdon Creek upper site
	URCPS13	Risdon Creek lower site
	URCPS14	Faggs Creek
	URCPS15	Kangaroo Bay lower site
	URCPS16	Kangaroo Bay mid site
	URCPS17	Kangaroo Bay upper site
	URCPS18	Clarence Plains Rivulet lower site
	URCPS19	Clarence Plains Rivulet mid site
	URCPS20	Clarence Plains Rivulet upper site
Kingborough Council	URCPS21	Kingston Rivulet
	URCPS22	Whitewater Creek 1
	URCPS23	Browns River
	URCPS24	Whitewater Creek 2
	URCPS25	Whitewater creek 3
	URCPS26	Kingston Wetlands
	URCPS27	Coffee Creek lower site
	URCPS28	Coffee Creek upper site
Brighton Council	URCPS29	Cove Creek lower site
	URCPS30	Cove Creek upper site
	URCPS31	Tivoli Green Wetlands
	URCPS32	Jordan River lower site
	URCPS33	Jordan River upper site
Derwent Valley Council	URCPS34	Lachlan River upper site
	URCPS35	Lachlan River lower site

Map1: URCP Monitoring Sites 2024-25



Building on the previous studies undertaken by the DEP, rainfall conditions were recorded for each monitoring event as the intention was to monitor these pollutants under base flow condition. Rainfall data was collected from three gauges (Hobart, Kingston, New Norfolk) before a geomean of each sample event was taken, highlighted the average rainfall that fell across the wider region. Average rainfall data from the three gauges for the 24 hours prior to monitoring was used to determine conditions under which sampling occurred. These are described below:

- Base flow – No rainfall in the 24 hours prior to monitoring
- Moderate flow – 0-10mm rainfall in the 24 hours prior to monitoring
- Storm event – More than 10mm rainfall in the 24 hours prior to monitoring

Of the twelve monitoring events, one occurred during storm flow, one occurred during moderate flow and ten occurred during base flow conditions.

This report aims to characterise the results of the 2024-25 stormwater sampling program, assessing their implications for both local catchments and the broader Derwent Estuary. By integrating current findings with historical data from previous DEP studies (2002–05 and 2010-11), the report provides a valuable perspective on long-term trends in stormwater pollution. This estuary-wide overview sets the foundation for understanding how water quality has evolved over time and highlights the importance of continued monitoring to inform effective environmental management.

3 2024 – 2025 REPORT CARD

The results of the 2024–2025 Stormwater Monitoring Program are presented in Figure 1. This "report card" format has been used previously in DEP programs conducted between 2002–2005 and in 2010-2011.

A key update in this report is the adoption of the Tasmanian EPA's default guideline values (DGVs) for the Derwent Estuary/Bruny Catchment (EPA Tasmania, 2021), replacing the previously used ANZECC (ANZECC, 2000) guidelines. These DGVs are based on the 80th percentile of monitoring data, and this same statistical approach has been applied to each site in the current program.

The report card includes results for the following analytes:

- **Turbidity**
- **Total Suspended Solids (TSS)**
- **Total Phosphorus**
- **Total Nitrogen**

In addition, **Enterococci** levels are assessed using the Poor Water Quality category from the Tasmanian Recreational Water Quality Guidelines (DoH, 2007). This is based on the geometric mean of the collected sample results. Site data for E Coli and Dissolved Nitrogen were not included as part of this report card as there is currently no appropriate metric to assess these results.

Each site was awarded a point for each parameter that was within the analytes reference value (either the DGV value or Rec water 'poor threshold'). Where a parameter was within +/- 10% of the reference value, 0.5 points were awarded for that analyte. The maximum score available was 5/5 – indicating all assessed parameters at the site were within the range specified by the reference value. This scoring system is closely aligned to the system used in previous DEP Stormwater monitoring programs.

Please note for sites that have been duplicated from the previous monitoring programs an additional score based upon the previous ANZECC (ANZECC, 2000) has also been generated to allow comparisons between monitoring periods.

Figure (1) - 2024 – 2025 Report Card

		Water Clarity		Nutrients		Faecal Bacteria				
Site	Site ID	Total suspended solids	Turbidity	Total Nitrogen	Total Phosphorous	Enterococci *	TAS EPA Score	ANZECC Score **	2010 – 2011 Score ^	2002 – 2005 Score ^
ANZECC ** Reference Value		5 mg/L	25 (NTU)	0.5 mg/L	0.05 mg/L	230 MPN/100mL				
TAS EPA Reference Value		11 mg/L	5.6 (NTU)	0.67 mg/L	0.02 mg/L	500 MPN/100mL				
Upper Rivulet Sites										
Humphreys Rivulet ^	URCPS02	6	5	0.33	0.01	134	5/5	4/5	4/5	5/5
Sandy Bay Rivulet ^	URCPS06	19	3.6	1.09	0.02	121	3/5	3/5	3/5	4/5
Hobart Rivulet ^	URCPS08	11.4	7.8	0.76	0.05	1100	0.5/5	2/5	4.5/5	5/5
New Town Rivulet ^	URCPS10	6	3.2	0.21	0.01	418	5/5	3/5	5/5	5/5
Risdon Creek	URCPS12	80.4	54	3.20	0.17	1465	0/5			
Kangaroo Bay Rivulet ^	URCPS17	8.8	14	1.99	0.11	492	1.5/5	1/5	1.5/5	2/5
Clarence Plains Rivulet ^	URCPS20	30	20.9	5.16	0.13	1638	0/5	1/5	1/5	4/5
Coffee Creek	URCPS28	19.6	14.4	1.0	0.11	154	1/5			
Cove Creek ^	URCPS30	340	154	2.38	0.23	1585	0/5	0/5	0/5	1.5/5
Jordan River	URCPS33	17.2	8.1	1.84	0.08	917	0/5			
Lachlan River ^	URCPS34	4	2.1	0.22	0.01	110	5/5	5/5	5/5	-
Middle Rivulet Sites										
Kangaroo Bay Rivulet	URCPS16	14.2	13.6	2.2	0.09	703	0/5			
Clarence Plains Rivulet	URCPS19	53.8	43.2	3.8	0.12	1004	0/5			
Whitewater Creek – UF	URCPS24	20.4	16.6	1.5	0.15	1993	0/5			
Whitewater Creek - LF	URCPS25	48.2	30.4	1.6	0.09	825	0/5			
Lower Rivulet Sites										
Prince of Wales Bay	URCPS01	10	9.7	3.18	0.21	3887	1/5			
Humphreys Rivulet ^	URCPS03	10	4.8	0.49	0.01	611	4/5	4/5	3/5	3/5
Faulkner's Rivulet ^	URCPS04	12.8	10.8	1.58	0.06	1184	0/5	1.5/5	1.5/5	2/5
Sandy Bay Rivulet ^	URCPS07	24.6	16.2	3.26	0.17	1157	0/5	1/5	2/5	2.5/5
Hobart Rivulet ^	URCPS09	12	9	1.54	0.12	1436	0.5/5	1/5	1/5	
New Town Rivulet ^	URCPS11	5.4	3.92	0.65	0.01	1044	4/5	3/5	2/5	4.5/5
Risdon Creek	URCPS13	37	39	1.69	0.07	286	1/5			
Faggs Creek	URCPS14	69.6	63.8	6.24	0.26	2638	0/5			
Kangaroo Bay Rivulet ^	URCPS15	15.6	12.9	2.03	0.10	1013	0/5	1/5	0/5	1.5/5
Clarence Plains Rivulet ^	URCPS18	17	11.6	1.21	0.11	1978	0/5	1/5	2/5	1/5
Kingston Rivulet ^	URCPS21	24.6	19	1.71	0.09	1214	0/5	1/5	0/5	0/5
Whitewater Creek	URCPS22	43.8	48.6	1.29	0.09	1100	0/5	0/5	0/5	0.5/5

Browns River ^	URCPS23	8.8	5.8	0.41	0.02	906	3.5/5	3/5	2.5/5	4/5
Coffee Creek	URCPS27	21.2	19	0.94	0.07	473	1/5			
Cove Creek ^	URCPS29	57.8	33.2	11.9	0.18	436	1/5	0/5	1/5	
Jordan River	URCPS32	7.6	4.8	1.38	0.08	467	3/5			
Lachlan River ^	URCPS35	7.8	4.1	0.32	0.01	210	5/5	4/5	5/5	4/5
Wetland Sites										
Goulds Lagoon	URCPS05	106.8	71.6	3.3	0.37	1078	0/5			
Kingston Wetlands	URCPS26	25.8	11.1	1.1	0.07	246	1/5			
Tivoli Green Wetland	URCPS31	198	80.8	6.1	0.48	1247	0/5			

Key	
(green)	Water Quality Score improved from previous monitoring
(red)	Water Quality Score declined from previous monitoring
(orange)	Site failed to meet any Tasmanian EPA DGV Thresholds

^ Highlights when sites have been previously monitored by the Derwent Estuary Program in either 2002/2005 & 2010/2011 and there corresponding report card score

* Enterococci reference values are based on the geometric mean of the 2024/2025 monitoring data and are used for comparison with previous monitoring programs. The Hazen percentile has not been included due to the limited number of data points.

**ANZECC score for 2024/2025 monitoring sites generated if site has been previously monitored, allowing for long term comparison. Score is based upon the previous ANZECC guideline values (ANZECC, 2000)

4 2024 – 2025 URCP STORMWATER AND RIVULET MONITORING RESULTS

The following section outlines the findings from the water quality monitoring program conducted under the Urban Rivers and Catchments Program (URCP) stormwater monitoring program. This program aimed to assess the baseline water quality conditions across the Derwent Estuary, with sampling carried out over a 12-month period from June 2024 to May 2025. A total of 35 monitoring sites were selected to provide spatial coverage across the estuary, with sampling events primarily targeting base flow conditions to capture representative water quality data unaffected by stormwater surges.

During the monitoring period, seven key water quality analytes were measured to evaluate the ecological health, and potential pollutant loads at each site. These analytes included:

- Total Suspended Solids (TSS): Indicative of particulate matter in the water, which can affect light penetration and aquatic habitats.
- Turbidity: A measure of water clarity, closely linked to TSS and often used as a proxy for sediment and pollutant transport.
- Total Nitrogen (TN) and Dissolved Nitrogen (Nitrate and Nitrite): Nutrient indicators that can contribute to eutrophication and algal blooms if present in excess.
- Total Phosphorus (TP): Another key nutrient that, in elevated concentrations, can exacerbate eutrophic conditions.
- Enterococci: A microbial indicator used to assess the presence of faecal contamination and potential public health risks.
- E. coli: Added to the monitoring profile in July 2024, this bacterium serves as a complementary faecal indicator, particularly relevant for recreational water quality assessments.

For each analyte, the 80th percentile concentration was calculated for every site. This statistical measure was chosen as it reflects current best practice for deriving Default Guideline Values (DGVs), offering a robust method for assessing typical water quality conditions while minimizing the influence of outliers. These percentile values were then compared with both the Tasmanian EPA (EPA Tasmania, 2021) Default Guideline Values and the legacy ANZECC (ANZECC, 2000) guidelines to evaluate compliance and identify potential areas of concern.

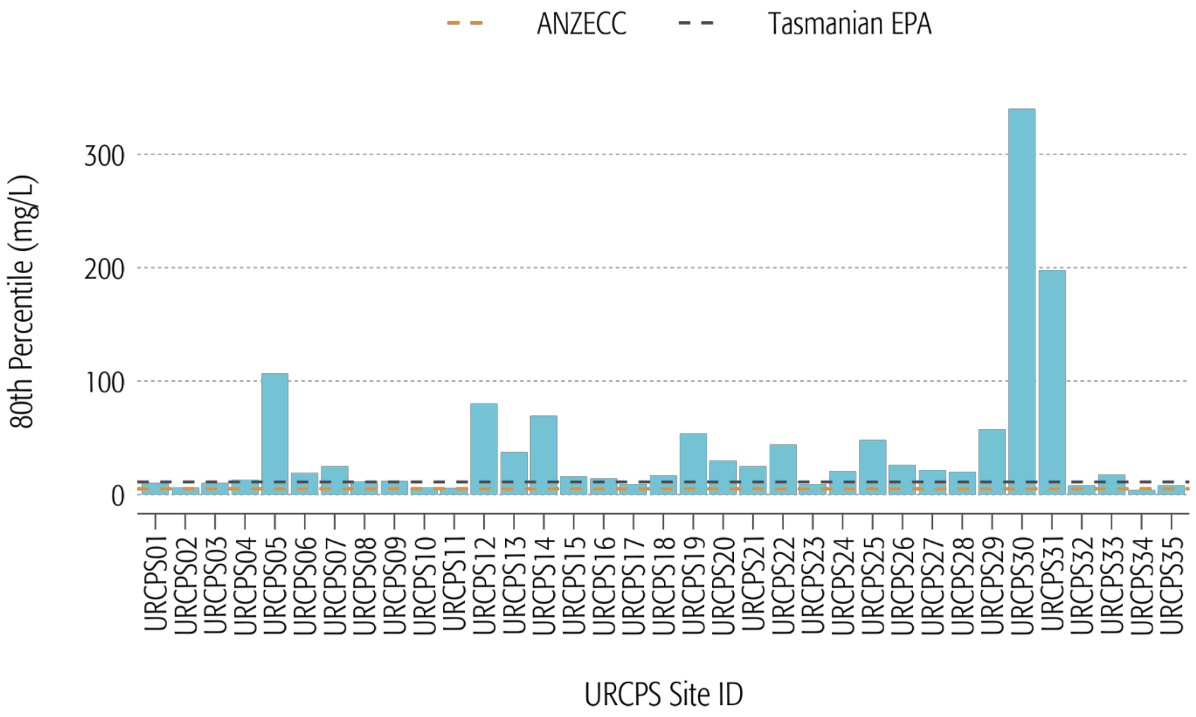
Preliminary analysis suggests that while many sites fall within acceptable ranges, some exhibit elevated concentrations for specific analytes, indicating localised pollution sources or catchment influences. Based on these findings, it has been proposed that broader, site-specific reference values may be more appropriate for future assessments. These proposed values, along with the rationale for their development, are discussed in detail in Section 6.

4.1 Water Clarity

To assess water clarity throughout the program, two key indicators were utilised: Total Suspended Solids (TSS) and turbidity. These parameters were selected due to their effectiveness in reflecting the concentration of particulate matter and the optical transparency of water, respectively. Sampling and analysis were conducted monthly at all designated monitoring sites, ensuring consistent temporal coverage and enabling the detection of seasonal or site-specific variations in water clarity.

Total Suspended Solids (TSS) for most sites follow the expected trend, with upper sites showing more favourable results compared to lower sites. Typically, this is driven by an increase in potential sources of TSS, such as sediment runoff, agricultural activities, and urban development, as you move further down the catchment. These sources contribute to higher concentrations of suspended particles in the water, leading to increased TSS levels at lower sites.

Figure (2) – Total Suspended Solids 80th percentile for 2024 – 2025 monitoring sites. ANZECC (2000) and Tasmanian EPA (2021) Default Guideline Values displayed on plot for comparison.

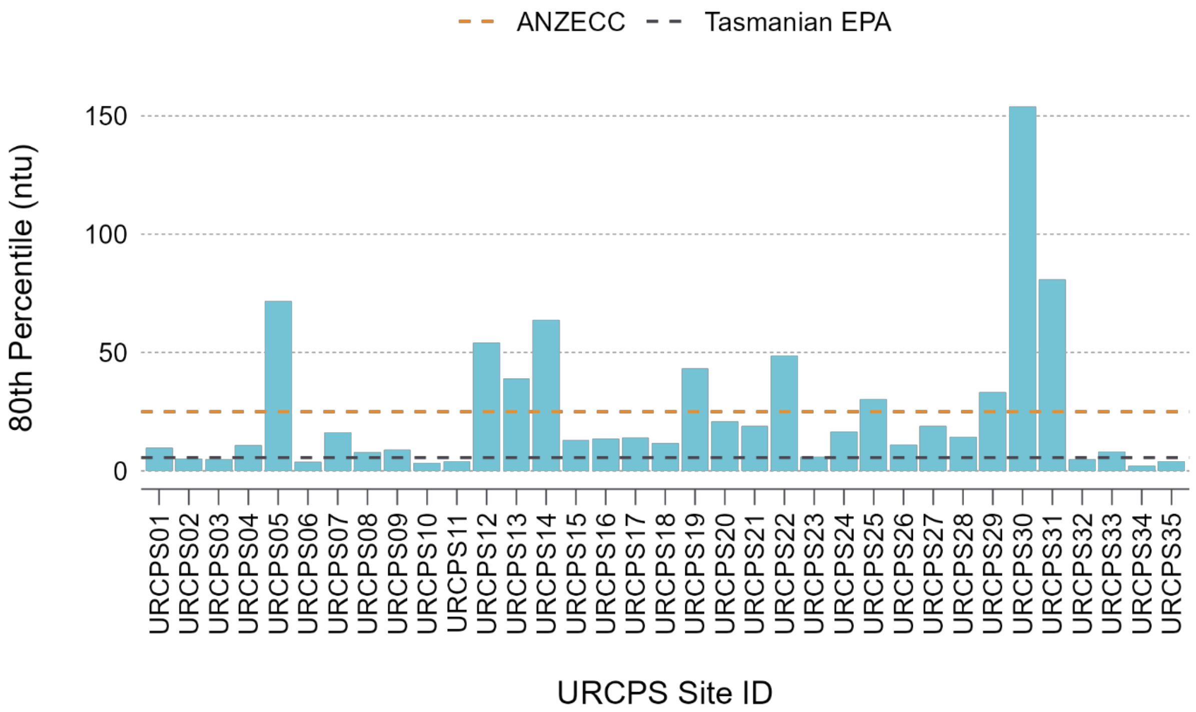


However, this trend differs for a few sites, namely Risdon Creek (URCPS12 & 13), Cove Creek (URCPS29 & 30), Faggs Creek (URCPS14), and Jordan River (URCPS32 & 33), where the TSS levels are higher at the upper sites likely driven by their dominant land use or nearby development. When assessed against both the previous ANZECC DGV (<5 mg/L) and the Tasmanian EPA DGV (11 mg/L), we note that many results exceed the ANZECC DGV while remaining compliant with the new Tasmanian DGV. The Tivoli Green Wetland (URCPS31) also experienced high TSS likely in part due to the current development occurring with the new development. Specifically, the previous ANZECC guidelines is more stringent, leading to more frequent exceedances. However, anomalies exist at New Town Rivulet and the Lachlan River, where both sites remain compliant under all conditions, indicating better water quality at these locations.

In contrast, sites on Cove Creek and Risdon Creek exceed both DGV thresholds, highlighting significant water quality issues at these locations.

Turbidity for most sites follows the expected trend, with upper sites showing more favourable results compared to lower sites. Typically, this is driven by an increase in potential sources of turbidity, such as sediment runoff, agricultural activities, and urban development, as you move further down the catchment. Like TSS turbidity is a crucial indicator in determining water clarity of the waterway.

Figure (3) – Turbidity 80th percentile for 2024 – 2025 monitoring sites. ANZECC (2000) and Tasmanian EPA (2021) Default Guideline Values displayed on plot for comparison.



Like sites with high TSS results, turbidity follows the same expected trends with Risdon Creek (URCPS12 & 13), Cove Creek (URCPS29 & 30), Faggs Creek (URCPS14), and Jordan River (URCPS32 & 33) all seeing high results. This is reflected in the results being significantly higher than both reference datasets. Furthermore, when assessed against both the previous ANZECC DGV (<25 NTU) and the Tasmanian EPA DGV (5.6 NTU), we note that many results exceed the Tasmanian DGV. Specifically, the Tasmanian DGV is more stringent, leading to more frequent exceedances. However, anomalies exist for both values at New Town Rivulet, Humphrey's Rivulet and Lachlan River, where results remain compliant under all conditions, indicating better water quality at these locations.

Of particular concern is Cove Creek due to the high turbidity and TSS results due in part due to the presence of dispersive soils within the catchment. The impact of a large area of exposed and erosion prone agricultural land in the upper catchment is perhaps one cause of this.

Overall elevated TSS and Turbidity results across the study area suggest that sediment pollution continues to have an impact on waterway health and the Derwent Estuary more broadly. Continued work targeting sediment is crucial in ensuring best practice management and improved waterway health will continue to be a focus for the DEP and partners.

4.2 Bacteriological water quality

Bacteriological water quality is a fundamental indicator of recreational water safety, particularly in urban coastal regions like Hobart, where there is many popular swimming sites close to the city. Monitoring this aspect of water quality is essential for safeguarding public health and ensuring that these sites remain suitable for recreational activities such as swimming, kayaking, and other water-based leisure.

In Australia, enterococci are the primary bacteriological indicator used to assess recreational water quality. This organism is favoured due to its strong correlation with gastrointestinal illness risk in marine and estuarine environments. Its presence typically indicates faecal contamination, which may originate from stormwater runoff, sewage overflows, or other point and non-point sources. Therefore, its inclusion in water quality monitoring programs is critical for providing accurate public health advice.

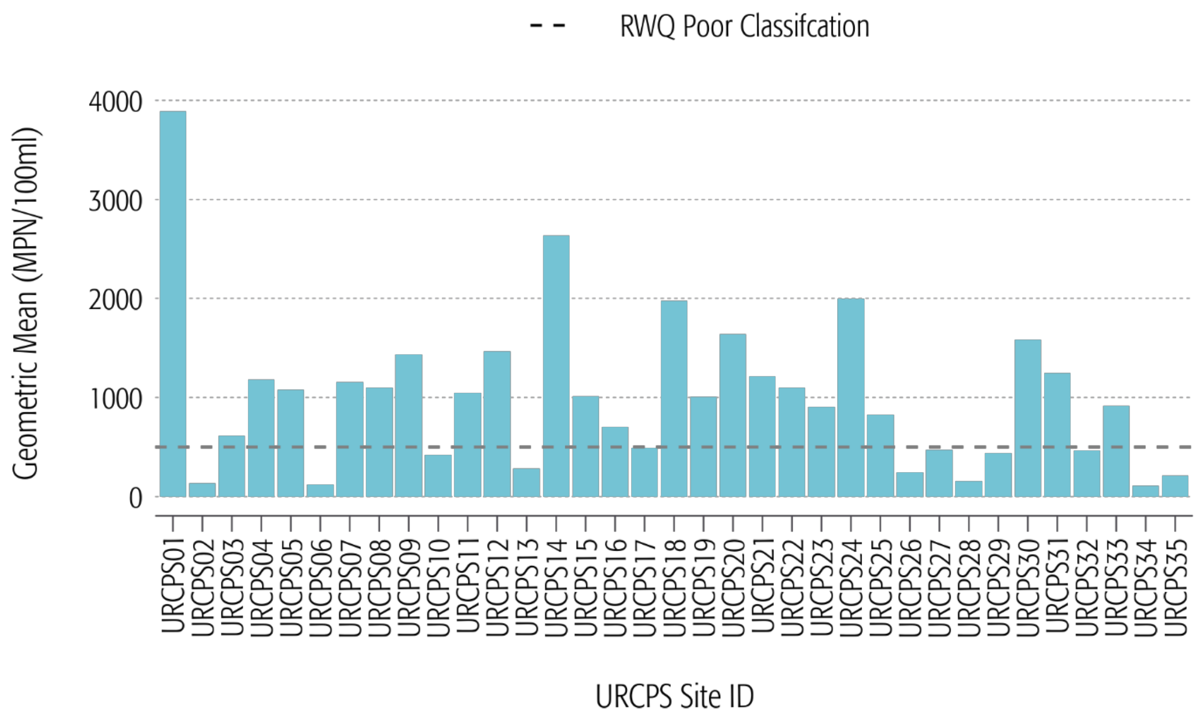
In response to recommendations from the Derwent Estuary Program's Stormwater Taskforce, Escherichia coli (E. coli) was added to the sampling program in July 2024. While enterococci are more suitable for saline environments, E. coli is commonly used in freshwater assessments. Including both indicators allows for a more comprehensive understanding of contamination sources and enhances the robustness of the analysis, especially in transitional zones where salinity may vary.

The analytical approach for bacteriological water quality involves calculating the geometric mean and assessing the 80th percentile of sample results. This method accounts for the high variability often observed in microbial data, which can fluctuate significantly due to environmental conditions and episodic pollution events. The geometric mean provides a central tendency that minimizes the influence of extreme values, while the 80th percentile helps identify elevated concentrations that may pose health risks. With a larger dataset, the Hazen percentile method could be employed to further refine the analysis and align it with national RWQ reporting standards.

Enterococci results were evaluated against the Tasmanian Recreational Water Quality Guidelines (Department of Health, 2007), specifically the 'poor' classification threshold of >500 MPN/100ml. This threshold is commonly used to determine whether water is safe for recreational use. As anticipated, the majority of sites exceeded this threshold, particularly those located in urban areas. This outcome reflects the influence of point source pollution, such as stormwater discharges and wastewater overflows, which are more prevalent in densely populated regions.

It is important to note that several external environmental factors were not assessed within the scope of this program. These include seasonal variations (e.g., rainfall patterns, temperature changes), weather events (e.g., heavy storms leading to runoff), and human activities (e.g., boating, shoreline development). Each of these can significantly impact bacteriological water quality and should be considered in future assessments to provide a more holistic understanding.

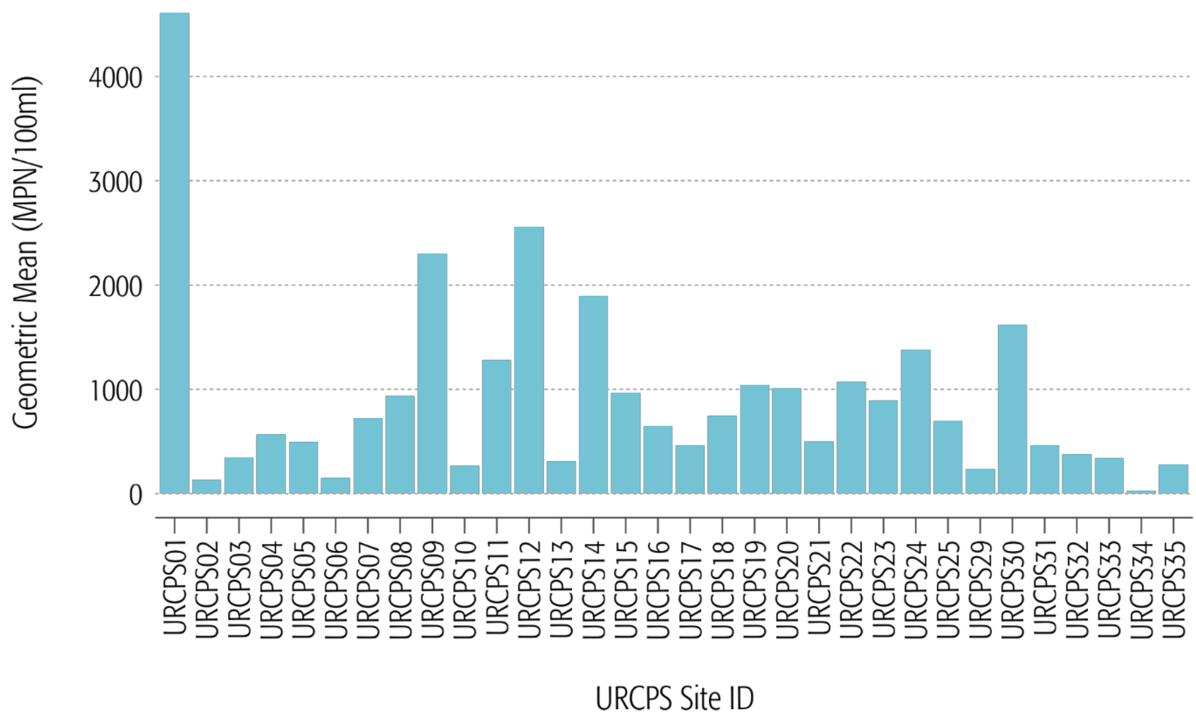
Figure (4) – Enterococci Geometric Mean for 2024 – 2025 monitoring sites. Poor water (>500 MPN) quality threshold from Tasmanian Recreational Water quality guideline.



Positively, sites located at the upper reaches of their respective catchments show lower mean Enterococci values, notably Humpherys Rivulet (URCPS02), Sandy Bay Rivulet (URCPS06), and Coffee Creek (URCPS28). This is likely due to the reduced number of potential pollution sources compared to more urbanised areas. The Lachlan River is the only waterway tested where both sites recorded mean values below the "poor" threshold, indicating water quality suitable for recreational use.

E. coli was a late addition to the monitoring program, introduced following consultation with the Derwent Estuary Program's Stormwater Taskforce as an additional indicator of bacterial water quality. However, there is currently no established metric for assessing E. coli in the context of stormwater use. Therefore, we will be echoing similar interpretations as those discussed for Enterococci results.

Figure (5) – E. Coli Geometric Mean for 2024 – 2025 monitoring sites.



Results from the E. coli analysis indicate trends similar to those observed for Enterococci, with significantly degraded water quality often found at urbanised, lower catchment sites. Of particular concern are the sites at Prince of Wales Bay (URCPS01), Hobart Rivulet (URCPS09), Risdon (URCPS12), and Faggs Creek (URCPS14), where E. coli levels were consistently elevated throughout the sampling period.

Conversely, sites with lower E. coli concentrations were typically located at the upper reaches of catchments, away from urban environments and their associated impacts.

Overall, the variability observed in both bacterial indicators suggests considerable volatility in interpreting results, especially when assessing trends across the entire sampling period. However, individual samples can be valuable for local source tracking of pollution, such as sewer spills or infiltration. This presents an opportunity for councils to conduct more detailed investigations within problematic catchments. Implementing source would enhance the effectiveness of mitigation strategies and support long-term improvements in water quality across Hobart's waterways.

4.3 Nutrients

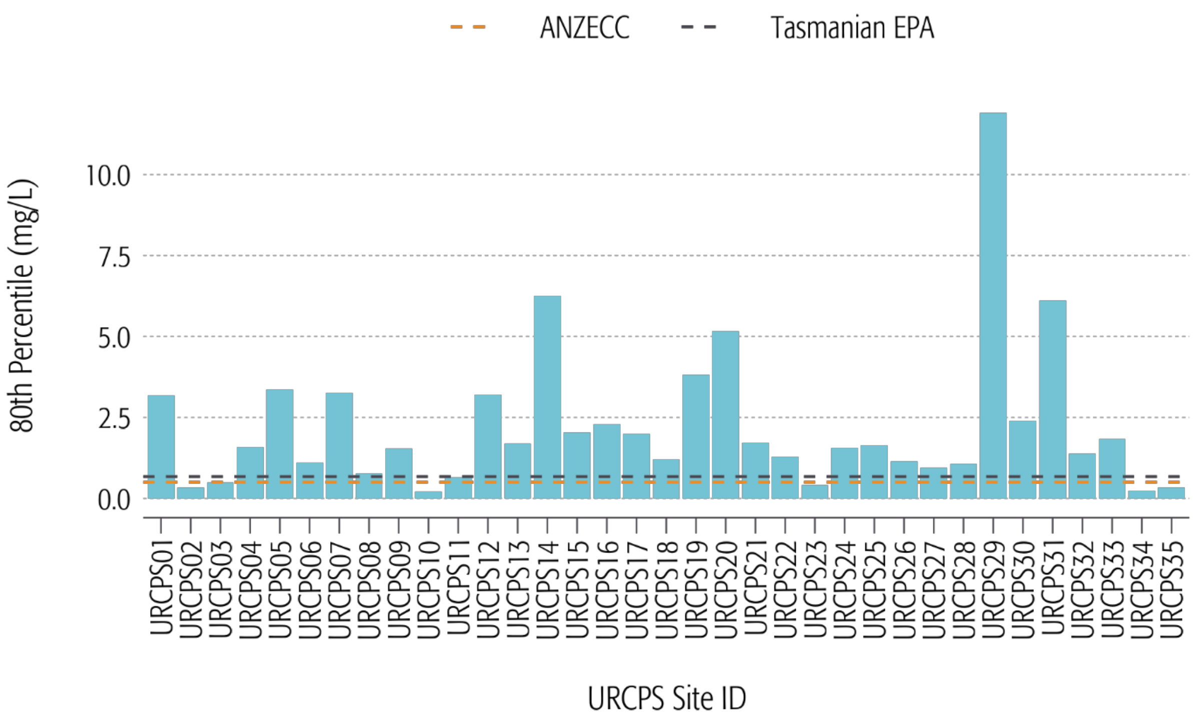
Total Nitrogen (TN), Total Phosphorus (TP), and Dissolved Nitrogen (Nitrate and Nitrite) were monitored monthly at all sampling sites to assess nutrient dynamics and overall water quality. These parameters are critical indicators of aquatic ecosystem health, as elevated concentrations can significantly disrupt ecological balance. Excessive nutrient loading–particularly nitrogen and phosphorus–can trigger eutrophication, a process where nutrient enrichment stimulates excessive algal growth. This often leads to nuisance algal blooms, including harmful algal species, which reduce light penetration, alter food webs, and upon decomposition, deplete dissolved oxygen levels in the water. This oxygen depletion, or hypoxia, can result in fish kills and long-term degradation of aquatic habitats.

Many stormwater treatment devices and water quality improvement systems claim to achieve up to 45% reduction in nutrient concentrations as part of their operational performance. However, verifying these claims in real-world conditions is challenging. The effectiveness of such devices can be influenced by site-specific factors, including upstream land use, existing pollution sources, hydrological variability, and maintenance practices. Without a clear understanding of these confounding variables, it is difficult to attribute observed reductions solely to the treatment systems.

Continued and consistent monitoring of TN, TP, and Nitrate and Nitrite is therefore essential. It not only helps in evaluating the true performance of mitigation measures but also provides early warning signs of nutrient enrichment that could lead to ecological disturbances. Long-term data collection supports adaptive management strategies and informs policy decisions aimed at protecting and restoring waterway health.

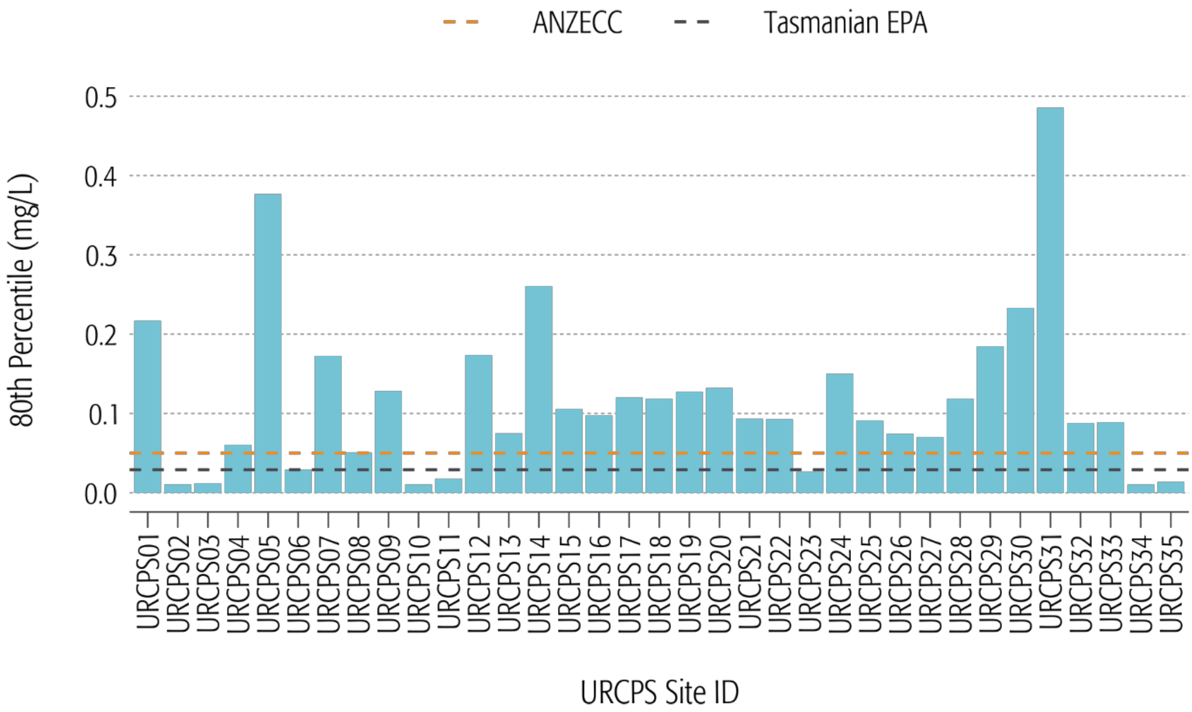
For Total Nitrogen we can assess the results using both the previous ANZECC DGV (<0.5 mg/L) and the Tasmanian EPA DGV (0.673 mg/L), with many results exceeding both reference values. However, specific outliers exist at Humphreys Rivulet (URCPS02 & URCPS03), New Town Rivulet Upper (URCPS10), Browns River (URCPS23) and Lachlan River (URCPS34 & URCPS35), where results are compliant with both DGV values. This suggests better water quality at these locations, potentially due to effective local water management practices or lower levels of pollution sources. The total nitrogen maximum was observed at the Cove Creek Upper site (URCPS29) which is below a nearby orchard.

Figure (6) – Total Nitrogen 80th percentile for 2024 – 2025 monitoring sites. ANZECC (2000) and Tasmanian EPA (2021) Default Guideline Values displayed on plot for comparison.



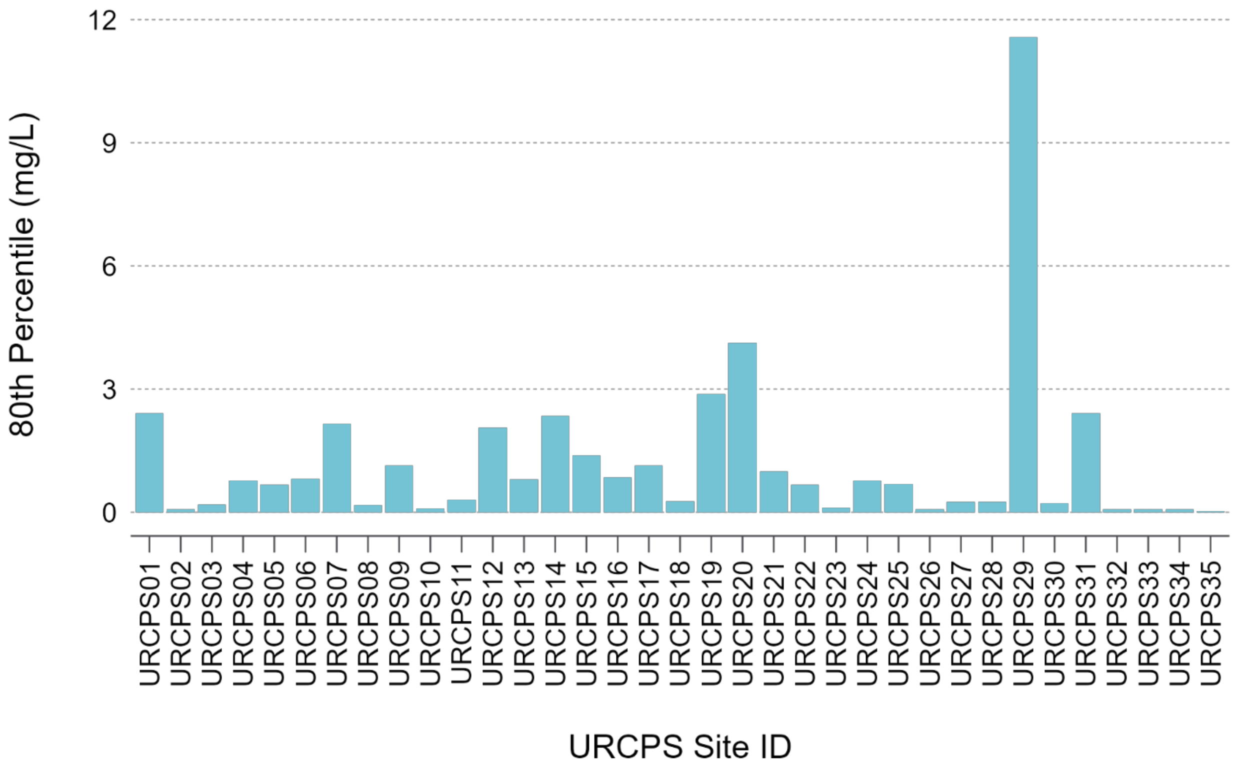
Total Phosphorous is another crucial nutrient indicator for waterway health with similar trends observed with Total Nitrogen. The majority of sites exceed both reference values including the previous ANZECC DGV (<0.05 mg/L) and the Tasmanian EPA DGV (0.029 mg/L). The exceptions to this are Humpherys Rivulet (URCPS02 & URCPS03), New Town Rivulet (URCPS10 & URCPS11), Browns River (URCPS23) and the Lachlan River (URCPS34 & URCPS35), where phosphorus concentrations are significantly lower, similar to the trends seen with total nitrogen. Like the maximum Total Nitrogen result, Cove Creek Upper (URCPS29) had the highest phosphorus value in the dataset.

Figure (7) – Total Phosphorous 80th percentile for 2024 – 2025 monitoring sites. ANZECC (2000) and Tasmanian EPA (2021) Default Guideline Values displayed on plot for comparison.



Finally, dissolved nitrogen–specifically nitrate and nitrite–serves as an additional tool for assessing the condition of these waterways, as it offers insight into the residual nutrient levels present in the water. Promisingly trends for dissolved nutrients follows what we have seen in total nitrogen where Humpherys Rivulet (URCPS02 & URCPS03), New Town Rivulet (URCPS10 & URCPS11), Browns River (URCPS23) and the Lachlan River (URCPS34 & URCPS35) observed lower 80th percentile values. Similarly, Cove Creek Upper (URCPS29) contained the Nitrate + Nitrite maximum suggesting localised nutrient pollution is a concern.

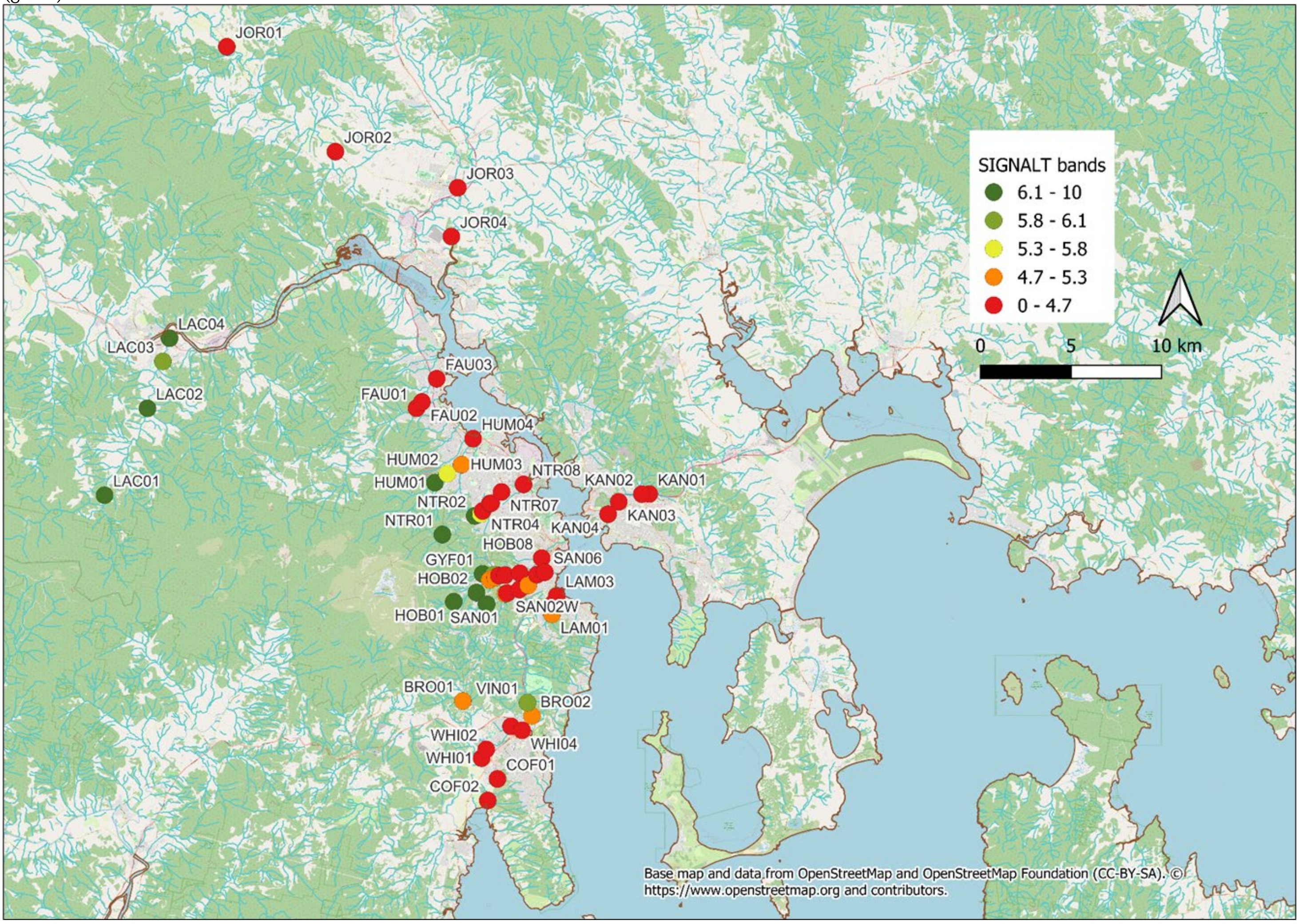
Figure (8) - Dissolved Nitrogen (Nitrate and Nitrite) for 2024 – 2025 monitoring sites.



4.4 Waterbug Survey

To complement the vast array of water quality information obtained throughout this program a survey of Waterbugs of 56 sites across the various tributaries entering the Derwent Estuary during spring 2024 was included. Samples allowed for the health of the waterway to be assessed using Waterbug data as they provide an insight into the waterway's long-term exposure to impacts such as pollution and sedimentation. The presence of more sensitive Waterbugs indicates lesser impacts, whereas sites populated only by "tolerant" organisms suggest impacted waters. Tolerant Waterbugs are those that have resilience to pollution, sediment and other impacts.

Map (2) - All 56 sites sampled as part of the Derwent Estuary tributaries Waterbug sampling project. Colours use weighted SIGNALT, higher scores (green) indicate sites in better condition.



Across both the water quality and Waterbug's data the following trends were observed.

- Quality declines across both metrics within the urban zone, with the most degraded sites typically being right before they enter the estuary.
- Sites within peri urban and rural use see trends in both metrics remain relatively stable throughout the catchment.
- Point sources and land use have the most profound effect on both metrics within any given catchment.

Further information regarding the Waterbug survey can be found in the supplementary report "Tributaries of the Derwent Estuary – Waterbug survey Spring 2024", prepared by John Gooderham, which can be found on our website.

5 COMPARISON WITH PREVIOUS DEP MONITORING RESULTS

The current report card provides an opportunity to compare recent water quality data with results from earlier monitoring programs conducted during 2002–2005 and 2010–2011. Of the sites included in the current assessment, 20 were also monitored in one or both previous programs. This overlap allows for a meaningful evaluation of long-term trends in water quality using the ANZECC guidelines as a benchmark.

Among these 20 repeat sites, the majority exhibited no significant change in water quality scores across the three monitoring periods, suggesting a degree of stability in those locations. However, seven sites showed a decline in water quality, indicating potential emerging pressures or degradation in catchment conditions. In contrast, five sites demonstrated improvements in water quality compared to earlier assessments. Notably, all five improving sites were located in the lower reaches of catchments that have experienced relatively little new development or land-use change since the last monitoring period. This suggests that catchment stability and limited urban expansion may be contributing factors to improved water quality outcomes.

As previously discussed, the data highlights change in water quality across the three sampling periods. The 2010–2011 monitoring cycle appears to represent a peak in contaminant levels, particularly for parameters such as turbidity (a measure of water clarity) and total nitrogen (a key nutrient indicator). This is clearly illustrated in Figures 9 and 10, where both parameters show elevated concentrations, likely reflecting increased runoff, erosion, or nutrient loading during that period.

Encouragingly, the most recent monitoring data show a general reduction in pollutant concentrations at many of the previously impacted sites. This downward trend suggests that some of the urban water management strategies implemented in recent years—such as improved stormwater treatment, riparian restoration, and catchment planning—may be beginning to yield positive results. While further monitoring is needed to confirm these trends and assess their long-term sustainability, the early signs are promising and highlight the importance of continued investment in integrated catchment and water quality management.

Figure (9) - Turbidity Geo Mean for selected sites across all monitoring periods. SW05 – DEP 2002/2005 Stormwater Monitoring. SW10 DEP 2010/2011 Stormwater Monitoring. URCP 2024/2025 Stormwater Monitoring.

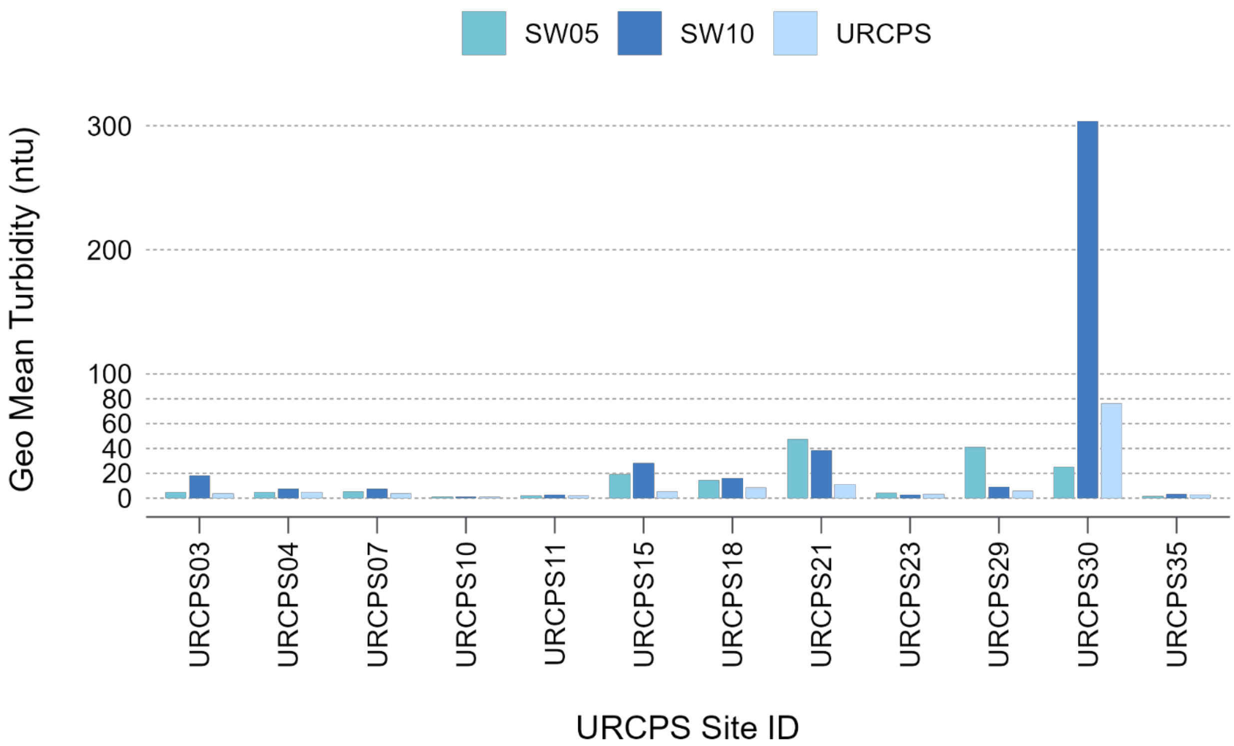
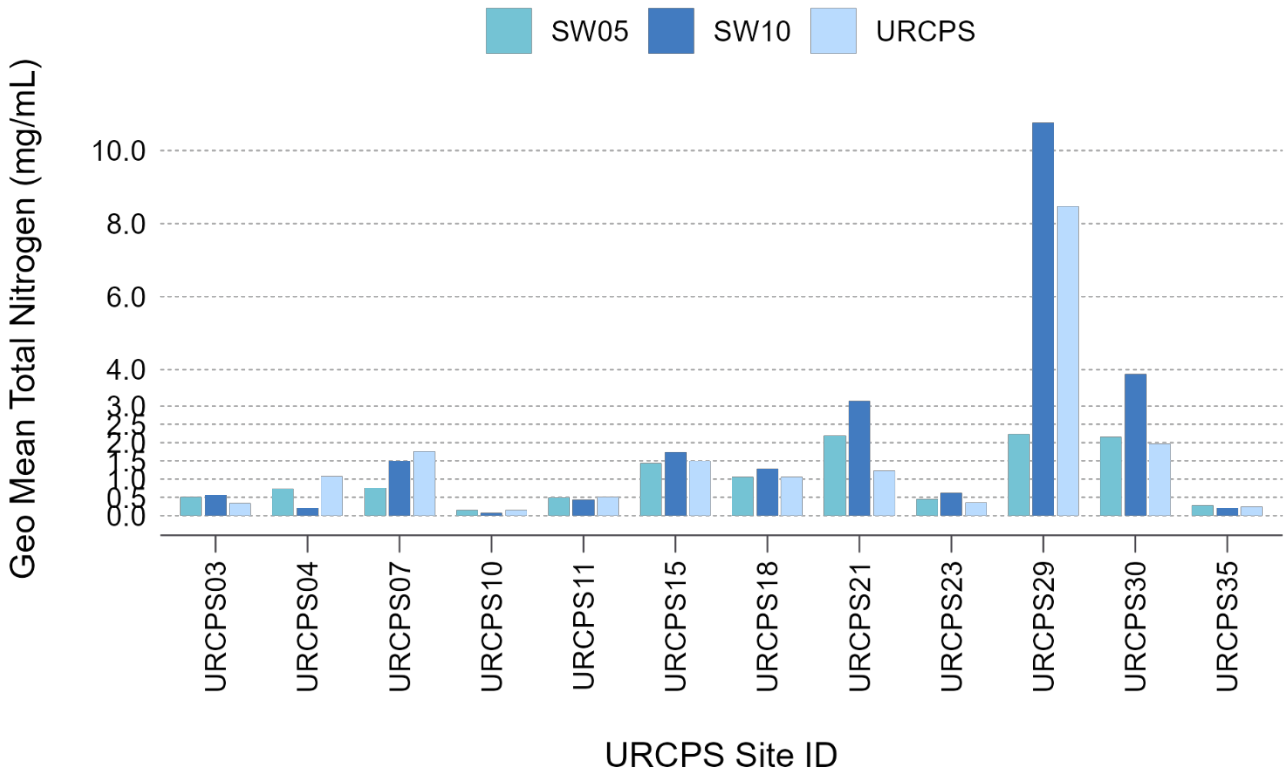


Figure (10) - Total Nitrogen Geo Mean for selected sites across all monitoring periods. SW05 – DEP 2002/2005 Stormwater Monitoring. SW10 DEP 2010/2011 Stormwater Monitoring. URCP 2024/2025 Stormwater Monitoring.



A closer examination of recent trends reveals significant shifts in stormwater and urban water management practices in Hobart, reflecting a broader evolution in environmental governance and infrastructure planning. One of the most pivotal developments in this space was the release of the State Stormwater Strategy by EPA Tasmania in late 2010. This strategy was designed as a comprehensive framework to mitigate the adverse impacts of stormwater runoff on Tasmania's waterways, which are particularly vulnerable due to the region's increasing urbanisation.

A cornerstone of the strategy was its emphasis on improving stormwater management in established urban areas, where legacy infrastructure often lacks the capacity or design to effectively manage both the volume and quality of runoff. The strategy also called for the restoration of urban waterways, many of which had been historically degraded or channelised, and for the implementation of stricter controls on stormwater discharges from commercial and industrial premises–a key source of pollutants.

Since the strategy's introduction, there has been a notable increase in the number of stormwater management plans developed by local councils across the greater Derwent Estuary. These plans serve as critical planning tools, enabling councils to set clear objectives for stormwater infrastructure, enforce development controls, and guide the selection and implementation of treatment systems. Importantly, they also support integrated water management by aligning stormwater planning with broader urban planning, land use, and environmental objectives.

The types of treatment systems being installed under these plans vary widely, ranging from green infrastructure–such as bio-retention systems, swales, rain gardens, and constructed wetlands–to grey infrastructure like gross pollutant traps, sedimentation basins, and underground detention tanks. Green infrastructure in particular, offers co-benefits such as urban cooling, biodiversity enhancement, and improved public amenity, making it an increasingly preferred option in urban design.

Quantitatively, the region has seen an increase in stormwater treatment assets, from approximately 50 devices prior to 2010 to over 200 devices currently. This expansion represents a substantial increase in the treatment capacity of urban catchments, enabling more effective interception and removal of pollutants before they reach natural waterways. While the performance of individual systems varies depending on design, maintenance, and catchment characteristics, the cumulative effect of this infrastructure is likely a driver behind the observed reductions in contaminant loads–including nutrients and sediments since 2010.

5.1 Summary of rainfall data across all previous monitoring programs

Pollutant concentrations in stormwater can increase significantly during periods of high rainfall, particularly in the first few hours of a storm. Therefore, rainfall conditions should be considered when comparing the results of the three stormwater monitoring programs.

Although the intent of these programs was to monitor base flow conditions, moderate to strong rainfall events were captured across all programs. Table (2) compares stormwater flow conditions and rainfall measured in the 24 hours prior to each sampling event.

Table (2) - Rainfall Summary

	2002 – 05 SW Program	2010 – 11 SW Program	2024 – 25 SW Program
Total number of samples	35	12	12
No. of events under base flow conditions	26	6	10
No. of events under moderate flow conditions	8	5	1
No. of events under storm flow conditions	1	1	1
Average rainfall in 24 hrs prior to sampling	0.6 mm	2.2 mm	1.2 mm

Overall, the 2010 – 11 monitoring programs had a significantly higher proportion of wet weather events, highlighted by the increased number of moderate flow conditions compared to the other programs. Average rainfall measured in the 24 hrs prior to sampling was also high in 2010 -11, approximately twice as high than the current stormwater monitoring program. The variation in rainfall patterns may help explain the decline in water quality observed across the three monitoring periods, particularly the peak around 2010. Additionally, other weather conditions—such as extended dry spells before rainfall—can also influence pollutant concentrations.

6 REFERENCE VALUES

Following the completion of the monitoring program, reference values—initially outlined in the Report Card—were further refined to establish council-specific benchmarks for end-of-line pollution targets. This refinement process ensures that even sites not directly monitored during the program have a scientifically grounded point of reference for interpreting future monitoring results, by using data from similar, well-studied sites to establish baseline conditions and expected trends. By tailoring values to each council area, the approach enhances the relevance and applicability of the data across a broader range of urban catchments.

To generate these reference values, the lowest site values within each council area were used to calculate an 80th percentile threshold. This method aligns with established practices employed by other environmental monitoring organisations, ensuring consistency and comparability across programs. The 80th percentile was chosen deliberately, as it reflects the reality that urban sites typically exhibit considerable ecological degradation due to their location within densely developed environments.

For bacterial indicators—Enterococci and Escherichia coli (E. coli)—the Geometric Mean was selected as the preferred statistical measure over the 80th percentile value due to the high degree of variability observed in the dataset. This variability is often driven by point source contamination, such as sewer overflows, stormwater discharges, or localised pollution events, which can cause sharp spikes in bacterial concentrations that are not representative of typical conditions.

The Geometric Mean provides a more stable and representative measure of central tendency for bacterial data, especially when values span several orders of magnitude. It reduces the influence of extreme outliers, which are common in microbial water quality monitoring, and offers a clearer picture of the long-term average condition of a site.

This approach is particularly relevant for recreational water quality assessments, where consistent exposure to elevated bacterial levels poses health risks. Values that exceed the established Geometric Mean should be interpreted as potential indicators of ongoing or significant contamination events, warranting further investigation or immediate management action. Such exceedances may signal persistent pollution sources or recent incidents that could impact public health and aquatic ecosystem integrity.

An exception to this methodology was made for the Derwent Valley Council, where only a single system was monitored during the program. In this case, refer to the report card (figure 1) which outlines the 80th percentile target value for each of the monitored sites in the Derwent Valley Council.

A breakdown of sites used for each council specific values is included below –

- **KCC** – URCPS21, URCPS22, URCPS23, URCPS24, URCPS25, URCPS27 & URCPS28
- **CCC** – URCPS12, URCPS13, URCPS14, URCPS15, URCPS16, URCPS17, URCPS18 URCPS19, URCPS20
- **Brighton** – URCPS29, URCPS30, URCPS33
- **GCC** – URCPS01, URCPS03, URCPS04

- **CoH** – URCPS07, URCPS08, URCPS09, URCPS11

Tabe 3 – Council reference values for each tested analyte. For bacterial indicators * (Enterococci & E Coli), values are based on the geometric mean rather than the 80th percentile.

		Water Clarity		Nutrients			Bacteria	
	n	TSS	Turbidity	Total Nitrogen	Nitrate + Nitrite	Total Phosphorous	Enterococci *	E. Coli *
		(mg/L)	(ntu)	(mg/L)	(mg/L)	(mg/L)	(MPN/100ml)	(MPN/100ml)
KCC	84	26.8	21	1.442	0.69	0.1	759	856
CCC	108	38	30.4	3.694	2.19	0.12	1026	887
Brighton	48	102.4	50	6.352	3.83	0.15	738	470
GCC	36	11	11	2.46	0.93	0.12	1411	968
CoH	48	19	10.44	1.492	0.97	0.143	1175	1187

By combining council-specific and site-specific reference values, we aim to improve the interpretation of future stormwater monitoring across the greater Derwent Estuary. Additionally, we have identified a strong case for developing stormwater-specific reference values to help councils and regulators better understand baseline levels within catchments. This will support the monitoring of changes over time and contribute to improved stormwater treatment and quality targets.

7 DISCUSSION

Stormwater quality in urban environments continues to be a pressing concern for local councils, decision-makers, and the broader community. Despite its significance, comprehensive and up-to-date studies that assess current stormwater conditions remain relatively scarce. Within the Greater Derwent Estuary region, previous investigations conducted in 2002–2005 and 2010–2011 established baseline pollutant concentrations. Building on these foundations, the current monitoring program adopted similar methodologies to ensure consistency and comparability across datasets, while also expanding the scope and scale of the study.

A key enhancement in the current program was the increase in monitoring sites from previous efforts to a total of 35—enabling broader geographic coverage and inclusion of diverse land use types. This expansion has allowed for a more nuanced understanding of how different land uses influence stormwater quality across the estuary. Additionally, the inclusion of a Waterbug survey provided broader environmental context, illustrating how changes in water quality affect the instream ecosystem.

As anticipated, urban catchments exhibited the highest levels of stormwater pollutants, particularly in areas undergoing active development. In contrast, relatively undisturbed or natural sites showed significantly lower pollutant loads. The most prevalent pollutants in urban areas were sediment-related, specifically turbidity and total suspended solids (TSS). These findings underscore the persistent challenges associated with land development and the management and control of on-site sediment. Catchments such as Cove Creek (URCPS29 and 30), Tivoli Green (URCPS31), Risdon Creek (URCPS12 and 13), and Faggs Creek (URCPS14) showed elevated turbidity and TSS levels, highlighting the impact of ongoing construction activities.

The environmental consequences of increased sedimentation are far-reaching. Elevated sediment loads reduce water clarity and contribute to the deoxygenation of aquatic systems, which can degrade ecosystem health and diminish the quality of life for people that rely on these waterways for recreation and aesthetic value. Marked reductions in Waterbug diversity are evident in locations where sediment-related impacts are present.

In more established urban catchments, such as Hobart and Glenorchy CBDs, sediment impacts were less pronounced. However, these areas showed higher concentrations of nutrients and bacteria, indicating potential intrusions from aging or compromised wastewater infrastructure, including sewer and septic systems. Elevated nutrient levels can stimulate algal growth and degrade water quality, while the presence of bacteria—particularly faecal indicators—raises concerns for public health, especially in areas used for recreational activities like swimming and walking.

Bacterial data, while useful for identifying sources of contamination, often poses challenges due to its variability and susceptibility to short-term fluctuations. Therefore, although bacteria are valuable for pinpointing pollution sources, they are less reliable than nutrient data for assessing the long-term health of waterways. New technologies are continually being developed in this space. For example, the Derwent Estuary Program had the opportunity to trial ZiP Diagnostics' *Bacteroides dorei* rapid testing platform, which detects human-specific faecal indicators. As expected, urban sites returned positive results, highlighting this tool as another resource decision-makers can use to identify contamination sources.

Given the community's strong connection to the estuary and its tributaries–including through activities such as walking, swimming, and other forms of recreation–this study reinforces the need for integrated planning approaches. These should merge water quality objectives with community values and amenity goals to create multifunctional public spaces that support both environmental and social outcomes.

Further investigation is warranted, particularly in developing catchments, to identify effective intervention strategies and educational initiatives aimed at reducing sediment runoff. The data from this study can serve as a benchmark for understanding the impacts of sedimentation and inform targeted training programs for contractors and builders across Tasmania. Emphasizing best practice site management and erosion control can significantly reduce sediment discharge into waterways.

Finally, regulatory frameworks may need to be revisited and strengthened to ensure compliance and accountability, especially in high-risk areas. Enhanced legislation, coupled with proactive education and monitoring, offers a pathway toward more sustainable urban development and improved stormwater quality across the Greater Derwent Estuary.

This study provides a comprehensive and timely update on stormwater quality across the Greater Derwent Estuary, highlighting the complex interplay between land use, urban development, and waterway health. By expanding the monitoring network and incorporating biological indicators such as Waterbugs, the program offers a more holistic understanding of ecosystem responses to pollution. The findings reinforce the urgent need for improved sediment and nutrient management, particularly in rapidly developing catchments, and underscore the value of emerging technologies in identifying contamination sources. Moving forward, a coordinated approach that integrates regulatory reform, community education, and on-ground pollution management will be essential to safeguarding the estuary's ecological integrity and ensuring it remains a valued asset for future generations.

8 ACKNOWLEDGEMENTS

As always, the DEP would like to sincerely thank all council staff and management who have supported the URCP Stormwater Monitoring Program, through providing sampling and technical advice.

To ZiP Diagnostics for providing the use of their ZiP P2 platform allowing for concurrent *Bacteroides dorei* alongside our water quality data.

John Gooderhem for providing support and technical guidance throughout the Waterbug's monitoring program.

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