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Recreational Water Quality Investigation

Blackman's Bay Beach (South)

Field Survey

prepared for

Kingborough Council

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Table of Contents

Version	Contributor/s	Date reviewed	Reviewed by	Notes
1	C. Manicom	n/a	n/a	Interim report provided Feb 2026
2	C. Manicom	27/05/2026	K. Ward	Updated with feedback from Kingborough Council

Cover photo: Southern Blackmans Bay during dye study, showing fluorescent dye discharging from the Illawarra outfall (Marine Solutions, December 2025).

Table of Figures

Executive Summary

Marine Solutions was engaged by Kingborough Council to (1) review the previous work conducted and (2) conduct a field study, to investigate and identify the factors driving poor water quality at the southern end of Blackmans Bay Beach. The review of previous works and existing knowledge, along with a proposed plan for a field study, was delivered in June 2025 (Marine Solutions 2025). The results of the field study are reported herein, and include an assessment of the dispersal of stormwater discharge into Blackmans Bay using fluorescent dye, an assessment of water movement and currents in southern Blackmans Bay using drogues, and water quality testing of faecal contamination of stormwater and recreational water following rainfall and periods of dry weather.

Dye studies in December 2025 showed that stormwater effluent was retained inshore and moved up and down the shoreline with the incoming and outgoing tide (consistent with tide-driven currents in the Derwent Estuary). Drogue studies showed that water movement further offshore in the bay is towards the shoreline in both incoming and outgoing tides, with the outgoing tide pulling water into the southern corner of the bay. These studies indicate that water is held against the shore by currents and moves back and forth in the southern corner of the bay. The three stormwater outfalls in southern Blackmans Bay discharge contaminated water relatively consistently into the receiving environment, these outfalls flank the recreational water quality sampling site to the north and south, and there appears to be high retention of water in southern Blackmans Bay.

Further, stormwater is retained for various periods of time in the pools/sump at stormwater outfalls which has the potential to accumulate faecal indicator bacteria (enterococci) as well as aggregate flocks of seagulls, which would increase contamination. Enterococci counts in recreational water samples in southern Blackmans Bay were highly variable over time with no clear evidence of a consistent impact from one factor. It appears there are multiple interacting variables that impact on water quality in Blackmans Bay that need to be considered in combination.

1 Introduction

1.1 Project scope

Marine Solutions were engaged by Kingborough Council to conduct a field survey to investigate the factors driving poor water quality at the southern end of Blackmans Bay Beach.

The first stage of the investigation was a review of the existing knowledge about the issue, including liaison with Kingborough Council and the Derwent Estuary Program, and review of the specialist studies documenting recreational water quality at Blackmans Bay and water quality results from testing both stormwater and recreational swimming sites. This review (see Appendix 1) informed the design of a field survey, which is documented in this report. The field survey included:

- An assessment of the contribution of the stormwater outlets into southern Blackmans Bay, and the dispersal of stormwater discharge into Blackmans Bay using a fluorescent water tracer (FWT).
- An assessment of water movement and currents in south Blackmans Bay using drogues.
- Water quality testing of faecal contamination and field parameters, including rainfall events.

1.2 Project background

There are four stormwater outfalls that drain into Blackmans Bay, one at the northern end of the bay and three in southern Blackmans Bay (Figure 1). The southern end of Blackmans Bay Beach has long been a popular recreational swimming spot, and from the summer of 2012-13, has been one of the sites monitored for recreational water quality by the Derwent Estuary Program (DEP). In this program, water quality is monitored weekly (Tuesdays) at popular swimming sites in the Derwent Estuary during the recreational season (December to March) by testing for faecal indicator bacteria (enterococci). From the 2017-18 recreation season onwards, water samples from the Blackmans Bay South site (Figure 1) have frequently failed bacterial guidelines, despite significant upgrades to sewer and stormwater infrastructure. Several studies have investigated the cause of contamination, including water quality monitoring, source tracking, seagull counts and sand contamination testing. These are described in Coughanowr (2019), Coughanowr (2020) and Kingborough Council (2020).

As part of the current study, Marine Solutions reviewed all available knowledge and information for the southern Blackmans Bay water quality issue (see Appendix 1). In summary, the past investigations and data indicate that stormwater is likely to be the main contributor to poor water quality in southern Blackmans Bay, with the most likely source of contamination suspected to be sewer ingress into the stormwater system. There is, however, not a direct correlation between poor stormwater outfall results and poor water quality at the beach, and also no clear correlation between the volume of stormwater (i.e., rainfall) and poor water quality at the beach.

It was Marine Solutions' aim to establish the conditions under which the water quality of south Blackmans Bay is contaminated by stormwater and provide recommendations for how to manage and reduce the impacts.

Figure 1. Blackmans Bay showing location of stormwater outfalls (red arrows) and the Derwent Estuary Program (DEP) recreational water quality (RWQ) sampling sites (blue stars). The three outfalls that discharge into southern Blackmans Bay are shown on the right.

1.2.1 Input and influences on contamination in southern Blackmans Bay

1.2.1.1 Stormwater inputs

Faecal indicator bacteria (enterococci counts) have been found to be consistently high in the three Blackmans Bay stormwater outfalls that discharge into southern Blackmans Bay (Figure 1) and this is the likely source of contamination of the water in the southern part of the bay. Stormwater samples are collected by the Kingborough Council environment team at the three southern outfalls twice a week and tested for enterococci.

1.2.1.2 Rainfall

It is known that localised contamination of the Derwent Estuary occurs after rainfall, particularly near stormwater outfalls, and swimming is not recommended in the Derwent for several days following heavy rain (recommended by the DEP since 2003).

1.2.1.3 Tides and currents

Water movement in the lower Derwent Estuary on a daily timescale is dominated by tidal flow (Herzfeld et al. 2005). Tides in the Derwent undergo a neap-spring cycle of ~14 days, meaning that the tidal range (~1 m in the Derwent) varies from maximum intensity (spring tides) to minimum intensity (neap tides), and back again in a two-week cycle. Spring tides have a large tidal range with stronger, faster tidal currents, whereas neap tides have a lower range with slower currents.

In the Derwent, water moves up the river (to the north) during the flood (incoming) tide and downstream (to the south) in the ebb (outgoing) tide (Herzfeld et al. 2005). The tide is asymmetrical with the ebb tide shorter and associated with stronger currents than the flood. Water flow is highly variable in the vicinity of Blackmans Bay, with the localised currents near the beach likely to be even more variable and dependent on wind and tidal conditions (Coughanowr 2019).

1.2.1.4 Stormwater sumps and pools

Enterococci (faecal bacteria) have been found to persist in the environment for extended periods of time by adhering to organic material, and have also been found to survive and multiply within other aquatic environments (i.e., without a continuous source of contamination; see Marine Solutions 2025, Appendix 1). There is a possibility that water retained in the pipeline sump at the Mid Beach outfall and in the beach pool below the Illawarra outfall between discharge events (e.g., following rainfall) provides a reservoir for enterococci colonisation. There is also daily retention of stormwater (between high tides) at the rockpool below the Flowerpot outfall (Figure 1).

Initially, Marine Solutions aimed to test whether the reservoir of stormwater at the sump on the Mid Beach outfall pipeline is suspended and collected at high tide and drawn out of the pipeline with the outgoing tide by adding fluorescent dye to water in the stormwater sump when the stormwater outfall was not discharging and observing the receiving waters around the outfall during the high and outgoing tide for the presence of dye-dosed sump water. This would help to explain contamination at the Blackmans Bay South recreational water quality site even in dry periods (no discharge). However, on the limited occasions that Marine Solutions has observed the Mid Beach outfall since commencing this study (November 2025 to April 2026), it was discharging to the environment on all occasions except two, when it was filled with sand (15 December 2025, 26 April 2026). During the survey period there was not an observed occasion (outfall not discharging) to attempt the dye study to test the suspension and collection of stormwater from the Mid Beach sump during a high - outgoing tide.

1.2.1.5 Reservoirs of enterococci

Enterococci have been found to adhere to organic material (e.g., plankton, seaweed) and persist in the environment for extended periods of time. Enterococci have also been reported to survive and multiply within some environments, including water, sediments and seaweeds (including kelp, Byappanahalli et al. 2003; and on seaweed wrack on beach sand, Imamura et al. 2011).

Sampling conducted in 2019-20 found no evidence of accumulation of sewage contamination in beach sand at Blackmans Bay (Holdsworth & Dix 2020), and the enterococci concentration of sand was lower than that of the overlying water, even in the vicinity of widespread seagull faeces (reported in Coughanowr 2019).

1.2.1.6 Turbulence

Wind and wave action can move enterococci from the sand and sediment into beach waters, elevating levels of enterococci in the water column (Menefee et al. 2026).

The southern end of Blackmans Bay beach is protected from south-westerly/southerly swell but is more exposed to the southeasterly swell prevailing in the summer months (as for other Kingborough beaches). The influence of wave action at the beach at the time of water sampling has been noted to influence enterococci concentration at Kingborough beaches (M. Steele, Kingborough Council, *pers. comm*. Nov 2025) and also at monitored Clarence beaches at Howrah and Bellerive (A. Forshaw, Clarence City Council, *pers. comm*. Apr 2026), i.e., samples are more likely to fail recreational water quality limits when wave action has stirred up the sediment at the beach.

In published reports, enterococci count has been found to vary in time and space due to increased tidal range (e.g., spring tides) and turbulence (e.g., wave action) which suggests that enterococci is mobilised by disturbance of the sediment, but a correlation between enterococci values in water and sediment has not been definitively shown (reviewed in Menefee et al. 2026).

1.2.1.7 Seagulls

There are very large numbers of seagulls (mostly silver gulls *Chroicocephalus novaehollandiae*) present seasonally along the southern half of Blackmans Bay beach. Faecal contamination of Blackmans Bay beach and water by gulls is a consistent source of public concern.

In southeast Tasmania, the breeding season for silver gulls extends from August to January (depending on weather conditions) and by February silver gulls have left their breeding colonies and moved to nearby beaches to feed and roost until the next breeding season (Woehler 2017). From counts conducted in 2019 and 2020, silver gull numbers at the southern end of Blackmans Bay beach peak in March / April (Coughanowr 2020).

A report assessing the presence of silver gulls and the contamination of water at southern Blackmans Bay was conducted by BirdLife Tasmania in 2017 and concluded that there was little evidence of a causal link between gulls and poor water quality at the time: poor water quality at Blackmans Bay occurred prior to the arrival of gulls at the beach, and the potential volume of gull faeces is minor in comparison to other inputs in the bay (Woehler 2017).

Targeted sand sampling for bacterial contamination from seagull faeces found that, although levels were higher in the sand at south Blackmans Bay compared to mid and north beach sites, the counts were considerably lower than bacterial levels in the water. It was reported that beach sand was unlikely a significant source of faecal contamination at the time of sampling and that stirring up of sediment during sampling did not increase bacterial counts (Coughanowr 2020).

1.2.2 Environmental parameters used to show contamination in southern Blackmans Bay

1.2.2.1 Faecal indicator bacteria

Enterococci are a group of bacteria found in the intestinal tracts of warm-blooded animals and are used to signal the presence of pathogens that cause gastrointestinal illness in recreational water. They survive well in seawater which makes them more useful than other faecal bacteria as an indicator of contamination. Enterococci are used world-wide as faecal indicator bacteria to assess the safety of recreational waters.

Recreational water quality at popular swimming beaches in the Derwent Estuary is monitored weekly (Tuesdays) during the recreational season (December to March) by testing for enterococci, including at three sites in Blackmans Bay (Figure 1). To test for enterococci, a single water sample is collected at each site into a lab-supplied sterile container, and samples are delivered to the Public Health Laboratory (PHL) within 24 hours of collection. In the lab, each sample is mixed with a reagent containing specific nutrient indicators, poured into a multi-well tray and incubated. Enzymes in the enterococci metabolise the indicator, causing positive wells in the tray to fluoresce under UV light or turn a distinct colour. The number of positive wells is counted and converted to a most probable number (MPN) per 100 mL of sample.

For recreational beach monitoring, if a sample exceeds 140 MPN per 100 mL of enterococci it triggers a re-test and a "failure" contamination result is recorded. Testing for enterococci only detects viable, or live bacteria. However, enterococci are very resilient and can survive in the water and sediment for long periods of time, and the testing does not differentiate between fresh contamination and live bacteria that have persisted in the water or sediment for some time.

1.2.2.2 Bacteroides

ZiP-Bactx-P2 testing uses a rapid laboratory procedure to detect human sewage and faecal contamination in water samples. The test detects human-specific *Bacteroides dorei* using a genetic marker, a DNA sequence uniquely specific to the human gut microbiome. Its presence in a water sample indicates human-derived faecal contamination. Its absence rules out human sources, even where conventional faecal indicator bacteria (like enterococci) counts are elevated.

Tests can be carried out on the same sample of water provided for enterococci testing, and results give a range (not a count) of: *not detected*, *positive-low* (weak signal), *positive-medium* (moderate signal), or *positive-high* (strong signal).

There are some limitations with testing for *Bacteroides* in ambient seawater: the DNA marker decays faster in seawater than it does in fresh water, and this combined with high dilution of into seawater can cause a true contamination event to show up as a lower signal (or no signal) than it would in fresh water. This also means that, because the DNA breaks down relatively quickly in seawater, a positive result (even a *positive-low*) indicates recent, active contamination rather than a legacy issue from weeks ago.

1.2.2.3 Salinity

Testing the electrical conductivity (EC) or salinity of water can be used as a cheap and effective estimate of the relative inputs of seawater (salinity of ~34 ppt) and stormwater (salinity of <1 ppt) and is particularly useful to indicate tidal ingress into freshwater, and stormwater discharge into the marine environment.

2 Field survey 2025 – 2026

2.1 Fluorescent water tracer in discharging stormwater

2.1.1 Methods

A fluorescent water tracer (FWT) was used to observe the movement of stormwater in south Blackmans Bay in an outgoing and incoming tide. On 8 December 2025, the three stormwater outfalls that discharge into southern Blackmans Bay (Flowerpot, Illawarra and Mid Beach, see Figure 1) were dosed with fluorescent water tracer (green dye) immediately prior to high tide. All three outfalls were flowing (discharging to the environment) on this occasion (Figure 2).

On 12 December 2025, the study was repeated, with the outfalls dosed immediately prior to low tide. At the time of the study on 12 December, the Flowerpot and Mid Beach outfalls were discharging low volumes of stormwater to the environment, and the Illawarra outfall was not discharging to the environment at the time (see Figure 3). Dye was added directly to the water at the shoreline near Illawarra outfall (Figure 3) and was dosed four times during the study (as the dye dispersed).

At each outfall, 25 – 50 g of fluorescein sodium salt WT was mixed with local stormwater and poured into the outfall so that it mixed with discharging stormwater (for dosing locations see Appendix 4, dosing details see Table 1 and images see Figure 2, Figure 3). The discharging dyed effluent was observed by personnel on the shore and aerial images were captured using a DJI Phantom 4 Pro v2 drone.

Table 1. Summary of dye dosing event, tide and conditions for the fluorescent dye surveys at Blackmans Bay.

Date	Tide*	Wind (strength and direction)	Stormwater outfall	Notes
8/12/2025	High, outgoing (high tide 11h05)	Moderate NW	Flowerpot	Dosed at 10h37, immediately visible in bay (Figure 2B).
			Illawarra	Dosed at 10h30, visible in bay at 10h45 (Figure 2C).
			Mid Beach	Dosed at Mid Beach sump (Figure 2A) at 10h52, visible in bay at 11h04.
			➢ All three outfalls were discharging stormwater to the environment at the time of this dye study.	
12/12/2025	Low, incoming (low tide 10h04)	Light W	Flowerpot	Low volume discharge at the time of dye study. Dosed at 09h26, immediately visible in adjacent rock pool. Visible in bay from ~12h30 (Figure 3A).
			Illawarra	Stormwater NOT discharging at time of study, dye added directly to water at shoreline at multiple times, starting at 09h48 (Figure 3C).
			Mid Beach	Low volume discharge at the time of dye study. Dosed at sump (Figure 2A) at 09h52, visible in bay at 10h06 (Figure 3B).

* Tide times based on the Bureau of Meteorology's Hobart tide predictions.

Figure 2. Fluorescein dye dosing into the three southern Blackmans Bay stormwater outfalls at high tide on 8 December 2025. (A) Dosing at sump on Mid Beach outfall, (B) dyed effluent discharging from the Mid Beach outfall (C) dosing directly into the discharging Flowerpot outfall, (D) dye-dosed stormwater discharging from Illawarra outfall to the drainage channel on the beach, and (E) Kingborough Council public information signage during the dye study.

Figure 3. Fluorescein dye dosing into the three southern Blackmans Bay stormwater outfalls at low tide on 12 December 2025. (A) Flowerpot outfall, showing dye in rock pool, (B) dye-dosed stormwater discharging at low volume from Mid Beach outfall, and (C) no stormwater discharge from Illawarra outfall and no drainage channel across the beach, so dye was added directly to water at the shoreline.

2.1.2 Results

2.1.2.1 High – outgoing tide

On 8 December 2025, dye discharging from the three southern stormwater outfalls into the high-outgoing tide was observed travelling south from the Mid Beach and Illawarra outfalls, and east along the rocky shoreline from the Flowerpot outfall (Figure 4, Figure 5).

On 8 December, the dye was observed in the environment for ~ 1 hour, until the dye discharging at the Mid Beach outfall had completely dispersed into the bay (no longer visible) and the tide had dropped so that the Illawarra outfall drainage channel on the beach was no longer discharging to the bay (Figure 6).

Figure 4. Orthomosaic of aerial images showing fluorescent dye discharging from the three southern Blackmans Bay outfalls (marked with red arrows) in the high-outgoing tide (background map: Google Earth Pro).

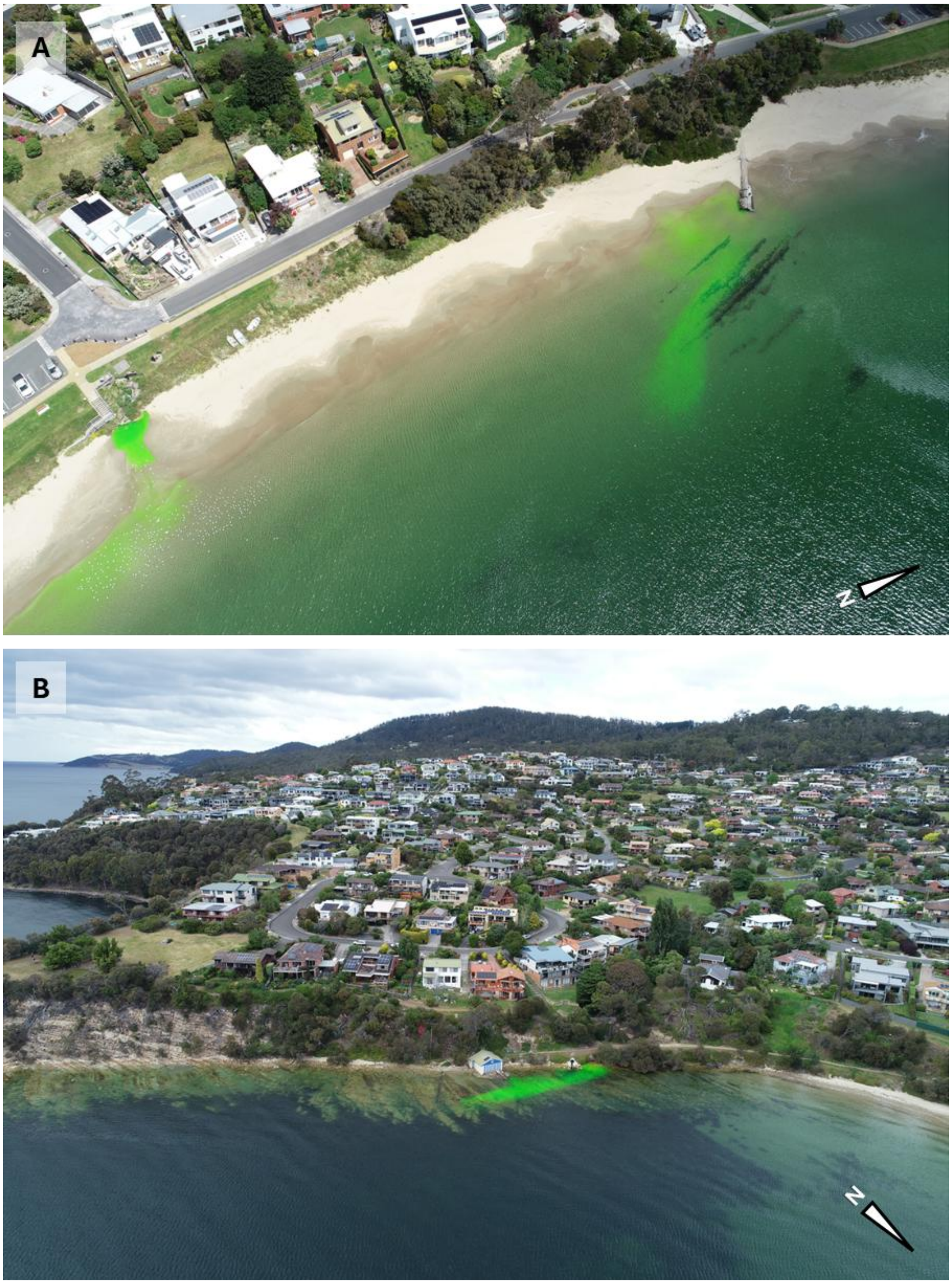

Figure 5. Non nadir aerial images of fluorescent dye discharging from (A) Mid Beach and Illawarra, and (B) Flowerpot stormwater outfalls in the high-outgoing tide.

Figure 6. One hour after dye dosing, (A) the tide had dropped so that the Illawarra stormwater outfall was no longer discharging to the bay, and (B) the dye-dosed effluent from Mid Beach outfall had dispersed and was no longer visible.

2.1.2.2 Low – incoming tide

On 12 December 2025, dye discharging from the three southern stormwater outfalls into the low-incoming tide varied in direction over the duration of the study period. The dye-dosed effluent was observed to initially travel south from the Mid Beach outfall and from the dosing point in front of the Illawarra outfall when the tide was low (30 minutes after low tide), similar to the outgoing tide (Figure 7, Figure 8). At low tide, dyed effluent discharging from the Flowerpot outfall was retained in the rocky intertidal area and was not clearly visible in the bay (Figure 3A, Figure 7, Figure 8).

As flow from the incoming tide increased (~2 hours after low tide), the current was observed to change direction and dye-dosed effluent was observed travelling north along the shoreline from the Mid Beach and Illawarra outfalls, and to the east along the rocky shoreline from the Flowerpot outfall (Figure 9, Figure 10).

Figure 7. Orthomosaic of aerial images showing fluorescent dye discharging from the three southern Blackmans Bay outfalls (marked with red arrows) into low tide (background map: Google Earth Pro).

Figure 8. Non nadir aerial images of fluorescent dye discharging from (A) Mid Beach and Illawarra, and (B) all three stormwater outfalls in the low tide.

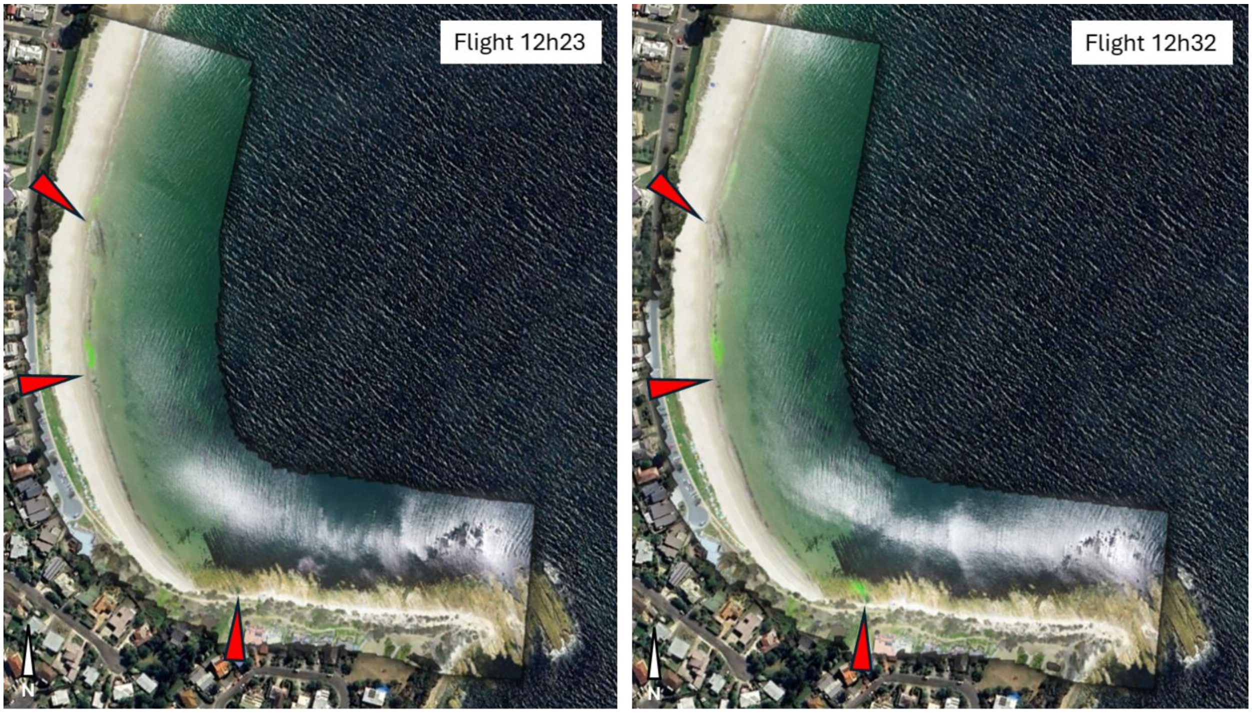

Figure 9. Orthomosaic of aerial images showing fluorescent dye discharging from the three southern Blackmans Bay outfalls (marked with red arrows) into the incoming tide (background map: Google Earth Pro).

Figure 10. Non nadir aerial image of fluorescent dye discharging from Mid Beach and Illawarra outfalls in the incoming tide.

2.2 Survey of current movement using drogues

2.2.1 Methods

Drogues were deployed in south Blackmans Bay to measure the direction and movement of surface water currents in southern Blackmans Bay, and therefore the likely distribution and dispersion pathways of a freshwater plume in surface waters. On 29 January 2026, two different types of drogues were deployed from a small boat in southern Blackmans Bay in calm conditions and their movements tracked with GPS over an outgoing and incoming tide.

Deeper water drogues consisted of a subsurface sea anchor (weighted rod), a sail drogue and a surface buoy (Figure 11A). Drogues were weighted such that the anchor and sail were entirely underwater with the surface buoy afloat. The surface buoy was minimal in size to minimize any effect of wind. Drogues were deployed at four locations in southern Blackmans Bay at outgoing to low tide, and then again (at the same starting locations) at low to incoming tide; refer to Table 2 and see Figure 12 (Drogues A – D). Each drogue had a Garmin 72 GPS unit housed in a water-tight Pelican case attached, logging GPS positions every 5 seconds. Track logs of the drogues were interpolated using these GPS positions. Start and end points of each deployment were recorded on the GPS units.

Oranges were used as drogues in the shallow water in southern Blackmans Bay, also in an outgoing and incoming tide (Figure 11B, C). Oranges are a useful, low-cost drogue for estimating currents in shallow water: they are easy to see, float low in the water (therefore minimally impacted by wind), and are biodegradable. Oranges were deployed at four locations in southern Blackmans Bay; three deployments during the outgoing tide and one during the incoming tide (refer to Table 2 and see Figure 12, Drogues 1 – 4). Oranges were left to move with the prevailing current and checked at ~15-minute intervals and a GPS position recorded for their location. GPS positions were used to provide track logs of drogue movement.

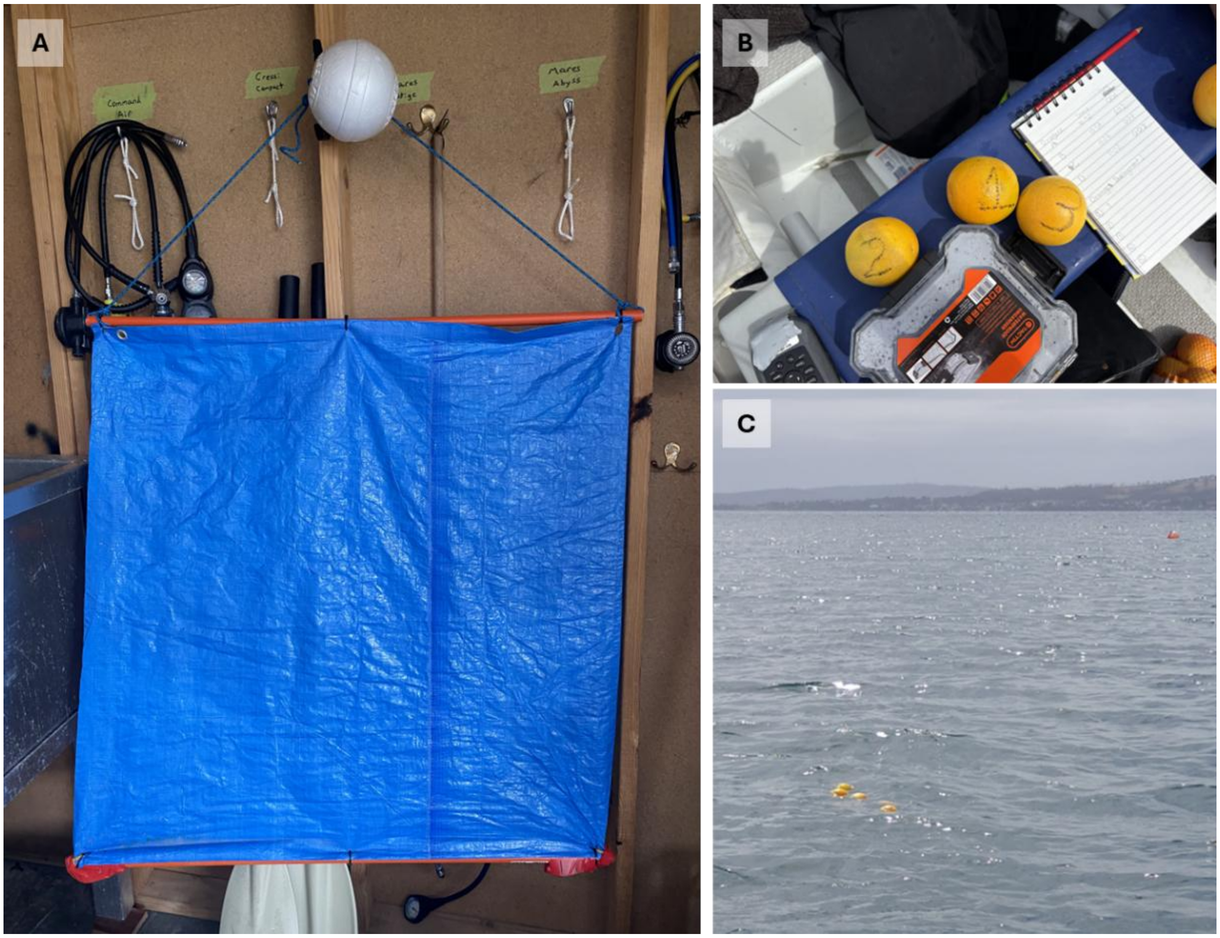

Figure 11. Two different drogues used in the Blackmans Bay current movement study: (A) deeper water drogues with anchor, sail and surface buoy, (B) oranges used as shallow water drogues, (C) oranges deployed in Blackmans Bay.

Figure 12. Starting locations of the two different types of drogues deployed in south Blackmans Bay, relative to the three stormwater outfalls in the area (locations marked with red triangles). Deeper water drogues A – D (blue markers) and shallow water drogues 1 – 4 (yellow markers).

Table 2. Deployment details for drogues in southern Blackmans Bay in January 2026. Low tide on the day of deployment was at 12h42 (Hobart tide time).

Drogue	Deployment	Tide	Time start	Time end	Distance covered + speed of movement (max)*
Deeper water (anchor, sail + surface buoy)	A	Outgoing	10h52	12h56	524 m; 1.2 m/s
	B		10h57	12h54	649 m; 0.5 m/s
	C		11h06	12h39	600 m; 0.9 m/s
	D		11h02	12h50	527 m; 0.4 m/s
	A	Incoming	13h00	13h55	296 m; 0.7 m/s
	B		13h02	13h58	189 m; 0.1 m/s
	C		12h47	13h47	323 m; 0.6 m/s
	D		13h04	13h52	214 m; ~0.1 m/s
Shallow water (oranges)	1	Outgoing	11h15	11h30	~87 m; ~0.1 m/s
	2	Outgoing	11h36	11h52	~35 m; ~0.05 m/s
	3	Outgoing to slack low	11h57	12h43	~253 m; ~0.1 m/s
	4	Low to incoming	13h08	13h43	~166 m; ~0.08 m/s

* Distance and speed of drogues recorded by continuous GPS tracking, or estimated (~) based on start and stop times and locations.

2.2.2 Results

All four deeper water drogues moved towards the shore from their deployment location in both the outgoing and incoming tide (Figure 13).

In the outgoing tide, both Drogues A and B (deployed off the southern headland of Blackmans Bay) moved quickly westward into the southern corner of Blackmans Bay, where they drifted for the remainder of the deployment period (Figure 13 insert). Drogue D, deployed further offshore within southern Blackmans Bay also moved quickly westward (in shore) and then to the north, parallel to the shoreline (Figure 13). Drogue C, deployed inshore, travelled rapidly north-west and then north, also parallel to the shoreline (Figure 13). Both Drogues C and D reversed direction and were travelling south at the end of the outgoing tide deployment (i.e., close to low tide, see Figure 13 insert).

In the incoming tide, all four drogues travelled in an approximately north westerly direction, all moving inshore of their starting location (Figure 13). Drogue movement was slightly slower in the incoming tide.

Similarly, the shallow water drogues (oranges) all moved towards the shore during both outgoing and incoming tide deployments. Shallow water drogues deployed inshore in southern Blackmans Bay (Drogues 1, 2, 4) all moved northwest towards the shore, regardless of tide (Figure 14). Drogue 3, deployed in mid-Blackmans Bay in the outgoing tide, travelled west and then northwest (Figure 14).

Figure 13. Track logs for four deeper water drogue deployments, from starting points A – D in the outgoing and incoming tide. Drogues were returned to the same starting point for both tides. White arrows show direction of drogue movement, inserts show detail of drogue movement at the end of outgoing tide deployment. Dashed line for drogue D in the incoming tide indicates presumed track of drogue to the recorded end point location (flat battery, track not fully recorded).

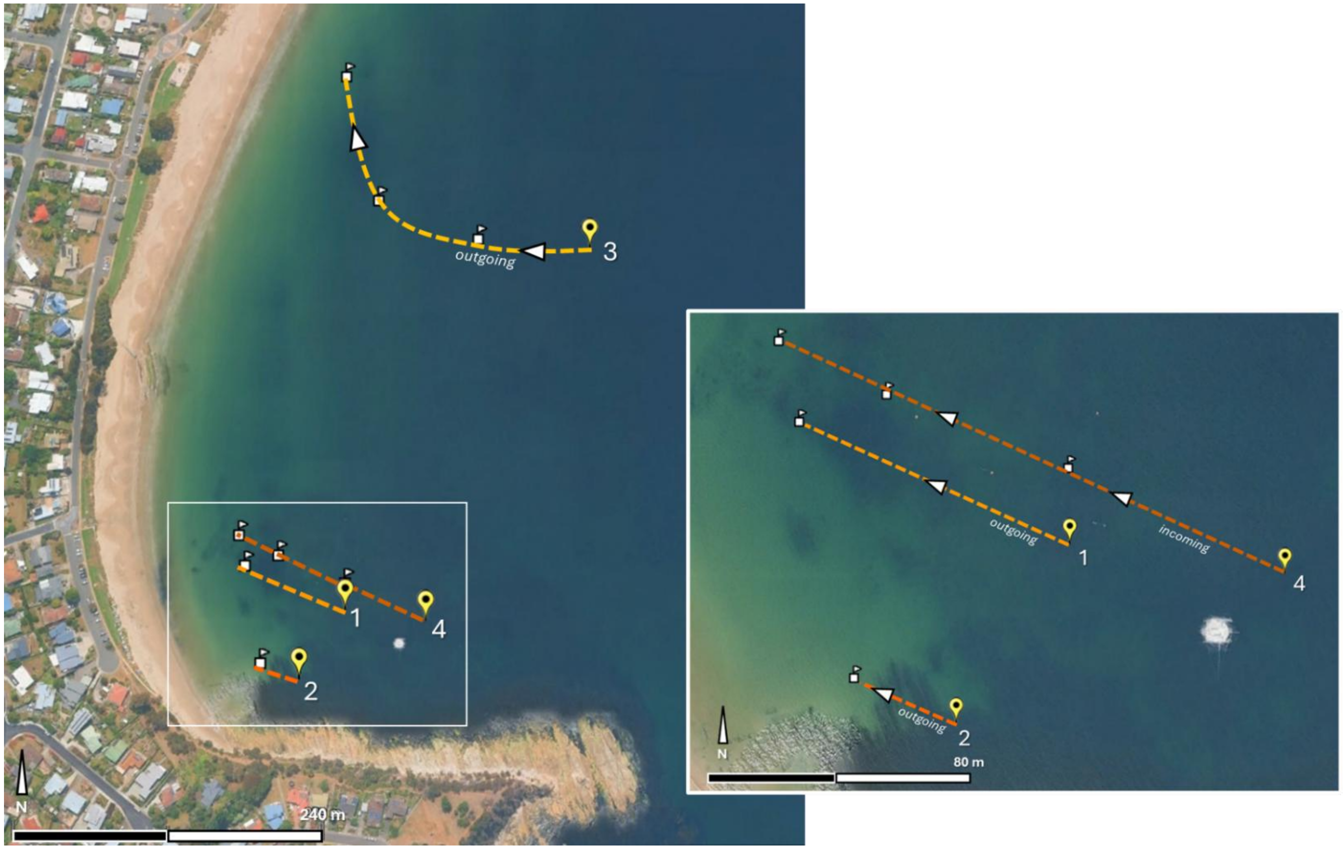

Figure 14. Track logs for four shallow water drogue (oranges) deployments, from starting points 1 – 4 in the outgoing and incoming tide in southern Blackmans Bay. Yellow markers show start locations, white markers show recorded locations during deployment, white arrows show direction of movement.

2.3 Observations of drift seaweed at southern Blackmans Bay

Along with the movement of drogues in southern Blackmans Bay, another indicator of current movement is the accumulation and retention of material in the bay. Drift seaweed was observed washed up on the southern beach in December 2025, and is generally a feature of the southern end of the bay over recent years (Figure 15, Appendix 5).

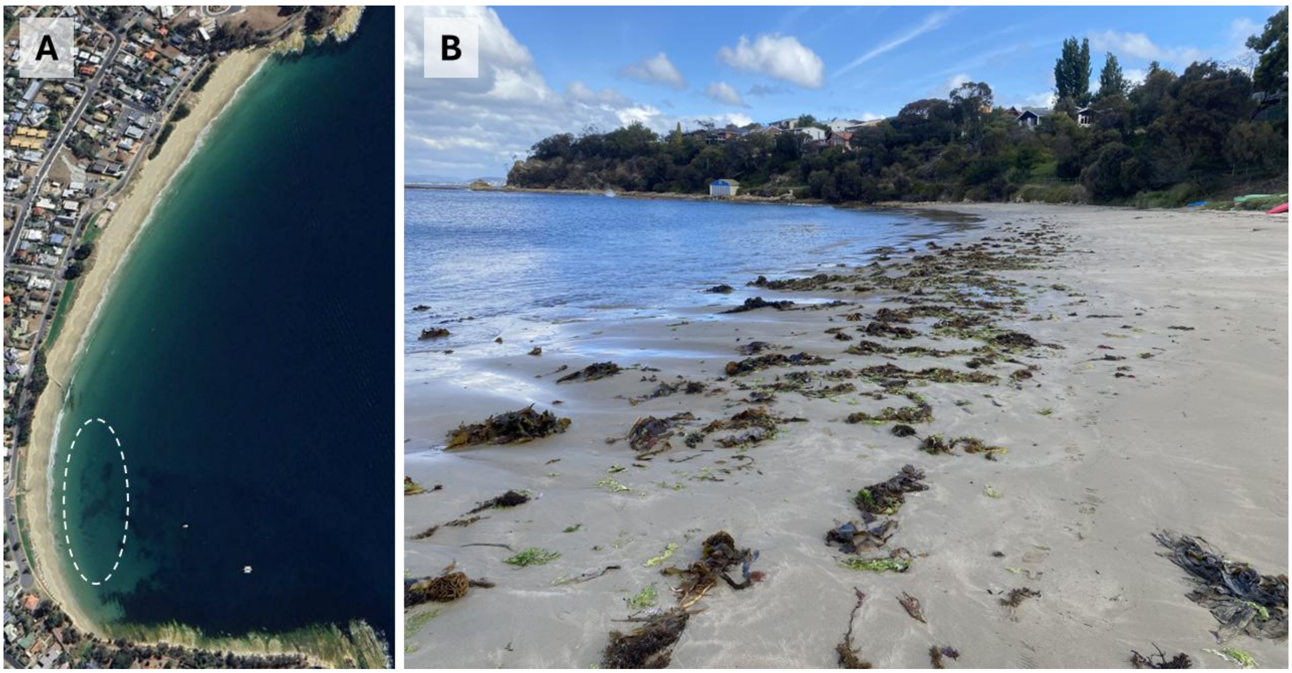

Figure 15. Southern end of Blackmans Bay showing accumulation of drift seaweed. (A) Google Earth image from 2024, more images included in Appendix 5, and (B) drift seaweed on southern Blackmans Bay Beach in December 2025.

2.4 Water quality testing following rainfall

Water quality testing on consecutive days following rainfall was intended to target rainfall events of 5 - 10 mm after a minimum 72-hour dry period (to separate from the impact of previous rainfall events). Sampling was intended to sample stormwater, the Blackmans Bay South recreational water quality site, and a reference site on the day before forecast rainfall, and then at 24-hour intervals for three days, to document the peak stormwater discharge impact and the decay over consecutive days.

This component of the study was difficult to undertake over the summer months, with limited rainfall events. Samples need to be delivered to PHL and tested within 24 hours of collection. Water sampled on a Sunday can be delivered to the lab on Monday, but the gap on Saturday has meant that the limited rainfall events since the start of this project (November 2025) have been difficult to monitor.

Two rounds of consecutive day water quality sampling were conducted; (1) in December 2025 when rainfall conditions were not optimal, and (2) in March 2026 in ideal rainfall conditions.

2.4.1 Methods

In December 2025, water samples were collected at three locations: (1) the sump on the Mid Beach stormwater outfall (see Figure 20), (2) Blackmans Bay South recreational water quality site (DEP RWQ SOUTH, and (3) Blackmans Bay North (DEP RWQ NORTH) recreational water quality site as a reference site (Figure 1).

Water samples were collected on 12 December 2025 prior to forecast rainfall of up to 6 mm[1]. Water samples were collected at each site on consecutive days to 16 December 2025 (by Marine Solutions and by Kingborough Council during routine sampling).

In March 2026, water samples were collected at the same three locations, and at two additional locations: (4) the pool on the beach below the Illawarra outfall (Figure 3C), and (5) the rockpool below the Flowerpot outfall (Figure 3A).

[1] Using combination of rainfall forecasts from BOM [MetEye rainfall forecast]() for the Blackmans Bay area (25% chance of more than 5 – 10 mm) and [hourly rainfall forecasts for Hobart]().

Water samples were collected on 23 March 2026 prior to forecast rainfall of 10 mm[2]. Water samples were collected at each site on consecutive days to 26 March 2026 (by Marine Solutions and by Kingborough Council during routine sampling).

On all sampling occasions, water samples were delivered to PHL in New Town for enterococci colony counts within 24 hours of collection.

2.4.2 Results

2.4.2.1 December 2025 sampling

Although showers were observed on the night of 12 December, no rainfall (0 mm) was recorded in the Bureau of Meteorology (BOM) daily observations for Hobart or Dennes Point. Rainfall (1.4 – 1.8 mm) was recorded on 15 December 2025 (Table 3).

The consecutive day monitoring in December 2025 indicated (Figure 16):

- Stormwater water quality was consistently poor (well-known from continuous monitoring by Kingborough Council).
- All three stormwater drains were discharging to the beach during the sampling period (Table 3, Figure 17).
- Recreational water quality site Blackmans Bay North was consistently low in enterococci, even following rainfall (well-known from weekly seasonal monitoring by Kingborough Council / Derwent Estuary Program).
- Water quality at the Blackmans Bay South recreational site was poor following rainfall. Water quality at the site exceeded the recreational water quality limit (140 MPN/100 mL) on 14/12/2025 and again on 16/12/2025 (Figure 16).
- Water quality at the Blackmans Bay South recreational site is highly variable, regardless of rainfall. Enterococci count varied from 175 to 20 to 388 to <10 MPN/100 mL over four days of sampling, apparently regardless of rainfall (Figure 16).

This event of consecutive day monitoring offered limited insight into water quality in southern Blackmans Bay following rainfall. It did, however, highlight that minor rainfall (i.e., showers) that do not register in BOM daily observations can have an impact on water quality (both stormwater and the receiving environment).

Table 3. Water quality sampling events, rainfall records and stormwater outfall observations during each sampling period.

Sampling event	Rainfall preceding sampling period[3] *Hobart (Dennes Pt)*	Total rainfall recorded during event[2] *Hobart (Dennes Pt)*	Stormwater observations at the time of sampling
12 – 16 December 2025	0 mm for 5 days (3 days)	1.4 mm (1.8 mm)	• Stormwater discharging from Mid Beach outfall on all sampling days. • Pool below Illawarra outfall present on all sampling days, not connected to ocean on 12/12 (see Figure 17).
23 – 26 March 2026	0 mm for 10 days (5 days)	17.4 mm (20.6 mm)	• Stormwater discharging from Mid Beach outfall on all sampling days. High discharge rate and elevated water level at sump on rainfall days. • Stormwater discharging from Illawarra outfall on all sampling days. No pool below Illawarra outfall at start of sampling (23/03), pool present and sampled on all other sampling days (Figure 18). • Stormwater discharging from Flowerpot outfall on all sampling days (Figure 19).

[2] BOM rainfall observations for Hobart (Dec 25 and Mar 26) and Dennes Point (Dec 25 and Mar 26). Values recorded at Dennes Point are given in (brackets) in this table.

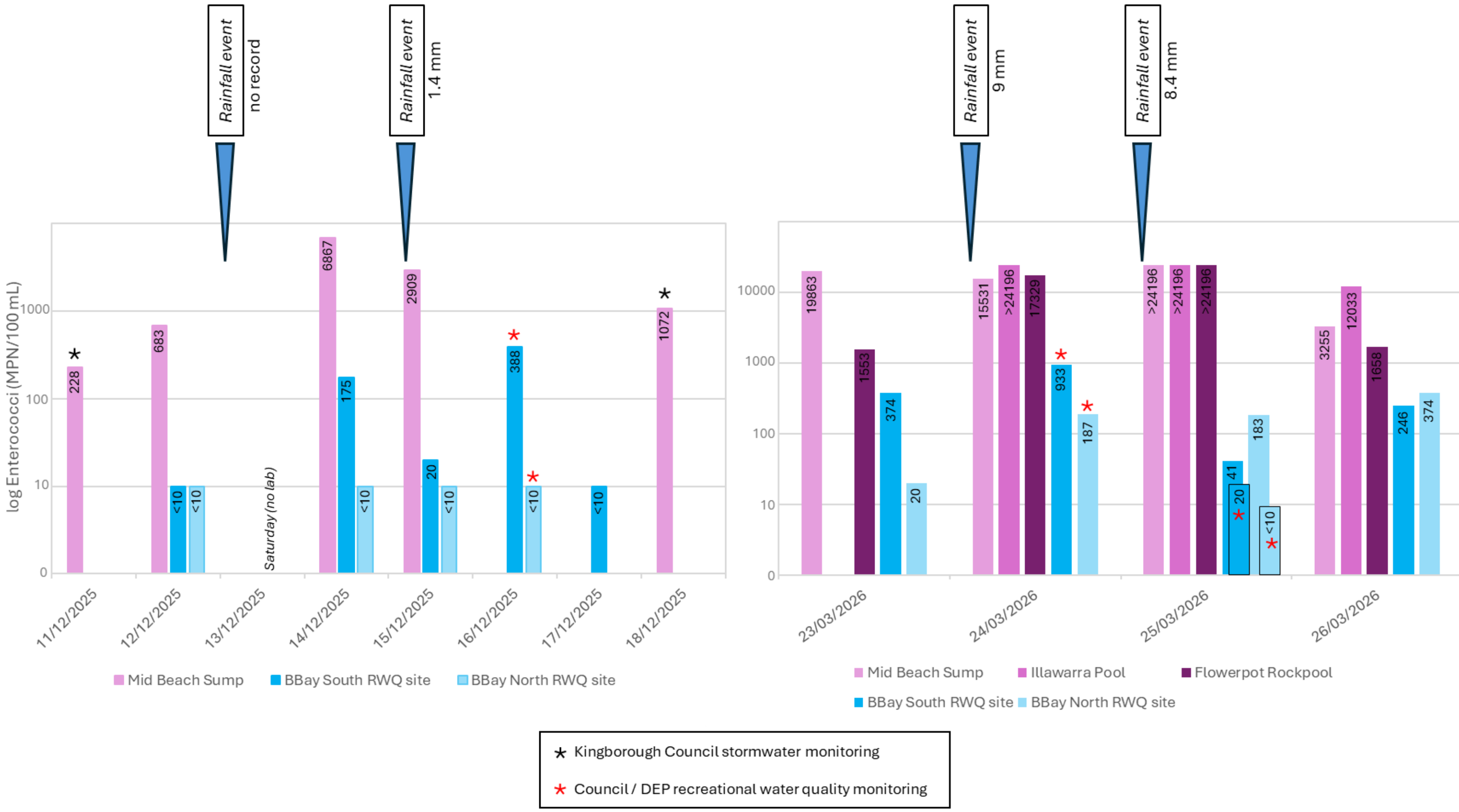

Figure 16. Water quality sampling (enterococci count) at stormwater and ambient sites in Blackmans Bay. Note logarithmic scale used to better visualise data as it spans orders of magnitude (actual values on columns).

Figure 17. Discharge at all three southern stormwater outfalls at Blackmans Bay during water quality sampling in December 2025.

2.4.2.2 March 2026 sampling

The consecutive day water quality sampling in March 2026 captured a period of time during the summer recreational period following 10 days of no recorded rainfall, and then two consecutive days of relatively high rainfall (BOM records of 9 mm and 8.4 mm on 24 March and 25 March 2026, Table 3).

The consecutive day monitoring in March 2026 indicated (Figure 16):

- Stormwater water quality is consistently poor, but worse following rainfall.
- Water quality in stormwater and at the Blackmans Bay South recreational site was poor prior to rainfall. On 23 March 2026, after 10 days of no rain and very low volume of discharging stormwater, water quality at the site exceeded the recreational guideline (374 MPN/100 mL).
- Water quality at the Blackmans Bay South recreational site was poor following rainfall, but also highly variable. Enterococci count exceeded varied from 933 to 41 to 246 MPN/100 mL over three days of sampling (Figure 16).
- There were small breaking waves along the shore (north and south) on all sampling occasions after rainfall (Appendix 2). High enterococci count coincided with elevated swell / wave action, but this was not consistent.
- Water quality at recreational water quality site Blackmans Bay North exceeded the recreational water quality limit on all days after rainfall, which is unusual for this site.[3]

This event of consecutive day monitoring again offered limited insight into water quality in southern Blackmans Bay following rainfall. There was variation in enterococci results between days of sampling, and on 25 March between Marine Solutions samples (at low incoming tide) and Kingborough Council samples (at mid incoming tide). Also notable is the elevated enterococci result

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[3] All sites in Kingborough (Taroona, Kingston, Blackmans Bay) had enterococci results which exceeded guidelines following the rainfall on Tuesday 24/03/2026. All sites were re-tested on 25/03/2026 and returned results ≤20 MPN/100 mL (except at Blackmans Bay Mid Beach), which differed from Marine Solutions results (KC ongoing monitoring results, recreational season 2025-26).

in stormwater and at the southern recreational site on 23 March, regardless of rainfall and stormwater discharge.

Figure 18. Conditions at the Illawarra stormwater outfall and beach pool during the March 2026 water quality sampling event, showing minimal discharge preceding rainfall (no pool on 23 March 2026), high volume discharge during rainfall (24 March 2026) and pooled discharge after rainfall (26 March 2026).

Figure 19. Conditions at the Flowerpot stormwater outfall and rockpool below during the March 2026 water quality sampling event, showing trickling discharge preceding rainfall (on 23 March 2026), high volume discharge during rainfall (24 March 2026) and trickling (minimal) discharge again after rainfall (26 March 2026).

2.5 Sumps / pools at stormwater outfalls

2.5.1 Methods

2.5.1.1 Mid Beach sump– Kingborough Council sampling

There is seawater ingress into the Blackmans Bay Mid Beach stormwater outfall at high tide and the Kingborough Council stormwater monitoring location for the Mid Beach outfall has been moved further upstream in the pipeline (Ocean Esplanade at Hazell Street access pit, see 'Mid Beach pipeline' in Figure 20) to avoid the influence of the tide on dilution. There is a possibility that water retained in the pipeline sump at the Mid Beach outfall.

Kingborough Council has sampled water quality (enterococci count) at both the Mid Beach pipeline (Hazell Street pit) and the Mid Beach pipeline sump twice a week since May 2025 (12 months of monitoring), with the aim of determining if there is stormwater retention in the sump, if this retention results in elevated bacterial levels in the sump, and the potential influence of this retention on water quality in the bay.

2.5.1.2 Outfall sump / pools – Marine Solutions sampling

Discharging stormwater at south Blackmans Bay is also retained in pools below the other two stormwater outfalls (Flowerpot and Illawarra, Figure 1) for periods of time, which may also act as reservoirs for bacteria.

Salinity testing was conducted at the Mid Beach sump site in different tidal conditions to allow some inferences to be made about tidal ingress and retention in the sump. The salinity of the pools below the Flowerpot and Illawarra outfalls was also tested in a range of tide and stormwater discharge conditions to attempt to understand the contribution of stormwater input, retention and seawater flushing.

Salinity of water at the Mid Beach sump, Illawarra pool, Flowerpot rockpool and the recreational water quality site Blackmans Bay South (Figure 1) was tested with a calibrated conductivity-temperature meter on nine occasions over December 2025, March and April 2026.

ZiP-Bactx-P2 testing for human-specific contamination was conducted on stormwater sump and pool samples on two occasions (26 March and 26 April 2026) to establish whether enterococci originated from human sewage.

Figure 20. The Mid Beach outfall, showing location of the access point on Ocean Esplanade opposite Hazell Street (Kingborough Council Mid Beach stormwater sampling point), location of sump and the outfall end on the beach.

2.5.2 Results

2.5.2.1 Mid Beach pipeline sump

Given the large catchment area that is drained via the Mid Beach stormwater outfall (relative to the Illawarra and Flowerpot catchments), and the tidal ingress into this pipeline at high tide (that then drains out during the outgoing tide), this stormwater outfall discharges to the Blackmans Bay receiving environment almost continuously (S. Woodhead, Kingborough Council, *pers. comm.* November 2025).

Regular bacterial count (enterococci) monitoring by Kingborough Council at both the Mid Beach pipeline and the Mid Beach sump since May 2025 (12 months of mostly weekly data) has revealed that enterococci counts in the sump sample are frequently greater than those in the Mid Beach pipeline sample (on 38 out of 84, or 45% of occasions when both sites were sampled, the Mid Beach sump had greater enterococci counts than the pipeline upstream, Kingborough Council water sampling results to date). This result occurred both when the pipeline was fully charged to Hazell Street (incoming - high tide) and not (outgoing – low tide) (observations by S. Woodhead, Kingborough Council, recorded with water sampling results).

Elevated enterococci in the sump sample occurred regardless of tidal state or tidal conditions (spring / neap tide). On some occasions, elevated enterococci count in the sump followed high rainfall in the week preceding sampling, but this was not consistently the case (Figure 21).

The highest enterococci count at the Blackmans Bay South recreational water quality site was recorded on 17 February 2026 (4,371 MPN/100 mL) followed high counts in the Mid Beach stormwater in the previous week (Figure 21). This was not clearly related to rainfall.

The high enterococci result on 17 February was preceded and followed by elevated concentrations (above recreational guidelines) so that water quality was poor in every sample collected at the site over a two week period (enterococci count >175 MPN/100 mL from 10/02/2026 to 24/02/2026, Figure 21, Kingborough Council 2025-26 recreational water quality sampling data). Elevated values are consistent with water quality results collected in February and March in previous years (S. Woodhead, Kingborough Council, *pers. comm*. February 2026). This suggests there may be a seasonal aspect to poor water quality.

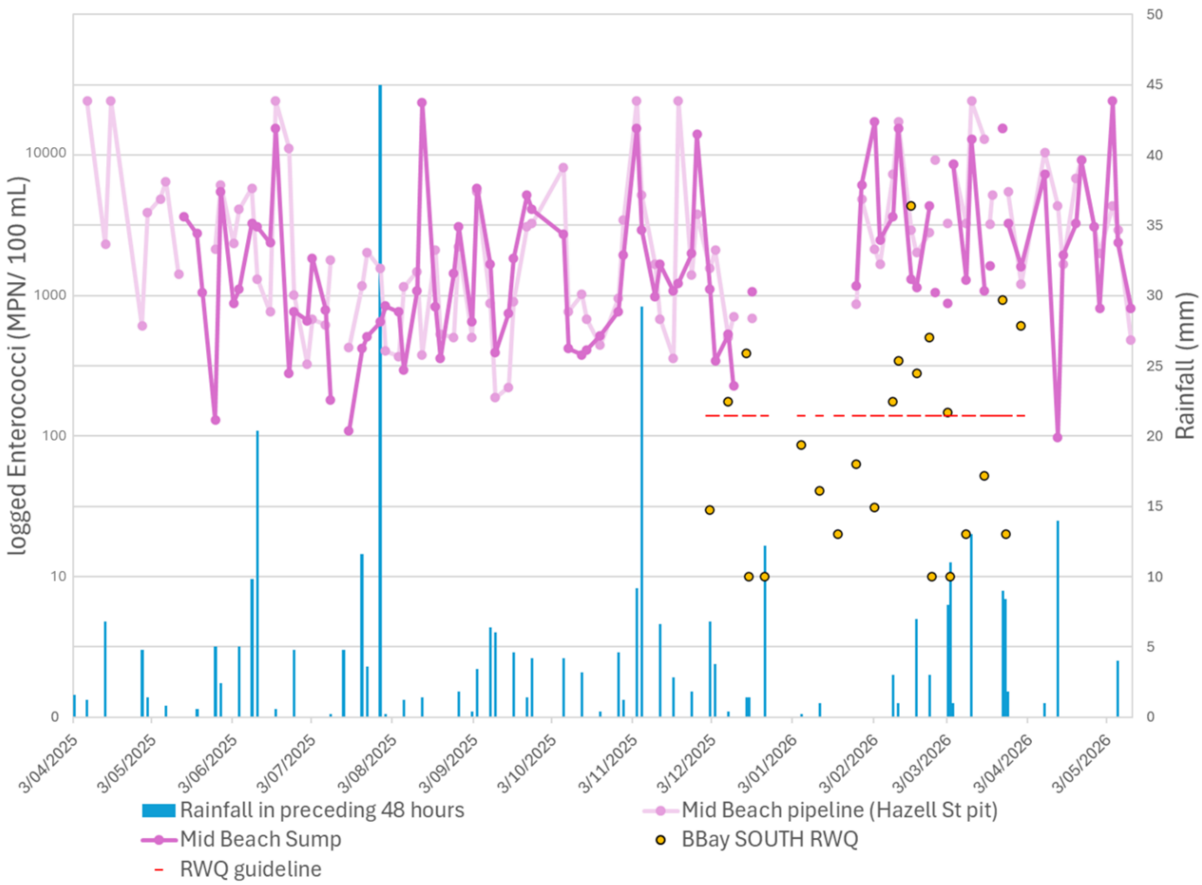

Figure 21. Enterococci counts in stormwater (Mid Beach outfall pipeline and downstream in the sump) since May 2025, and recreational water quality site at Blackmans Bay south for the 2025-26 recreational season (all data from Kingborough Council), with Hobart rainfall (mm)[4].

Note the logarithmic scale used to better visualise data and compare stormwater and recreational water quality results (as they span orders of magnitude).

The Blackmans Bay South recreational water quality results include the re-test values on the following day following failure. These were included to show the daily variation in enterococci results.

[4] Bureau of Meteorology (BOM) daily rainfall observations for Hobart (Ellerslie Road) {station 094029} https://www.bom.gov.au/climate/dwo/IDCJDW7021.latest.shtml

Salinity testing was conducted at the Mid Beach sump site in different tidal conditions to allow some inferences to be made about tidal ingress and retention in the sump. Salinity at the sump site was compared to stormwater (accessed at the Illawarra outfall and assumed to be similar to the Mid Beach stormwater salinity) and seawater in the bay during water quality sampling in December 2025 and March 2026 (see sampling details in Section 2.4).

Stormwater draining from the catchment is fresh (<1 ppt) and ambient salinity in the bay is typical of seawater (~ 34 ppt, see Appendix 6). Salinity of Mid Beach sump water ranged from 4.5 ppt at low tide to 29.1 ppt at high tide (Appendix 6), showing that there is tidal ingress and suggesting that there is retention of stormwater in the Mid Beach sump in a range of conditions. From the available data it appears likely that, under some conditions, enterococci bacteria accumulate in sump water in the Mid Beach outfall. From observations of water level in the Mid Beach pipeline and the salinity of sump water, it is certain that sump water is flushed by the incoming tide.

2.5.2.2 Illawarra and Flowerpot outfalls

Discharging stormwater at the southern end of Blackmans Bay is also retained in pools below the other two stormwater outfalls (Flowerpot and Illawarra, Figure 1) for periods of time. Stormwater was observed discharging from both the Flowerpot and Illawarra outfalls on every occasion that Marine Solutions visited Blackmans Bay since commencing this study (November 2025 to April 2026), usually as a trickle of stormwater unless following a rainfall event.

At the Flowerpot outfall, stormwater is retained in a rockpool below the outfall at low tide (Figure 22). At mid to high tide this rockpool is inundated and the contents are largely flushed with seawater. Salinity in the Flowerpot rockpool measured (at low tide when accessible) ranged from fresh (0.4 ppt, i.e., entirely stormwater) to saline (32.5 ppt, i.e., mostly seawater, Appendix 6).

At the Illawarra outfall, stormwater is retained in a pool on the beach, the nature and volume of which is dependent on stormwater flows and tide (Figure 23). After extended periods of dry weather there is no pool below the Illawarra outfall and trickling stormwater discharge soaks into the sand (see Figure 18 LEFT). At higher stormwater discharge and/or high tide the pool is open to the bay, and at low stormwater discharge and/or low tide the pool is isolated from the bay (Figure 23). Salinity in the Illawarra pool also ranged from fresh (0.0 ppt) to saline (31.2 ppt), indicating stormwater input and seawater flushing of the pool.

Salinity measurements show

- There is both tidal ingress and retention of stormwater in the Mid Beach sump in a range of conditions.
- There is tidal ingress into the pool below the Illawarra stormwater outfall and frequent tidal flushing of the stormwater that collects in this pool.
- There was continual stormwater input to the rockpool below the Flowerpot outfall (and Illawarra pool and Mid Beach sump) on all sampling occasions (i.e., salinity of pools / sump was always lower/fresher than ambient seawater).

Figure 22. Rockpool below the Flowerpot stormwater outfall at south Blackmans Bay at (A) low tide when isolated from the bay, and (B) mid tide when flushed by seawater. See Figure 2C for image of high tide at this site.

Figure 23. Pool below the Illawarra stormwater outfall at south Blackmans Bay at (A) high tide and high discharge, (B) lower tide and discharge, and (C) low discharge and isolated from the bay.

2.5.2.3 Bacteroides testing

ZiP testing for *Bacteriodes* was conducted when enterococci counts were elevated in samples on two occasions: after high rainfall in March 2026, and after a period of dry weather in April 2026 (Appendix 7). Samples from the Mid Beach sump and Flowerpot rockpool were elevated in enterococci and returned *positive-mid* detection for *Bacteriodes* on both sampling occasions, meaning that there was a distinct, mid-range presence of human sewage in these two stormwater sumps. The pool below the Illawarra outfall was only present and sampled in March 2026 and had elevated enterococci and a positive-low detection for *Bacteriodes* (i.e., trace amount of human sewage in the sample).

Bacteriodes was not detected in the ambient seawater samples collected at the recreational water quality sites (south, mid and north).

2.6 Observations of seagulls at southern Blackmans Bay beach

Seagulls (mostly silver gulls *Chroicocephalus novaehollandiae* but also kelp gulls *Larus dominicanus*) were observed on Blackmans Bay beach throughout the period of the field survey (November 2025 to April 2026). As noted in previous years (reported in Coughanowr 2020; M. Steele, Kingborough Council, *pers. comm.* 2025), seagull abundance on Blackmans Bay beach increased significantly over March / April 2026 compared to earlier in the recreational season.

Large flocks of seagulls were observed both in the shallow water and resting on the beach, with aggregations of gulls in the pools of stormwater below the Flowerpot and Illawarra outfalls (Figure 24). Seagull faeces on the sand along the waterline was a distinct feature of the beach in March and April 2026 (Figure 24E).

A sample of fresh seagull faeces (from multiple droppings) was collected from the beach sand between Mid Beach and Illawarra outfalls on 13 April 2026 and tested by PHL. Results revealed high enterococci count (19,040 MPN/g) and no detection of *B. doreii*.

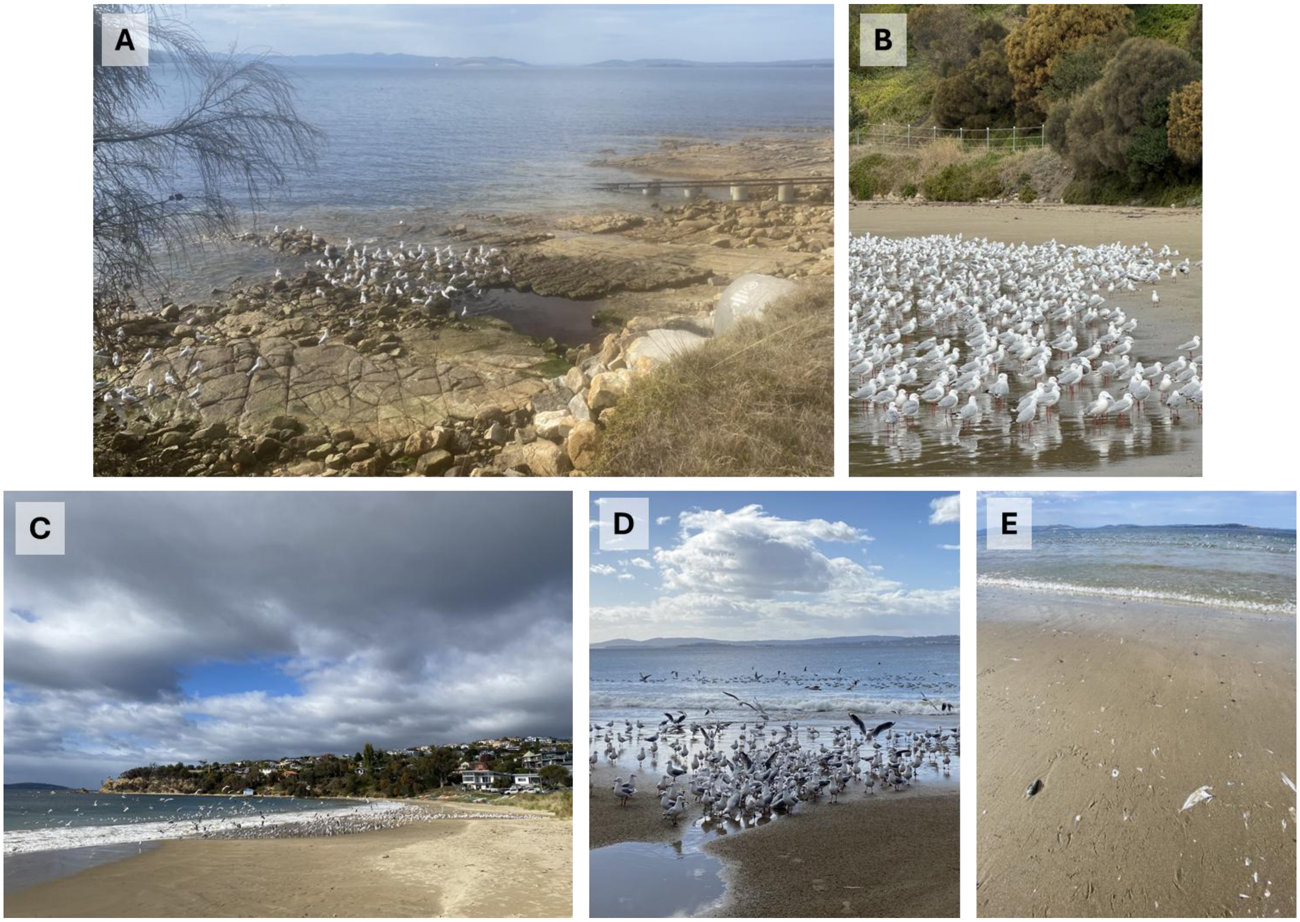

Figure 24. Observation of seagulls at southern Blackmans Bay in March and April 2026, showing (A) seagulls in the rockpool below the Flowerpot outfall, (B) and (C) large flock on the beach and in the water at the southern end of the beach, (D) seagulls in the stormwater discharging from the Illawarra outfall, and (E) seagull faeces on the beach sand at Blackmans Bay south.

3 Discussion and Conclusions

Elevations in enterococci concentration at southern Blackmans Bay occurred throughout the recreational season (1 December to 31 March) but were more frequent later in the season (February and March). This coincides with warmer water (and sediment) temperatures but also with the presence of large flocks of seagulls at the site. Enterococci are frequently detected in water samples collected in southern Blackmans Bay. The three stormwater outfalls that drain most of the Blackmans Bay catchment discharge into the southern part of the bay and flow continuously. Blackmans Bay stormwater contains consistently elevated enterococci concentrations.

3.1 Hydrodynamics of southern Blackmans Bay

The dye studies showed that stormwater discharging from the three southern outfalls is retained in inshore waters in southern Blackmans Bay. Movement of dye-dosed stormwater effluent (south with the outgoing tide; south turning to north with the incoming tide) was consistent with tide-driven currents in the Derwent Estuary.

The shape of Blackmans Bay combined with the action of the Coriolis force in the Derwent Estuary would result in surface waters pushed onshore in northerly and easterly winds, and shelter from southerly and westerly winds, especially at the southern end of the bay.

Given that:

- the three stormwater outfalls flank the Blackmans Bay South recreational water quality site to the north and south, and
- enterococci counts in the stormwater from all three outfalls frequently exceed public health guidelines (>80% of occasions at Illawarra and Flowerpot outfalls, and 100% of occasions at the Mid Beach outfall over the last 12 months), and
- stormwater effluent is retained inshore, moves up and down the shoreline and is continuously replenished by ongoing discharge,

it is clear that stormwater has a significant influence on water quality on the inshore waters of southern Blackmans Bay.

The results of the drogue study, showing the movement of water further offshore within the bay, was not consistent with the expected direction of tidal currents in the Derwent Estuary. All drogue tracks over both the outgoing and incoming tide showed movement of water into southern Blackmans Bay, indicating that water in the bay is retained in the southern corner.

Both the dye and drogues studies indicate that water is retained in southern Blackmans Bay and there is limited flushing, so that the continuous input of contaminated stormwater from the three outfalls likely accumulates in the southern corner of the bay, resulting in regularly contaminated water quality.

As another indicator of local currents, drift seaweed was observed to collect in the southern part of the bay. This may have implications for other contamination inputs in the bay (e.g., contamination from seagulls).

3.2 Inputs to contamination of southern Blackmans Bay

The three stormwater outfalls in southern Blackmans Bay discharge relatively consistently into the receiving environment, as a trickle in periods of dry weather and as large volumes after rainfall. Stormwater is retained in the sump at the Mid Beach outfall, in the pool below the Illawarra outfall, and temporarily (between tides) in the rockpool below the Flowerpot outfall. Results of water sampling and observations at these sumps/pools showed:

- Elevated enterococci counts in water samples regardless of rainfall,
- Positive results for active contamination from dilute human sewage,
- Continuous stormwater discharge (fresh water),
- Tidal ingress into sumps/pools, showing that water in the pool is regularly collected by the incoming tide and flushed into the bay,

- The pools (below Illawarra and Flowerpot) are attractive to seagulls, likely as a source of fresh water for drinking.

The prolific number of seagulls (mainly silver gulls) present on the sand and in the shallow water in the middle and southern end of Blackmans Bay beach over February, March and April 2026 was notable. It is not known whether numbers have increased at Blackmans Bay specifically, but silver gull numbers have increased in southern Tasmania in recent years (Australasian Seabird Group media release, June 2024). Seagull faeces contain enterococci bacteria, seagulls defaecate on the beach and in the water, and it is possible that contamination from seagulls adds to the poor water quality at Blackmans Bay. Seagulls were also abundant at southern and middle Kingston Beach over late summer without similar poor water quality results over the 2025-26 recreational season (*pers. obs.* and Kingborough Council water quality data).

Wave action at the beach did coincide with elevated enterococci counts (as also observed by Kingborough and Clarence Council officers), but there were also elevated enterococci counts in water samples when there was minimal wave action.

Notably, there was no *positive-high Bacteroides* result in the stormwater sumps/pools, indicating no severe, active, local human faecal contamination event, despite very high enterococci counts (>12,000 MPN/100 mL).

3.3 High variation in enterococci counts

The most notable result of ambient (recreational site) water quality testing was the variability in enterococci results. This has been evident in week-to-week sampling at Blackmans Bay South since 2018, but also in day-to-day sampling over the 2025-26 summer period. When a recreational water sample exceeds the guideline value a re-test of water quality is carried out the following day at the site. These re-test results are frequently vastly different from the original sample (Figure 16). Also notable is the variability in enterococci counts between consecutive days of sampling by Marine

Solutions (see Section 2.4), and variability in counts between Kingborough Council and Marine Solutions samples on the same day (Figure 16).

There is strong evidence from published literature that, no matter how quickly and carefully a sample is collected or how rapidly a test result can be obtained, a single sample of water will not adequately describe water quality for an entire day. In published experiments looking at the variability in enterococci in water samples from various beaches by collecting water samples every minute or every hour, it was found that enterococci count can change by an average 60% between consecutive samples, and by as much as 700% (Boehm 2007). Understanding and accepting the variation and uncertainty of 'patchy' water quality does not solve the issue of recreational water quality failure at Blackmans Bay South, which is determined from weekly testing of enterococci counts from a single sample, a method that is unlikely to change. Also, the persistence of poor water quality results at Blackmans Bay South throughout the recreational season relative to other sites in the Derwent Estuary monitored in the same way indicates ongoing contamination at the site, and more testing (more sites, replicate samples) is unlikely to change the result.

Enterococci count was found to be impacted by rainfall (and increased stormwater discharge), but counts were also high during long periods of dry weather. There was no consistent or predictable drop off in enterococci count in water samples following flushing from a rainfall event. Contamination was not strongly related to tidal state or wind direction. Contamination does coincide with increased turbulence (wave action stirring up the sand), but not consistently. The frequency of contaminated samples coincided with the late-summer influx of seagulls to the beach, but again this was inconsistent (water quality failures also occurred early in the recreational season, and water quality was often good when there were many seagulls on site).

On the two occasions that *Bacteroides* testing was conducted, there was no detection in ambient seawater samples (recreational water quality sites) even though the enterococci counts were relatively elevated (above guideline values). This may rule out human sewage contamination at the recreation sites at the time of sampling or indicate that this contamination was too dilute for detection. This does suggest there may be non-human enterococci inputs, such as from seagulls or from natural populations of enterococci, for example in beach sand or in the sand and algae of stormwater sumps/pools. It would be informative to test for *Bacteriodes* in future ambient seawater samples with very high enterococci counts (e.g., the highly contaminated Blackmans Bay South recreational water quality sample collected in February 2026, see Section 2.5.2). This would require regular water quality testing and prior planning with the PHL to retain samples until the results of enterococci testing were available and is suggested for the 2026-27 recreational season.

In summary, the field survey has shown that:

- Contaminated stormwater discharges into southern Blackmans Bay from three locations that flank the Blackmans Bay South recreational water quality site to the north and south.
- Stormwater discharging into the bay is retained inshore, moves up and down the shoreline with the outgoing and incoming tide, and is continuously replenished by ongoing discharge.
- Stormwater is retained for various periods of time in pools/sumps at each of these outfalls. Enterococci bacteria may accumulate in these pools (attached to sand or algae), and the pools are attractive to seagulls (which add to the enterococci load).
- There is tidal ingress into the pools/sumps so that contaminated water is frequently collected by the tide and flushed into the bay.
- High variation and fluctuation in contamination at the Blackmans Bay South recreational water quality site are a feature of enterococci testing in the ambient environment.

In conclusion, there are multiple interacting variables that impact on water quality in Blackmans Bay that need to be considered in combination because they are difficult to isolate. Contamination of stormwater, continuously discharging stormwater, retention of stormwater in pools and sumps and the input of seagulls likely all contribute to poor water quality in southern Blackmans Bay.

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5 Appendices

Appendix 1. Marine Solutions review document

Recreational Water Quality Investigation, Blackmans Bay Beach (South): Review of Existing Knowledge. Prepared by Marine Solutions for Kingborough Council, June 2025.

See attached: 2025_06 Marine Solutions BBay WQ Overview & Investigation _appendix.pdf

Appendix 2. Operational Summary

Date	Personnel#	Time (start)	Time (end)	Cloud x/8	Rain	Wind	Swell	Tide*	Works conducted
8/12/2025	[redacted]	0930	1230	7/8 to 3/8	Nil	10-15 knots NW	Nil	High, outgoing 0516 - 1.06m 1105 - 1.59m 1854 - 0.14m	Fluorescein dosing of three southern BBay outfalls in outgoing tide
12/12/2025	[redacted]	0850	1330	4/8	Nil	5 knots W	Nil	Low, incoming 0401 - 1.24m 1004 - 0.83m 1520 - 1.11m	Fluorescein dosing of three southern BBay outfalls in incoming tide Water sampling – Day 1 (pre rainfall)

Date	Personnel#	Time (start)	Time (end)	Cloud x/8	Rain	Wind	Swell	Tide*	Works conducted
14//12/2025	[redacted]	1700	1735	7/8	Nil	15 kts NW	Nil		Water sampling – Day 3 (post-rainfall)
15/12/2025	[redacted]	1640	1725	4/8	Nil	10 kts SW	0.2m		Water sampling – Day 4 (post-rainfall)
29/01/2026	[redacted]	1030	1430	6/8	Nil	8 kts NW	Nil	Outgoing to low, then incoming 0452 - 1.56m 1242 - 0.27m 1934 - 1.00m	Drogue study
23/03/2026	[redacted]	0930	1045		Nil	Nil	0.2m	Low, incoming 0724 - 0.37m 1352 - 1.10m	Water sampling – Day 1 (pre rainfall)
24/03/2026	[redacted]	0900	1000	8/8	Yes	10 kts SW	0.4m	Low, incoming 0822 - 0.29m 1505 - 1.10m	Water sampling – Day 2 (during rainfall)
25/03/2026	[redacted]	1030	1145	6/8	Nil	10 kts SW	0.4m	Low 0141 - 1.48m 0919 - 0.26m 1629 - 1.10m	Water sampling – Day 3 (post-rainfall)

Date	Personnel#	Time (start)	Time (end)	Cloud x/8	Rain	Wind	Swell	Tide*	Works conducted
26/03/2026	[redacted]	1000	1100	6/8	Nil	5 kts SE	0.2m	Low 0234 - 1.48m 1015 - 0.25m 1731 - 1.10m	Water sampling – Day 4 (post-rainfall) ZiP-Bactx-P2 testing
13/04/2026	[redacted]	1200		1/8	Nil	NA	0.4m	Low	Seagull faeces sample
17/04/2026	[redacted]	1000	1100	3/8	Nil	5 kts SW	0.4m	Outgoing 0748 - 1.16m 1310 - 0.76m	Water sampling
22/04/2026	[redacted]	1400	1500	1/8	Nil	10 kts N	0.2m	High 0703 - 0.19m 1417 - 1.18m 1832 - 1.04m	Water sampling
26/04/2026	[redacted]	1330	1500	1/8	Nil	5 kts NW	0.2m	Incoming 1030 - 0.43m 1713 - 1.20m	Water sampling ZiP-Bactx-P2 testing

Marine Solutions personnel, except where indicated (KC = Kingborough Council)

* Tide times and heights based on the Bureau of Meteorology's Hobart tide predictions.

Appendix 3. Documents and datasets used to inform this report

Document / Dataset	Provided by	Date provided
2025-26 Recreation season beach and stormwater outfall results combined	S. Woodhead, Kingborough Council	Regularly to mid May 2026
2025 Blackmans Bay winter sampling results 2025	S. Woodhead, Kingborough Council	December 2025
Kingborough Council water sampling records from 2018	S. Woodhead, Kingborough Council	April 2025
Coughanowr, C. A. (2020) BLACKMANS BAY RECREATIONAL WATER QUALITY REVIEW: SEPTEMBER 2019 THROUGH JUNE 2020 (10 July 2020)	M. Steele, Kingborough Council	April 2025
Holdsworth, D. & Dix, S. (2020) Results – Sampling program to investigate faecal pollution and faecal source markers at Blackmans Bay and Kingston Beach 2019-2020 (a pilot study). Version 1.5 updated 25 Nov 2020	M. Steele, Kingborough Council	April 2025
Woehler, E. J. (2017) Water quality and the potential involvement of Silver Gulls at Blackmans Bay Beach, Winter 2017. Report to Kingborough Council, October 2017	M. Steele, Kingborough Council	April 2025

Appendix 4. GPS locations relevant to this study

	Site Name	Chart Zone	Easting	Northing	Notes
Dye dosing	Mid Beach outfall	55G	526412.72	5238609.44	Dosed at sump, upstream of outfall
	Illawarra outfall	55G	526404.94	5238451.89	Dosed at weir, upstream of outfall (8/12/2025)
	Shoreline near Illawarra outfall	55G	526441.69	5238449.53	Dosed at low tide (12/12/2025)
	Flowerpot outfall	55G	526570.15	5238263.58	Dosed at outfall
Drogue study	Drogue A start	55G	526937.90	5238291.46	
	Drogue A outgoing stop	55G	526610.17	5238307.18	
	Drogue A incoming stop	55G	526734.17	5238482.82	
	Drogue B start	55G	527076.00	5238321.23	
	Drogue B outgoing stop	55G	526552.97	5238498.40	
	Drogue B incoming stop	55G	526916.75	5238384.05	
	Drogue C start	55G	526707.55	5238470.60	
	Drogue C outgoing stop	55G	526653.57	5238925.45	
	Drogue C incoming stop	55G	526547.37	5238673.00	
	Drogue D start	55G	526905.56	5238502.14	
	Drogue D outgoing stop	55G	526565.81	5238700.58	
	Drogue D incoming stop	55G	526713.00	5238593.84	
	Drogue 1 start	55G	526615.08	5238375.01	
	Drogue 1 stop	55G	526535.04	5238413.85	
	Drogue 2 start	55G	526581.95	5238322.94	
	Drogue 2 stop	55G	526551.12	5238337.72	
	Drogue 3 start	55G	526804.33	5238667.22	
	Drogue 3 stop	55G	526599.77	5238818.16	
	Drogue 4 start	55G	526679.51	5238366.32	
	Drogue 4 stop	55G	526529.42	5238437.97	

Appendix 5. Satellite images of Blackmans Bay to show accumulation of seaweed in southern corner

Note that this is close to the location of the Blackmans Bay South recreational water quality testing site.

Image source: Google Earth Pro

Appendix 6. Salinity of stormwater and the receiving environment in southern Blackmans Bay

Water quality testing events in December 2025, March 2026, April 2026. NM = not measured.

Date	Tidal state	Rainfall over previous day	Salinity (ppt)				
			Stormwater at Illawarra outfall*	Mid Beach outfall sump	Pool at Illawarra outfall	Pool at Flowerpot outfall	Seawater in southern Blackmans Bay
12/12/2025	low		0.4	9.2	0.2	29.9	33.2
14/12/2025	high		0.2	24.6	0.0	NM	34.9
15/12/2025	incoming		0.1	25.2	NM	NM	34.2
23/03/2026	incoming		0.1	29.0	no pool	0.4	33.8
25/03/2026	low		0.2	4.5	31.2	32.5	34.2
26/03/2026	low		0.1	28.5	18.8	31.1	34.5
17/04/2026	outgoing		0.1	21.5	22.1	30.4	34.1
22/04/2026	high		0.0	25.9	27.7	NM	34.2
26/04/2026	incoming		0.0	29.1	no pool	26.5	34.2

* accessible as it discharges down bank to beach, assumed similar salinity to Mid Beach + Flowerpot outfalls.

Appendix 7. *Bacteroides* testing results for stormwater and the receiving environment in Blackmans Bay

Results of ZiP-Bactx-P2 testing for human-specific contamination (presence of *Bacteroides dorei*) and enterococci counts. NM = not measured.

Date	Tidal state		Mid Beach outfall sump	Pool at Illawarra outfall	Pool at Flowerpot outfall	Blackmans Bay SOUTH RWQ	Blackmans Bay MID RWQ	Blackmans Bay NORTH RWQ
26/03/2026	low	Enterococci MPN/100 mL	12,033	2,613	1,658	246	NM	374
		B. dorei /50 mL	Positive-mid	Positive-low	Positive-mid	Not detected	NM	Not detected
26/04/2026	incoming	Enterococci MPN/100 mL	9,474	NM	15,531	441	384	NM
		B. dorei /50 mL	Positive-mid	NM	Positive-mid	Not detected	Not detected	NM