Southern Beaches Recreational Water Quality 2022-2023 Annual Report

Figure 1 Overview of sampling locations in Sorell Council area. More detailed maps provided in Appendix 1

"Sorell Council pays their respect to the traditional and original owners of this land the Mumirimina people, to pay respect to those that have passed before us and to acknowledge today's Tasmanian Aboriginal community who are custodians of this land".

Report prepared by **Rachel Tenni in accordance with the *Public Health Act 1997 and Recreational Water Quality Guidelines* - August 2007.**

SORELL COUNCIL

CONTENTS

LIST OF FIGURES

LIST OF TABLES

A NATURAL RECREATIONAL WATER BODIES

A-1 NAME AND LOCATION OF NATURAL WATER BODY AND PURPOSE.

Recreational water sampling undertaken by Sorell Council focuses on the broader Southern Beaches area between Connelly's Beach and Midway Point shown in Figure 1. Appendix 1 provides greater detail of all seven sampling locations. All Beaches are considered primary contact beaches with additional secondary contact such as fishing, boating and diving occurring at all sites. Primrose Beach is habitat for the Red Spotted Hand fish currently listed as critically endangered adding greater emphasis on monitoring the recreational water body for human induced pollutants. Red Ochre Beach North and South along with Tiger Head Beach are points where the ocean water is channeled and concentrated into Barilla Bay and Orielton Lagoon, both world renowned RAMSAR wetlands and home to oyster farming activities attached to a worldwide export industry. This highlights the importance of monitoring the recreational water bodies along this coastline due to the multi-faceted layers of public health safety and the unique world class environmental values.

Table 1 Sorell Council's Location and recreational purpose for water body use. All sites are primary contact sites.

Name and location of water body	Recreational Purpose for water body use
Connellys Marsh Knights Road	Swimming, Boating, Fishing, Snorkelling
Primrose Sands Beach: Petrel Street	Swimming, Boating, Fishing, Snorkelling
Park Beach: Park Beach Road Dodges Ferry	Swimming, Surfing, Fishing
Red Ochre South: Parnella Road Dodges Ferry	Swimming, Boating, Fishing
Red Ochre North: Tiger Head Rd Dodges Ferry	Swimming; Boating, Fishing, Environmental Values
Tigerhead Beach: Seventh Ave Dodges Ferry	Swimming, Boating, Fishing
McKinly St Beach Access Midway Point	Swimming, Boating, Fishing
Blue Lagoon	Secondary contact point (stormwater collection point)

A-2 DATE AND TYPE OF SAMPLING UNDERTAKEN AND RESULTS

Beaches and pools microbiological sampling was conducted in accordance with AS/NZS 5667, Water Quality -Sampling. Samples are collected in sterile containers provided by the Public Health Laboratory. Grab samples were used to collect water from a depth of approximately 300mm below the surface in water 600-1000mm deep. Aseptic techniques were used to avoid sample contamination.

Russell Kemp (AMO) and Rachel Tenni (EHO) collected water samples. Rachel Tenni conducted sanitary surveys at the start of the summer sampling period and noted any changes throughout the season shown in table 5.

Weekly samples were collected, in accordance with the *Public Health Act 1997 and Tasmanian Water Quality Guidelines*, during the three month summer period 2022-2023 as detailed. No sampling was undertaken over the Christmas-New Year period.

Samples are stored and transported under refrigeration (iced esky) to the Laboratory, arriving within three hours of collection.

A-3 BEACH SAMPLING -TESTS AND ANALYSES PERFORMED

A-3.i MICROBIOLOGICAL TESTING

Samples were tested for Enterococci (Faecal streptococci); results obtained were presumptive unless a presumptive result indicated an exceedance of the 140 organisms/100mL. Risk classifications are based on Table 5.10 of the NH&MRC Guidelines for Recreational Water.

A-3.ii SANITARY SURVEY

Sanitary surveys show the influences that each Beach has in relation to tidal influence, housing density, stormwater infrastructure, geomorphology and land use (i.e. agriculture, grazing, cropping, residential, land clearing). Table 2 refers to the sanitary surveys performed at the start of each sampling season (December). The Southern Beaches sanitary surveys are performed annually to determine any changes/influences/causative effects on the water quality of the recreational beach.

Table 2 Sanitary survey of all beaches

Location	Sanitary Survey Risk	Risk
Connellys Marsh Beach	Boatsheds, yachts moored ~400m from sample site, OSWMS on nearby properties, river at southern end of beach running through heavily grazed farms with livestock grazing within the riparian zone and river proper.	Moderate-high
Primrose Sands Beach	Failing OSWMS above beach, vehicle movement on beach (prohibited activity), and Stormwater minimal infrastructure.	*Moderate (fair)
Park Beach	High density OSWMS large dune system for protection against seepage, toilet block nearest to sample site. High energy beach	Low
Red Ochre South Beach	Stormwater outfalls; birdlife habitat protected area Spectacle Head, boatsheds, gravelly beach, higher density housing with OSWMS, greater threat of nutrient enrichment from OSWMS	High
Red Ochre North Beach	Bird life, OSWMS, medium density housing Spectacle Head a known rookery for shorebirds.	Moderate-high
Tiger Head Beach (Seventh Ave)	Large Stormwater outfalls, unsewered area, high density residential with Onsite waste management systems.	High
McKinly St Midway Point	Large stormwater outfalls onto beach, Orielton Lagoon RAMSAR wetland protected area. Higher density urbanisation with increased gross litter being washed into waterway. Hard surface land clearing. History of sewerage failure from pump station situated above the beach	High
Blue Lagoon	Secondary contact point monitoring for stormwater quality	High

*moderate is also known as fair

A-4 RESULTS AND DISCUSSION OF SAMPLING ANALYSIS

Rainfall data was collected from the Sorell abattoirs rain gauge which is located at Ingham's Processing factory. The change occurred due to the lack of quality control with the BOM data from the Dodges Ferry rain gauge. Therefore, data was taken from Sorell.

The following table (table 3) shows the relationship between water quality results and rainfall during the 2022-2023 season using the Pearson's r correlation. The 2022-2023 summer sampling period showed four beaches with strong correlations between rainfall and microbiological analysis results while Red ochre north and Tigerhead Beach returned a moderate correlation. Red ochre South beach showed no correlation with rainfall data. Appendix 8 provides The Tasmanian climate summary for summer 2022-2023. No major changes in recreational water quality bacteriological sampling were identified.

Table 3 Pearson's r correlation for 2022-23 summer sampling season

Name and location of water body	Pearson r Correlation result.
Connellys Marsh Knights Road	0.64 strong
Primrose Sands Beach: Petrel Street	0.55 strong
Park Beach: Park Beach Road Dodges Ferry	0.43 strong
Red Ochre South: Parnella Road Dodges Ferry	0.02 none
Red Ochre North: Tiger head Rd Dodges Ferry	0.39 moderate
Tigerhead Beach: Seventh Ave Dodges Ferry	0.37 moderate
McKinly St Beach Access Midway Point	0.63 strong

Pearson's r Correlation

If r = +.70 or higher Very strong positive relationship
+.40 to +.69 Strong positive relationship
+.30 to +.39 Moderate positive relationship
+.20 to +.29 weak positive relationship
+.01 to +.19 No or negligible relationship
-.01 to -.19 No or negligible relationship
-.20 to -.29 weak negative relationship
-.30 to -.39 Moderate negative relationship
-.40 to -.69 Strong negative relationship
-.70 or higher Very strong negative relationship

Table 4 uses a rolling five-year dataset for determining the 95th Hazen percentile (table 4). As determined by NHMRC and Tasmanian Recreational Water Quality Guidelines, the analysis shows four out of the seven southern Beaches remaining stable while two beaches improved and one beach declined in water quality from the previous summer season. The results are used in conjunction with sanitary survey data to determine classification of the beaches.

The rainfall data becomes an important part of our management of Council's stormwater system to accommodate varying flows at Sorell's main recreational water sites. There are up to five unfiltered stormwater outfalls surrounding the sample sites. Microbiological sampling results showed higher than usual bacterial detection however, the detection was generally below trigger value for all sites with the exception of McKinley Street Midway point due to sewer overflows after high intensity rainfall events.

A multifaceted approach using sanitary surveys and other variables such as wind, tides, temperature, population, stormwater, concentration of onsite waste management systems, intensive land clearing and agriculture, inappropriate development, high density housing close to waterways/increase in

hard surfaces and the severe fragmentation of native vegetation are all variables that may influence the water quality of the Southern Beaches. Rainfall event variables such as frequency, duration, volume and intensity influence the relationship of water quality and Southern Beaches as shown in previous reports.

Table 4 95th Hazen percentile figures from previous 5yrs

Site	***Connellys Beach***	***Primrose Sands***	***Park Beach***	***Red Ochre South***	***Red Ochre North***	***Tiger Head Beach***	***McKinly Beach***
Percentile	95	95	95	95	95	95	95
Minimum data points needed	10	10	10	10	10	10	10
Number data points you have	81	81	81	81	81	81	81
Data minimum	0	0	0	0	0	0	9
Data maximum	187	100	41	833	218	146	1050
Hazen result	41	63	20	72.7	140.3	78.95	294.35
****TRWQG category***	*A*	*A*	*A*	*A*	*A*	*A*	*B*
*****NHMRC category***	*B*	*B*	*A*	*B*	*B*	*B*	*C*
**Tasmanian Recreational Water Quality Guidelines 2007*							
***NHMRC 2006 to be used with classification matrix for faecal pollution of recreational water environments.*							

Table 5 represents the variation from 2021-2022 season to 2022-2023 season. Most sites were stable with minimal changes in water quality, however, the 2021-2022 summer sampling period was particularly dry while 2022-2023 summer season recorded average rainfall.

Table 5 Recreational Beaches monitored by Sorell Council. Red denotes Poor quality (>500MPN100mL/1), amber Denotes moderate quality (200-500MPN 100mL-1) and green denotes good water quality (<200MPN 100mL-1).

	Beaches/River	**Status 2022/23 based upon 5-year 95th Hazen percentile for Enterococci**	**Trend based upon 5-year 95th Hazen percentile for Enterococci**
1	Connellys Marsh	Good B	improved water quality from 52 (2017-2022) to 41 (2018-2023)
2	Primrose Sands	Good B	water quality stable from 58 (2017-2022) to 63 (2018-2023)
3	Park Beach	Good A	water quality stable no change 20 (2017-2022) to 20 (2018-2023)
4	Red Ochre South	Good B	stable water quality from 72.40 (2017-2022) to 72.7 (2018-2023)
5	Red Ochre North	Good B	water quality decrease from 124.00 (2017-2022) to 140.3 (2018-2023)
6	Tigerhead Beach	Good B	water quality improvement from 133.00 (2017-2022) to 78.95 (2018-2023)
7	McKinly Beach	Moderate C (fair)	water quality stable from 298.65 (2017-2022) to 294.35 (2018-2023)

A-5 SWIMMING BEACH CLASSIFICATION FOR START OF 2023-2024 SWIMMING SEASON.

The water quality classification for each Beach based on Table 5.13 – Classification matrix for faecal pollution in recreational water environments taken from the NHMRC – Guidelines for Managing Risks in Recreational Water. The Sorell Environmental Health Officer will use the Tasmanian Recreational Water Guidelines (green column) classification for the 2023-2024 summer season.

Table 6 Sorell Council Beach classifications based on 2022-23 summer sampling season.

Location	Sanitary survey risk	Water quality category based on 95% hazen percentile - 5year indicator organisms results	Combined Category NHRMRC	Tasmanian Rec Water Guidelines classification
Connellys Beach	Moderate-high	B	Fair	Good
Primrose Beach	Moderate	B	Good	Good
Park Beach	Low	A	Very Good	Good
Red Ochre Beach (South)	High	B	Fair	Good
Red Ochre Beach (North) aka Blue Lagoon	Moderate-High	B	Good	Good
Tigerhead Beach (Seventh Ave)	High	B	Fair	Good
McKinly St, Midway Point	High	C	Poor	Moderate (Fair)

No changes to classification status this season.

A-6 NATURAL WATER BODY DISCUSSION ON POTENTIAL SOURCES OF POLLUTION

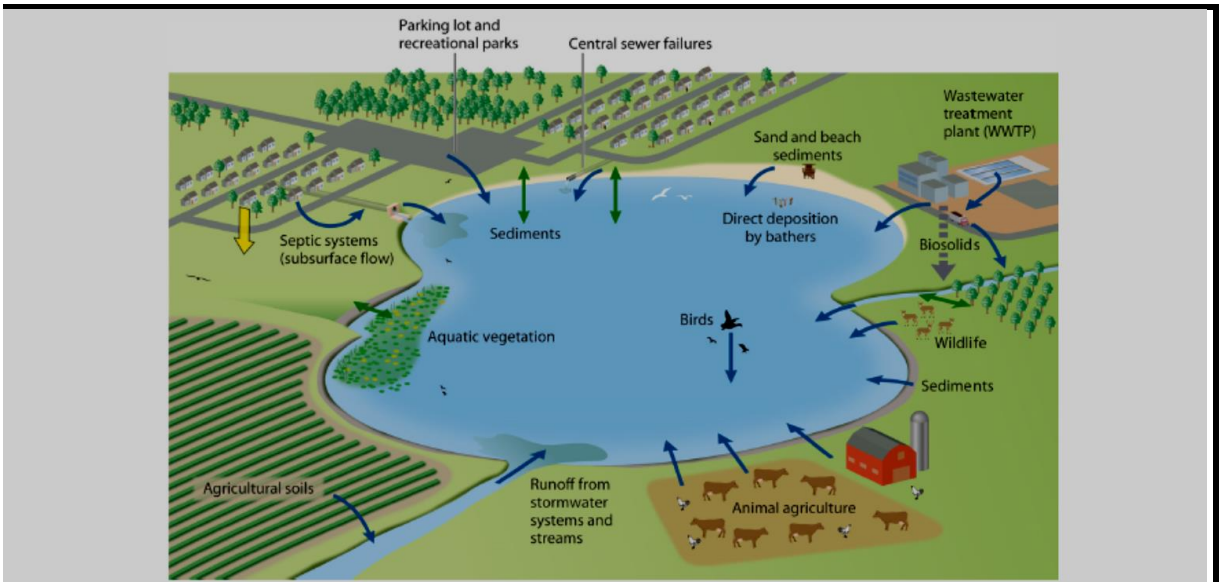

FIG 1 Sources of enterococci in water bodies (blue arrows) as well as sinks where enterococci are immobilized (yellow arrow) and areas of flux, in which enterococci can transition from a reservoir to the water column and vice versa (green arrows). Fluxes act as secondary sources or sinks depending upon the conditions.

Figure 2 Sources of enterococci is water bodies

The catchment areas of each of the recreational sampling sites (excluding McKinly St, which is serviced by reticulated sewerage) contain significant numbers of septic tanks and other on-site wastewater management systems. Some of which suffer varying levels of malfunction during periods of wet weather. Stormwater systems or creeks may convey pollutants discharged from on-site wastewater management systems to beach areas. Stormwater outfalls discharge in the vicinity of each of the recreational sampling sites, with the exception of Park Beach. Sorell Council were required to release water from Blue Lagoon Dodges ferry. Signage was erected to alert people not to swim during the release period and for 2 days following as advised after rainfall.

Dodges Ferry Lagoons. TasWater commissioned a Dodges Ferry Sewerage Technical Due Diligence Report in 2018. The report investigated the current status of the lagoons. This included the potential impacts from the 25yo sewage lagoon system to environment and public health. One finding concluded that a 'relatively high' risk of seepage within the underlying aquifers can potentially cause groundwater contamination and therefore increase the risk of pathogen contamination in nearby recreational waters. Increased nitrification has been recorded in nearby groundwater testing. TasWater is continuing to assess alternative options to upgrade the existing system increasing the treatment process to tertiary level and mitigate any contamination risk in the future. Sorell Council's environmental health and stormwater crew continue to monitor the condition and performance of the sewage lagoons.

Onsite Waste Management systems continue to play a significant role in recreational water quality due to the abundance and increased urbanisation of the Southern Beaches. Haphazard land clearing for residential dwellings has continued to increase dramatically with ribbon development occurring along the whole of the Southern Beaches from Dodges Ferry to Carlton Beach. This has seen vegetation cleared for hard surfaces, increased population, and higher visitation within the area. The introduction of the Southern beach On-site waste water and Stormwater Management Specific area plan has provided Council with a means to assess proposed developments onsite waste water management systems to ensure pollution from onsite waste water is mitigated through secondary

waste treatment via aerated waste treatment systems and raised sand filter beds. Both treatments provide nutrient reduction through evapotransipiration and uptake of excess nutrients through planting and the import of filtered sand beds.

A-7 NATURAL WATER BODY CONCLUSIONS/RECOMMENDATIONS

All sites are categorized as 'good' according to the Tasmanian Recreational Water Guidelines with the exception of McKinly Beach which is 'moderate' (Fair). The 2022/23 summer season recreational water quality of the Southern Beaches remained stable overall with little changes shown in the sanitary surveys conducted and bacteriological sampling. The continued sub divisions and development on small blocks increasing urbanisation of the Southern Beaches means less natural vegetation and landforms; reducing natural beneficial stormwater filtration. A major factor for the McKinley St classification can be attributed to increasing high volume stormwater flow concentrations from sudden storm events due to climate change. Due to the sewer pump station requiring substantial upgrade to accommodate for the increased housing in Midway Point, McKinly Street will continue to decline in quality until TasWater upgrade their infrastructure. In general climate change and increased urbanisation may result in increased volumes of unfiltered runoff from hard surfaces, potentially resulting in lowering the recreational water quality, leading to poor health for humans and extinction of the already threatened handfish.

Sorell Council has currently identified issues specific to the Sorell LGA;

- Inconsistences in rain water tank specifications in permits issued across various urban subdivisions;
- Inconsistencies in design and installation of stormwater outlets to roadside drains;
- Creation of easements for existing stormwater infrastructure;
- Development in flood-prone areas; and
- Administrative Processes.

These inconsistencies have been highlighted with the approved 'Stormwater in New Developments Policy'. The Stormwater asset management Plan has tasked regulatory and environmental teams to create a water quality monitoring schedule in accordance with Sorell Council's Planning Policy and statutory obligations. This will provide data to guide Council's future stormwater policy to 'hopefully' require all future developments to increase the percentage of pervious surfaces as part of Water Sensitive Urban Design within their applications to ensure the necessary balance between human habitation and natural landscapes.

The introduction of strategic planning in Water Sensitive Urban Design (WSUD) continues to be a high priority. Sorell Council has identified future population growth and greater urban development in the Southern Beaches area. This will bring with it increased pollution, land clearing, greater hard surface areas resulting in increasing stormwater flows and faecal infiltration into the surrounding environment.

To future proof the Southern Beaches from declining water quality that can lead to gastrointestinal and respiratory infections causing illnesses such as diarrhea, skin rashes, ear pain, coughs, lung congestion and eye pain, it is important, where possible to create riparian zones from 10m to 40m in existing creeks, rivers and natural water catchment areas to provide natural filtration systems before stormwater enters the primary recreational ocean beaches. Swales, infiltration systems and constructed wetlands are excellent at capturing gross pollutants, however treatment trains (a sequence of stormwater treatments, designed to meet the needs of a particular environment in order to maximise results. Treatment trains are important when a treatment measure needs pre-

treatments to remove pollutants, such as nutrients and fine sediment, which would otherwise impact its performance), rainwater tanks and onsite waste water systems remain the key to treating microbial pollutants before entering the recreational beaches. Sorell Council should educate land owners of their responsibility to maintain native vegetation along streams and riverbanks; to reduce fertilizer run off and to encourage sustainable development. Adhoc sub divisions close to sensitive aquatic areas have been approved to the detriment of the surrounding landscapes. Iron Creek has been neglected of any riparian zoning. According to long term local land owners, Platypus were once abundant in this catchment and have not been seen upstream for many years. It is recommended to sample Iron Creek for baseline data and investigate ways to work towards reestablishing healthy water catchment areas.

No stormwater pipes should be channeled directly to oceans unless a series of treatment ponds, and filtering systems have been implemented upstream prior to discharge. Onsite waste water must be treated while remaining within property boundaries to allow Council to achieve an uncontaminated clean environment for a safer and healthier future for Sorell Council area residents, visitors and the unique fauna and flora.

Future recommendations for McKinly is to request TasWater to provide improved bunding/protection around their infrastructure to ensure the sewage overflows are significantly reduced in volume before entering Pittwater. It is Council's responsibility to ensure the area remains an intact ecosystem reducing the human impacts through incompatible development.

Sorell Council should adopt a proactive management plan for all protected coastal and inland waterways. One recommendation is to provide public tracks and trails alongside the main creeks and rivers to create a network of human connectivity while providing riparian zones and wildlife corridors. Waterways are an excellent way of improving the environmental health of the local area and public health of the communities who live within our area.

A-8 REFERENCES

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2. *Enterococci in the Environment Muruleedhara N. Byappanahalli, Meredith B. Nevers, Asja Korajkic, Zachery R. Staley, and Valerie J. Harwood* Americian Society of Microbiology *and Molecular Biology Reviews December 2012 Vol 76. Downloaded from https://mmbr.asm.org/content/mmbr/76/4/685.full.pdf*
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9. Assessing the effectiveness of water sensitive urban design in southeast Queensland. https://eprints.qut.edu.au/34119/1/Nathaniel_Parker_Thesis.pdf accessed August 6 2020
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GUIDELINES

The Tasmanian Recreational Water Quality Guidelines 2007

National Health and Medical Research Council (NHMRC) "Guidelines for Managing Risks in Recreational Waters 2006

Australian Guidelines for Urban Stormwater Management (historical guidelines) https://www.waterquality.gov.au/guidelines/urban-stormwater.

Microbial Quality of Recreational Water Guidance Notes- Western Australia Department of Health and the University of Western Australia.

LEGISLATION

Public Health Act 1997

APPENDICES

APPENDIX 1 – COLOUR ATLAS RECREATIONAL WATER SAMPLING SITES

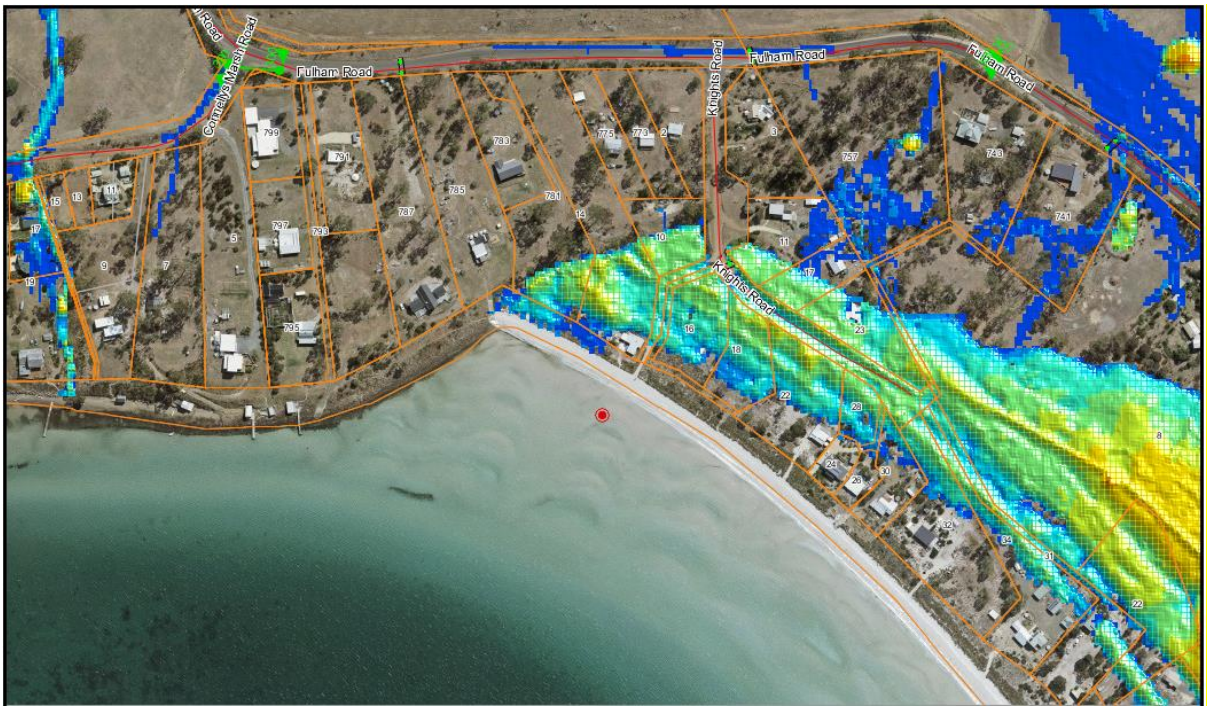


Figure 3 Connellys Marsh showing flood extent and stormwater infrastructure

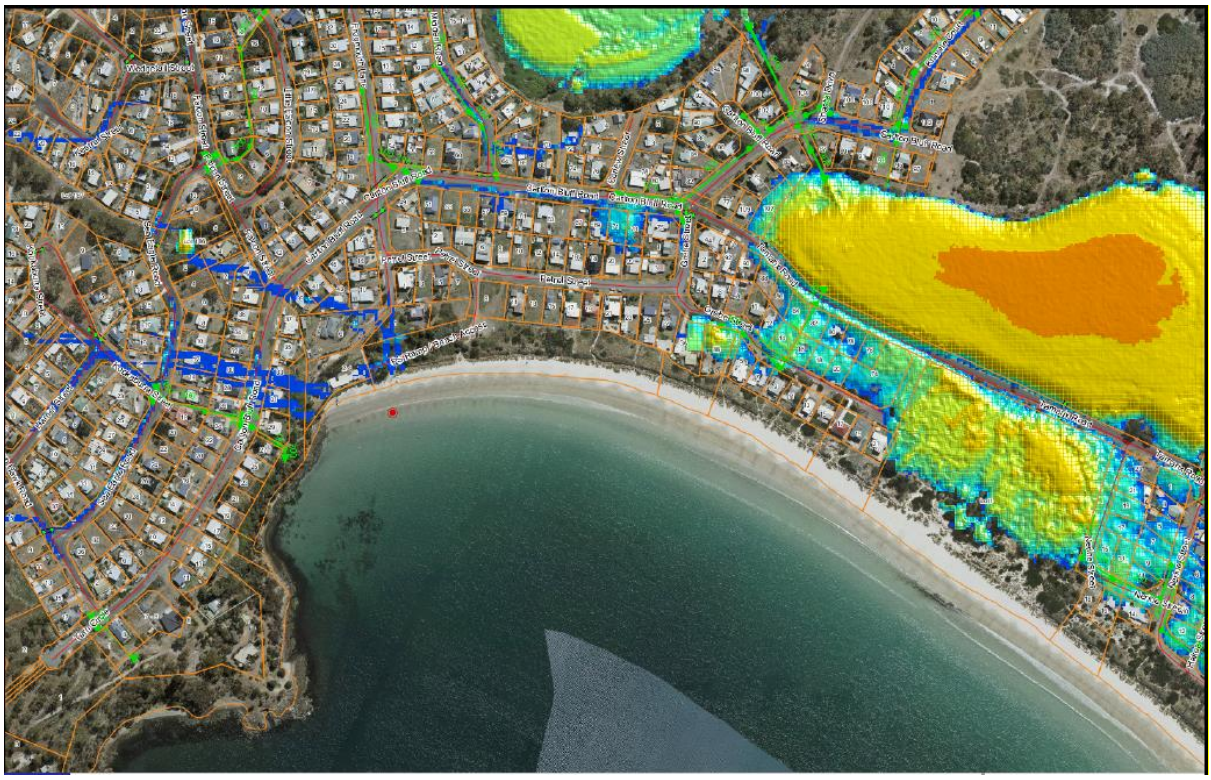


Figure 4 Primrose Sands Beach showing flood extent and stormwater infrastructure

Figure 5 Park Beach Carlton showing flood extent and stormwater infrastructure

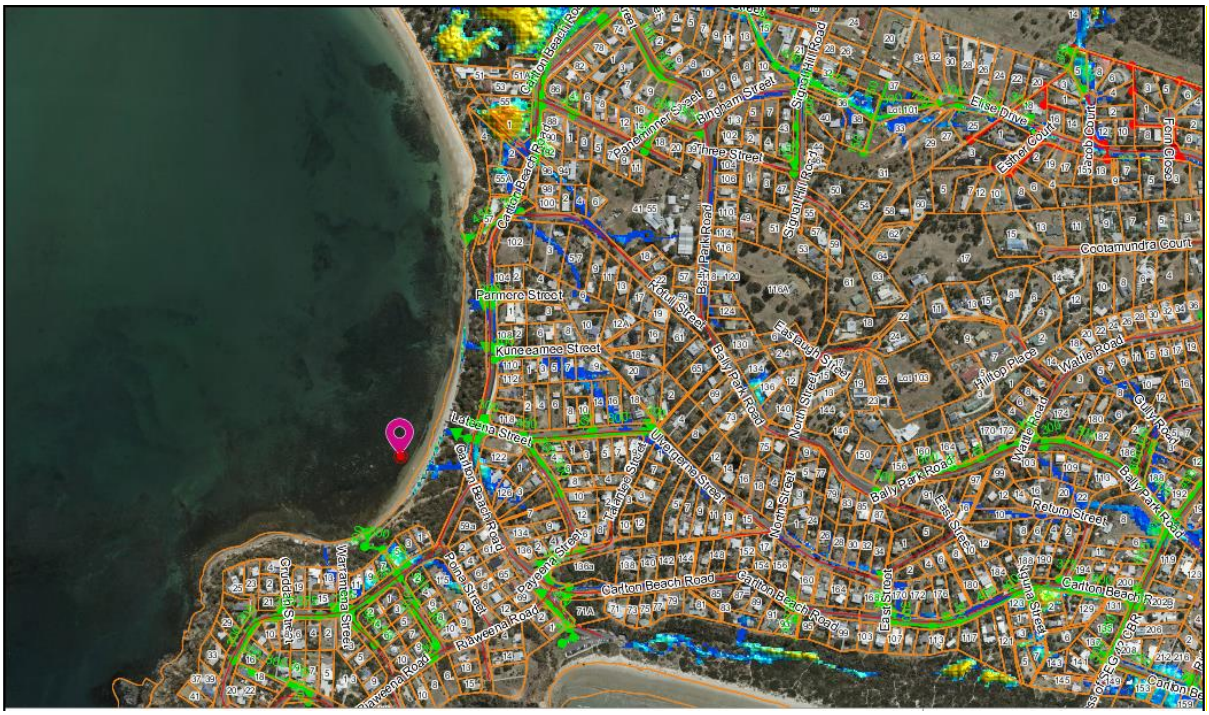


Figure 6 Red Ochre Beach South showing flood extent and stormwater infrastructure

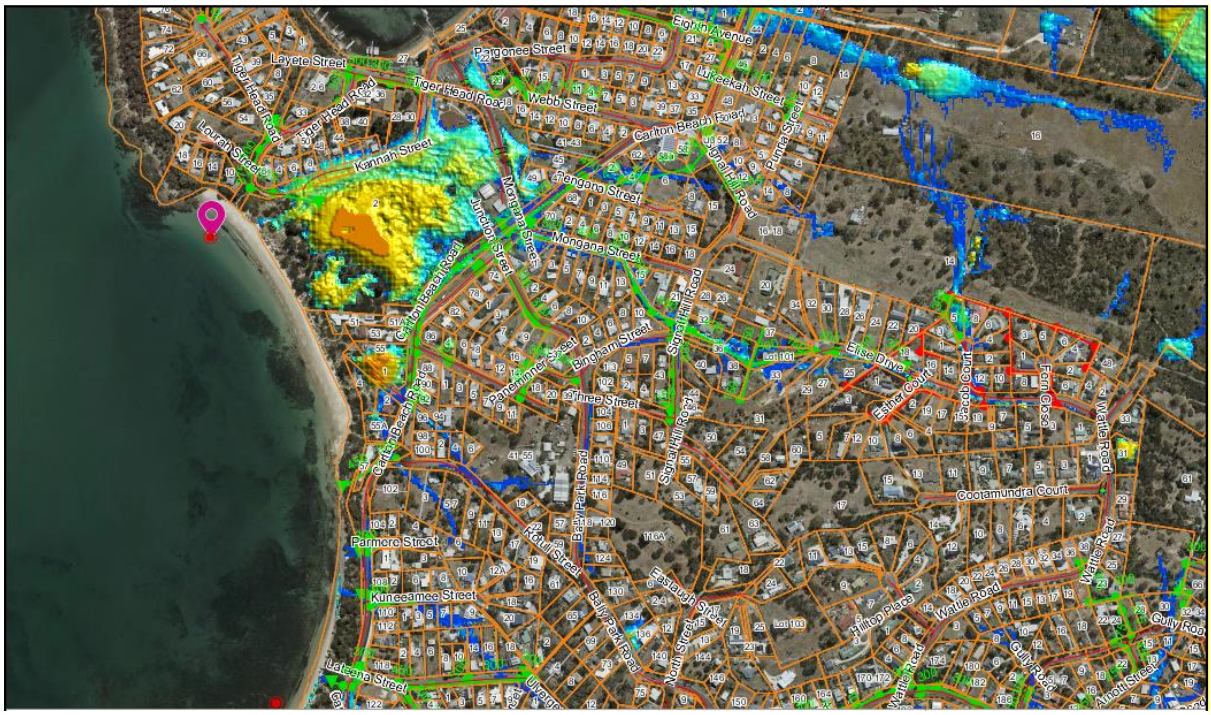


Figure 7 Red Ochre Beach North showing flood extent and stormwater infrastructure

Figure 8 Tiger Head Beach @ 7th Ave showing flood extent and stormwater infrastructure

Figure 9 McKinly St Beach sewer in red; stormwater in green, flood risk and waterway shown

APPENDIX 2 – SUMMARY OF RECREATIONAL WATER BODY SAMPLING RESULTS 2022-2023

Table 7 data results from 2022-23 summer season red denoting poor sample result and amber denoting a fair sample result. Red denotes a failed water result, amber some contamination and pink minor reading.

Enterococci testing from 100ml grab sample (pink 10 is quantified however denotes <10 CFU)							
2022-2023 Date of sample	**Connellys Beach**	**Primrose Beach**	**Park Beach**	**Red Ochre - South**	**Red Ochre - North**	**Tigerhead - Seventh Avenue**	**McKinley St Midway Point**
6/12/2022	10	10	10	10	148	20	10
12/12/2022	187	75	41	10	98	74	987
19/12/2022	10	31	10	10	10	10	10
3/01/2023	10	10	10	10	20	20	52
9/01/2023	10	10	10	10	10	30	20
16/01/2023	10	10	10	10	10	10	10
23/01/2023	10	10	10	10	10	10	31
30/01/2023	10	10	10	10	10	10	10
7/02/2023	10	10	10	10	10	10	10
14/02/2023	10	10	10	10	10	10	10
20/02/2023	10	20	41	98	52	63	20
27/02/2023	10	10	10	20	10	20	10
6/03/2023	10	10	20	41	10	146	63
14/03/2023	10	10	10	10	10	10	10
20/03/2023	10	10	10	10	10	10	20
27/03/2023	10	10	10	20	10	20	10

APPENDIX 3 RAINFALL DATA

Table 8 Rainfall data taken from Sorell Abbatoirs rain gauge manually read by a volunteer Weather Observer and was quality controlled by Bureau of Meteorology. *72 hour cumulative Rainfall measurements preceding the sample day.*

Date 2022-23	Total Rainfall(mm) for preceding 3 days Taken from Sorell Abbatoirs.
6/12/2022	4.2
12/12/2022	11.0
19/12/2022	1.0
3/01/2023	0
9/01/2023	0
16/01/2023	0
23/01/2023	2.4
30/01/2023	1.6
7/02/2023	5.8
14/02/2023	1.6
20/02/2023	2.0
27/02/2023	9.8
6/03/2023	5.0
14/03/2023	1.6
20/03/2023	1.6
27/03/2023	2.2

The total rainfall for the four months Dec 2022-Mar 2023

APPENDIX 4 - GUIDELINE VALUES FOR MICROBIAL QUALITY OF RECREATIONAL WATERS

For marine waters, only faecal streptococci (Enterococci) showed a dose-response relationship for both gastrointestinal illness and Acute Febrile Respiratory Infection (AFRI). A recent reanalysis of this data using a range of contemporary statistical tools has confirmed that the relationships originally reported are robust to alternative statistical approaches.

The cut-off or bounding values (40, 200, and 500) are expressed in terms of the 95th percentile of numbers of faecal streptococci per 100 mL, and represent readily understood levels of risk, based on the exposure conditions of the key studies.

For the purpose of water-quality monitoring, the terms 'faecal streptococci', 'intestinal Enterococci' and 'Enterococci' are considered to be synonymous. Exposure to recreational waters with these measured indicators refers to body contact that is likely to involve head immersion, such as swimming, surfing, white-water canoeing, scuba diving and dinghy-boat sailing.

95th Percentile value of intestinal Enterococci / 100ml (rounded Values)	Basis of derivation	Estimated risk per exposure
$\leq$ 40 A	This range is below the NOAEL in most epidemiological studies.	<1% GI illness risk <0.3% AFRI risk The upper 95th percentile value of 40/100ml relates to an average probability of less than one case of gastroenteritis in every 100 exposures. The AFRI burden would be negligible.
41-200 B	The 200/100 ml value is above the threshold of illness transmission reported in most epidemiological studies that have attempted to define a NOAEL or LOAEL for GI illness	1-5% GI illness risk 0.3-1.9% AFRI risk The upper 95th percentile value of 200/100 ml relates to an average probability of one case of gastroenteritis in 20 exposures. The AFRI illness rate at this upper value would be less than 19 per 1000 exposures, or less than approximately 1 in 50 exposures.
201-500 C	This range represents a substantial elevation in the probability of all adverse health outcomes for which dose-response data are available.	5-10% GI illness risk 1.9-3.9% AFRI risk This range of 95th percentiles represents a probability of 1 in 10 to 1 in 20 of gastroenteritis for a single exposure. Exposures in this category also suggest a risk of AFRI in the range of 19-39 per 1000 exposures, or a range of approximately 1 in 50 to 1 in 25 exposures.

>500 D	Above this level, there may be a significant risk of high levels of minor illness transmissions.	>10% GI illness risk >3.9% AFRI risk There is a greater than 10% chance of gastroenteritis per single exposure. The AFRI illness rate at the 95th percentile point of >500/100ml would be greater than 39 per 1000 exposures, or greater than approximately 1 in 25 exposures.

Notes:

1. Abbreviations used: A-D are the corresponding microbial water quality assessment categories used as part of the classification procedure; AFRI = acute febrile respiratory illness; GI = gastrointestinal; LOAEL = lowest-observed-adverse-effect level; NOAEL = no-observed-adverse-effect level.
2. The "exposure" in the key studies was a minimum of 10 minutes of swimming involving three head immersions. It is envisaged that this is equivalent to many immersion activities of similar duration, but it may underestimate risk for longer periods of water contact or for activities involving higher risks of water ingestion (see also note 8)
3. The "estimated risk" refers to the excess risk of illness (relative to a group of non-bathers) among a group of bathers who have been exposed to faecally contaminate recreational water under conditions similar to those in the key studies.
4. The functional form used in the dose-response curve assumes no further illness outside the range of data (i.e., at concentrations above 158 intestinal enterococci/100ml). Thus, the estimates of illness rate reported above this value are likely to be underestimates of the actual disease incidence attributable to recreational water exposure.
5. The estimated risks were derived from sewage-impacted marine waters. Different sources of pollution and more or less aggressive environments may modify the risks.
6. This table may not relate to children, the elderly or the immunocompromised, who could have lower immunity and might require a greater degree of protection. There are presently no adequate data with which to quantify this, and no correction factors are therefore applied.
7. Epidemiological data on fresh waters or exposures other than swimming (e.g., high-exposure activities such as surfing, dinghy boat sailing or white-water canoeing) are currently inadequate to present a parallel analysis for defined risks. Thus, a single series of microbial values is proposed, for all recreational uses of water, because insufficient evidence exists at present to do otherwise. However, it is recommended that the length and frequency of exposure encountered by special interest groups (such as bodysurfers, board riders, windsurfers, sub-aqua divers, canoeists and dinghy sailors) be taken into account.
8. Where disinfection is used to reduce the density of index organisms in effluent and discharges, the presumed relationship between intestinal Enterococci (as an index of faecal contamination) and pathogen presence may be altered. This alteration is, at present, poorly understood. In water receiving such effluents and discharges, intestinal Enterococci counts may not provide an accurate estimate of the risk of suffering from gastrointestinal symptoms or AFRI.
9. Risk attributable to exposure to recreational water is calculated after the method given by Wyer et al. (1999), in which a $\log_{10}$ standard deviation of 0.8103 for faecal streptococci was assumed. If the true

standard deviation for a Beach is less than 0.8103, then reliance on this approach would tend to overestimate the health risk for people above the threshold level, and vice versa.

Note that the values presented in this table do not take account of health outcomes other than gastroenteritis and AFRI. Where other outcomes are of public health concern, then the risks should also be assessed and appropriate action taken.

10. Guideline values should be applied to water used recreationally and at the times of recreational use. This implies care in the design of monitoring programs to ensure that representative samples are obtained.

Page 70-71, Guidelines for Safe Recreational Water Environments – Vol 1 – Coastal and Fresh Waters – World Health Organisation, Geneva, 2003.

APPENDIX 5 CLASSIFICATION MATRIX FOR FAECAL POLLUTION OF RECREATIONAL WATER ENVIRONMENTS.

Table 5.13 Classification matrix for faecal pollution of recreational water environments*

		Microbial water quality assessment category (95th percentiles — intestinal enterococci/100 mL)				Exceptional circumstances[c]
		A ≤ 40	B 41–200	C 201–500	D > 500	
Sanitary inspection category (Susceptibility to faecal influence)	Very low	Very good	Very good	Follow up[b]	Follow up[b]	ACTION
	Low	Very good	Good	Follow up[b]	Follow up[b]	
	Moderate	Good[a]	Good	Poor	Poor	
	High	Good[a]	Fair*	Poor	Very poor	
	Very high	Follow up[a]	Fair*	Poor	Very poor	
	Exceptional circumstances[c]	ACTION				

a Indicates possible discontinuous/sporadic contamination (often driven by results such as rainfall). This is most commonly associated with the presence of sewage – contaminated stormwater. These results should be investigated further, and initial follow-up should include verification of the sanitary inspection category and ensuring that samples recorded include 'event' periods. Confirm analytical results, review possible analytical errors.

b Implies nonsewage sources of faecal indicators (eg livestock), which need to be verified.

c Exceptional circumstances are known periods of higher risk such as during an outbreak involving a human or other pathogen that may be waterborne (eg avian botulism — where outbreaks of avian botulism occur, swimming or other aquatic recreational activities should not be permitted), or the rupture of a sewer in a recreational water catchment area etc. Under such circumstances the classification matrix may not fairly represent risk/safety.

* In certain circumstances there may be a risk of transmission of pathogens associated with more severe health effects through recreational water use. The human health risk depends greatly on specific (often local) circumstances. Public health authorities should be engaged in the identification and interpretation of such conditions.

Figure 10 NH&MRC Guidelines for Managing Risks in Recreational Water

APPENDIX 7 TASMANIAN RECREATIONAL WATER QUALITY GUIDELINES

The Tasmanian Recreational Water Quality Guidelines, (the "Tasmanian Guidelines") adopted, by reference, the National Health and Medical Research Council (NHMRC) "Guidelines for Managing Risks in Recreational Waters 2006", (the "new NHMRC Guidelines"); provide a range of guideline values in respect of Enterococci sample statistics, which should be considered in combination with sanitary survey results, in assessing the suitability of recreational water bodies for primary contact recreation.

Whilst monitoring for Enterococci or Thermotolerant Coliforms is considered to provide evidence of faecal contamination in a water body; it does not provide anything more than an indication of the likely presence of viral contamination. Enteric viruses such as Hepatitis A, Norovirus, and Adenovirus may be present in wastewater and are all capable of causing illness in humans, often requiring very low infective doses to actually cause infection. These viruses represent the most likely risk to public health from primary contact recreation in water contaminated by wastewater effluents, even when the more easily detectable bacteria, such as Enterococci or Thermotolerant Coliforms are only detected at levels which are unlikely to result in direct bacterial infections.

This is especially significant where such recreational waters are known to be impacted by point sources of urban wastewater from unsewered areas and consequent high risk of human faecal contamination. To summarise, where otherwise low levels of faecal contamination are detected, there may well be a significant risk of transmission of viral infections, especially if the source of this faecal contamination is thought or known to be of human origin, rather than, for example, from native wildlife such as shore birds.

The NHMRC Guidelines are based in part upon a World Health Organisation publication (WHO, 2003, Guidelines for Safe Recreational Water Environments – Vol 1 – Coastal and Fresh Waters, Geneva) which provide an A to D risk management classification, based on 95th Percentile figures derived from monitoring program results. The classifications are based on the actual observed risk of developing illness such as Gastro Intestinal Illness (GI illness) and/or Acute Febrile Respiratory Infection (AFRI) after primary contact recreation in waters contaminated with a given range of Enterococcus bacteria of human faecal origin. This risk management classification is adopted by both the NHMRC and Tasmanian Guidelines. The NHMRC Guidelines provide in principle for a risk-based approach to recreational water quality classification, linking the decision making process to sanitary survey results combined with microbiological surveys, however neither the NHMRC Guidelines nor the Tasmanian Guidelines provide a clear and objective means of achieving this. The Tasmanian guidelines classify waters in the B category as "Good" despite studies elsewhere which demonstrate significant risks of infection in swimmers using waters in this category.

Cat. A – 95th Percentile <40 orgs/100mL equates to <1% GI illness risk & =<0.3% AFRI risk

Cat. B – 95th Percentile 41-200 orgs/100mL, equates to 1-5% GI illness risk & 0.35-3.95% AFRI risk

Cat. C – 95th Percentile of 201-500 orgs/100mL, equates to 5-10% GI illness risk & 1.9-3.9% AFRI risk

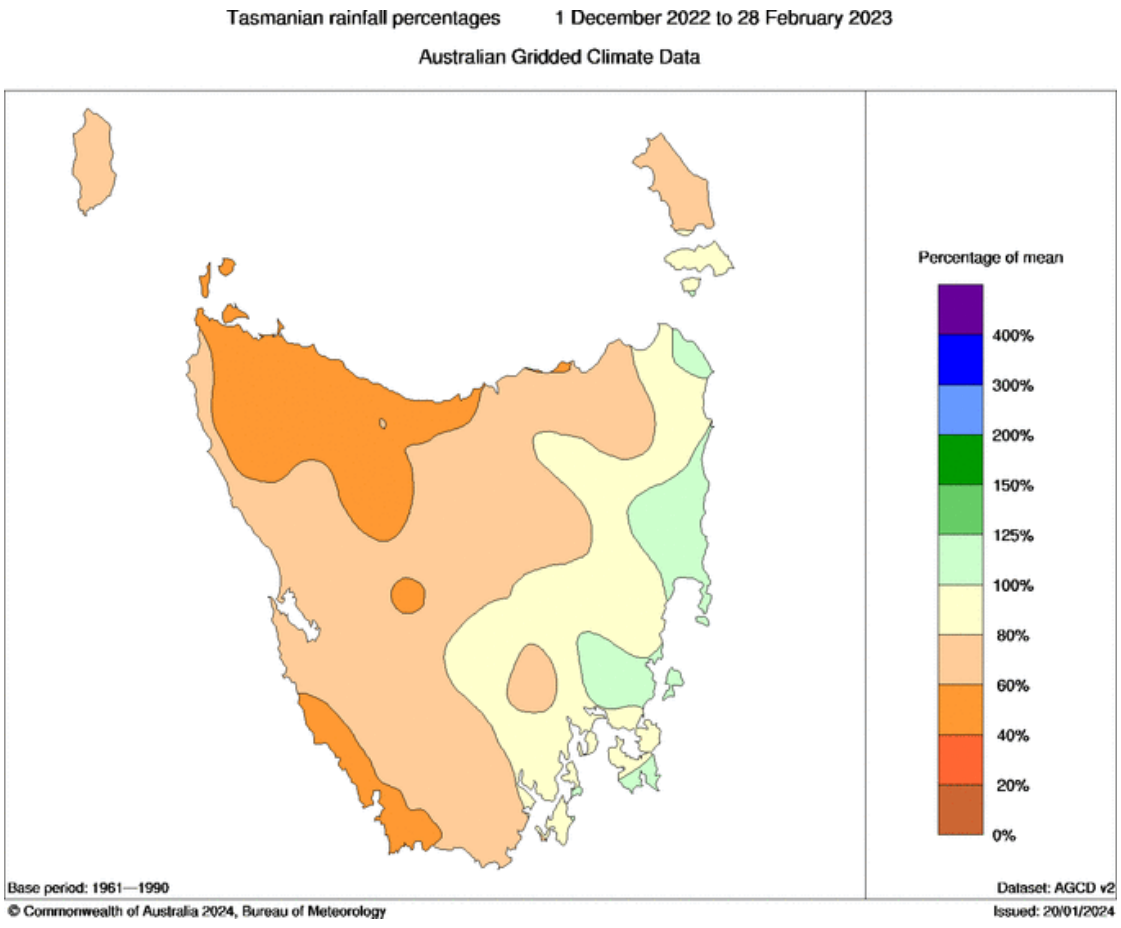
Cat. D – 95th Percentile of >500 orgs/100mL equates to >10%% GI illness risk & >3.9% AFRI risk.

The Tas Guidelines combine Categories A and B (i.e. 0-40 and 41-200) into a single "Good" Water Quality Indicator, with Category C described as "Moderate" and Category D as "Poor". They also provide for a requirement to resample within 48 hours of a sample returning a result greater than

140 Enterococci per 100mL and to “close” Beaches where two consecutive water results exceed 280. The NHMRC Guidelines by contrast define waters in both the C and D Categories as “Poor”.

APPENDIX 7: SUMMARY OF EAST COAST WEATHER DATA SOURCE BUREAU OF METEOROLOGY ACCESSED OCTOBER2023.

	2022	2023	2023	2023				
	Dec	**Jan**	**Feb**	**Mar**		**Rank**		
				Site No.				
	Orielton (East Orielton Road)			94130				
Mthly Total	96.4	9.6	54	22	182	Average		
Mnthly Mean (all yrs)	57.6	50.5	36	42	186.1			
				Site No.				
	Wattle Hill			94064				
Mthly Total	109.6	15	72.6	27.2	224.4	Average		
Mnthly Mean (all yrs)	67	51.2	47.4	49.6	215.2			
				Site Nos.				
	Hobart Airport			94008	94250			
Mthly Total	67.4	*4.4*	*39.4*	*19.6*	130.8	Average		
Mnthly Mean (all yrs)	52.1	40.2	34.9	36.3	163.5			



Southeast (district 94)			Total for summer 22-23	Average for summer	Rank of summer 22-23	Fraction of summer average
Campania (Kincora)			117.6	109	average	108%
Cape Bruny (Cape Bruny)			132	151.9	average	87%
Dover			172.6	172	average	100%
Dunalley (Stroud Point)			136.8	119.6	average	114%
Grove (Research Station)			160.4	148.8	average	108%
Hobart (Ellerslie Road)			135.2	142.4	average	95%
Hobart Airport			111.2			
kunanyi (Mount Wellington Pinnacle)			233.6	253.5	average	92%
Tasman Island			218.6	178.6	average	122%