Clarence City Council

Recreational Waters Report

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CONTENTS

1.0 WATER BODY DETAILS

1.1 Pools and Spas

The following public swimming pools and spas shown in table 1 are located within Clarence City Council municipality.

Table 1: Public swimming pools and spas located in Clarence City Council

Swimming Pools	Location
Steve's Swim School (was Acton Swim Centre)	Acton Park
Clarence Aquatic Centre (YMCA)	Montagu Bay
Sea Horse Swim Centre	Howrah
Barilla Thermal Springs	Cambridge
RAMADA (was Wyndham Resort)	Seven Mile Beach
Oceana Health and Fitness	Mornington
Clarence Joint Therapy	Howrah
Shellz Swim Centre	Rokeby East
Richmond Caravan Park	Richmond
SwimKamp	Lauderdale

Swimming pool centres are responsible for undertaking their own sampling. Analysis reports are forwarded to Council monthly and if a failed result is returned, Department of Health (DoH) and Council require a resample to be taken. In the event a resample fails then the pool will be closed for further investigation. The Public Health Laboratory is obliged to inform DoH immediately on receiving a failed sample. Environmental Health officers can inspect all recorded data and associated log books randomly to ensure compliance.

1.2 Beach and River Sites

Five sites located along the Derwent Estuary in Clarence City Council's municipality from Bellerive to Little Howrah Beach have previously been identified as primary contact "swimming" sites. The Derwent Estuary Program (DEP) coordinates "Beach Watch" which requires weekly sampling from the first week of December through to the last week in March of each of the above beaches. Clarence City Council maintains a 'Winter Beaches' sampling

program on a monthly basis to maintain monitoring of the Derwent Estuary throughout winter. Beaches sampled throughout the year were (1) Bellerive Beach West, (3) Howrah Beach West (Silwood), (4) Howrah Beach Middle (Salacia), (5) Howrah Beach East and (6) Little Howrah Beach. Additional sample locations at Bellerive Beach East (2) and Lauderdale Beach (7) were added in 2019/2020 after consultation with the DEP.

Enterococci are a faecal indicator organism within recreational waters and determine the water quality of the recreational beaches. The DEP is responsible for the 95th Hazen Percentile analysis which classifies each beach as good (0-200), fair (200-500), or poor (≥500) as required under the *Recreational Water Quality Guidelines 2007, Public Health Act 1997.* Figure 1 highlights the sample site locations regularly monitored by Clarence City Council. The DEP is responsible for sampling four additional sites along the Derwent Estuary within the Council's municipality, these being Kangaroo Bay, Geilston Bay, Montagu Bay and Lindisfarne Bay. These bays are considered to be secondary contact sites by the DEP and are classified as "environmental" sites for reporting of sample results.

Figure 1: Environmental Health Services of Clarence Council Sample sites. Locations in the Clarence municipality; Bellerive Beach West(1), Bellerive Beach East (2), Howrah West (Silwood) (3), Howrah Middle (Salacia) (4), Howrah East (5) Little Howrah (6), and Lauderdale Beach (7).

2.0 SAMPLING UNDERTAKEN AND RESULTS

2.1 Pool and Spa Sampling

All pool and spa sites are sampled for Heterotrophic Plate Count, *E. coli* and *Pseudomonas aeruginosa*. In addition, pool temperature, residual chlorine level, and pH are recorded. As previously stated, it is a requirement of the *Recreational Water Quality Guidelines 2007* that all failed samples are reported to DoH and resampling is undertaken.

All pool and spa sample results must be within the parameters shown in table 1, to operate without causing a potential public health risk.

Table 2: Microbiological Verification provisions and chemical parameters for public swimming pools and public spa pools

Type of Organism	Maximum Count Allowable
Heterotrophic Plate Count	100 Colony Forming Units (CFU) per ml.
Thermotolerant coliforms/E.coli	< 1 per 100ml
Pseudomonas *aeruginosa*	<1 per 100ml
Residual Chlorine (ppm)	Min. 2mg/l

Source *Public Health Act 1997,* and *Recreational Water Quality Guidelines 2007*

Appendix 2 provides all bacteriological analysis data results received from all recreational pools and spas within Clarence City Council. Results that fail to comply with *Recreational Water Quality Guidelines 2007* under the *Public Health Act 1997* are highlighted.

2.2 Beach Sampling

All recreational beach samples are analysed for Enterococci. Data is taken for the following; pH, temperature, turbidity and salinity as shown in Appendix 1. Samples that did not comply with the *Recreational Water Quality Guidelines 2007* limits for primary or secondary contact are highlighted in the tables and consequently retested during the summer swimming season. Clarence City Council along with the DEP have agreed to implement 'flip down' signage in response to two consecutive samples of greater than 140 enterococci/100mL to display an advisory warning. When the water quality improves to acceptable levels i.e. less than 140 enterococci/100mL, the sign can be folded back up displaying only the long-term classification. Table 3 summarises the results provided by DEP as to the status of each primary and secondary contact beach in Clarence. There was no change to the status of any

of the swimming sites monitored by Clarence after the 2019/2020 swimming season. All beaches were graded as 'good' according to DEP apart from Howrah Beach Middle (Salacia Ave) which remained 'fair'. Bellerive Beach East has not been added to the DEP statistics as the site does not have 5 years of data.

Table 3: Recreational beaches monitored by Clarence City Council. Red denotes Poor quality (>500MPN100mL/1), amber Denotes fair quality (200-500MPN 100mL-1) and green denotes good water quality (<200MPN 100mL-1). Sourced from DEP.

	Beaches/River	**Status 2019/2020 based upon 5-year 95th Hazen percentile for Enterococci**	**Trend based upon 5-year 95th Hazen percentile for Enterococci**
1	Bellerive Beach West	Good	Stable 182 (2018/19) to 180 (2019/20)
2	Howrah Beach West (Silwood Ave)	Good	Stable 119 (2018/19) and 119 (2019/20)
3	Howrah Beach middle (Salacia Ave)	Fair	Slight improvement in quality from 418 (2018/19) to 410 (2019/20)
4	Howrah Beach East	Good	Stable 194 (2018/19) to 192 (2019/20)
5	Little Howrah Beach	Good	Slight decline in quality from 113 (2018/19) to 128 (2019/20)

Table 4 DEP responsible sample sites. Red denotes Poor quality (>500MPN100mL/1), amber Denotes fair quality (200-500MPN 100mL-1) and green denotes good water quality (<200MPN 100mL-1). Sourced from DEP.

Beaches/River	**Status 2019/2020 based upon 5-year 95th Hazen percentile for Enterococci**	**Trend based upon 5-year 95th Hazen percentile for Enterococci**
Geilston Bay	Good	Improvement from 262 (2018/19) to 158 (2019/20)
Lindisfarne Bay	Fair	Decrease in quality from 197 (2018/19) to 275 (2019/20)
Montagu Bay	Good	Improvement from 40 (2018/19) to 22 (2019/20)
Kangaroo Bay	Good	Stable 50 (2018/19) to 53 (2019/20)

3.0 SAMPLING DISCUSSION

3.1 Pool Sampling

There were no reported failures in the pool and spa results (results in Appendix 2) in 2019/20. There were no pool closures due to failed samples in 2019/20.

Due to staffing changes and the rollout of Councils new IT system some missed pool samples were not followed up during the 2019/20 year.

Due to the Covid shutdown of pools it was possible that there were some missed samples in March 2020. There was also some confusion regarding the re-opening of pools with some pools re-opening after taking two samples up to five days apart rather than within 48 hours as specified in the Guidelines. Due to the extenuating circumstances of Covid action has not been taken about these breaches.

Some pools had not yet re-opened at the end of the 2019/20 year.

Council will send out a letter to all pool owners to remind them of their obligations under the *Recreational Water Quality Guidelines 2007* particularly the requirement to sample monthly and also to provide chemical parameters with samples.

3.2 Beach Sampling

During the 2019/20 summer sampling period 130 samples were taken in total with 4 of these samples exceeding the primary contact guideline limit of 140 enterococci /100mL.

The 2019/20 summer sampling season had average rainfall recorded with four significant rain events recorded at Ellerslie Road weather station in Hobart (BOM). The DEP defines a significant rainfall event as an event with greater than 10mm in a 24 hour period. None of the rainfall events this season occurred within 24 hours prior to a sampling day.

During the 2019/20 summer sampling period there were three exceedances of the guideline limit at swimming sites and all three occurred when there had been little or no rainfall recorded in the 72 hours prior to sampling. A sample from Little Howrah Beach taken on the 3rd of December exceeded 140 enterococci /100mL after just 2.2mm was recorded in Hobart in the 72 hours prior to sampling. Then on the 23rd of December samples from Howrah Middle (Salacia St) and Bellerive West exceeded 140 enterococci /100mL after 0mm of rain had been recorded in the 72 hours prior to sampling. This lack of rainfall suggests that there

may have been another source of enterococci other than stormwater involved in these elevated enterococci results. Other potential sources of contamination include; a spill of untreated sewage from a Taswater treatment plant, flocks of seagulls or other birds and concentrations of enterococci in sand and sediments. As no other sample sites in the Derwent Estuary returned high results on these days it indicates that the contamination was quite localised.

A re-sample was taken for the exceedance on 3rd December and returned a result well within the limit of 140 enterococci /100mL. There was no re-sample taken for the exceedances on 23rd December due to the shutdown of the Council chambers for the Christmas period and also the Public Health Lab shutdown over this period.

Stormwater runoff after rain events continues to be the dominant cause of poor water quality on the eastern shore beaches (DEP, 2020). Clarence Council committed funds in 2017 to conduct investigative works throughout the stormwater network by sampling for enterococci and *E.Coli* bacteria to identify cross connections or cracks in stormwater/sewer infrastructure. These stormwater investigations continued during 2019/20 with 100 bacteriological samples collected from the Howrah stormwater network. Dye testing and CCTV surveys were also undertaken as part of the investigations.

Council have also worked with DEPs Stormwater Investigation Taskforce during the 2019/20 year to develop a "Source Tracking Toolkit" which can be used by Council EHOs as a guide to tracking sources of faecal contamination in stormwater. An exercise was hosted by Clarence and DEP in Mortyn Park in October 2019 to test a variety of new methods with a number of other Council EHOs involved along with Taswater and EPA staff. This exercise identified that Ammonia test kits which are inexpensive and give a result quickly, can be used to identify stormwater contamination. Clarence have continued to test for Ammonia along with E.Coli and Enterococci in order to build up a dataset with promising results so far.

Works to repair two separate leaking sewer mains identified as a result of the stormwater investigation were completed by TasWater during the 2019/2020 year. The works involved re-lining a section of sewer main between Banjorrah and Alawarra Streets and re-lining a section of sewer in Mortyn Place which was leaking directly into a stormwater pit. Further

testing is required in both areas to verify if these works were effective in preventing sewage contamination of stormwater. Further areas were identified for Taswater to repair in Merinda Street.

10 bacteriological samples were collected from Lauderdale Canal during 2019/20 to determine if the canal could be used for "Primary Contact" activities as part of a new Council Park development in the area with. Results indicated that the Canal would not be suitable for swimming with 4 results over the limit of 140 enterococci /100mL with one of these over 1000. The high bacterial results did not correlate with rainfall in the preceding 48 hours prior to sampling suggesting that stormwater was not the main cause of contamination. Testing of sterol markers was also undertaken in the Canal in order to determine the source of the contamination. The sterol results indicated that bird faecal matter was the main contaminant in the canal.

Sampling results for the monthly winter sampling program conducted during 2019/2020 returned no samples that exceeded the 140 enterococci/100mL guideline limit for primary contact in this period from a total of 25 samples. Winter sampling was temporarily suspended in 2020 due to Covid restrictions.

The ongoing stormwater sampling program in the Howrah catchment and the Derwent Estuary Program continue to recommend areas of high priority where further work to improve the quality of stormwater being discharged to Howrah Beach could be undertaken. These recommendations remain current for 2019/20 and include:

- Using water sensitive urban design principles to treat stormwater before it enters the Derwent. The DEP identified Wentworth Park as an area that offers space where these features could be potentially located.
- Installing Litter Traps where space allows. Kangaroo Bay Rivulet and the creek in Minerva Park are possible locations where basket style litter traps could be trialled. These litter traps are relatively low cost and are being used already by Brighton and Kingborough Councils.
- Upgrading Wentworth Park sewage pump station and increasing storage capacity to deal with storm events.

- Increasing storage of stormwater behind Lucas Street which is known to flood from the sewer in heavy rainfall events and then discharge through stormwater infrastructure to the beach. This stormwater overflow also pools in the park between Wentworth Park and Howrah Primary creating a possible public health risk.

There were no significant stormwater capital works projects completed in the 2019/20 year, however the new Stormwater System Management Plan 2019 for the Clarence municipal area was adopted by Council during this year. This plan contains recommendations for Water Sensitive Urban Design (WSUD) structures that could be installed to improve stormwater quality and establishing performance objectives for stormwater treatment. These objectives cover the retention of total suspended solids, phosphorus, nitrogen and litter, but do not take into account reductions in faecal bacteria. The plan identifies Beach Street and South Street Reserve in Bellerive and Mortyn Park as areas where Litter or Gross Pollutant Traps could be retrofitted to existing stormwater infrastructure. Locations for installation for 'street-scale' and 'end of line' bioretention areas are also identified in the plan. Bio retention areas are primarily designed to remove nutrients but there have been a number of studies, including Bratieres et al (2008), that have suggested that bio retention may also aid in removing faecal bacteria from stormwater.

4.0 CONCLUDING REMARKS AND RECOMMENDATIONS

The 2019/20 summer recreational water sampling season saw a slight improvement in water quality across the majority of sampling sites but no changes to the DEP risk classifications with Middle Howrah still classified as 'Fair'. However, there is still much work to be done to improve water quality in the catchment areas of Howrah and Bellerive Beaches. Stormwater has been identified previously by the DEP as a major source of faecal contamination into these beaches and Investigation work conducted by Council has identified several sources of contamination into the catchment which have in turn been rectified by TasWater. There will be a continued focus on stormwater investigation in the Howrah Beach catchment in the 2020/21 year with ongoing collaboration with Taswater and the DEP.

While identifying the source of stormwater contamination is important, it is also important that further initiatives are taken by Council to improve the quality of stormwater through the use of WSUD structures in the sites that have been identified in Councils stormwater management plans. While not strictly public health related, there are also recommendations in the stormwater management plans for gross pollutant or litter traps to be fitted to a number of locations close to outfalls.

APPENDIX 1 Recreational Beach Summer and Winter Results

Table 5: Primary Contact Recreational Water sampling results for all beaches taken monthly throughout winter and weekly in conjunction with the DEP program during the summer months. Results from 01/07/2019-30/06/2020 with exceedances of 140 enterococci/100mL highlighted.

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Bellerive Beach West							
	02-Jul-2019	11.8	3.40	-	-	20	19/1926
	07-Aug-2019	10.8	3.20	8.00	0	5	19/2273
	03-Sep-2019	11.6	2.96	8.14	1	5	19/2548
	01-Oct-2019	12.0	-	-	4	5	19/2845
	05-Nov-2019	14.5	2.92	8.13	7	5	19/3221
	02-Dec-2019	-	-	-	-	5	19/3541
	03-Dec-2019	14.0	3.00	8.00	1	5	19/3572
	10-Dec-2019	15.3	1.56	7.99	4	10	19/3702
	17-Dec-2019	17.4	2.33	8.04	26	5	19/3822
	23-Dec-2019	16.3	2.82	8.13	24	173	19/3877
	30-Dec-2019	19.4	2.81	8.21	0	10	19/3893
	07-Jan-2020	18.4	2.87	8.16	0	5	20/0047
	14-Jan-2020	17.6	3.12	8.15	3	10	20/0153
	21-Jan-2020	17.1	3.08	8.05	2	10	20/0228
	28-Jan-2020	17.2	3.23	8.00	3	5	20/0309
	04-Feb-2020	16.7	3.35	7.94	3	5	20/0406
	11-Feb-2020	17.2	2.79	7.95	1	31	20/0482
	18-Feb-2020	17.1	3.11	8.06	0	20	20/0611
	25-Feb-2020	18.2	2.87	7.98	0	10	20/0705
	03-Mar-2020	16.0	3.25	7.99	0	5	20/0801
	10-Mar-2020	15.7	2.47	7.98	10	5	20/0886
	17-Mar-2020	16.2	3.33	7.81	0	5	20/0991
	24-Mar-2020	15.7	3.44	7.98	0	5	20/1063
	31-Mar-2020	15.4	7.86	7.86	1	5	20/1138

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Bellerive Beach East							
	03-Dec-2019	14.0	3.00	8.00	2.0	10	19/3572
	10-Dec-2019	15.0	1.55	8.04	4.0	10	19/3702
	17-Dec-2019	17.3	2.39	8.06	1.0	10	19/3822
	23-Dec-2019	16.4	2.85	8.18	0.0	10	19/3877
	30-Dec-2019	19.6	2.73	8.18	0.0	5	19/3893
	07-Jan-2020	18.0	2.88	8.26	0.0	5	20/0047
	14-Jan-2020	18.7	3.17	8.19	0.0	41	20/0153
	21-Jan-2020	17.3	3.13	8.06	1.0	5	20/0228
	28-Jan-2020	17.0	3.22	7.99	1.0	5	20/0309
	04-Feb-2020	16.4	3.26	8.02	3.0	5	20/0406
	11-Feb-2020	17.1	3.01	7.99	4.0	5	20/0482
	18-Feb-2020	17.2	2.98	8.05	0.0	5	20/0611
	25-Feb-2020	18.0	2.82	8.06	0.0	10	20/0705
	03-Mar-2020	16.0	3.20	7.97	0.0	5	20/0801
	10-Mar-2020	15.2	2.41	7.95	10.0	5	20/0886
	17-Mar-2020	15.2	3.08	7.92	0.0	10	20/0991
	24-Mar-2020	15.1	2.88	8.03	0.0	20	20/1063
	31-Mar-2020	15.3	3.23	7.95	1.0	5	20/1138

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Howrah Beach West (Silwood)							
	02-Jul-2019	11.8	3.40	0.00	0.0	5	19/1926
	07-Aug-2019	10.5	3.13	8.04	0.0	5	19/2273
	03-Sep-2019	11.1	2.68	8.08	0.0	5	19/2548
	01-Oct-2019	12.4	2.83	8.23	0.0	5	19/2845
	05-Nov-2019	14.3	2.92	8.25	2.0	5	19/3221
	03-Dec-2019	14.0	3.00	8.08	3.0	5	19/3572
	17-Dec-2019	17.2	2.08	7.97	0.0	10	19/3822
	23-Dec-2019	16.2	2.78	8.12	15.0	5	19/3877
	30-Dec-2019	19.2	2.79	8.21	1.0	5	19/3893
	07-Jan-2020	18.3	2.86	8.13	0.0	5	20/0047
	14-Jan-2020	18.1	3.18	8.19	0.0	10	20/0153
	21-Jan-2020	17.3	3.14	8.03	2.0	41	20/0228
	28-Jan-2020	16.6	3.20	8.01	2.0	41	20/0309
	04-Feb-2020	16.1	3.28	8.06	1.0	5	20/0406
	11-Feb-2020	17.1	2.85	7.96	3.0	52	20/0482
	18-Feb-2020	16.9	2.90	8.07	0.0	20	20/0611
	25-Feb-2020	18.0	2.86	8.17	0.0	5	20/0705
	03-Mar-2020	16.0	3.19	7.97	0.0	10	20/0801
	10-Mar-2020	15.2	2.50	7.98	10.0	5	20/0886
	17-Mar-2020	15.3	3.05	8.01	0.0	10	20/0991
	24-Mar-2020	14.9	2.80	8.04	0.0	20	20/1063
	31-Mar-2020	15.7	3.27	8.01	1.0	5	20/1138

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Howrah Beach Middle (Salacia)							
	02-Jul-2019	11.8	3.39	0.00	0.0	5	19/1926
	07-Aug-2019	10.3	3.12	7.97	1.0	5	19/2273
	03-Sep-2019	11.3	2.63	8.05	0.0	5	19/2548
	01-Oct-2019	12.6	2.80	8.25	3.0	5	19/2845
	05-Nov-2019	14.1	2.94	8.22	2.0	5	19/3221
	03-Dec-2019	14.3	3.00	8.06	0.0	5	19/3572
	10-Dec-2019	15.3	1.70	7.98	8.0	5	19/3702
	10-Dec-2019	15.0	1.91	8.09	4.0	20	19/3702
	17-Dec-2019	16.8	1.97	7.96	1.0	5	19/3822
	23-Dec-2019	16.2	2.86	8.13	4.0	228	19/3877
	30-Dec-2019	19.2	2.78	8.20	0.0	5	19/3893
	07-Jan-2020	18.1	2.88	8.16	3.0	5	20/0047
	14-Jan-2020	18.3	3.21	8.18	0.0	10	20/0153
	21-Jan-2020	17.4	3.15	8.03	2.0	10	20/0228
	28-Jan-2020	16.5	3.19	8.01	3.0	5	20/0309
	04-Feb-2020	16.4	3.27	8.03	5.0	5	20/0406
	11-Feb-2020	17.2	2.91	7.98	1.0	63	20/0482
	18-Feb-2020	16.9	2.87	8.07	0.0	10	20/0611
	25-Feb-2020	17.8	2.81	8.18	0.0	10	20/0705
	03-Mar-2020	16.0	3.18	7.97	0.0	10	20/0801
	10-Mar-2020	15.1	2.48	7.96	10.0	10	20/0886
	17-Mar-2020	15.3	3.04	8.01	0.0	5	20/0991
	24-Mar-2020	14.7	2.65	8.00	0.0	5	20/1063
	31-Mar-2020	15.6	3.20	8.01	3.0	5	20/1138

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Howrah Beach East							
	02-Jul-2019	12.0	3.40	0.00	0.0	41	19/1926
	07-Aug-2019	10.3	3.11	7.96	1.0	5	19/2273
	03-Sep-2019	11.5	2.64	8.05	0.0	5	19/2548
	01-Oct-2019	13.1	2.77	8.24	2.0	5	19/2845
	05-Nov-2019	13.9	2.84	8.22	2.0	5	19/3221
	03-Dec-2019	14.4	3.01	8.06	1.0	10	19/3572
	10-Dec-2019	15.0	1.77	8.05	5.0	5	19/3702
	17-Dec-2019	17.1	1.99	7.96	1.0	10	19/3822
	23-Dec-2019	16.1	8.10	8.10	5.0	52	19/3877
	30-Dec-2019	18.9	2.78	8.21	2.0	5	19/3893
	07-Jan-2020	17.8	2.91	8.15	10.0	5	20/0047
	14-Jan-2020	18.1	3.22	8.19	0.0	31	20/0153
	21-Jan-2020	17.5	3.16	8.03	25.0	5	20/0228
	28-Jan-2020	16.5	3.19	8.01	3.0	5	20/0309
	04-Feb-2020	16.6	3.25	8.03	2.0	31	20/0406
	11-Feb-2020	17.2	2.93	7.99	1.0	20	20/0482
	18-Feb-2020	17.0	2.88	8.07	0.0	5	20/0611
	25-Feb-2020	17.9	2.79	8.17	0.0	5	20/0705
	03-Mar-2020	16.2	3.23	7.97	0.0	5	20/0801
	10-Mar-2020	14.9	2.46	7.97	10.0	5	20/0886
	17-Mar-2020	15.4	3.04	8.01	0.0	5	20/0991
	24-Mar-2020	14.7	2.64	8.00	0.0	5	20/1063
	31-Mar-2020	15.3	3.19	8.02	0.0	10	20/1138

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Little Howrah Beach							
	02-Jul-2019	12.0	3.40	0.00	0.0	98	19/1926
	07-Aug-2019	10.0	3.05	8.05	1.0	20	19/2273
	03-Sep-2019	11.6	2.64	8.16	0.0	5	19/2548
	01-Oct-2019	12.4	2.75	8.35	4.0	5	19/2845
	05-Nov-2019	13.9	2.84	8.26	2.0	5	19/3221
	03-Dec-2019	14.3	3.00	8.08	3.0	169	19/3572
	05-Dec-2019	13.6	3.04	0.00	4.0	30	19/3620
	10-Dec-2019	15.1	1.86	8.07	5.0	5	19/3702
	17-Dec-2019	16.1	2.10	7.98	0.0	5	19/3822
	23-Dec-2019	16.2	2.89	8.01	4.0	10	19/3877
	30-Dec-2019	19.0	2.79	8.18	2.0	5	19/3893
	07-Jan-2020	17.8	3.02	8.16	2.0	5	20/0047
	14-Jan-2020	17.6	3.22	8.10	0.0	10	20/0153
	21-Jan-2020	17.6	3.18	8.09	4.0	10	20/0228
	28-Jan-2020	16.2	3.18	7.96	1.0	5	20/0309
	04-Feb-2020	16.6	3.25	8.24	6.0	5	20/0406
	11-Feb-2020	17.1	3.08	7.99	1.0	5	20/0482
	18-Feb-2020	17.1	2.89	8.13	0.0	5	20/0611
	25-Feb-2020	18.5	2.79	8.19	0.0	63	20/0705
	03-Mar-2020	16.3	3.30	8.09	0.0	5	20/0801
	10-Mar-2020	14.4	2.48	8.09	10.0	5	20/0886
	17-Mar-2020	15.1	3.04	8.12	0.0	5	20/0991
	24-Mar-2020	14.9	2.66	8.17	0.0	5	20/1063
	31-Mar-2020	15.3	3.19	8.08	1.0	5	20/1138

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Lauderdale Beach - 124 Bayview Road (Reserve)							
	03-Dec-2019	14.7	3.41	8.08	6.0	5	19/3571
	10-Dec-2019	16.2	3.42	8.12	11.0	10	19/3703
	17-Dec-2019	17.6	3.35	8.11	2.0	5	19/3823
	23-Dec-2019	16.0	3.36	7.94	10.0	20	19/3878
	30-Dec-2019	19.4	3.41	7.86	0.0	5	19/3894
	07-Jan-2020	18.8	3.46	8.11	3.0	10	20/0048
	14-Jan-2020	19.3	3.49	8.05	3.0	86	20/0154
	21-Jan-2020	18.5	3.47	8.07	8.0	5	20/0229
	28-Jan-2020	17.6	3.47	7.89	2.0	20	20/0308
	04-Feb-2020	17.8	3.49	8.07	10.0	5	20/0407
	11-Feb-2020	18.1	3.53	8.07	1.0	5	20/0483
	18-Feb-2020	18.0	3.51	8.12	0.0	5	20/0613
	25-Feb-2020	19.1	3.64	8.21	0.0	5	20/0706
	03-Mar-2020	16.4	3.59	8.02	0.0	5	20/0802
	10-Mar-2020	16.2	3.45	8.04	10.0	5	20/0887
	17-Mar-2020	15.7	3.44	7.98	0.0	5	20/0993
	24-Mar-2020	16.6	3.50	7.98	0.0	5	20/1065
	31-Mar-2020	16.6	3.47	7.99	9.0	5	20/1140

Site	Date Collected	Temperature °C	Salinity	pH	Turbidity NTU	Enterococci /100mL	Job Reference
Lauderdale Canal							
	24-Mar-2020	0.0	0.00	0.00	0.0	379	20/1170
	31-Mar-2020	15.6	3.28	8.13	1.0	20	20/1140
	08-Apr-2020	0.0	0.00	0.00	0.0	75	20/1221
	15-Apr-2020	0.0	0.00	0.00	0.0	110	20/1245
	21-Apr-2020	0.0	0.00	0.00	0.0	109	20/1302
	29-Apr-2020	0.0	0.00	0.00	0.0	282	20/1391
	06-May-2020	0.0	0.00	0.00	0.0	75	20/1475
	13-May-2020	0.0	0.00	0.00	0.0	156	20/1537
	21-May-2020	0.0	0.00	0.00	0.0	1017	20/1634
	29-Jun-2020	0.0	0.00	0.00	0.0	5	20/2044

APPENDIX 2 Pool sample results for all swimming pools covered by the *Recreational Water Quality Guidelines 2007* in The City of Clarence

Table 6 All Swimming Pool and Spa monthly sampling results. Results from 01/07/2019-30/06/2020. Failed results highlighted in yellow.

Pool Name	Date Collected	pH	Temperature °C	Residual Chlorine ppm	Standard Plate Count	E. coli	Ps. aeruginosa
Steves Swim Centre - Pool							
161 Axiom Way, ACTON PARK TAS 7170 Enclosed, Salt	01-Oct-2019	7.40	33		1	<1	<1
	06-Jan-2020	0.00	0		<1	<1	<1
	24-Feb-2020	0.00	0		<1	<1	<1
	11-Jun-2020	7.40	23	1.50	<1	<1	<1
	11-Jun-2020	7.40	23		<1	<1	<1
Barilla Thermal Springs							
	05-Jul-2019	6.20	35		<1	<1	<1
	28-Aug-2019	6.80	34		<1	<1	<1
	27-Nov-2019	0.00	36		1	<1	<1
	21-Jan-2020	0.00	34		<1	<1	<1
	13-Feb-2020	6.80	35		<1	<1	<1

Pool Name	Date Collected	pH	Temperature °C	Res. Chlorine ppm	Standard Plate Count	E. coli	Ps. aeruginosa
Clarence Joint Therapy							
273 Clarence Street, HOWRAH	25-Jul-2019	7.60	35	2.00	1(est)	<1	<1
Enclosed	29-Aug-2019	7.60	35	2.00	<1	<1	<1
Hypochlorite	22-Oct-2019	7.60	34	2.00	<1	<1	<1
	26-Sep-2019	7.60	35	2.00	<1	<1	<1
	21-Nov-2019	7.60	35	2.00	<1	<1	<1
	17-Dec-2019	7.80	35	2.00	<1	<1	<1
	28-Jan-2020	7.80	35	5.00	<1	<1	<1
	26-Feb-2020	0.00	35		<1	<1	<1
	28-May-2020	7.80	20	2.00	<1	<1	<1
	02-Jun-2020	7.80	18	4.00	<1	<1	<1
Clarence YMCA -Olympic Pool							
4 Loinah Crescent, MONTAGU BAY TAS	01-Jul-2019	0.00	28		<1	<1	<1
7018	07-Aug-2019	7.90	28	3.30	<1	<1	<1
Hypochlorite	12-Sep-2019	7.80	28	3.40	<1	<1	<1
Enclosed	02-Oct-2019	7.45	29	3.00	<1	<1	<1
	06-Nov-2019	7.75	28	5.10	<1	<1	<1
	11-Dec-2019	7.60	28	3.00	<1	<1	<1
	08-Jan-2020	7.80	28	3.10	<1	<1	<1
	18-Feb-2020	7.40	28	2.00	1	<1	<1
	12-Mar-2020	7.60	28	7.60	<1	<1	<1
	27-May-2020	7.80	28	4.60	<1	<1	<1
	03-Jun-2020	8.20	28	3.20	<1	<1	<1

Pool Name	Date Collected	pH	Temperature °C	Res. Chlorine ppm	Standard Plate Count	E. coli	Ps. aeruginosa
Clarence YMCA -Toddler Pool							
	01-Jul-2019	0.00	28		2(est)	<1	<1
Hypochlorite	07-Aug-2019	7.40	27	2.50	<1	<1	<1
Enclosed	12-Sep-2019	7.50	28	2.90	1(est)	<1	<1
	02-Oct-2019	7.55	28	2.00	<1	<1	<1
	06-Nov-2019	7.55	28	4.70	<1	<1	<1
	11-Dec-2019	7.60	28	3.00	<1	<1	<1
	08-Jan-2020	8.00	28	2.20	<1	<1	<1
	18-Feb-2020	7.50	28	2.00	3	<1	<1
	12-Mar-2020	7.45	28	1.90	2	<1	<1
	27-May-2020	7.80	28	4.60	<1	<1	<1
	03-Jun-2020	8.20	28	3.20	<1	<1	<1
Clarence YMCA -Wading Pool							
Hypochlorite	01-Jul-2019	0.00	28		46	<1	<1
Enclosed	07-Aug-2019	7.60	28	2.40	1(est)	<1	<1
	12-Sep-2019	7.80	28	2.60	<1	<1	<1
	02-Oct-2019	7.45	28	2.00	<1	<1	<1
	06-Nov-2019	7.60	28	4.80	<1	<1	<1
	11-Dec-2019	7.40	28	3.00	<1	<1	<1
	08-Jan-2020	7.40	28	2.50	<1	<1	<1
	18-Feb-2020	7.50	28	2.00	<1	<1	<1
	12-Mar-2020	7.28	28	1.10	1	<1	<1
	27-May-2020	7.80	28	4.60	<1	<1	<1
	03-Jun-2020	8.20	28	3.20	<1	<1	<1

Pool Name	Date Collected	pH	Temperature °C	Res. Chlorine ppm	Standard Plate Count	E. coli	Ps. aeruginosa
Oceana Hydro Pool							
Enclosed	29-Jul-2019	7.60	33	2.00	62	<1	<1
Hypochlorite	12-Sep-2019	7.60	33	2.00	<1	<1	<1
	31-Oct-2019	7.60	33	2.00	1	<1	<1
	20-Dec-2019	7.60	33	2.00	<1	<1	<1
	21-Jan-2020	7.60	33	2.00	<1	<1	<1
	28-Feb-2020	7.60	33	2.00	1	<1	<1
Oceana Infants Pool							
Hypochlorite	29-Jul-2019	7.60	33	2.00	3(est)	<1	<1
Enclosed	12-Sep-2019	7.60	33	2.00	<1	<1	<1
	31-Oct-2019	7.40	33	2.00	26	<1	<1
	20-Dec-2019	7.60	33	2.00	<1	<1	<1
	21-Jan-2020	7.60	33	2.00	<1	<1	<1
	28-Feb-2020	7.60	33	2.00	1	<1	<1
	29-Jun-2020	7.60	33	2.00	<1	<1	<1
Oceana Main Pool							
Enclosed	29-Jul-2019	7.60	29	2.00	<1	<1	<1
Hypochlorite	12-Sep-2019	7.60	24	2.00	1(est)	<1	<0
	31-Oct-2019	7.40	30	2.00	<1	<1	<1
	20-Dec-2019	7.60	29	2.00	<1	<1	<1
	21-Jan-2020	7.60	29	2.00	<1	<1	<1
	29-Jun-2020	7.60	29	2.00	<1	<1	<1
Richmond Caravan Park - Pool							
Salt	07-Jan-2020	7.50	24	2.00	<1	<1	<1
	18-Feb-2020	7.50	22	2.00	<1	<1	<1

Pool Name	Date Collected	pH	Temperature °C	Residual Chlorine ppm	Standard Plate Count	E. coli	Ps. aeruginosa
Seahorse Swim Centre							
Enclosed	04-Jul-2019	7.60	32	2.00	1 (est)	<1	<1
Salt	08-Aug-2019	7.60	32	2.00	1(est)	<1	<1
	12-Sep-2019	7.60	32	2.00	<1	<1	<1
	17-Oct-2019	7.60	32	2.00	2	<1	<1
	07-Nov-2019	7.80	32	2.00	1	<1	<1
	05-Dec-2019	7.60	32	2.00	6	<1	<1
	05-Feb-2020	7.60	33	2.50	<1	<1	<1
	19-Mar-2020	7.60	32	2.50	3	<1	<1
Shellz Swim Centre							
77 Grange Road East, ROKEBY	25-Jul-2019	0.00	32		<1	<1	<1
Enclosed	28-Aug-2019	7.30	32		<1	<1	<1
Salt	25-Sep-2019	7.30	30		<1	<1	<1
	29-Oct-2019	7.20	32		<1	<1	<1
	20-Nov-2019	7.30	32		<1	<1	<1
	28-Jan-2020	7.30	32		<1	<1	<1
	26-Feb-2020	7.30	32		<1	<1	<1
	25-Mar-2020	7.30	32		<1	<1	<1
	20-May-2020	7.30	30		<1	<1	<1
	10-Jun-2020	7.30	30		<1	<1	<1
Swimkamp							
538 South Arm Road, LAUDERDALE	05-Feb-2020	0.00	0		<1	<1	<1
Enclosed	04-Jun-2020	7.10	29	2.19	<1	<1	<1
Chlorine	05-Jun-2020	7.40	29	3.10	<1	<1	<1

Pool Name	Date Collected	pH	Temperature °C	Residual Chlorine ppm	Standard Plate Count	E. coli	Ps. aeruginosa
Wyndham Pool							
Open Air	23-Jul-2019	7.45	28	3.00	<1	<1	<1
	27-Aug-2019	7.45	28	3.00	<1	<1	<1
	24-Sep-2019	7.45	28	3.00	<1	<1	<1
	15-Oct-2019	7.45	28	3.00	2	<1	<1
	12-Nov-2019	7.45	28	3.00	1	<1	<1
	10-Dec-2019	7.45	28	3.00	<1	<1	<1
	21-Jan-2020	7.45	28	3.00	30	<1	<1
	25-Feb-2020	7.45	28	3.00	1	<1	<1
	17-Mar-2020	7.45	28	3.00	Lab Error	<1	<1
	09-Jun-2020	7.45	28	3.00	<1	<1	<1
	16-Jun-2020	7.45	28	3.00	<1	<1	<1
Wyndham Spa							
Open Air	23-Jul-2019	7.50	38	630mV	<1	<1	<1
(ORP, redox)	27-Aug-2019	7.50	38	630mV	39(est)	<1	<1
measure in millivolts	24-Sep-2019	7.50	38	630mV	<1	<1	<1
	15-Oct-2019	7.50	38	630mV	1	<1	<1
	12-Nov-2019	7.50	38	630mV	2	<1	<1
	10-Dec-2019	7.50	38	630mV	<1	<1	<1
	21-Jan-2020	7.50	38	630mV	<1	<1	<1
	25-Feb-2020	7.50	38	630mV	<1	<1	<1
	17-Mar-2020	7.50	38	630mV	Lab Error	<1	<1

5.0 REFERENCES

Coughanowr C, Whitehead S, Whitehead J, Einoder L and Taylor U. 2010. *State of the Derwent Estuary 2015: A review of environmental data from 2009 to 2014*. Derwent Estuary Program, DPIPWE, Tasmania

Weller-Wong, A., & Visby, I. (2020). Recreational Water Quality Program, Annual Report 2019/20. Hobart, Australia. https://www.derwentestuary.org.au/assets/2019-20_End_of_season_RWQ_report_2.pdf

Department of Health and Human Services (2007) *Recreational Water Quality Guidelines 2007*.

NHMRC, 2008. *Guidelines for managing risks in recreational water*. Australian Government National Health and Medical Research Council.

Kovacevic, S & Patterson, T (2019). *Bellerive-Howrah Beach Stormwater System Management Plan (draft report).* Ramboll

Bratières K, Fletcher TD, Deletic A, Alcazar L, Le Coustumer S, et al.. (2008) *Removal of nutrients, heavy metals and pathogens by stormwater biofilters*. 11th International Conference on Urban Drainage (ICUD); Edinburgh. International Water Association.