Coastal engineering scoping study for a tidal swimming facility: Port River, Adelaide

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Project details

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1 Introduction

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Figure 1.1 Overview of Port River

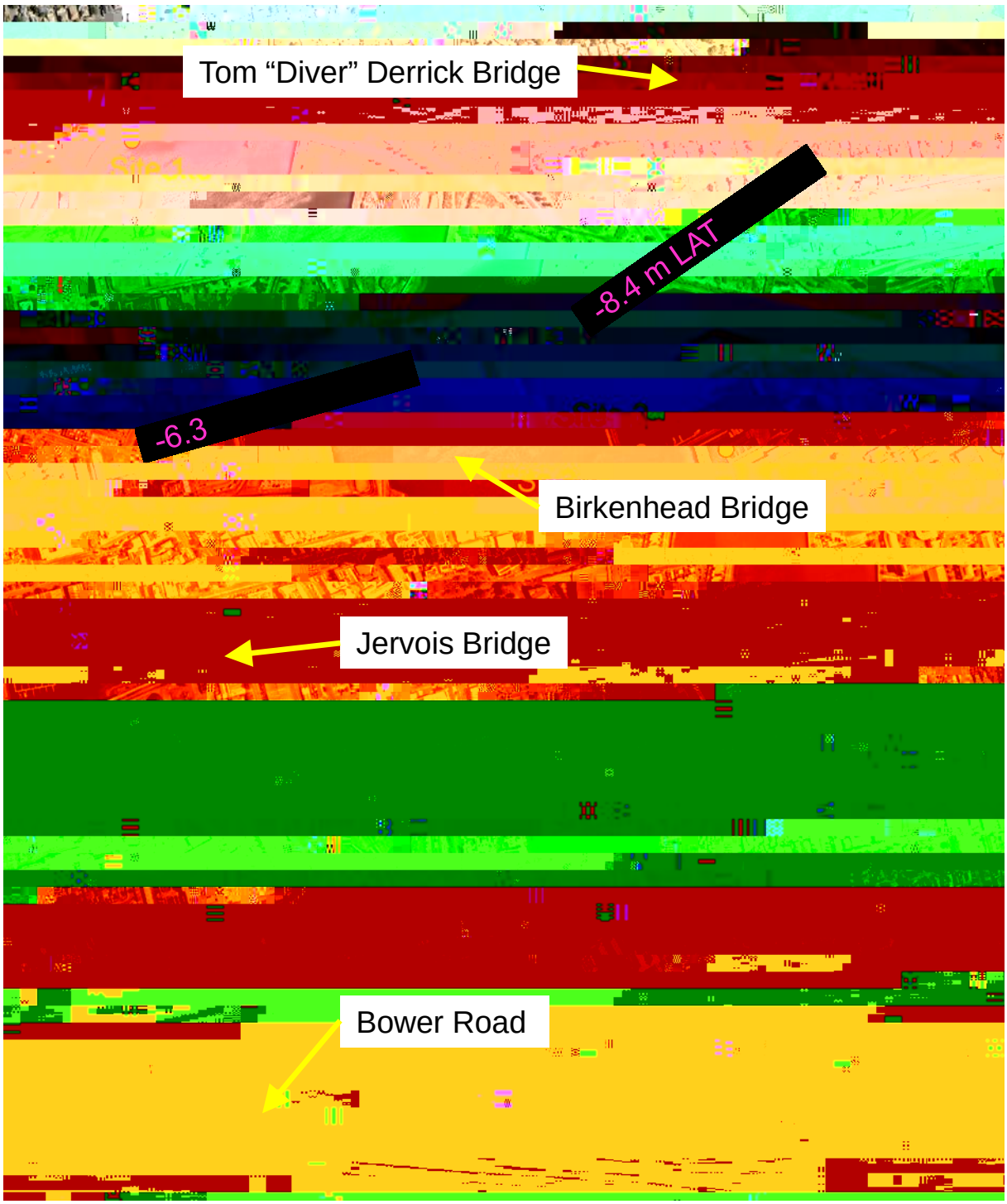

Figure 1.2 Zoomed in view of four potential sites for a tidal pool
(19 December 2022, Source: Nearmap)

2.4 Site 1

Site 1 is located immediately to the north of the boat ramp at Cruickshanks Beach (Figure 2.1), just upstream of Tom “Diver” Derrick Bridge.

2.6 Site 3

Site 3 is located adjacent to Hart's Mill Playground, just upstream of Folklore Cafe (Figure 2.3). A floating pontoon exists which is used for boats and fishing. A beach only pontoon is not possible at this site.

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2.7 Site 4

Site 4 is located within an enclosed bay adjacent to Joyce Snadden Reserve (Figure 2.4). Open space is available on land adjacent to the proposed site that could be used for amenities to support a tidal pool. With the addition of some beach nourishment, a beach-entry pool may be possible at this site (based on review of bathymetric data provided by Flinders Ports [Flinders Ports, 2022]). A pipe in the south-east corner of the embayment discharges stormwater into the Port River from the Hack Street pumping station (see also Figure 3.3).

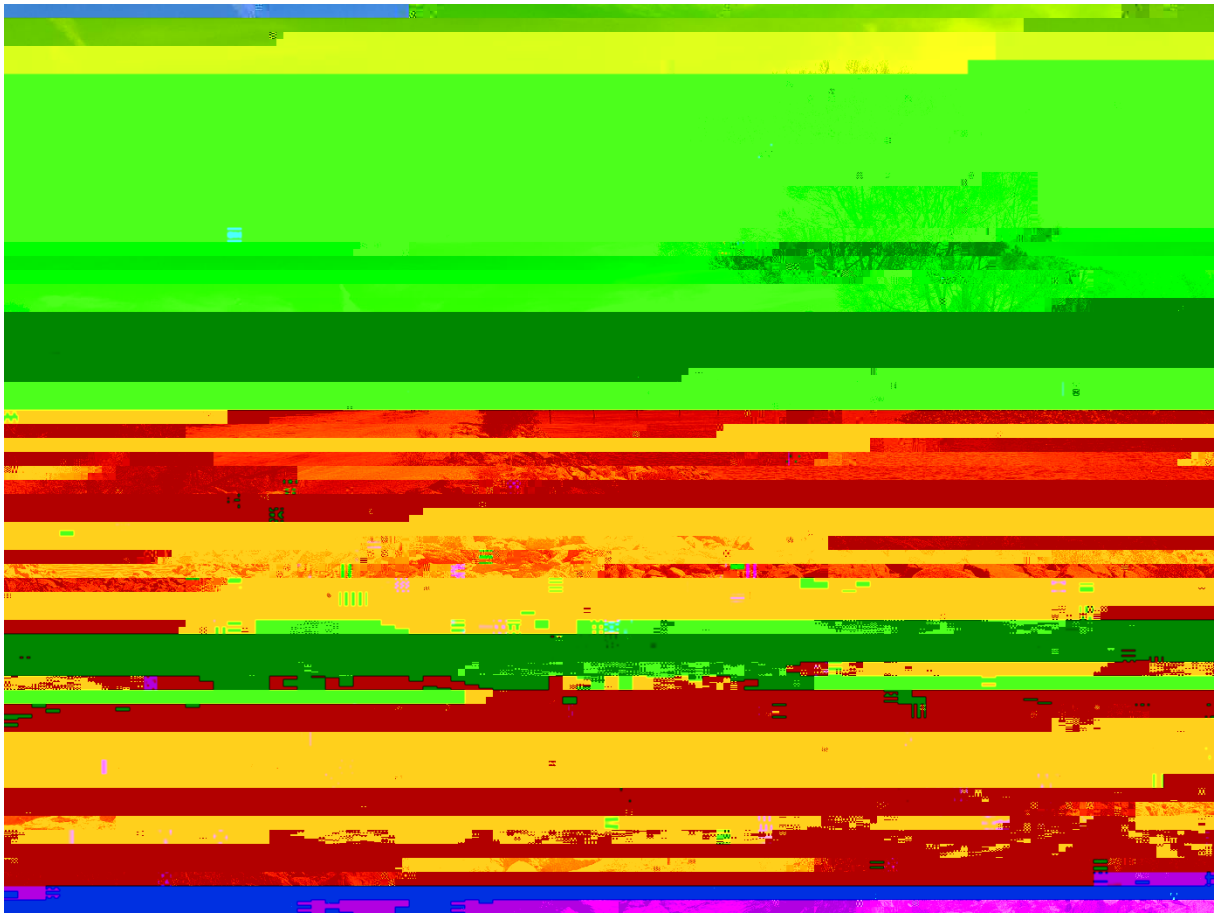

Figure 2.4 Potential tidal pool site 4: Joyce Snadden Reserve (Source: ECF)

3 Site-specific environmental constraints

3.1 Water quality

leaves the area in 12.5 hours. This tidal flushing (exchange) process is an important consideration for water quality at the potential pool sites.

While coupled hydrodynamic-water quality modelling has not been undertaken, tidal flushing is expected to reduce with distance from the mouth of the Port River. That is, tidal flushing is highest at Site 1, reducing for Sites 2 and 3, and lowest at Site 4.

Further to this, WRL considers that forces from tidal currents are not expected to be a significant influence on the design, or usage, of the tidal pool. Based on the same assumptions above for spring tide conditions, peak tidal velocities in this area of the Port River are estimated to be below 0.05 m/s.

3.1.2 Inflows from West Lakes

At the head of the Port River estuary at Bower Road, outflows from the constructed West Lakes system enter the Port River. Ocean water is drawn into the West Lakes system on the upper part of the tide, and released into the Port River on the lower part of the tide (Figure 3.1). In this manner, the entire volume of West Lakes is replaced approximately every 10 days (Dyer, 2012). The average daily flow of sea water through West Lakes is approximately 358 ML (LWC, 2021) (split unevenly across two high tides). Considering the magnitude of these outflows, in addition to tidal flushing, the quality of water released from West Lakes is a significant contributor to water quality at all of the potential pool sites (Figure 3.2). Note that water quality measurements from within the West Lakes system were not available to WRL.

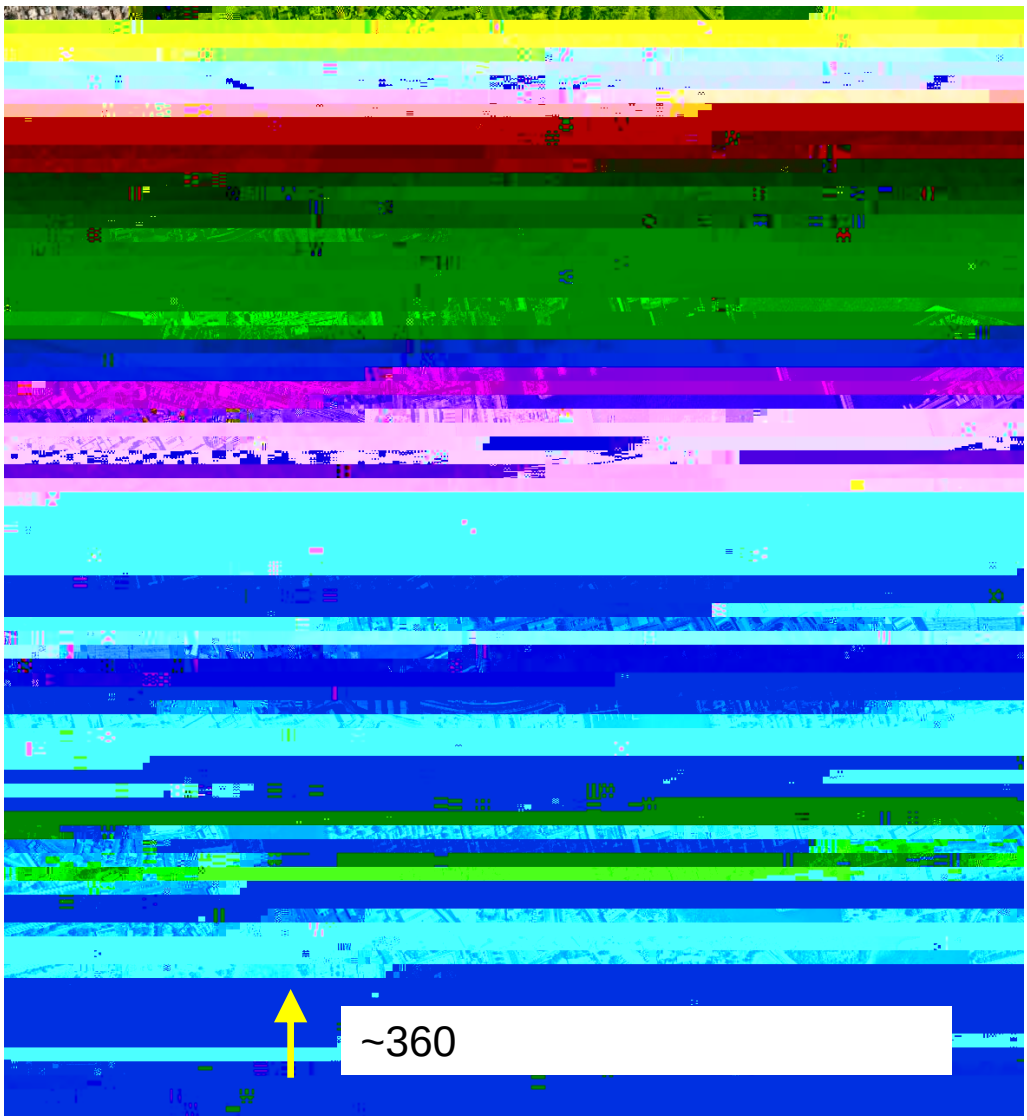

Figure 3.2 Magnitude of t idal exchange and inflows from West Lakes syste m (19 December 2022, Source: Nearmap)

3.1.3 Stormwater

Stormwater inputs to the area containing the four potential tidal pool sites are discussed in two separate stormwater management plans regarding the eastern side (Southfront, 2018) and western side (Southfront, 2019) of the Port River. Figure 3.3 shows the key stormwater infrastructure in the area including stormwater drains, pump stations and rising mains.

Figure 3.3 Stormwater drainage infrastructure near the four potential tidal pool sites (adapted/merged by WRL from Southfront, 2018 and Southfront, 2019)

It can be seen that all four potential tidal pool sites have adjacent stormwater outlets. Coupled hydrodynamic-water quality modelling would be required to assess the differences in water quality at each of the four sites.

Land use for sub-catchments discharging near the four potential pool sites are predominantly residential and industrial/commercial (i.e. high impervious percentage). Potential water quality risks from the stormwater for pool users are increased suspended sediments (turbidity and sedimentation), nutrients, metals, pesticides, hydrocarbons, emerging organic contaminants, litter and reduced salinity.

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Table 3.2 Comparison of water quality measurements with guideline values
(January 2005 June 2008 , total 34 samples)

Parameter	Guideline	Minimum	Median	Maximum
Cadmium (total) (mg/L)	<0.002*	<0.0005	0.0035	0.0077
Copper (total) (mg/L)	<2*	0.0016	0.01	0.0365
Lead (total) (mg/L)	<0.01*	<0.0005	0.005	0.005
Mercury (total) (mg/L)	<0.001*	<0.0003	0.0003	0.0004
Nickel (total) (mg/L)	<0.02*	0.0005	0.005	0.02
Zinc (total)(mg/L)	<3*	<0.03	0.03	0.082
Chlorophyll a (µg/L)	n/a	2.05	9.505	42.2
Dissolved oxygen (mg/L)	>5.9**	4	6.8	11.95
Enterococci (per 100 mL)	<200*	0	6	100
Turbidity (NTU)	n/a	0.51	1.275	4.2
Ammonia (as N) (mg/L)	<0.5*	0.011	0.252	0.613
Total Nitrogen (mg/L)	n/a	0.076	0.73	1.659
Oxidised Nitrogen (as N) (mg/L)	n/a	0.026	0.14	0.369
TKN (as N) (mg/L)	n/a	<0.05	0.48	1.29
Phosphorus (sol) (mg/L)	n/a	<0.005	0.009	0.028
Total Phosphorus (mg/L)	n/a	0.005	0.047	0.086

* Guideline value for this parameter sourced from the Guidelines for Managing Risks in Recreational Water (NHMRC, 2008).

** Guideline value for Dissolved Oxygen in mg/L inferred by WRL from 80% saturation value sourced from the Guidelines for Managing Risks in Recreational Water (NHMRC, 2008) assuming a temperature of 20°C and salinity of 35 ppt.

Table 3.3 Comparison of water quality measurements with guideline vmmentses 0.000008871 0 595.32 842

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Tidal anomalies primarily result from factors such as regional wind setup (or setdown) and barometric

Ports in November 2020 in the zone shown in Figure

3.2 Sediment size

two of the locations (Sites 19 and 25) in the EPA (2000) study, the distribution of grain sizes within bed sediment samples was analysed (Table 3.8). Australian Standard 1726 (2017) classifies rticles less than 75 µm as silt/clay, particles between 75 µm and 2.36 mm as sand and particles ween 2.36 and 63 mm as gravel. While the upper range in Table 3.8, doesn't exactly match the ssification transition from sand to gravel, it can be seen that the samples from the two sites comprised y different particle sizes. At Site 19 (Bower Road; the upstream tidal limit), there was a very high %) silt/clay content but further downstream at Site 25 (Jenkins Street, Birkenhead), the silt/clay ntent was much less (12%), with sand content of at least 64%.

Table 3.8 Grain size of bed sediment samples (EPA 2000)

Grain size of sediments (% of sample)	Site 19: Bower Road	Site 25: Jenkins Street, Birkenhead
<75 µm	70	12
<75 µm – 2 mm	29	64
>2 mm	1	24

3.7 Wave climate

WRL considers that wave climate, from a range of sources, is not a significant influence on the design of the tidal pool. Based on the speed limit and existing vessel types, waves generated by boats adjacent to the four potential tidal pool sites will have small wave heights and short wave periods. Similarly, due to the short fetches within this part of the Port River (less than 400 m), wind generated waves have small heights and short periods. Long period ocean swell waves also do not penetrate into the Port River upstream to the four potential tidal pool sites. Tsunamis are extremely rare and have not been considered in this study.

3.8 Pool entry

As discussed in Section 2, a beach-entry pool may be possible at Sites 1 and 4 with the addition of beach nourishment. This is not possible at Sites 2 and 3 since they interface with the wharf.

A conventional pool with a vertical, moderate depth entrance (so that swimmers' feet do not touch the existing bed sediments) is also possible at all four sites.

3.9 Summary of environmental constraints

As outlined in the preceding discussion, based on available data, the following environmental constraints cannot be differentiated between the four potential pool sites:

- Water quality (general)
- Extreme water levels (storm surge)
- Bed sediments
- Dolphins
- Shellfish and barnacles
- Wave climate
- Pool entry (conventional vertical, moderate depth entrance)

For those constraints for which the four potential pool sites can be differentiated, a summary is presented in Table 3.9.

Table 3.9 Comparison of four

4 General design elements of good tidal pools

4.1 Body of knowledge

4.1.1 BT 2541 6(i)1010 5(mm)000ll 155000ll

individuals were advised that they would not be directly quoted, but that rather their opinions and observations would be collated to form an overall picture.

4.1.3 Literature

There is minimal available literature regarding tidal pools. Most t5-o.50000887104 re9n3ature

use netting on all three sides (Figure 4.10), however in the opinion of the authors, such pools have diminished ambience.

WRL recommends that the jetty/walkway be fixed at an elevation above the Highest Astronomical Tide to minimise the need for maintenance (removal of marine growth) on its components. This is in contrast to a floating walkway which would have a much greater area requiring ongoing removal of marine growth.

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Figure 4.1 Timber and steel bar perimeter Brighton Baths , VIC (James Carley)

Figure 4.2 Netting detail

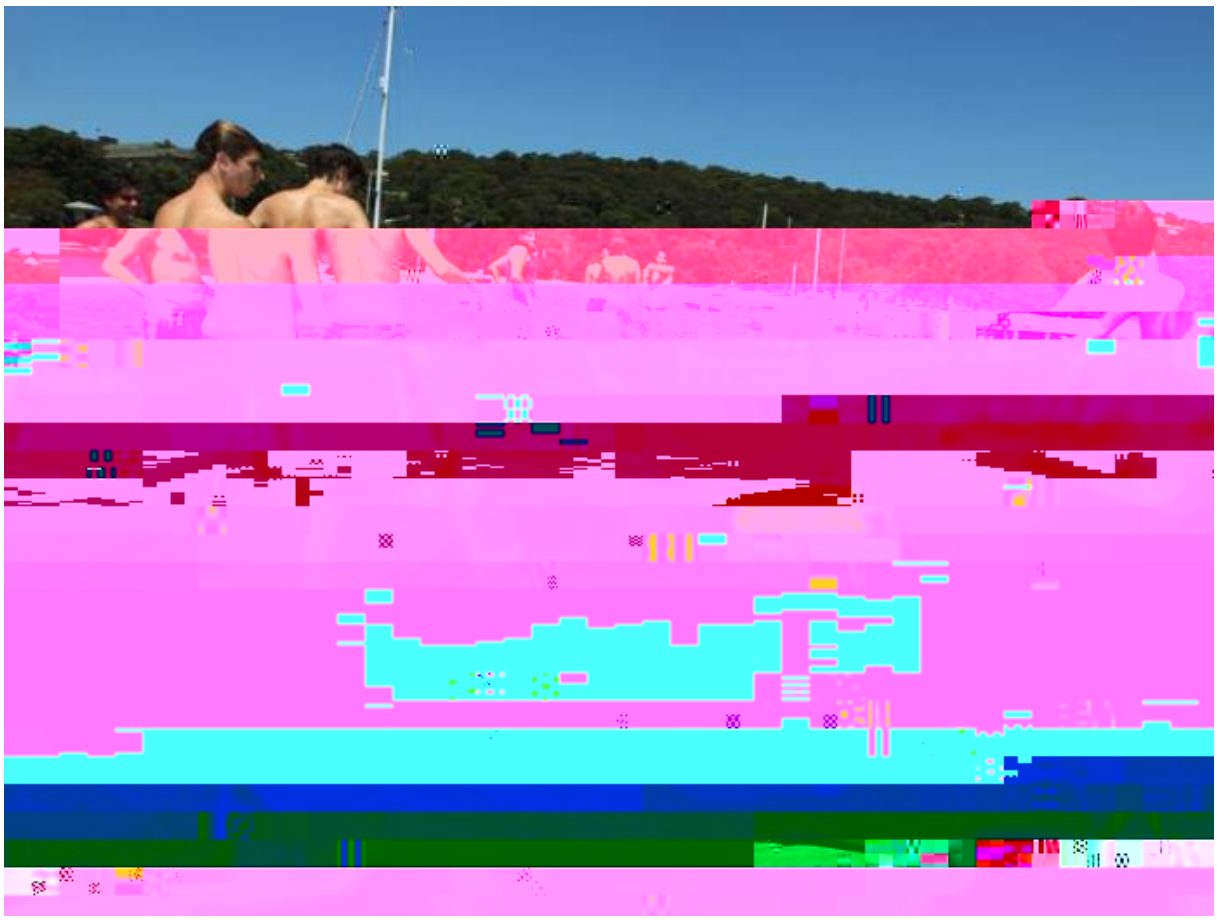

Figure 4.7 Walkway popularity Balmoral Baths , NSW

Figure 4.8 Single -sided walkway tidal pool Belmont Baths , VIC (homely.com.au)

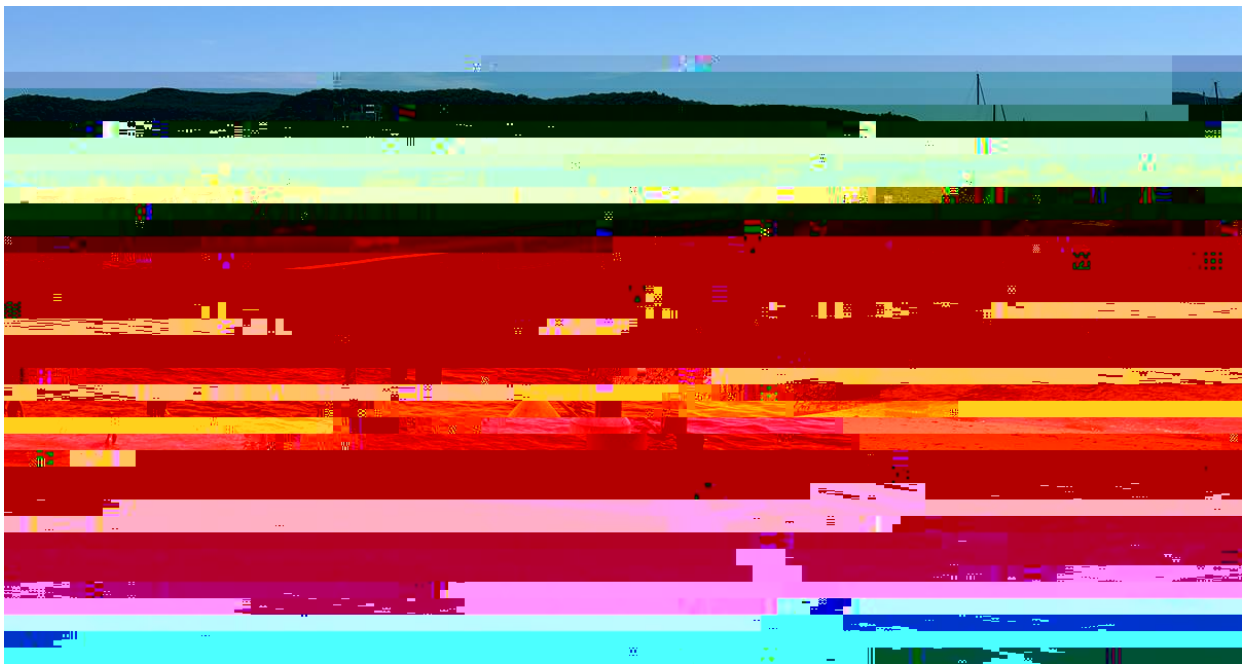

Figure 4.9 Single-sided walkway tidal pool Taylors Point Baths, NSW (James Carley)

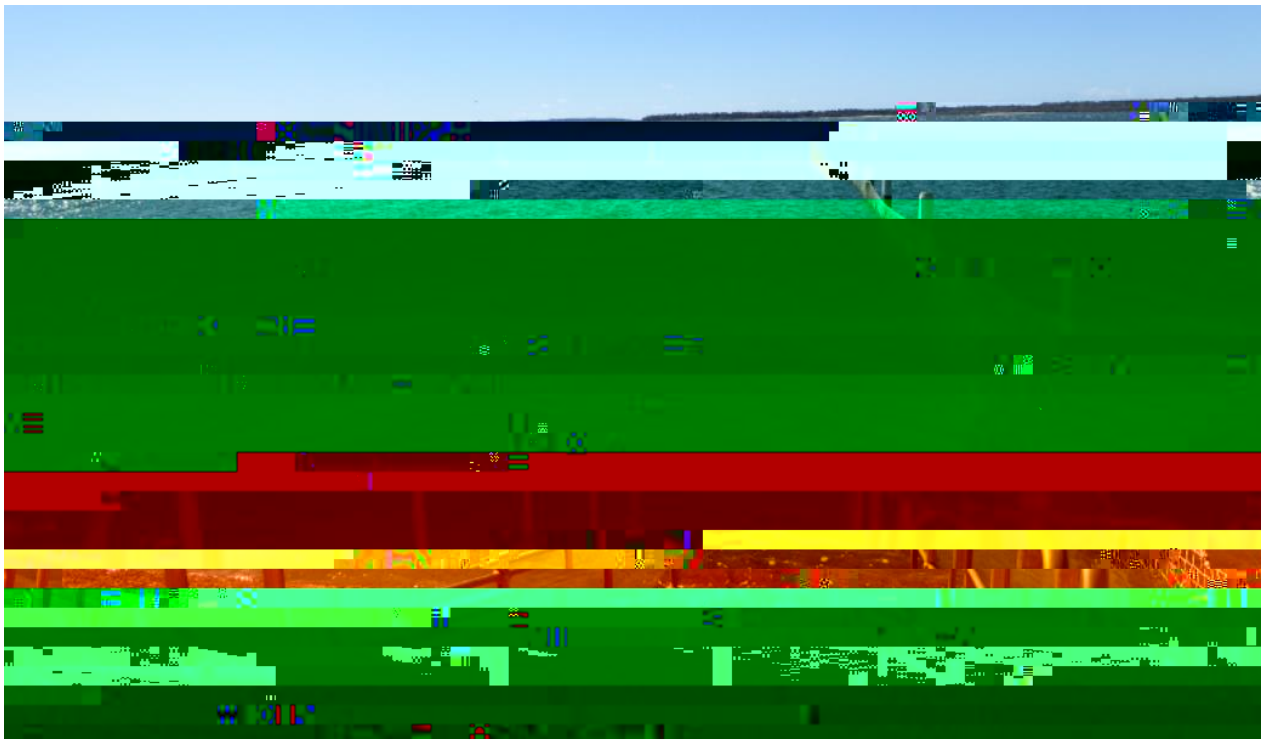

Figure 4.10 Net only enclosure Vanston Baths, Sandringham, NSW (oceanpoolsnsw.net.au)

Figure 4.13 Pontoons and lane ropes Northbridge Baths , NSW (https://swimming .coffee/)

Figure 4.14 Floating turning boards for lap swimmers Greenwich Baths, NSW

Figure 4.15 Fixed turning boards for lap swimmers Brighton Baths, VIC

5 Site-specific tidal pool concept design

5.1 Adopted design elements

A sketch of tidal pool Concept Design 1 which includes a continuous timber jetty/walkway on three sides with beach nourishment

Figure 5.1 Tidal pool Concept Design 1

jetty/walkway on three sides , netting on three sides, includes beach nourishment contours are water depths below LAT from Flinders Ports, 2009 (13 September 2022, Source: Nearmap)

5.2 Maintenance

Typical maintenance items include:

- Water quality testing
- General cleaning and rubbish removal
- Removal of sharp marine growth from touchable surfaces
- Antifouling of pontoons
- Repairs to decking
- Repairs to signage
- Placement of sand at beach-entry (if a beach-entry pool is adopted)

Table 5.3 Indicative annual maintenance cost estimates for each tidal pool concept design

Item	Concept Design 1 (Figure 5.1)	Concept Design 2 (Figure 5.2)	Concept Design 3 (Figure 5.3)	Concept Design 4 (Figure 5.4)
Timber jetty/walkway deck repairs	$30,000	$10,000	$30,000	$10,000
Netting inspection and repairs	$60,000	$60,000	$70,000	$70,000
Antifouling of pontoons	$10,000	$10,000	$10,000	$10,000
Beach nourishment (ongoing)	$10,000	$10,000	-	-
TOTAL	$110,000	$90,000	$110,000	$90,000

5.4 Potential usage

Table 5

By combining the plausible range of visits to the proposed Port River tidal pool from Section 5.4 (20,000