Coring and Installation of Groundwater Infrastructure on the Sir Richard Peninsula, South Australia

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Executive Summary

This report summarises the field investigation and borehole drilling activities conducted on the Sir Richard Peninsula, South Australia, during 7–14 October 2025. This work is a part of the fourth milestone ("Groundwater monitoring") of the project "Coastal beach-dune dynamics and management under future climate change".

A team from Flinders University, led by Professor Patrick Hesp, visited the proposed drilling sites and performed an extensive field investigation. The activities include drilling and coring of boreholes, hand-augered holes, installation of wells, deploying water level loggers, undertaking primary water quality measurements and high resolution RTK measurements of borehole positions. These investigations will be followed by subsequent site visits, each with a duration of 1 to 3 days, to monitor groundwater levels and assess water-quality data into the foreseeable future.

Acknowledgements

We acknowledge the cultural connections to the land and connected waters, as well as the cultural significance of waterbirds that exist between people of the Ngarrindjeri and Boandik Nations across the Coorong, Lower Lakes, and Murray Mouth region. We recognise that First Nations peoples' spiritual, social, cultural, and economic practices come from their lands and waters, and they continue to maintain their cultural heritage, economies, languages, and laws which are of ongoing importance. We are committed to fostering and nurturing ongoing relationships with First Nations communities in the CLLMM region as we collectively work toward healthy, resilient and thriving lands, waters, ecosystems and communities across the region.

This project was funded by the Goyder Institute for Water Research's CLLMM Research Centre, which is funded by the Australian Government. We thank the CLLMM Research Centre staff, and particularly Nick Whiterod, for project initiation, logistical and field support, and management. We thank the Goyder Institute for Water Research, Research Advisory Committee. We particularly thank Nick Pannell of Geochem Technologies (https://geochemtech.com.au/) for operation of the Geoprobe, drilling and coring on the Peninsula. We also thank Rosemary Kartinyeri and Chaneil Kartinyeri (Ngarrindjeri Aboriginal Corporation) for providing field support and observation. Additional thanks to James McCallum (Flinders University) and Claire Sims (DEW) for reviews.

1. Introduction

The project "Coastal beach–dune dynamics and management under future climate change" aims to assess the dynamics and stability of dunes on the Sir Richard and Younghusband Peninsulas. The project tasks include a review of existing literature, historical analysis of coastal dynamics, assessment of storm-induced beach erosion, evaluation of sea-level-rise impacts, analysis of morphological change and vegetation cover, and groundwater monitoring. This study focuses on Task 4, "Groundwater Monitoring", specifically Task 4a, which involves the construction of a long-term groundwater monitoring transect across the Sir Richard Peninsula.

A coastal sand barrier is shore-parallel and sub-aqueous accumulation of sand formed by waves, tides and wind processes (Hesp and Short, 1999). They are in essence, a "barrier" between the sea and the hinterland. They may be quite small and, for example, comprise only a beach and overwash terrace, or be massive and comprise large dune systems. They are characteristic features of wave-dominated coastal regions (Dillenburg and Hesp, 2009), and provide both physical and ecological protection to inland environments (Otvos, 2020). However, coastal sand barriers are fragile and increasingly threatened by sea-level rise, climate change, shoreline erosion, vegetation loss and foredune destabilization (Otvos, 2020; Costas, 2022).

In South Australia, the Sir Richard Peninsula and the Younghusband Peninsula together form a major coastal sand barrier that separates the Southern Ocean from the River Murray and Coorong lagoon system respectively, with the two peninsulas divided by the mouth of the Murray River (Dillenburg et al., 2020). These barriers face growing challenges from future sea-level rise and climate change, which are expected to cause saltwater intrusion, alter groundwater and soil hydrology, and affect associated vegetation and fauna. While previous studies of this coastal region have examined the geomorphology (Short and Hesp, 1978; 1982), the dynamics of the Murray Mouth (Bourman et al., 2000), and the local geomorphology and archaeology (Bourman and Murray-Wallace, 1991), there currently exists no research on the influence of current and future stresses, and especially sea-level rise on barrier stability, and the dunefield vegetation, geomorphological processes, and groundwater systems within the Sir Richard Peninsula.

To address this knowledge gap, a monitoring network of multiple piezometers has been established along a transect across the Sir Richard Peninsula under Task 4 ("Groundwater Monitoring") of the project "Coastal beach-dune dynamics and management under future climate change". The transect was chosen for its ease of access for both drilling and subsequent monitoring, its relatively natural state, and its representativeness as a typical coastal barrier in the SE. The monitoring network will enable direct observation of groundwater levels and salinity, and provide insights into watertable wave propagation, interactions between storms and elevated water levels, and impacts of long-term sea-level rise on fresh groundwater lenses, dune responses, and long-term changes in vegetation, soil and ecological interactions.

This report presents the first field investigation conducted as a part of this task. The fieldwork involved drilling and installing observation wells at six sites, resulting in a total of 11 wells of varying depths along the transect. The sites are located adjacent to the Beacon 19 Boat Ramp track extending from the Murray River (at Beacon 19 Boat Ramp car park) to the ocean, as shown in Figure 1. The wells are equipped with water level and salinity loggers for continuous groundwater monitoring. Sediment cores were collected for dating and analysis of sedimentological properties to determine the age structure of the coastal barrier and understand the hydrological behavior of the shallow sands and aquifers. Additionally, 10 hand-augered drill holes, labelled as SR1 to SR10 (SR – Sir Richard) were obtained. Multiple points were surveyed by Real-Time Kinematic (RTK) to obtain high resolution locational information for each drill hole. The locations of the observation wells, SR hand-augered boreholes and survey points are shown in Figure 2.

Figure 1. The sand dunes of the Sir Richard Peninsula. The photograph shows the Beacon 19 Boat Ramp track which formed the transect along which well installation sites are located (Photo credit: Patrick Hesp taken on 8 October 2025).

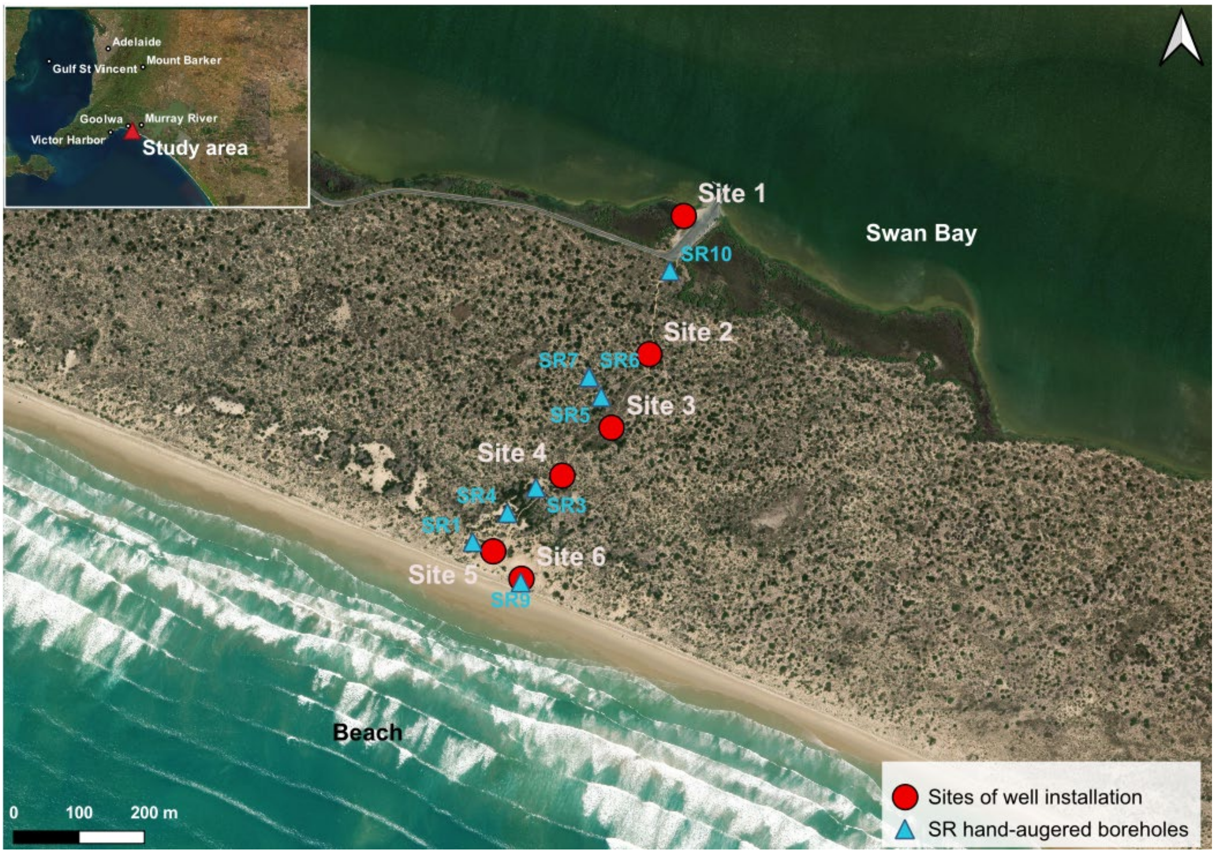


Figure 2. Locations where the various field activities were carried out. Inset map shows the location of the study area (red triangle) in relation to Adelaide and the Murray River, South Australia.

The field investigation was conducted between 7 to 13 October 2025 by a team from Flinders University and elsewhere including: Prof. Patrick Hesp (7 to 13 October 2025), Prof. Adrian Werner (7 to 13 October 2025), Dr Sanjukta Das (7, 10 and 13 October 2025), Dr Guohua Hou (7, 10 and 13 October 2025), Harry Nash (Honours student, 7 to 10 October 2025), and PhD students Amin Gholami and Mahsa Gholami (10 October 2025). Nick Pannell, Managing Director of Geochem Technologies Pty Ltd, served as the driller (7 to 13 October 2025). Nick Whiterod and Tiff Nay from the CLLMM Research Centre visited the site on 7 October 2025. Rosemary Kartinyeri and Chaneil Kartinyeri from Ngarrindjeri Aboriginal Corporation (NAC) were present throughout the fieldwork to oversee and engage with the investigation.

The methods, observations and key findings from this field investigation are described in the subsequent sections of this report.

2 Methodology

2.1 Well Installation

Well installation in this study involved drilling boreholes using a Geoprobe 6620DT drill rig, using primarily pushing, and some auguring. The goal was two-fold: (a) to obtain complete cores of the sediments of the Sir Richard Peninsula for the purposes of characterising the geology and stratigraphy, and for Optically Stimulated Luminescence (OSL) dating of the sediments, and (b) to install observation wells that allow for continuous monitoring of the groundwater levels and water quality at various depths below ground. The process comprised several key stages including site assessment, acquisition of necessary permits, borehole drilling, casing, well completion, logger installation and water sampling. The drill rig is depicted in Figure 3.

Figure 3. Geoprobe 6620DT drill rig used on the Sir Richard Peninsula. The photograph shows Harry Nash, Rosemary Kartinyeri, Chaneil Kartinyeri, Nick Pannell and Patrick Hesp (left to right) (Photo credit: Patrick Hesp taken on 8 October 2025).

All installation steps were carefully conducted in compliance with regulatory requirements. Approval for the construction of a network of wells on the Sir Richard Peninsula, intended for monitoring long-term changes in salinity and watertable levels, was granted by the South Australian Department for Environment and Water (DEW). Permits were authorized by the Minister for Climate, Environment and Water, DEW, for the installation of wells at six locations, named as Sites 1, 2, 3, 4, 5 and 6. Multiple wells of varying depths were installed at several sites to gain insight into water quality variations with depth. Each well is labelled by the site number followed by a letter A, B, or C, corresponding to shallow, intermediate, and deep wells, respectively (where multiple wells were installed at a given site). Figure 4 shows the borehole 5C (i.e., site 5, deepest well) soon after drilling.

Figure 4. Borehole 5C drilled at Site 5 (Photo credit: Sanjukta Das taken on 7 October 2025).

The Geoprobe 6620DT drilling rig applied two techniques for installing wells: Push Tube DT325 and the Hollow Auger 200 mm, where the former also allowed for the attainment of sediment cores. The Push Tube DT325 uses direct-push technology, where a dual-tube (DT) rod assembly is hydraulically pushed into the ground without rotary action. The DT system consists of an outer casing that supports the borehole and an inner casing that obtains the soil core. This approach provides a rapid, economical means of drilling, producing continuous sediment cores with minimal disturbance or cuttings (Sundaram et al., 2009). For deeper wells, the Hollow Auger (200 mm) method was adopted. In this technique, mechanical rotation of the auger flights removes soil cuttings while simultaneously advancing the borehole (Sundaram et al., 2009). The two drilling systems used in this study are shown in Figure 5.

Figure 5. (a) Push Tube DT325 and (b) Hollow Auger 200 mm (Photo credit: (a) Sanjukta Das taken on 7 October 2025 and (b) Adrian Werner taken on 8 October 2025).

After drilling the boreholes, PVC well casings with a diameter of 50 mm, screened over various depth intervals depending on core length, were installed within the boreholes. Additional lengths of PVC pipe were trimmed to extend the casing slightly above ground level. Each well was secured with a well cap, and the borehole was protected with a bore shield and backfilled with concrete. The well casing and bore shield are shown in Figure 6.

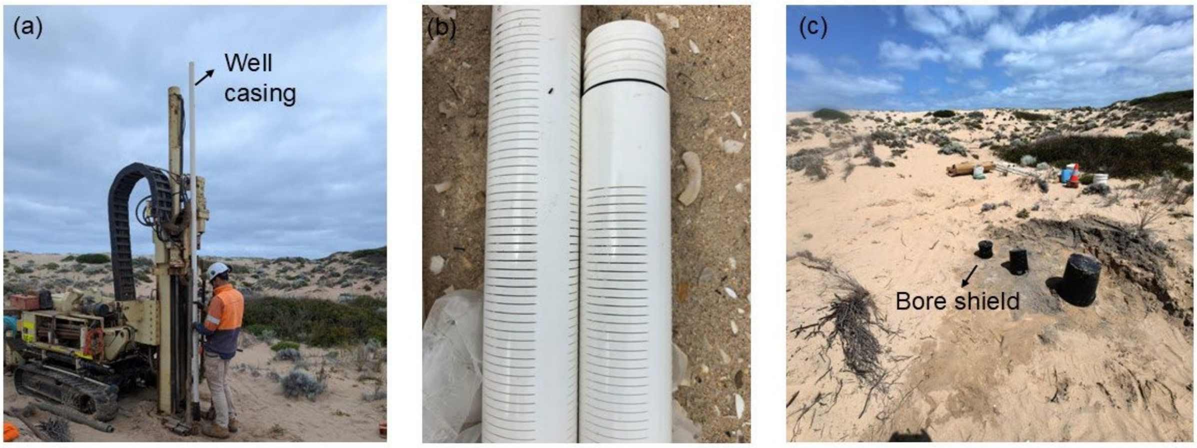


Figure 6. (a) Installation of well casing, (b) Screened section of well and (c) Bore shields at Site 5 (Photo credit: (a) Sanjukta Das taken on 7 October 2025, (b) and (c) Guohua Hou taken on 10 October 2025).

A summary of the details of the sites, wells, the permits obtained, and the method of drilling are provided in Table 1.

Table 1. A summary of the permits and drilling methods for various wells at the six sites.

SITE NUMBER	WELL NUMBER	INSTALLATION DATE	PERMIT NUMBER	METHOD OF DRILLING
1	1A	13/10/2025	P-510559	Push Tube DT325
	1B	13/10/2025	P-510560	Push Tube DT325
2	2	9/10/2025	P-510561	Push Tube DT325
3	3A	8/10/2025	P-510562	Push Tube DT325
	3B	8/10/2025	P-510562	Push Tube DT325
	3C	9/10/2025	P-510564	Hollow Auger 200 mm
4	4	8/10/2025	P-510565	Push Tube DT325
5	5A	7/10/2025	P-510566	Push Tube DT325
	5B	7/10/2025	P-510567	Push Tube DT325
	5C	10/10/2025	P-510568	Hollow Auger 200 mm
6	6	10/10/2025	P-510569	Push Tube DT325

2.2 *Collection of Core Samples*

Core sampling of subsurface materials was conducted for the purpose of stratigraphic analysis and for later OSL dating. Successive cylindrical cores, each approximately 1.2 m in length, such as 0-1.2 m, 1.2-2.4 m, and so on, were collected using the Push Tube DT325 method to obtain a continuous profile of the subsurface material. Each core sample was immediately wrapped in black plastic and securely sealed to prevent moisture loss, exposure to light, and potential contamination prior to laboratory analysis. The samples were clearly labelled with the site number and the corresponding start and end depths of collection. The core samples collected at Site 5 are shown in Figure 7.

Figure 7. Core samples collected at Site 5 (Photo credit: Guohua Hou taken on 7 October 2025).

2.3 Surveying the Wells

After the installation of the wells, a reference point was marked on the top of the casing (TOC) within the bore shield. The ground surface and reference point elevations were surveyed using a Global Navigation Satellite System (GNSS) receiver. The survey pole of the GNSS instrument was positioned sequentially at the ground level and at the TOC reference point to record precise geographic coordinates and elevations relative to the Australian Height Datum (AHD). The surveyed position and elevation data for all wells are summarised in Table 2, while Figure 8 illustrates the field surveying process. All Easting and Northing coordinates are provided in the Map Grid of Australia (MGA) projection, UTM Zone 54S, based on the GDA94 datum. All elevations reported in this document are referenced to the Australian Height Datum (AHD), where 0.0 m AHD approximates mean sea level.

Figure 8. Surveying the wells at Site 5. The photograph shows Patrick Hesp, Sanjukta Das and Adrian Werner (left to right) (Photo credit: Guohua Hou taken on 10 October 2025).

Table 2. Surveyed positions and elevations at the ground level and TOC reference points for wells at all study sites.

LOCATION	EASTING (m)	NORTHING (m)	LATITUDE	LONGITUDE	ELEVATION (m AHD)
Site 1					
Ground level	1392217.047	6023306.910	35^0 31' 53''S	138^0 49' 33''E	1.269
Well 1A	1392216.886	6023305.814	35^0 31' 53''S	138^0 49' 33''E	1.311
Well 1B	1392217.291	6023306.176	35^0 31' 53''S	138^0 49' 33''E	1.285
Site 2					
Ground level	1392121.112	6023039.313	35^0 32' 01''S	138^0 49' 30''E	6.440
Well 2	1392121.194	6023039.290	35^0 32' 01''S	138^0 49' 30''E	6.559
Site 3					
Ground level	1392031.484	6022901.206	35^0 32' 06''S	138^0 49' 27''E	1.257
Well 3A	1392032.010	6022900.575	35^0 32' 06''S	138^0 49' 27''E	1.322
Well 3B	1392031.371	6022901.334	35^0 32' 06''S	138^0 49' 27''E	1.336
Well 3C	1392030.635	6022902.311	35^0 32' 06''S	138^0 49' 27''E	1.395
Site 4					
Ground level	1391924.261	6022816.221	35^0 32' 09''S	138^0 49' 23''E	8.344
Well 4	1391924.116	6022816.203	35^0 32' 09''S	138^0 49' 23''E	8.378
Site 5					
Ground level	1391771.680	6022679.939	35^0 32' 14''S	138^0 49' 18''E	2.051
Well 5A	1391771.624	6022679.877	35^0 32' 14''S	138^0 49' 18''E	2.108
Well 5B	1391771.615	6022679.292	35^0 32' 14''S	138^0 49' 18''E	2.080
Well 5C	1391771.565	6022680.509	35^0 32' 14''S	138^0 49' 18''E	2.102
Site 6					
Ground level	1391822.259	6022619.977	35^0 32' 16''S	138^0 49' 20''E	3.687
Well 6	1391822.206	6022620.101	35^0 32' 16''S	138^0 49' 20''E	3.795

2.4 Water Level Measurement

Water level loggers were installed in all the wells, except Well 1A, to monitor fluctuations in the watertable. A logger will be installed in Well 1A during the next field visit. Solinst Levelogger 5 (Model 3001 M10) pressure transducers were used for this purpose. A Solinst Baro logger 5 (Model 3001) was installed in the bore shield of Well 2, as shown in Figure 9, to record atmospheric pressure to correct water level measurements from loggers in all the wells for barometric pressure fluctuations. Two Solinst Levelogger 5 Level, Temperature, and Conductivity (LTC) loggers (Model 3001

M10 C80) were installed in Wells 5A and 6. These LTC loggers are used to continuously record water level, temperature, and electrical conductivity, providing insights into groundwater fluctuations, thermal variations, and salinity.

Figure 9. Baro logger in Well 2 (Photo credit: Guohua Hou taken on 15 October 2025).

The loggers are secured to the well cap using stainless steel cable. The cable length is the distance between the attachment point on the well cap and the top of the logger. A schematic representation of these measurements is shown in Figure 10.

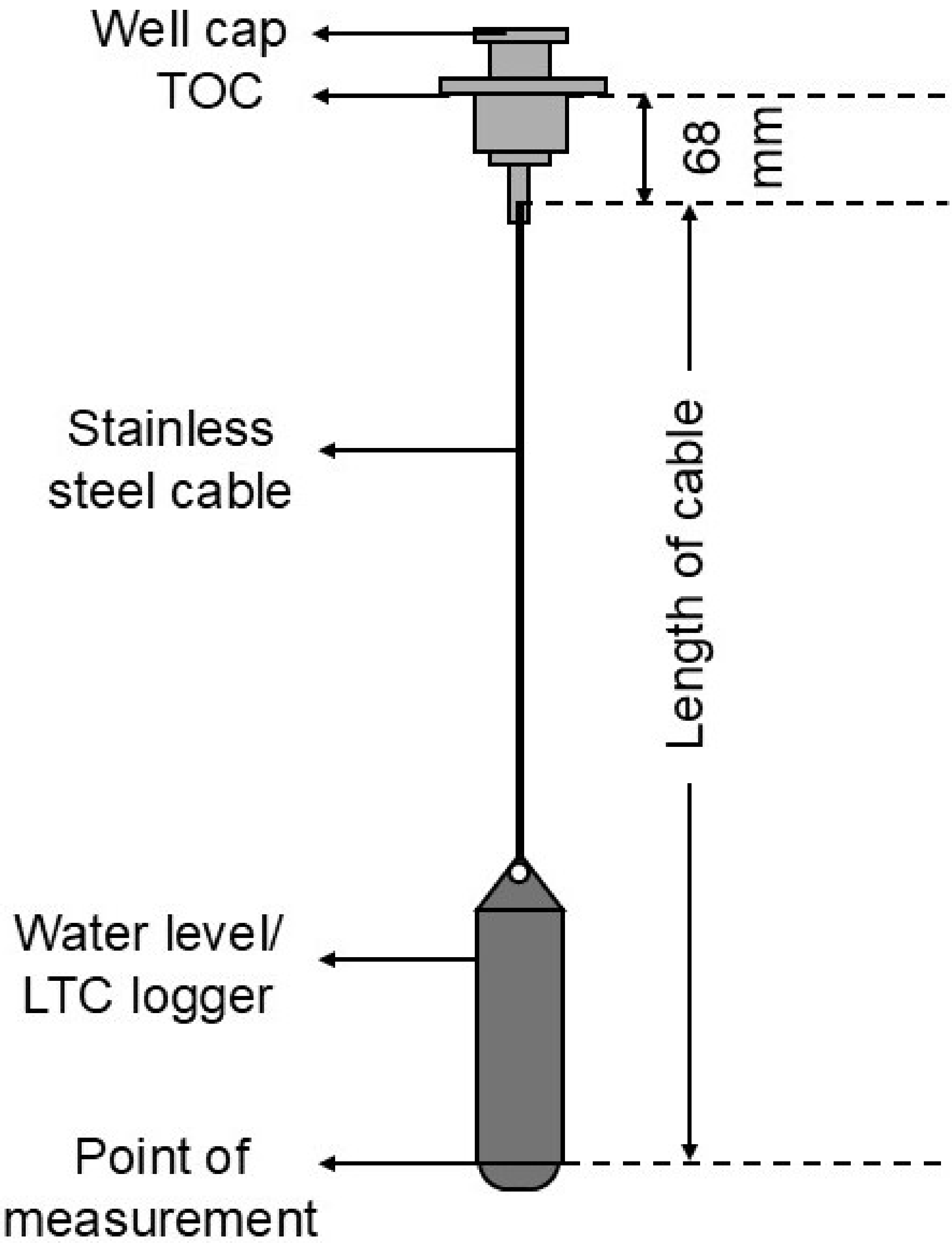


Figure 10. Schematic representation of fastening of the logger to the well cap.

Water level measurements during the field investigation (7–13 October 2025) were obtained from all the wells using a Solinst Dip Meter, as shown in Figure 11. Data from the installed loggers will be retrieved during the next field visit.

Figure 11. Use of the dip meter to measure watertable depth. The photograph shows Adrian Werner, Amin Gholami and Guohua Hou (left to right) (Photo credit: Sanjukta Das taken on 10 October 2025).

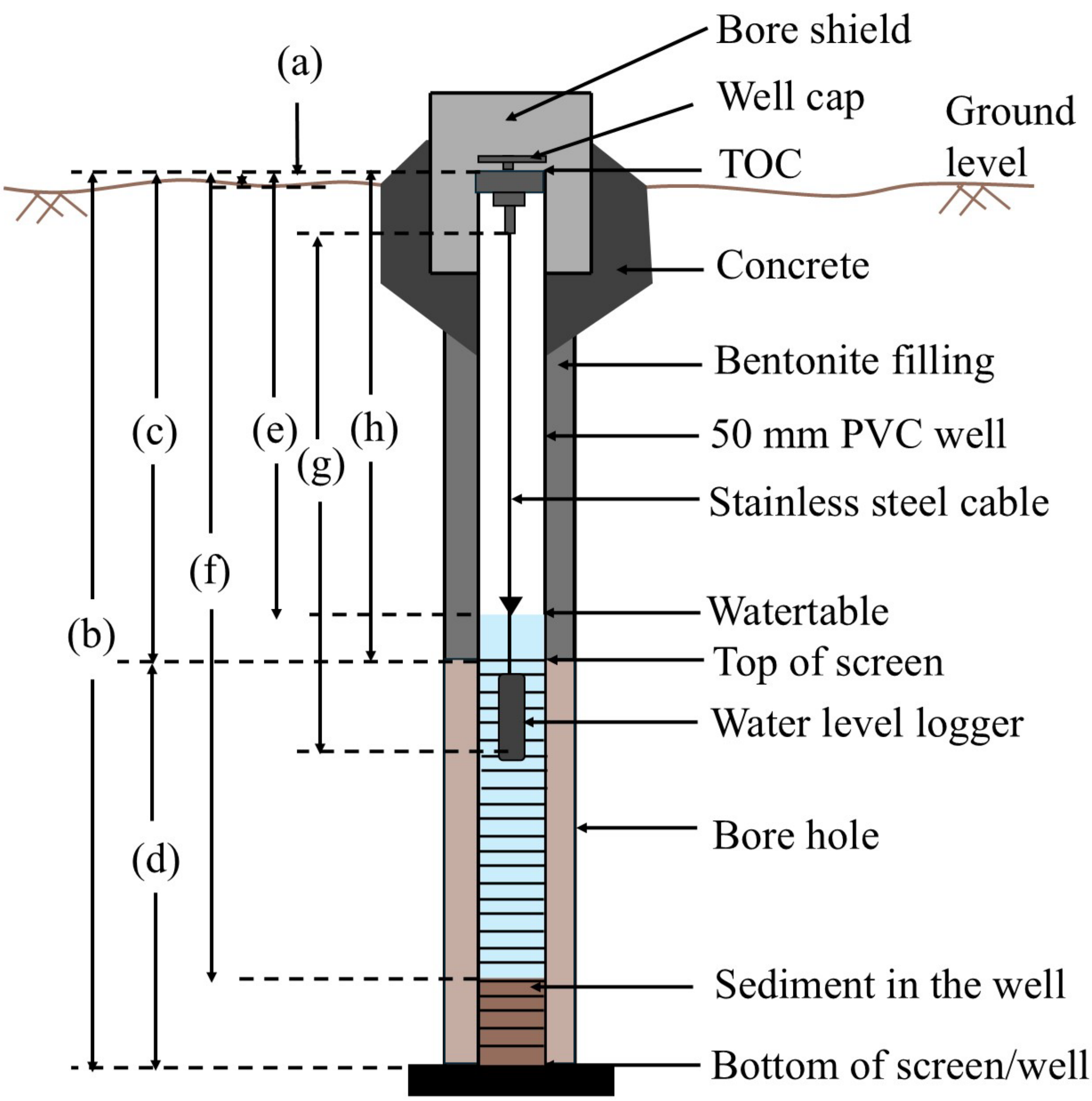
2.5 Water Quality Assessment

After the wells were installed, water samples were pumped for a preliminary water quality assessment. The pump hose was connected to a battery and generator, and water quality parameters were measured using a YSI 556 MPS multi-probe field meter. The meter was initially calibrated for pH, electrical conductivity, and dissolved oxygen. Water quality measurements were then recorded at each well, as shown in Figure 12.

Figure 12. Example of water quality assessment using YSI 556 MPS multi-probe field meter (Photo credit: Sanjukta Das taken on 10 October 2025).

3 Details of the Wells

A schematic representation of the wells (not to scale) is shown in Figure 13. The labels (a)–(g) correspond to the notations used in the data presented in the following sections. The annular space between the well casing and the borehole is filled with bentonite to prevent vertical flow along the annulus. In sections where bentonite is not placed, it is assumed that the borehole and well casing are in direct contact, with no intervening gap. The locations of the six sites and the wells are shown in Figure 14.



(a)	Height of reference point from ground level	(e)	Depth to water table from TOC
(b)	Depth of the screen/well bottom from TOC	(f)	Depth to the occurrence of sediment in well from TOC
(c)	Top of screen from TOC	(g)	Length of stainless steel cable attached to the logger
(d)	Length of screen	(h)	Depth of bentonite seal

Figure 13. Schematic sketch of the wells.

Figure 14. The locations of the six sites and the eleven wells.

3.1 Site 1

Site 1 is closest to the Murray River, adjacent to the car park of Beacon 19 Boat Ramp track, as shown in Figure 14. Wells 1A and 1B are located on the seaward and lagoon sides, respectively. The site and well details are provided in Table 3. Currently, Well 1A is not equipped with a logger and the installation is planned for the next field visit.

Table 3. Details of wells 1A and 1B

PARAMETER	NOTATION	WELL 1A	WELL 1B
Height of reference point from ground level (m)	(a)	0.042	0.016
Groundwater level elevation (m AHD)	-	0.571	0.525
Depth of the well bottom (m) from TOC (m)	(b)	1.8	6
Top of screen from TOC (m)	(c)	0.8	5
Bottom of screen from TOC (m)	(b)	1.8	6
Length of screen (m)	(d)	1	1
Depth to watertable (m) from TOC	(e)	0.74	0.76
Depth to the occurrence of sediment in the well, from TOC (m)	(f)	1.43	> 3
Length of stainless steel cable attached to the logger (m)	(g)	-	2.5
Location of bentonite seal from TOC (m)	-	0.1-0.6	0.1-1

3.2 *Site 2*

Site 2 is located at the end of the landward ridge closest to the Murray River (see Figure 14) and contains a single well. The details of the well are provided in Table 4. The well casing prior to trimming, along with the pumping operation performed for the collection of groundwater samples from Well 2, is shown in Figure 15.

Table 4. Details of Well 2

PARAMETER	NOTATION	WELL 2
Height of reference point from ground level (m)	(a)	0.119
Groundwater level elevation (m AHD)	-	0.524
Depth of the well bottom from TOC (m)	(b)	9.6
Top of screen from TOC (m)	(c)	5.6
Bottom of screen from TOC (m)	(b)	9.6
Length of screen (m)	(d)	4
Depth to watertable from TOC (m)	(e)	6.035
Depth to the occurrence of sediment in the well, from TOC (m)	(f)	9.084
Length of stainless steel cable attached to the logger (m)	(g)	~7.3
Location of bentonite seal from TOC (m)	-	0.1-1.5

Figure 15. Pumping groundwater from Well 2 (Photo credit: Guohua Hou taken on 13 October 2025).

3.3 Site 3

Site 3 contains three wells. Well 3C is the deepest and is located closest to Beacon 19 Boat Ramp Broadwalk, while Well 3A is the farthest from it. The intermediate well is Well 3B (see Figure 14). The details of these wells are provided in Table 5.

Table 5. Details of Wells 3A, 3B and 3C

PARAMETER	NOTATION	WELL 3A	WELL 3B	WELL 3C
Height of reference point from ground level (m)	(a)	0.065	0.079	0.138
Groundwater level elevation (m AHD)	-	0.579	0.728	0.665
Depth of well bottom from TOC (m)	(b)	2.7	5.3	9
Top of screen from TOC (m)	(c)	1.5	4.3	3
Bottom of screen from TOC (m)	(b)	2.7	5.3	9
Length of screen (m)	(d)	1.2	1	6
Depth to watertable from TOC (m)	(e)	0.743	0.608	0.730
Depth to the occurrence of sediment in the well, from TOC (m)	(f)	2.595	5.119	>7.7
Length of stainless steel cable attached to the logger (m)	(g)	1.5	2	2
Location of bentonite seal from TOC (m)	-	0.1-0.5	0.1-1	0.1-0.6

3.4 *Site 4*

There is one well at Site 4, situated on the top of a dune ridge. The details of the well are tabulated in Table 6.

Table 6. Details of Well 4

PARAMETER	NOTATION	WELL 4
Height of reference point from ground level (m)	(a)	0.034
Groundwater level elevation (m AHD)	-	0.783
Depth of the well bottom from TOC (m)	(b)	8
Top of screen from TOC (m)	(c)	6.5
Bottom of screen from TOC (m)	(b)	8
Length of screen (m)	(d)	1.5
Depth to watertable from TOC (m)	(e)	7.595
Depth to the occurrence of sediment in the well, from TOC (m)	(f)	7.905
Length of stainless steel cable attached to the logger (m)	(g)	7.7
Location of bentonite seal from TOC (m)	-	0.1-0.6

3.5 *Site 5*

Site 5 is located near the foredune and has three wells. When facing the wells from the Beacon 19 Boat Ramp track, Well 5B is on the left, Well 5C on the right, and the centre one, Well 5A, is the shallowest (see Figure 14). An LTC logger is installed in Well 5A. The details of the wells are provided in Table 7 and Figure 16.

Table 7. Details of Wells 5A, 5B and 5C

PARAMETER	NOTATION	WELL 5A	WELL 5B	WELL 5C
Height of reference point from ground level (m)	(a)	0.057	0.029	0.051
Groundwater level elevation (m AHD)	-	~0.668	~0.640	~0.662
Depth of the well bottom from TOC (m)	(b)	3	5.5	9
Top of screen from TOC (m)	(c)	1.5	4	3
Bottom of screen from TOC (m)	(b)	3	5.5	9
Length of screen (m)	(d)	1.5	1.5	6
Depth to watertable from TOC (m)	(e)	~1.44	~1.44	~1.44
Length of stainless steel cable attached to the logger (m)	(g)	~2	~2.5	~2.5
Location of bentonite seal from TOC (m)	-	0.1-1	0.1-1	0.1-0.6

Figure 16. Wells 5A, 5B and 5C, prior to completion of the bore shields, etc. (Photo credit: Guohua Hou taken on 10 October 2025).

3.6 *Site 6*

There is one well at location 6 located in the rear of a blowout, which is a wind-eroded depression, adjacent to the beach. The presence of a beach blowout indicates dune instability and an increased vulnerability to seawater intrusion. The details are provided in Table 8. An LTC logger is installed in Well 6.

Table 8. Details of Well 6

PARAMETER	NOTATION	WELL 6
Height of reference point from ground level (m)	(a)	0.108
Groundwater level elevation (m AHD)	-	0.901
Depth of the well bottom from TOC (m)	(b)	3.5
Top of screen from TOC (m)	(c)	2
Bottom of screen from TOC (m)	(b)	3.5
Length of screen (m)	(d)	1.5
Depth to watertable from TOC (m)	(e)	2.894
Depth to the occurrence of sediment in the well, from TOC (m)	(f)	3.500
Length of stainless steel cable attached to the logger (m)	(g)	3.3
Location of bentonite seal from TOC (m)	-	0.1–0.6

4 Water Level Logger Data

An initial sample of data from Well 1B is shown in Figure 17. This 43-hour (from 2 p.m. on 13/10/2025 to 9 a.m. on 15/10/2025) monitoring record indicates that the logger was operating reliably.

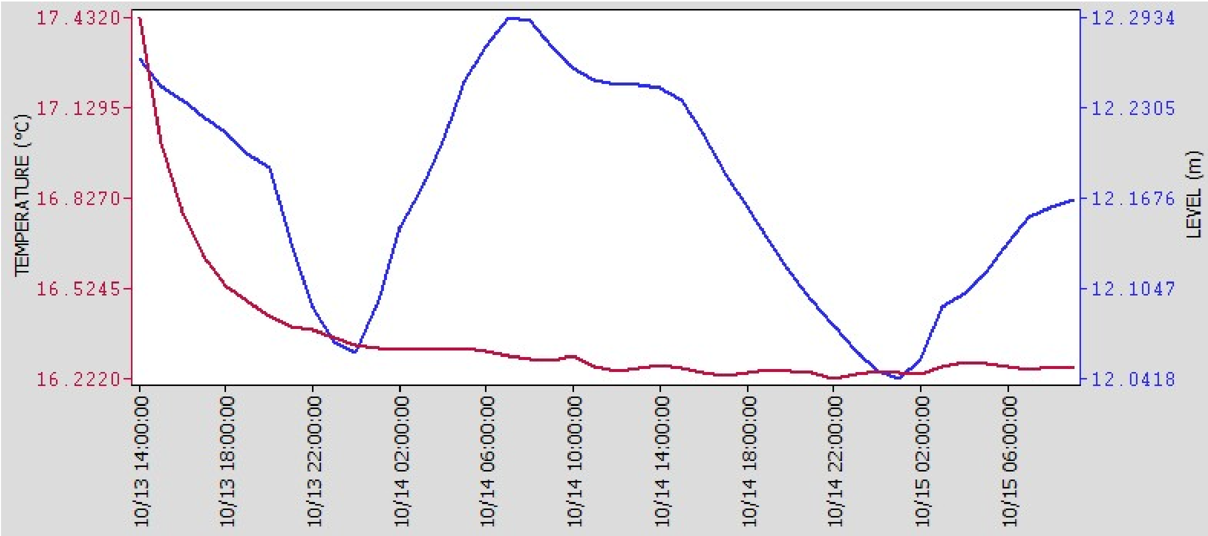


Figure 17. Water level and temperature data at well 1B over the 43-hour monitoring period.

5 Water Quality Data

Wells 1A and 1B were drilled on the final day (13 October 2025). Well 4 was filled with sand, which was flushed out using water from Well 3A, while Well 6 was similarly filled with sand and flushed using seawater. Consequently, YSI multi-probe field meter measurements were not recorded at Sites 1, 4, and 6. Although the sand filling was unanticipated and was flushed out of the well, there remains a risk of a similar occurrence in the future. Water quality measurements for Sites 2, 3, and 5 are presented in Table 9.

Table 9. YSI multi-probe field meter measurements at Sites 2, 3 and 5. These are indicative values only that are likely influenced by the drilling process and may not accurately represent ambient groundwater quality.

WELL	ELECTRICAL CONDUCTIVITY (µS/cm)	TOTAL DISSOLVED SOLIDS (TDS) (g/l)	DISSOLVED OXYGEN (DO) (%)	pH
Well 2	3,507	2.851	18.3	4.79
Well 3A	10,191	8.556	5.5	5.97
Well 3B	3,751	3.076	4.7	7.06
Well 3C	18,516	15.04	4.3	6.89
Well 5A	3,027	2.543	94.4	7.34
Well 5B	35,679	29.38	36.6	7.04
Well 5C	39,253	31.80	17.0	7.15

6 Beach to Deflation Plain Topographic Survey Transect

In order to examine the topographic or elevation differences between the beach and the deflation plain (a flat or gently sloping landform unit produced by wind erosion) and Site 5 on the foredune, a RTK survey was conducted across the beach to foredune and into the deflation plain (Figure 18). The variation in elevation with respect to the distance from the beach is plotted in Figure 19, where the distance from the beach refers to the distance of each measurement point from point 1. The tide was around 0.9 m AHD at the time of starting measurement (3:35 pm on 07 October 2025).

Figure 18. Points 1 to 32 of cross-dune survey measurements.

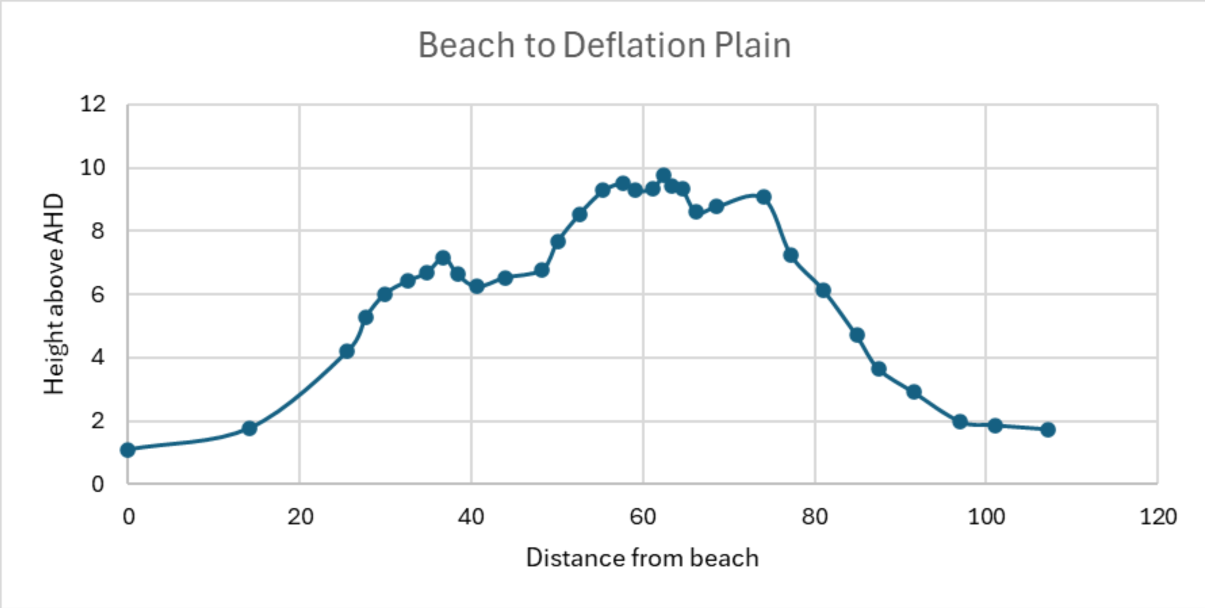


Figure 19. Variation of height of deflation plain. It may be seen that the floor of the deflation plain at approximately 100 m from the beach is roughly at the same level as the top of the backshore at approximately 15 m from the beach.

7 Details of Other Sir Richard (SR) Hand-Augered Holes

Details of the SR hand-augered holes are presented in Table 10. The Easting and Northing coordinates are given in the Map Grid of Australia (MGA) projection, UTM Zone 54S, based on the GDA94 datum. All elevations reported in this document are referenced to the Australian Height Datum (AHD).

Table 10. Details of SR hand-augered holes

LABEL	LOCATION	EASTING (m)	NORTHING (m)	LATITUDE	LONGITUDE	ELEVATION (m AHD)	DEPTH INTERVAL (m)
SR1	Top of the dune, opposite Site 5.	1391732.490	6022702.686	35^{0} 32' 13''S	138^{0} 49' 16''E	8.776	2.5–2.7
SR2	Near Site 5	-	-	-	-	-	2.89–3.14
SR3	In the deflation plain at the seaward edge of the terminal major ridge island, near Site 4.	1391869.036	6022797.483	35^{0} 32' 10''S	138^{0} 49' 21''E	1.594	1.0–1.28
SR4	Mid deflation plain, closer to beach	1391807.650	6022753.313	35^{0} 32' 12''S	138^{0} 49' 19''E	1.492	0.86–1.11
SR5	NW ridge opposite Site 3	1392016.957	6022964.459	35^{0} 32' 04''S	138^{0} 49' 26''E	6.527	2.8–3.0
SR6	Next higher ridge NW of SR5, opposite Site 3	1391996.853	6023006.144	35^{0} 32' 03''S	138^{0} 49' 25''E	9.534	1.8–2.0
SR7	Next higher ridge NW of SR5, opposite Site 3	1391996.853	6023006.144	35^{0} 32' 03''S	138^{0} 49' 25''E	9.534	4.0–4.2
SR8	Near Site 2	-	-	-	-	-	7–9
SR9	Side at base of old foredune next to Site 6	1391819.943	6022613.104	35^{0} 32' 16''S	138^{0} 49' 20''E	3.987	0–0.22
SR10	Near car park	1392178.785	6023200.475	35^{0} 31' 56''S	138^{0} 49' 32''E	1.312	1.0–1.20

8 Lithology

The lithological data at the various well locations is tabulated in Table 11.

Table 11. Lithology or descriptions at other locations (additional investigations)

LOCATION	LITHOLOGY/DESCRIPTION
Site 1	
Well 1A	Grey fine to medium sand from 0-1.8 m which is moist from 0.5 m.
Well 1B	Grey fine to medium sand from 0-6 m which is moist from 0.5 m.
Site 2	
Well 2	0-4 m: yellow brown fine to medium dry sand, 4-8 m: moist grey sand, 8-9.6m: moist grey sand, with low liquid limit fines.
Site 3	0-23 cm dark gray sandy 23 - 30 cm dark yellow brown sand 30 - 92 cm yellow brown sand 92 - 102 cm light gray fine sand 102 - 109 cm iron-stained layer 109 - 120 cm medium gray sand with black root fragments 120 - 141 cm dark gray fine sand 141 - 154 cm diffuse black boundary 154 -190 cm medium gray fine sand (500 mm loss; total depth 2.4 m) Bottom of Site consists of coarse sand with shell fragments and whole shells, possibly echinoderms or nerites (periwinkles), and surface pebbles. 9.0 m depth – shells 8.0 m depth – mud balls and small shells (possibly estuarine)
Well 3A	0-1 m: grey/brown, fine and moist sand, 1-2.7 m: grey, fine to coarse, and moist sand.
Well 3B	0-1 m: grey/brown, fine and moist sand, 1-4 m: grey, fine to coarse, moist sand, 4-5.3 m: grey, moist, fine to coarse sand with shell inclusions.
Well 3C	0-1 m: grey/brown, fine and moist sand, 1-4 m: grey, fine to coarse, moist sand, 4-9 m: grey, moist, fine to coarse sand with shell inclusions.
Site 4	
Well 4	0-6 m: yellow brown fine to medium sand, 6-8 m: grey and moist fine to medium sand.
Site 5	
Well 5A	0-1 m: yellow brown and dry fine to medium sand, 1-3 m: grey and moist fine to medium sand.
Well 5B	0-1 m: yellow brown and dry fine to medium sand, 1-5 m: grey and moist fine to medium sand, 5-5.5 m: grey and moist fine to medium sand with shell inclusions.
Well 5C	0-1 m: yellow brown and dry fine to medium sand, 1-5 m: grey and moist fine to medium sand, 5-9 m: grey and moist fine to medium sand with shell inclusions.
Site 6	

Well 6	0-2 m: yellow brown and dry fine sand, 2-3.5 m: grey, fine and moist sand.
SR Hand-Augered Holes	
SR3	Minor shell fragments in yellowish brown sand
SR8	Medium to coarse shelly sand (9–8 m). Shell samples collected from various horizons.

9 Conclusions

The first phase of field investigations for establishing a long-term groundwater and environmental monitoring network across the Sir Richard Peninsula is documented in this report as part of the project "Coastal beach-dune dynamics and management under future climate change." The primary objectives, including the drilling and construction of monitoring wells, installation of loggers, collection of core samples, and surveying of the well sites, were successfully completed.

A total of 11 monitoring wells were installed across six sites. The wells were constructed to varying depths by employing the Push Tube DT325 and Hollow Auger (200 mm) drilling techniques. In addition, 10 hand-augered boreholes (SR1–SR10) were drilled for lithological observations. All wells were precisely surveyed.

From groundwater observations, a shallow watertable (< 2 m) was identified in low-lying and seaward areas, while deeper levels (> 7 m) were recorded beneath the dune crests at Sites 2 and 4. Preliminary water quality data were observed to indicate increasing salinity with depth and spatial variability across the peninsula, consistent with the influence of seawater intrusion near the foredune. The sediment profile was observed to consist of yellow-brown dry sands overlying grey, moist, fine to medium sands, with shell fragments observed at greater depths at Sites 3 and 5.

Future work is planned to involve regular data retrieval from the installed loggers and periodic water quality monitoring at six-month intervals, detailed sediment analysis and OSL dating of sediments in the cores for further interpretation of the geology, stratigraphy, hydrogeological dynamics and assessment of temporal variations in groundwater levels and quality.

10 References

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