

URI 986-14

1986/14. Groundwater investigations at Richardsons Beach, Coles Bay

D.J. Sloane

Abstract

A sequence of Quaternary aeolian, marine and backswamp deposits up to ten metres thick has been deposited in a structurally-controlled granite trough near Richardsons Beach, Coles Bay. The upper marine sand is an unconfined aquifer which can provide a small source of moderately saline groundwater. A suitable location, adjacent to an electricity supply and which can be readily connected to the existing water supply, has been pump tested and the groundwater analysed. The groundwater is suitable for the Freycinet National Park toilet facilities and could be used as a supplementary supply during periods of drought.

INTRODUCTION

At the request of the National Parks and Wildlife Service, investigations were conducted at Richardsons Beach, Coles Bay [EP075350], into the possibility of obtaining a supplementary water supply from groundwater. The present Coles Bay water supply reaches critical levels during periods of drought and the influx of visitors to the Freycinet National Park places heavy demands on the supply, for both drinking and toilet facilities, during the summer months. The Richardsons Beach area was selected as having the best potential for such a groundwater supply, on the basis of its geomorphology. This area is also a major camping site.

GEOMORPHOLOGY

Richardsons Beach is approximately one kilometre in length and extends in an approximate north-south direction between the Coles Bay township and the Chateau, at the foot of The Hazards. A single frontal dune approximately five metres in height backs the beach and extends almost along its entire length. A gently sloping swampy terrace backs the frontal dune and extends up to one kilometre inland at its furthest point. The terrace is approximately triangular in shape with an area of about 0.6 km² and an altitude of approximately one to two metres above high water mark. Ranger Creek drains the granite hills adjacent to Cape Tourville to the east and flows along the northern edge of the terrace, breaching the frontal dune towards the northern end of Richardsons Beach. The terrace may be subdivided into two ill-defined levels with an altitude difference of about 0.5 to one metre. The lower level is a floodplain of Ranger Creek to the north while the higher level to the south is probably of marine origin. The area is surrounded by steep granite hills to the north, east and south.

GENERAL GEOLOGY

Quaternary aeolian, marine and backswamp sandy sediments underlie the coastal terrace inland from Richardsons Beach. Red adamellite is the predominant granitic rock which crops out on the hills surrounding the coastal terrace. The geology of the granites is complex and compositional variations are related to hydrothermal alteration. Acid dykes have intruded the granite in a pattern which is largely structurally controlled. The structure of the area is controlled by cross-faulting which may have produced graben-type features. The bedrock trough described below may be related to the faulting of the region.

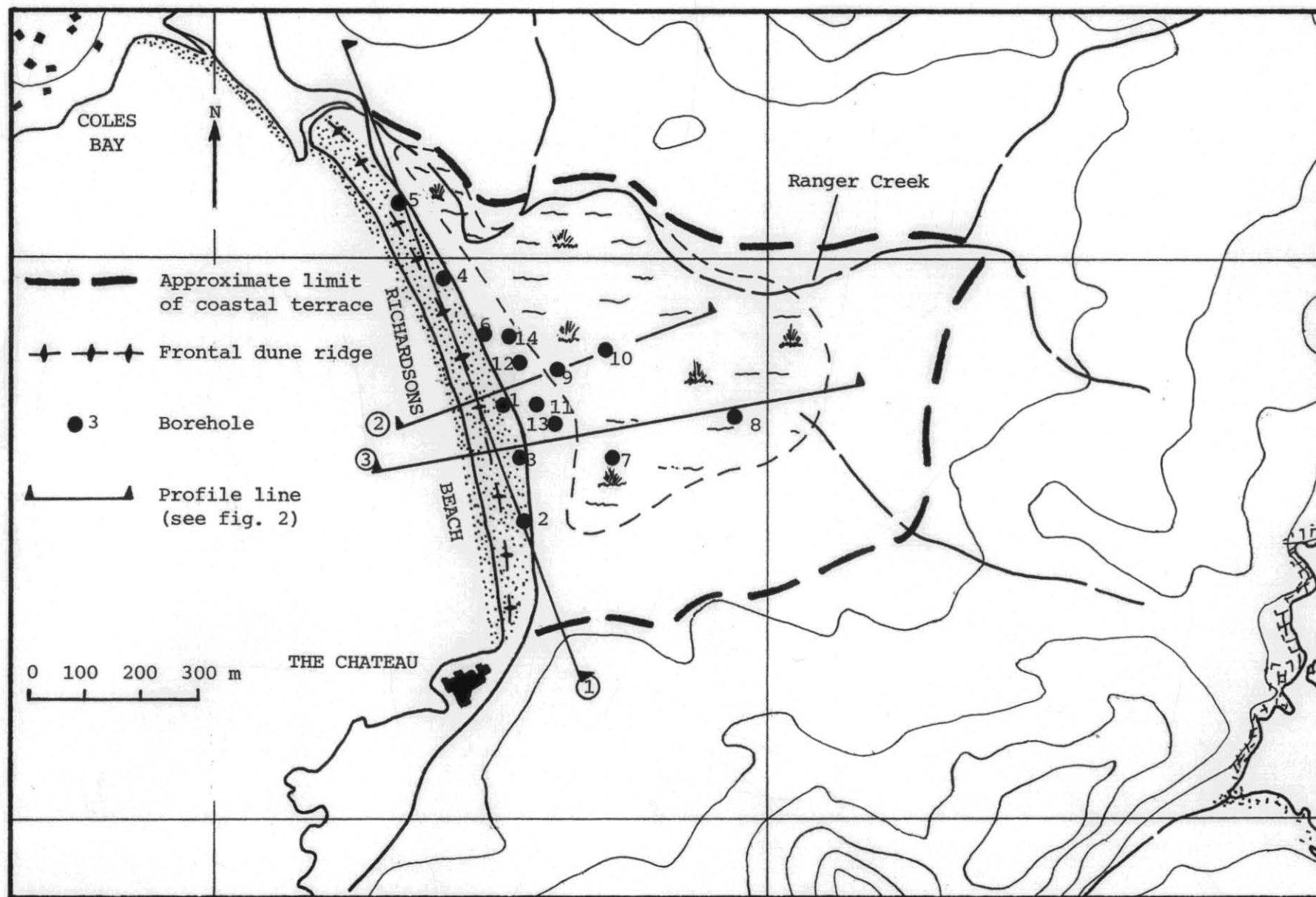


Figure 1. Location of boreholes, Richardsons Beach

5 cm

RESULTS OF AUGER DRILLING

Fourteen augered boreholes were drilled in the terrace area at the rear of Richardsons Beach. The holes were drilled with a Triefus trailer-mounted drill and extended to depths of ten metres from the ground surface. The borehole logs are presented in Appendix 1 and the location of drill holes is shown on Figure 1.

The terrace area is underlain by a relatively complex sequence of Quaternary sediments, with large variations in clay and gravel content. A simplified stratigraphy is shown on Figure 2, where three profiles have been plotted. These profiles show a veneer of aeolian sand approximately one metre thick, overlying a clean, shelly, medium-grained marine sand unit. The marine sand is up to 3.8 m in thickness in the area of the borehole 1 to 10 profile line (Line 2).

Beneath the clean marine sand unit the sediments become variable in composition with a clay component that generally increases inland. The clayey sand is finer in grain size than the overlying marine sand and often grades or interdigitates with more gravelly sediments. The gravel particles have been directly derived from the surrounding granite hills and the particle angularity indicates a short distance of transport. Lenses of fine grey sand are also apparent. These lower, clayey sedimentary units also have layers or lenses of organic-rich clay and clayey sand and occasional shell-rich lenses. The lower sediments are considered to have been deposited in a backswamp environment with periodic influxes of fine and coarser sediment, depending on the depositional energy of runoff and streams from the surrounding granite hills.

The granite basement is in the form of a trough, trending in a north-west direction. The trend of this basement trough shows as an apparent granite bar beneath the fore dunes in the two profile lines, approximately perpendicular to Richardsons Beach and shown on Figures 1 and 2. The basement trough is probably controlled by faulting of the granitic rocks.

HYDROLOGY

The Quaternary sediments all contain groundwater as an unconfined aquifer. The aquifer units with the best potential for providing groundwater which can be easily extracted by spear bores are considered to be the coarser marine sands with very low or nil clay content. These sands tend to be thickest at the rear of the fore dune.

Nine of the auger holes were selected for pump testing. A 50 mm diameter, 0.6 m long stainless steel well screen was jetted into each of the selected auger holes. Number 10 or 15 screens were selected on the basis of the grain size of the potential aquifer. The pump tests were abandoned if the spears produced low yields or if the conductivity of the groundwater indicated a high salinity. Augered boreholes 1, 11 and 12 were each pump tested for a period of two hours and water samples were taken after 90 minutes from the start of pumping. The results of the pump testing have been summarised in Table 1.

As expected, the low yielding spears were located in the finer grained sediments and therefore yields generally decreased inland. Groundwater salinities varied from 1490 to 2620 ppm for total dissolved solids analysed from the laboratory samples. The major chemical component of the groundwater is sodium chloride. Salinities increased towards Ranger Creek and a field test indicated that water in the small lagoon at the mouth of

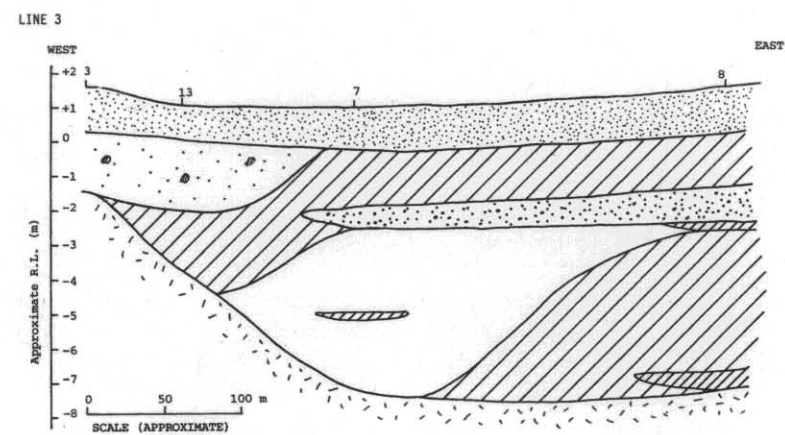
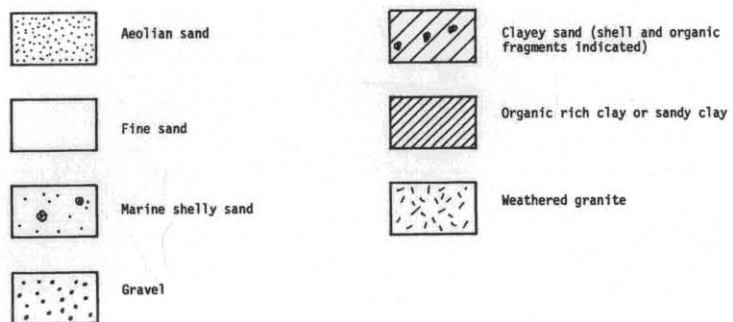
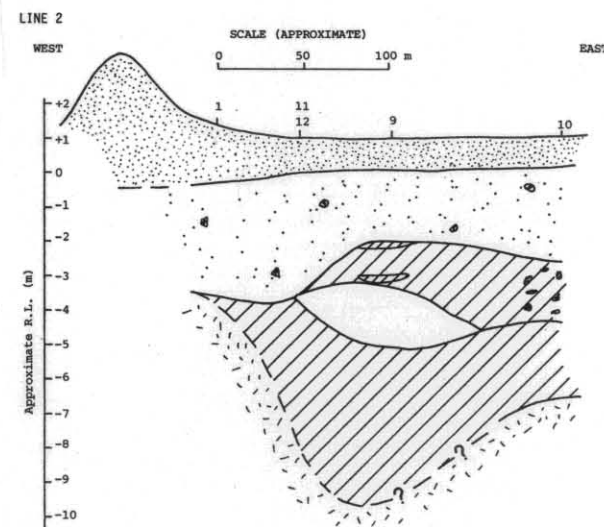
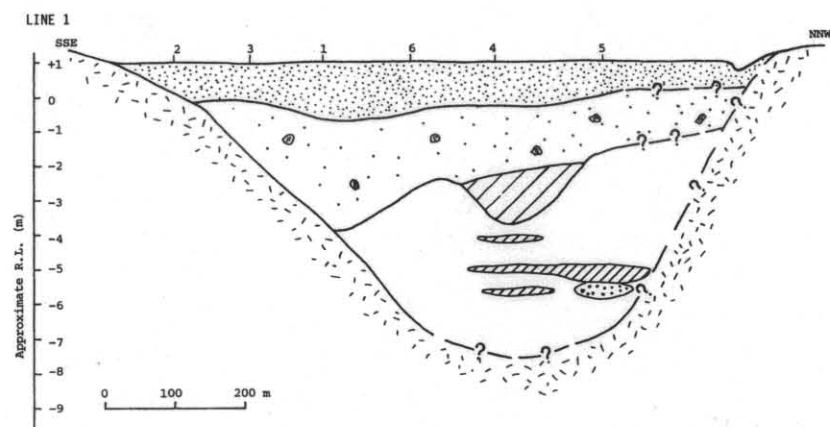


Figure 2. Diagrammatic sedimentary profiles at Richardsons Beach

5 cm

Table 1. SUMMARISED RESULTS OF PUMP TESTING

Hole	Screen Interval (m)	Pump Rate (l/min)	Standing Water Level (m)	Field Conductivity (μ S/cm)	Analysed TDS
1	4.4 - 5.0	16	1.3	2400	1740
4	2.6 - 3.2	8	1.8	5000	
5	4.4 - 5.0	8	1.5	4600	2620
6	4.4 - 5.0	7.5	2.0	2500	1530
7	3.0 - 3.6	<2	1.3	2100	
8	2.2 - 2.8	<2	1.0	2100	
9	4.4 - 5.0	5.2	1.0	3200	
11	3.4 - 4.0	10.4	1.25	3000	1880
12	4.4 - 5.0	10.4	1.25	2500	1420
14	4.4 - 5.0	7.2	1.3	2600	1490

this creek had an approximate salinity of 10 000 ppm. The sand bar at the mouth of Ranger Creek is periodically breached during high tides and south-westerly storm conditions. Saline water is therefore trapped in the lagoon and undoubtedly increases the salinity of the groundwater adjacent to the creek. An improvement in groundwater quality could be made by constructing a small weir at the mouth of Ranger Creek in order to prevent saltwater influx.

As augering and pump testing proceeded it became apparent that the groundwater was unsuitable for human consumption. The investigations were altered in order to determine a suitable aquifer and location to provide water suitable for toilet facilities. In view of the borehole information previously determined, bores 11 and 12 were drilled adjacent to the electricity transmission lines which traverse the terrace. Both the aquifer thickness and water quality were considered suitable in this area, but two boreholes were considered necessary in order to provide a sufficient quantity of groundwater.

Boreholes 11 and 12 are considered to have a potential for providing 21 l/min (280 gallons per hour) of groundwater with an average salinity of 1650 ppm. They are immediately adjacent to the electricity supply, are centrally located, and can be readily connected to the pipelines which supply the toilet facilities.

CONCLUSION

Quaternary sediments underlie a 0.6 km² low lying terrace, inland from Richardsons Beach, Coles Bay. Approximately one metre of aeolian sand overlies up to 3.8 m of marine shelly sand. Below the marine sand are up to seven metres of clayey sand and fine sand which contains organic clay and sandy clay layers and lenses and some gravel. The sediments have been deposited in a structurally controlled trough in the underlying granite, trending approximately in a north-west direction.

The sediments are an unconfined aquifer which contains small quantities of moderately saline groundwater. The groundwater analysed varies in salinity from 1420 ppm to 2620 ppm and is likely to be even more saline in the vicinity of Ranger Creek. Pump testing of shallow spear bores yielded up to 16 litres/minute of groundwater. The groundwater is unsuitable for human consumption but may be used for toilet facilities.

A suitable supply of groundwater was located towards the centre of the beach and immediately adjacent to the electricity supply inland from the major fore dune. The combined yield of two spears was tested at 21 l/min (280 gallons/hour) of groundwater with an average salinity of 1650 ppm. This supply can be easily connected to existing water supply lines which service the toilets and can therefore be used as a supplementary system during periods of drought.

[8 January 1986]

APPENDIX 1

Logs of augered boreholes

ENGINEERING LOG - BOREHOLE

borehole no.

RB1

sheet 1 of 1

7/21

project FREYCINET GROUNDWATER				location RICHARDSONS BEACH			
co-ordinates				drill type TRIFFUS		hole commenced	
R.L.				drill method AUGER		hole completed	
inclination 90°				drill fluid		drilled by DC	
bearing						logged by DJS	
						checked by	

penetration 1 2 3	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency	density index	hand penetr- ometer kPa 25 100 200 400	structure, geology
				0			<u>SAND</u> . Yellow brown. Medium - coarse. Quartz. Well rounded particles to 4mm dia. Poorly sorted.	D				AEDLIAN SAND
				1				M				
				2			<u>SAND</u> . Dull yellow brown. Medium-fine Approx 10% shell fragments and quartz particles to 2mm dia.	W				--?--?-- MARINE SAND
				3								
				4								
			16 l/min 1200ppm (meter)	5		CL	<u>SANDY & GRAVELLY CLAY</u> . Yellow brown - grey brown. Medium - fine sand and gravel to 50%.					WEATHERED GRANITE?
				6								

5 cm

ENGINEERING LOG – BOREHOLE





borehole no.


RB2

sheet 1 of 1

8/21

project		FREYCINET		GROUNDWATER		location		RICHARDSONS BEACH	
co-ordinates				drill type		TRIEFUS		hole commenced	
R.L.				drill method		AUGER		hole completed	
inclination 90°				drill fluid				drilled by BC	
bearing								logged by DJS	
								checked by	

penetration 1 2 3	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
				0		SW	SAND. Grey brown. Fine quartz sand. well sorted				AEOLIAN SAND
				1							
				2		GC	GRAVELLY CLAY. Yellow brown-grey brown 30% gravel - angular quartz and feldspar particles				WEATHERED GRANITE
				3							



ENGINEERING LOG – BOREHOLE

borehole no.

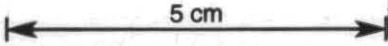
RB3

sheet 1 of 1

9/21

project		FREYCINET GROUNDWATER		location		RICHARDSONS BEACH	
co-ordinates		drill type		TRIEFUS		hole commenced	
R.L.		drill method		AUGER		hole completed	
inclination 90°		drill fluid				drilled by GC	
bearing						logged by DJS	
						checked by	

penetration 1 2 3	support water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			0		SW	<u>SAND</u> . Yellow brown. Medium-fine quartz sand. Well sorted				
			1							
			2			<u>SAND</u> . Yellow brown. Medium quartz sand. Approx 10% shell and frags.				
			3		GC	<u>GRAVELLY CLAY</u> . Yellow brown-grey brown. 40% angular quartz and feldspar particles to 5mm dia.				WEATHERED GRANITE
			4							
			5							



5 cm

$10/2$

project		FREYCINET GROUNDWATER		location		RICHARDSONS BEACH						
co-ordinates				drill type		TRIEFUS						
R.L.				drill method		AUGER						
inclination		90°		drill fluid								
bearing						hole commenced hole completed drilled by DC logged by DTS checked by						
penetration	support	water	notes	metres	log	classification	material	moisture	consistency	density index	hand penetrometer kPa	structure, geology
1 2 3				R.L. depth	graphic log	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.				25 50 100 200 400	
				0		SW-SP	<u>SAND</u> Fine - coarse granule sand. Grey. Quartz particles to 4 mm. Poorly sorted.					Aeolian SAND.
				1								
				2		SW	<u>SAND</u> . Medium - fine quartz sand. Olive grey. Approx 15% shell frags.					MARINE SAND.
			5000ppm (motor)									
			52/min									
				3								
				4	/ /	SC	<u>CLAYEY SAND</u> . Olive grey. Fine sand with approx 30% clay. Grey brown organic? clay layers.					
				5		SC	<u>SAND</u> Fine grained. 10% clay. Some clay layers. Some organic seaweed? particles					
				6								
				7		SW	<u>SAND</u> . Yellow brown fine sand.					
				8								
				9								

ENGINEERING LOG - BOREHOLE

borehole no.

RB5

sheet 1 of 1

11/21

project FREYCINET GROUNDWATER				location RICHARDSONS BEACH							
co-ordinates				drill type TRIEFUS		hole commenced					
R.L.				drill method AUGER		hole completed					
inclination 90°				drill fluid		drilled by RL					
bearing						logged by DSJ					
						checked by					
penetration	support	water	notes samples, tests	metres R.L. depth	log graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
1 2 3				0		SW	SAND. Dull yellow orange				Aeolian SAND
				1		SP	SAND. Medium - coarse quartz sand Some fine gravel.				MARINE SAND
				2							
				3		SW	SAND. Medium - fine quartz sand. Olive-grey.				
				4							
			6,000ppm (nickel) 8L/min	5							
				6							
				7		SW	CLAY: Moderate plasticity. Grey. Organic rich. Some shell fragments GRAVEL. Medium - fine quartz gravel. Approx 10% shell fragments.				
				8		CH	SAND. Olive. fine quartz sand. GRAVELLY CLAY. Grey. Approx 30% medium - coarse angular quartz gravel.				WEATHERED GRAVITE?
				9							

ENGINEERING LOG - BOREHOLE

borehole no.

RB6

sheet 1 of 1

12/21

project FREYNET GROUNDWATER				location RICHARDSONS BEACH			
co-ordinates				drill type TREFUS		hole commenced	
R.L.				drill method AUGER		hole completed	
inclination 90°				drill fluid		drilled by BC	
bearing						logged by DJS	
						checked by	

penetration 1 2 3	support water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			0			<u>SAND</u> . Fine-medium quartz sand. well sorted. Light grey-dull yellow orange.	D			AEOLIAN SAND
			1		SW					
			2				M			---?--- MARINE SAND
			3		SP	<u>SAND</u> . Medium-coarse. Some fine-medium gravel. Olive brown. Poorly sorted	W			
			4		SW	<u>SAND</u> Medium-fine grained. Trace clay. Light grey-fawn. Well sorted				
		2,500 ppm 10 SEAGEN 7.52/min	5							
			6							
			7							
			8		GC	<u>CLAYEY GRAVEL</u> . Grey-yellow brown. medium gravel-angular quartz particles.				--- WEATHERED GRANITE
			9							

ENGINEERING LOG - BOREHOLE

borehole no.

R87

sheet 1 of 1

13/21

project FREYCINET GROUNDWATER				location RICHARDSONS BEACH							
co-ordinates				drill type TRIEFUS		hole commenced					
R.L.				drill method AUGER		hole completed					
inclination 90°				drill fluid		drilled by BC					
bearing						logged by DJS					
						checked by					
penetration	support	water	notes samples, tests	metres R.L. depth	log graphic	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetrometer kPa	structure, geology
1 2 3				0		SW	<u>SAND</u> . Yellow brown. Medium-fine quartz sand. Some shell particles	D			MARINE SAND
			21,000ppm	1				M			
				2		SC	<u>CLAYEY SAND</u> . Grey brown. Medium-fine sand. Some shell fragments. Approx 30% clay. Some organic clay lenses or layers.	W			
			42L/min 800ppm (metre)	3		GP	<u>SANDY GRAVEL</u> . Medium gravel. Angular particles. Yellow brown. 30% medium sand				
			15 SCREEN	4		SC	<u>SAND</u> . Fine. Light grey. Qtz. sand Trace clay.				
				5							
				6			<u>CLAY</u> - Plastic, grey. Organic fragments.				
				7							
				8							
				9		GC	<u>CLAYEY GRAVEL</u> . Grey. Medium-coarse gravel. Angular particles. Approx 30% clay.				WEATHERED GRANITE?
							<u>GRANITE</u> .				GRANITE BEDROCK

5 cm

14/21

project		FREYCINET		GROUNDWATER		location		RICHARDSONS BEACH			
co-ordinates						drill type		TRIEFUS		hole commenced	
R.L.						drill method		AUER		hole completed	
inclination 90°						drill fluid				drilled by BC	
bearing										logged by DJS	
										checked by	
penetration	support	water	notes samples, tests	metres depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa	structure, geology
1 2 3				0	/ / / /	SW	SAND. Medium-fine. Yellow brown. Quartz sand	D			AEOLIAN SAND?
				1	/ / / /	SC	CLAYEY SAND. Yellow brown. Quartz sand - medium grained. Some shell. Approx 20% clay.	M			MARINE & ALLUVIAL DEPOSITS
				2	/ / / /	SW	GRAVELLY SAND. Medium-coarse sand. Some medium gravel. Grey. Angular particles.	W			
				3	/ / / /		CLAYEY SAND. Grey. Medium quartz sand. Approx 25% clay. Some medium gravel-angular fragments to 4mm diameter. Variations in clay and gravel content. Organic clay layer at 3.8m				
				4	/ / / /	SC					
				5	/ / / /						
				6	/ / / /						
				7	/ / / /						
				8	/ / / /	OL	SANDY CLAY. Dark brown. Organic rich. Approx 30% medium sand				
				9	/ / / /	GC	CLAYEY GRAVEL. Yellow brown-grey. Approx 40% clay. Angular medium gravel - ang				WEATHERED GRANITE
				10	/ / / /		GRANITE				GRANITE BEDROCK

ENGINEERING LOG - BOREHOLE

borehole no.

RB9

sheet 1 of 1

15/21

project FRETCHET GROUNDWATER				location RICHARDSONS BEACH							
co-ordinates				drill type TRIEFUS		hole commenced					
R.L.				drill method AUGER		hole completed					
inclination 90°				drill fluid		drilled by DC					
bearing						logged by DSS					
						checked by					
penetration	support	water	notes	metres	log	classification	material	moisture	consistency	hand	structure, geology
123				R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	penetr-ometer kPa	
				0		SW	<u>SAND</u> . Fine-medium quartz sand. Grey brown.	D			AECIAN SAND?
				1				M			
				2		SP	<u>GRAVELLY SAND</u> . Medium quartz sand. Grey. Fine-medium gravel approx 30%. Trace pebbles to 1 cm diameter.	W			MARINE SAND
				3							
				4			<u>CLAYEY SAND</u> . Yellow brown-grey brown. Medium-fine sand. Approx 20% clay. Some ^{organic} clay layers or lenses.				ALLUVIAL & MARINE DEPOSITS?
				5			<u>SAND</u> . Light grey. Fine-medium quartz sand. Trace clay.				
				6							
				7			<u>CLAYEY AND GRAVELLY SAND</u> . Yellow brown-light grey. Medium sand. Approx 25% medium gravel-angular particles. Approx 20% clay.				
				8							
				9							
				10							

5.24/min
3,200ppm
(meter)

10 S.A.G.E.R.

5 cm

ENGINEERING LOG – BOREHOLE

 borehole no.
RB10
 sheet 1 of 1

16/21

project		FREYQUET		GROUNDWATER		location		RICHARDSONS BEACH				
co-ordinates				drill type		TRIEMPUS		hole commenced				
R.L.				drill method		AUGER		hole completed				
inclination 90°				drill fluid				drilled by BC				
bearing								logged by DJS				
								checked by				
penetration	support	water	notes	metres	metres	log	classification	material	moisture	consistency	hand	structure, geology
1 2 3			samples, tests	R.L.	depth	graphic log	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	density index	penetr-ometer kPa	
					0	////	SW	<u>SAND</u> . Fine-medium quartz sand. Yellow brown.				Aeolian sand
					1	●		<u>SAND</u> . Medium-coarse. Qtz. sand. Approx 10% coarse sand and shell. Light grey.				MARINE SANDS
					2	●	SW					
					3	●						
					4	●	SC	<u>CLAYEY SAND</u> . Olive grey. Medium quartz sand. Approx 25% clay. Approx 10% whole shell and fragments. - bivalves + gastropods. Some wood fragments.				
					5	●						
					6	●	SC	<u>CLAYEY SAND</u> . Fine quartz sand. Olive grey. Very minor amount shell fragments. Trace fine gravel. Approx 15% clay.				
					7	●						
					8	●		GRANITE BEDROCK				BEDROCK

ENGINEERING LOG - BOREHOLE

borehole no.

RB 11

sheet

of

17/21

project FREYCINET GROUNDWATER				location RICHARDSONS BEACH								
co-ordinates				drill type TRIEPU		hole commenced						
R.L.				drill method ANGER		hole completed						
inclination 90°				drill fluid		drilled by BC						
bearing						logged by DJS.						
						checked by						
penetration	support	water	notes	metres	graphic log	classification	material	moisture	consistency	density	hand	structure, geology
1 2 3			samples, tests	R.L.	depth	symbol	soil type: plasticity or particle characteristics, colour, secondary and minor components.	condition	index		penetr-ometer kPa	
											25 50 100 200 400	
				0	///		<u>SAND</u> . Yellow brown. Medium-fine quartz sand.					AEOLIAN SAND?
				1	///							
				2	///		<u>SAND</u> . Medium-coarse. Dull yellow brown. True fine-medium gravel well rounded particles.					MARINE SAND
				3	///	SW	<u>SAND</u> . Medium quartz sand. Yellow brown-grey. Approx 10% shell fragments.					
			10.4 cf/m 1500ppm (meter)	4	///							
				5	///	CL	<u>GRAVELLY CLAY</u> . Grey. Moderate plasticity. Approx 25% medium-fine gravel - angular quartz and feldspar?					WEATHERED GRANITE?

ENGINEERING LOG - BOREHOLE

borehole no.

RB12

sheet 1 of 1

18/21

project FREYCINET GROUNDWATER				location RICHARDSONS BEACH							
co-ordinates				drill type TRIEFUS		hole commenced					
R.L.				drill method AUGER		hole completed					
inclination 90°				drill fluid		drilled by BC					
bearing						logged by DJS					
						checked by					
penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa 25 100 200 400	structure, geology
123				0		SW	<u>SAND</u> . Yellow brown. Fine-medium quartz sand.				Aeolian SAND
				1		SP	<u>SAND</u> . Dull yellow brown. Medium-coarse quartz sand. Some fine gravel				MARINE SAND
				2							
				3		SW	<u>SAND</u> . Yellow brown-grey. Medium quartz sand. Approx 10% shell fragments.				
				4							
			10.4 (1/2 in) 1,500 ppm (water)	5							
				6		CL	<u>SANDY CLAY</u> . Yellow brown-grey brown. Approx 25% medium quartz sand.				
				7							

5 cm

ENGINEERING LOG - BOREHOLE

borehole no.

RB13

sheet 1 of 1

19/21

project FREYCINET GROUNDWATER				location RICHARDSONS BEACH							
co-ordinates				drill type TRIEFUS		hole commenced					
R.L.				drill method AUGER		hole completed					
inclination 90°				drill fluid		drilled by DC					
bearing						logged by DJS					
						checked by					
penetration	support	water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
1 2 3				0				D			AEOLIAN SAND
				1	SW		SAND. Dull yellowish brown. Medium quartz sand. Some coarse sand and fine gravel - to 5mm diameter.	M			-? -?
				2				W			MARINE SAND
				3							
				4	SC		CLAYEY SAND. Grey-yellow brown. Medium sand. Trace shell fragments. Approx 10%-20% clay.				
				5			GRAVELLY CLAY. Light grey. Mod. plasticity clay.				WEATHERED GRANITE.
				6							
				7							
				8							
				9							
				10							

ENGINEERING LOG – BOREHOLE

borehole no.

RB 14

sheet 1 of 1

20/21

project FREYCINET GROUNDWATER				location RICHARDSONS BEACH			
co-ordinates				drill type TRIEFUS		hole commenced	
R.L.				drill method AUGER		hole completed	
inclination 90°				drill fluid		drilled by BL	
bearing						logged by DJJ	
						checked by	

penetration 1 2 3	support water	notes samples, tests	metres R.L. depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency density index	hand penetr- ometer kPa 25 50 100 200 400	structure, geology
			0		SW	<u>SAND</u> . Dull yellowish brown. Medium-fine quartz sand. Well sorted	D			
			1				M			
			2			<u>SAND</u> . Greyish yellow brown. Medium-fine quartz sand.	W			
			3							
			4		SW	<u>SAND</u> . Light grey, fine-medium quartz sand.				
			5							
		7.2 l/min 1,500 ppm (meter)	6							
		DRILL FAILED	7							

5 cm

APPENDIX 2

Chemical analyses of groundwater samples

	RB1	RB5	RB6	RB11	RB14	RB12
pH	6.4	7.0	6.3	6.6	6.3	6.7
Conductivity ($\mu\text{S}/\text{cm}$)	2600	4300	2300	2900	2300	2200
<i>Item (mg/l)</i>						
CO_3	Nil	Nil	Nil	Nil	Nil	Nil
HCO_3	230	220	170	290	170	320
Cl	740	1230	640	890	640	590
SO_4	54	190	59	14	55	47
SiO_2	4.7	8.5	7.0	4.1	7.1	4.8
Ca	46	45	35	27	35	46
Mg	55	87	52	50	52	47
Fe	6.5	0.3	5.7	1.0	6.1	0.6
Al	<0.2	0.5	1.0	<0.2	1.0	<0.2
K	29	32	17	37	17	25
Na	440	740	360	550	360	380
TDS	1740	2620	1530	1880	1490	1420
Hardness (Permanent)	165	290	175	240	180	49
(Temporary)	190	185	140	35	140	260
Alkalinity as CaCO_3	190	185	140	240	140	260