



# Groundwater investigations at Freycinet Peninsula

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## Abstract

Groundwater investigations were conducted at seven camping sites on the Freycinet Peninsula and Schouten Island. The sediments encountered during the investigation were variable in composition and had a high clay component, derived from the weathered granite. The general lack of a sufficient thickness of clean sand and the presence of weathered granite bedrock at shallow depth resulted in generally unfavourable conditions for producing groundwater from shallow spears.

Successful spear bores were installed at two of the camp sites investigated, at Bryans Beach and South Wineglass Beach. The groundwater obtained from these spears is considered suitable for human consumption.

## INTRODUCTION

At the request of the Department of Lands, Parks and Wildlife, groundwater investigations were conducted at various localities on the Freycinet Peninsula and Schouten Island.

Camping sites at Wineglass Bay, Bryans Beach, Cooks Beach and Hazards Beach on the Freycinet Peninsula, and at Crocketts Bay on Schouten Island, all suffer from a shortage of fresh water during dry summers. Most of the sites are located adjacent to small ephemeral streams.

Hand-augered holes were drilled at each site and spear bores installed at suitable locations. Previous investigations at Richardsons Beach, near Coles Bay (Sloane, 1986), indicated that small but useful quantities of suitable quality groundwater may be extracted from coastal sites where suitable thicknesses of clean marine sand occur. The distribution of these sands in the Freycinet Peninsula area is variable, as most of the Quaternary coastal sediments contain a high proportion of clayey sediment, derived from weathered granite.

## GEOLOGY

The dominant rock type of the Freycinet Peninsula is a porphyritic adamellite. Small embayments in the granite coastline have been filled with clayey sand and gravel derived from weathered granite. Variable thicknesses of marine sands overlie and interdigitate with the clayey sediments. The sediments were probably deposited during the Quaternary period, and the marine sands were probably deposited during the Holocene as the sea level rose to its present level from the last interglacial minimum.

A veneer of windblown sand of variable thickness overlies the sediments. The windblown sands are usually in the form of frontal dune ridges at the rear of beaches, with sand sheets extending inland.

Most of the beaches are of the bay-head type, and appear to be aligned with a dominant south-westerly swell direction. The Wineglass Beach and Hazards Beach isthmus is a tombolo feature linking two major granite outcrops. The isthmus also has low hills of weathered granite which are distinct from the bare granite outcrops forming The Hazards and Mt Freycinet–Mt Graham.

## GROUNDWATER INVESTIGATIONS

Hand-augered holes were drilled at the seven sites shown on the locality map (fig. 1). Test spear bores were installed at locations where a suitable thickness of saturated clean sand was encountered. The spear bores which were installed and pump tested consisted of 50 mm diameter, number 10 stainless steel screens, 600 mm in length. The results of each investigation hole are summarised below.

### 1. North Wineglass

#### (a) Camp site terrace—adjacent to creek

0.0–0.6 m	aeolian sand
0.6 m	clayey gravel, EW (extremely weathered) granite

#### (b) Adjacent to dry lagoon

0.0–0.4 m	aeolian sand
0.4–1.2 m	organic peaty clay
1.2–2.1 m	fine sand
2.1–2.3 m	clayey gravel (EW granite)

Groundwater field conductivity 1000  $\mu\text{S}$ =700 ppm TDS (total dissolved solids). Standing water level (SWL)=1.2 m.

**SUMMARY:** Insufficient thickness of clean marine sand of suitable permeability. Not suitable for spear bore installation but suitable for a well.

### 2. South Wineglass

#### (a) Camp site adjacent to dry creek

0.0–0.4 m	aeolian sand
0.4–1.2 m	clayey sand and organics, peat, wood, high $\text{H}_2\text{S}$
1.2–1.5 m	medium sand with wood, $\text{H}_2\text{S}$

#### (b) Small terrace about 10 m from creek

0.0–0.9 m	aeolian sand
0.9–1.8 m	medium marine shelly sand

**SUMMARY:** Spear bore installed to 3.8 m, Number 10, 0.25 mm screen. Pump tested at 10 L/min (125 gph). Field conductivity 830  $\mu\text{S}$ =580 ppm TDS. Standing water level

about 2.8 m at this pumping rate. Groundwater suitable for human consumption.

**3. Schouten Island—Crocketts Bay**

*(a) Camp site terrace level*

- 0.0–1.5 m aeolian sand
- 1.5 m clayey gravel, EW granite

*(b) Lower terrace near creek*

- 0.0–2.9 m clean marine sand with shell fragments.

**SUMMARY:** Spear bore installed at site (b) to 2.9 m, Number 10 screen. Pump tested at 4.5 L/min (60 gph). Field conductivity 28 500  $\mu\text{S}$ =20 000 ppm TDS. Creek conductivity 24 300  $\mu\text{S}$ =17 000 ppm TDS. Groundwater unsuitable for human consumption.

**4. Cooks Beach**

*(a) Dry lagoon edge, adjacent to camp site*

- 0.0–0.6 m organic clayey sand
- 0.6–1.4 m fine brown sand
- 1.4 m clayey gravel (EW granite?)

SWL 0.75 metres. Field conductivity 2570  $\mu\text{S}$ =1800 ppm TDS.

*(b) as above, 50 m south, behind frontal dune*

- 0.0–1.0 m medium aeolian sand
- 1.0–1.8 m grey marine sand
- 1.8–2.2 m olive-green sandy clay

SWL 1.45 metres. Field conductivity 9300  $\mu\text{S}$ =6500 ppm TDS.

**SUMMARY:** Sand thickness and permeability unsuitable for spear bore installation. Groundwater quality unsuitable for human consumption.

**5. North Hazards Beach**

*Rear of frontal dune*

- 0.0–0.8 m fine aeolian sand
- 0.8–1.6 m organic rich sand
- 1.6–2.0 m gravelly clay (EW granite?)

SWL 1.0 metres. Field conductivity 1450  $\mu\text{S}$ =1000 ppm TDS.

Adjacent small lagoon conductivity 5300  $\mu\text{S}$ =3700 ppm TDS.

**SUMMARY:** Sand thickness and permeability unsuitable for spear bore installation. Groundwater quality unsuitable for human consumption.

**6. South Hazards Beach**

*(a) Camp site, adjacent to Lagunta Creek*

- 0.0–0.5 m organic clayey sand
- 0.5–1.3 m fine sand, trace clay, organics
- 1.3–1.6 m medium fawn marine sand
- 1.6 m granite?

Field conductivity of groundwater 12 900  $\mu\text{S}$ =9000 ppm TDS.

Field conductivity of creek 20 000  $\mu\text{S}$ =14 000 ppm TDS.

*(b) Swale behind frontal dune, 50 m from camp site*

- 0.0–0.8 m organic clayey sand
- 0.8–1.7 m medium marine sand
- 1.7 m gravelly clay (EW granite?)

Field conductivity of groundwater 17 100  $\mu\text{S}$ =12 000 ppm TDS.

*(c) As above, 150 m from camp site*

- 0.0–0.9 m aeolian sand
- 0.9–1.5 m organic clayey sand
- 1.5–2.2 m medium marine sand
- 2.2 m clayey gravel (EW granite?)

Field conductivity of groundwater 1450  $\mu\text{S}$ =1000 ppm TDS.

**SUMMARY:** Sand thickness and permeability unsuitable for spear bore installation. Groundwater quality unsuitable for human consumption.

**7. Bryans Beach**

- 0.0–2.7 m clean marine sand, some shell fragments

**SUMMARY:** Spear bore installed to about 2.8 m, Number 10 screen. SWL approx 1.2 m. Spear pump tested at 15 L/min (200 gph). Field conductivity of groundwater 1300  $\mu\text{S}$ =910 ppm TDS. Groundwater suitable for human consumption.

In summary, the geological conditions were similar to those encountered at Richardsons Beach (Sloane, 1986). *In situ* weathered granite or clayey gravel sediments were generally encountered at shallow depth at most sites.

The area at North Wineglass beach, adjacent to the lagoon, is considered suitable for the installation of a well. The groundwater quality is quite good, and a sufficient thickness of sand is present. Concrete liners could be hand dug to about 2.5 metres. Site (c) at South Hazards beach is probably marginally suitable for well construction. The groundwater quality, as measured in the field, is just within the limits of suitability for human consumption, and laboratory water analysis would probably give a lower result for total dissolved solids. A well at this site could be dug to about 2.5 metres.

Only three sites were suitable for the installation of test spears. These sites were at Bryans Beach, south Wineglass Beach, and Moreys Bay on Schouten Island. The latter test spear produced groundwater of high salinity which is unsuitable for human consumption. The spears at the other two sites were left in the ground so that hand pumps could be installed at a later date.

**GROUNDWATER QUALITY**

The variation in water quality within the sediments is attributable to the limited extent of the clean marine sand aquifer and a marine influence on the groundwater. Both tidal and seasonal influxes of sea water are evident at most sites. This is indicated by the salinity levels of the coastal lagoons and creeks. A pHox conductivity meter was used to measure the salinity levels during investigations.

Samples of groundwater from the two successful spear bores have been analysed by the Tasmania Department of Mines Laboratories. The results confirm that the groundwater is suitable for human consumption, especially when considering the water may be used by

campers for short periods of time. The water samples were not tested for bacterial contamination, however contamination is unlikely to be a problem.

The analysis results indicate that both samples have sodium chloride as their dominant constituent. The water is a little corrosive (pH 5.6) and the iron (Fe) content may stain clothing if used for washing. Some salt encrustation will occur on utensils when boiling the water.

**CONCLUSIONS**

The sediments encountered during the investigation were variable in composition and had a high clay component, derived from the weathered granite. The general lack of sufficient thicknesses of clean sand results in unfavourable conditions for producing groundwater from shallow spears. Any further investigations will encounter similar conditions, and therefore the prediction of groundwater occurrence is difficult. Any proposed site

will need to be investigated in a similar way to the investigations described above. Each site must firstly be tested by augering, followed by spear bore pumping if geological conditions are suitable.

Successful spear bores were installed at two of the camp sites investigated, at Bryans Beach and South Wineglass Beach. The groundwater obtained from these spears is considered suitable for human consumption. Tests for bacterial contamination were not performed, however contamination is not considered to be a potential problem.

**REFERENCE**

SLOANE, D. J. 1986. Groundwater investigations at Richardsons Beach, Coles Bay. *Unpubl. Rep. Dep Mines Tasm.* 1986/14.

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**APPENDIX 1**

**Groundwater analysis**

<i>Reg. No.</i>	850748	872236
<i>Locality</i>	Bryans Beach	Wineglass Bay
pH	5.6	5.6
Conductivity (µS/cm)	850	820
<i>Item (mg/L)</i>		
CO <sub>3</sub>	Nil	Nil
HCO <sub>3</sub>	7.4	15.0
Cl	260	240
SO <sub>4</sub>	39	31
Ca	2.5	5.5
Mg	15	9.8
Fe	0.5	0.3
Al	2.1	2.5
K	7.8	7.9
Na	145	160
Total Dissolved Solids	690	580
Permanent hardness	74	56
Temporary hardness	6.1	12.5
Alkalinity as CaCO <sub>3</sub>	6.1	12.5



Figure 1. Location of investigation sites, Freycinet Peninsula.