

## Groundwater investigations near Coles Bay.

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## Abstract

At "Hermit's Haven" near Hepburn Point at Coles Bay, permanent groundwater probably exists only in small isolated pockets of dune sand behind the beaches. Elsewhere on the 13 ha property, the superficial sand, clay and gravel deposits overlying basement granite are irregular in thickness and variable in lithology. Even after heavy rain, they contain only temporary perched water tables. To provide water for a proposed holiday development, the creek along the western boundary of the property should be dammed.

## INTRODUCTION

J.W. Cohen and Associates requested a groundwater investigation be made at "Hermit's Haven" [FP043370], a 12.6 ha property 1 km east of Hepburn Point near Coles Bay (fig. 1). The land will probably be developed as a holiday complex with caravans and units, but no reticulated water supply is available. Permission has been obtained to build a dam on the property boundary, but the storage area will lie outside the title limits. The owner requested advice on possible alternative groundwater supplies. The site was visited on 17, 18 and 19 April 1978.

## PREVIOUS STUDIES

Groves (1966) mapped the geology of the Coles Bay district and discussed the petrology and structural relationships of the granitic rocks. Matthews (1966) investigated a possible dam site near the town and Leaman (1968a, b, c) studied both surface and groundwater sources for a town supply. Leaman made resistivity and drilling surveys 1 km north-east of "Hermit's Haven" and favoured a groundwater supply from unconsolidated sediments overlying granite.

## GEOLOGY

*General*

The basement rock throughout the Coles Bay area is Devonian granite (Groves, 1966). At Hepburn Point, the granite is bounded by Jurassic dolerite and elsewhere in low-lying areas in creeks and near the coast, it is covered by a veneer of Quaternary and possibly Tertiary sand, gravel and clay. The district is dotted with many workings which sluice alluvial cassiterite from these deposits.

*Site geology*

The property (fig. 1) slopes gently south from Coles Bay Road to a coastal frontage on Great Oyster Bay. Devonian granite crops out at sea level and in the creek near the western boundary of the property. The granite exposed on the coast has been intruded by numerous fine-grained porphyritic red and dark grey microgranitic dykes.

Except for isolated granite outcrops near the shacks and near the property entrance, no demonstrably *in situ* granite was observed over the remainder of "Hermit's Haven", although quite large boulders occur in places near the creek. Instead, the land is covered by sandy grey loam overlying

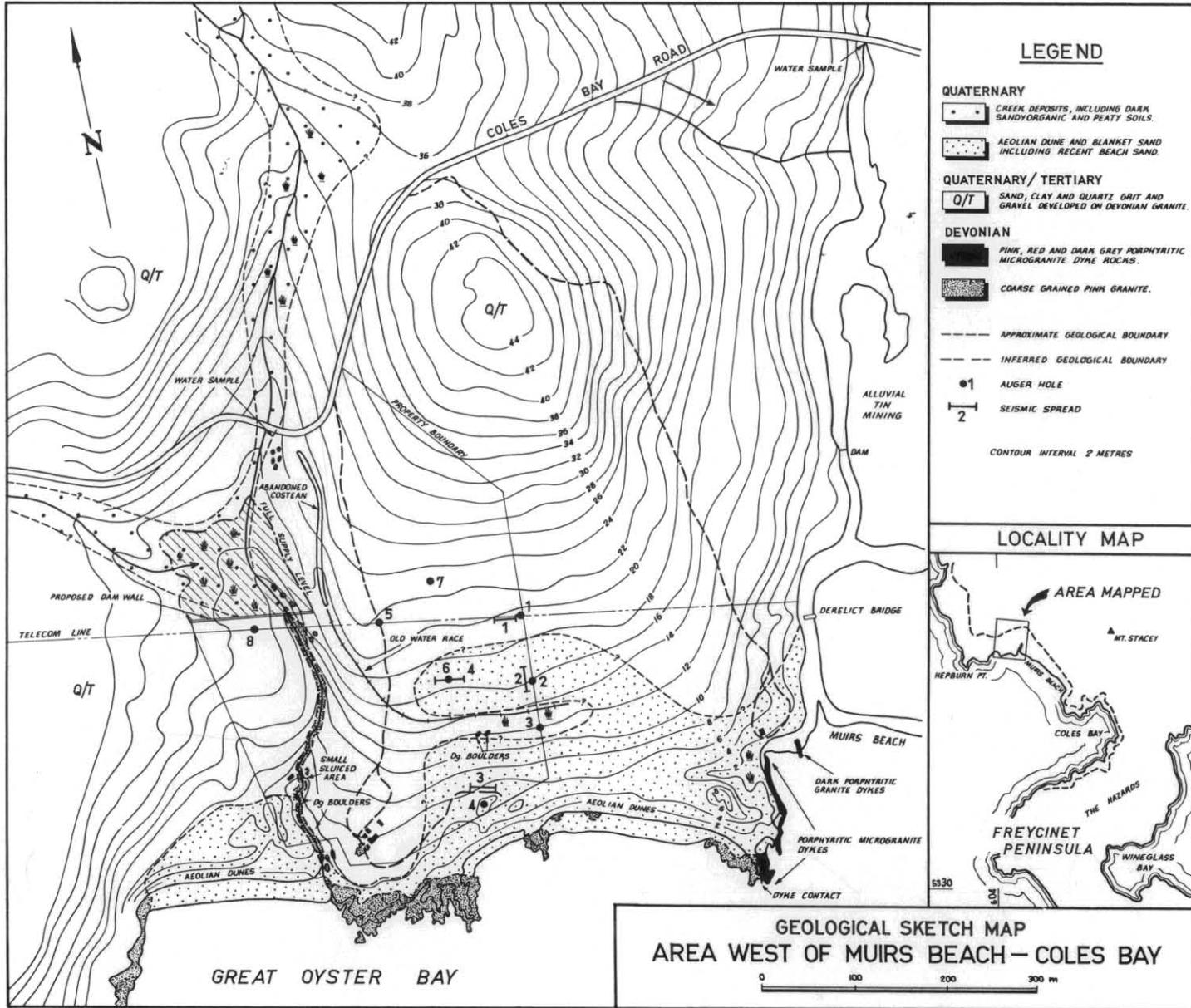


Table 1. SALINITY OF GROUNDWATER AND SURFACE WATERS

Sample	Conductivity at 25°C ( $\mu$ S/cm)	Approximate salinity (mg/l) *
Auger hole 2	635	310
Auger hole 3	558	280
Auger hole 4	625	310
Auger hole 6	1150	570
Auger hole 8	850	430
Coles Bay town supply	370	180
Creek <sup>1</sup>	960	480
Creek <sup>2</sup>	550	270

1. Collected from Coles Bay Road bridge over major creek 700 m east of property entrance.
2. Collected from Coles Bay Road bridge over creek flowing down western property boundary.

\* Total dissolved solids, calculated as NaCl.

sand, clay and quartz grit. Most of the sand is probably aeolian, but the textured and mottled clay and quartz-clay grit are undoubtedly derived from the weathering of the underlying granite. These superficial sediments are the most likely source of economic groundwater in the area. The underlying granite is structurally unknown and deep drilling is required to assess its groundwater potential. Accordingly, the sediments were studied to determine their thickness and groundwater potential.

#### HAND AUGERING

The logs (Appendix 1) from eight shallow auger holes (fig. 1) indicate the variable thickness and lithology of the deposits. They include thin textured clayey and gritty soil horizons developed on weathered granite; deeper soil profiles with aeolian sand, iron-stained B horizons, clay and grit; and thicker coastal sections of aeolian dune sand lying directly on fresh granite. The dune sand thins rapidly inland.

Five of the auger holes struck water but with the exception of the region near hole 4, it seems unlikely that any permanent water table exists. Coles Bay received 117 mm of rain in the preceding fortnight (table 2) and the holes intersected zones of shallow and temporary seepage only. (In Hole 1 the water table is demonstrably perched on clayey quartz grit).

#### SEISMIC SURVEY

Three seismic refraction spreads were conducted over each of the three most promising auger holes (2, 4 and 6) and one was laid near Hole 1. Each spread was designed to show the depth of saturated sand present and the degree of fracturing and weathering of the underlying granite.

Results from all four spreads were inconclusive and difficult to analyse. All indicated a thickness of dry sand well in excess of that previously established by augering and surprisingly, no seismic velocities were recorded indicative of saturated sand. This suggests that if present at all, the

Table 2. RAINFALL FIGURES FOR COLES BAY.<sup>1</sup>

Month	Rainfall average (mm) 1961-1965 <sup>2</sup>	1974	1975	1976	1977	Average	1978
Jan.	34.8	35.2	52.7	119.6	63.4	61.1	57.6
Feb.	72	26.6	11.4	14.8	113.2	47.6	130.8
March	32	56.8	25.9	78.2	5	39.6	142.6
April	46.5	270.3	28.6	27.0	12.8	77.0	117 <sup>3</sup>
May	53.3	106.8	69.2	9.0	85.5	64.8	
June	35	90.4	49.2	72.6	51.4	59.7	
July	77.8	201.4	192.5	48.6	83.2	120.7	
Aug.	64.5	26.6	114.4	114.6	28.4	69.7	
Sept.	37.3	60.2	102	104	23.7	65.4	
Oct.	40.0	77.4	132.4	166.4	31	89.4	
Nov.	43.3	74.2	125.8	199	75.2	103.5	
Dec.	74.3	99.6	9.8	80.2	6.4	54.1	
TOTAL:	610.8	1125.5	913.9	1034	579.2	852.6	

1. Collected and compiled by park ranger, National Parks and Wildlife Service, Coles Bay.
2. Average calculated from figures quoted by Matthews (1966, p. 74).
3. Total for period 1-17/4/78.

layer of saturated sand is thin and may be perched above an unsaturated zone. Thus a velocity inversion exists; waves refracted in such cases travel by longer paths than usual and produce anomalously large thicknesses for lower velocity refractors.

The seismic spreads showed that the underlying granite has a seismic velocity of about 5000 m/sec, indicating that it is relatively unjointed, unweathered and probably a poor aquifer with low storage and transmissive properties.

#### WATER SALINITY

Groundwater from five auger holes and surface water from two creeks and the town water supply were tested for conductivity and approximate total dissolved solids (TDS, table 1).

The best water tested was the town supply (180 mg/l) which is reticulated from a dam in granite at an elevation of 80 m near Mt Stacey. The two creeks showed surprisingly different salinities in view of the recent heavy rains. Both drain peaty and swampy areas, but Creek 1 (480 mg/l) is longer than Creek 2 (270 mg/l) and has a larger catchment.

The groundwater salinity varies from 280 mg/l (Hole 3) to 570 mg/l (Hole 6). There appears to be a pattern to the results, with the deeper the water table the poorer the quality. The salinities are likely to increase with time as the groundwater continues to interact with the sediments through which it passes. Nevertheless, all of the groundwater is suitable for drinking provided that a bacteriological analysis is satisfactory, turbidity is reduced and H<sub>2</sub>S is eliminated by aeration.

## SURFACE WATER HYDROLOGY

The proposed dam (fig. 1) with a crest length of about 135 m and a height of 6-7 m will impound approximately 28000 m<sup>3</sup> of water. The catchment area of about 1 km<sup>2</sup> (10<sup>6</sup> m<sup>2</sup>) receives an annual average rainfall (table 2) of 850 mm. If a (conservative) 20% flows as run-off to the dam the annual volume of water available is 1.7 x 10<sup>5</sup> m<sup>3</sup>. If the rainfall were evenly distributed throughout the year, the dam would take 2-3 months to fill. Assuming that, on average, one person uses 1 m<sup>3</sup> water daily, the storage should supply 500 people for 8 weeks without recharge.

## CONCLUSIONS

Temporary and probably perched water tables exist in various parts of the property after heavy rain. At the same time, other areas are dry. The most favourable site for extracting groundwater is near the beach east of the shacks where the aeolian dunes are thickest. Sufficient groundwater exists to supply one or two households, but the resource is clearly incapable of supplying the proposed holiday development.

The creek on the western property boundary should be dammed as initially proposed. Annual discharge will be more than adequate for the required needs and the water quality is suitable for drinking.

## REFERENCES

- GROVES, D.I. 1966. Granites of the Coles Bay area. *Tech.Rep.Dept Mines Tasm.* 10 : 64-71.
- MATTHEWS, W.L. 1966. Proposed dam site at Coles Bay. *Tech.Rep.Dept Mines Tasm.* 10 : 73-74.
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[1 May 1978]

## APPENDIX 1

## Logs of auger holes.

## Hole 1.

<i>Depth (m)</i>	<i>Interpretation</i>
0-0.2	Grey-black peaty loam.
0.2-0.45	Orange-brown iron-stained partly cemented sand.
0.45-0.9	White sand.
0.9-2.4	Yellow-grey and white mottled clayey saturated sand (perched water table?), grading to slightly clayey medium grained grey sand near 1.8 m.
2.4-2.5	Damp slightly clayey poorly sorted grey quartz grit and sand.
2.5-3.0	Dry, grey mottled and textured gritty clay, apparently grading into weathered granite.

## Hole 2.

0-0.3	Dark grey sandy loam.
0.3-1.5	Pale grey-buff fine grained slightly clayey sand.

Standing water level 1.0 m, Salinity 310 mg/l TDS.

## Hole 3.

0-0.2	Dark grey peaty loam.
0.2-0.4	Grey-buff weathered granite.
0.4-	Brown-yellow weathered granite.

Standing water level 0.2 m, Salinity 280 mg/l TDS.

## Hole 4.

0-0.6	Dark grey-black slightly clayey organic sand. H <sub>2</sub> S smell.
0.6-1.4	Buff medium-fine grained slightly clayey quartz sand.

Standing water level 0.9 m, Salinity 310 mg/l TDS.

## Hole 5.

0-0.1	Grey sandy topsoil.
0.1-0.6	Stiff brown textured and mottled clay, derived from weathered granite.

## Hole 6.

0-0.1	Grey black sandy loam.
0.1-0.6	Dark grey organic quartz sand.
0.6-1.1	Orange-brown iron-stained and partly cemented quartz sand.

## Hole 6 (continued)

Depth	Interpretation
1.1-2.0	Damp, brown-grey slightly clayey fine grained quartz sand; quartz grit at 1.5 m. H <sub>2</sub> S smell.
2.0-	Saturated fine grained slightly clayey quartz sand.

Standing water level 1.6 m, Salinity 570 mg/l TDS.

## Hole 7.

0-0.1	Dark grey sandy loam.
0.1-0.3	Grey quartz sand.
0.3-0.4	Orange-brown iron-stained and organic partly compacted quartz sand.
0.4-1.1	White quartz sand.
1.1-1.5	Mottled yellow and white clayey and gritty quartz sand.
1.5-2.0	Buff-grey-pale yellow partly compacted clayey fine-grained quartz sand.
2.0-2.5	Compact grey textured and mottled clay, containing white weathered feldspars and quartz grit. May be weathered granite.

## Hole 8.

0-0.1	Grey sandy loam.
0.1-0.3	Pale grey quartz sand.
0.3-0.6	Orange-brown iron-stained and organic partly compacted quartz sand.
0.6-1.4	White quartz sand.

Standing water level 1.3 m, Salinity 430 mg/l TDS.