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Investigation of water seepage at Beauty Point

by W. L. MATTHEWS

The Department of Mines undertook shallow drilling around the north-eastern margin of a sand pit to the west of Beauty Point following some concern that seepage water may have been coming from the pit. The land, part of a sand mining operation by Stornoway Hewitt Pty Ltd, and the surrounding properties were examined in June 1988 and eight holes were augered in the area surrounding the pit to the east and northeast. Stand pipes were installed in the holes. The logs of the holes are given in Appendix 1, with the approximate positions of the holes shown on Figure 1. It is proposed to survey these positions more accurately at a later date.

Each hole extended through sand and gravelly material (i.e. permeable material) before passing into clay and silty clay. The sand mining operation removes the sand or permeable material and exposes the silty clay and clay. Provided good drainage is established in the base of the pit, rainwater falling on the site can be controlled and it was recommended that drainage be directed to the south. While the sand is in place, rainwater will seep underground into the sand and provide a reservoir to supply seepages over a long period. The removal of the sand from the top of the hill is therefore likely to lessen the water available to supply seepages downslope, provided a good drainage system is installed in the pit.

The sand deposits are probably Tertiary in age and have probably been deposited by an ancient stream. The material is variable, both vertically and laterally. Some consists of fine sand with a varying clay content, while other zones are relatively coarse gritty sand with semi-transparent fragments that may have been derived from the weathering of granite (e.g. in the headwaters of the ancestral South Esk River). Localised zones of the coarse material have undergone cementation, resulting in the formation of a compact rock. Lateral variations in the material can be quite rapid, e.g. on the eastern side of the pit, near where extraction is now taking place, there are clay boulder beds while just to the north there is good quality coarse sand exposed in the pit side.

Beneath the sand deposits there are silty clay and silty sand layers that are often coffee brown in colour while at lower levels gravelly clay (fragments of quartz up to 20 mm across) and sandy clay were encountered in the drill holes. Occasional outcrops of basalt can be seen around the slope at lower levels, while in other areas a boulder or two of basalt is present. Previous drilling in the general area has shown the basalt to be at varying depths beneath the surface and of varying thicknesses. Tertiary sediments, consisting dominantly of clayey material, occur under the basalt.

Removal of the permeable sand will remove a reservoir for water to be stored on top of the hill and this will remove a source for continued seepage to downslope areas. Rain falling on the mined area, if properly graded, should run off quite quickly where material with low permeability is exposed in the base of the pit.

Basalt can be quite permeable, as shown by the high success rate of water bores drilled into it. If basalt comes near the surface in the base of the pit area it could act as a conduit for water movement to downslope areas. Preventing water from this source from coming out on the lower slopes to the east would be very difficult.

As excess water can have an adverse effect on the stability of slopes underlain by clay, it is recommended that the pit base be graded so that all surface water runs to the south in the already constructed drain. No surface water should be allowed to escape from the northern or eastern side of the pit.

The possibility of installing a drain around the slope lower down than the pit lip should also be examined. This should catch at least some of the water seeping from the pit to downslope areas and again could be graded down towards the south and extend around the north side of the part of the pit being worked. A problem exists with such a drain, as in hole 2 apparently quite permeable sand exists to deeper levels and the drain may have to be lined with clay or some other material (e.g. plastic sheeting) with low permeability in this area and other areas where permeable sand occurs in the drain base. It is expected that some co-ordination with the council would be needed to install such a drain, unless it is discharged into a natural water course.

Alternatively it may be possible to install the drain to run the water northwest towards the valley that extends towards Ilfraville.

It was proposed to put tracer dyes in holes in the pit area to determine whether there is significant seepage to downslope areas east and northeast of the pit.

Water testing

Further investigations were undertaken at the sand pit in March 1989. A dye was placed in holes in the pit floor and water was taken from the holes drilled surrounding the pit and near two houses from time to time for checking. To date no conclusive evidence has been established that water is seeping from the pit base to these two houses.

Water samples taken from the settling ponds and Mead's seepage have been analysed (Table 1). The most significant features of these analyses are the very low pH values (particularly from the settling ponds), the relatively high sulphate content of the water compared to total dissolved solids content, and the low total salinity (TDS). Some previous analyses of water (in 1976) from drill holes and from seepages emanating from landslides indicated higher total salinities (about 1000 mg/L or greater). This suggests that water analysed recently has not percolated through the deeper clay layers or has had limited time underground (i.e. to dissolve salts in the soil and clay sediments).

Conductivities on samples taken from the holes drilled in 1988 suggest relatively low salinities and are probably similar in range to the recent chemical analyses.

It is uncertain whether the spring water supplying Mead's seepage originates from the sand pits area. The total salinity in the seepage is a little higher than that from the pits while the pH is markedly higher. Sulphate is 3.5 times higher in Boral's pond and 1.6 times higher in Hewitt's than in the seepage water even though the total salinity in Mead's is higher. Chemical changes take place as water seeps through underground materials which makes it difficult to trace the source of seepage water. Much of the area around Beauty Point is blanketed by sand, gravel and permeable soils that will store rainwater to supply seepages over extended periods which is an additional difficulty. It is proposed to continue monitoring water in the holes drilled in 1988.

[18 April 1989]

Table 1

Analyses of water samples

Reg. No.	892210	892211	892212
pH	3.5	3.6	5.9
Conductivity (S/cm)	220	200	330
CO_3 (mg/l)	Nil	Nil	Nil
HCO_3 (mg/l)	Nil	Nil	58
Cl (mg/l)	26	39	62
SO_4 (mg/l)	47	22	13.5
Ca (mg/l)	4.2	3.8	8.7
Mg (mg/l)	3.2	2.3	7.0
Fe (mg/l)	0.1	0.1	0.3
Al (mg/l)	<0.2	0.3	<0.2
K (mg/l)	1.2	1.3	1.3
Na (mg/l)	25	28	38
TDS (mg/l)	160	190	250
Hardness (Permanent)	24	21	3.7
Hardness (Temporary)	Nil	Nil	47
Alkalinity as $CaCO_3$	Nil	Nil	47
Locality	Boral settling ponds	Hewitt's settling ponds	Mead's seepage
Date collected	15 March 1989	16 March 1989	16 March 1989

Analyses by J. Lethborg, Department of Mines Laboratory, Launceston

APPENDIX 1

Logs of auger holes

Hole 1

0 – 0.9 m	Fine quartz gravel, sandy matrix
0.9 – 1.5 m	Fine grey brown silty sand, very hard
1.5 – 2.4 m	Softer brown silty clay
2.4 – 3.4 m	Light brown very soft silty clay

Hole 2

0 – 1.5 m	Fine quartz gravel, occasional fragments up to 20 mm across, hard zone at 1.2 m, wet
1.5 – 2.1 m	As above, lighter colour
2.1 – 3.4 m	Light grey silty sand and grit – damp
3.4 – 4.0 m	Dark brown gritty sand, damp
4.0 – 4.6 m	Dark brown clayey silty grit, dry
4.6 – 6.1 m	Light brown grey gritty silty clay, dry

Hole 3

0 – 0.9 m	Grey clayey gravel, damp
0.9 – 1.8 m	Light brown gritty silt, dry
1.8 – 2.4 m	Dark brown sandy silt, some grit
2.4 – 3.7 m	Lighter brown gravelly silt to fine sand, dry
3.7 – 5.2 m	Light grey brown silt with fine sand, clayey, some quartz pebbles, dry
5.2 – 5.8 m	As above, becoming more gravelly
5.8 – 7.0 m	Light grey silt to sand, gravelly, wet, some clay
7.0 – 7.9 m	Light grey clayey silt, some gravel fragments, thin bands grey plastic clay

Hole 4

0 – 0.9 m	Grey quartz gravel, wet
0.9 – 1.4 m	Brown silty gravel, damp
1.4 – 1.8 m	Hard dry silty sand
1.8 – 2.4 m	Light grey silty sand
2.4 – 3.4 m	Brown sand, fine grained
3.4 – 4.3 m	Light brown clayey silty sand
4.3 – 5.2 m	Light brown clayey silty sand, some gravel
5.2 – 6.1 m	Light grey brown clayey silty gravel, quartz fragments up to 20 mm across, some dominantly clay zones at base, damp

Hole 5

0 – 0.9 m	Grey sand, damp
0.9 – 1.5 m	Dark brown silty sand
1.5 – 2.1 m	Light brown silty clay
2.1 – 3.4 m	Light grey brown silty sandy clay, dampish
3.4 – 5.8 m	Light grey brown silty clay, plastic, dampish

Hole 6

0 – 0.6 m	Grey sand, some clay
0.6 – 0.9 m	Dark brown organic rich clayey sand
0.9 – 1.5 m	Grey plastic clay
1.5 – 2.7 m	Light brown and brownish grey plastic clay
2.7 – 3.4 m	Grey clay, plastic

Hole 7

0	–	0.9 m	Grey and brown sand
0.9	–	1.4 m	Dark brown gravelly clay
1.4	–		Refusal, no further drilling possible

Hole 8

0	–	0.9 m	Grey quartz sand – wet
0.9	–	1.4 m	Dark brown gravelly sand, wet, organic material
1.4	–	1.5 m	Brown clay, fairly dry
1.5	–	2.4 m	Light grey brown clay, some quartz fragments up to 20 mm across
2.4	–	3.4 m	Light brown silty clay

Figure 1

Location of auger holes and spring