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GROUNDWATER INVESTIGATION AT THE
HUME INDUSTRIAL ESTATE, A.C.T., 1978

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by

G. Jacobson & P.D. Hohnen

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GROUNDWATER INVESTIGATION AT THE HUME INDUSTRIAL ESTATE, A.C.T., 1978

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G. Jacobson & P.D. Hohnen

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ABSTRACT

Groundwater at the Hume Industrial Estate, A.C.T., occurs in discontinuous sandy aquifers within a colluvial/alluvial sequence. Organic contamination of groundwater has been confirmed from analyses to determine the Dissolved Organic Carbon and phenol content. The plume of polluted groundwater extends about one kilometre downstream of a timber mill.

INTRODUCTION

At the request of the National Capital Development Commission a groundwater investigation was undertaken during 1978 at the Hume Industrial Estate (Fig. 1). The object of the investigation was to assess groundwater quality and provide monitoring points for possible pollution of groundwater from the disposal of industrial effluent in the area.

Fifteen auger holes were drilled by contractors, Stewart Bros Pty Ltd, in March 1978. Locations of the holes are shown in Figure 2. The holes were equipped with slotted PVC casing and were gravel packed, with a cement apron to prevent the entry of surface water. Sampling was done in conjunction with the Conservation and Agriculture Laboratory of the Department of the Capital Territory, which also undertook the analysis of samples.

HYDROGEOLOGY

At the site, several metres of colluvium and alluvium overlie weathered Silurian volcanic rocks (Hohnen, 1975). The colluvium and alluvium consist of interbedded, discontinuous layers of sand, silt and clay. Bedrock was intersected in two drillholes at a depth of 4 m; it consists of extremely to moderately weathered tuff.

The colluvium and alluvium contain sand aquifers, and groundwater has been encountered in 13 of the 15 drillholes. Ten of these drillholes contain water intermittently (Table 1). Water levels in the drillholes are below ground level, and groundwater flow is generally to the northwest.

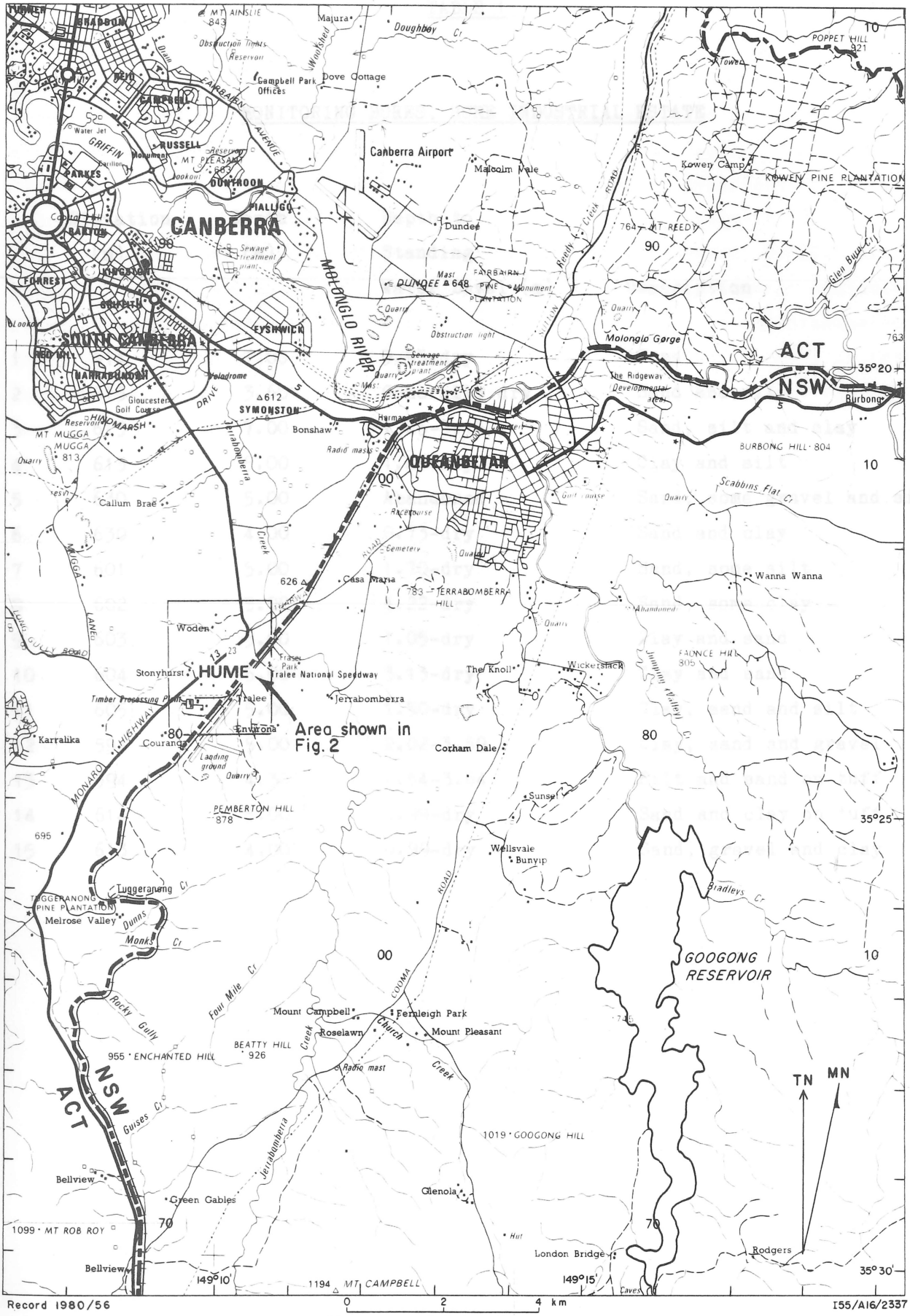

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Fig. 1 LOCATION MAP

TABLE 1

MONITORING BORES, HUME INDUSTRIAL ESTATE

	Elevation (m)	Depth (m)	Depth to Standing Water Level (m)	Description
1	614	7.00	3.95-dry	Sand
2	615	3.60	Generally dry	Sand and silt
3	613	7.00	1.25-5.16	Sand, silt and clay
4	613	5.00	1.86-dry	Clay and silt
5	630	5.00	Abandoned	Sand, some gravel and silt
6	630	4.00	0.73-dry	Sand and clay
7	601	5.00	1.70-dry	Sand, some silt
8	602	5.00	4.22-dry	Sand, some clay
9	603	5.00	1.05-dry	Clay and sand
10	604	5.00	3.13-dry	Clay and sand
11	605	5.00	1.50-dry	Clay, sand and silt
12	594	5.00	2.02-3.59	Clay, sand and gravel
13	594	4.30	2.54-3.64	Silt and sand on tuff
14	614	5.00	0.99-dry	Sand and clay on tuff
15	613	4.00	0.99-dry	Sand, gravel and clay

WATER QUALITY

Bores were bailed and then allowed to recover for 24 hours before sampling. Samples were taken with a PVC bailer, and analysed by the Conservation and Agriculture Laboratory of the Department of the Capital Territory, Canberra. Determination of phenols was undertaken by the Department of Health Laboratory, Canberra. Sampling was done about every two months in 1978.

Results of chemical tests for Dissolved Organic Carbon (D.O.C.) are given in Table 2. This test is a rapid method of indicating organic contamination (Hughes & others, 1974). Background values of D.O.C. in uncontaminated groundwater in the A.C.T. are roughly 1-3 mg/L, and the D.O.C. content in farm dams is generally 8-20 mg/L (Evans & Bennett, 1978; Jacobson, 1978). Test results for the bores at Hume (Table 2) indicate that bores 3, 6, 9, 10, 11, and 12 contained organically polluted groundwater. The phenol contents (Table 3) of these bores were greater than the World Health Organisation standard for drinking water, which is 0.002 mg/L.

Pollution in bore 6 is attributed to earth works carried out shortly before the bore was sampled and to dumped timber. Bores 3, 9, 10, 11 and 12 which are downstream of a timber mill, have contained water with D.O.C. levels that are much greater than background, and indicate a groundwater pollution plume emanating from the mill effluent (Fig. 2). Effluents from the timber mill consist of glue waste and log soaking water which contain up to 2500 mg/L D.O.C. and 14 mg/L phenols and are disposed of by settling and oxidation in ponds. The pollution plume could be caused by leakage of effluent from the ponds or by overflow into drainage channels which recharge the groundwater aquifers.

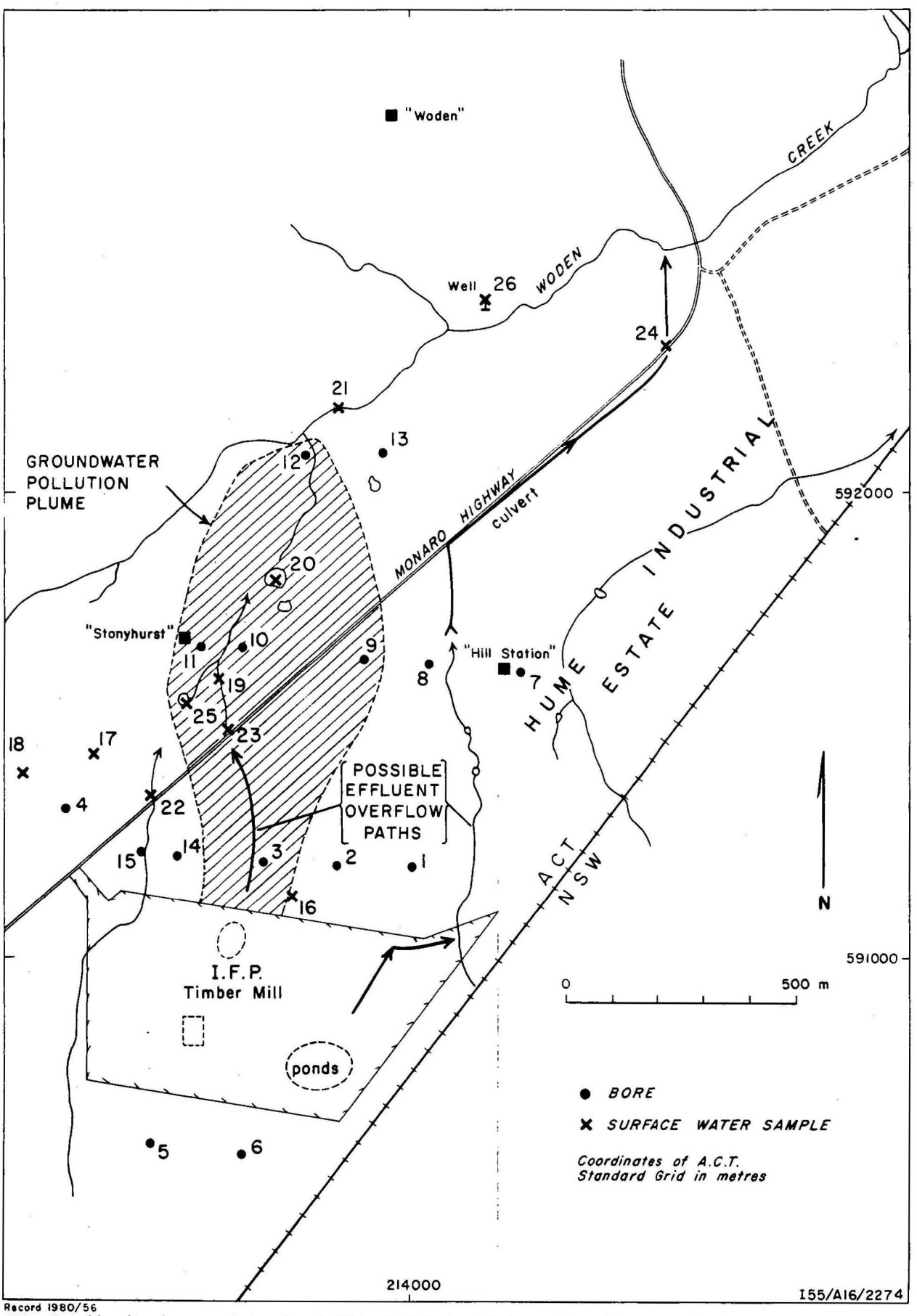

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Fig.2 Monitoring points for infiltrated industrial wastes–Hume Industrial Estate

TABLE 2

TEST RESULTS - DISSOLVED ORGANIC CARBON

in milligrams per litre

Location		28/3/78	15/5/78	23/6/78	26/7/78	21/9/78	28/11/78	19/12/78
Bore	1		5			6		
"	3	37	22		35	20.5	24.5	
"	4					5.5		
"	6				40	27	54	
"	7					63		
"	8					18.5		
"	9	32				7		
"	10		9		21	1.5		
"	11				8	6	15	
"	12	4.5	5.5		13	10.5	8	
"	13	2	10		1.5	3.5	5	
"	14					11.5	16	
"	15					7.5	13	
Dam	16	3.5	8					24
"	17	27	23				22	
"	18	12.5	20				27	
"	19	22	16				16	
"	20	32	23				23	
"	21	8	8					
Culvert	22	60	48				12	8.5
"	23	12	7					6
"	24	15	15					8
Dam	25	25	14					8.5
Well	26			3	1			6

Determinations by Conservation and Agriculture Laboratory, Department of the Capital Territory, Canberra

TABLE 3

DETERMINATIONS OF PHENOLS IN GROUNDWATER

by Department of Health Laboratory, Canberra

Bore	Total phenols (mg/L)	
	28/3/78	26/7/78
3	N.D.	0.7
6	-	0.8
9	1.0	-
10	-	0.9
11	-	0.7
12	<0.1	0.5
13	<0.1	<0.1

CONCLUSIONS

1. A groundwater pollution plume containing D.O.C. in excess of background extends for one kilometre north of a timber mill.

2. The source of the pollutant is believed to be effluent from the timber mill. Contamination of groundwater could have been caused by seepage from the effluent ponds or the ponds may have overflowed.

REFERENCES

EVANS, R. & BENNETT, D.G., 1978 - Geological and geophysical investigation of the proposed Mugga South landfill site, A.C.T., 1977. Bureau of Mineral Resources Australia - Record 1978/69.

HOHNEN, P.D., 1975 - Engineering geology and environmental factors of the proposed Jerrabomberra Industrial Estate, A.C.T. Bureau of Mineral Resources, Australia - Record 1975/36.

HUGHES, J.L., ECCLES, L.A. & MALCOLM, R.L., 1974 - Dissolved Organic Carbon (DOC), an index of organic contamination in ground water near Barstow, California. Ground Water, 12, 283-290

JACOBSON, G., 1978 - The establishment of a leachate monitoring system at the West Belconnen landfill site, A.C.T, 1976-7. Bureau of Mineral Resources Australia - Record 1978/83.

APPENDIX 1

LOGS OF AUGER HOLES

by

P.D. Hohnen

HUME INDUSTRIAL ESTATE - LOGS OF AUGER HOLES

Hole 1

0-3 m	Mixture of very fine sand and silt - slopewash derived from acid volcanics - and less common medium to coarse-grained sand. Little or no clay. Colour pale cream-grey.
3-4 m	As above, but with higher proportion (~30%) of medium to coarse-grained sand.
4-5 m	Well-graded, slightly clayey, coarse to fine sand.
5-7 m	Fine sand; possibly insitu weathered tuff. Colour orange, flecked white.

Hole 2

0-1 m	Medium greyish-brown silt grading down to bleached, pale grey silt. Lower 20 cm is very stiff, shiny, medium grey clay with dark red mottles.
1-2 m	About 60 cm recovered of cream friable powdery, very fine sand and silt with minor coarse sand.
2-3.6 m	Recovered 10 cm of wet, bright orange-yellow, medium and coarse, poorly graded sand with minor lean clay. Lower 25 cm is of banded cream and pale yellow, friable, powdery fine sand and silt with minor coarse sand.

Hole 3

0-1 m	Medium grey-brown, fine sandy silt at top grading down to pale fawnish grey friable silt, then down to cream, cemented, well-graded mixture of coarse sand to silt.
1-2 m	Very poorly sorted, pebbly-sandy slopewash. Lower 30 cm of core is very stiff, compacted, pale creamish grey sandy clay grading down to well-graded medium-grained sand to silt with some clay. Core (dried) breaks with difficulty.
2-3 m	Stiff, densely compacted, pale creamy grey, medium to fine sand and silt mixture with clay binder.
3-4 m	Mottled pale grey and orange, slightly clayey very fine sand and silt.
4-5 m	Only 15 cm core recovered: partly as above, partly pinkish well-graded medium to fine sand and silt.

5-7 m	Mottled pale grey and dirty yellow, fine sandy clay and gravelly, coarse to fine sand with minor clay. Some well-graded fawn, coarse to fine sand.

Hole 4

0-0.1 m	Pale yellowish, greyish brown silt.
0.1-0.2 m	Pale pinkish cream very fine sand.
0.20-0.25 m	Banded pale grey and orange, sandy lean clay.
0.2501.00 m	No recovery.
1-2 m	Recovered 45 cm of mottled, creamy, pale grey and orange sandy, stiff, lean clay.
2-3 m	Recovered 40 cm of well compacted, pinkish cream, well graded, very coarse to very fine sand. Little or no clay - crumbles in hand with difficulty.
3-4 m	As above, but some well sorted medium sand layers.
4-5 m	Recovered 50 cm of pale cream, well sorted, fine sand with small amounts of clay binder. Moderately friable when dry. Last 10 cm is mottled cream and grey sandy clay.

Hole 5

0-1 m	Recovered 10 cm yellowish grey-brown, fine sandy silt followed by about 30 cm of fawnish cream fine sand and silt.
1-2	Recovered 20 cm of loose friable well graded, pale pinkish fawn sand.
2-3 m	Recovered 80 cm of uniform pale pinkish fawn, well graded sand with medium to fine sand and silt. Crumbles readily in hand to dusty sand.
3-4 m	Moderately strong, pale cream and grey banded, well-sorted medium sand and fine sandy silt.
4-5 m	Well graded, pale reddish brown, loose to lightly bonded gravel to fine sand.

Hole 6

0-0.30 m	Pale greyish brown sandy, silty topsoil.
0.30-0.65 m	Medium greyish brown and cream-grey mottled sandy clay - well compacted, very stiff core.
0.65-1.00 m	No recovery.

1-2 m — Pale fawnish grey, well-graded clayey sand, grading down to greyish fawn, slightly clayey sand, grading down to grey, extremely stiff, slightly sandy clay.

2-3 m — Friable yellow, orange, pale red and greyish brown, well graded coarse sand to very fine sandy slopewash.

3-4 m — Banded cream and very pale grey powdery, very fine sandy and silty slopewash.

Hole 7

0-1 m — Medium greyish brown grading down to yellowish pale grey, fine sandy silt.

1-2 m — Greyish and reddish, chocolate brown, loose, wet (aquifer) poorly graded, slightly clayey medium sand. Lower 15 cm is stiff, pale grey lean clay.

2-3 m — Mottled brownish grey and orange, compacted, well-graded coarse to fine sand with minor clay.

3-4 m — Pale greyish and yellowish brown, friable, well graded, very fine sand and silt with some medium to coarse sand.

4-5 m — Yellowish brown friable gravel in silty fine sand.

Hole 8

0-1 m — 10 cm pale yellowish brown silty, fine sandy topsoil, followed by 12 cm ferruginised and manganiferous gravel layer. Lower 13 cm of core is mottled red and brownish grey, very stiff, highly compacted sandy clay.

1-2 m — Pale creamy grey, very fine sand and silt with some coarse sand dispersed through it and concentrated in bands that are cemented quite strongly. Compacted but still friable except for cemented bands.

2-3 m — As above, but with some yellow staining and more binder - not so friable.

3-4 m — 15 cm pale cream and yellowish grey, well graded sand - some friable but some bound with clay and very strong and compacted. Lower 35 cm is very stiff, compacted, pale greyish cream, well graded medium-fine sand with some clay binder. Core is hard to break when dry.

4-5 m — Coarsely mottled, pale grey and bright orange coarse friable sand with some clay binder. Pebbles become more common with increasing depth - black chert and tuff.

Hole 9

0-1 m	Fine sandy, greyish fawn, loose dry silt overlies stiff, banded and mottled, fawnish grey and orange-yellow sandy clay.
1-2 m	Very stiff and compacted, sandy, gravelly clay - mottled fawn and orange.
2-3 m	Pale grey to fawn, well-graded coarse to fine sand and silt, minor clay. Core compacted, stiff, crumbles to dusty sand in hand with difficulty.
3.4 m	Banded pale grey, lean clay and fawn to orange-yellow, well graded coarse to fine sand; compact, strong to friable, owing to varied amounts of clay binder.
4-5 m	Upper half of core run is well sorted, very fine sand with some lean clay binder - crumbles readily in hand to very fine sand and silt with slight plasticity.

Hole 10

0-1 m	10 cm pale greyish brown fine sandy silt followed by 25 cm loose, pale fawn very fine sand and silt. Last 5 cm of core is very strongly compacted, well graded clayey sand.
1-2 m	Well compacted, moderately strong, slightly sandy, pebbly clay.
2-3 m	Cream, well graded coarse to fine sand with clay binder followed by yellow-grey lean clay. Lower 5 cm of core is strongly compacted sandy clay.
3-4 m	Moderately strong, coarsely mottled, yellow and cream, well graded banded sandy clay. Layer of pale fawn lean clay, 10 cm thick, near end of core run. Bottom 5 cm is lightly cemented, well graded sand. Layers of sand with less clay occur within more clayeylayers. Scattered volcanic rock pebbles occur throughout.
4-5 m	Cream, well compacted, weak to moderately strong, well graded pebbly sand; where slightly clayey, core is strong; where clay is absent, core is weak and friable sand.

Hole 11

0-0.60 m	No recovery.
0.60-0.70 m	Cream-grey friable sandy silt topsoil.
0.70-1.00 m	Mottled orange and brownish grey, stiff, compacted sandy clay.
1-2 m	Cream, with pale orange bands and mottles, coarse sand grading to very fine sand and silt - friable to loose.

2-3 m — As above, but with some clay binder; core is hard to break by hand. Colour is mottled yellowish and grey, with some fawn and orange layers.

3-4 m — Pinkish and greyish fawn, very well graded coarse sand grading to very fine sand with little or no clay; friable but strongly compacted. Slopewash derived from volcanic rocks.

4-5 m — Upper 15 cm of core is friable to loose, poorly graded medium to coarse sand with pale mauve volcanic rock clasts. Lower part of run is stiff, highly compacted, well-graded coarse to very fine sand with some clay binder. Overall colour is fawn, but material is made up of pink, mauve, fawn, and cream clasts.

Hole 12

0-1 m — Pale fawnish grey friable, slightly sandy silt.

1-2 m — Fawn with orange spots and stains, well-graded fine gravel to silt including much fine sand and some lean clay. Core breaks in hand with difficulty due to strong compaction and clay binder.

2-3 m — Moist, slightly plastic and cohesive, pale brown, fine sandy clay.

3-4 m — Greyish fawn and pinkish fawn, well-sorted, medium-grained quartz sand with clay binder. Some small pebbles in the core which is very stiff, slightly moist, and has low plasticity and moderate cohesion when compacted by auger.

4-5 m — Layered, pale greyish fawn sandy, slightly gravelly, clay to clayey fine sand. Core is stiff, very moist, slightly plastic and moderately cohesive owing to compaction by auger. Interbedded yellowish to fawn, medium to coarse, well sorted sand with little or no clay. The sand layers are about 2 cm thick at bottom of core run, but loose coarse sand at top of run is 25 cm thick and saturated.

Hole 13

0-1 m — Medium yellowish brown, very fine sandy silt.

1-2 m — Mottled fawn to medium greyish brown and orange, clayey well graded sand. Owing to compaction by auger, core breaks with difficulty by hand when dry.

2-3 m	Moderately well-sorted medium to coarse grained sand. Crumbles with moderate difficulty when dry.
3-4 m	Pale greyish cream, well-graded coarse to fine sand with much clay binder: core difficult to break by hand when dry. Last 10 cm of core run is pebble layer of volcanic rock clasts.
4-4.3 m	Moderately weathered crystal-vitric tuff comprising abundant plagioclase with some quartz, in a greyish purple microcrystalline matrix.

Hole 14

0-1 m	Pale greyish brown silt grading down to pale greyish cream sandy silt (slopewash).
1-2 m	Compacted, very stiff, mottled grey and orange, very sandy clay.
2-3 m	Mottled pale grey and orange, slightly clayey, well-graded medium to fine sand.
3-4 m	Compacted, pale greyish-brown and orange well-graded coarse sand to silt with some lean clay. Moist.
4-5 m	Orange, flecked with cream, in situ, extremely to highly weathered tuff; comprising a little quartz but mostly weathered feldspar and medium to fine sand size, volcanic rock fragments.

Hole 15

0-1 m	Upper 40 cm is yellowish and greyish brown, fine sandy silt topsoil. Lower 20 cm is well compacted, stiff, mottled grey and yellow, moderately clayey, well-graded, moist, coarse to fine sand.
1-2 m	Orange, pale grey and brownish-yellow, coarsely banded, well-graded, slightly clayey sand and well-sorted, clayey gravel and medium sand aquifers (saturated).
2-3 m	Banded, pale grey and bright orange-yellow, alternate layers of stiff sandy clay and loose wet clayey, well sorted sand aquifers.
3-4 m	Mottled, medium and pale grey, compacted, sandy, stiff clay.