

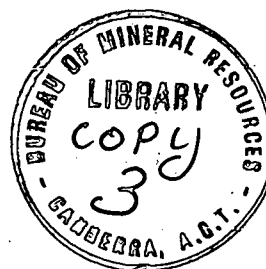
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BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

Record 1974/189



INVESTIGATION OF DRAINAGE PROBLEM, SECTIONS

23 AND 30, AINSLIE, A.C.T.

by

P.D. HOHNEN

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SUMMARY

A drainage problem in the Canberra suburb of Ainslie has been investigated by augering. The problem is caused by groundwater seeping from a confined sandy clay aquifer beneath a former watercourse. Recommendations for remedial drainage works have been made.

INTRODUCTION

In August 1972, the National Capital Development Commission (NCDC) requested the Commonwealth Department of Works (CDW) to undertake a comprehensive study of drainage problems on Blocks 16-19, 22, and 23 of Section 23, and Block 16 of Section 30, Ainslie and advise on the feasibility of constructing residences on these blocks. CDW, in turn, requested the Bureau of Mineral Resources (BMR) to advise on the 'nature and physical properties of the subsoil; potentiometric surface and variation therein; movement of groundwater; and stratigraphy; in addition, to make an appreciation of the effects of these upon any building on the area'.

A large area of Section 23, Ainslie, is affected by poor drainage of surface and shallow subsurface water, and six blocks of land are water-logged for long periods. Block 16 of Section 30 on the opposite side of Cowper Street is on the eastern margin of the affected area.

An earlier investigation of the problem was undertaken by E.G. Wilson in August 1959, but subsequent remedial work carried out by CDW was not completely successful (Wilson, 1959).

METHOD OF INVESTIGATION

On 18 August 1972, after an unusually dry winter, the topsoil on all blocks was almost saturated, and on Block 17 an area of seepage (Plate 1) was producing a trickle of water. The seepage was probably caused by the up-rooting of a willow tree whose roots tapped a shallow aquifer.

Continuous undisturbed core was obtained from seven 11cm diameter holes drilled by a 'Proline' auger to a maximum depth of 5.5m. The undisturbed soil samples were logged on the site according to the Unified Soil Classification system (Pl. 2). Piezometers were installed in each auger hole.

RESULTS

All holes intersected a sandy clay aquifer containing some pebbles up to 1 cm in diameter, at depths ranging from 1.5 to 1.8 m below ground surface. Water from the aquifer seeped into the auger holes at rates between 1.8 l/h and 9.0 l/h, which indicates that the aquifer has low permeability. Grey to black clays (OH) of extremely low permeability overlie the aquifer, and mottled grey and yellow clays (CH) underlie it. The latter probably prevent the upward movement of groundwater from any lower aquifers (apart from capillary action) whereas the former reduce infiltration from precipitation, irrigation, and run-off.

On 25 August 1972, the water levels in piezometers indicated that the potentiometric surface was above ground surface over about 75 percent of Block 17. Rainfall totalling 29.2 mm was recorded in Ainslie between 9 a.m. on 28 August and 9 a.m. on 31 August, and on the last day of this period water-levels in the piezometers were up to 40 cm above previous levels (see Table 1). At this time, the area where the potentiometric surface was above ground surface was estimated to cover 80 percent of Block 17, 30 percent of Block 18 and about 60 percent of Block 19. A constant gradient was assumed for the potentiometric surface across Blocks 17, 18, 19, 22, and 23, with the fall from northeast to southwest. On September 5, after five days without rain, water-levels were still up to 23 cm above levels measured on 25 August.

CONCLUSIONS

The area affected by seepage is a naturally waterlogged area resulting from poor drainage of a former shallow watercourse that was present before development, and can be seen on aerial photographs taken in 1944. The catchment area of this watercourse is about 0.4 km² and slopes within the catchment are gentle. Some obstructions to drainage might

have been caused by the placement of fill over the watercourse during the levelling of Section 23. Construction of the Majura and Ainslie Sports Grounds across the lower end of the depression might also have restricted the movement of surface water and shallow groundwater from the area.

The saturated clay soils in this area derive their water from a confined sandy clay aquifer at a depth of more than 1.5 m below the surface. Water from the aquifer seeps into the overlying clays and keeps them in a saturated condition.

TABLE 1. STANDING WATER LEVELS IN PIEZOMETERS AT SECTION 23, AINSLIE
(IN METRES RELATIVE TO GROUND SURFACE)

DATE MEASURED	HOLE NO.						
	1	2	3	4	5	6	7
23.8.72	+?						
24.8.72	+?		-1.00	-1.05	-0.30		
25.8.72	+?	-0.35	-1.00	-1.02	+0.13	-0.69	-0.30
31.8.72	+?	+0.05	-1.00	-1.00	+0.18	-0.66	-0.18
5.9.72	+?	-0.13	-1.00	-1.02	+0.13	-0.69	-0.30
12.9.72	+?	-0.18	-0.95	-1.00	+0.13	-0.84	-0.23
13.9.72	+0.61	-0.15	-0.89	-0.97	+0.23	-0.89	-0.18

+? Water seeping from outside of piezometer pipe at ground-level, but water below ground-level inside pipe. By 13.9.72, the blockage had cleared allowing water inside the pipe to rise to 0.61 m above ground-level.

RECOMMENDATIONS

A trench drain at least 2 m deep should be constructed along the eastern frontage of Blocks 17, 18, and 19; it should also pass along the northern side of Block 17, and along the southern side of Block 19 (see Pl. 1).

Drainage pipes should be laid in a well-graded sand bed and covered by compacted, impermeable fill. The design should provide that the sand bed coincides with the aquifer. It might be necessary to over-deepen the trench in places and back-fill with the selected sand pack.

The proposed drains should connect to the existing stormwater drain below Blocks 18 and 22; the groundwater, under natural seepage pressure, will rise to enter the existing stormwater drain, but the level of entry should be at the top of the stormwater pipe to prevent recharge of the aquifer by stormwater.

The excavated drains should be inspected by a geologist, and should remain open for about one week after connection with the stormwater drain has been made. During this period the piezometric levels should be monitored.

Special consideration should be given to the design of foundations in this area where the clayey soils have poor bearing capacity.

REFERENCE

WILSON, E.G., 1959 - Unpublished Note, Tech. File Bur.¹ Min. Resour. Aust.

No. N/S1/55-16, part 9(a), folios 28-30.

PLATE 1 DRAINAGE INVESTIGATION BLOCKS 17-19, 22-23 SECTION 23, AINSLIE

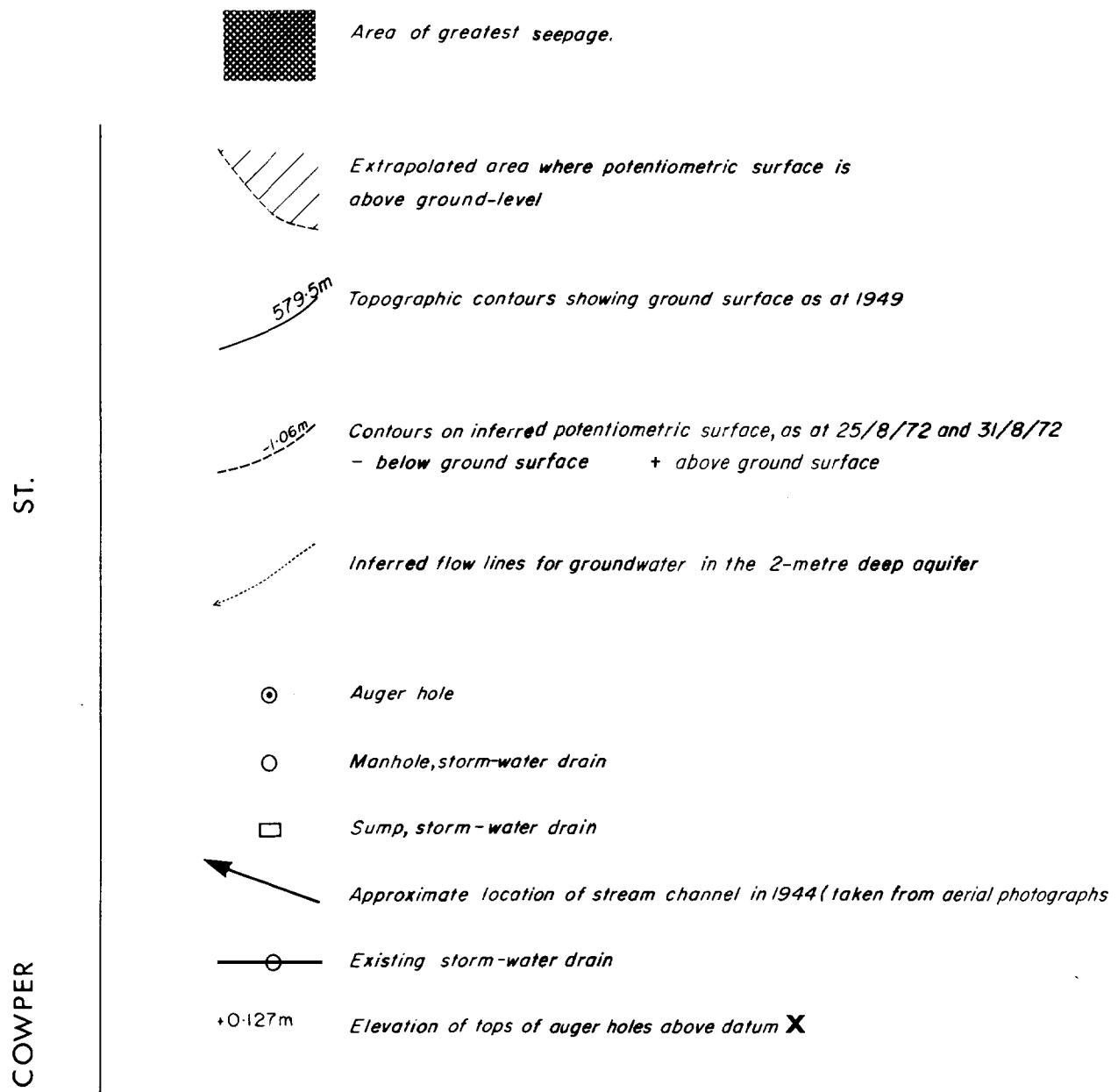
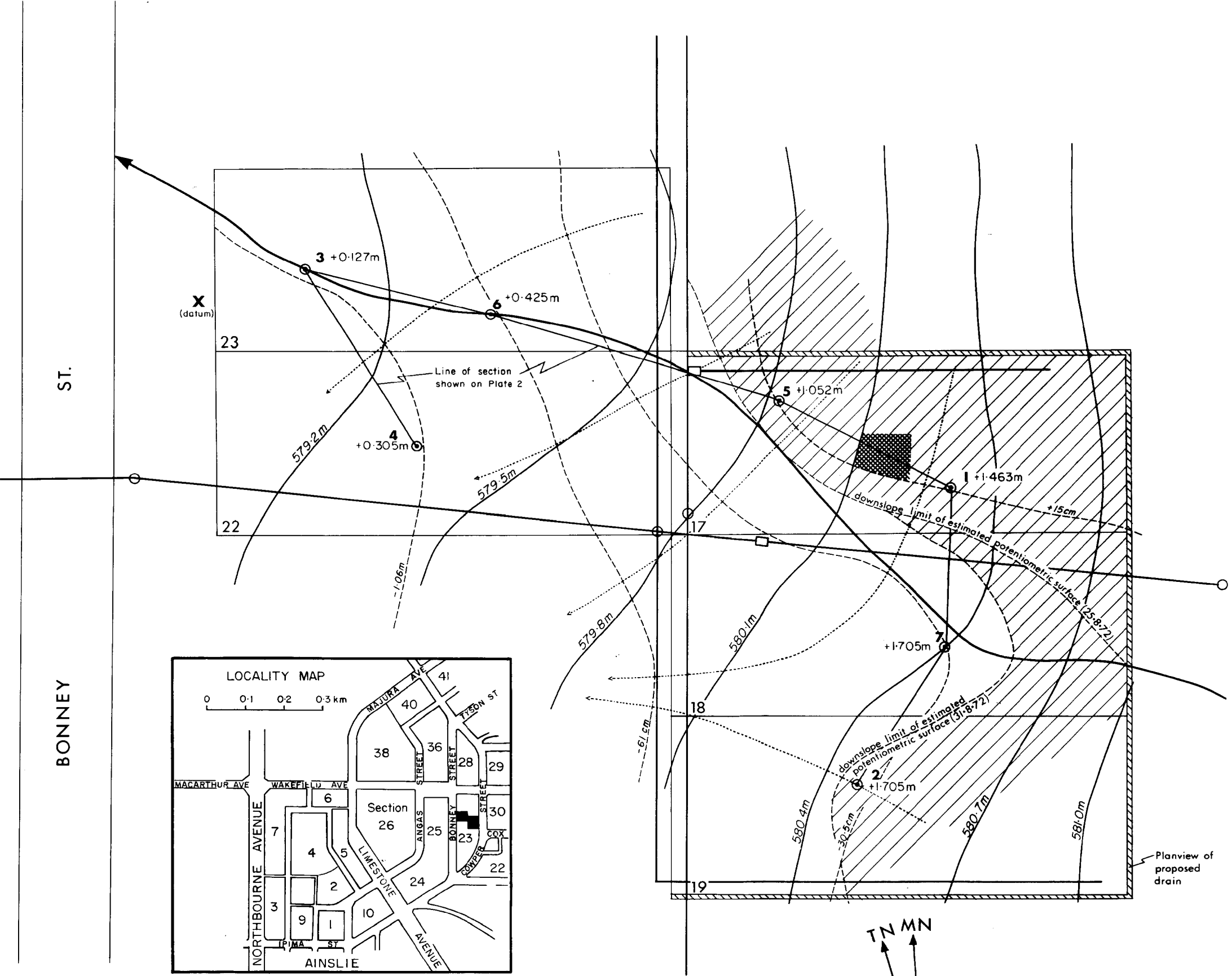


PLATE 1


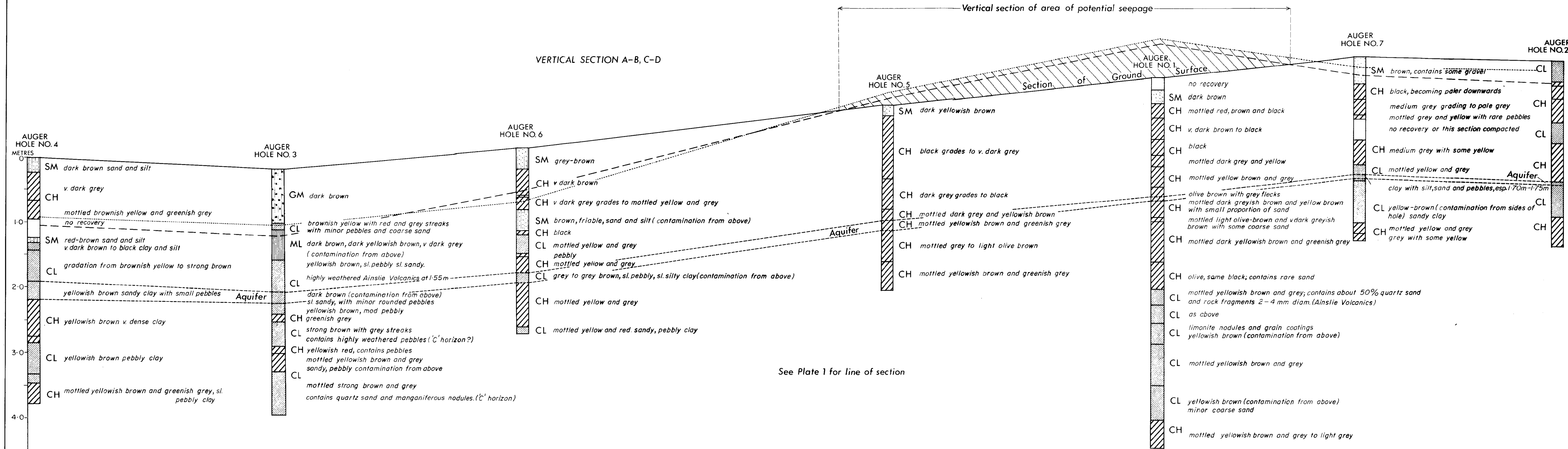
<div>SCALE</div> <div><div>020406080 Feet</div><div>0510152025 Metres</div></div>		<div>COMMONWEALTH OF AUSTRALIA</div> <div><div>BUREAU OF MINERAL RESOURCES</div><div>CANBERRA, A.C.T.</div></div> <div></div>	
BASE MAP/SURVEY Cwlth. Dept Works		TITLE PLAN VIEW OF AREA STUDIED SHOWING PROPOSED DRAINS	
GEOLOGY BY P.D.HOHNNEN		PROJECT DRAINAGE INVESTIGATION, BLOCK 17-19, 22-23, SECTION 23	
COMPILED AND CHECKED	CHECKED AND APPROVED	TO ACCOMPANY RECORD 1974/-189	
PROJECT GEOLOGIST	SENIOR GEOLOGIST	DRAWN BY P.L.BLYTHE	DRAWING NUMBER 155/A16/998
SUPERVISING GEOLOGIST			

PLATE 2 DRAINAGE INVESTIGATION BLOCKS 17-19, 22-23 SECTION 23, AINSLIE



$\frac{V}{H} = \frac{6}{1}$

..... Section of potentiometric surface on 13/9/72

--- Section of potentiometric surface on 25/8/72
















MAJOR DIVISIONS		SYMBOLS		TYPICAL NAMES						
COARSE GRAINED SOILS More than 1/2 of soil > No. 200 sieve size	GRAVELS (More than 1/2 of coarse fraction > no. 4 U.S. sieve size)	GW		Well graded gravels or gravel-sand mixtures, little or no fines*	FINE GRAINED SOILS More than 1/2 of soil < No. 200 sieve size	SILTS AND CLAYS Liquid limit > 50	ML		Inorganic silt and very fine sands, rock flour, silty or clayey fine sands or clayey silts with low plasticity	
		GP		Poorly graded gravels or gravel-sand mixtures, little or no fines			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		GM		Silty gravels, gravel-sand-silt mixture			OL		Organic silts and organic silty clays of low plasticity	
		GC		Clayey gravels, gravel-sand-clay mixture			MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
	SANDS (More than 1/2 of coarse fraction > no. 4 U.S. sieve size)	SW		Well graded sands or gravelly sands, little or no fines		SILTS AND CLAYS Liquid limit > 50	CH		Inorganic clays of high plasticity, fat clays	
		SP		Poorly graded sands or gravelly sands, little or no fines			OH		Organic clays of medium to high plasticity, organic silty clays, organic silts	
		SM		Silty sands, sand silt-mixtures			HIGHLY ORGANIC SOILS	Pt		Peat and other highly organic soils
		SC		Clayey sands, sand-clay mixtures						

PLATE 2

COMMONWEALTH OF AUSTRALIA

BUREAU OF MINERAL RESOURCES

CANBERRA, A.C.T.

SCALE

0 3 6 9 metres

BASE MAP/SURVEY

GEOLOGY BY

P.D. HOHNEN

COMPILED AND CHECKED

CHECKED AND APPROVED

PROJECT GEOLOGIST

SENIOR GEOLOGIST

SUPERVISING GEOLOGIST

TITLE

CORRELATION OF SOIL LOGS SHOWING

AQUIFER AND POTENTIOMETRIC LEVELS

PROJECT

DRAINAGE INVESTIGATION,

BLOCK 17-19, 22-23, SECTION 23, AI

TO ACCOMPANY

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P.L. BLYTHE

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