DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept. Bk. No. 80/23

GROUNDWATER POLLUTION POTENTIAL AT NARACOORTE ABATTOIR

By

M.H. STADTER

GEOLOGICAL SURVEY

FEBRUARY, 1980.

D.M. No. 317/77
Eng. Geol. No. NA 4

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ABSTRACT

A hydrogeological investigation was carried out to assess the groundwater pollution potential of the waste disposal system in use at the Naracoorte Abattoir. Effluent from the abattoir is initially treated in two anaerobic lagoons and then in a large aerobic lagoon.

These waste disposal lagoons have been constructed in the vicinity of a ridge of Gambier Limestone which is a widespread and important water table aquifer.

The limestone was exposed during the construction of the anaerobic lagoons and consequently the risk of groundwater pollution is high. There is also risk of collapse of the floor of the anaerobic lagoons by piping effects. The pollution potential of the aerobic lagoon is small as it is underlain by over 10 m of impermeable sandy clay.

It is recommended that measurements be made by the E.&W.S. Department of the inflow and outflow for the anaerobic lagoons to determine their leakage and this together with the results of their water quality monitoring programme will determine whether any further investigations are necessary.

INTRODUCTION

A hydrogeological study was carried out by the Department of Mines and Energy to assess the groundwater pollution potential of the waste disposal system being used at the Naracoorte Abattoir. The study was made in conjunction with a number of other Government Departments, as part of an overall assessment of the waste disposal method by the South East Water Resources Investigation Sub-Committee.

The Narcoorte Abattoir is situated about 6 km east of the Naracoorte township, which is located approximately 300 km southeast of Adelaide (see Fig. 1).

The abattoir was constructed in 1973 with a designed capacity for the slaughter of 500 cattle and 10 000 sheep per week. An investigation of the foundation conditions for the buildings was made by the Department of Mines and Energy (June, 1973) and a recommendation was made that no effluent be allowed to contaminate the groundwater.

A lagoonal waste disposal system for the abattoir effluent was designed by engineering concultants and approved by the Engineering and Water Supply Department (E.W.S. Docket 252/76). Production at the abattoir commenced in October, 1973 and was generally continuous until its closure in August, 1975. The abattoir recommended production towards the end of 1977 and today is an important local industry.

The Department of Mines and Energy became involved in the pollution investigation programme in mid-1975 and since that time a number of observation wells have been drilled in the vicinity of the waste disposal lagoons. Routine water level monitoring has been carried out since that time.

The E.& W.S. Department have been monitoring groundwater quality for regular sampling of the observation wells.

GEOLOGY

The abattoir complex is situated about prominent nrothwest - southeast trending exposed ridge of Gambier Limestone (Rochow, 1969). The waste disposal lagoons occur on the western side of this ridge whereas the abattoir proper (buildings, slaughterhouse etc) is found on the eastern side (see Fig. 2).

The Gambier Limestone is generally fossilferous and is cream to yellow in colour. It contains both micro- and macro- solution features, some of which have been infilled with red-brown clay.

The limestone is Tertiary in age (ranging from lower Oligocene to Miocene). The ridge is thought to represent a shoreline feature with a coastal cliff on its western side.

Flanking the ridge on both sides and overlying the Gambier Limestone are younger sediments of Tertiary and Quaternary age. The sediments consist essentially of sands and interbedded clays, and these are described in detail in Figure 3 and in the stratigraphic well logs presented in Appendix A. The sediments attain a thickness of about 15 metres.

The east-west geological cross-section (Fig. 3) was compiled from drill-hole information and the results of a shallow seismic refraction survey (Micenko, 1979) and shows the relationship of the various lithological units.

HYDROGEOLOGY

The Gambier Limestone, as exposed in the ridge near the abattoir, is an important and widespread water table aquifer. Groundwater extracted from it is used for a variety of purposes, including human consumption. The status and location of all known water wells in the vicinity of the Naracoorte Abbattoir is shown in Figure 4.

Underlying the limestone at a depth of about 120 metres is a confined aquifer consisting of unconsolidated sands of Lower Tertiary age (Dilwyn Formation). The two aquifers are separated by an aquiclude consisting of dark coloured clays and silts. The only production wells which have been drilled into this aquifer are those used to supply the Naracoorte township.

Groundwater Gradient

The regional groundwater gradient of the water table aquifer, as established from routine monitoring of a widespread

network of observation wells, is in a general southwesterly direction. A typical set of water table contours (for March, 1977) is shown in Figure 5. Additional water table contour plans have been presented in an earlier report (Lang, 1977).

In the vicinity of the abattoir, water level monitoring of a more closely spaced observation network has shown that a higher groundwater gradient is associated with the limestone ridge (see Fig. 6) This suggests that the ridge is a zone of higher local recharge.

Depth of Water and Seasonal Fluctuation

The depths to the water table vary due to the topographical differences - beneath the ridge the depth to water is about 20 metres and away from the ridge the depth is approximately 15 metres.

Hydrographs for selected observation wells have been presented in Figures 7 and 8. Water levels which have been monitored on a monthly basis since mid-1975 show a decline of about 1 metre since that time; this is due to a period of lower than normal rainfall. A seasonal fluctuation of 1 - 2 metres could be expected.

Water Quality

The total dissolved solids content of the groundwater from the water table aquifer varies from about 900 mg/litre up to 3 000 mg/litre.

For pollution investigations the nitrate ion concentration is generally used as an indicator of groundwater contamination. Due to the paucity of regional water quality data however, background levels are generally based only on a few chemical analyses. Harvey (1979) shows that background median nitrate concentration for the abattoir area varies from 0 to 4 mg/litre.

Water samples were collected at the time of the observation well drilling programme in the vicinity of the waste disposal lagoons and revealed nitrate concentrations (as NO_3) of up to 40 mg/litre (see Appendix B). This suggests that either the background nitrate concentration is higher than anticipated or some previous practice at the abattoir has created a pollution plume in the area.

Conductivity Profiling

Conductivity profiling was carried out in some of the observation wells in April, 1978 and the profiles are presented in Figure 9. The results show that the wells located away from the limestone ridge have a conductivity variation of only 150 EC units whereas the well (Jes 51) situated near the ridge has a variation of about 500 EC units with a marked lower conductivity zone near the top of the water table. This confirms that the ridge is a zone of higher local recharge.

WASTE DISPOSAL METHOD

The main source of effluent from the abattoir is from the factory itself, but a minor amount is also produced from the washdown of the holding yards. The total pollutional load of the wastewaters has been estimated to be equivalent to the sewage from about 30 000 people (E.W.S. Docket 5391/71).

The factory effluent is screened and then discharged into two adjoining anaerobic lagoons (see Fig. 2 and Plate 2). The anaerobic conditions are achieved by the depth of the lagoon - reported to be 5 - 6 metres. Effluent from these lagoons flows through a gravity main to a large aerobic lagoon where the wastewater is subjected to aeration, evaporation, and downward seepage through the soil profile.

The effluent produced from the washdown of the holding yards

is discharged to a small lagoon north of the abattoir from where it drains into Naracoorte Creek.

POLLUTION POTENTIAL

Due to the variation of the geological conditions beneath the anaerobic and aerobic disposal lagoons, the pollution potential of each will be discussed separately.

1. Anaerobic Lagoons

These adjoining lagoons were excavated to a depth of about 3 metres and limestone was exposed in places at the base of the lagoons. A large limestone boulder (believed to have been removed during the excavations) is still present at the surface along the eastern edge of the lagoons. A "thin" layer of clay is reported to have been spread over the base of the lagoons (A.F. Williams, pers. comm.).

It appears from the lagoon construction details, the drilling, and the results of the seismic survey, that in places the effluent in the anaerobic lagoons is separated from the limestone by the thin veneer of emplaced clay. In other places the effluent and the limestone are separated by the Parilla Sand (Fig. 3) which, with its clay and silt interbeds, has a low vertical permeability.

The risk of groundwater pollution from the anaerobic lagoons is considered high due to the presence of the limestone near the base of the lagoons. The limestone has a high permeability due to its very porous nature, and it is cavernous (drilling of observation well JES 51 revealed cavities). Should there be seepage paths through the clay into the limestone near the base of the lagoon, there is also the risk of collapse of the floor of the lagoons (Warren, 1976). This is caused by subsurface erosion of

unconsolidated material within solution cavities in the unsaturated zone of the limestone. This erosion occurs because of the increase in velocity of fluid movement compared with natural recharge conditions, due to the increased hydrostatic pressure of the impounded effluent.

Some downward percolation of effluent along the interface between the limestone and the Parilla Sand (see Fig. 3) is also possible, and may be significant if there is considerable leakage from the lagoons.

No measurements are available for the inflow or outflow for the lagoons and therefore it is not known to what extent the lagoons are leaking.

2. Aerobic Lagoon

The geological conditions beneath the large aerobic lagoon are more uniform (see Fig. 3). Most of the lagoon is underlain by about 12 metres of clay and then about 12 metres of Parilla Sand. The depth to the water table is approximately 17 metres.

Due to the low permeability of the clay and Parilla Sand, the seepage loss and hence the pollution potential is expected to be small. Preliminary work by the E.&W.S. Department (Harvey, 1979) has shown that the seepage rates have decreased from an initial 2 to 3 mm per day to less than 1 mm per day since 1977. This decrease being due to a gradual sealing of the base of the lagoon by mineral and organic matter.

Because of the low seepage rate, most of the fluid loss from the lagoon will be due to evaporation. The efficiency of the lagoon therefore is largely dependant on its surface area and a problem of excess wastewater

could occur in the future should there be a marked increase in production from the abattoir or if a prolonged period of rainfall is experienced. Should the excess wastewater be used for irrigation, careful management is necessary to prevent salinization of the soil profile (Hartley, Dept. Agriculture, report in preparation).

CONCLUSIONS

The waste disposal system at the Naracoorte Abattoir could have a deleterious affect on the quality of the groundwater due to leakage of effluent from the anaerobic lagoons directly into the highly permeable Gambier Limestone aquifer. Such leakage could also produce collapse of the floor of the lagoons by piping thereby increasing any groundwater pollution.

Should pollution of the water table aquifer occur, then the velocity of the pollution plume would be about 19 metres/year in a downgradient direction (that is, southwesterly). This velocity was calculated using aquifer parameters from the Naracoorte township area and assuming that the groundwater flow was laminar. The actual velocity of the pollution plume could be higher if the groundwater flow was turbulent (which occurs when the aquifer is cavernous).

Due to the presence of domestic supply wells downgradient of the effluent disposal lagoons, any groundwater pollution is undesirable and appropriate steps should be taken to ensure that it does not occur.

RECOMMENDATIONS

To determine whether any groundwater pollution is occurring from the waste disposal lagoons, it is recommended that:

(1) an assessment be made by the E. & W. S. Department of the results of their water quality monitoring programme, and

(2) through the South East Water Resouces Investigation Committee, some measurements be made of the inflow and outflow of the anaerobic lagoons to determine the magnitude of the leakage from these lagoons.

The results from the above will determine whether any further investigations are necessary.

MHS:AF

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GEOLOGIST (NARACOORTE)

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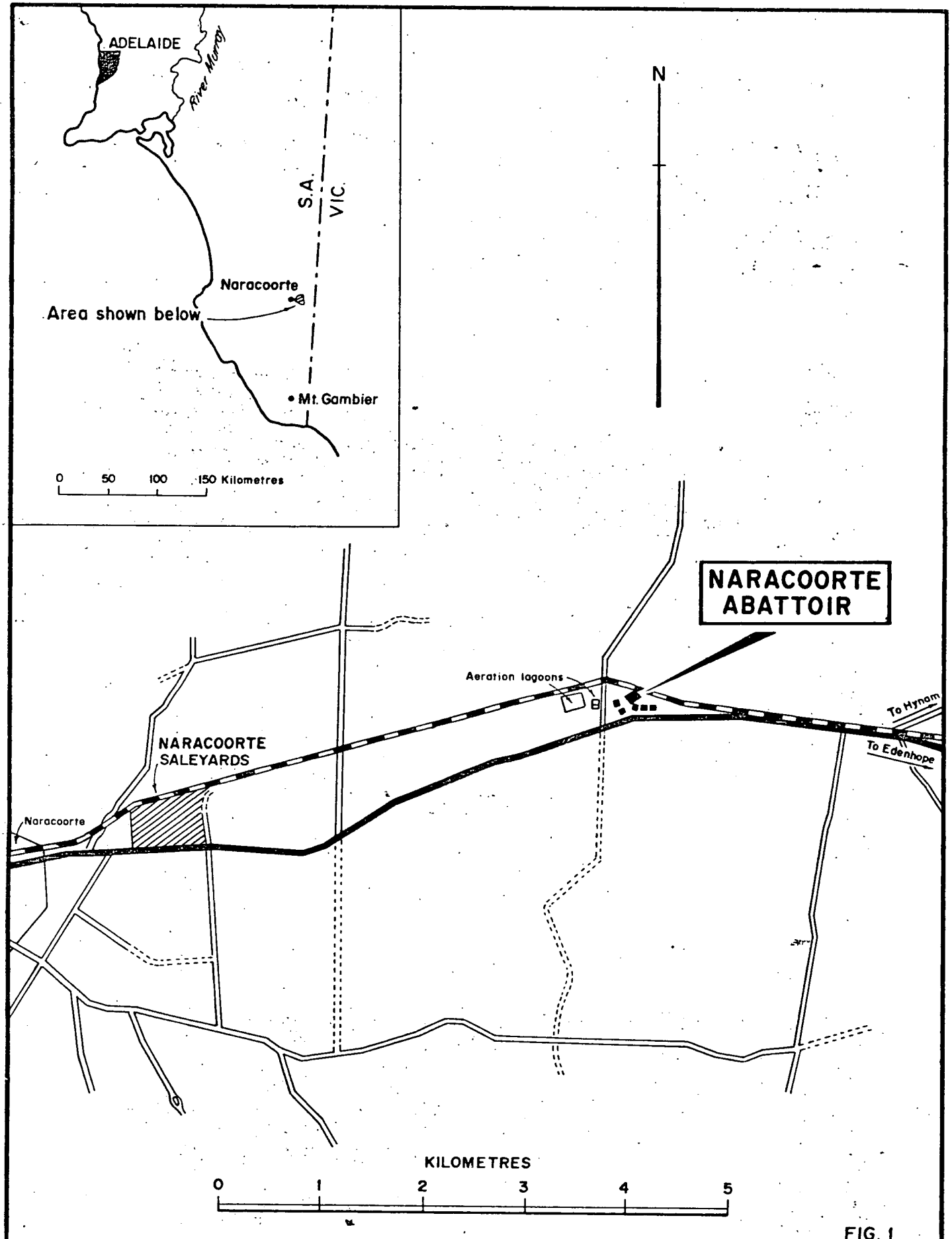

FIG. 1

	DEPARTMENT OF MINES – SOUTH AUSTRALIA	SCALE 1:50000
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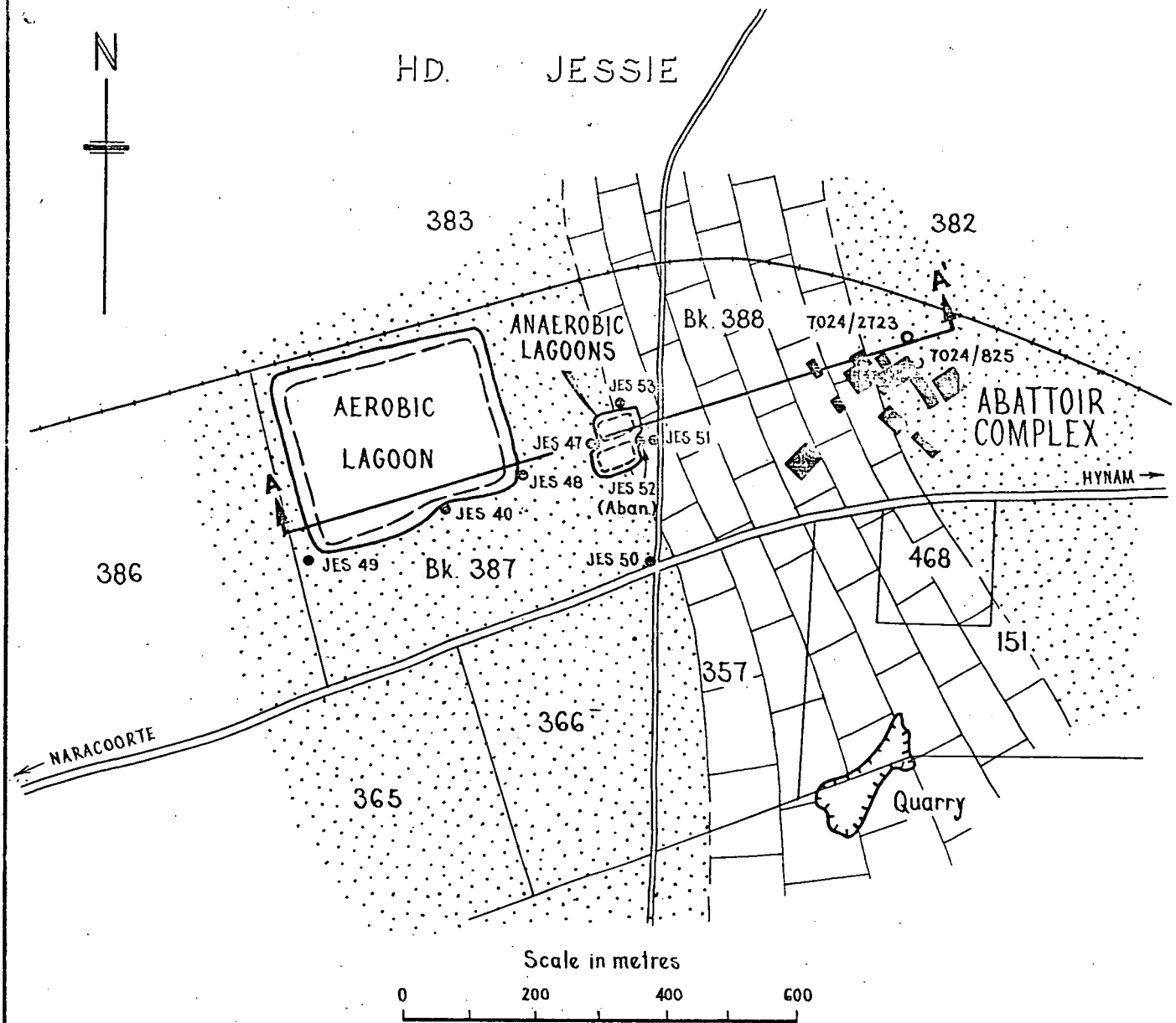
DRN. L.P.R. CKD	LOCALITY PLAN	PLAN NUMBER S 14622



● JES 47 — Observation well and number
o 7024/2723 — Well, with unit number
} With available stratigraphic information

Geological boundary (approximate)

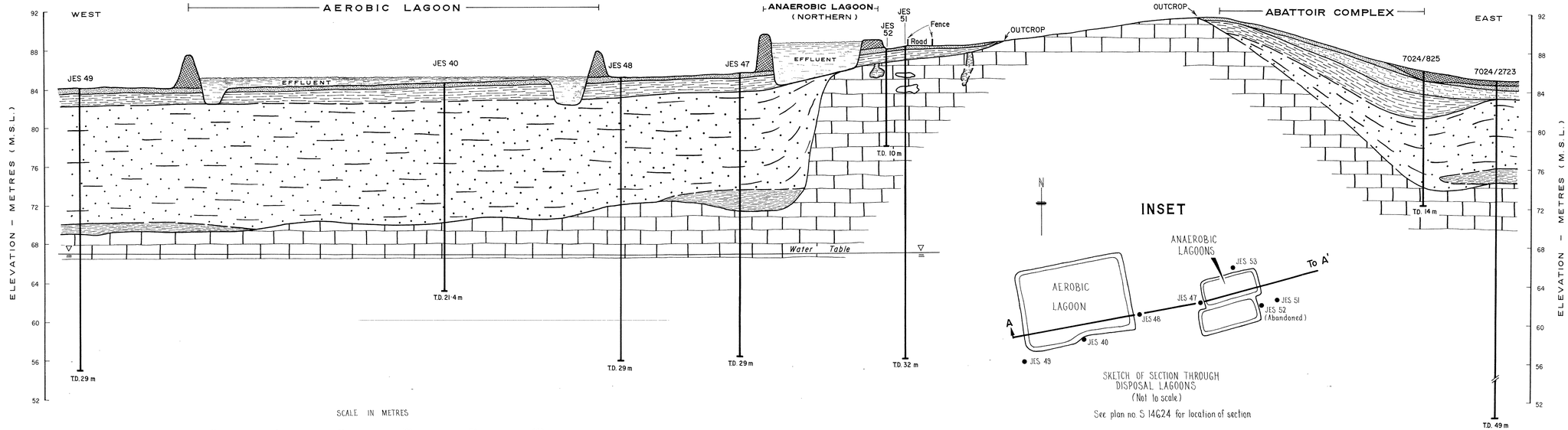
A A' — Geological cross section (see plan no. 80-93)

TOPSOIL: Generally grey loamy sand, (see plan no. 80-93 for detailed description).

GAMBIER LIMESTONE: Soft to hard, fossiliferous, fine to coarse grained, cream to yellow. Recrystallized in part and cavernous. Overlain by terra rossa soil to depths of two metres

FIG. 2

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE As shown
COMPILED A.F.W.	NARACOORTE ABATTOIR POLLUTION STUDY	DATE Feb. 1980
DRN M.R. CKD	GENERALIZED SITE GEOLOGY	PLAN NUMBER S 14623



SKETCH OF SECTION THROUGH DISPOSAL LAGOONS
(Not to scale)

See plan no. S 14624 for location of section

LEGEND

	FILL	
	TOPSOIL	West of JES 52, SAND, silty, fine to medium grained quartz, non-calcareous, maghemite and limonite pebbles to 15 mm, clayey towards base, brown. Well drained. East of JES 52, SAND/CLAY (Terra Rossa). Sand as above, brown to red-brown, passing into clay, sandy with minor quartz, ironstone pebbles, non-calcareous, red-brown. Poorly drained.
	SILT	Sandy, with fine quartz, calcareous, minor clay, orange, mottled yellow and grey.
	BLANCHETOWN CLAY Equivalent	CLAY, silty with up to 40% quartz, (especially near base) pockets of limestone, soft silt to hard, fine grained fragments to 20 mm
	PARILLA SAND Equivalent	SAND, fine to medium grained quartz, silt and clay to 40%, non-calcareous, ferruginous pebbles to 20 mm, mottled yellow, grey, pink and brown, weakly cemented. CLAY, sandy with up to 40% quartz sand as above, plastic, in beds and layers near base. Limestone fragments towards base of unit. Poor to moderate drainage.
	GAMBIER LIMESTONE (Aquifer)	LIMESTONE, fossiliferous, hard fine grained to soft coarse grained, minor quartz, clayey near top (weathered), macro and micro solution features often infilled with red-brown clay. Cream, light grey and yellow.

FIG. 3

DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA

NARACOORTE ABATTOIR POLLUTION STUDY

GEOLOGICAL CROSS SECTION A - A' THROUGH ABATTOIR COMPLEX AND EFFLUENT DISPOSAL LAGOONS

COMPILED G.A.M. A.F.W.	C.O.D. DATE
DRAWN M.R.	SCALE As shown
DATE Feb. 1980	PLAN NUMBER
CHECKED	80 - 124

1808

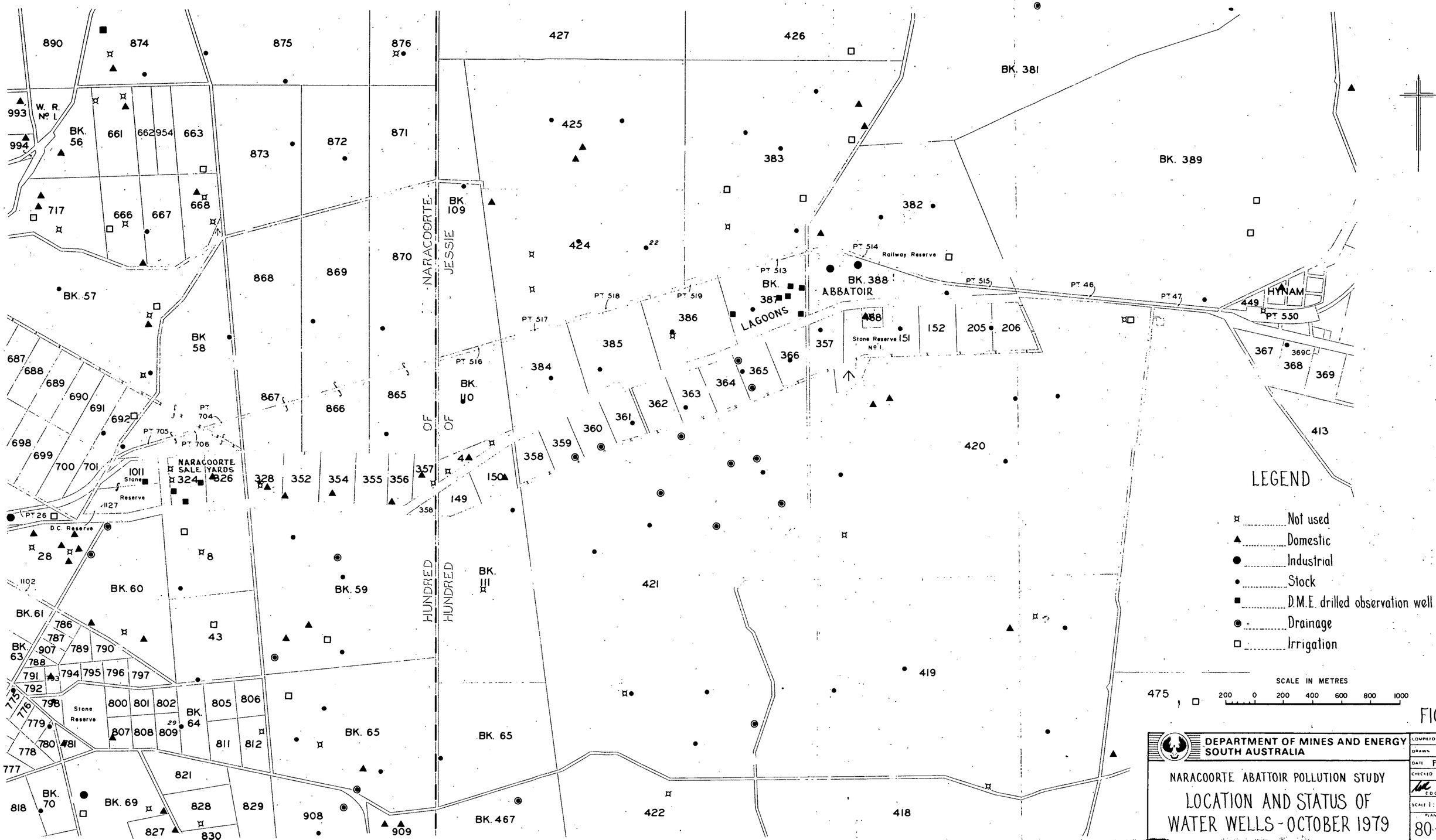


FIG. 4

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

COMPILED D.L.
DRAWN M.R.
DATE FEB. 1980
CHECKED
COO DATE
SCALE 1:20,000
PLAN NUMBER 80-125

NARACOORTE ABATTOIR POLLUTION STUDY

LOCATION AND STATUS OF WATER WELLS - OCTOBER 1979

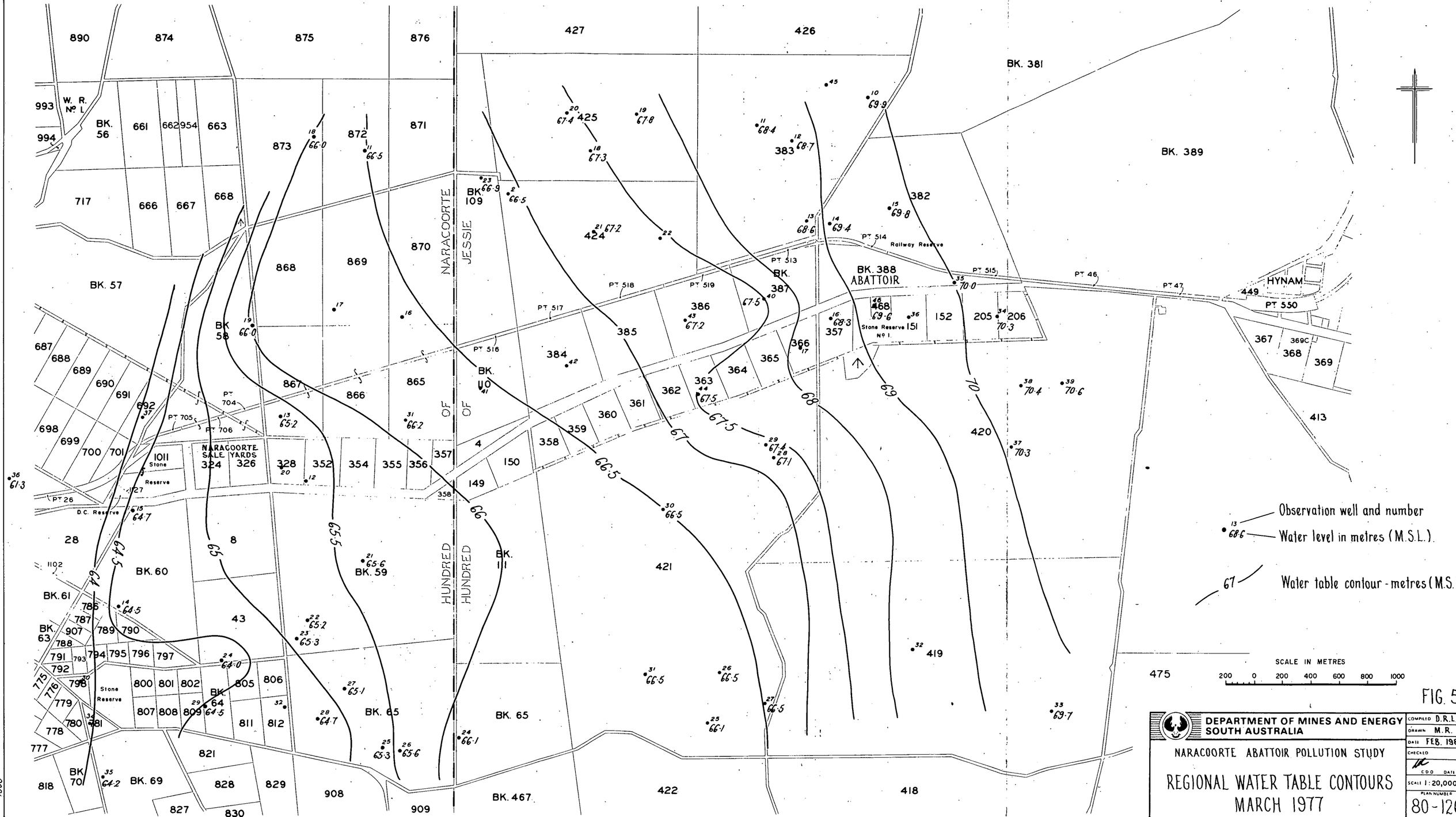


FIG. 5

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NARACOORTE ABATTOIR POLLUTION STUDY

REGIONAL WATER TABLE CONTOURS
MARCH 1977

COMPILED	D.R.L.
DRAWN	M.R.
DATE	FEB. 1980
CHECKED	
C.D.O.	DATE
SCALE	1:20,000
PLAN NUMBER	80-126

1808

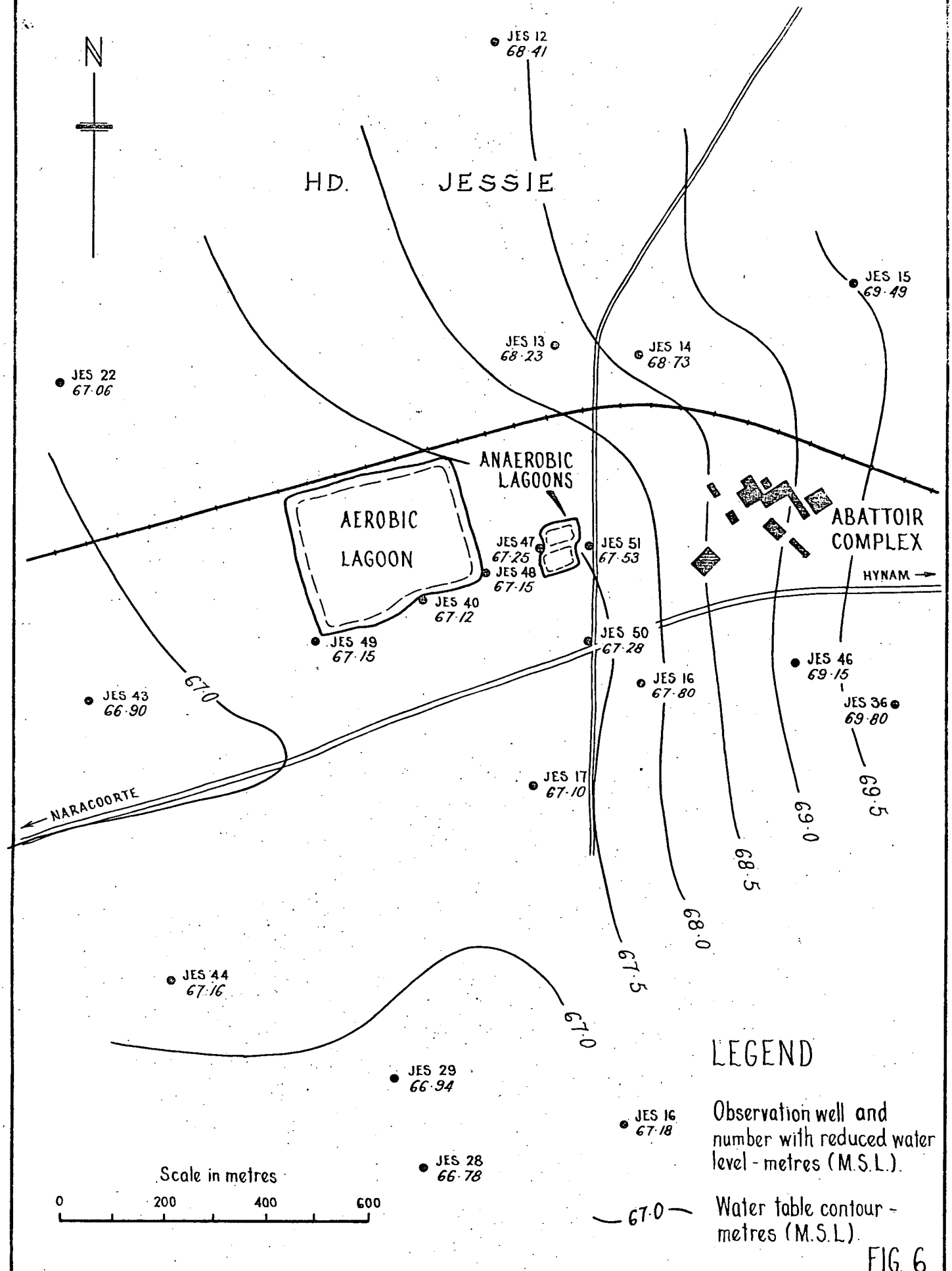


FIG. 6

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE As shown
COMPILED A.F.W.	NARACOORTE ABATTOIR POLLUTION STUDY	DATE Feb. 1980
DRN M.R. CKD	WATER TABLE CONTOURS - FEB. 1978	PLAN NUMBER S 14624

ELEVATION OF WATER TABLE – METRES (M.S.L.)

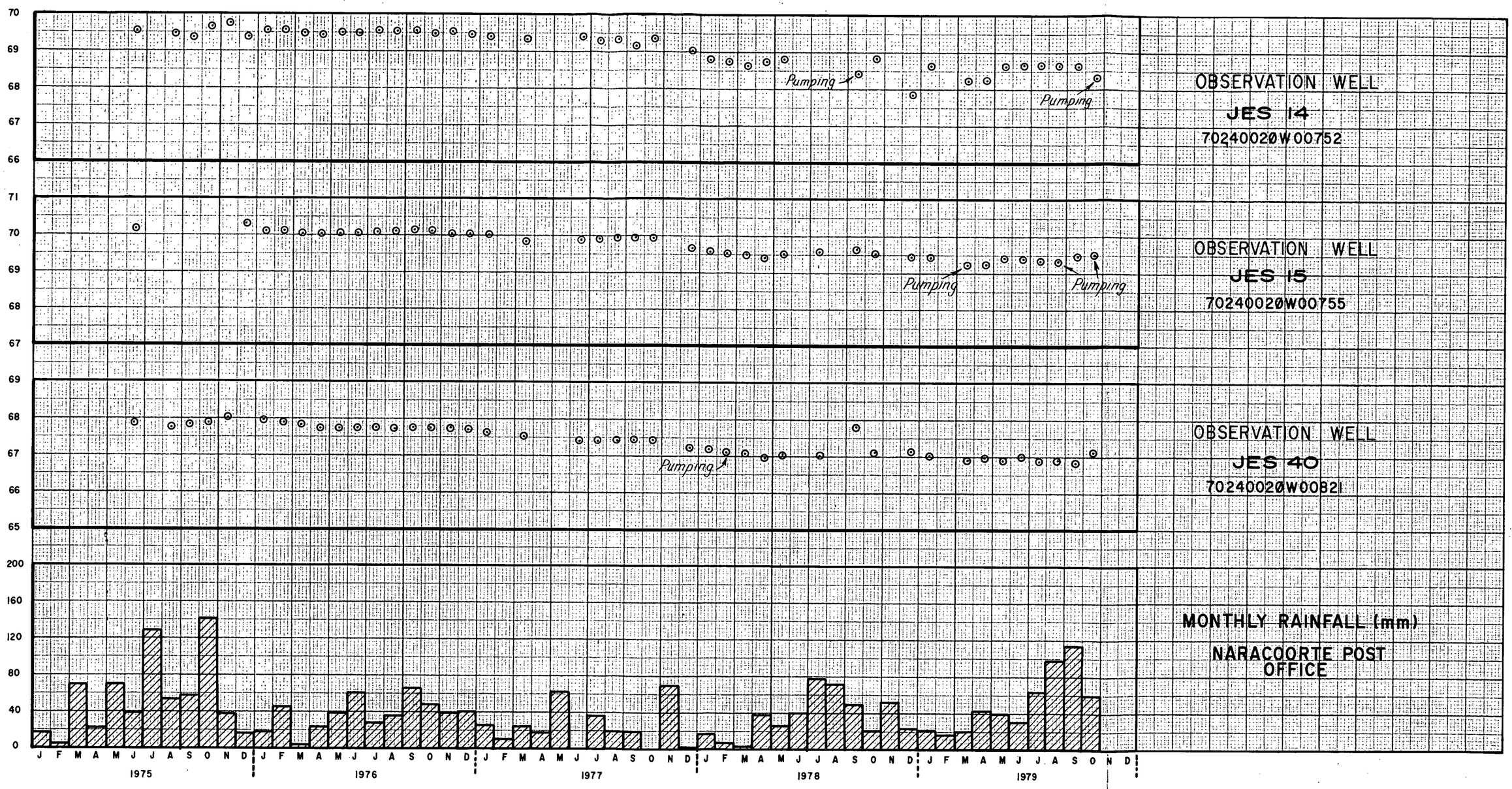
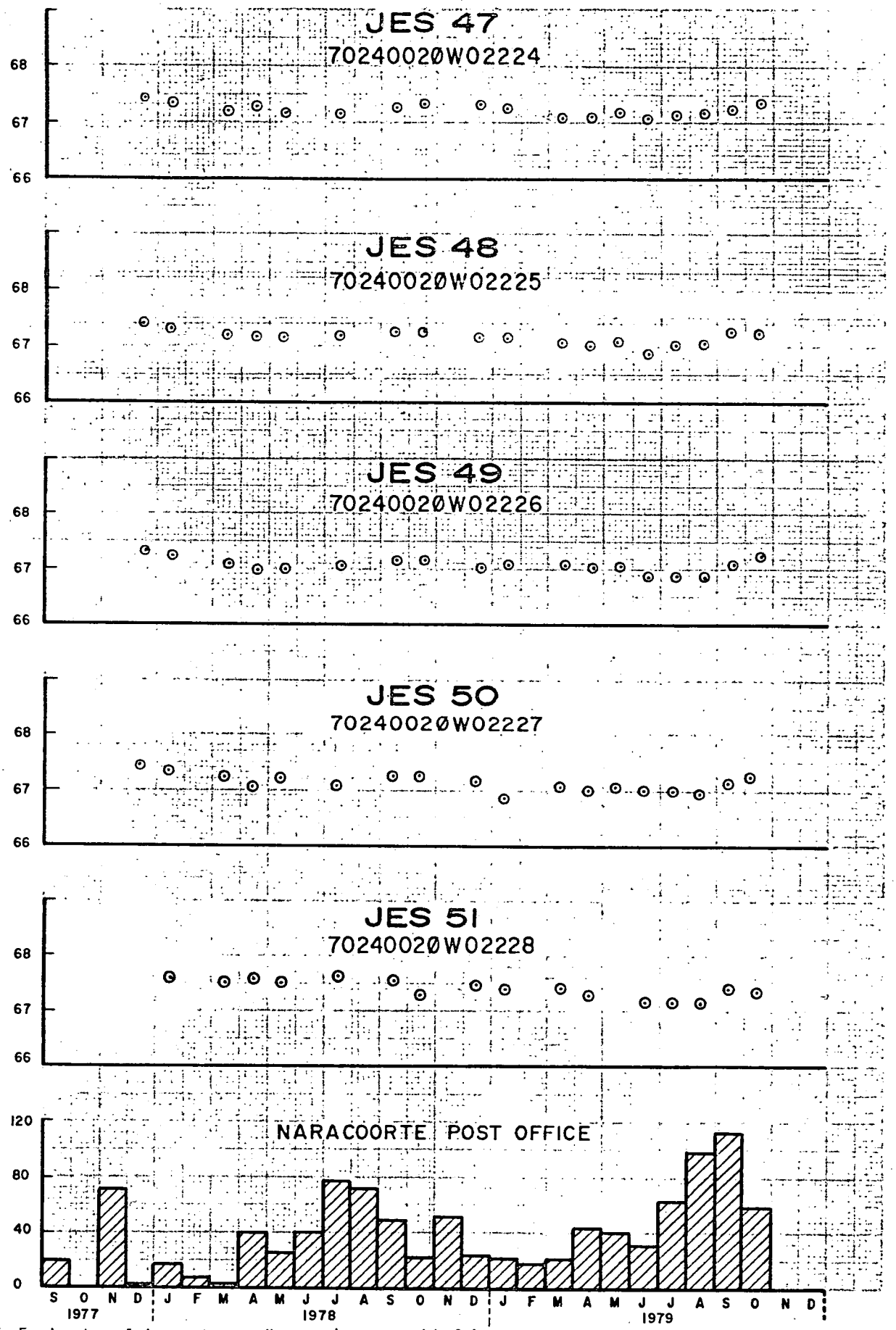


FIG. 7

NOTE :- For location of observation wells, see plan no. S 14624

	DEPARTMENT OF MINES — SOUTH AUSTRALIA	Scale : —
Compiled : F.S.	NARACOORTE ABATTOIR POLLUTION STUDY	Date : Feb. 1980
Drn. M.R. | Ckd	OBSERVATION WELL HYDROGRAPHS	Drg. No.
	JES 14, 15, 40	80 - 127

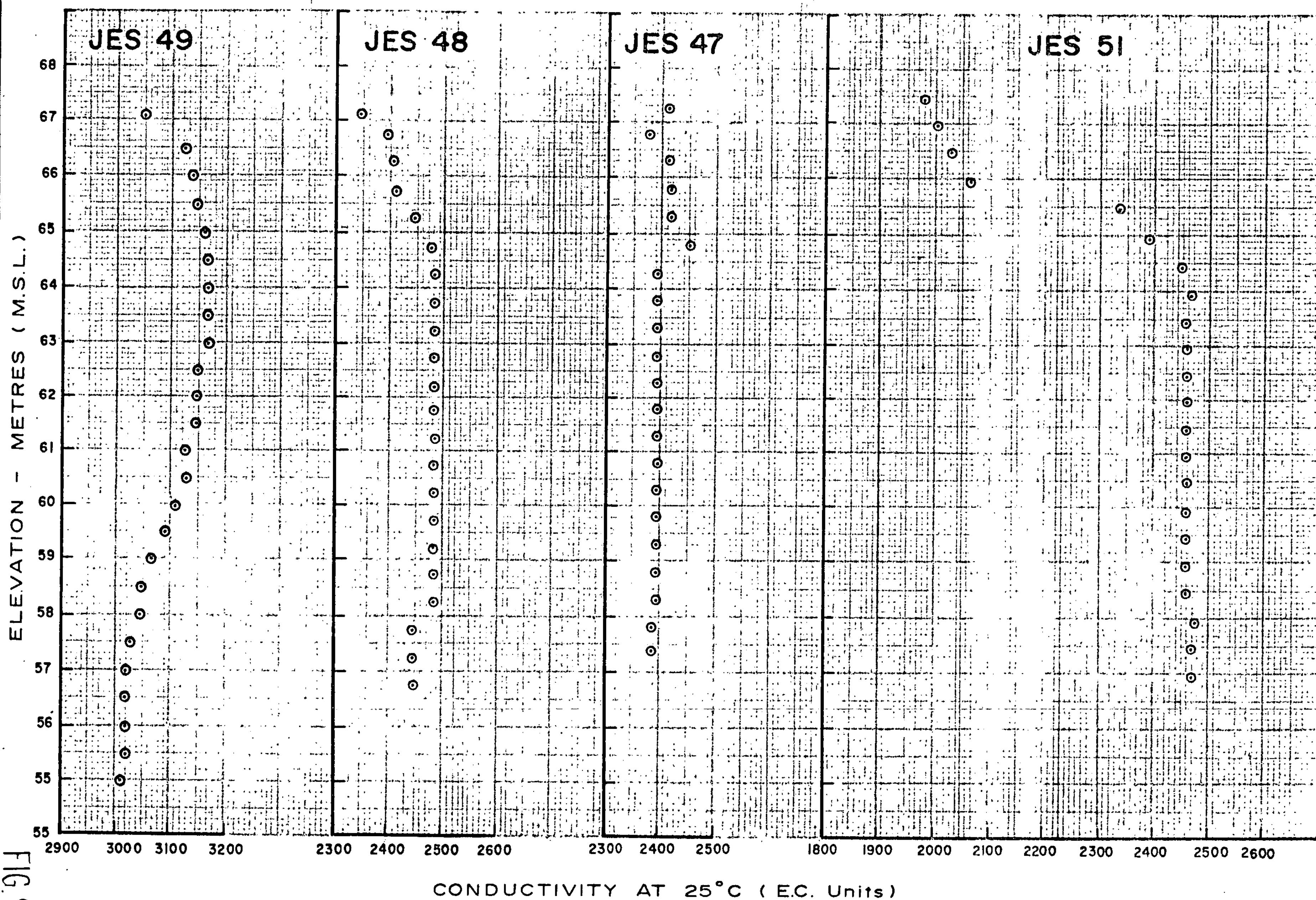
1808



NOTE:- For location of observation wells see plan no. S 14624

FIG. 8

	DEPARTMENT OF MINES AND ENERGY SOUTH AUSTRALIA	SCALE –
COMPILED F.S.	NARACOORTE ABATTOIR POLLUTION STUDY	DATE Feb. 1980
DRN M.R. CKD	OBSERVATION WELL HYDROGRAPHS	PLAN NUMBER
	JES 47 TO JES 51	S 14626



NOTE :- For location of observation wells see plan no. S 14624

Date of profiling 4/4/78

FIG. 9

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

NARACOORTE ABATTOIR POLLUTION STUDY
CONDUCTIVITY PROFILES
OBSERVATION WELLS JES 47, 48, 49, 51

COMPILED	F.S.
DRN	M.R.
CKD	
SCALE	-
DATE	Feb. 1980
PLAN NUMBER	S 14625

APPENDIX A

Stratigraphic Well Logs

A-1

NARACOORTE ABBATOIR DEPARTMENT OF MINES — SOUTH AUSTRALIA
PROJECT: POLLUTION STUDY ENGINEERING DIVISION

BORE LOG

HOLE NO. NG 3
UNIT/STATE NO: 7024002WW02224
SERIAL NO.
FOLDER NO.

LOCATION OR CO-ORDS:
SEC. Bk 387 HD. JESSIE
EL Surface
EL ref. point
Datum

DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	SUPPLY *m³/day	SUPPLY Method of test	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis W. NO.

HOLE Dia. DEPTH m.	CORE	GRAPHIC LOG	DEPTH (m) from	DEPTH (m) to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
			0	0.3	TOPSOIL - silt/sand, organic remains, maghemite pebbles to 10mm. Non calcareous, brown.					
			0.3	0.7	CLAY, well cemented, minor fine quartz. Mottled red, brown, yellow. Calcareous after 0.6m					
1			0.7	1.1	SILT, gravelly, predominantly lime. Soft to hard					
			1.1	2.0	CLAY, calcareous with lime pockets and nodules Friable in part. Less lime, more fine quartz with depth.					
2			2.0	2.9	SAND, fine quartz, clay 0 to 15%, mottled yellow, brown, grey, ferruginous, some CLAY pockets. Moderately well cemented.					
3			2.9	3.5	SAND up to 35% silt, clay mottled, very stiff well cemented. Ferruginous.					
			3.5	6.0	SAND, as for 2.1 to 2.7m, mottled, some clay pockets, ferruginous nodules. Less well cemented than above. Becomes more clayey and tough after 5m.					
4										
5										
6			6.0	9.6	SAND, micaceous, silt, clay-45% qtz fine gr., mottled yellow, pink, grey, brown, red brown. Tough, plastic, well cemented. Minor ferruginous material. Quartz becomes coarser after 9m.					
7										
8										

152mm to 15.69m.

*NOTE: 1000 gals./hr. = 110 m³/day

REMARKS: Permit No. 2352
Detailed Core Description 0 - 10.8m given on p. 3 - 7
Observation Well JES 47

DRILL TYPE c/tool LOGGED BY: AFW
CIRCULATION: Water DATE 6,7,17/10/7
START: 4.10.77 TRACED BY:
FINISH 14.10.77 DATE:
SHEET 1 OF 7

A-2

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABBATOIR POLLUTION STUDY

BORE LOG

CONTINUATION SHEET

HOLE NO. NG 31

UNIT/STATE NO. 7024002WW02224

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
			9.6	10.8	SAND, as for 3.5-6.0, 10-40% clay, quartz fine to medium, coarser after 10.0m. Mottled less well cemented.					
			10.8	12	CLAY, SAND, 50 : 50 - as above					
			12	14	CLAY, sandy with quartz fine to 2-3mm, rest as above. Becomes calcareous below 13m.					
			14	27	LIMESTONE, mainly carbonate grains and few fossil fragments. Silty, clayey probably from above. Fine to medium grained, soft to moderately well cemented. Brownish yellow. 15-16m a.a, little quartz, some shell fragments. 16-20m - as above, large lumps, less silt.			152mm to 15.69m.		
					20-23m, as above, clean, medium to coarse grained soft to hard, mainly fossil fragments orange, yellow.					
					23-24m a.a. slightly silty - shell fragments to 10mm.					
					24-27m a.a. cleaner, some large rock fragments to 20mm. Moderately well cemented.					
			27	29	SAND, 100% carbonate, coarse to gravelly, weakly cemented to uncemented. Some very hard fragments					

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

A-3

HOLE NO NG 31

UNIT/STATE NO: 7024002WW02224

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

CORE DESCRIPTION

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	0		Top-SILT (topsoil), predominantly quartz, some to 2mm. Non calcareous, abundant plant matter. Light to dark brown. Core weakly cemented, breaks easily, little structure, quite porous in part (secondary - burrowing organisms). Fairly dry.
	0.1		Middle- as above, grading to fine quartz SAND with small pockets of the above silt. Some hard ferruginous non magnetic nodules and grains to 3mm. Non calcareous, mottled very pale fawn to mid brown. Core crumbly, friable.
	0.2		Bottom - GRAVELLY SAND, 5% clayey pockets, abundant strongly magnetic maghemite pebbles to 10mm, sub to well rounded. Non calcareous. Mottled very light to mid brown and some yellowish and red brown blotches. Core better cemented than middle section (more clayey). Fewer roots, burrows etc. Damp.
	0.3		Top - as above passing into non calcareous CLAY, sandy pockets as above and maghemite. Colour mottled light brown, grey brown, yellow brown and red brown. Minor organic remains, some burrowing. Core very stiff, well cemented. Damp.
	0.4		Middle - CLAY as above, some fine quartz, mostly red brown with yellow and grey brown mottles. Few sandy pockets only, minor maghemite. Few burrows, roots etc. Some black patches (Fe or Mn?). Core tough, plastic, well cemented. Damp. 20% retained by 75 micron (.075mm) sieve.
	0.5		Bottom - as above, more yellow and grey brown c.f. red. Non calcareous. Noticeably more moist than above.
	0.6		Top - as above, but lime inclusions, small 1mm patches to nodules up to 10mm, soft to well cemented. No maghemite. Moisture as for 0.15 to 0.5m.
	0.7		Middle - as above, passing into a weakly cemented GRAVELLY SILT- predominantly limestone, some marly fraction. Hard pebbles to 15mm. Orange to yellow brown - minor root casts, few burrows. Core weakly cemented, friable. Damp.
	0.8		Bottom - as above
	0.9		Top - as above, some white carbonate.
	1.0		Middle - as above with some yellow grey soft clay pockets _ black stains. Core still friable but slightly better cemented.
	1.1		Bottom - as above but passing into MARL or CALCAREOUS CLAY as clay pockets enlarge. Light to dark orange brown. Pebbly limestone to 15mm. Core better cemented, friable only in calcareous pockets.
	1.2		Top - CLAY, greyish yellow, orange brown, few black stains, non calcareous, fine quartz 20-30% although some to 1mm. Contains large pods of LIMESTONE, silt to gravel

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

A-4

HOLE NO NG 31

UNIT/STATE NO: 7024002WW02224

PROJECT: NARACOORTE ABBATOIR POLLUTION STUDY

CORE DESCRIPTION

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
			size, soft to very hard, similar to that described for 0.75 to 1.05m. No organic remains or burrows. Core well cemented in general but breaks easily through limey zones which are randomly distributed throughout. Moisture as above.
	1.3		Middle, Bottom - as above, but less orange brown.
	1.4		
	1.5		Top - (poor recovery - 60%) - as above, large limestone pockets
			Middle, Bottom - as above
	1.8		Top - as above, 30-40% fine quartz, increasing with depth. Minor carbonate
	1.9		Middle - as above, up to 50% fine quartz, mottled grey, yellow and brown, non calcareous. Core less well cemented, more friable
	2.0		Bottom - as above, SAND, mostly fine quartz, clay to 20 to 30%. Some more clayey pockets.
	2.1		Top - SAND, as above, fine quartz, 10-20% clay and silt. Non calcareous. Yellow brown and grey mottling. Nodules and concretions of non magnetic ironstone, black to dark brown. Core cemented, partly friable, damp.
	2.2		Middle - as above, less clay with depth.
	2.3		Bottom - SAND, no clay, minor silt, rest as above. Core weakly cemented breaks easily along grain boundaries.
	2.4		Top - as above, some red brown iron staining. Moisture content slightly greater - almost moist in places
			Middle - as above, 5-10% clay and silt, some in pockets. 70% retained by 75 micron (0.075mm) sieve.
	2.6		Bottom - as above
	2.7		Top - as above, up to 10-15% clay
			Middle - as above, more clayey. Core better cemented, stiff.
	2.9		Bottom - as above passing into mottled non calcareous CLAY, pockets of sand as above. Clay very quartzose with

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

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HOLE NO NG 31

UNIT/STATE NO: 7024002WW02224

PROJECT: NARACOORTE ABBATOIR POLLUTION STUDY

CORE DESCRIPTION

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
			grains to 2mm, poorly sorted. Core very stiff, well cemented, similar to 0.3 to 0.6m. No secondary porosity.
	3.1		Top - as above, some pockets of coarse quartz sandy clay, red brown, yellow, brown and grey mottling. Few ferruginous nodules. Core very stiff, well cemented.
			Middle, Bottom - as above.
	3.3		Top - SAND, some quartz to 3mm, few calcareous grains, mainly red brown with some grey and yellow brown mottles. Core well cemented but breaks more easily than above. 65% retained by 75 micron (0.075mm) sieve
	3.4		Middle - as above, some quartz and ironstone pebbles to 10mm.
	3.5		Bottom - as above Yellow red brown mottled, clay, silt to 20% but some more clayey pockets Minor coarse quartz only. Core as above, slightly more friable.
	3.6		Top, Middle, Bottom - as above, clayey SAND, few ferruginous nodules.
	3.9		Top - as above, passing into less clayey sand (5-10% at max). Still pockets of slightly more clayey sand as for 3.6-3.9m. Middle, Bottom - as above
	4.2		Top, Middle - as above. 75% retained by 75 micron (0.075mm) sieve in sample 4.3-4.4m
	4.4		Bottom - as above, mottling changing to pink, grey and yellow brown and little clay (few patches with 10-15%).
	4.5		Top as above, red brown cf. pink in mottling. Core moderately well cemented, partly friable.
	4.6		Middle - as above
	4.7		Bottom - as above, pink, red brown etc.
	4.8		Top as above
	4.9		Middle as above - more friable
	5.0		Bottom as above, no pink or red brown mottling. Nodules of dark brown non magnetic ironstone. Clayey as for 4.5 - 4.8m.
	5.1		Top - as above, minor ironstone. 75% retained by 75 micron (0.075mm) sieve.
	5.2		Middle - as above, slightly more friable core.
	5.3		Bottom - as above, clay fraction 20-30%. Core extremely tough, well cemented
	5.4		Top (core recovery - 60%) - as above, variable clay pockets, mottling mainly yellow brown and grey. Core tough-well cemented.
	5.5		extremely stiff. Middle, Bottom - as above

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ENGINEERING DIVISION

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HOLE NO NG 31

UNIT/STATE NO: 7022002WW02224

PROJECT: NARACOORTE ABBATOIR POLLUTION STUDY

CORE DESCRIPTION

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	5.7		Top - as above, abundant mottles of brown ferruginous material, some quite hard nodules. Clay varies 5-10% to maximum of 15-20% in pockets.
	5.8		Middle - as above, nodlues to 10-15mm, very hard, non magnetic.
	5.9		Bottom - as above, no pink mottling. Core slightly more friable than above
	6.0		Top - SAND more clayey,, micaceous, fine to occasionally coarse (3mm) quartz and white non calcareous grains - probably felspar (show cleavage). Mottled brown yellow pink and grey - more variable than above. Core very tough, plastic, stiff.
	6.1		Middle, Bottom - as above
	6.2		
	6.3		Top, Middle, Bottom - all as above, rounded weathered felspar grains and quartz grains to 3-4mm. Irregular patches and layers (lenses and stringers of lighter material in darker main mass). 60% retained on 75 micron (0.075mm) sieve in 6.3-6.4m interval.
	6.6		All as above
	7.1		
	7.6		60% retained on 75 micron (0.075mm) sieve in 7.6 - 7.7m interval.
	8.1		Top (recovery 60%) some nodular ferruginous material
	8.2		Middle, Bottom, as above
	8.3		
	8.4		Top, Middle, Bottom - as above, minor ferruginous material
	8.7		Top, Middle, Bottom - as above, very little pink or red brown colour, mostly yellow brown, some grey some ferruginous stains - irregular patches of light grey sandy clay.
	8.8		55% retained on 75 micron (0.075mm) sieve in 8.8 - 8.9m interval.
	8.9		
	9.0		Top (recovery 60%) - as above 50% - mottled red brown, brown, yellow, grey, fine to coarse quartz. Core more friable.
	9.1		Middle, Bottom - as above but quartz up to 2-3mm, micaceous, felspathic as above. Core friable as 9.0-9.1m
	9.2		

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

A-7

HOLE NO NG 31

UNIT/STATE NO: 7024002WW02224

PROJECT: NARACOORTE ABBATOIR POLLUTION STUDY

CORE DESCRIPTION

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	9.4		Top - as above, red brown, yellow and brown, 2-3% felspar and mica. Middle, Bottom - grey in mottling also.
	9.6		Top - as above, SAND, 20-30% clay, rest as above but quartz fine to medium grained. Middle - SAND, clayey, as above mainly yellow brown and grey mottled. Bottom - as above
	9.9		Top - as above, passing into coarser clayey sand - similar to quartz in 9.3-9.6 interval but core more friable, less well cemented.
	10.0		Middle - clayey coarse grained quartz sand as above.
	10.1		Bottom - as above, less clay - 15-20% cf 30-40% as above
	10.2		Top - as above
	10.3		Middle - as above, passing into generally finer grained sand and grey yellow brown and red brown mottled. Poorly sorted with grains fine to 4mm.
	10.4		Bottom - as above.
	10.5		Top- as for top 10.2-10.5, coarse. 70% retained on 75 micron (0.075mm) sieve.
	10.6		Middle - as for bottom 10.2-10.5 but 20-30% clay
	10.7		Bottom - as above, silty & clayey pods.
			END OF CORE SAMPLES - 10.8m

A-8

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

BORE LOG

HOLE NO. NG 32
UNIT/STATE NO: 7024002WW02225
SERIAL NO:
FOLDER NO.

LOCATION OR CO-ORDS:

SEC. Bk 387 HD. JESSIE

EL Surface
EL ref. point
Datum

DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	SUPPLY *m³/day	SUPPLY Method of test	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis W. NO.

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	DEPTH (m) to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
0.25			0	0.3	TOPSOIL - mixture of CLAY, 10-15% fine quartz grey, red brown mottled, non calcareous, reasonably well cemented and SAND, silty 10% fine to coarse grained quartz subangular. Minor organic material. Dry					
0.5			0.3	2.0	CLAY, non calcareous, silty, sticky, abundant quartz silt size to medium grained, Fawn.					
1.0					1-2m as above, very sandy, carbonate fragments silt size to fragments of 10mm. Brownish grey					
			2	13	SAND, silt size to coarse grained quartz, 30% clay, silt. Very slightly calcareous, weakly cemented, pale brown. 3-4m as above, non - calcareous, 10-20% clay. Pale orange brown.			203mm to 4.9m		
					4-5m as above, some carbonate grains (from above?)					
5					5-6m as above, non calcareous					
					6-10m as above, few fragments of ironstone (non maghetic) to 5mm. 15-25% clay. Mottled red brown and grey.			152mm to 14.93m		
10					10-11m as above, 30% clay, yellow brown in colour.					

*NOTE: 1000 gals./hr. = 110 m³/day

REMARKS

Permit No. 2352
Observation Well JES 48

DRILL TYPE C/tool	LOGGED BY: AFW
CIRCULATION Water	DATE: 31·10·77
START: 17·10·77	TRACED BY:
FINISH: 20·10·77	DATE:
SHEET 1 OF 2	

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

BORE LOG

CONTINUATION SHEET

A-9

HOLE NO: G 32

UNIT/STATE NO: 7024002WW02225

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
					11-12m as above, some fine grained well cemented yellow limestone fragments.					
					12-13m as above, could be individual fragments in clayey sand.					
			13	29	LIMESTONE, silty 10-15% quartz, fine to medium grained, moderately to well cemented, fossiliferous with bryozoal & shell fragments forams. At 14-15m, some ferruginous fragments and sandy clay, possibly from above. 15-16m as above, 15% silt, slightly sticky, no ironstone. Softer than above.			152mm to 14.93m.		
15					16-18m as above, poorly to moderately well cemented.					
					18-19m as above, well cemented. Large fragments to 30mm showing solution features.					
					19-20m as above, dark yellow brown.					
20					20-21m as above, quartz less than 5%, less well cemented.					
					21-25m, some fine grained, very hard material					
25					25-26m as above, generally coarser grained					
					26-27m as for 21-15m					
					27-29m as above, better cemented, finer grained.					
					END OF HOLE - 29m					
30										

DEPARTMENT OF MINES SOUTH AUSTRALIA

HYDROGEOLOGY SECTION

BORE LOG

HIRER E. & W. S. DEPT.

Drill type Cable tool
Circulation Water
Driller A.H. Anderson
Start 21.10.77
Finish 28.10.77

Logged by A.F.W.
Date logged 24/10/77
Bore Diameter 152mm
DEPTH 29m

A.M.G. Zone
Coords. E
" N
Datum Elev.
(m) Ref. Pt. Elev.
Surface Elev.

HUNDRED JESSIE
SECTION Bk 387
STATE No. 7024002WW02226
Project No NG 33
Docket No.
Bore Serial No.

Depth to Water cut m	Depth to standing water (m)	SUPPLY		TOTAL DISSOLVED SOLIDS	
		litres/sec.	Method of test	Milligrammes/litre	Analysis W No.
19.00	16.65				

REMARKS

Permit No. 2352 = Observation Well JES 49
S.W.L. on 6/12/77 : 17.19m

CASING | WATERS CUT | WATER LEVEL | DEPTH (m) | CORE | GRAPHIC LOG | AGE | UNIT

DEPTH (m) from	to	DESCRIPTION
0	0.5	SAND, TOPSOIL: quartz, fine gr., maghemite 15mm, weakly cemented. 10-15% clay 0.4-0.5
0.5	1.8	CLAY: up to 30-40% quartz (fine), mottled grey yellow and red brown. Well cemented Calcareous pockets 1.0-1.5m
1.8	14	SAND: 10% clay, rest fine grained quartz Some pockets 40-50%, non-calcareous, mott-led red brown, yellow, grey. Friable core. Some med. quartz after 2.4m. Clay to 30% in places and core better cemented. Vertical layering (ferruginous)
		4.2-10.3. Carbonaceous? material 6-6.4. Few calcareous and ferruginous grains 6.9-7.2m

152mm to 16.77m

Detailed core description on pgs. 3.4.5/5.

Drn: | Sheet 1 of 5
Date. | Bore Folder No.

PF No S10537 MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

BORE LOG

CONTINUATION SHEET

A-11

HOLE NO. NG 33

UNIT/STATE NO: 7024002WW02226

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
					13-14m as above, passing into fine grained limestone, probably pebbles and boulders in sand. Clayey.			152mm to 16.77m		
			14	15	CLAY: mottled grey and yellow brown, calcareous and contains ironstone fragments.					
			15	29	Passes into limestone, fine to med. grained, bryozoal, shell fragments, forams. Yellow brown. 10-15% silt and light brownish yellow 15-18m					
					18-19m as above, slightly better cemented, cleaner and silt less than 5%.					
					19-20m as above, some fine grained, well cemented material					
					20-21m, softer, less cemented than above.					
					21-22m as above but cleaner, coarse grained, soft to well cemented.					
					22-24m as above, medium to coarse grained.					
					24-25m as above, fine grained very hard to coarse grained, soft.					
					25-26m as for 23-24m					
					26-28m as for 24-25m					
					28-29m as above, mainly fine to medium grained					
					END OF HOLE: 29m					

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

CORE DESCRIPTION

A-12

HOLE NO NG 33
UNIT/STATE NO: 7024002WW02226

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
			Top:SAND (topsoil), quartz, mainly fine grained with minor coarse fraction. 5% silt, abundant organic matter, non calcareous, pale grey brown. Core soft, weakly cemented, dry.
	0.1		Middle: as above, less moisture.
	0.2		Bottom: as above, contains maghemite to 10mm. Core more friable
	0.3	Fe	Top : as above, maghemite pebbles to 15mm (20-30%), weakly calcareous. Core completely breaks down.
	0.4	Fe	Middle: as above, but 10-15% clay, mottled yellow and pale grey brown. Core weakly cemented, breaks easily but not as friable as above.
	0.5	Fe	Bottom: CLAY 10-20% fine grained quartz as above, non calcareous minor rootlets. Mottled grey, yellow and red brown. Core tough very well cemented.
	0.6	Fe	Top: as above 40-50% fine quartz, 1-2% maghemite to 15mm, non calcareous, yellow brown. Core tough as for 0.5-0.6m
	0.7		Middle: as above.. 45% retained on 75 micron (0.075mm) sieve
	0.8		Bottom: as above
	0.9	Fe	Top: as above
	1.0		Middle: as above with large pockets of lime which varies from a fine loosely cemented silt to hard well cemented pebbles to 20mm. Core cemented as above except friable across lime pockets. Pockets appear discontinuous.
	1.1		Bottom: as above, some black stains (manganese?), no maghemite but few ferruginous pebbles.
	1.2		Top: as above, few lime pockets, mottled yellow and orange brown
	1.3		Middle, Bottom: as above
	1.5		Top; as above, 20-30% quartz, non calcareous, core extremely well cemented, tough, stiff.
	1.6		Middle, Bottom: as above
	1.8		Top: as above, passing into SAND, as above, 10% clay with some pockets 40-50%. Non calcareous, mottled red brown, light grey, yellow. Core friable but moderately cemented in clayey pockets.
	1.9		Middle, Bottom: as above
	2.1		Top, middle: as above. 65% retained on 75 micron (0.075mm) sieve in 2.2 to 2.3 m interval.
	2.3		Bottom: as above, predominantly red brown colour in mottling.
	2.4		Top: as above, 10-15% medium grained quartz mottled light yellow grey and pink.

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

CORE DESCRIPTION

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HOLE NO NG 33
UNIT/STATE NO: 7024002WW02226

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	2.5		Middle, Bottom : as above
	2.7		Top : as above, 20-30% clay. Core better cemented, tough.
	2.8		Middle, Bottom : as above
	3.0		Top : only 60% recovery. As above for 2.4-2.7 - clay less than 10%, few more clayey pockets. Mottled light grey, yellow, pink. Core weakly cemented, friable as for 2.4-2.7.
	3.1		Middle, Bottom : as above.
	3.3	Fe	Top : as above, few dark brown ferruginous pockets.
			Middle : as above but 15-20% clay. Core slightly better cemented. 65% retained on 75 micron (0.075mm) sieve.
	3.5		Bottom : as above 3.3-3.4
	3.6		Top : as above, quartz fine to medium grained, few pockets with 20-30% clay. Core weakly cemented, friable.
	3.7		Middle : slightly more clayey, mainly yellow grey, brown mottled. Core better cemented.
	3.8		Bottom : as above, mainly grey and pink mottling.
	3.9		Top : as above, grey, yellow and pink brown mottling, 5-10% clay, some white grains, probably felspar. Core cemented as above.
	4.0		Middle, Bottom : as above.
	4.2		Top : as above, predominantly pink brown and grey mottling. Layering apparently parallel to core axis (vertical)
	4.3		Middle, Bottom : as above. 80% retained on 75 micron (0.075mm) sieve in 4.4 to 4.5m interval.
	4.5		Top, Middle, Bottom : as above.
	4.8		Top ; as above, very few clay pockets; layering as above. Yellow pink and grey mottled.
	4.9		Middle, Bottom : as above
	5.1		Top, Middle, Bottom : as above, some brown layering.
	5.4		Top, Middle, Bottom : as above, some brown layering. 85% retained on 75 micron (0.075mm) sieve in 5.5 to 5.6m interval
	5.7		Top : as above, core slightly better cemented than above.
	5.8		Middle : as above, slightly more clayey. Vertical layering. Orange brown yellow and grey mottling.
	5.9		Bottom : as above
	6.0		Top : as above, mainly grey yellow, orange mottling. Layering. Some dark brown?carbonaceous material.

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

A-14

HOLE NO NG 33
UNIT/STATE NO: 7024002WW0222G

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

CORE DESCRIPTION

CORE Dia. DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
6.1		Middle, Bottom : as above
6.3		Top : as above, becoming more clayey (15-20%). Again ? carbonaceous material.
6.4		Middle, Bottom : as above
6.6		Top : as above, 10-15% clay, grey, pale pink, yellow and dark brown mottling. No ? carbonaceous matter.
		Middle: as above, no dark brown colour
6.8		Bottom : as above
6.9		Top : as for 5.4-5.7m. Pink and grey mottling. Non calcareous, no Fe grains. Core criss cross by irregular yellow ferruginous laminae
		Middle, Bottom : as above
7.2		Top : as above yellow grey and pink mottling. Non calcareous, no Fe grains. Few coarse grains to 1mm and ferruginous grains.
7.3		Middle, Bottom : as above
7.5		Top : as above mainly grey and pink
7.6		Middle: as above. 75% retained on 75 micron (0.075) sieve.
7.7		Bottom : as above, 10-15% clay. Core better cemented than above.
7.8		Top : as above, grey pink, yellow, dark brown mottling.
7.9		Middle, Bottom : as above.
8.1		Top : as above, yellow pink and grey mottled. Core breaks more easily.
8.2		Middle : some irregular laminae as before.
8.3		Bottom : as above
8.4		All as above. 80% retained on 75 micron (o.075mm) sieve in 8.5 to 8.6m interval.
8.7		All as above
9.0		Top : as above, mainly grey with pink yellow and brown mottling.
9.1		Middle, Bottom : as above
9.3		Top : as above more yellow brown mottling than above.
9.4		Middle: Bottom, as above. 80% retained on 75 micron (0.075mm) sieve in 9.4 to 9.5m interval.
9.6		All as above
10.3		

DEPARTMENT OF MINES SOUTH AUSTRALIA

HYDROGEOLOGY SECTION

BORE LOG

HIRER E. & W. S. DEPT.

Drill type Cable tool
Circulation Water
Driller W. Kahl
Start 1.11.77
Finish 4.11.77

Logged by A.F.W.
Date logged 7.11.77
Bore Diameter 152mm
DEPTH 30m

A.M.G. Zone
Coords. E
" N
Datum Elev.
(m) Ref. Pt. Elev.
Surface Elev.

HUNDRED JESSIE
SECTION BK 387
STATE No. 7024002WW02227
Project No. NG 34
Docket No.
Bore Serial No.

Depth to Water cut (m)	Depth to standing water (m)	SUPPLY		TOTAL DISSOLVED SOLIDS	
		litres/sec.	Method of test	Milligrammes/litre	Analysis W. No.
20.00	19.45				

REMARKS NARACOORTE ABATTOIR POLLUTION STUDY
PERMIT NO. 2352
OBSERVATION WELL JES 50

CASING | WATERS CUT | WATER LEVEL | DEPTH (m) | CORE | GRAPHIC LOG | AGE | UNIT

152mm to 14.68m

DEPTH (m) from	to	DESCRIPTION
0	0.5	SAND:(topsoil), fine to coarse quartz, subangular pebbles from 3-15mm of well rounded ironstone, some maghemite, 10% silt. Non calcareous, greyish brown.
0.5	1.0	CLAY: slightly calcareous, some ironstone as above, 30-40% quartz, sticky, pale orange brown.
1.0	4.0	SAND: fine grained quartz, 30-40% clay, sticky, some fragments of fine grained limestone. Pale yellow brown.
		2-4m as above, 45-50% clay in parts, few ironstone fragments. Slightly calcareous. Orange brown. Non calcareous after 3m.
4.0	5.0	SILT: 30% fine to coarse grained quartz, 10-20% clay. Non calcareous, orange brown.
5.0	7.0	SAND, fine to coarse grained quartz, 25-35% clay, mottled red brown, grey and yellow.
7.0	8.0	SILT as for 4-5m, 15-25% clay.
8.0	11.0	CLAY: 30-40% fine to gritty quartz, sticky pale yellow brown, non calcareous.
		9-11m as above, up to 50% sand in part. Frags. of sandy limestone-hard, well cemented and composed of fine to med. grained quartz and carbonate grains.

Drn:	Sheet 1 of 2
Date:	Bore Folder No.

PF Nº S10537 MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

BORE LOG

CONTINUATION SHEET

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HOLE NO. NG 34

UNIT/STATE NO: 7024002WW02227

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
			11.0	30.0	LIMESTONE: 15% fine to med. quartz, rest carbonate grains, shell and bryozoal frags. foraams, 10% silt. Moderately well cemented. 12-14m as above, but better cemented 14-15m as above, coarse grained, some frags. to 5mm. Some dark red brown clay (infilling solution cavity?), soft to moderately well cemented. 15-16m as above, 12-13m - no clay 16-17m as above, 20-25% silt 17-19m as above, softer 19-20m as for 15-16m, some large shell frags. and silty 10-15% 20-21m soft (as for 14-15m) to well cemented (as for 11-12m). Shells & bryozoa to 5mm. 21-22m as for 14-15m 22-26m as for 20-21m 26-27m, some fine grained very hard material. 27-28m as for 22-26m 28-29m as for 26-27m 29-30m as above, mainly well cemented. END OF HOLE: 30m			152mm to 14.68m.		

SHEET 2 OF 2

DEPARTMENT OF MINES SOUTH AUSTRALIA

HYDROGEOLOGY SECTION

A-17

BORE LOG

HIRER E. & W. S. DEPT.

Drill type Cable Tool
Circulation Water
Driller A.H. ANDERSON
Start 7/11/77
Finish 15/11/77

Logged by GAH/RJF
Date logged 18/11/77
Bore Diameter 152mm
DEPTH 32m

A.M.G. Zone
Coords. E
" N
Datum Elev.
(m) Ref. Pt. Elev.
Surface Elev.

HUNDRED JESSIE
SECTION BK 387
STATE No. 7024002WW02228
Project No. NG 35
Docket No.
Bore Serial No.

Depth to Water cut im	Depth to standing water (m)	SUPPLY		TOTAL DISSOLVED SOLIDS	
		litres/sec.	Method of test	Milligrammes/litre	Analysis W No.
22.0	20.83				

REMARKS

Permit No. 2352 - OBSERVATION WELL JES 51
NARACOORTE ABATTOIRS POLLUTION STUDY

CASING | WATERS CUT | WATER LEVEL | DEPTH (m) | CORE | GRAPHIC LOG | AGE | UNIT

152mm to 3.25m.

DEPTH (m) from	to	DESCRIPTION
0	0.3	TOPSOIL: Silt/sand passing into clay fine to coarse quartz. 30-40% silt. Organic remains. Non calcareous. Poorly cemented. Brown to red brown.
0.3	1.5	CLAY: Red brown, non calcareous, shows slicken-side affects. Some maghemite pebbles to 5mm. Moderately cemented. 20% fine quartz. 0.6-0.9 as above. mottled red brown, bit of yellow. Very slightly calcareous. 0.9-1.2 as above, some black material ? charcoal. Contains some irregular layering. 1.2-1.5 as above, passing into mixture of CLAY & LIMESTONE latter soft, rubbly to hard, dense, fine grained material. Cream to brown.
1.5	1.55	CLAY as above with some limestone pockets.
1.55	2.0	LIMESTONE: see below
2.0	5.0	CAVITY: in limestone
5.0	32.0	LIMESTONE: med. to coarse, sub-angular carbonate grains, bryozoal, shell frags & forams. 5% med. to coarse, clear & rose quartz, subrounded. Mod. cemented. Minor silt and Fe frags. Light brown to tan. 6-7m as above, carbonate grains are fine to coarse some well cemented. <5% quartz. 10% light brown silt. 7-8m as above, hard, fine grained carbonate. Some Fe staining. 10% quartz. 8-9m as above, 20% orange silt. Overall fine to med. grained. Orange brown.

Detailed core description 0-1.55m given on p. 3,4-4.

Drn: | Sheet 1 of 4
Date: | Bore Folder No.

PF No S10537 MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT NARACOORTE ABATTOIR POLLUTION STUDY

BORE LOG

CONTINUATION SHEET

A-18

HOLE NO. NG 35

UNIT/STATE NO: 7024002WW02228

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL

9-10m, as for 7-8m interval, but still 20% silt.

10-12m, as above, fine to med. grained, 15-20% fine, subangular, milky quartz. Moderately to well cemented. Light brown.

12-13m, as above, yellow to brown. 20-30% silt. 10% qtz. Less fossils. Mod. cemented.

13-14m as above, weaker cementing. Pale yellow to orange.

14-15m as above, dominantly fine grained overall.

15-16m as above. 30% yellow to brown silt. Weakly to well cemented.

16-17m as above, fawn, 30-40% yellow silt. Weakly cemented.

17-18m as above, 40-50% silt. Cream to yellow.

18-19m as for 7-8m interval, Fe pebbles to 4mm.

19-20m as for 16-17m interval, weak to moderate cementing. Tan.

20-21m as above, fine to coarse. Well cemented. 10-20% silt. Fawn.

21-22m as above, 5% fine, clear/milky quartz.

22-23m as above, becoming more fossiliferous. Weakly cemented.

23-24m as above, some grains well cemented.

24-25m as above, light brown. Fine to medium carbonate. Moderately cemented.

25-26m as above, generally fine grained. Very calcareous. Non cemented. Fawn.

26-27m as above, pale yellow to fawn. 10% fine quartz.

27-28m as above, all fine to medium grained. Very fossiliferous.

28-29m as above, some grains well cemented.

29-30m as above, 20% silt.

30-31m as above, hard fine grained well cemented limestone, very dense. Shell frags. to 8mm 5% silt. Minor fine glauconite chips.

31-32m as above, fine to coarse carbonate grains, 30% silt. Mod.-well cemented. Fawn to pale yellow.

END OF HOLE 32m

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

CORE DESCRIPTION

A-19

HOLE NO NG 35

UNIT/STATE NO: 7024002WW02228

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	0		TOP: SAND (topsoil) fine to coarse grained quartz. 30-40% SILT. 10-15% CLAY. Non calcareous. Abundant organic remains. Brown. Core friable but weakly cemented.
	0.1		MIDDLE: as above passing into CLAY, non calcareous, organic remains. 20% fine quartz. Red brown. Core cemented as above.
	0.2		BOTTOM: as above
	0.3		TOP: CLAY as above, shows signs of slickenside. Some pebbles of maghemite and Fe up to 5mm. Core friable but breaks into larger fragments.
	0.4		MIDDLE: as above, core less friable and shows abundant slickenside
	0.5		BOTTOM: as above
	0.6		TOP: as above, mottled red brown, bit of yellow. Very slightly calcareous.
	0.7		MIDDLE: as above
	0.8		BOTTOM: as above
	0.9		TOP: as above, some black material ? charcoal. Core breaks less easily than above and contains some irregular layering.
	1.0		MIDDLE: as above.
	1.1		BOTTOM: as above
	1.2		TOP: as above

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIR POLLUTION STUDY

CORE DESCRIPTION

A-20

HOLE NO DG 35

UNIT/STATE NO: 7024002WW02228

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	1.3		MIDDLE: as above
	1.4		BOTTOM: as above, passing into mixture of CLAY or LIMESTONE which varies from soft, silty, rubbly to hard, dense, fine grained material. Cream to brown.
	1.5		CLAY: as above, with some LIMESTONE pockets.
	1.55		END OF CORE SAMPLES 1.55m

DEPARTMENT OF MINES SOUTH AUSTRALIA

HYDROGEOLOGY SECTION

A-21

BORE LOG

HIRER E. & W. S. DEPT.

Drill type Cable tool
Circulation Water
Driller W.E. Kahl
Start 16.11.77
Finish 18.11.77

Logged by GAM/RJF
Date logged 21/11, 6.12.77
Bore Diameter 152mm
DEPTH 10m

A.M.G. Zone
Coords. E
N
Datum Elev.
(m) Ref. Pt. Elev.
Surface Elev.

HUNDRED JESSIE
SECTION BK 387
STATE No. 7024002WW02229
Project No. NG 36
Docket No.
Bore Serial No.

Depth to Water cut (m)	Depth to standing water (m)	SUPPLY		TOTAL DISSOLVED SOLIDS	
		litres/sec.	Method of test	Milligrammes/litre	Analysis W. No.

REMARKS Permit No. 2352. Naracoorte Abattoir Pollution Study. Well was backfilled and abandoned

CASING | WATERS CUT | WATER LEVEL | DEPTH (m) | CORE | GRAPHIC LOG | AGE | UNIT

DEPTH (m) from	to	DESCRIPTION
0	0.7	SAND, fine to coarse, subang. to subround qtz. Frags. of white cemented carbonate 20-30% silt. Abundant organic material. Light to mid brown. 0.3-0.7 as above, abundant Fe and maghemite pebbles to 10mm. 50% silt passing into non-calcareous clay.
0.7	1.4	CLAY firm, mottled red brown, orange and yellow. Some irregular layering & slicken-side affects. 20-30% medium qtz decreases with depth. Fe & maghemite pebbles to 3mm. Strongly cemented. 1.3-1.4 as above, passing into limestone varying from soft, silty to hard dense material.
1.4	10.0	LIMESTONE, frags. of very hard, dense, fine grained limestone, few soft white carbonate grains. 10% fine-med. clear qtz. 40% red brown silt. Ferruginous pebbles to 6mm. Reddish brown. Weakly to well cemented. 2.0-3.0 as above, fossiliferous, becoming less well cemented. Tan to orange brown. 3.0-4.0 as above, very calcareous, abundant fossils. <10% qtz. fine grained. 20-30% silt, pink-pale orange. White medium carbonaceous material abundant. 4.0-5.0 as above fine to coarse, less dense, hard limestone. No Fe pebbles. Shell frags. to9mm, some dark staining? Maganese. Mod.-well cemented. Pink-fawn. 5.0-6.0 as above, <5% qtz. becoming less silty (15-20%). Cream to fawn.

Detailed core description 0-14m given on pg. 3-3.

Drn: | Sheet 1 of 3
Date: | Bore Folder No.

PF Nº S10537 MH

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIRS POLLUTION STUDY

BORE LOG

CONTINUATION SHEET

A-22

HOLE NO. NG 36

UNIT/STATE NO: 7024002WW02229

HOLE Dia. DEPTH m	CORE	GRAPHIC LOG	DEPTH (m) from	to	GEOLOGICAL DESCRIPTION OF SAMPLE	UNIT	AGE	CASING	WATERS CUT	WATER LEVEL
6.0					6.0-7.0 as above, dominantly fossiliferous material, dark staining present. Minor qtz. Pink to fawn. Few small ferruginous pebbles. (? contamination).					
7.0					7.0-8.0 as above, 15% yellow silt. Well cemented, no Fe pebbles. Yellow to brown.					
8.0					8.0-9.0 as above, white/yellow carbonate grains are generally medium. Minor dark staining.					
9.0					9.0-10.0 fine to med. carbonate, less fossils more well cemented than above. Orange brown to tan. Abundant rose, green shiny material? feldspar or ? recrystallized calcite. Silty up to 40%					
10.0					END OF HOLE 10m					

DEPARTMENT OF MINES — SOUTH AUSTRALIA
ENGINEERING DIVISION

PROJECT: NARACOORTE ABATTOIRS POLLUTION STUDY

CORE DESCRIPTION

A-23

HOLE NO: G 36

UNIT/STATE NO: 7024002WW02229

PERMIT NO: 2352

CORE Dia.	DEPTH m	GRAPHIC LOG	GEOLOGICAL DESCRIPTION OF CORE
	0		TOP: SAND, fine to coarse, subangular to subrounded, clear/rose qtz. Nodules of cemented carbonate (pss. contam) 20-30% silt. Abundant organic matter. Light to mid brown. Core-friable.
	0.1		MIDDLE: as above, 30-40% silt.
	0.2		BOTTOM: as above
	0.3		TOP: as above, minor carbonate grains, some Fe pebbles to 8mm. 50% silt.
	0.4		MIDDLE: as above, sine to coarse, few milky qtz. grains, dominantly Fe stained. 1% Fe and maghemite pebbles. Again 50% silt. Pink to light brown. Core powderish and friable.
	0.5		BOTTOM: as above, non calcareous
	0.6		TOP: as above, silt to medium, clear/Fe stained qtz. 30% Fe and maghemite pebbles to 10mm. Very silty passing into non calcareous CLAY
	.73		MIDDLE: CLAY, mottled red brown & yellow, shows slickenside affects. 20-30% medium qtz. as above. Few Fe & maghemite pebbles
	.80		to 3mm. Core strongly cemented.
	.86		BOTTOM: as above
	1.0		TOP: as above, clay very firm, some irregular layering. 15-20% qtz. Mottled orange, red brown, bit of yellow. Cementing as above.
	1.1		MIDDLE: as above
	1.2		BOTTOM: as above
	1.3		As above, passing into LIMESTONE, varying from soft, silty, friable to very hard, dense fine grained material. Reddish brown to off white.
	1.4		

END OF CORE SAMPLES: 1.4m

PROJECT: NARACOORTE ABATTOIR POLLUTION INVESTIGATION

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: JES 53

UNIT / STATE NO: 7024 002 OW 02750

DM

LOCATION OR COORDS:

SEC BK 387 HD. JESSIE

EL Surface m

EL Ref. Point m Datum

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
	20	22				NOT TESTED		1464	W — 3378/79

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
0	0.3		Topsoil	Grey-brown silt, organic, with ironstone pebbles to 1 cm.			127	-0.6	22
0.3	3.6		CLAY	Mottled red, brown, yellow and grey; plastic with minor ironstone pebbles. Some fragments of limestone to 6 mm.				(slotted	
				0.8-2.1 : Clay as above, sandy with up to 30% limestone fragments.				20 - 22)	
3.6	8.4		SAND	Fine to medium grained, clayey, mottled red, brown, pale grey and yellow. Non-calcareous and weakly cemented.					
8.4	14.5		SILT AND CLAY	Interbedded silts and clays SILT: mottled yellow, brown, micaceous, clayey. CLAY: mottled red, brown and pale yellow. Sandy, highly plastic. Some limestone fragments towards base.					
14.5	22.0		LIMESTONE	Pale yellow to brown, minor red brown clay (from solution features). Fossiliferous and moderately to well cemented.					

REMARKS:

Completed as observation well with 127mm I.D. PVC casing.

*NOTE: 110 kl / day = 1000gals / hr.

DRILL TYPE: GEMCO & C/TOOL

CIRCULATION: -

SHEET 1 OF 1

COMPLETED: 5/7/79

LOGGED BY: F. Stadter

DATE: 3/1/80

A-24

A-25

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

PROJECT S.E. MEATWORKS

FEATURE FOUNDATIONS

LOCATION. NARACOORTE

SECTION 388

HUNDRED. JESSIE

CO-ORDS

HOLE CH 1

SERIAL No. 343/73

R.L. Surface. FT.

R.L. Collar FT.

Datum.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. / DEPTH m	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME. Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL CASING	MOISTURE CONTENT	Consistency Compct. Dens'y.	FIELD TEST DATA: BLOWS PER 30 cm (20 40 60 80)	SOILTEST P'TR METER Units * (1 2 3 4)
? RECENT — PROBABLE FILL			ML	SILT SOIL, LOW PLASTICITY. Dk. grey fine sandy silt. Trace angular gravel to 2cm.		H	Ls		
			CH	CLAY SOIL, HIGH PLASTICITY. Grey brown clay. Jointed, sheared.		<PL	St		
			ML	SILT SOIL, LOW PLASTICITY. Yellow calcareous fine sandy silt, trace clay.		H	MC		
			CH	CLAY SOIL, HIGH PLASTICITY. Grey-brown clay. Jointed, sheared.		<PL	St		
? RECENT — POSSIBLE FILL	1.0		ML	SILT SOIL, LOW PLASTICITY. Orange-yellow calcareous fine sandy silt, trace clay. Friable to v. weakly cemented.		H	MC		
	2.0		MH	SILT SOIL, HIGH PLASTICITY. Grey-orange mottled clayey silt. Gravel to 5mm. Infilled 2cm ϕ hole.		D	MC	A139; 3,5,5, N=13	
PLEISTOCENE — BLANCHETOWN CLAY	3.0		CH	CLAY SOIL, HIGH PLASTICITY. Grey-orange mottled silty clay. Breaks into angular 5mm blocks.		≈PL	St	A138; 3,4,5, N=12; 6 for 15cms; A44	
	4.0								
	5.0				NO WATER CUT			5,10,8 N=23	
? PLIO-PLEISTOCENE — ? PARILLA SAND	6.0		SM	SAND SOIL, EXCESS SILTY FINES. Orange-brown/grey mottled silty fine sand.				8 for 15cms; A49; 8,9,11, N=28	
	7.0					D	MD	20 for 15cms; A6	
	8.0			15cm band brown-grey fine sand. Trace clay appears at 8.55m, becoming more common with increasing depth				6,5,6, N=17	
	9.0			Cont. sheet 2				12 for 15cms	

TYPE OF SAMPLE

- A shoe (SA)
- D " (SD)
- E " (SE)
- G " (SG)
- Sealed Tube - A Shoe - SAL
- Standard Penetration Test - SPT

Water level, (date) 7 Dec. '66 — WC Water cut — Casing

CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
S — Soft	MC — Moderately Compact	L — Loose	D — Damp
F — Firm	C — Compact	MD — Medium Dense	M — Moist
St. — Stiff	VC — Very Compact	D — Dense	W — Wet
V. St. — Very Stiff		VD — Very Dense	S — Saturated
H. — Hard			LL — Liquid Limit
			PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. CT 2

TYPE

DRILLER TOOHEY

START 11 Dec. 1972

FINISH 13 Dec. 1972

LOGGED BY R.F. JEUNE

DATE 19th Dec. '72

TRACED D.W.W.

CHECKED A.F.

SHEET 1 OF 2

DRG No. S10099

Ke6

P.F. No. S6676a MB

Unit No. 7024002EW00825

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF CABLE TOOL HOLE

PROJECT S.E. MEATWORKS

FEATURE FOUNDATIONS

LOCATION NARACOORTE

SECTION 388

HUNDRED JESSIE

CO-ORDS

HOLE CH 1

SERIAL No. 343/73

R.L. Surface FT.

R.L. Collar FT.

Datum

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. DEPTH m	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL CASING	MOISTURE CONTENT	Consistency Compct. Dens'y	FIELD TEST DATA: BLOWS PER 30 cm (20 40 60 80)	FIELD TEST DATA: SOILTEST P'TR'METER Units * (1 2 3 4)
				CONTINUED FROM SHEET 1					
PLIOCENE	9.0		SM			D	MD	A 12 7, 9, 11, N=27	
	10.0		SC	SAND, EXCESS CLAY FINES Brownish yellow clayey fine sand.		D	MD	12 for 15cms. A 10 9	
	11.0		CH	CLAY SOIL, HIGH PLASTICITY Yellow-brown silty clay. Black flecks.		D	ST	6, 8, 9, N=23	
			SM	SAND, EXCESS SILTY FINES Orange silty fine sand, trace clay.		D	MD		
	12.0		CH	CLAY SOIL, HIGH PLASTICITY Yellow-brown silty clay.		D	ST	7 for 15 cms. A 22	
? LOWER MIOCENE — ? GAMBIER LIMESTONE — Weathered Limestone			SM	SAND, EXCESS SILTY FINES. White highly calcareous silty sand, trace clay.		D	MD	9, 12, 16 N = 37	
? LOWER MIOCENE — ? GAMBIER LIMESTONE — Relatively unweathered limestone	13.0		ROCK	LIMESTONE. Fragments of strong crystalline limestone in matrix of weakly cemented calcareous silty fine sand.		D	ROCK	A 12 4 DAMAGED	
	14.0			END OF BORE 13.95 METRES					

TYPE OF SAMPLE

A shoe (SA)
D " (SD)
E " (SE)
G " (SG)
Sealed Tube - A Shoe - SAL
Standard Penetration Test - SPT

Water level, (date) 7 Dec. 66
WC Water cut
Casing

CONSISTENCY (Clays)

VS. — Very Soft
S — Soft
F — Firm
St. — Stiff
V. St. — Very Stiff
H. — Hard

COMPACTNESS (Silts)

Ls — Loose
MC — Moderately Compact
C — Compact
V C — Very Compact

RELATIVE DENSITY (Sands)

VL — Very Loose
L — Loose
MD-Medium Dense
D — Dense
VD — Very Dense

MOISTURE CONTENT

H — Humid
D — Damp
M — Moist
W — Wet
S — Saturated
LL — Liquid Limit
PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. C.T. 2
TYPE
DRILLER TOOHEY
START 11 Dec 1972
FINISH 13 Dec 1972

LOGGED BY R.F. JEUNE
DATE 19th Dec. '72
TRACED D.W.W.
CHECKED A.F.

SHEET 2 OF 2

DRG No. S10099a Ke6

P.F. No. S6676a MB

Unit No. 7024002EW00825

PROJECT: S.E. MEATS (AUST.) LTD. WATER SUPPLY

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: PERMIT NO. 2625

UNIT / ~~SHEET~~ NO 7024002WW02723

LOCATION OR COORDS:

SEC. 388 HD. JESSIE

EL Surface m

EL Ref. Point m Datum

DM

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
									W —

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
0	1		TOPSOIL -SAND	Qtz. fine to medium grained, uncemented, contains pebbles of ironstone up to 10 mm. Grey brown.					
1	3		NO SAMPLE						
3	4		SAND	Fine grained qtz. 15-20% clay. Some ironstone as above. Non calcareous. Weakly cemented. Mottled grey and yellow brown.					
4	5		AS ABOVE	20-30% clay. Micaceous. Yellow brown with grey & pink pockets. Mainly fine grained.					
5	6		AS ABOVE	Perhaps 10-15% clay. Mottled red brown, pink, grey & yellow brown.					
6	7		AS ABOVE	As for 4-5m interval. Red brown & yellow brown mottled.					
7	9		AS ABOVE	Mainly yellow brown.					
9	10		CLAY	Sandy perhaps 30-40%. Grey, yellow brown mottled. Weakly cemented. Non calcareous.					

REMARKS:

DRILLED BY B.D. BENNETT

*NOTE: 110 kl / day = 1000gals / hr.

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 1 OF 3

COMPLETED:

LOGGED BY: A.F.W.

DATE: 20/2/78

A-27

PROJECT: S.E. MEATS (AUST.) LTD. WATER SUPPLY

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

PERMIT NO.

HOLE NO: 2625

UNIT / ~~STATE~~ NO 7024002WW02723

DM

LOCATION OR COORDS:

SEC. 388 HD. JESSIE

EL Surface m

EL Ref. Point m Datum

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
									W —

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
10	11		CLAY	Passing into limestone, fine to medium grained, fossiliferous. Soft to well cement-ed lumps. Brown to yellow.					
11	14		LIMESTONE	As Above. Clay pockets within limestone. Weakly cemented.					
14	17		LIMESTONE/CLAY	As Above. Better cemented with some hard material present. Yellow brown.					
17	29		LIMESTONE	Minor silt & clay (<5%). Yellow to cream, mod. to well cemented, fine to coarse grained. Fossiliferous.					
29	35		AS ABOVE	Becoming pale grey.					
35	38		AS ABOVE	10-15% silt and marl.					
38	44		AS ABOVE	Minor flint. Mod. hard to well cemented. <5% silt.					
44	47		AS ABOVE	Fine to coarse. 10-15% silt. Abundant fossils. Minor flint.					

REMARKS:

*NOTE: 110 kl / day = 1000gals / hr.

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 2 OF 3

COMPLETED:

LOGGED BY: A.F.W.

DATE: 20/2/78

A-29

PROJECT: S.E. MEATS (AUST.) LTD. WATER SUPPLY

MINES DEPARTMENT — SOUTH AUSTRALIA
ENGINEERING DIVISION

WATER WELL LOG

HOLE NO: PERMIT NO. 2625

UNIT / ~~STATE~~ NO 7024002WW02723

DM

LOCATION OR COORDS:

SEC. 388 HD. JESSIE

EL Surface m

EL Ref. Point m Datum

AQUIFER SUMMARY:	DEPTH TO WATER CUT (m)	DEPTH TO STANDING WATER (m)	INTERVAL TESTED From:	INTERVAL TESTED To:	SUPPLY kilolitres/day*	SUPPLY Test Length (hrs)	SUPPLY Method	TOTAL DISSOLVED SOLIDS milligrammes/litre	TOTAL DISSOLVED SOLIDS Analysis No:
									W —

DEPTH (m) From	DEPTH (m) To	GRAPHIC LOG	ROCK / SEDIMENT NAME	GEOLOGICAL DESCRIPTION	FORMATION / AGE	DEPTH CORE SAMPLE	CASING Dia(mm)	CASING From(m)	CASING To(m)
47	49		AS ABOVE	Becoming more silty. Sticky, 5% marl. Glauconitic. Mostly very fine to fine grained. END OF HOLE - 49 m					

REMARKS:

*NOTE: 110 kl / day = 1000gals / hr.

DRILL TYPE: CABLE TOOL

CIRCULATION: WATER

SHEET 3 OF 3

COMPLETED:

LOGGED BY: A.F.W.

DATE: 20/2/78

A-29

APPENDIX B

Full Chemical Analyses of Observation Wells -

WATER ANALYSIS REPORT

SAMPLE No. W6572/77 JOB No. 1769-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	120	6.0
MAGNESIUM	(Mg)	63	5.2
SODIUM	(Na)	343	14.9
POTASSIUM	(K)	10	0.3
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	555	9.1
SULPHATE	(SO_4)	72	1.5
CHLORIDE	(Cl)	506	14.3
FLUORIDE	(F)		
NITRATE	(NO_3)	20	0.3
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	26.3	DIFF = 1.2
ANIONS	(me/ℓ)	25.2	SUM = 51.5

$\frac{\text{DIFF } 100}{\text{SUM}}$ = 2.2%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 2626

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1407
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	559
CARBONATE HARDNESS AS $CaCO_3$	455
NON-CARBONATE HARDNESS AS $CaCO_3$	104
TOTAL ALKALINITY AS $CaCO_3$	455
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.7
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 56.6%

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. μ-S/cm
SAMPLE DEPTH 18.5m

OBS. No. JES 47
HOLE No. NG 31
D.M. No. 7024002OWO2224

B-1

WATER ANALYSIS REPORT

SAMPLE No. W6575/77 JOB No. 1769-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	69	3.4
MAGNESIUM	(Mg)	51	4.2
SODIUM	(Na)	212	9.2
POTASSIUM	(K)	7	0.2
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	389	6.4
SULPHATE	(SO_4)	49	1.0
CHLORIDE	(Cl)	344	9.7
FLUORIDE	(F)		
NITRATE	(NO_3)	21	0.3
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	17.0	DIFF = 0.4
ANIONS	(me/ℓ)	17.4	SUM = 34.5

$\frac{\text{DIFF } 100}{\text{SUM}}$ = 1.1%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 1629

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	944
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	382
CARBONATE HARDNESS AS $CaCO_3$	319
NON-CARBONATE HARDNESS AS $CaCO_3$	63
TOTAL ALKALINITY AS $CaCO_3$	319
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	8.2
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 54.1%

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm
SAMPLE DEPTH 29.0 M

OBS. No. JES 47
HOLE No. NG 31
D.M. No. 7024002OW02224

WATER ANALYSIS REPORT

SAMPLE No. W6576/77 JOB No. 1769-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	119	5.9
MAGNESIUM	(Mg)	66	5.4
SODIUM	(Na)	333	14.5
POTASSIUM	(K)	8	0.2
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	515	8.4
SULPHATE	(SO_4)	88	1.8
CHLORIDE	(Cl)	581	16.4
FLUORIDE	(F)		
NITRATE	(NO_3)	10	0.2
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	26.1	DIFF = 0.7
ANIONS	(me/ℓ)	26.8	SUM = 52.8

$\frac{\text{DIFF } 100}{\text{SUM}}$ = 1.4%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 2605

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1457
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	569
CARBONATE HARDNESS AS $CaCO_3$	422
NON-CARBONATE HARDNESS AS $CaCO_3$	147
TOTAL ALKALINITY AS $CaCO_3$	422
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	8.0
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	55.6

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm
SAMPLE DEPTH 19.0m

OBS. No. JES 48
HOLE No. NG 32
D.M. No. 7024002OWO2225

WATER ANALYSIS REPORT

SAMPLE No. W6688/77 JOB No. 1834-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	130	6.5
MAGNESIUM	(Mg)	81	6.7
SODIUM	(Na)	475	20.7
POTASSIUM	(K)	10	0.3
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	515	8.4
SULPHATE	(SO_4)	135	2.8
CHLORIDE	(Cl)	840	23.7
FLUORIDE	(F)		
NITRATE	(NO_3)	3	0.1
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	34.1	DIFF = 0.9
ANIONS	(me/ℓ)	35.0	SUM = 69.0

$\frac{\text{DIFF } 100}{\text{SUM}}$ = 1.3%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 3490

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1927
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	658
CARBONATE HARDNESS AS $CaCO_3$	422
NON-CARBONATE HARDNESS AS $CaCO_3$	236
TOTAL ALKALINITY AS $CaCO_3$	422
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.3
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 60.7%

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. μ-S/cm
SAMPLE DEPTH 19.0m

OBS. No. JES 49
HOLE No. NG 33
D.M. No. 7024002OWO2226

B-4

WATER ANALYSIS REPORT

SAMPLE No. W6691/77 JOB No. 1834-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	133	6.6
MAGNESIUM	(Mg)	80	6.6
SODIUM	(Na)	450	19.6
POTASSIUM	(K)	10	0.3
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	518	8.5
SULPHATE	(SO_4)	130	2.7
CHLORIDE	(Cl)	805	22.7
FLUORIDE	(F)		
NITRATE	(NO_3)	2	0
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	33.0	DIFF = 0.9
ANIONS	(me/ℓ)	33.9	SUM = 67.0

DIFF 100 / SUM = 1.3%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 3110

	MILLIGRAMS PER LITRE mg/ℓ
TOTAL DISSOLVED SOLIDS	
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1865
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	661
CARBONATE HARDNESS AS $CaCO_3$	424
NON-CARBONATE HARDNESS AS $CaCO_3$	237
TOTAL ALKALINITY AS $CaCO_3$	424
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.1
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	59.2%

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm
SAMPLE DEPTH 29.0 m

OBS. No. JES 49
HOLE No. NG 33
D.M. No. 70240020W02226

WATER ANALYSIS REPORT

SAMPLE No. W6692/77 JOB No. 1834-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	116	5.8
MAGNESIUM	(Mg)	55	4.5
SODIUM	(Na)	313	13.6
POTASSIUM	(K)	8	0.2
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	515	8.4
SULPHATE	(SO_4)	74	1.6
CHLORIDE	(Cl)	511	14.4
FLUORIDE	(F)		
NITRATE	(NO_3)	3	0
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE

CATIONS	(me/ℓ)	24.1	DIFF = 0.3
ANIONS	(me/ℓ)	24.4	SUM = 48.6

DIFF 100 / SUM = 0.6%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 2389

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1333
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	516
CARBONATE HARDNESS AS $CaCO_3$	422
NON-CARBONATE HARDNESS AS $CaCO_3$	94
TOTAL ALKALINITY AS $CaCO_3$	422
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.2
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 56.4%

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm
SAMPLE DEPTH 20.0m

OBS. No. JES 50
HOLE No. NG 34
D.M. No. 70240020W02227

WATER ANALYSIS REPORT

SAMPLE No. W6695/77 JOB No. 1834-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	118	5.9
MAGNESIUM	(Mg)	56	4.6
SODIUM	(Na)	300	13.0
POTASSIUM	(K)	8	0.2
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	521	8.5
SULPHATE	(SO_4)	70	1.4
CHLORIDE	(Cl)	491	13.8
FLUORIDE	(F)		
NITRATE	(NO_3)	8	0.1
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE			
CATIONS	(me/ℓ)	23.7	DIFF = 0.3
ANIONS	(me/ℓ)	24.0	SUM = 47.7

DIFF 100 / SUM = 0.4%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C 2310

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1307
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	525
CARBONATE HARDNESS AS $CaCO_3$	427
NON-CARBONATE HARDNESS AS $CaCO_3$	98
TOTAL ALKALINITY AS $CaCO_3$	427
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.3
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	

SODIUM TO TOTAL CATION RATIO(me/ℓ) 55.0%

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm
SAMPLE DEPTH 30.0m

OBS. No. JES 50
HOLE No. NG 34
D.M. No. 70240020W02227

L 8

WATER ANALYSIS REPORT

SAMPLE No. W6966/77 JOB No. 2142-78

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	120	6.0
MAGNESIUM	(Mg)	45	3.7
SODIUM	(Na)	243	10.6
POTASSIUM	(K)	7	0.2
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	496	8.1
SULPHATE	(SO_4)	49	1.0
CHLORIDE	(Cl)	378	10.7
FLUORIDE	(F)		
NITRATE	(NO_3)	40	0.6
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE				
CATIONS	(me/ℓ)	20.4	DIFF =	0.1
ANIONS	(me/ℓ)	20.5	SUM =	40.9

DIFF 100 / SUM = 0.1%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.)
MICRO-S/cm AT 25 DEG.C 2108

TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1126
C. RESIDUE ON EVAP. AT 180 DEG.C	

TOTAL HARDNESS AS $CaCO_3$	485
CARBONATE HARDNESS AS $CaCO_3$	406
NON-CARBONATE HARDNESS AS $CaCO_3$	78
TOTAL ALKALINITY AS $CaCO_3$	406
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	

	UNITS
REACTION - pH	7.5
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	51.7%

NAME -
ADDRESS
DATE COLLECTED
SAMPLE COLLECTED BY:

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm
SAMPLE DEPTH 22.0m

OBS. No. JES 51
HOLE No. NG 35
D.M. No. 7024002OWO2228

WATER ANALYSIS REPORT

SAMPLE No. W3378/79 JOB No. 575-80

CHEMICAL COMPOSITION

		MILLIGRAMS PER LITRE mg/ℓ	MILLEQUIVS. PER LITRE me/ℓ
CATIONS			
CALCIUM	(Ca)	115	5.7
MAGNESIUM	(Mg)	60	4.9
SODIUM	(Na)	350	15.2
POTASSIUM	(K)	9.0	.2
IRON	(Fe)		
ANIONS			
HYDROXIDE	(OH)		
CARBONATE	(CO_3)		
BICARBONATE	(HCO_3)	580	9.5
SULPHATE	(SO_4)	98	2.0
CHLORIDE	(Cl)	538	15.2
FLUORIDE	(F)		
NITRATE	(NO_3)	9	.1
PHOSPHATE	(PO_4)		

TOTALS AND BALANCE				
CATIONS	(me/ℓ)	26.1	DIFF =	.7
ANIONS	(me/ℓ)	26.9	SUM =	53.0

$\frac{\text{DIFF 100}}{\text{SUM}}$ = 1.4%

DERIVED AND OTHER DATA

CONDUCTIVITY (E.C.) MICRO-S/cm AT 25 DEG.C	2772
TOTAL DISSOLVED SOLIDS	MILLIGRAMS PER LITRE mg/ℓ
A. BASED ON E.C.	
B. CALCULATED (HCO_3=CO_3)	1464.
C. RESIDUE ON EVAP. AT 180 DEG.C	
TOTAL HARDNESS AS $CaCO_3$	534.
CARBONATE HARDNESS AS $CaCO_3$	475.
NON-CARBONATE HARDNESS AS $CaCO_3$	59.
TOTAL ALKALINITY AS $CaCO_3$	475.
FREE CARBON DIOXIDE (CO_2)	
SUSPENDED SOLIDS	
SILICA (SiO_2)	
BORON (B)	
	UNITS
REACTION - pH	7.1
TURBIDITY (JACKSON)	
COLOUR (HAZEN)	
SODIUM TO TOTAL CATION RATIO(me/ℓ)	58.3%

NAME - SA Dept. Mines & Energy
ADDRESS Naracoorte
DATE COLLECTED 05/07/79
SAMPLE COLLECTED BY: A. Anderson

FIELD TEMP. °C
FIELD pH @ °C
FIELD COND. µ-S/cm
SAMPLE DEPTH: 22.0 M

OBS. No. JES 53
HOLE No. -
D.M. No. 7024002WW02750
Permit No. 90237

8, 9