

Hydrogeology Report No 1995/37
Manjimup Shallow Basin Drilling Project
Phase 4

by
C.J. Prangle

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Western Australia

Geological Survey

Perth 1995

INTRODUCTION

The Manjimup Shallow Basins Project is approximately 10 km north of Manjimup in the south west of Western Australia. It is one of several areas identified by Laws, 1992, as being likely to contain minor sedimentary basins and palaeochannels which may contain potable groundwater.

Exploratory drilling was completed at Chungarup, 12 km east of Manjimup, and at Palgarup 10 km north of Manjimup in June 1993, (Hawkes, 1993). Prospects at Chungarup were poor, the only successful bore yielding moderate amounts of water from fractured granite containing quartz veins. At Palgarup small yields of fresh water were obtained from up to 17 m of Tertiary sediments.

Further drilling was carried out in December 1993 (Thorpe, 1994), of the Palgarup transect and initial drilling of the Wilgarup transect, approximately 20 km north of Manjimup. The Palgarup transect has limited prospects for drinking water supplies but the Wilgarup transect was found to contain a significant ground water resource of variable salinity in Tertiary palaeochannel sediments on the drainage divide between the Donnelly and Wilgarup Rivers.

This latest phase of drilling (Phase 4) aimed to define further the distribution of coarse sands containing fresh ground water on the Wilgarup transect and two drainage lines to the north. The project consisted of a geophysical survey followed by limited drilling aimed at verifying the survey results.

The drilling project was completed during March 1995 and carried out under the Groundwater Exploration Initiative programme conducted by the Geological Survey of Western Australia (GSWA), Department of Minerals and Energy.

GEOPHYSICAL AND DRILLING PROGRAM

The first stage of the work program was a combined gravity and ground based transient electromagnetic (TEM) survey over three transects in a northerly line from Wilgarup Road to approximately 2 km north of Ross Seaton Road (Fig 1.), completed by World Geoscience Corporation. The results of the TEM survey are presented in Perry (1995). The survey transects were selected using a combination of aerial photo interpretation and topography. The aerial photo interpretation is reproduced and extended as figure 2.

Selection of drilling sites, based on the TEM survey, aimed at identifying the thickest sediments on each transect (Commander, 1995). The drilling programme also aimed to determine the vertical salinity distribution and water levels by the installation of narrow diameter piezometers.

Drilling was completed by the Water Authority of Western Australia under contract to the Geological Survey using air core drilling methods. Five exploratory bores were drilled, two of which were cased and completed as piezometers. Bore locations are shown on Figure 1.

Bore details are presented in Appendix 1 and a summary of the data is given in Table 1.

TABLE 1 BORE DATA

Bore	Depth (m)	Slotted Sections (m)	Water Level (m bgl)	Airlift Yield (m ³ /d)	Salinity (mg/L)	Tertiary Thickness (m)	Bedrock Type
MJB23	19	n.a.	n.a.	n.a.	n.a.	n.a.	Gneiss
MJB24	22	6.0 - 12.0	2.14	49	645	19.0	Schist
MJB25	27	6.0 - 12.0	2.41	86	660	16.5	Schist
MJB26	36	n.a.	n.a.	n.a.	n.a.	n.a.	Gneiss
MJB27	20	n.a.	n.a.	n.a.	n.a.	n.a.	Gneiss

Strata samples were collected during drilling at one metre intervals, logged on site, and representative samples of major lithologies retained. All bores were drilled into granite or schist bedrock.

Drilling of transient electromagnetic (TEM) targets on Transect 2 and Transect 3 (Fig. 1), intersected only clay over shallow basement. A strongly lineated gneiss was intersected at 18.5 metres on one transect and at 20 metres on the second. No bores were constructed at these sites and the holes were backfilled to surface.

In two bores on Transect 1 sedimentary material was encountered and piezometers were constructed using 50 mm ND PVC casing slotted over the desired aquifer intersections (Table 1). The bores were gravel packed with 8 - 16 graded sand to 0.3 m below surface and a lockable steel standpipe installed in a cement block at surface. The two piezometers were developed by airlifting until discharge became clear, and water samples for salinity measurement and comprehensive chemical analysis were collected at the completion of airlifting.

Airlift yields cannot be directly compared with previous results as MJB 24 and MJB 25 were constructed with 50 mm slotted casing, compared with 80 mm previously used (Thorpe, 1994).

GEOLOGY

The regional geology consists of Archaean bedrock of schist and gneiss. Thin Tertiary deposits of sands and clays occur in a palaeochannel environment, possibly associated with a former tributary or headwaters of the Donnelly River. The Tertiary sediments are up to 19 metres thick. The palaeochannel sediments are subdivisible into three units, after Thorpe, (1994).

- Unit 3 A continuous bed of light grey clay.
- Unit 2 A bed of medium to coarse grained quartz sand, generally moderately to well sorted, with subangular grains. Layers containing concentrations of black heavy minerals, possibly ilmenite, occur near the base of the unit at 12 to 18 m depth at MJB 16. Units 1 and 2 are interpreted to be fluvial infilling of a palaeochannel.
- Unit 1 A basal unit, not present at all sites, comprising a fine-grained quartz gravel at MJB 22 and an organic rich clayey sand at MJB 21, 17 and 25.
Palynological analysis of samples indicated that the age of the sediments is Eocene (Thorpe, 1994).

The interpreted extent of Tertiary cover is shown in Figure 2 as well as the indicated area of palaeochannel sands. Transect 1 was planned to assess the extent of Tertiary sediments extending in a northerly direction from those defined in previous drilling by Thorpe, 1994. Results from TEM indicated several encouraging targets for drilling and three sites were drilled, MJB24 to MJB 26. Palaeochannel sands correlating with unit 1 and 2 were intersected in MJB24 and MJB25 only. Up to 5 m of clay sediments of unit 3 were intersected in all bores, as a confining layer in MJB24 and MJB25, and directly over weathered Archaean clay in MJB26 (Fig 3).

The bedrock in MJB24 and MJB25 was a chloritic schist and in MJB26 a strongly sheared gneiss. The average weathered bedrock profile was 10 metres and consisted of blue - green to grey - blue micaceous, silty, gritty, clay over schist and light grey to cream grey clay over the gneiss.

Laterite overlies the sediments and ranges from massive to nodular and pisolitic.

HYDROGEOLOGY

The palaeochannel aquifer sands composed of Unit 1 and 2 are approximately 10 m thick in bores MJB 24 and MJB 25. The sands are confined by clay of Unit 3, and the total saturated thickness is up to 15 m.

The northern extent of the palaeochannel is undefined. It is probable that all of the bore sites from previous drilling programs are located on the southern side of the palaeochannel. MJB24 and MJB25 were drilled on a northerly trend across the palaeochannel. These bore sites are approximately 400 m apart indicating that the palaeochannel at this point has a probable width of between 500 m to 1 km. The palaeochannel has been defined over a length of approximately 3 km, exhibits a meandering nature and may extend to the east and west.

Groundwater samples from the aquifer have a significant range in salinity from 645 mg/L (MJB24) to 4190 mg/l (MJB 15) (Thorpe, 1994), and both vertical and lateral salinity variations occur in the aquifer. Higher salinity groundwater occurs at the channel margins due to lateral flow of brackish groundwater into the aquifer from the weathered bedrock, while low salinity water occurs in the centre of the palaeochannel where there is more permeable aquifer material subject to recharge. The salinity of groundwater in MJB 24 and MJB 25 is less than 700 mg/L, lower than in previously drilled bores, indicating local recharge. The salinity distribution is shown in Figure 4.

Groundwater levels indicate that the area between MJB 25 and MJB 17 forms the centre of the watershed between the Wilgarup and Donnelly rivers. Water level contours indicate that groundwater flows south eastward to the Wilgarup River and westward to the Donnelly River (Fig. 4). The watershed is predominantly flat and drainage channels have been cut through the area to encourage surface drainage. As one of these drainage channels pass very close to MJB 17 there is the possibility that local groundwater levels may be modified causing localised mounding. The main area subject to inundation

during the winter periods is between MJB 24, MJB 25 and MJB 17 and it is likely that the groundwater levels are highest directly beneath this area.

CONCLUSIONS

The exploration program successfully defined further fresh groundwater resources in the Manjimup area.

Two holes intersected up to 10 m of Tertiary palaeochannel sands containing fresh water. Two sites approximately 3 - 5 km north of the Wilgarup transect were also drilled but failed to intersect sediments.

The use of Transient electromagnetic surveys (TEM) did not significantly assist in the determination of fresh groundwater exploration targets in the region.

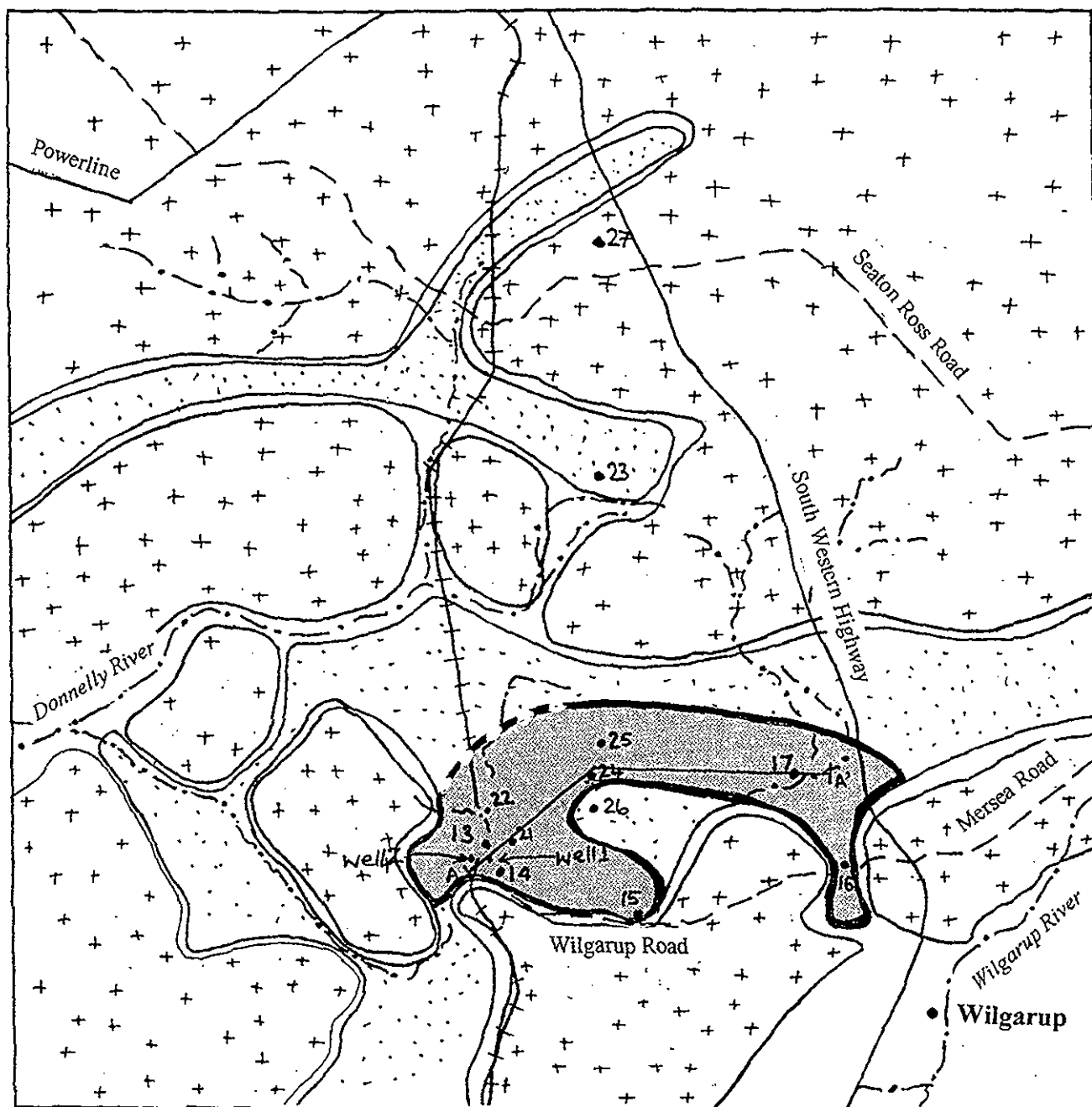
Aerial photo interpretation indicates a possible extension to the palaeochannel system both east and west of the currently investigated area.

RECOMMENDATIONS

From the aerial photo interpretation of the area it is possible that an extension of the Tertiary palaeochannel deposits occurs further east and west. Exploration of this region is recommended if further resources are deemed necessary for this area. Bore sites should be selected using aerial photo interpretation to define regions overlain by sediments.

REFERENCES

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- THORPE, P.M., 1994, Manjimup Shallow Basins Drilling Project Phase 3: Western Australian Geological Survey, Hydrogeology Report 1994/2, (Unpublished)



- Defined extent of Tertiary Sands
- Bore, number
- Shallow Archaean Bedrock
- Inferred extent of Tertiary Sediments
- Railway Line
- Road Major
- Road Minor
- Watercourses
- A ——— A' } Cross Sections
- B ——— B' }

2 km

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

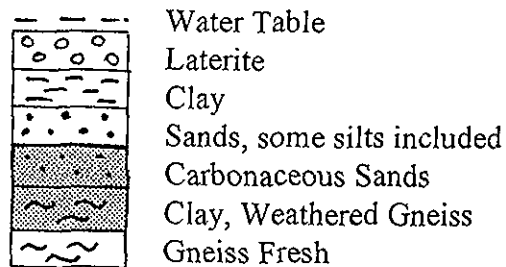
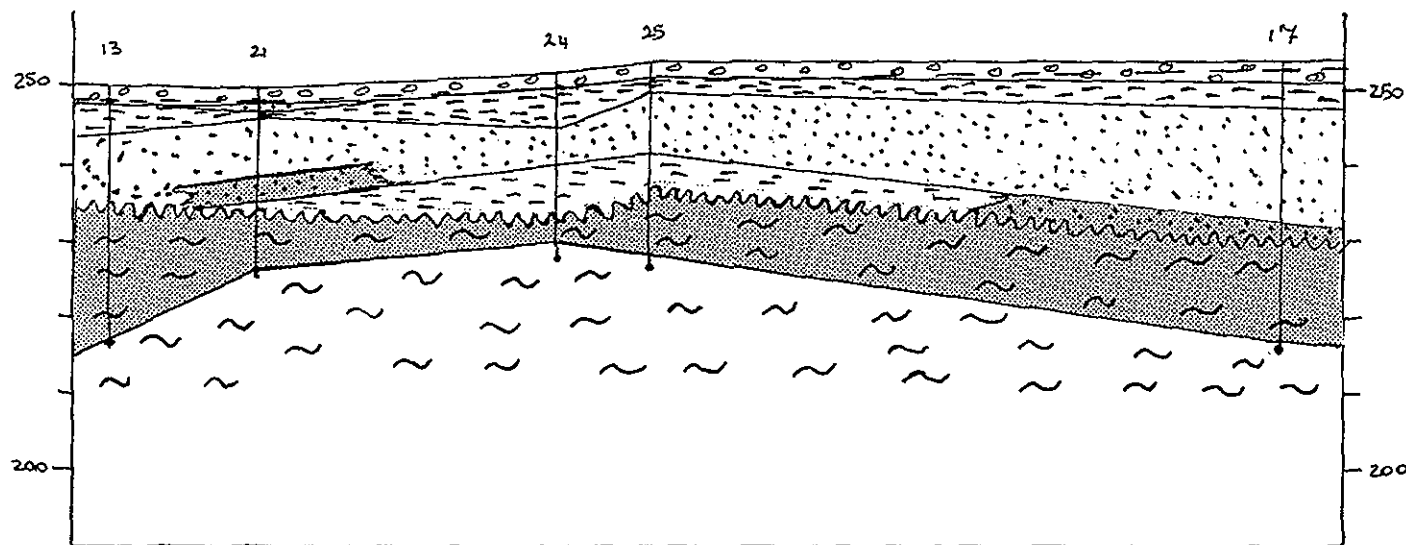
	INITIAL	DATE
COMP	C. J. P.	24/01/96
DRAWN	C. J. P.	24/01/96
APVD	.	.

Figure 2
Interpreted Geology Showing Tertiary Sediment Extent

MAP INDEX	
SI/ 50-10	

TO ACCOMPANY

HYDROGEOLOGY REPORT 1995/37 by C.J. Prangley



SCALE 1:200 Horizontal
1:100 Vertical

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

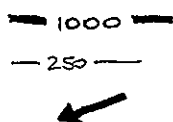
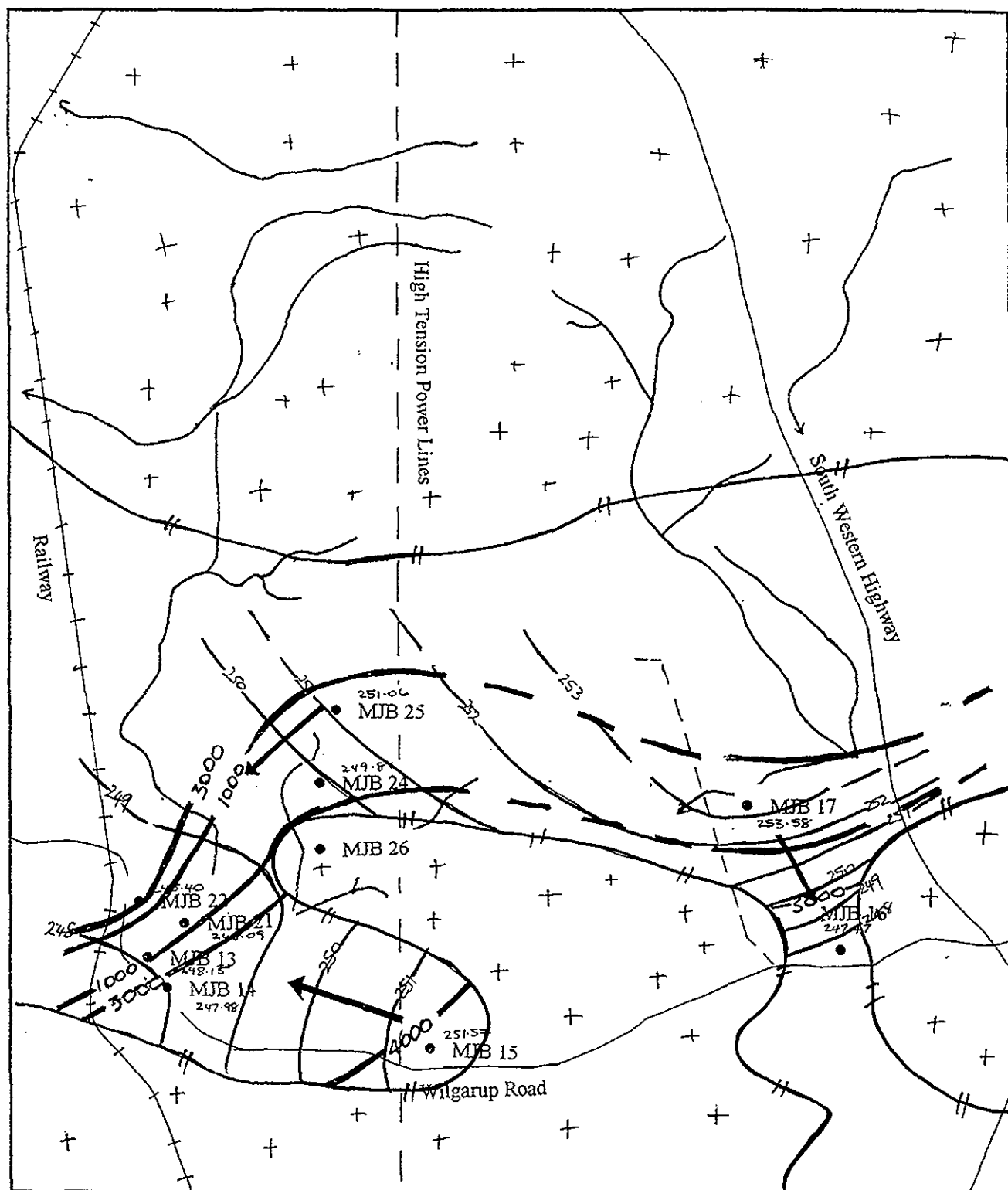
*	INITIAL	DATE
COMP	C. J. P.	25/3/96
DRAWN	C. J. P.	25/3/96
APVD	*	*

Figure 3
Cross Section Showing Tertiary Sequence.

MAP INDEX
SI 50-6

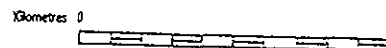
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Isohalines
Water Level Contours
Flow Directions

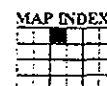
SCALE 1:25 000



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

	INITIAL	DATE
COMP	C. J. P.	24/01/96
DRAWN	C. J. P.	24/01/96
APVD		

Figure 4
Isohalines, Water Level Contours and Flow Directions

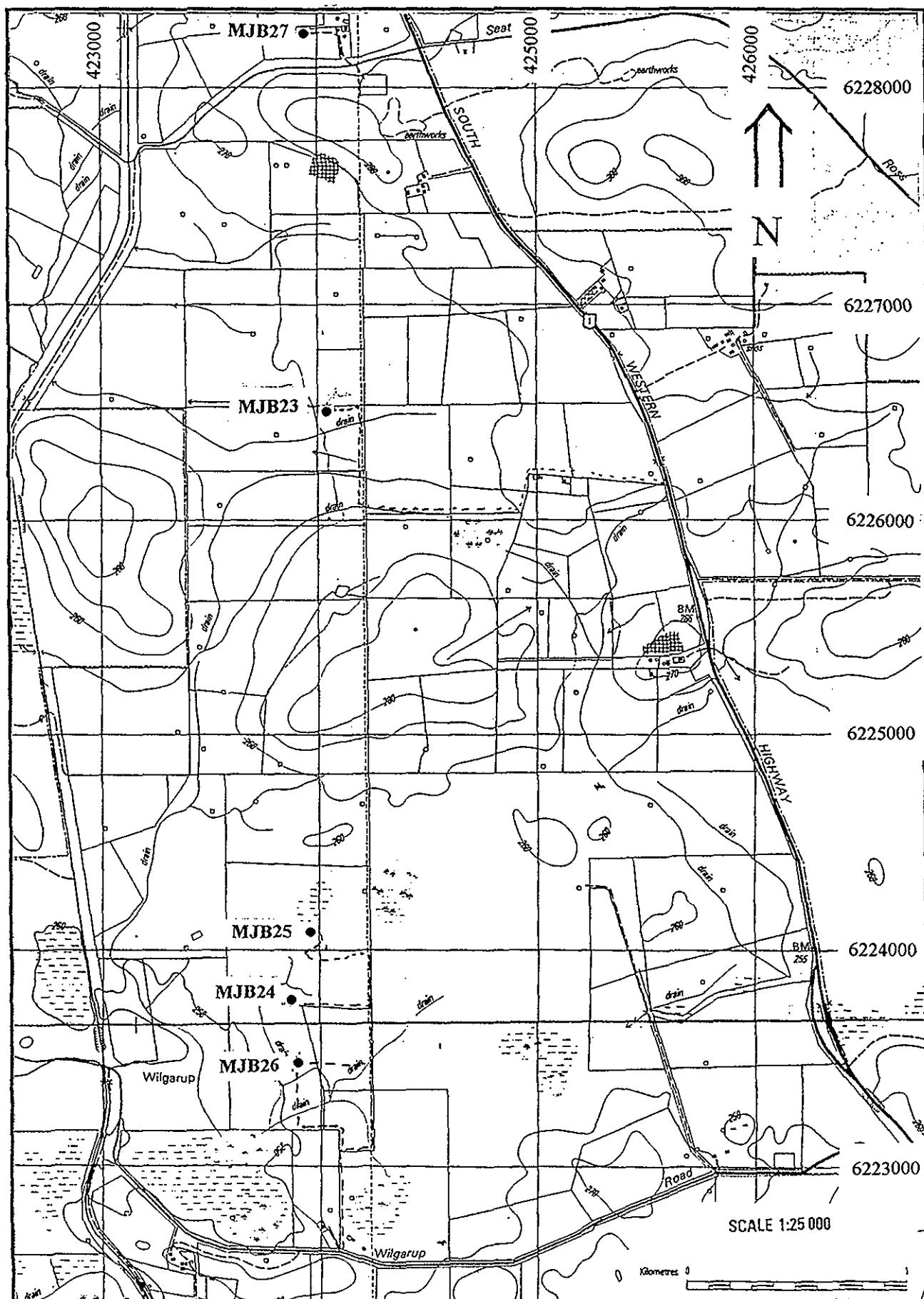


SI/ 50-10

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APPENDIX 1



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

	INITIAL	DATE
COMP	C. J. P.	18/7/95
DRAWN	C. J. P.	18/7/95
APVD	*	*

Location Plan Manjimup Drilling Phase 4

MAP INDEX
SU/ 50-10

TO ACCOMPANY

HYDROGEOLOGY REPORT 1995/37 by C.J. Prangley

MANJIMUP SHALLOW BASIN DRILLING PROJECT

BORE COMPLETION REPORT FOR SITE MJB23

LOCATION AND IDENTIFICATION

OWNER : Geological Survey of Western Australia

LOCATION : This exploration bore was drilled on Nelson Location 3838 approximately 30 km south of Bridgetown. Access to the bore site is approximately 2.4 km south of the intersection of Seaton Ross Road. Enter into the paddock north of the homestead, drive around the back of the homestead and barns and the track bends to the south and then west. Follow this track through the gate then to the north of the dam and then east through the next two gates. Turn North and travel along the powerlines for approximately 300 metres. At the boundary fence of the property turn east and travel a further 150 metres to reach the bore site. This site was abandoned, no bore was constructed,

MAP SHEET : 1:250,000 SI 50 - 10 Pemberton ; 1:50,000 2129 - VI Wilgarup

AMG REF : Easting 4 24 054; Northing 62 26 530

PURPOSE : Exploratory

	<u>MJB23</u>
GSWA REFERENCE	SI 50-10 2129 -4 -A-10
SWRIS REFERENCE	G 60719123.5
NATURAL SURFACE	approximately 260 mAHD
STATUS	Abandoned

CONSTRUCTION

DRILLED BY : Water Authority of Western Australia

DRILLING RIG : Rig, Edson 6000 RC Air Core Driller Graham Waghorn

METHOD : Bores were drilled by using a reverse circulation air core string and a tungsten tipped core bit 131 mm in diameter.

	<u>MJB23</u>
COMMENCED:	19 March 1995
COMPLETED:	19 March 1995
TOTAL DEPTH:	19 m

GEOLOGICAL DATA

SAMPLES : Cuttings at 1 m intervals Logged by C.J. Prangley

REPOSITORY OF
SAMPLES : GSWA Core Library

SUMMARY LOG

Depth (m)	Age	Lithology
0.0 - 2.0	Quaternary	Clay/Sand, minor lateritic pebbles
2.0 - 19.0	Archaean	Clay grading into strongly weathered Gneiss

CUTTINGS SAMPLE LOG SITE MJB23

DEPTH (m)		LITHOLOGICAL DESCRIPTION
0.0 - 1.5	SAND	Grey brown, very fine to fine grained, well sorted, subrounded.
1.5 - 2.0	SANDY CLAY	Red brown sand is very fine to fine grained, well sorted, subrounded.
2.0 - 3.0	CLAY	Cream and red brown, kaolinitic / talcosic texture to clay.
3.0 - 4.0	CLAY	Cream and brown, kaolinitic / talcosic texture to clay.
4.0 - 7.0	CLAY	Brown, kaolinitic / talcosic texture to clay.
7.0 - 8.0	CLAY	Cream, kaolinitic / talcosic texture to clay.
8.0 - 12.0	CLAY	Grey, feldspathic, kaolinitic / talcosic texture to clay.
12.0 - 13.0	CLAY	Red brown, gritty, sticky.
13.0 - 16.0	CLAY	Green brown, gritty, sticky.
16.0 - 17.0	CLAY	Red brown, gritty, sticky.
17.0 - 18.0	CLAY	Brown, gritty, sticky.
18.0 - 19.0	CLAY	Brown, gritty, sticky grading into fresh well lineated Gneiss at 18.5 m.

MANJIMUP STAGE 4

BORE NO MJB 23

SITE LOCN 23

DRILLER WATER AUTHORITY OF WA

SUPERVISOR C. PRANGLEY

RIG TYPE AIRCORE

COMMENCED 19-Mar-95

COMPLETED 19-Mar-95

DESCRIPTION OF STRATA	SECTION	N.S.	DEPTH	CASING	DETAILS
			0.0		SCREEN TYPE DIAMETER MATERIAL STAINLESS STEEL SLOTS
SAND		1.5	0.01 B/F	SEALS SURFACE SEAL BOTTOM PLUG
SANDY CLAY		2.0		AIRLIFTING & PUMPING DATA RATE m ³ /day TEMP °C SALINITY CONDITION TIME INTERVAL
CLAY		18.0	BACKFILLED	NOTES HOLE DIAM 131MM DRILLED, BACKFILLED SWL NOT TAKEN
GNEISS		19.0	19.00 BOS	DEPARTMENT OF MINES DRILLING BRANCH
drilling suspended					DRN B M-J DATE 26-Jul-95

MANJIMUP SHALLOW BASIN DRILLING PROJECT

BORE COMPLETION REPORT FOR SITE MJB24

LOCATION AND IDENTIFICATION

OWNER : Geological Survey of Western Australia

LOCATION : This site is located on Nelson Location No 12580, approximately 3 km west on Wilgarup Road from the intersection of Wilgarup Road and the South Western Highway. The bore is located 800 m north of Wilgarup Road and 400 m west of the high tension powerlines. Access to the site is north between the homestead near the road and the lake. At the first fence turn east and then north. Approximately 650 m north turn east and travel a further 350 m along the fenceline. This is bore site MJB24.

MAP SHEET : 1:250,000 SI 50-10 Pemberton; 1:50,000 2129 - 4 Wilgarup.

AMG REF : Easting 4 23 871; Northing 62 23 756

PURPOSE : Exploratory

	<u>MJB24</u>
GSWA REFERENCE	SI 50-10 2129-4-A-11
SWRIS REFERENCE	G 60719124.7
NATURAL SURFACE	252.01 m AHD
CASING TOP	252.97 m AHD
STATUS	Monitoring

CONSTRUCTION

DRILLED BY : Water Authority of Western Australia

DRILLING RIG : Rig, Edson 6000 RC Air Core Driller Graham Waghorn

METHOD : Bores were drilled by using a reverse circulation air core string and a tungsten tipped core bit 131mm in diameter. 50mm ND bore casing was installed through the drill string.

	<u>MJB24</u>
COMMENCED:	19 March 1995
COMPLETED:	20 March 1995
TOTAL DEPTH:	22m
BORE CASING:	+0.84 - 6.0 m, 50 mm ND PVC Blank casing 6.0 - 12.0 m, 50 mm ND 1 mm Slotted PVC casing 12.0 - 22.0 m, 50 mm ND PVC Blank casing
ANNULUS:	Gravel packed with $\frac{1}{8}$ to $\frac{1}{16}$ graded sand from 0 - 22 m.

GEOLOGICAL DATA

SAMPLES : Cuttings at 1 m intervals Logged by C.J. Prangley.

REPOSITORY OF
SAMPLES : GSWA Core Library

SUMMARY LOG

Depth (m)	Age	Lithology
0 - 19	Quaternary	Clay / Sand, minor lateritic pebbles
19 -23.5	Archaean	Schist strongly chloritic

HYDROGEOLOGICAL DATA

CHEMICAL ANALYSES : A one litre water sample was taken at the cessation of airlift development of the bore and submitted to Australian Environmental Laboratories for analysis. The results of the analysis are on the next page.

	<u>MJB24</u>
OBSERVATION INTERVAL	6.0 - 12.0 m
SALINITY	660 mg/L
AIRLIFT RATE	49 m ³ /day
WATER LEVEL	2.14 m bgl

CUTTINGS SAMPLE LOG SITE MJB24

DEPTH (m)		LITHOLOGICAL DESCRIPTION
0.0 - 2.0	LATERITE / SAND	Brown to orange brown, sand is fine grained, well sorted moderately rounded.
2.0 - 3.5	SAND	Cream brown fine to medium grained, clayey.
3.5 - 6.0	CLAY	Light grey lacustrine.
6.0 - 7.0	CLAY	Grey, lacustrine.
7.0 - 12.0	SAND	Grey, fine to medium grained, subangular to subrounded, well sorted, saturated, minor clay, trace of mineral sands.
12.0 - 13.0	CLAY	Brown, sticky.
13.0 - 19.0	CLAY	Grey, sticky, trace of sand.
19.0 - 21.0	SILT	Dark grey to black.
21.0 - 22.0	SCHIST	Dark grey, chlorite, biotite, hornblende basement rock.



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Australian
Environmental
Laboratories

DEPARTMENT OF MINERALS AND ENERGY
Geological Survey Of Western Australia
100 Plain Street
EAST PERTH WA 6004

MANJIMUP
4079/94
25 May 1995

CERTIFICATE OF ANALYSIS

Sample: MJB24_121987

Analyte	Result	Units	Method	Ref: 03255.001
Colour	1.	Col.Un.		
Conductivity	1.1	mS/cm	APHA 2510.B	
TDS(calc.)	660.	mg/L		
TDS	630.	mg/L	APHA 2540.C	
pH	7.4		APHA 4500-H.B	
Ca	11.	mg/L	APHA 3110;3111.A,B,D	
Mg	32.	mg/L	APHA 3110;3111.A,B,D	
Fe	<0.1	mg/L	APHA 3110;3111.A,B,D	
Si	4.2	mg/L	APHA 3110;3111.A,B,D	
Na	155.	mg/L	APHA 3110;3111.A,B,D	
K	1.2	mg/L	APHA 3110;3111.A,B,D	
Al	0.3	mg/L	APHA 3110;3111.A,B,D	
Alkalinity_T	89.	mg/L	APHA 2320.B	
CO3	<1.	mg/L	APHA 2320.B	
HCO3	110.	mg/L	APHA 2320.B	
Cl	290.	mg/L	APHA 4500-Cl.B	
F	0.1	mg/L	4500-F.C	
SO4	21.	mg/L	SO4_Turbidity	
NO3	4.2	mg/L	SKALAR	
B	<0.1	mg/L	ASTM D4190, APHA 3111B.	
C/A_Balance	0.94		Calculation	
Hardness_T	160.	mg/L		

Appearance: Clear water with small amount of residue; Odour: Nil.

Lien Tang Senior Chemist

MANJIMUP STAGE 4

BORE NO MJB 24

SITE LOCN 24

DRILLER WATER AUTHORITY OF WA

SUPERVISOR C. PRANGLEY
RIG TYPE AIRCORE

COMMENCED 19-Mar-95

COMPLETED 20-Mar-95

DESCRIPTION OF STRATA	SECTION	N.S.	DEPTH	CASING	DETAILS
				LOCKING CAP	<u>SLOTS</u> TYPE IN-LINE DIAMETER 50MM MATERIAL CLASS 12 PVC SLOTS 6 - 12M
			0.0	8" PIPE 0.03m AGL	<u>SEALS</u> SURFACE SEAL CEMENT BOTTOM PLUG PVC CAP
LATERITE/ SAND			2.0		<u>AIRLIFTING & PUMPING DATA</u> RATE 49.00m ³ /day TEMP °C SALINITY 645 PPM CONDITION TIME INTERVAL
SAND			3.5	50MM CLASS 12 PLAIN PVC	<u>NOTES</u> HOLE DIAM 131MM DRILLED, CASED, GRAVEL PACKED AIRLIFTED, CEMENTED STANDPIPE
CLAY			7.0	50MM CLASS 12 SLOTTED PVC	SWL 2.14 M BGL
SAND			12.0		
CLAY			19.0		
SILT			21.0		
BASEMENT			23.5	23.50 PVC CAP	DEPARTMENT OF MINES DRILLING BRANCH
drilling suspended					DRN B M-J DATE 26-Jul-95

MANJIMUP SHALLOW BASIN DRILLING PROJECT

BORE COMPLETION REPORT FOR SITE MJB25

LOCATION AND IDENTIFICATION

OWNER : Geological Survey of Western Australia

LOCATION : This site is located on Nelson Location No 12580, approximately 3 km west on Wilgarup Road from the intersection of Wilgarup Road and the South Western Highway. The bore is located 800 m north of Wilgarup Road and 400 m west of the high tension powerlines. Access to the site is north between the homestead near the road and the lake. At the first fence turn east and then north. Approximately 900 m north turn east and travel a further 300 m along the fenceline (It will be necessary to drive around the southern side of the copse of trees present). This is bore site MJB25.

MAP SHEET : 1:250,000 SI 50-10 Pemberton; 1:50,000 2129 - 4 Wilgarup.

AMG REF : Easting 4 23 971; Northing 62 24 095

PURPOSE : Exploratory

	<u>MJB25</u>
GSWA REFERENCE	SI 50-10 2129-4-A-12
SWRIS REFERENCE	G 60719125.9
NATURAL SURFACE	253.47 m AHD
CASING TOP	254.42 m AHD
STATUS	Monitoring

CONSTRUCTION

DRILLED BY : Water Authority of Western Australia

DRILLING RIG : Rig, Edson 6000 RC Air Core Driller Graham Waghorn

METHOD : Bores were drilled by using a reverse circulation air core string and a tungsten tipped core bit 131mm in diameter. 50mm ND bore casing was installed through the drill string.

	<u>MJB25</u>
COMMENCED:	19 March 1995
COMPLETED:	20 March 1995
TOTAL DEPTH:	27.0 m
BORE CASING:	+0.84 - 6.0 m, 50 mm ND Blank PVC casing 6.0 - 12.0 m, 50 mm ND 1 mm Slotted PVC casing 12.0 - 27.0 m, 50 mm ND Blank PVC casing
ANNULUS:	Gravel packed with $\frac{1}{8}$ to $\frac{1}{16}$ graded sand from 0.0 - 27.0 m.

GEOLOGICAL DATA

SAMPLES : Cuttings at 1 m intervals. Logged by C.J. Prangley

REPOSITORY OF
SAMPLES : GSWA Core Library

SUMMARY LOG

Depth (m)	Age	Lithology
0.0 - 16.5	Quaternary	Clay / Sand, minor lateritic pebbles
16.5 -27.0	Archaean	Weathered clay grading into chloritic schist.

HYDROGEOLOGICAL DATA

CHEMICAL ANALYSES : A one litre ground water sample was taken at the cessation of airlift development of the bore and submitted to Australian Environmental Laboratories for analysis. The results of the analysis are on the next page

	<u>MJB25</u>
OBSERVATION INTERVAL	6.0 - 12.0 m
SALINITY	660 mg/L
AIRLIFT RATE	86 m ³ /day
WATER LEVEL	2.41 m bgl

CUTTINGS SAMPLE LOG SITE MJB25

DEPTH (m)		LITHOLOGICAL DESCRIPTION
0.0 - 2.0	LATERITE / SAND	Orange brown, sand is fine to medium grained, moderately sorted, moderately rounded.
2.0 - 4.0	CLAYEY SAND	Grey, fine to medium grained, moderately sorted, silty.
4.0 - 5.0	SAND	Grey, very fine grained, well sorted, well rounded, no clay.
5.0 - 6.0	SAND / SILT	Grey, 50:50, sand is very fine grained, well sorted, well rounded, no clay.
6.0 - 7.0	SILT	Grey, moist, minor fine grained sand.
7.0 - 8.0	SAND	Grey, fine to medium grained, well sorted, subrounded, minor clay.
8.0 - 9.0	SAND	Grey, medium to coarse grained, well sorted, minor clay, subrounded.
9.0 - 11.0	SAND	Grey, coarse grained, well sorted, minor clay, subrounded.
11.0 - 12.0	SILT	Brown, stiff, clayey in part, 10% sand, coarse grained.
12.0 - 13.0	CLAY	Grey sticky, brown in part, possibly silt.
13.0 - 15.0	CLAY	Dark brown, carbonaceous.
15.0 - 16.0	SILT / CLAY	Brown.
16.0 - 17.0	SILT / CLAY	Brown grading into blue grey.
17.0 - 22.0	CLAY	Blue grey, gritty, weathered basement clay, micaceous.
22.0 - 26.0	CLAY	Dark blue grey, gritty, weathered basement clay, micaceous.
26.0 - 27.0	SCHIST	Dark grey green chloritic.



National Association
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Australia

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Australian
Environmental
Laboratories

DEPARTMENT OF MINERALS AND ENERGY
Geological Survey Of Western Australia
100 Plain Street
EAST PERTH WA 6004

MANJIMUP
GSA FileNo 4079/94
12 June 1995

CERTIFICATE OF ANALYSIS

Sample: MJB25_121988

Analyte	Result	Units	Method	Ref: 03255.002
Colour	1.	Col.Un.		
Conductivity	1.1	mS/cm	APHA 2510.B	
TDS(calc.)	660.	mg/L		
TDS	620.	mg/L	APHA 2540.C	
pH	6.8		APHA 4500-H.B	
Ca	8.1	mg/L	APHA 3110;3111.A,B,D	
Mg	23.	mg/L	APHA 3110;3111.A,B,D	
Fe	<0.1	mg/L	APHA 3110;3111.A,B,D	
Si	4.	mg/L	APHA 3110;3111.A,B,D	
Na	200.	mg/L	APHA 3110;3111.A,B,D	
K	1.	mg/L	APHA 3110;3111.A,B,D	
Al	0.1	mg/L	APHA 3110;3111.A,B,D	
Alkalinity_T	36.	mg/L	APHA 2320.B	
CO3	<1.	mg/L	APHA 2320.B	
HCO3	44.	mg/L	APHA 2320.B	
Cl	310.	mg/L	APHA 4500-Cl.B	
F	0.1	mg/L	4500-F.C	
SO4	31.	mg/L	SO4_Turbidity	
NO3	3.9	mg/L	SKALAR	
B	<0.1	mg/L	ASTM D4190, APHA 3111B.	
C/A_Balance	1.08		Calculation	
Hardness_T	115.	mg/L		

Appearance: Clear water with small amount of residue; Odour: Nil.

Lien Tang Senior Chemist

MANJIMUP STAGE 4

BORE N^o MJB 25

SITE LOCN 25

DRILLER WATER AUTHORITY OF WA

SUPERVISOR C. PRANGLEY
RIG TYPE AIRCORE

COMMENCED 19-Mar-95

COMPLETED 20-Mar-95

DESCRIPTION OF STRATA	SECTION	N.S.	DEPTH	CASING	DETAILS
			0.0	LOCKING CAP	<u>SLOTS</u> TYPE IN-LINE DIAMETER 50MM MATERIAL CLASS 12 PVC SLOTS 6 - 12M
LATERITE/ SAND			2.0		<u>SEALS</u> SURFACE SEAL CEMENT BOTTOM PLUG PVC CAP
CLAYEY SAND			4.0	50MM CLASS 12 PLAIN PVC	<u>AIRLIFTING & PUMPING DATA</u> RATE 86.00m ³ /day TEMP °C SALINITY 595 PPM CONDITION TIME INTERVAL
SAND			5.5		<u>NOTES</u> HOLE DIAM 131MM
SILT			7.0	6.00	DRILLED, CASED, GRAVEL PACKED AIRLIFTED, CEMENTED STANDPIPE
SAND			11.0	50MM CLASS 12 SLOTTED PVC	SWL 2.41 M BGL
SILT			12.0	12.00	
CLAY			15.0		
SILT/CLAY			17.0		
CLAY			26.0		
SCHIST			27.0	27.00 PVC CAP	DEPARTMENT OF MINES DRILLING BRANCH
drilling suspended					DRN B M-J DATE 26-Jul-95

MANJIMUP SHALLOW BASIN DRILLING PROJECT

BORE COMPLETION REPORT FOR SITE MJB26

LOCATION AND IDENTIFICATION

OWNER : Geological Survey of Western Australia

LOCATION : This site is located on Nelson Location No 12580, approximately 3 km west on Wilgarup Road from the intersection of Wilgarup Road and the South Western Highway. The bore is located 800 m north of Wilgarup Road and 400 m west of the high tension powerlines. Access to the site is north between the homestead near the road and the lake. At the first fence turn east and then north. Approximately 400 m north turn east and travel a further 350 m. This is bore site MJB26. No bore has been constructed

MAP SHEET : 1:250,000 SI 50-10 Pemberton; 1:50,000 2129 - 4 Wilgarup.

AMG REF : Easting 4 23 899; Northing 62 23 478

PURPOSE : Exploratory

	<u>MJB26</u>
GSWA REFERENCE	SI 50-10 2129-4-B-17
SWRIS REFERENCE	G 60719126.0
NATURAL SURFACE	approximately 255 mAHD
STATUS	Abandoned

CONSTRUCTION

DRILLED BY : Water Authority of Western Australia

DRILLING RIG : Rig, Edson 6000 RC Air Core Driller Graham Waghorn

METHOD : Bores were drilled by using a reverse circulation air core string and a tungsten tipped core bit 131 mm in diameter.

	<u>MJB26</u>
COMMENCED:	19 March 1995
COMPLETED:	20 March 1995
TOTAL DEPTH:	36m

GEOLOGICAL DATA

SAMPLES : Cuttings at 1 m intervals. Logged by C.J. Prangley

REPOSITORY OF
SAMPLES : GSWA Core Library

SUMMARY LOG

Depth (m)	Age	Lithology
0 - 14.0	Quaternary	Clay / Sand, minor lateritic pebbles
14.0 - 36.0	Archaean	Weathered clay grading into hard Gneiss.

CUTTINGS SAMPLE LOG SITE MJB26

DEPTH (m)		LITHOLOGICAL DESCRIPTION
0.0 - 1.0	LATERITE / SAND	Orange brown, no clay.
1.0 - 3.0	CLAY	Cream brown, silty in part, micaceous, soapy.
3.0 - 5.0	CLAY	Brown grey, plastic, soapy.
5.0 - 6.0	CLAY	Brown, gravelly, lateritic nodules, sticky clay.
6.0 - 7.0	CLAY	Grey brown, gritty.
7.0 - 12.0	CLAY	Grey, gritty.
12.0 - 14.0	CLAY	Grey, gritty, micaceous.
14.0 - 20.0	CLAY	Light grey, gritty, micaceous, talcosic.
20.0 - 21.0	CLAY	Light grey and trace of cream, weathered feldspars, gritty, micaceous, talcosic.
21.0 - 26.0	CLAY	Light grey, gritty, micaceous, talcosic.
26.0 - 28.0	CLAY	Grey, gritty, micaceous, talcosic.
28.0 - 29.0	CLAY	Grey with brown tinges, gritty, micaceous, talcosic.
29.0 - 35.0	CLAY	Light grey, gritty, micaceous, talcosic.
35.0 - 36.0	GNEISS	Cream grey, hard, feldspathic, minor mica and quartz veins.

CLIENT GEOLOGICAL SURVEY OF WA		SURFACE RL		SHEET NO 1 OF 1		FILE NO 281.7	
MANJIMUP STAGE 4							
BORE NO MJB 26							
SITE LOCN 26		SUPERVISOR C. PRANGLEY		COMMENCED		20-Mar-95	
DRILLER WATER AUTHORITY OF WA		RIG TYPE AIRCORE		COMPLETED		20-Mar-95	
DESCRIPTION OF STRATA		SECTION N.S.		DEPTH CASING		DETAILS	
LATERITE		0.0 1.0				SLOTS TYPE DIAMETER MATERIAL SLOTS SEALS SURFACE SEAL BOTTOM PLUG AIRLIFTING & PUMPING DATA RATE m ³ /day SALINITY CONDITION TEMP °C TIME INTERVAL NOTES HOLE DIAM 131MM DRILLED, BACKFILLED SWL NOT TAKEN	
CLAY							
SCHIST		34.0		35.00 BOS			
drilling suspended		35.0					
				DEPARTMENT OF MINES DRILLING BRANCH			
				DRN B M-J DATE 26-Jul-95			

MANJIMUP SHALLOW BASIN DRILLING PROJECT

BORE COMPLETION REPORT FOR SITE MJB27

LOCATION AND IDENTIFICATION

OWNER : Geological Survey of Western Australia

LOCATION : This exploration bore is drilled on Location 11848, the property is owned by J.W. White. Access to this site is via the homestead located approximately 400 m west on Seaton Ross Road from the intersection of Seaton Ross Road and the South Western Highway. Drive in past the homestead and west past the large shed into the first paddock, move to the north side of the paddock and travel approximately 150 m west.

MAP SHEET : 1:250,000 SI 50-10 Pemberton; 1:50,000 2129 - 4 Wilgarup.

AMG REF : Easting 4 23 938; Northing 62 28 254

PURPOSE : Exploratory

	<u>MJB27</u>
GSWA REFERENCE	SI 50-10 2129-4-A-13
SWRIS REFERENCE	G 60719127.2
NATURAL SURFACE	approximately 265 m AHD
STATUS	Abandoned

CONSTRUCTION

DRILLED BY : Water Authority of Western Australia

DRILLING RIG : Rig, Edson 6000 RC Air Core, Driller Graham Waghorn

METHOD : Bores were drilled by using a reverse circulation air core string and a tungsten tipped core bit 131 mm in diameter.

	<u>MJB27</u>
COMMENCED:	20 March 1995
COMPLETED:	20 March 1995
TOTAL DEPTH:	20 m

GEOLOGICAL DATA

SAMPLES : Cuttings at 1 m intervals. Logged by C.J. Prangley

REPOSITORY OF

SAMPLES : GSWA Core Library

SUMMARY LOG

Depth (m)	Age	Lithology
0 - 2	Quaternary	Clay / Sand, minor lateritic pebbles
2.0 -20.0	Archaean	Weathered clay grading into gneiss

CUTTINGS SAMPLE LOG SITE MJB27

DEPTH (m)	LITHOLOGICAL DESCRIPTION	
0.0 - 1.0	LATERITE	Red brown, pisolitic gravels
1.0 - 2.0	CLAYEY SAND	Yellow brown, micaceous in part.
2.0 - 3.0	CLAY	Brown cream, silty.
3.0 - 5.0	CLAY	Grey to grey brown, kaolinitic soapy and talcosic texture.
5.0 - 6.0	CLAY	Red brown, minor iron nodules.
6.0 - 12.0	CLAY	Orange brown gritty, minor cream coloured weathered feldspars.
12.0 - 14.0	CLAY	Blue grey, minor cream coloured weathered feldspars, minor quartz..
14.0 - 18.0	CLAY	Blue grey, gritty, minor feldspars, minor quartz.
18.0 - 20.0	CLAY	Blue grey, gritty, vein quartz at 20 m, minor feldspars, REFUSAL.

MANJIMUP STAGE 4

BORE NO MJB 27

SITE LOCN 27

DRILLER WATER AUTHORITY OF WA

SUPERVISOR C. PRANGLEY

RIG TYPE AIRCORE

COMMENCED 20-Mar-95

COMPLETED 20-Mar-95

DESCRIPTION OF STRATA	SECTION	N.S.	DEPTH	CASING	DETAILS
			0.0		<u>SLOTS</u> TYPE DIAMETER MATERIAL SLOTS
LATERITE			1.0		<u>SEALS</u> SURFACE SEAL BOTTOM PLUG
CLAYEY SAND			2.0		<u>AIRLIFTING & PUMPING DATA</u> RATE m ³ /day TEMP °C SALINITY CONDITION TIME INTERVAL
CLAY			20.0	20.00 BOS	<u>NOTES</u> HOLE DIAM 131MM DRILLED, OPEN HOLE SWL NOT TAKEN
drilling suspended					DEPARTMENT OF MINES DRILLING BRANCH DRN B M-J DATE 26-Jul-95