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Groundwater Resources of the Northern Midlands and Fingal Valley Regions



Tasmania

MINERAL RESOURCES TASMANIA

Groundwater Resources of the Northern Midlands and Fingal Valley Regions

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Note: These maps are only included with this report as reduced size images.
Full scale maps are available separately from Mineral Resources Tasmania.

FOREWORD

This project was undertaken as part of the Tasmanian Regional Drought Initiative, a program comprising a series of projects designed to alleviate the impact of drought in the Northern Midlands and Fingal Valley districts of Tasmania, by improving drought-preparedness within the farming community. The TRDI program was co-ordinated by the Department of Primary Industries, Water and Environment.

Other projects in this program reviewed surface water and land resources, options for farm enterprise diversification factors that hinder and support changes at farm level, and risk management of drought and changes in farm operation.

This report provides an overview of the groundwater resources of the region, including likely yields and chemistry of water derived from the local aquifers. Regional groundwater maps have been prepared to aid in assessing potential development of the resource.

Executive Summary

- The regional geology and hydrology can be summarised as a complex series of sedimentary and igneous rock sequences, which form highly variable moderate to low-yield fractured aquifers. Topographically elevated regions, on the margins of the TRDI area, form recharge zones for the aquifers, with a generalised groundwater flow pattern towards the low-lying valleys.
- Regional examination of aquifer characteristics, using existing data and field tests carried out as part of the project, indicated a that number of general conclusions could be applied to the resource:
 - there was widespread groundwater availability across the region;
 - water yields from boreholes were highly variable, but generally only low or moderate;
 - the highest yields were obtained from distinct aquifer types, or in the vicinity of known geological lineaments.
- Groundwater chemistry data for the region indicates that the water is wholly suitable for traditional livestock farming, but the opportunity for use of groundwater as a principal supply for diversification into irrigation cropping is generally limited by:
 - restricted bore yields;
 - moderate to high salinity of many groundwaters in the region, those with the most elevated salinities being from water tables encountered nearest to the surface;
 - the nature of the aquifers themselves, including mineralogy and flow regime;
 - the suitability of existing soils.
- Analysis of all data on a regional scale has enabled the production of a series of four maps of the region, to assist in the assessment of future groundwater resource development. These include:
 - a map of the TRDI area, showing the locations of boreholes examined during the study;
 - a hydrogeological map of each of the main drainage basins within the TRDI area;
 - a regional groundwater prospectivity map of the Macquarie Basin, giving details of the aquifer type, predicted salinity of bore waters and possible restrictions on water use.
- A number of probable target locations for future drilling of successful extraction bores have been identified.

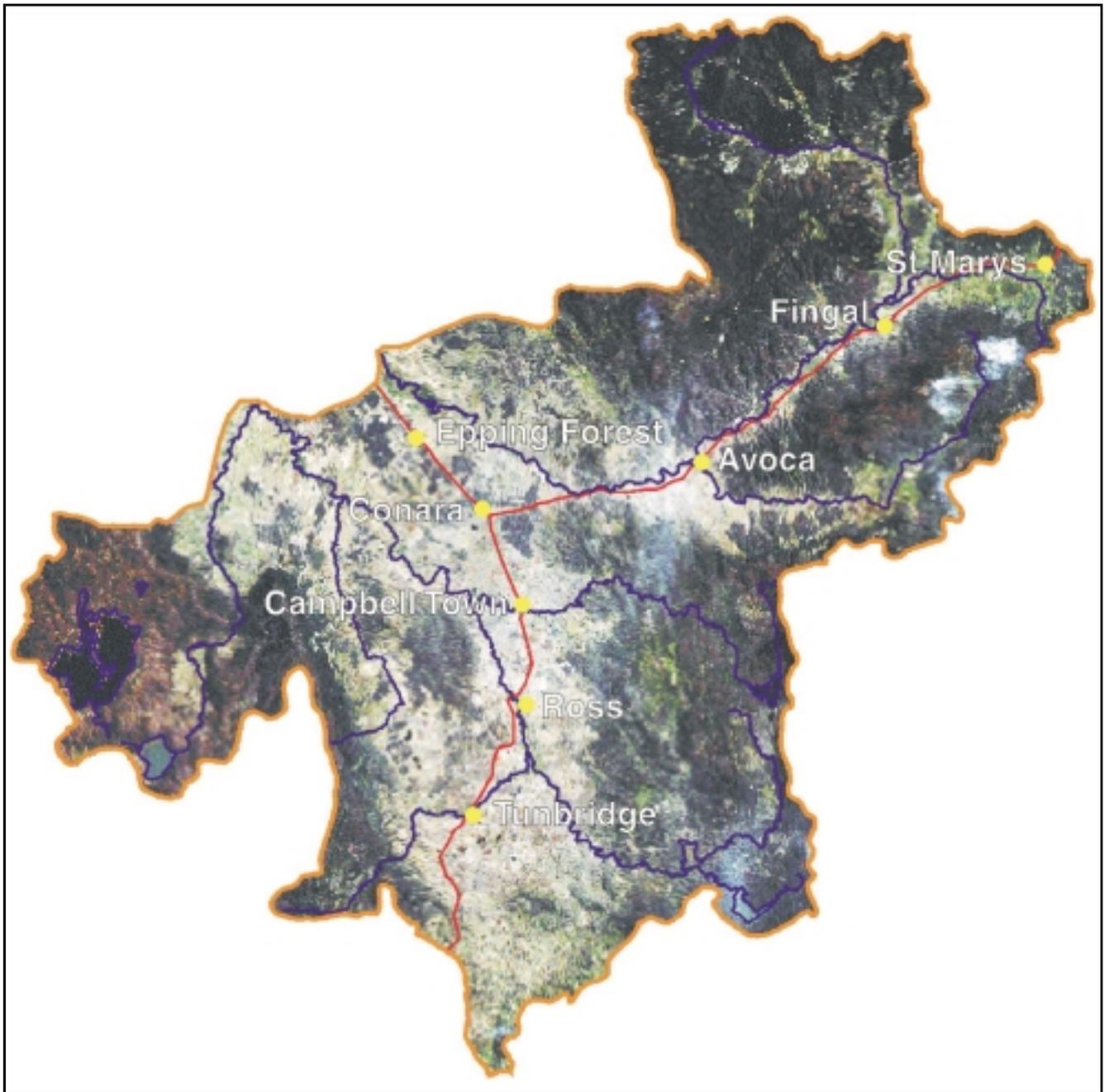


Figure 1

LANDSAT image of the study area

Introduction

This project is one of a series of projects which comprise the Tasmanian Regional Drought Initiative (TRDI) which focus on the Northern Midlands and Fingal Valley areas of Tasmania. These districts were declared drought exceptional circumstances during the period 1994–1995. As a result, the TRDI was developed to determine ways in which farmers in this region could be better prepared for drought.

The particular emphasis of this TRDI project is on regional groundwater resources. The project aims to provide an assessment of present and future development prospects and their suitability for agricultural use.

Regional groundwater prospectivity and hydrogeology maps have been produced as part of the study. These will allow easy visualisation of the findings and provide readily accessible information for prediction of future resource development potential. (Note: these maps are only included in this report as reduced images. Full scale maps are available separately from Mineral Resources Tasmania).

Objectives

The objectives of this particular TRDI project were to:

1. Enable better utilisation of the groundwater resources, to aid farm diversification and water management issues;
2. Collate and review existing relevant groundwater data;
3. Undertake field investigations to obtain new data from existing boreholes to allow assessment of the potential of currently utilised reserves;
4. Implement a drilling program to test the hydrogeological concepts, as an aid to increasing the success rate of new bores; and
5. Provision of an easily accessible summary of information, with recommendations for the agricultural community.

Previous Studies

The major previous investigations of the region's groundwater consisted of overviews by Nye in 1921 and 1926. Matthews (1983) provided a detailed account of the Longford Basin in the northwestern part of the TRDI project area (fig. 2).

Physiography

The boundaries of the project area (fig. 1) are essentially defined by the drainage divides of the Macquarie River and South Esk River basins. The primary focus of the TRDI was on areas suitable for agricultural diversification. Consequently this project

has generally concentrated on the central lowlands of each drainage basin.

Regional topography has a strong influence on the local direction and flow of groundwater. The study area consists of a number of high relief areas composed of variably fractured crystalline rock which form the edges to two main drainage basins. These enclose a central, topographically lower drainage basin, composed of fractured sedimentary rocks interspersed with lavas and overlain by unconsolidated material.

Climate

Climatic effects provide one of the main controls on local groundwater recharge and salinity. Rainfall in the project area is highest in the mountainous areas, with mean annual rainfalls averaging between 1000 and 1300 millimetres. Maximum values are experienced on the periphery of the South Esk drainage basin. In the lowland areas, reduced humidity is associated with lower precipitation, giving average rainfall figures of less than 600 mm per annum (fig. 3). The net precipitation gradient produces a regional groundwater flow towards the centre of each basin.

Geology

The regional geology and hydrogeology comprise a complex series of sedimentary and igneous rock sequences, which form highly variable moderate to low-yield fractured aquifers. Topographically elevated regions, on the TRDI area margins, form recharge zones for the aquifers, with a generalised groundwater flow pattern towards the low-lying valleys. The northwestern part of the study area is underlain by a Tertiary basin, in which the hydrogeology is essentially governed by intergranular flow.

The geology of most of the project area is covered by the 1:50 000 scale geological maps of Oatlands (Sheet 68), Interlaken (61), Lake River (54), Snow Hill (55), Ben Lomond (48), St Marys (49) and St Helens (41). The remaining area is covered by the 1:250 000 scale Southeast Tasmania and Northeast Tasmania regional geological maps.

The geology of the area can be subdivided into a number of major geological units:

Igneous rocks

- Tertiary basalt – infilled rift valleys in areas of the Fingal Valley and the Northern Midlands;
- Jurassic dolerite – intruded predominantly into the Late Triassic rocks;
- Devonian granite – intruded into Silurian/Devonian rocks in the Fingal Valley.

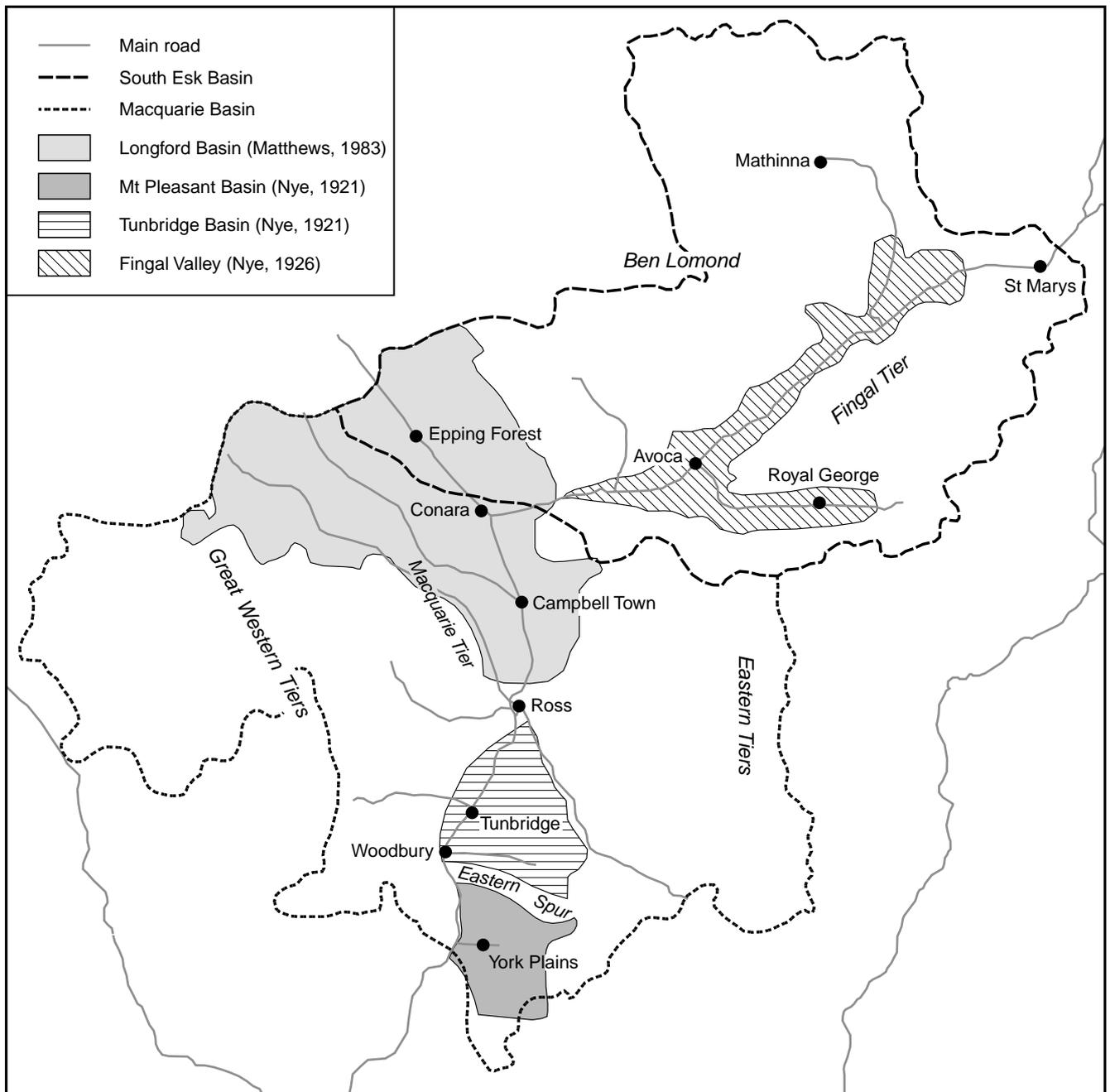


Figure 2

Major previous investigations throughout the study area

Sedimentary rocks

- Triassic rocks – predominantly exposed in southern regions of the Macquarie Basin;
- Permian rocks – occur throughout the TRDI study area;
- Silurian and Devonian rocks – predominantly exposed in the Fingal Valley.

Unconsolidated sediments

- Quaternary and Tertiary sediments – infilled rift valleys in areas of the Northern Midlands and Fingal Valley.

Groundwater Exploration Program

Existing borehole data

As part of the study, information from 375 existing boreholes was collated, using the statewide BORIS database maintained by MRT (fig. 4) (more detailed information is given on Map 1). This was supplemented by new analyses where required, incorporating levels of pH, nitrate, conductivity and salinity at each borehole location. Where yield was sufficiently high (>3 L/sec), field surveying by GPS was used to assess the proximity of boreholes to major geological faults and lineaments.

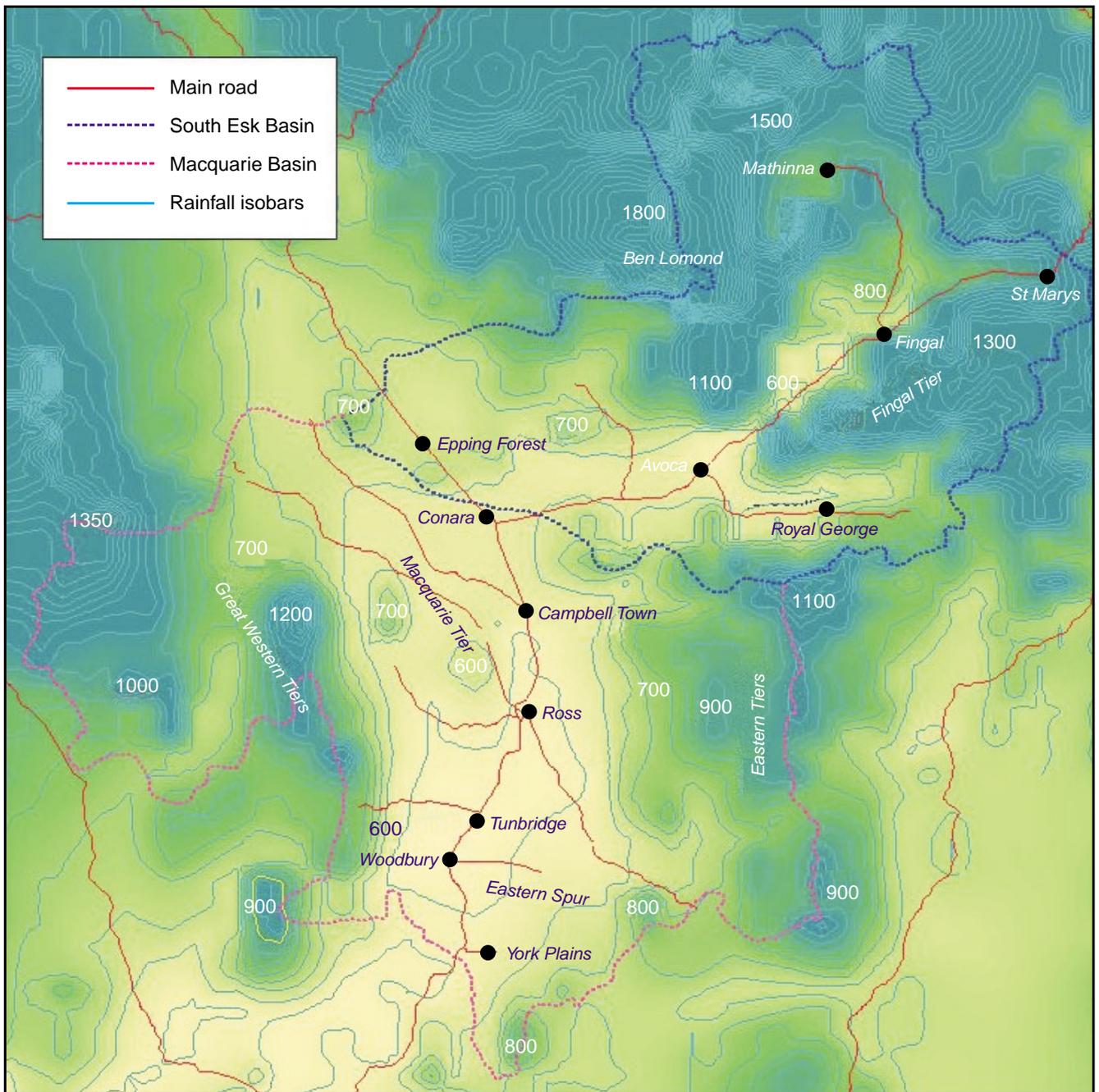


Figure 3

Average annual precipitation of the study area. Isobars at 50 mm intervals.

Measurement of water conductivity with depth allowed for the construction of a salinity model for the Macquarie Basin. This enabled the production of estimated ranges of water salinity with depth of borehole. These ranges have been incorporated into Maps 2 and 3.

TRDI drilling program

The second phase of the study involved a drilling program, with the aims of:

- Gaining a better understanding of the overall groundwater resources of the area;
- Improving the prediction of successful well location and construction;

- Ascertaining the potential for high and moderate yield irrigation supplies in areas most suitable for agricultural development.

Certain geological lineaments were identified within the Macquarie Basin, using a combination of topographic data, Landsat imagery and magnetic surveying. These lineaments are shown on Maps 2 and 3. Magnetic lineaments may either represent dolerite/sedimentary rock contacts, fault lines or contacts with aquitards in unconsolidated sediments. Topographic lineaments were used in sedimentary rock sequences and dolerite to define certain faults and major joints. A number of lineaments were investigated during this study, with some degree of success, as potential sites for resource wells.

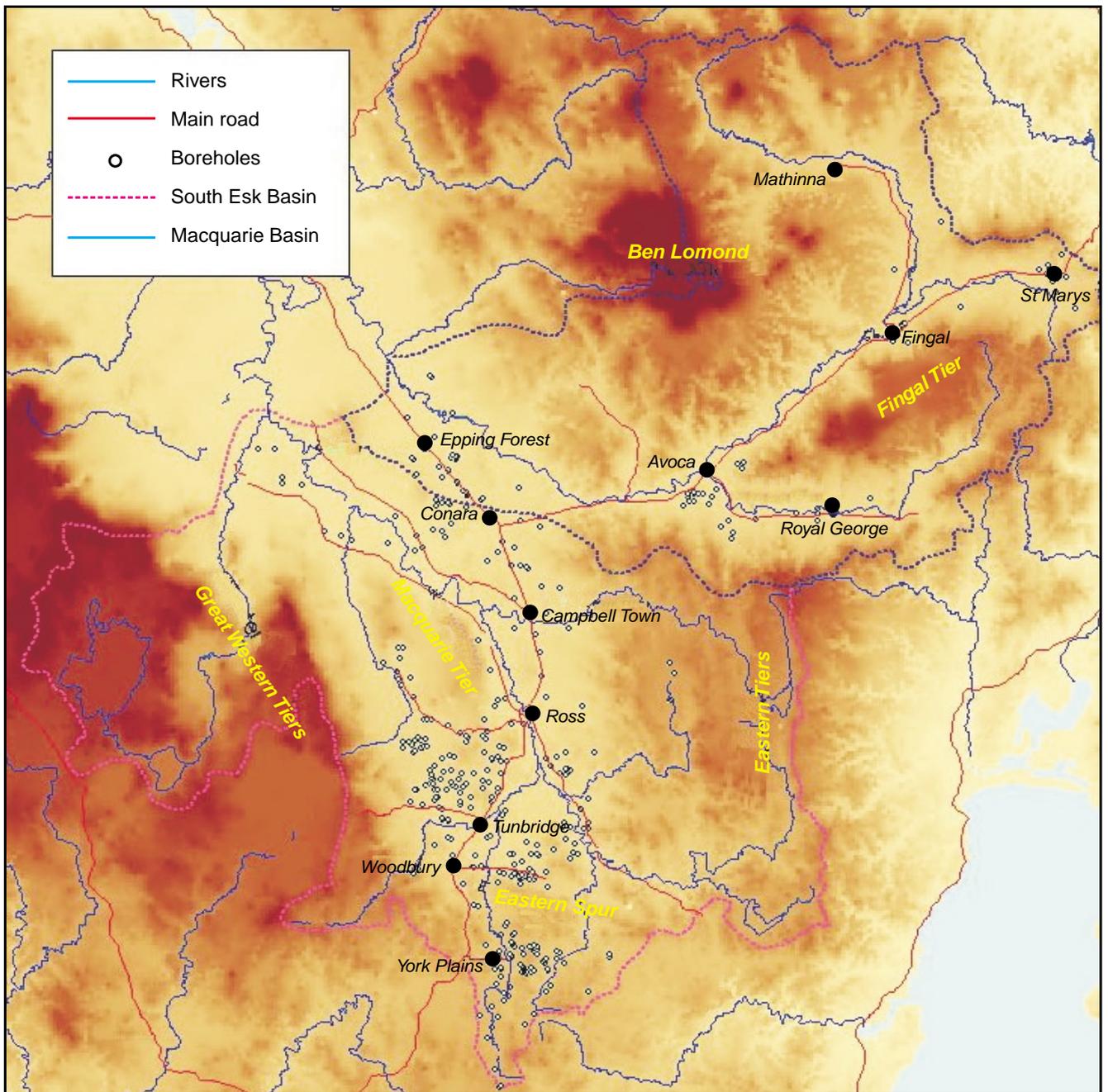


Figure 4

Digital elevation model showing the distribution of documented boreholes in the study area

Thirty new boreholes were drilled to test aquifer characteristics and reliability as a resource, examine the influence of geological, hydrological or geophysical structures, and to assess the potential for increased resource production at greater depth. Of these holes, 26 were drilled in the Northern Midlands and four in the Fingal Valley (fig. 5). The water samples extracted were analysed for principal cations and anions, as well as pH, conductivity, hardness, alkalinity and TDS.

Six boreholes were selected for well testing to determine aquifer properties. These holes were developed to allow insertion of a down-hole pump. Each of these wells was pumped at steady state for a fixed period and values of drawdown with time recorded. The borehole logs and the results of the chemical analyses are summarised in Appendix 4. The results of the well testing are detailed in Appendix 5.

The results from the TRDI drilling program are shown in Table 1. In general, the optimum well yields tended to be obtained with increasing depth of the bore in most aquifers.

A summary of results from the TRDI drilling (Table 2) indicates that, based on yield, the most prospective aquifers are within the Tertiary basalt. The Early Triassic and Permian rocks have similar prospects but there was only limited success drilling in the Jurassic dolerite, Late Triassic rocks and Tertiary sediments.

Results of pump tests from six selected boreholes were analysed to give values of transmissivity and storage for the aquifer surrounding each well. Approximate well yield was also calculated. The values of T and S are shown, with the corresponding aquifer type, in Table 3.

Table 1

Summary of drilling results from the TRDI drilling program (see Figure 5 for locations)

Bore	Property	Rock Unit	Depth (m)	Yield (gallons/hour)	Yield (litres/sec)	Conductivity (µS/cm)
193	Charlton	Tertiary sediments	13	0	0.00	
207	Beaufront	Late Triassic	19	5	0.01	
212	Beaufront	Early Triassic	109	3000	3.79	4150
215	Beaufront	Tertiary basalt	79	720	0.91	3330
220	Beaufront	Late Triassic	31	360	0.45	8170
221	Beaufront	Early Triassic	37	0	0.00	
224	Somercotes	Early Triassic	19	0	0.00	
227	Somercotes	Early Triassic	19	50	0.06	
229	Somercotes	Permian	73	1800	2.27	1710
249	Frankston	Early Triassic	85	2400	3.03	2620
254	Beaufront	Permian	55	360	0.45	1460
257	Ashby	Early Triassic	73	6500	8.21	1260
260	Chiswick	Tertiary basalt	37	19000	23.99	2390
267	Bloomfield	Early Triassic	60	7200	9.09	4630
270	Downward	Early Triassic	47	300	0.38	1630
271	Camelford	Tertiary basalt	54	20000	25.26	2910
274	Fosterville	Dolerite	36	150	0.19	1300
276	Quorn Hall	Tertiary basalt	85	600	0.76	780
278	Riccarton	Tertiary basalt	78	1600	2.02	2900
280	Douglas Park	Tertiary basalt	49	15000	18.94	1380
281	Riccarton	Tertiary basalt	79	2400	3.03	1128
282	Snaresbrook	Tertiary basalt	61	2400	3.03	3090
289	Kenilworth	Tertiary sediments	55	400	0.51	
302	Meadow Bank	Tertiary basalt	31	1800	2.27	5390
307	Quarry Hill	Tertiary sediments	69	20	0.03	
321	Windfalls	Permian	85	6000	7.58	1950
329	Benham	Late Triassic	103	960	1.21	4460
353	Hanson	Tertiary sediments	31	250	0.32	10700
386	Kooringa	Permian	55	3000	3.79	880
399	Malahide	Tertiary sediments	19	200	0.25	

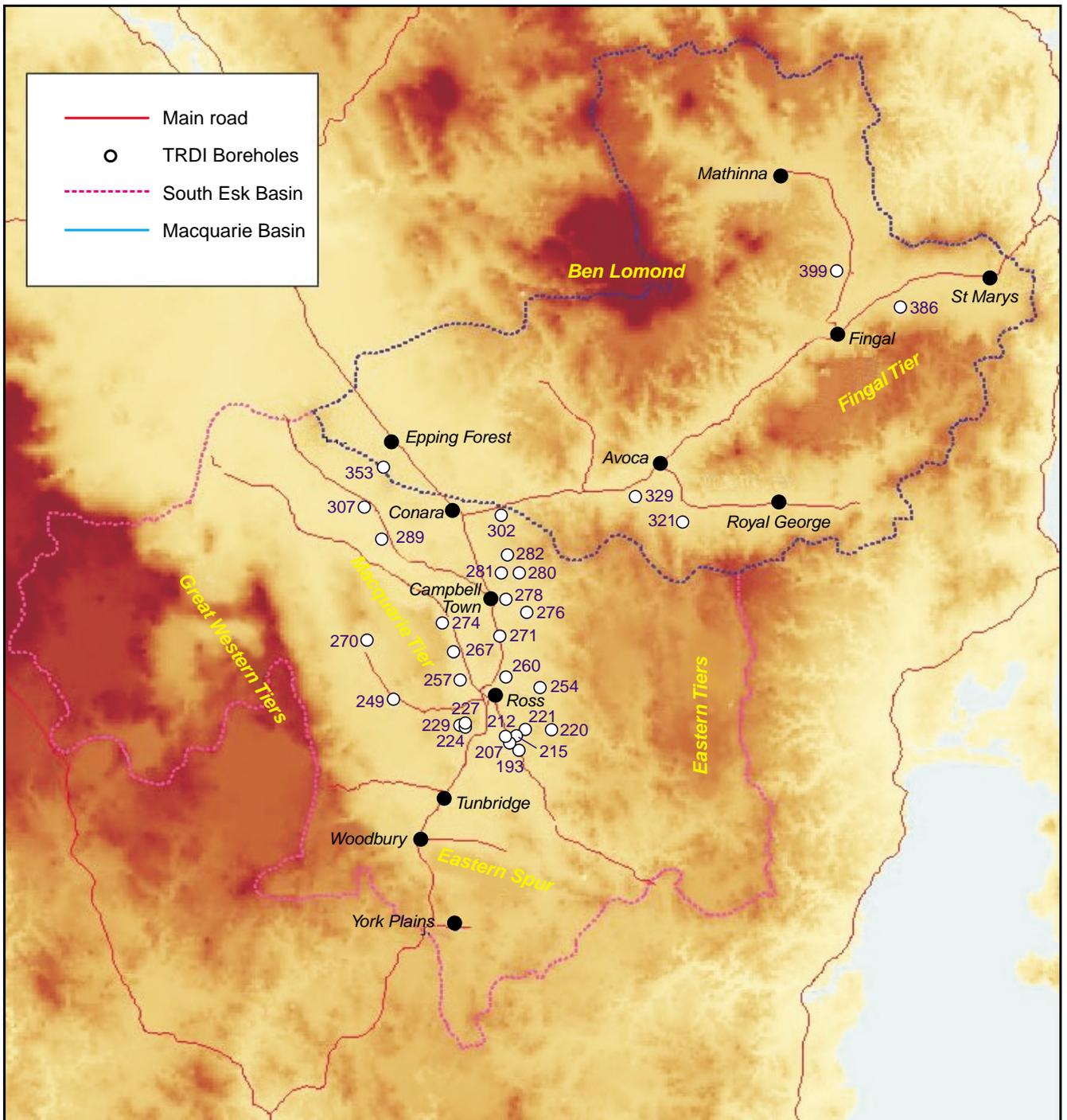


Figure 5

Digital elevation model showing locations of the boreholes drilled as part of this project

Table 2

Summary of TRDI bores from Table 1

Rock unit	Average depth (m)	Average yield (GPH)	Average yield (l/s)	Ave. conductivity ($\mu\text{S}/\text{cm}$)
Tertiary basalt	61	7058	8.9	2589
Jurassic dolerite	36	150	0.2	1300
Devonian granite	-	-	-	-
Late Triassic	51	442	0.6	6315
Early Triassic	51	2431	3.1	2858
Permian	67	2790	3.5	1500
Tertiary sediments	37	174	0.2	10700

Table 3*Summary of results from pump testing*

Bore Name (property)	Aquifer	Bore	Transmissivity (metres/day)	Storage Coefficient	Optimal Yield (l/sec)	Conductivity($\mu\text{S}/\text{cm}$)	
						Start pump test	End pump test
Windfalls	Permian	321	105.1	1.97×10^{-4}	12.64	6460	2680
Kooringa	Permian	386	3.4	1.59×10^{-5}	2.78	1360	1000
Ashby	Early Triassic	257	37.27	3.50×10^{-7}	6.68	1080	1330
Douglas Park	Tertiary basalt	280	64.2	9.61×10^{-4}	22.38	1570	1690
Camelford	Tertiary basalt	271	128	5.62×10^{-4}	54.33	4370	3330
Chiswick	Tertiary basalt	260	102.9	2.06×10^{-3}	48.22	2860	2780

Table 4*Summary of the main geological units and principal aquifer types within the study area*

<i>Fractured Igneous Rocks</i>	<i>Aquifer Type</i>
Tertiary basalt	Major aquifer
Jurassic dolerite	Locally minor to important aquifer
Devonian granite	Minor local aquifer
<i>Fractured Sedimentary Rocks</i>	<i>Aquifer Type</i>
Late Triassic rocks	Unimportant as aquifer
Early Triassic rocks	Locally important aquifer
Permian rocks	Locally important aquifer
<i>Unconsolidated Sediments</i>	<i>Aquifer Type</i>
Tertiary and Quaternary	Localised major aquifer

Hydrogeology

Borehole data for the TRDI study area indicate that all known aquifers in the region operate as either confined or semi-confined (i.e. leaky) systems. The nature of the aquifers is such that flow rates tend to be reasonably low, but this is dependent on the siting of the actual production well and the local fracture state of the aquifer. This has allowed the subdivision of the aquifers into distinct types according to the potential yield, as shown and summarised in Table 4.

The calculation of physical aquifer characteristics involved the division of boreholes, according to yield, into 'successful' (>0.05 l/sec) and 'unsuccessful' (<0.05 l/sec) bores (see table in Maps 2 and 3).

With the exception of the Tertiary basalt and unconsolidated sediments, the potential yield of a well in the region is governed solely by the open-ness and spacing of fractures in the rock. The inherent high primary porosity of the Tertiary basalt provides these rocks with a greater storage potential than other rocks in the region. The hydrogeology of the unconsolidated sediments was summarised by Matthews (1983), with the characteristic flow regime noted as comprising discontinuous high permeability units separated by a number of low permeability aquitards.

The aquifers noted above primarily operate as confined aquifer systems. The exceptions to this are the

basins of shallow unconsolidated Tertiary and Quaternary sediments, which operate as semi-confined (leaky) or unconfined aquifer systems, in which water transmissivity is dependant almost entirely on intergranular porosity.

A large number of major faults are present throughout the area. The principal faults occur to the east of the Great Western Tiers highlands and trend NW-SE (Matthews, 1996). The associated fracturing has a governing effect on the groundwater flow regime.

The Permian aquifers are, in most cases, likely to produce some of the higher yields of the sedimentary rocks, particularly in the Fingal Valley, because of the significant amount of stress-relief fracturing within them. Late Triassic aquifers tend to have reduced permeability relative to the Permian and Early Triassic rocks and are frequently dissected by dolerite (Forsyth, 1989). The net result is a reduced yield relative to the Permian and Early Triassic formations.

Igneous rock aquifers (with the exception of the Tertiary basalt) depend entirely on their fracture state for permeability, and therefore tend to be highly site-specific in the placing of resource production wells. A degree of planning should therefore be carried out when considering the location of such wells. The most successful bores in dolerite, for example, as identified by the present study, were those close to probable contact areas between dolerite and

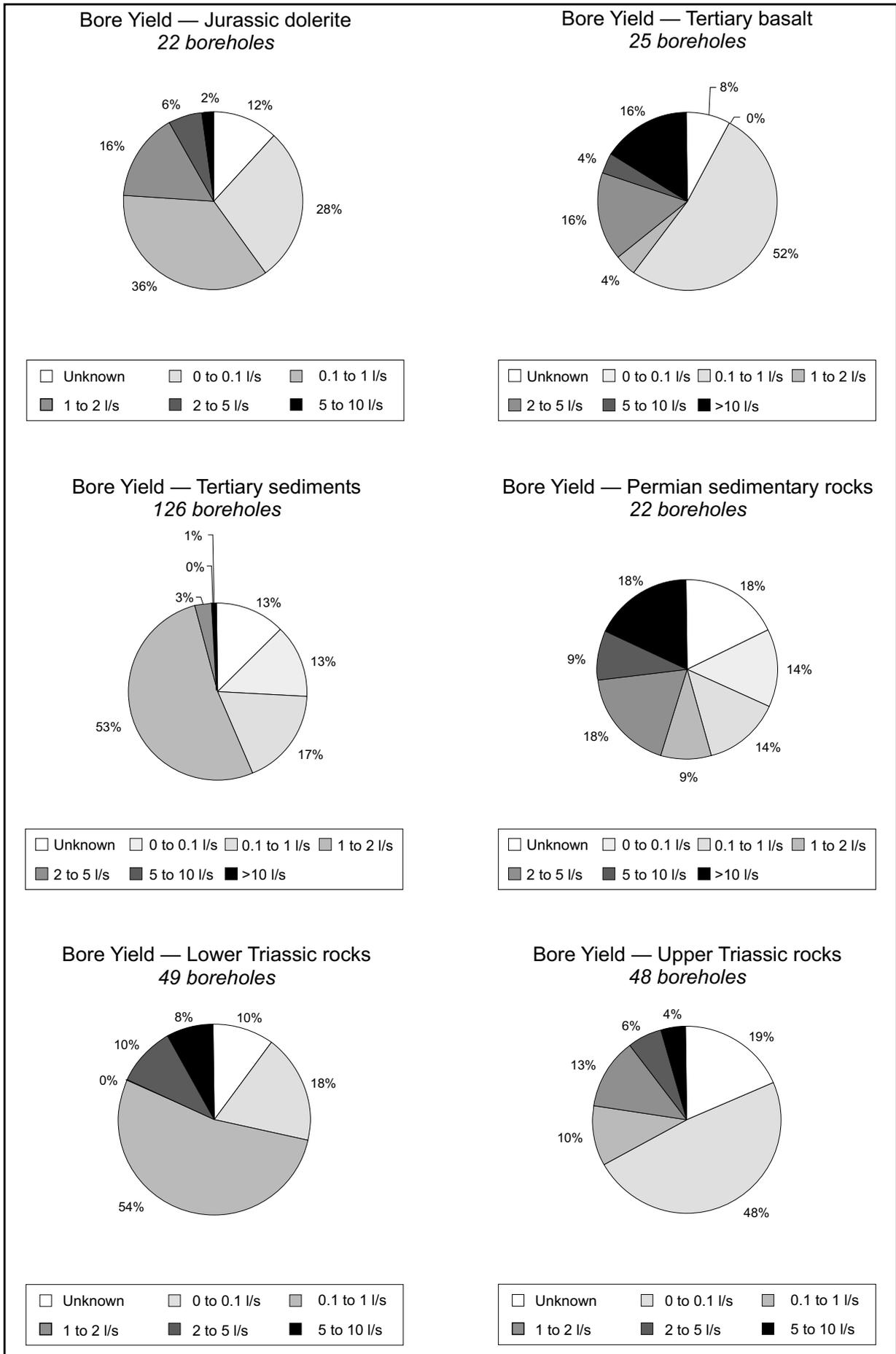


Figure 6

Bore yield data from BORIS showing the aquifer characteristics of the six main hydrogeological units

neighbouring rocks and those sited where the degree of fracturing may be assumed to be highest. Silurian and Devonian rocks, with the exception of seven boreholes in the Fingal Valley, have been little used as potential reserves within the study area.

The Tertiary basaltic rocks, whilst considered to be primarily a fractured aquifer, contain a large number of voids within them, producing a higher primary porosity. This is enhanced in thinner basalt layers (Leaman, 1965). Post-depositional development of extensive and highly interconnected cooling joint systems has produced high transmissivity and moderate permeability aquifer systems with high storage, giving moderate yields for most resource wells in basalt. These extensive fracture systems tend to promote rapid recharge, either directly into the aquifer or by percolation through overburden. The highest yields were obtained where multiple, thin layer sequences of basalt were encountered (e.g. bores 280 and 260). The pie diagrams in Figure 6 provide a summary of the yields obtained for each aquifer type.

Aquifers formed of unconsolidated materials comprise a relatively small part of the TRDI area, but may be regarded as a locally important resource for future supply purposes in the region.

Where the geological sequence comprises a layering of aquifer types, the juxtaposition of the lesser aquifers and the basalt is likely to produce the most productive extraction wells.

The proximity of boreholes to lineaments and faults has been shown by the study to have some very broad correlation with yield, the faults more so than the lineaments. This is obviously primarily dependent on the fracture orientation and spacing, but has potential for use as an aid to bore siting.

Groundwater chemistry

The individual aquifers of the area have characteristic chemical signatures which has allowed the aquifers to be subdivided according to yield and salinity (Map 4). The principal aquifers are noted in Table 4.

Salinity

Higher salinities in the Northern Midlands part of the study area have resulted in an extensive monitoring program in a large number of existing boreholes. The relatively low salinity of groundwater extracted in the Fingal Valley, combined with a sparse data set, meant that it was impractical to examine that area in detail during this study.

The concentration of extraction wells and frequency of sampling in the Northern Midlands allowed the

construction of a salinity map (Map 4), with salinity being expressed in terms of electrical conductivity.

The average salinity (conductivity) of groundwater wells in various regions of the study area is shown in Figure 7, which covers an area from Mt Seymour in the south to the north of the basin at Epping Forest. Part of the southwestern end of the Fingal Valley is also included as a comparison.

The high groundwater salinities encountered in bores in the vicinity of Tunbridge and Lemont are probably related to soil salinisation, produced by concentration of salts in the near-surface groundwater. The principal aquifer in this area is an interdigitated sequence of Quaternary clay, sand and gravel.

The study confirmed the assumption that deeper wells produce better quality (less saline) water, although evidence exists in certain areas for contamination of the deeper groundwater by the more saline waters from near-surface aquifers. The total ion chemistries of the groundwaters of the region are shown in the Piper diagram (fig. 8).

In the TRDI area, the average salinity (conductivity) of waters from wells between 0 and 10 m deep was 5670 $\mu\text{S}/\text{cm}$, whereas wells below 10 m depth had an average salinity (conductivity) of 2670 $\mu\text{S}/\text{cm}$. There was a net similarity of principal ion chemistries, as illustrated on the Piper diagram (fig. 9). This made it impossible to definitely ascribe the origin of the salinity to any particular aquifer type. The average water composition from each aquifer type with dominant cations being those of the alkali metals, and characterised by low buffering capacity, is to be expected from the dissolution of alkali minerals in the surrounding predominantly low-carbonate rocks.

The accompanying salinity data (Tables 5 to 7) should be considered in relation to the guidelines included in the SALTPAK document issued by the Department of Primary Industry (1992).

These tables demonstrate that the high level of salinity in most of the local groundwater results in a potentially very low suitability for irrigation of most crops.

Comparison with the guidelines applicable to water for stock use (Farmnote 166, Department of Agriculture, 1984) shows that there is less of a problem in using this water for stock watering purposes.

The regional groundwater may be judged as generally acceptable for use as stock water. The potential for regional variation in groundwater salinity is such that caution is advised in the use of this water for animals with lower salinity tolerance.

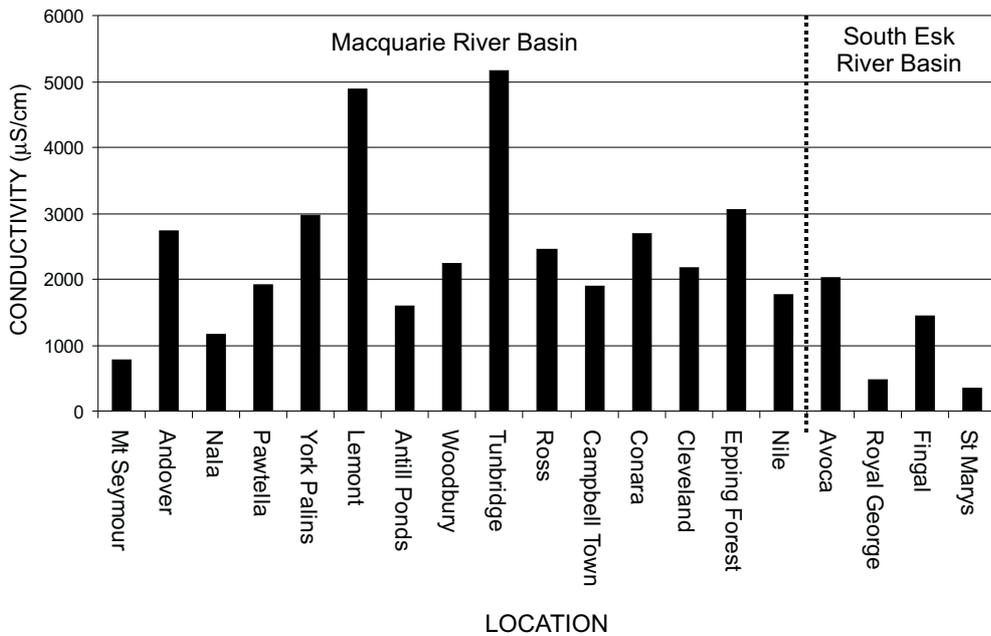


Figure 7
Average salinity of groundwater bores at different locations in the study area

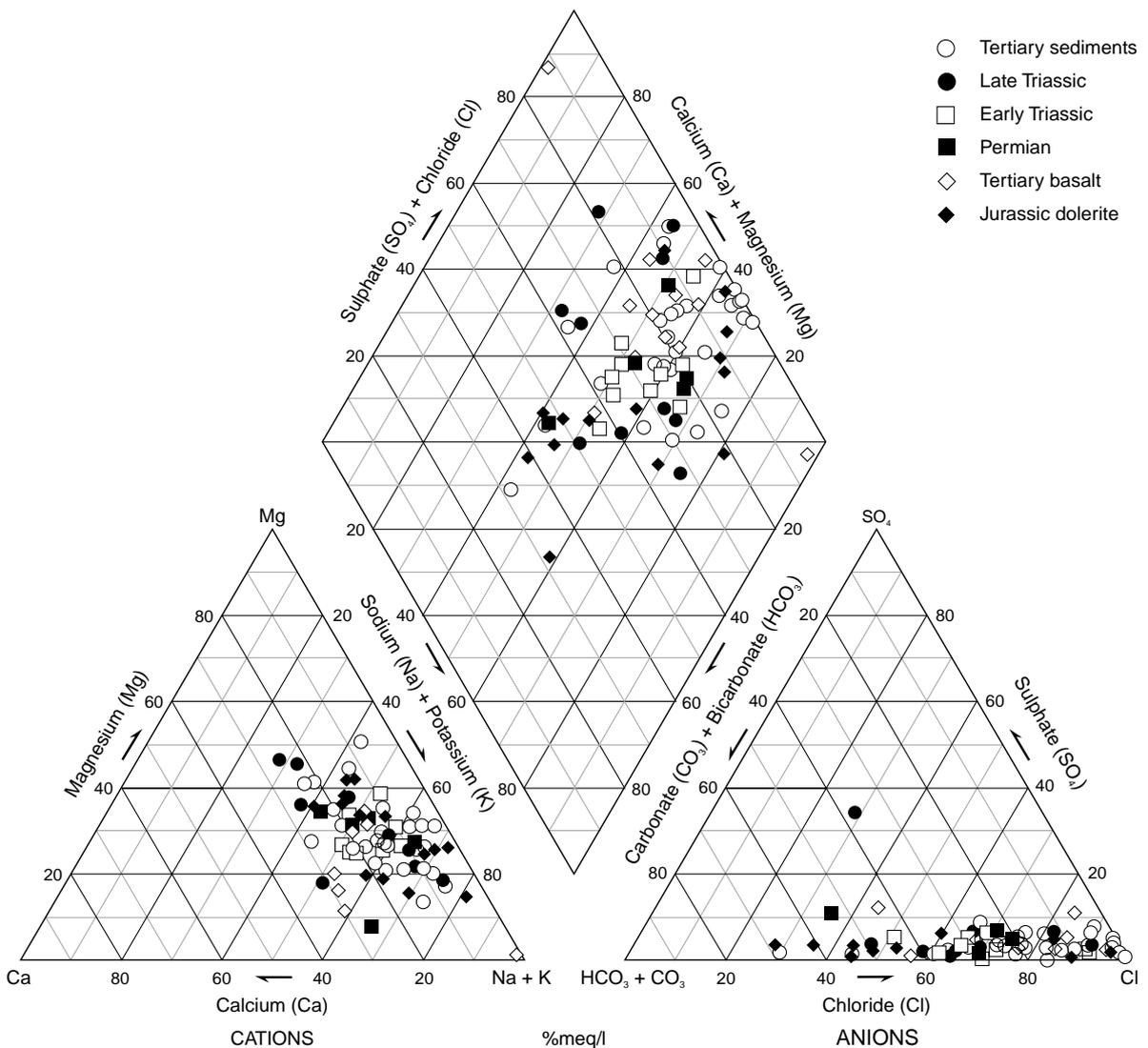


Figure 8

Piper diagram showing the chemical ratios of analysed bores within the TRDI project area. See Appendix 3 for raw data.

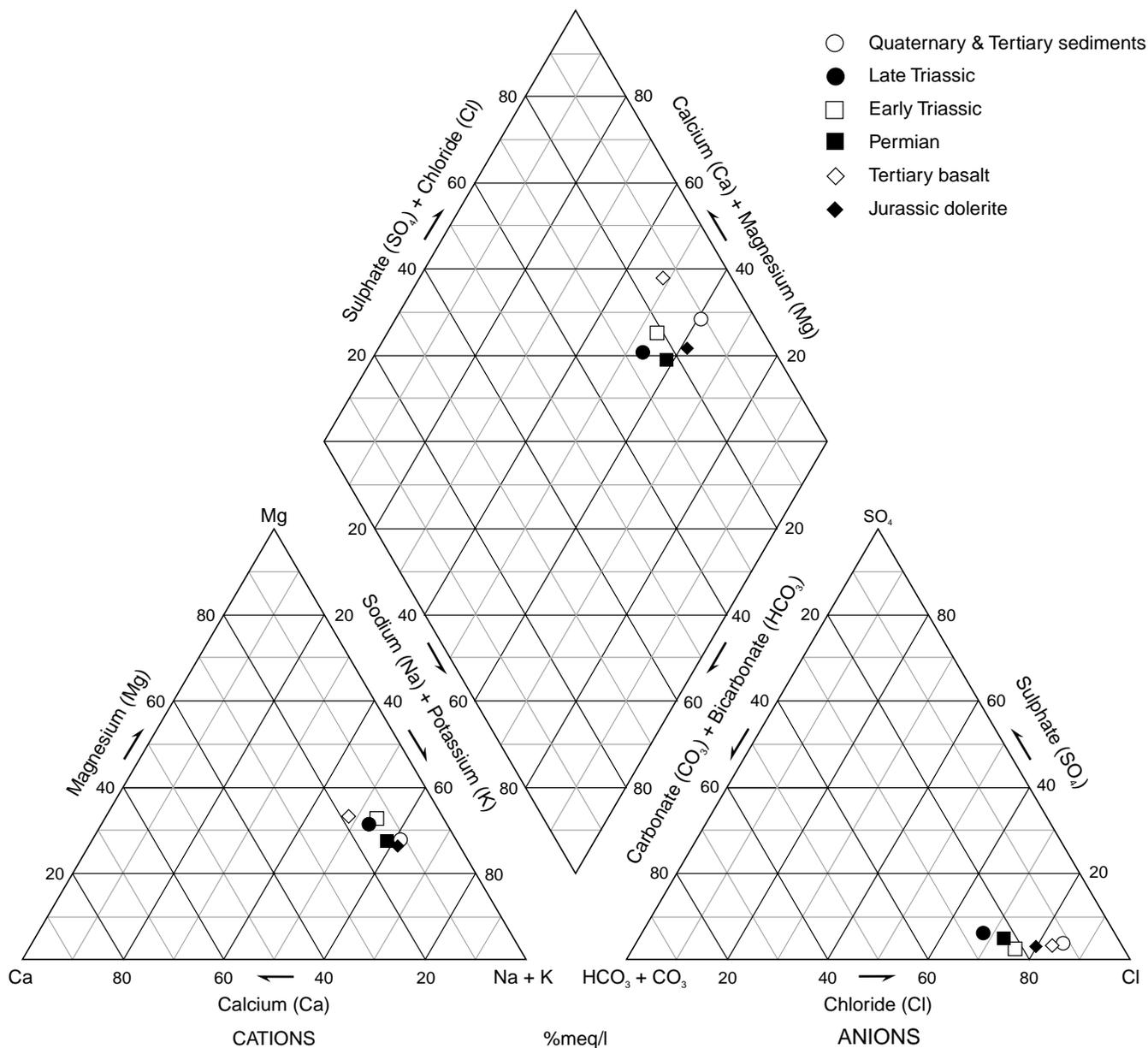


Figure 9

Piper diagram showing the average chemical ratios of groundwater from major hydrological units within the TRDI project area

Table 5

Salinity of irrigation water which may cause up to 10% reduction in crop yield for pasture plants (SALTPAK, DPI, 1992)

Pasture plants	Conductivity ($\mu\text{S}/\text{cm}$)
Wheatgrass, tall	5000
Wheatgrass, fairway	5000
Ryegrass	3700
Sorghum, alnum	4500
Barley, hay	4000
Wheatgrass, crested	2300
Lucerne	1300
Clover	1100

Table 6

Salinity of irrigation water which may cause up to 10% reduction in crop yield for vegetable crops (SALTPAK, DPI, 1992)

Vegetable crop	Conductivity ($\mu\text{S}/\text{cm}$)
Onion	800
Lettuce	900
Potato	1100
Spinach	1300
Tomato	1500
Cauliflower	1700
Pea	1700
Broccoli	1900
Beetroot	2700
Zucchini	3150

Table 7

Salinity of irrigation water which may cause up to 10% reduction in crop yield for field crops (SALTPAK, DPI, 1992)

Field Crop	Conductivity ($\mu\text{S}/\text{cm}$)
Onion	800
Poppies	1000
Potato	1100
Soybean	3300
Wheat	4000
Barley (grain)	5300

Table 8

Maximum continuous concentration for healthy growth of livestock (Farmnote 166, 1984)

Livestock	Conductivity ($\mu\text{S}/\text{cm}$)
Pigs	3000
Poultry	3000
Dairy cattle	5000
Horses	6000
Beef cattle	6000
Sheep	10000

Table 9

Summary of sodium percentage for analysed groundwater samples in the study area

Water Bearing Unit (no. of wells)	Range (%)	Average (%)
Tertiary basalt (12)	2–60	48
Early Triassic (10)	28–68	50
Late Triassic (12)	43–67	54
Permian (5)	43–66	55
Jurassic dolerite (15)	41–81	59
Tertiary sediments (27)	42–76	59

Sodium Percentage

The sodium percentage provides a measure of the sodium fraction in the groundwater, expressed as a percentage of the total cations in the water (as meq/l)

Publications by the United States Salinity Laboratory indicate that water with a sodium percentage exceeding 50% is not suitable for irrigation. In most cases, the values in Table 9 indicate that a deflocculation of clay in the soil and consequent reduction in soil permeability is likely to occur if these waters are used for irrigation. The high salinities (as TDS) within the study area are also less likely to be reduced by the natural cation exchange capability of the soil at these high values of sodium percentage, indicating a restriction on the use of water for arable irrigation. A histogram comparing sodium percentage and bore frequency is given in Figure 10.

Sodium Adsorption Ratio (SAR) and Exchangeable Sodium Percentage (ESP)

The Sodium Adsorption Ratio (SAR) is a more accurate method for determining the suitability of groundwater for irrigation, as it is an indicator of the amount of free sodium, in water, available for cation exchange with a soil.

The Exchangeable Sodium Percentage (ESP) is a measure of the sodium in a soil which is or will be in cation exchange equilibrium with groundwater of a particular composition. It can be predicted for soils following application of water of known composition, from the SAR value of the water, using a nomogram developed by the USSL.

A summary of the calculated values of SAR and ESP for boreholes in the study area is shown in Tables 10 and 11. A graphical representation of SAR and bore frequency is shown in Figure 11.

Figure 13 indicates the suitability of water samples for irrigation based on a combination of SAR and EC (salinity) values. As a general rule, groundwater extracted from Tertiary sediments is more likely to cause soil structure problems when used for irrigation, more so than water from Tertiary basalt and some sedimentary rocks.

The ESP frequency for the total number of bores sampled is shown in the histogram in Figure 12.

Consideration of the findings of Hart (1974) on Exchangeable Sodium Percentage, which regard an

Table 10

Summary of SAR values for analysed groundwater samples in the study area

Aquifer (sample size)	Range (%)	Average (%)
Tertiary basalt (12)	0.3–33.9	17
Early Triassic (10)	2.8–44.7	17
Permian (5)	6.9–34.6	18
Late Triassic (12)	13.3–35.4	22
Tertiary sediments (27)	4.4–65.7	24
Jurassic dolerite (15)	9.2–59.8	31

Table 11

Summary of ESP value for analysed groundwater samples in the study area

Aquifer (sample size)	Range (%)	Average (%)
Tertiary basalt (12)	0–32.8	18
Early Triassic (10)	2.8–39	18
Late Triassic (12)	2.8–39	18
Permian (5)	8.2–33	19
Tertiary sediments (27)	4.9–48.9	24
Jurassic dolerite (15)	10.9–46.5	28

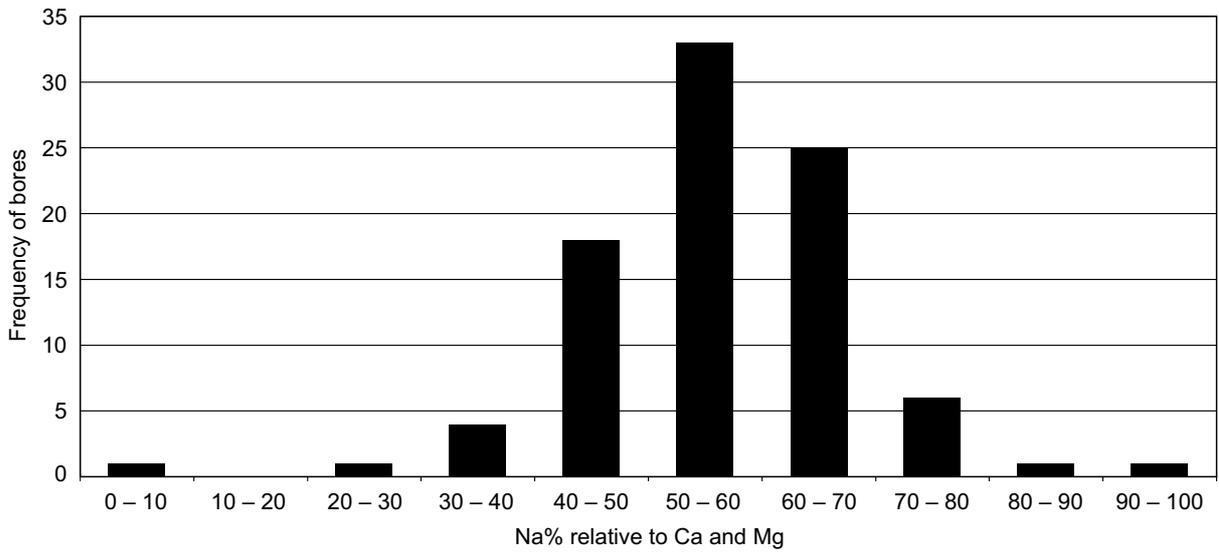


Figure 10. *Na% of analysed groundwater samples*

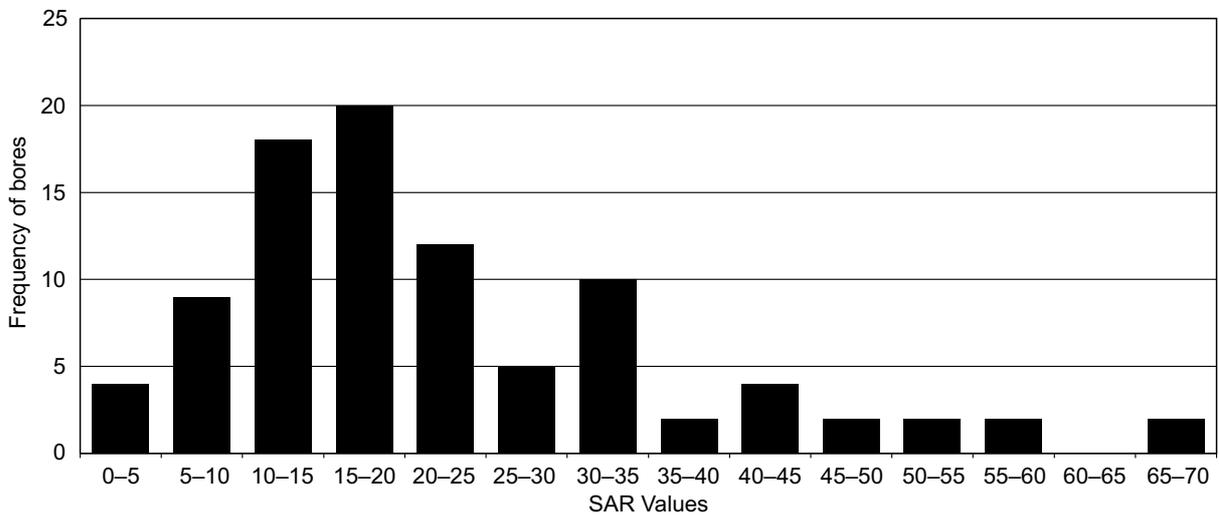


Figure 11. *SAR values of analysed groundwater samples*

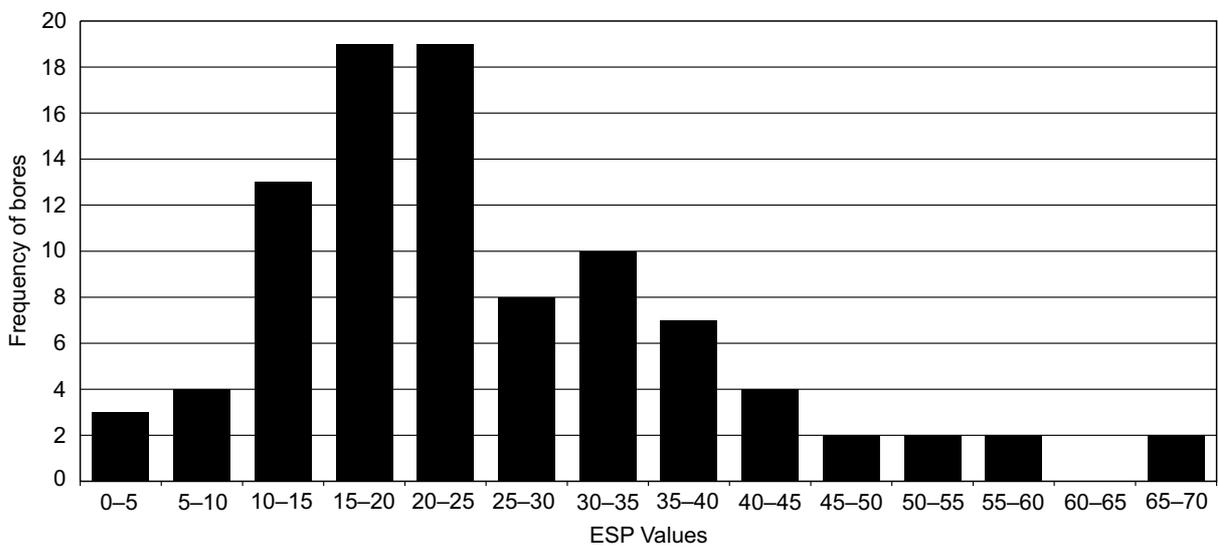


Figure 12. *ESP values of analysed groundwater samples*

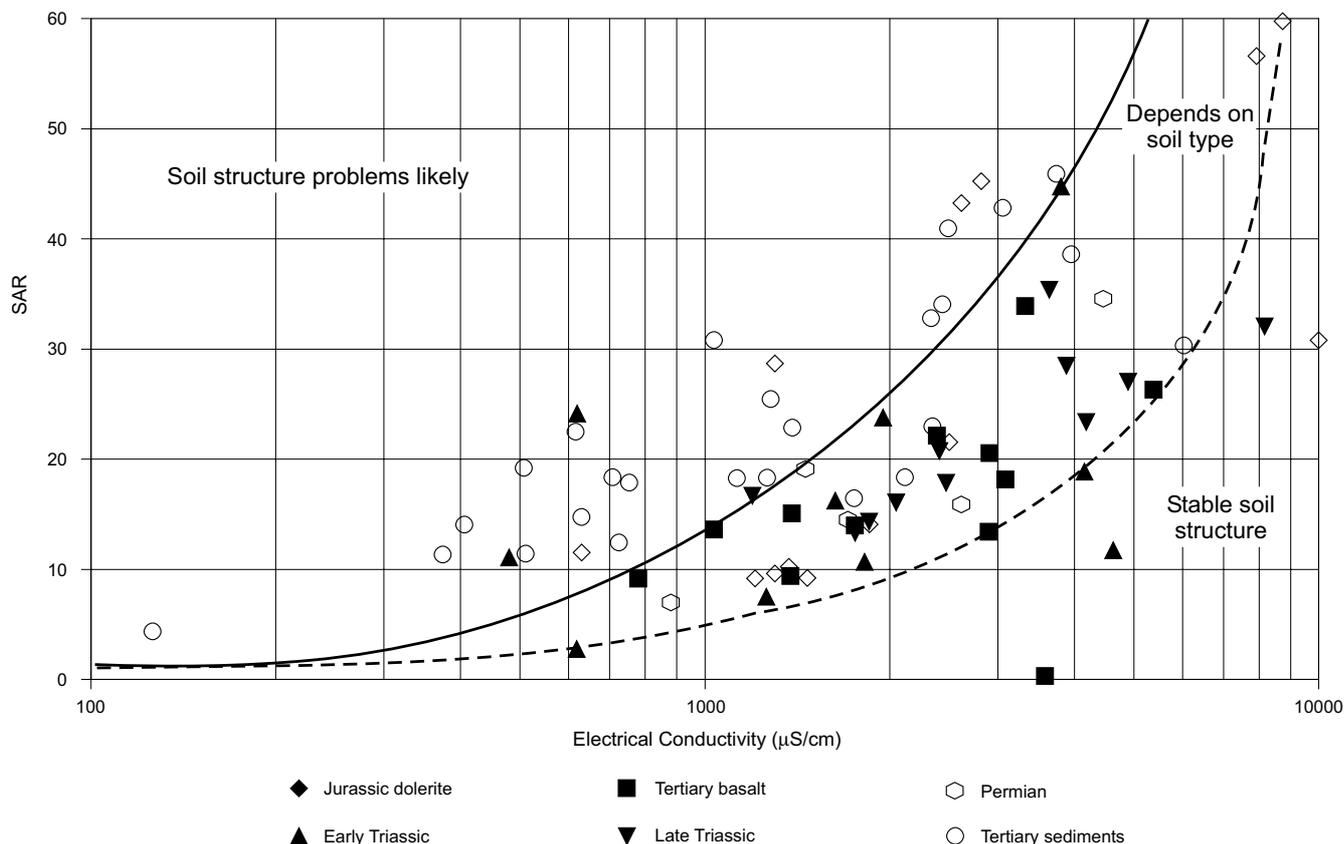


Figure 13

Relationship between SAR and EC of irrigation water for prediction of soil structural stability, showing groundwater samples (from ANZGFMWQ, 1999)

ESP exceeding 15% as the threshold at which soil degradation may occur, conclusively shows that these waters are only likely to have limited use for irrigation purposes.

The graph of SAR vs. conductivity (fig. 13) for groundwater from the study area clearly indicates that there is a potential and variable degree of risk of soil damage from most waters within the region, if applied in undiluted form. In general, groundwater derived from Tertiary sediments is most likely to cause degradation of soil structure. In any proposed use of the region's groundwater as a crop supply, the characteristics of the soil type would require consideration in order to assess the degree of risk prior to irrigation.

Residual Sodium Carbonate (RSC)

This provides an indicator of the excess bicarbonate in solution and the potential for development of alkaline soils. The US Salinity Laboratory provides a tentative classification as follows:

<i>RSC in irrigation water (epm)</i>	<i>Usefulness</i>
<1.25	Probably safe
1.25–2.5	Marginal
>2.5	Unsuitable for irrigation

The apparent indication is that there is limited likelihood of alkaline soil development from the groundwaters in the TRDI area, but this must be considered in the light of the merely approximate USSL classification.

Table 12

Summary of RSC values for analysed groundwater samples in the study area

<i>Aquifer (sample size)</i>	<i>Range</i>	<i>Average</i>
Early Triassic (10)	0–2.0	0.6
Tertiary basalt (12)	0.1–1.6	0.8
Tertiary sediments (27)	0–2.6	0.8
Late Triassic (12)	0–2.1	0.9
Permian (5)	0.6–2.3	1.3
Jurassic dolerite (15)	0–5.8	1.6

[In the foregoing text concerned with groundwater chemistry, certain generalised conclusions regarding the potential use of the local groundwater as an irrigation supply assume the application of the water as an undiluted and untreated irrigant. There may be potential for reduction of the salinity by chemical treatment or by dilution with surface water. This is not addressed within this document, as it would need to be examined on a site-specific, cost-benefit basis.]

Future drilling target prospects for the Northern Midlands and Fingal Valley Regions

There are two factors to be considered with respect to obtaining optimum yield from any potential bore.

- identification of the prospective source aquifer;
- the proximity of lineaments and faults to the proposed bore location.

The following comments are generalised observations for each of the principal hydrogeological units identified within the study area.

Unconsolidated sediments

The most productive units for groundwater are the sand and gravel horizons, particularly in the Cleveland region. The conglomerate found at depth at the base of the Great Western Tiers may represent reasonable drilling targets.

Permo-Silurian sedimentary rocks

The best prospects are likely to be in the Fingal Valley rather than in the Northern Midlands region. Specific areas identified as having the most potential success for groundwater extraction are:

- Fingal Valley;
 - south of the Royal George Road and east of the township of Royal George;
 - south of Esk Main Road, between the townships of Fingal and St Marys;
 - northeast of the confluence of the Break O'Day and South Esk rivers;
- Northern Midlands;
 - base of the Great Western Tiers may prove prospective.
 - there is likely to be less prospectivity in the area around the township of Ross (Matthews, 1973).

Early Triassic sedimentary rocks

These rocks are regarded as being prospective throughout the entire study area. The data from borehole information suggests that increased yields are produced as a result of increased borehole depth.

Late Triassic sedimentary rocks

Poor yields and low success rate of bores typify these rocks. Limited success can be achieved by careful site selection associated with lineaments, faults or geological boundaries.

Tertiary basalt

The most prospective areas within this unit tend to be situated in the vicinity of Campbell Town and to the north of Ross.

There is some evidence to suggest that location of bore sites over infilled river valleys may result in an increase in the probability of success.

Jurassic dolerite

Prospectivity in this unit is generally regarded as low, unless in the vicinity of major fracture zones.

Devonian granite

This is generally regarded as a poor aquifer, although some success may be obtained in regions of intense fracturing

Conclusions

- Groundwater can contribute to improving drought preparedness throughout the study region in areas where traditional farming practices prevail;
- There is widespread availability of groundwater of sufficient quality and quantity for stock supplies;
- Limited scope exists for farm diversification into alternative enterprises such as irrigated cropping;
- The potential for increased groundwater resources has generally been shown to be linked to the presence of faults and lineaments;
- The yield and quality of groundwater have proved to be highly variable across the study area;
- A general relationship has been found to exist between hydrogeological units and the success of bores.

Acknowledgements

This project was conducted with the assistance of landowners who allowed access to properties and provided valuable information which aided in the development of the project.

Assistance from staff in Mineral Resources Tasmania with expertise in groundwater hydrology, data management, and geological mapping is also greatly appreciated. Guidance and support was provided by the TRDI steering committee.

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Glossary

- Aquiclude:** A permeable saturated rock that does not provide groundwater at a sufficient yield to be considered locally as a resource
- Aquifer:** A subsurface storage of water which may be tapped into to yield useable quantities of water as a resource
- Aquitard:** An impermeable rock
- Basalt:** A fine-grained igneous rock which has been extruded to the surface in the form of lava
- Basin:** A term applied loosely to some form of natural or artificial depression, varying in extent, in the Earth's crust
- Brecciated:** A process where a solidified rock is broken or fractured due to pressure acting on the rock
- Conductivity:** Electrical conductivity is an approximate measure of the salt concentration within a sample of water, although the conductivity of ions in solution will vary depending on the types of ions present
- Conduit:** A pipe or channel, such as a drain. In geology a conduit is any structure through which water is preferentially transmitted, e.g. a fault
- Confined:** An aquifer which is bounded above and below by relatively impermeable materials aquifer
- Devonian:** A geological time period which extends from 395 to 345 million years ago, having a duration of 50 million years
- Discharge:** Groundwater discharge is the natural expulsion of water from the subsurface to the surface in the form of a spring or artesian well

- Dolerite:** A medium-grained basic hypabyssal igneous rock, mineralogically and chemically the same as gabbro and basalt
- Drainage basin:** The tract of land drained by a sole river system
- Fault:** A fracture in rock along which there has been an observable amount of displacement
- Fissure:** An extensive crack, a narrow opening cleft or fracture made by splitting, especially in a rock
- Fractured aquifer:** A body of rock, or series of rocks capable of supplying useful quantities of water as a resource
- Graben:** A downthrown block between two parallel faults
- Granite:** A coarse-grained igneous rock consisting essentially of quartz (20–40%), alkali feldspar, and very commonly a mica, biotite and/or muscovite
- Groundwater:** All the water derived from percolation of rainwater, from water trapped in a sediment at its time of deposition and from magmatic sources, lying under the surface of the ground above an impermeable layer, but excluding underground streams
- Hydraulic conductivity (permeability):** The ability of a rock, unconsolidated sediment, or soil to permit water flow through its pores
- Hydrogeological unit:** Geological unit which has which has distinct aquifer characteristics. The hydrogeological unit may be further classified into either unconsolidated sediments or fractured rocks. Water stored in these rocks or sediments is referred to as aquifers
- Hydrogeology:** The study of groundwater
- Igneous:** Igneous rocks are derived from the expulsion of magma from deep within the Earth's liquid mantle into upper levels of the crust where it subsequently cools against other rocks and hardens
- Intrusion:** An igneous body which has forced itself into pre-existing rocks, either along some definite structural feature, e.g. bedding planes, joints, cleavages, etc., or by deformation and crosscutting of the invaded rocks
- Jurassic:** Named from the Jura Mountains of France, the Jurassic System is the period of time extending from 195 to 135 million years having a duration of 60 million years
- Lineament:** A natural line in the landscape which may be interpreted from aerial photographs, satellite images, topography, magnetic images or any other interface which displays tonal contrast based on geographic imaging. Lineaments may be related to faulting, jointing, and bedding planes, igneous contacts, or any other linear structures
- Lithified:** The process which results in the formation of a massive rock from a loose sediment (from Lithifaction)
- Lithology:** Rock type identified in terms of its mineral composition and texture
- Magnetic image:** An image which displays magnetic signals which are emitted from a surface. Aeroplanes may be used to capture magnetic information of the Earth's crust by flying low over the landscape with a magnetic sensory device
- Metamorphism:** The processes by which changes are brought about in rocks within the Earth's crust by the agencies of heat, pressure, and chemically active fluids
- Offloading:** A weathering process where rocks are eroded from a surface, relieving pressure applied downward

through gravity, resulting in elastic rebound and fracturing of the crust

Permian: The period of time from 280 to 225 million years, a duration of 55 million years

Porosity: The number of void spaces in a rock or sediment, either interconnected or unconnected, expressed as a percentage of rock volume

Quaternary: The latest period of time in the stratigraphic column, 0–2 million years, represented by local accumulations of glacial and post-glacial deposits

Recharge: A process whereby water from the Earth's surface infiltrates through the soil or directly into the rock adding water into the groundwater system

Rift Valley: An elongated trough bounded by faults; in all cases the tectonic depression and a geomorphological valley coincide; the term 'graben' appears to be synonymous

Salinity: The degree of concentration of common salt in a solution, determined by measuring the density of the solution, and usually expressed in parts per thousand by mass

Silurian: A geological period which extended from 435 to 395 million years ago, having a duration of 40 million years

Stratigraphy: The study of stratified rocks (sedimentary and volcanic) especially their sequence in time, the character of the rocks and the correlation of beds in different localities

Tertiary: The period of time which elapsed between the end of the Cretaceous and the present time, having a duration of 65 million years, from 65 to 0 million years (although the limits are defined variously by different authors)

Transmissivity: The ability of an aquifer to transmit water. Expressed as the rate at which water passes through a unit width of the aquifer under a unit hydraulic gradient

Triassic: geological period of time extending from 225 to 195 million years, with a duration of 30 million years

Unconfined aquifer: An aquifer in which the water table defines the upper limit

Unconsolidated aquifer: Water-bearing formation (bed or stratum) of permeable rock, sand, or gravel capable of yielding significant quantities of water

Void: Intergranular openings in uncemented sediments; microscopic intercrystal and intracrystal openings in crystalline rocks; large pores such as vesicle holes or tubes; solution cavities; openings and caverns; and planar surfaces such as joints and faults of all sizes and arrangements in all types of competent consolidated rocks. These may occur as syn-genetic primary voids or post-genetic secondary voids

Yield: Quantity of groundwater that can be pumped from a water bore at any one time

[31 May 2000]

APPENDIX 1

Borehole summaries for all bores drilled within the study area, including those drilled in this study

Bore	Site-id	Property	Date	Yield l/s	Conductivity ($\mu\text{S}/\text{cm}$)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
1	16946	Sunnybanks	02/09/99	0.6	556		51.8	33.5, 45.7	51.8	Yes	No
2	4152	Sunnybanks	01/01/78	0.3			22.0	16.5	3.0	No	No
3	16948	Pincrest	12/10/98	0.6	1011		44.2	33.5	30.0	Yes	No
4	4064	Ceres	01/01/52	0.1			30.2	24.4		Yes	No
5	4128	Lillies Leaf	01/01/49	0.3			19.8	12.2		Yes	No
6	4143	Lillies Leaf	01/01/52	0.4			32.0	7.6	NTB	Yes	No
7	16954	Melrose	05/19/99	0.8	3370		18.0	12	18.0	Yes	No
8	16916	Lowick	01/01/60		2880		4.0		0.0	No	No
9	16953	Melrose	05/17/95	0.3	2810		40.0	24 (0.26)	40.0	Yes	No
10	4044	Lillies Leaf	01/01/52	0.3	1900		16.8	7.6	cased	Yes	No
11	4058	Ashgrove	01/01/67				27.1	8.5	27.1	No	No
12	4063	Lillies Leaf	01/01/49	0.3			24.4	9.1		Yes	No
13	2573		01/01/22	0.3	480	686	36.6	27.4		Yes	Yes
14	4048		01/01/62	0.5	1844		21.3	9.1	3.2	No	No
15	4060	Dalkeith	01/01/66	0.4	1180		51.8	45.9	NTB	Yes	No
16	15938	The Dingle	03/01/75			2460	24.4			Yes	Yes
17	15919	Leamington	12/06/49				4.6		0.0	Yes	No
18	4070	Roseville	01/01/60	0.4			13.7	12.2	3.4	Yes	No
19	15920	Leamington	10/07/60	0.3	2470		16.8	13.7 (0.25)	3.7	Yes	No
20	4053	Roseville	01/01/80	0.1			45.7	22.9		Yes	No
21	4056	Rockville	01/01/80	0.0			29.0		0.0	Yes	No
22	4017	Woodburn	01/01/48	0.4			22.9	7.6	cased	Yes	No
23	4016	Woodburn	01/01/48	0.4			33.5	22.9		Yes	No
24	4050		01/01/48	0.4			36.9	24.4		Yes	No
25	16945	Woodburn	12/04/97	1.6	1240		36.0	11.5, 12, 23, 33 (1.58)	36.0	Yes	No
26	16941	Wyheemi Vale	12/05/97	1.3	2110		19.0	3.5, 15 (1.26)	19.0	Yes	No
27	16965		02/13/98	1.1	2780		37.0	27 (1.05)	0.0	No	No
28	16956	Green Hills	02/12/98	0.3	920		19.0	9 (0.25)	19.0	Yes	No
29	16958	Green Hills	02/11/98	0.0			36.0		0.0	Yes	No
30	4057	Rockville	01/01/81	0.4			30.5	19	30.5	Yes	No
31	16962	Malvern	06/03/98	0.0			43.0		0.0	Yes	No
32	15780	Rockville	03/14/95	1.0	1000		117.0	86 (0.6), 29 (0.19), 96 (1.01)	cased	Yes	No

Bore	Site-id	Property	Date	Yield l/s	Conductivity (μ S/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
33	4054	Rockville	01/01/80	0.0			29.0		0.0	Yes	No
34	4142	Woodburn	01/01/49	0.3	1800		21.3	12.2	cased	Yes	No
35	16961	Malvern	06/03/98	0.0			49.0		0.0	Yes	No
36	4052	Malvern	01/01/48	0.4			36.6	18.3		Yes	No
37	4055	Rockville	01/01/80	0.0	850		29.0		0.0	Yes	No
38	16963	Malvern	06/02/98	0.0			73.0		0.0	Yes	No
39	4051	Malvern	01/01/48	0.3			16.9	4.6		Yes	No
40	3985	Rockville	01/01/48	0.2	7600		27.7	19.2	cased	Yes	No
41	15886	Handroyd	06/16/48	0.4			39.6	18.3 (0.38)		Yes	No
42	15934	Leamington	04/27/50	0.4	1890		32.0	16.8 (0.38)	cased	Yes	No
43	3984	Rockville	01/01/48	0.4			39.6	22.9	cased	Yes	No
44	15921	Leamington	04/29/48	0.4	2270		39.6	10.7 (0.4)	cased	Yes	No
45	3987	Rockville	01/01/50	0.4			29.0	16.8		Yes	No
46	3986	Rockville	01/01/48	0.3			24.4	19.8	NTB	Yes	No
47	3990	Invarell	01/01/80				38.1		38.1	Yes	No
48	15918	Leamington	05/19/48	0.4	1790		36.9	4.6 (0.38)	cased	Yes	No
49	3989	Invarell	01/01/80	0.2	5170		51.8	15.2	51.8	Yes	No
50	15885	Leamington	05/31/48	0.4			37.5	10.7 (0.38)	NTB	Yes	No
51	4084	Wyndham	01/01/66	1.0	8110		30.5	27.4		Yes	No
52	15917	Leamington	05/06/48	0.2			19.8	15.2 (0.19)	cased	Yes	No
53	16920	Council	01/01/80		470		3.7		0.0	No	No
54	15940	Woodland Park	03/12/75	0.0			7.9		cased	Yes	No
55	4022	Wyndham	01/01/80				29.0		29.0	Yes	No
56	4083	Wyndham	01/01/66	1.0			24.4	18.3		Yes	No
57	16921	Wyndham	05/18/99		755		85.3		0.0	No	No
58	4012	Hillcrest	01/01/81	0.0			61.0		0.0	No	Yes
59	15939	Woodland Park	03/10/75	0.1	4890	7650	9.1		cased	Yes	No
60	16942	Wyndham	05/24/99	0.5	1980		85.3	64 (0.52)	64.0	Yes	No
61	15926	Handroyd	04/18/50	0.3	2590		33.5	16.8 (0.31)	cased	Yes	No
62	4004	Invarell	01/01/48	0.0			64.0		0.0	Yes	No
63	15925	Handroyd	04/06/50	0.1			30.5	13.7 (0.06)	NTB	Yes	No
64	16943	Hillcrest	02/16/98	0.0			42.0		0.0	Yes	No
65	16944	Hillcrest	02/16/98	0.0			55.0		0.0	Yes	No
66	15875	Mt Pleasant	01/06/81				51.8		NTB	Yes	Yes
67	4023	Wyndham	01/01/80	1.1	2050	1240	24.4	15.2	6.1	Yes	No
68	4006	Mt Pleasant	01/01/51	0.0			42.7		0.0	Yes	No
69	15876	Mt Pleasant	01/06/81	0.1			39.6	25.6 (0.063)		Yes	No

Bore	Site-id	Property	Date	Yield l/s	Conductivity (μ S/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
70	4010	Mt Pleasant	01/01/80	0.0			33.5		33.5	Yes	No
71	193	York House	01/01/81	0.3	2710		53.0	46	53.0	Yes	No
72	4011	Mt Pleasant	01/01/80	0.0			38.1		38.1	Yes	No
73	4013	Mt Pleasant	01/01/81	0.0			76.2		0.0	No	No
74	4003	Invarell	01/01/48	0.2			74.7	61	NTB	Yes	No
75	4081	Sorel Springs	01/01/48	0.0			53.3		0.0	Yes	No
76	4190	Sorel Springs	01/01/66	0.3			18.3	12.2	NTB	Yes	No
77	4191	Sorel Springs	01/01/66	0.3			7.3	7	NTB	Yes	No
78	4192	Sorel Springs	01/01/66	0.0			7.0		0.0	Yes	No
79	16917	York House	01/01/70		3010		32.0		0.0	No	No
80	16918	York House	01/01/70		1160		11.0		0.0	No	No
81	16915	York House	01/01/70	0.4	4200		16.4		0.0	No	No
82	2561	Brooklands	01/01/48	0.0			3.7		0.0	Yes	No
83	2562	York House	01/01/49	0.3			23.8	13.7	NTB	Yes	No
84	16728	Brooklands	01/01/50		1310					No	No
85	2546	Brooklands	01/01/52	0.5			16.8	8.2		Yes	No
86	16914	Ratharney	01/01/81	7.3			33.5	24	0.0	No	No
87	16939	Ratharney	12/16/98	3.7			36.6	26.2 (3.68)	12.2	Yes	No
88	16938	Ratharney	12/16/98	3.7			61.0	26.2 (3.68)	43.0	Yes	No
89	16935	Brooklands	03/24/98	0.1	1860		49.0	36 (0.1)	49.0	Yes	No
90	16913	The Braes	01/01/99	0.1	1360				0.0	No	No
91	2508	Kuranda	01/01/80	0.2	2500	2090	29.0	15	3.7	Yes	Yes
92	16912	The Braes	01/01/81		2040		36.8		0.0	No	No
93	16911	The Braes	12/17/98	0.1			51.8		0.0	No	No
94	2516	The Braes	01/01/51	0.3			39.6	16.8		Yes	No
95	2512	The Braes	01/01/60	0.0			5.2		0.0	Yes	No
96	2515	The Braes	01/01/51	0.2			38.1	12.2		Yes	No
97	16906	The Braes	01/01/81	1.6			36.0		0.0	No	No
98	2513	The Braes	01/01/60	0.3	3110		26.5	22.8	3.4	Yes	No
99	2506	Kuranda	01/01/73	0.0			35.7		0.0	Yes	No
100	16936	The Braes	12/17/98	0.3	1381		54.9	12 (0.31)		Yes	No
101	2571	The Braes	01/01/26	0.1	3637	5196	94.5			No	Yes
102	2511	Kuranda	01/01/67				17.1	11.3	17.1	Yes	No
103	2504	Kuranda	01/01/73	0.4	3110		19.2	7.6	3.4	Yes	No
104	2510	Kuranda	01/01/60	0.4	2460		21.3	13.7	8.4	Yes	No
105	2590		01/01/84	0.0			36.6		0.0	Yes	No
106	16727	Kuranda	01/01/80	1.9	1757	1140				Yes	Yes

Bore	Site-id	Property	Date	Yield l/s	Conductivity (μ S/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
107	2567	Glen Morey	01/01/29		1195	1707	33.5	26.8		Yes	Yes
108	2500	The Braes	01/01/51	0.2			39.6	10.7		Yes	No
109	15976	Ratharney	01/01/29				71.9			Yes	No
110	2501	Glen Morey	01/01/67	0.2			25.9	13.7		Yes	No
111	2570	The Braes	01/01/26	0.5	1728	2468	45.7			No	Yes
112	16934	Lowes Park	04/24/98	0.2	1620		73.0	30 (0.16)	48.0	Yes	No
113	2514	Lowes Park	01/01/51	0.1			38.1	18.3		Yes	No
114	2541	Lowes Park	01/01/51	0.4			30.5	12.8	NTB	Yes	No
115	2507	Lowes Park	01/01/73	0.4			3.4	2.4	3.7	Yes	No
116	2499	Glen Morey	01/01/51	0.5	2540		22.9	6.1		Yes	No
117	16725	Glen Morey	01/01/60	3.8	2410	1490				No	Yes
118	16713	Mt Morriston	11/05/97	0.4	1208	776	24.0	3 (0.38)	24.0	Yes	Yes
119	2540	Lowes Park	01/01/50	0.4	1400		27.4	6.1		Yes	No
120	2502	Ratharney	01/01/51	0.4			30.5	9.1		Yes	No
121	17053	Waringa	01/01/95		1090	700	11.0	8	0.0	No	Yes
122	15972	Mt Morriston	03/24/80				24.4		NTB	Yes	No
123	16726	Glen Morey	01/01/60	6.3	3880	2520	5.0			No	Yes
124	2542	Lowes Park	01/01/51	0.4			27.4	9.1		Yes	No
125	2565	Glen Morey	01/01/26	0.8	2470	1680	30.4			No	Yes
126	2566	Glen Morey	01/01/24	0.2	1852	1679	45.7	30.4	cased	No	Yes
127	15973	Mt Morriston	03/25/80	1.5	1370	790	33.5	18.3 (1.52)	3.7	Yes	Yes
128	15965	Ratharney	01/30/73	0.6	960		21.0	5.18 (0.63)	21.3	Yes	No
129	2503	Ratharney	01/01/51	0.0			19.2		0.0	Yes	No
130	2519	Cheam	01/01/80	0.3			30.5			Yes	No
131	15971	Mt Morriston	03/20/80	0.5	1855	1070	33.5	6.09, 12.9, 21.33 (0.45)	4.6	Yes	Yes
132	2498	Glen Morey	01/01/51	0.4	3240		24.4	9.1		Yes	No
133	15970	Mt Morriston	03/20/80	1.5	1758	1130	33.5	24.38 (1.52)	7.6	Yes	Yes
134	2536	The Plains	01/01/67		4300		12.2	7.6	12.2	Yes	No
135	17054	The Plains	01/01/95		12100	9270	34.0	32	0.0	No	Yes
136	2575		01/01/26	0.8	725	1036	10.3			No	Yes
137	2574		01/01/26	0.3	1814	2592	30.4			No	Yes
138	15966	Mt Morriston	03/18/80				29.0			Yes	No
139	15975	Mt Morriston	03/26/80				9.1			Yes	No
140	15968	Mt Morriston	03/19/80	0.9	7150		24.4	15.24, 19.14, 21.33	1.8	Yes	No
141	15967	Mt Morriston	03/18/80	0.3			29.0	15.2 (0.25)	29.0	Yes	No
142	15974	Mt Morriston	03/26/80				36.6			Yes	No
143	15969	Mt Morriston	03/19/80				29.0			No	No

Bore	Site-id	Property	Date	Yield l/s	Conductivity (μ S/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
144	2545		01/01/67	0.0			15.2		0.0	Yes	No
145	2544		01/01/67	0.0			21.0		0.0	Yes	No
146	17055	Cheam	01/01/95		590	470	16.0	12	0.0	Yes	Yes
147	2576	Facifern	01/01/84	0.4			30.5	6.1	30.5	Yes	No
148	16933	Cheam	01/19/99	4.2	350		18.3	9.1 (4.2)	15.2	Yes	No
149	2569	Ballochmyle	01/01/29	1.5	882	1260		67.1		No	Yes
150	2568	Ballochmyle	01/01/29		3807	5438	43.0	38.1		Yes	Yes
151	16721	Charlton	01/01/49		1492	956				No	Yes
152	2518	Cheam	01/01/80	0.3	1160	960	11.3	4.6	11.3	Yes	Yes
153	17056	Cheam	01/01/95		7710		18.0	10	0.0	No	No
154	2523	Facifern	01/01/80	2.3			24.4	15.2	10.1	Yes	No
155	2520	Facifern	01/01/80	1.3			33.5	15.2	6.4	Yes	No
156	2559	Annondale	01/01/80	0.4	1400		15.2	4.6	15.2	Yes	No
157	2558	Annondale	01/01/80	0.3	1370		12.2	6.1	5.2	Yes	No
158	2538	Homeview	01/01/80	0.1	904		51.8		cased	Yes	No
159	2521	Facifern	01/01/80	0.4	490		38.1	13.7	10.3	Yes	No
160	2517	Cheam	01/01/80	0.4			9.1	8.1	9.1	Yes	No
161	2539	Homeview	01/01/80	0.6	630	520	12.2	4.6	2.1	Yes	Yes
162	15964	Charlton	12/08/66	0.4			13.1	5.5 (0.38)	9.1	Yes	No
163	2560	Homeview	01/01/66	0.5	2320		12.8	12.2		Yes	No
164	2556	Annondale	01/01/80	0.3	2620	3950	12.2	3.7	5.8	Yes	Yes
165	17057	Annondale	01/01/95		7920	5220	11.0	8	0.0	No	Yes
166	2537	Homeview	01/01/80	0.0			12.2		0.0	Yes	No
167	2581	Facifern	01/01/84	0.5			22.8	16.7	21.3	Yes	No
168	16901	Lochiel West	01/01/80		2930		25.0		0.0	No	No
169	2555	Annondale	01/01/80	0.6	1720		12.2	4.6	11.3	Yes	No
170	2554	Annondale	01/01/80	0.0			15.2		0.0	Yes	No
171	2591	Annondale	01/01/84	0.0			22.8		0.0	Yes	No
172	2592	Annondale	01/01/84	0.0			16.7		0.0	Yes	No
173	2580	Facifern	01/01/84	1.1	2230		22.8	11.7	21.3	Yes	No
174	2583	Lochiel West	01/01/84	2.5			25.9	15.2	25.9	Yes	No
175	2530	Lochiel West	01/01/56				42.7	29.9		Yes	No
176	2578	Facifern	01/01/84	0.0			25.9		0.0	Yes	No
177	2582	Facifern	01/01/84	1.3	10520	7350	29.0	9.1	27.4	Yes	Yes
178	2579	Facifern	01/01/84	0.4	3890		29.0	12.2	27.4	Yes	No
179	2589	Annondale	01/01/84	0.4	680		12.2	6.1	12.2	Yes	No
180	2552	Annondale	01/01/80	0.6	2000		12.2	6.1	11.3	Yes	No
181	17059	Annondale	01/01/95		1330		11.0	10	0.0	No	No

Bore	Site-id	Property	Date	Yield l/s	Conductivity (µS/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
182	2531	Lochiel West	01/01/68	0.6	6080		36.6	13.7	18.9	Yes	No
183	2549	Annondale	01/01/80	1.5	2820	1680	12.2	6.1	4.6	Yes	Yes
184	2532	Lochiel West	01/01/80	2.3			19.8	4.6	3.1	Yes	No
185	2529	Lochiel West	01/01/56	0.2	2300		59.4	42.7		Yes	No
186	2551	Annondale	01/01/80	0.0	2450		29.0		0.0	Yes	No
187	2577	Lochiel West	01/01/84	0.0			38.1		0.0	Yes	No
188	2550	Annondale	01/01/80		3940		29.0		NTB	Yes	No
189	17060	Annondale	01/01/95		6400		22.0	13	0.0	No	No
190	15959	Charlton	03/09/63	0.3			27.4	15.24 (0.32)	5.0	Yes	No
191	2593	Annondale	01/01/84	0.5	4400		30.5	9.1	30.5	Yes	No
192	2553	Annondale	01/01/80	0.4	4300		6.7	3.7	6.7	Yes	No
193	17767	Charlton	03/01/00	0.0			13.0		0.0	*Yes	No
194	2557	Lochiel West	01/01/67	0.1			36.6	15.2	2.4	Yes	No
195	2533	Williamwood	01/01/80	0.0			21.3		0.0	Yes	No
196	2534	Lochiel West	01/01/80	0.0			29.0		0.0	Yes	No
197	15958	Charlton	03/07/63				21.3	18.29 (0.1)	NTB	Yes	No
198	2548	Fhilston	01/01/80	0.0			19.8		0.0	Yes	No
199	17061	Fhilston	01/01/95		15100		22.0	10	0.0	No	No
200	2584	Lochiel West	01/01/84	0.4	1450		19.8	9.1	19.8	Yes	No
201	2547	Annondale	01/01/80	0.0			29.0		0.0	Yes	No
202	15960	Charlton	03/11/63	0.0			2.4		0.0	Yes	No
203	15961	Charlton	03/12/63	0.0			10.1		0.0	Yes	No
204	15962	Charlton	11/29/65	0.0			3.7		0.0	Yes	No
205	15963	Charlton	12/06/65	0.0			9.6		0.0	Yes	No
206	2505	Fhilston	01/01/73	0.5	6560		21.3	15.9	21.3	Yes	No
207	17768	Beaufront	03/01/00	0.0			37.0		0.0	*Yes	No
208	16722	Lochiel West	01/01/80							No	No
209	2586	Lochiel West	01/01/84	0.0			30.5		0.0	Yes	No
210	2587	Lochiel West	01/01/84	0.0			16.7		0.0	Yes	No
211	16723	Fhilston	01/01/70	0.0	14670	10400			0.0	No	Yes
212	17769	Beaufront	03/02/00	3.8	4150	2810	109.0	25 (0.45), 100 (3.54)		*Yes	Yes
213	2588	Lochiel West	01/01/84	0.0			16.7		0.0	Yes	No
214	2509	Fhilston	01/01/80	0.3	1470	944	35.1	21.3	1.2	Yes	Yes
215	17764	Beaufront	02/09/00	0.9	3330	5980	79.0	10 (0.06), 22 (0.37)		*Yes	No
216	2585	Lochiel West	01/01/84	0.0			25.9		0.0	Yes	No
217	16724	Fhilston	01/01/70		6030	4080				No	Yes
218	17043	Verwood	09/01/98	0.0	5594		9.0		9.0	Yes	No
219	2535	Lochiel West	01/01/80	0.9	5000		29.0	15.2	1.8	Yes	No

Bore	Site-id	Property	Date	Yield l/s	Conductivity (μ S/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
220	17762	Beaufront	01/25/00	0.5	8170	2140	31.0	15 (0.45), 30 (0.51)		*Yes	Yes
221	17765	Beaufront	02/09/00	0.0			19.0			*Yes	No
222	17044	Verwood	09/01/98	0.0	8339		3.6		0.0	Yes	No
223	17046	Verwood	09/01/98	0.0	606		4.5		4.5	Yes	No
224	17757	Somercotes	02/22/00	0.0			19.0		0.0	*Yes	No
225	17040	Verwood	09/01/98	0.0	10562		5.4		5.4	Yes	No
226	17042	Verwood	09/01/98	0.0	9612		3.6		3.6	Yes	No
227	17758	Somercotes	02/23/00	0.1			19.0	(0.06)		*Yes	No
228	17041	Verwood	09/01/98	0.0	12928		8.8		8.8	Yes	No
229	17759	Somercotes	02/23/00	2.3	1710	1210	73.0	23 (0.45), 41 (0.76), 46 (2.27)		*Yes	Yes
230	17062	Verwood	01/01/95		12600		18.0	9	0.0	No	No
231	17045	Verwood	09/01/98	0.0	874		6.3		6.3	Yes	No
232	17048	Verwood	09/01/98	0.0	925		9.0		9.0	Yes	No
233	17049	Verwood	09/01/98				9.0		9.0	Yes	No
234	2524	Williamwood	01/01/80	0.0			29.0		0.0	Yes	No
235	17047	Verwood	09/01/98	0.0	8705		8.8		8.8	Yes	No
236	17051	Verwood	09/01/98	0.0	16634		4.5		4.5	Yes	No
237	17063	Verwood	01/01/95		17500		40.0	36	0.0	No	No
238	16908	Williamwood	01/01/88	0.0			4.8		0.0	No	No
239	2526	Williamwood	01/01/81	0.0			29.0		0.0	Yes	No
240	17050	Verwood	09/01/98	0.0	6889		8.1		8.1	Yes	No
241	2525	Williamwood	01/01/81	3.5	2360		26.2	23	6.0	Yes	No
242	2527	Williamwood	01/01/81	0.1			84.0	50	NTB	Yes	No
243	2564	Ellensworth	01/01/84	0.6	1819	1300	30.4	13.7	30.4	Yes	Yes
244	16905	Williamwood	01/01/98		2480		60.0		0.0	No	No
245	16937		03/24/99	0.0			54.9		0.0	Yes	No
246	16904	Williamwood	01/01/88		2020		26.0		0.0	No	No
247	16902		01/01/97		1520		23.9		0.0	No	No
248	17064	Verwood	01/01/95		4180	5220	18.0	13	0.0	No	Yes
249	17761	Frankston	03/08/00	3.0	2620	1730	83.0	27 (0.8), 63 (1.8), 75 (2.3), 83 (3.0)		*Yes	Yes
250	2528	Ashby	01/01/81				76.0	40	12.0	Yes	No
251	16907	Frankston	01/01/80	2.6	1470		27.0		0.0	No	No
252	16553	Council	10/10/90	0.4	3470		80.0	16 (0.38)	18.0	No	No
253	16729	Williamwood	11/24/83	3.8			30.0	15 (3.78)	30.0	Yes	No
254	17763	Beaufront	01/26/00	0.5	1460	982	55.0	5 (0.19), 30,(0.45)		*Yes	Yes
255	16940	Windfalls	02/08/73	0.7			18.3	4.2 (0.67)	18.3	Yes	No
256	16694	Windfalls	08/26/98	0.3			25.9	21.3 (0.25)	25.9	Yes	No
257	17760	Ashby	02/29/00	8.2	1260	808	73.0	15,(0.9), 30 (3), 41 (4.5), 45 (7), 50 (8)		*Yes	Yes

Bore	Site-id	Property	Date	Yield l/s	Conductivity (µS/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
258	2563	Ashby	01/01/50	0.0			6.7		0.0	Yes	No
259	16903	Council	01/01/80		350		17.0		0.0	No	No
260	17766	Chiswick	02/10/00	24.0	2390	1900	37.0	11 (2.3), 19 (4.5), 28 (19), 33(24)		*Yes	Yes
261	15848	Plassey	01/01/82	0.0			39.6		0.0	Yes	No
262	15847	Auburn	01/01/82				15.2			Yes	No
263	15849	Preston	01/01/82	2.5	1690		30.5		cased	Yes	No
264	16695	Sharlands	03/16/86	0.3	2680		32.0	16.8 (0.34)	9.1	Yes	No
265	16930	Windfalls	02/05/73	0.7	1210		10.4	1.8 (0.73)	10.4	Yes	No
266	15846	Plassey	01/01/82	0.0			27.4		0.0	Yes	No
267	17746	Bloomfield	03/07/00	9.1	4630	3270	52.0	33 (1), 37 (1.4), 45 (3.7), 52 (9.1)		*Yes	Yes
268	16929	Windfalls	02/06/73	0.6			15.8	3.6 (0.63)	15.2	Yes	No
269	16712	Downward	04/01/98	0.5	386		30.0		30.0	Yes	No
270	17742	Downward	01/25/00	0.4	1630	1050	47.0	18 (0.13), 41 (0.38)		*Yes	Yes
271	17755	Camelford	03/13/00	25.3	2910	2020	55.0	11 (0.66), 40 (6.95), 44(?), 46 (25.26)		*Yes	Yes
272	15845	Downward	03/10/77	0.6	1010		29.0	13.7 (0.57)	2.4	Yes	No
273	15844	Downward	03/01/77	0.0			44.2		0.0	Yes	No
274	17747	Fosterville	03/10/00	0.2	1300	789	37.0	10 (0.19)		*Yes	Yes
275	15816		11/19/70	15.1	1386	1980	15.2	3.1 (15.12)	15.2	Yes	Yes
276	17748	Quorn Hall	01/27/00	0.8	780	560	85.0	18 (0.38), 65 (0.76)		*Yes	Yes
277	15805	Fosterville	04/08/73	1.3			14.6	4.9, 9.5 (1.26)	9.5	Yes	No
278	17756	Riccarton	03/14/00	2.0	2900	856	79.0	9 (1.39), 41 (1.77), 66 (2.02)		*Yes	Yes
279	15812	Merton Vale	11/14/51	0.4	2310		15.2	6.1 (0.44)	cased	Yes	No
280	17751	Douglas Park	02/03/00	18.9	1380	932	49.0	19 (1), 28 (1.8), 34 (11), 38 (13), 46(19)		*Yes	Yes
281	17752	Riccarton	02/08/00	3.0	1128	2050	79.0	3 (0.06), 19 (0.37), 59 (3.03)		*Yes	Yes
282	17753	Snaresbrook	02/21/00	3.0	3090	2380	61.0	11(0.3), 13(0.4), 22(2.3), 49(3), 52(4.5)		*Yes	Yes
283	15851	Snaresbrook	11/22/80	8.8			38.1	6.1 (8.84)	6.1	Yes	No
284	15819	Snaresbrook	05/04/66	0.9	1390	1985	12.2	6.1 (8.82)		Yes	Yes
285	15820	Snaresbrook	10/14/68	0.9	3584	5120	20.4	9.1 (0.9)		Yes	Yes
286	15821	Snaresbrook	10/16/68	1.3			11.3		10.7	No	No
287	15840	St Johnstone	05/28/69	0.1	10000	6990	22.9	6.7 (0.88)	7.0	Yes	Yes
288	15839	Wanstead	05/25/65	0.1			74.7		19.8	Yes	No
289	17743	Kenilworth	02/11/00	0.5			55.0	2 (0.51)		*Yes	No
290	16966	Kenilworth	03/05/65	0.4	1580		42.7	3.1, 38.1 (0.38)	0.0	Yes	No
291	15850	Meadow Bank	03/31/80	0.1			27.4			Yes	No
292	15811	Wanstead	11/09/51	0.4	1036	1480	22.9	20.7 (0.38)		Yes	Yes
293	15823	Greenhill	12/12/69	4.4	375	535	42.7		36.6	Yes	Yes
294	16705	Meadow Bank	11/25/97	0.5			42.7	27.4, 36.6 (0.5)	42.7	Yes	No

Bore	Site-id	Property	Date	Yield l/s	Conductivity (μ S/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
295	15808	Isis Vale	02/01/73				34.1	8.2 (0.12)		Yes	No
296	16967	Kenilworth	01/01/67		1930		37.2		0.0	No	No
297	15815	Barton	12/03/69	1.3	630	900	83.8		51.8	Yes	Yes
298	15831	Kenilworth	03/19/63	0.3	1620		29.0	12.2 (0.31)		Yes	No
299	15838	Kenilworth	05/25/69	1.5	1300	1230	19.8	19.8, 20.4, 20.7, 39.6, 52.4, 67 (1.5)	6.4	Yes	Yes
300	15814	Barton	08/28/67	0.0			44.8		0.0	Yes	No
301	16968	Kenilworth	01/01/67		1150		7.0		0.0	No	No
302		Meadow Bank	02/22/00	2.3	5390	4180	31.0	10 (0.69), 25 (2.27)		*Yes	Yes
303	16927	Forest Hall	09/01/98	5.3			60.0	24, 33, 47 (5.25)	0.0	Yes	No
304	15795	Council	06/28/97	0.3	619	884	36.6	30.5 (0.25)		Yes	Yes
305	15796	Council	06/28/97	0.3	619	884.12	39.6	30.5 (0.25)		Yes	Yes
306	15813	Meadow Bank	09/13/68		1271	1815	36.6	13.7		Yes	Yes
307	17744	Quarry Hill	02/11/00	0.0			69.0			*Yes	No
308	15794		07/05/68	1.8	1281	1830	57.6		42.7	Yes	Yes
309	16928	Forest Hall	02/10/98	4.7			55.0	21, 27, 37 (4.73)	55.0	Yes	No
310	16909	Forest Hall	01/01/96		2900		0.0		0.0	No	No
311	16925	Forest Hall	08/31/98	4.2			30.0	9 (4.2)	29.0	No	No
312	15836	Forest Hall	06/05/67	3.2	1036	1480	22.9	16.8 (3.15)	16.8	Yes	Yes
313	15837	Forest Hall	06/08/67	3.8	725	1035	18.3	13.4 (3.78)	18.3	Yes	Yes
314	16926	Somerset	08/29/98	1.3	2620		18.0	11 (1.26)	18.0	Yes	No
315	15842	Chanak	11/25/69	3.9	1750	2500	196.9		111.3	Yes	Yes
316	15807	Stone Quarry	02/01/73	0.1			15.9	3.1 (0.12)		Yes	No
317	15806	Stone Quarry	02/01/73				34.4			Yes	No
318	15829	Delmont	10/02/69	0.3			65.6			Yes	No
319	15830	Staunton	02/09/70	4.9	511	730	153.0		61.0	Yes	Yes
320	16693	Benham	08/25/98	0.5	1300		59.5	42.2 (0.5)	59.5	Yes	No
321	17749	Windfalls	01/28/00	7.6	1950	1230	85.0	16 (0.38), 81 (7.58)		*Yes	Yes
322	16932	Benham	12/15/82	0.4	1568		36.6	12.2 (0.1), 24.4 (0.37)	36.6	Yes	No
323	16922	Benham	03/01/98		2180		13.2			No	No
324	16678	Snow Hill	01/18/73	0.0			16.8		0.0	Yes	No
325	16931	Benham	08/26/98	0.2	563		25.9	21.3 (0.2)	25.9	Yes	No
326	16679	Snow Hill	01/18/73	0.3			4.6	1.5 (0.25)	0.0	Yes	No
327	16677	Snow Hill	01/18/73	0.8			16.8	1.83 (0.76)	0.0	Yes	No
328	16676	Snow Hill	01/17/73	0.8			4.9	1.27 (0.76)	0.0	Yes	No
329	17750	Benham	02/02/00	1.2	4460	3100	103.0	13 (0.1), 52 (0.6), 65 (0.9), 90 (1.2)		*Yes	Yes
330	16682	Benham	12/15/82	0.5			38.1	18.3 (0.45)	38.1	Yes	No
331	16686	Benham	12/30/82				47.3		0.0	Yes	No

Bore	Site-id	Property	Date	Yield l/s	Conductivity (μ S/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
332	16687	Benham	12/30/82				25.9		0.0	Yes	No
333	15818	Glen Esk	10/14/70	15.1	2338	3340	35.1		34.9	Yes	Yes
334	16680		01/19/73	1.8	481		30.5	7, 19.2, 20.7 (1.76)	20.0	Yes	No
335	15817	Glen Esk	06/12/68	0.4	2440	3485	61.0	22.9, 45.7 (0.44)	33.5	Yes	Yes
336	16683	Benham	12/16/82	3.5			19.8	13.7 (3.54)	24.4	Yes	No
337	16689	Benham	12/31/82	0.3			30.5	9.1 (0.3)	30.5	Yes	No
338	15793		11/13/63	0.8	708	1011	44.2			Yes	Yes
339	15828		01/01/74	0.6	616	880	32.3	22.9 (0.63)	32.3	Yes	Yes
340	16709		02/08/96	0.3			30.0	19, 30 (0.3)	30.0	Yes	No
341	16690	Benham	01/02/83				19.8		0.0	Yes	No
342	16684	Benham	12/17/82				19.8		0.0	Yes	No
343	16685	Benham	12/17/82	0.8			29.0	24.4 (0.76)	29.0	Yes	No
344	16688	Benham	12/30/82				41.2		0.0	Yes	No
345	16691	Benham	01/02/83				15.2		0.0	Yes	No
346	15824		01/01/67	3.8	3740	2370	28.7	22.9 (3.87)	6.1	Yes	Yes
347	16708		03/06/97	3.2	8730		45.0	36 (3.16)	45.0	Yes	Yes
348	16692	Benham	01/04/83	3.8			19.8	9.1 (3.79)	19.8	Yes	No
349	15822	Glen Esk	10/30/68	0.5	754	1077	53.3	27.4 (0.45)		Yes	Yes
350	16969		10/29/98	0.0			45.7	23 (0.001)	0.0	No	No
351	16959		10/29/98	0.0			35.0		0.0	No	No
352	15825		11/19/68	0.6	508	725	46.6	18.3 (0.6), 26		Yes	Yes
353	17745		02/18/00	0.3	10700	7880	31.0	11(0.06), 19(0.32)		*Yes	Yes
354	15826	Kelvar	11/22/68				45.0			Yes	No
355	16710	Kelvar	12/08/95	0.3			30.0	14.5 (0.3)	30.0	Yes	No
356	15827	Kelvar	11/27/68	0.4	2350	2795	29.0	27.4 (0.38)	29.0	Yes	Yes
357	16698		12/17/97				43.0		0.0	Yes	No
358	16711		04/22/91	0.5	2310		44.2	36.6, 44.2 (0.5)	44.2	Yes	No
359	3827		01/01/69	0.0			57.9		0.0	Yes	No
360	16697		11/03/97				33.0		0.0	Yes	No
361	16696		11/03/97				42.0		0.0	Yes	No
362	16706		07/16/96	0.0			30.0		0.0	Yes	No
363	16707		07/16/96	0.3			30.0	21, 44 (0.25)	26.0	Yes	No
364	15799	Woorak	11/26/80				15.2	12.5	12.4	Yes	No
365	15801	Woorak	04/03/81				15.2			Yes	No
366	15841		12/14/68	0.2	406	580	53.3	15.2 (0.17)		Yes	Yes
367	15800	Woorak	04/03/81				19.8			Yes	No
368	15803	Woorak	04/04/81				15.2			Yes	No
369	15797	Woorak	06/05/67	0.8	1264	1805	16.2	10.7 (0.75)	16.2	Yes	Yes

Bore	Site-id	Property	Date	Yield l/s	Conductivity (µS/cm)	TDS (mg/l)	Depth (m)	Depth Water Struck (m) & (yield (l/s))	Casing (m)	Geological Log	Chemical Analysis
370	15798	Woorak	11/25/80				19.8			Yes	No
371	15804	Woorak	07/16/81	1.1			17.4	8.3 (1.1)	17.4	Yes	No
372	15802	Woorak	04/03/81				42.7			Yes	No
373	15843	Esk Vale	01/23/69	2.7	3952	5645	53.3	21.3 (2.7)	30.5	Yes	Yes
374	3776	The Bend	01/01/69	2.7	2492	3560	54.9	6.1		Yes	Yes
375	3837	Fernhill	01/01/69	2.7	3059	4370	47.2			Yes	Yes
376	3782	Fordon	01/01/69	0.5	2121	3030	50.3			Yes	Yes
377	3783	Fordon	01/01/70	2.3	126	180	73.5		39.6	Yes	Yes
378	16657		02/01/96	5.1	2310		27.0	8 (5.05)	27.0	Yes	No
379	16656	Council	02/02/95	10.1	1240		30.0	9, 12 (10.1)	30.0	Yes	No
380	16655	Council	02/02/95	12.6	1311		30.0	9, 18 (12.62)	30.0	Yes	No
381	16653	Lloyds North	09/16/80	5.1	1422		51.8	24.4, 36.6, 42.7, 48.8	15.2	Yes	No
382	16651	Cornwall Coal Co.	09/15/80	6.1			33.5	6.1, 18.3, 24.4, 29	12.2	Yes	No
383	16652	Cornwall Coal Co	09/15/80				30.5		0.0	Yes	No
384	16650	Cornwall Coal Co	09/12/80	1.9			15.2	6.1 (1.89)	12.2	Yes	No
385	16660		07/12/85	0.2	80		24.4	18.3 (0.19)	24.4	Yes	No
386	17741	Kooringa	02/01/00	3.8	880	547	55.0	49(3.79)		*Yes	Yes
387	16669	Council	01/31/95	0.0			45.0	17 (0.01)	0.0	Yes	No
388	16663	Londaura	02/26/84	1.5			9.0	2.5 (1.51)	0.0	No	No
389	16667		01/31/95				15.0	6	0.0	Yes	No
390	16664	Council	01/24/95	0.0			45.0		0.0	No	No
391	16665	Council	01/24/95	12.6			30.0	13, 27 (12.63), 15 (0.57)	30.0	Yes	No
392	16674	Council	10/16/98	10.0	550		49.0	15, 19, 22, 25, 28, 29, 42.5, 43 (10)	49.0	Yes	No
393	16670	Council	01/31/95	10.1			36.0	7, 18, 27 (10.1)	15.0	Yes	No
394	16668	Council	01/31/95				15.0	9	0.0	Yes	No
395	16671		08/05/97	1.0			52.0	15, 18, 26, 29 (0.95)	52.0	Yes	No
396	16673	Council	10/15/98	0.9	290		55.0	20, 22, 24 25, 28, 31 (0.9)	0.0	Yes	No
397	16654	Malahide	03/11/92	6.3			79.3	42.7, 54.7 (6.31)	7.3	Yes	No
398	16672	Council	10/14/98	3.0	490		55.0	26, 32, 36, 43 (3.01)	55.0	Yes	No
399	17740	Malahide	02/02/00	0.3			19.0	(0.25)		*Yes	Yes
400	16675		08/28/98				40.2	33.5	0.0	No	No
401	16666	Council	01/30/95				24.0		0.0	Yes	No
402	16658	Beauty Flats	09/30/98				33.5		0.0	No	No
403	16924	Beauty Flats	09/30/98				33.5		NTB	No	No

NTB = No trace of bore

*Yes = TRDI bore (refer to logs in Appendix 4 of this report)

APPENDIX 2

Lithological logs for all bores drilled within the study area before 2000

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	
1	0	0.3	topsoil	Q	20	0	0.45	topsoil	Q	
	0.3	1.5	clay	Q		0.45	15.5	sandstone	Rq	
	1.5	51.8	sandstone	Rq		15.5	20.4	mudstone	Rq	
3	0	1.2	topsoil/clay	Q	20.4	26.8	sandstone	Rq		
	1.2	3.6	clay	Q	26.8	30.5	mudstone	Rq		
	3.6	9.1	clay/mudstone	Rq	30.5	45.7	sandstone	Rq		
	9.1	30.5	mudstone/sandstone	Rq	21	0	15.2	clay	Q	
	30.5	42.7	sandstone/dolerite	Rq		15.2	28.9	grey mudstone	Rvv	
4	0	0.3	topsoil	Q	22	0	0.6	topsoil	Q	
	0.3	3	mudstone	Rvv		0.6	5	clay	Q	
	3	12.2	sandstone	Rvv		5	6.7	sandstone	Rvc	
	12.2	19.8	mudstone	Rvv		6.7	12.5	mudstone	Rvc	
	19.8	22.9	sandstone	Rvv		12.5	15.5	black mudstone	Rvc	
	22.9	27.4	baked mudstone	Rvv		15.5	22.9	mudstone	Rvc	
	27.4	30.2	dolerite	Jd		23	0	0.45	topsoil	Q
5	0	0.8	topsoil	Q	0.45		1.7	clay	Q	
	0.8	1.4	sand	Q	1.7		16.3	sandstone	Rvc	
	1.4	2.7	clay	Q	16.3		18.3	mudstone	Rvc	
	2.7	19.8	sandstone	Rq	18.3		21.6	sandstone	Rvc	
6	0	1.4	topsoil	Q	21.6		29.1	mudstone	Rvc	
	1.4	3.8	shale	Q	29.1		33.5	sandstone	Rvc	
	3.8	16	sandstone	Rq	24	0	1.8	topsoil	Q	
7	0	18	sandstone	Rq		1.8	21.2	sandstone	Rvc	
	9	0	40	siltstone		Rvv	21.2	25.7	mudstone	Rvc
		25.7	36.9	sandstone		Rvc	25	0	27	weathered dolerite
10	0	2.4	topsoil/sand and clay	Q	27	36		siltstone	Rvc	
	2.4	7.9	mudstone	Rvv	26	0	1.5	sandy clay	Q	
	7.9	12.2	weathered dolerite	Jd		1.5	19	weathered dolerite	Jd	
	12.2	16.8	mudstone	Rvv	28	0	2	clay	Q	
12	0	0.45	topsoil	Q		2	9	sandy clay/sandstone	Rvc	
	0.45	18.3	sandstone	Rq		9	19	clay/grey mudstone	Rvc	
	18.3	19.2	mudstone	Rq		29	0	6	sandstone	Rvc
	19.2	23.8	sandstone	Rq	6		12	mudstone	Rvc	
23.8	24.4	dolerite	Jd	12	36		mudstone	Rvc		
13	0	36.6	mudstone/felspathic sandstone/sandstone	Rq	30	0	0.2	topsoil	Q	
	14	0	18.2	clay and sandstone		Rvc	0.2	0.3	clay	Q
18.2		21.3	shale with coal	Rvc		0.3	8	mudstone	Rvv	
15		0	0.3	topsoil		Q	8	8.2	coal	Rvv
	0.3	1.5	clay	Q	8.2	30.5	mudstone	Rvv		
	1.5	51.8	sandstone	Rq	31	0	3	clay	Q	
16	0	0.61	topsoil	Q		3	18	sandstone	Rvc	
	0.61	9.14	clay	Q		18	43	mudstone	Rvc	
	9.14	15.24	shale	Rvc	32	0	0.2	sandy loam	Q	
15.24	24.38	sandstone	Rvc	0.2		4	clay	Q		
17	0	0.45	topsoil	Q		4	10	siltstone	Rvc	
	0.45	1.2	clay	Q		10	35	mudstone	Rvc	
	1.2	4.6	dolerite boulders	Jd		35	45	sandstone	Rvc	
18	0	0.6	topsoil	Q		45	59.5	mudstone	Rvc	
	0.6	12.2	sandstone	Rvc		59.5	72	mudstone	Rvc	
	12.2	13.7	shale	Rvv	72	73	clay	Rvc		
	19	0	0.9	topsoil	Q	73	81	sandstone	Rvc	
0.9		0.9	16.8	sandstone	Rvc	81	85	red mudstone	Rq	
		85	108	white sandstone	Rq	85	108	white sandstone	Rq	
		108	117	green sandstone	Pj	108	117	green sandstone	Pj	

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>
33	0	3	clay	Q	43	21.4	25.3	shale	Rvc
	3	28.9	hard mudstone and dolerite	Rvv		25.3	31.4	sandstone	Rvc
34	0	0.6	topsoil	Q	44	31.4	39.6	shale	Rvc
	0.6	2.6	clay	Q		0.6	14.5	sandstone	Rvc
	2.6	4.9	ironstone and pug	Q		14.5	15.7	carbonaceous shale	Rvc
	4.9	9.8	mudstone	Rvc		15.7	23.8	mudstone	Rvc
	9.8	21.3	ironstone and shale	Rvc		23.8	39.6	sandstone	Rvc
35	0	2	clay	Q	45	0	0.6	topsoil	Q
	2	49	mudstone	Rvc		0.6	1.7	clay	Q
36	0	0.3	topsoil	Q	1.7	3.2	sandstone	Rvc	
	0.3	1.5	clay	Q	3.2	7.6	sandstone	Rvc	
	1.5	12.6	sandstone	Rvc	7.6	9.7	mudstone	Rvc	
	12.6	13.7	mudstone	Rvc	9.7	10.7	mudstone	Rvc	
	13.7	21.9	sandstone	Rvc	10.7	14.3	sandstone	Rvc	
	21.9	36.6	sandstone	Rvc	14.3	16.1	mudstone	Rvc	
					16.1	18.3	sandstone	Rvc	
37	0	10	clay	Q	18.3	22.6	mudstone	Rvc	
	10	28.9	mudstone	Rvv	22.6	25.9	sandstone	Rvc	
38	0	2	clay	Q	25.9	27.7	mudstone	Rvc	
	2	73	sandstone/mudstone/coal	Rvc	27.7	28.9	sandstone	Rvc	
39	0	0.3	topsoil	Q	46	0	0.5	topsoil	Q
	0.3	4.6	sandstone	Rvc		0.5	1.1	clay	Q
	4.6	5	mudstone	Rvc		1.1	2.4	sandstone	Rvc
	5	8.4	sandstone	Rvc		2.4	12.5	mudstone	Rvc
	8.4	9.1	mudstone	Rvc		12.5	13.7	mudstone	Rvc
	9.1	16.9	sandstone	Rvc		13.7	24.4	mudstone	Rvc
40	0	0.3	topsoil	Q	47	0	0.3	topsoil	Q
	0.3	1.2	clay	Q		0.3	10.7	clay	Q
	1.2	4.4	sandstone	Rvc		10.7	38.1	siltstone	Rvc
	4.4	4.9	shale	Rvc	48	0	0.45	topsoil	Q
	4.9	5.2	shale	Rvc		0.45	2.1	clay	Q
	5.2	8.2	sandstone	Rvc		2.1	14.6	sandstone	Rvc
	8.2	18.9	sandy shale	Rvc		14.6	15.8	mudstone	Rvc
	18.9	20.6	sandstone	Rvc		15.8	29.3	sandstone	Rvc
	20.6	27.7	shale	Rvc		29.3	36.9	mudstone	Rvc
41	0	0.3	topsoil	Q	49	0	0.3	topsoil	Q
	0.3	0.5	clay	Q		0.3	5.2	clay	Q
	0.5	7	sandstone	Rvc		5.2	51.8	sandstone	Rvc
	7	8.5	mudstone	Rvc	50	0	0.4	topsoil	Q
	8.5	13.4	sandstone	Rvc		0.4	1	clay	Q
	13.4	17.1	mudstone	Rvc		1	2.6	dolerite	Jd
	17.1	19.8	sandstone	Rvc		2.6	10.7	sandstone	Rvc
	19.8	21.6	mudstone	Rvc		10.7	12.5	mudstone	Rvc
	21.6	22.9	sandstone	Rvc		12.5	18.3	sandstone	Rvc
	22.9	30.8	mudstone	Rvc		18.3	27.7	mudstone	Rvc
	30.8	39.9	sandstone	Rvc		27.7	31.1	mudstone	Rvc
				31.1	35.3	sandstone	Rvc		
				35.3	37.5	mudstone	Rvc		
42	0	0.3	topsoil	Q	51	0	1.8	topsoil	Q
	0.3	15.5	sandstone	Rvc		1.8	6.1	clay	Q
	15.5	22.9	mudstone	Rvc		6.1	30.5	mudstone	Rvv
	22.9	30.5	sandstone	Rvc	52	0	15.2	sandstone	Rvc
	30.5	32	mudstone	Rvc		15.2	19.8	mudstone	Rvc
43	0	0.9	topsoil	Q	19.8	20	mudstone	Rvc	
	0.9	1.7	sandstone	Rvc	54	6.1	7.92	sandstone	Rvc
	1.7	2.9	pug	Rvc		0	0.61	topsoil	Q
	2.9	4.2	shale	Rvc		0.61	1.82	clay	Q
	4.2	6.4	sandstone	Rvc	1.82	6.1	mudstone	Rvc	
	6.4	8.1	shale	Rvc	55	0	0.3	topsoil	Q
	8.1	10.7	sandstone	Rvc		0	10.7	sandstone	Rvc
	10.7	12.5	shale	Rvc		0.3	13.7	coal	Rvc
	12.5	14.3	sandstone	Rvc		10.7	13.7	coal	Rvc
	14.3	16.7	slate	Rvc		13.7	28.9	sandstone	Rvc
	16.7	18.3	shale	Rvc					
	18.3	21.4	sandstone	Rvc					

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	
56	0	1.2	topsoil	Q	68	0	0.45	topsoil	Q	
	1.2	3	clay and sand	Q		0.45	1.8	clay	Q	
	3	7.6	sandstone	Rvc		1.8	16.8	sandstone	Rvc	
	7.6	12.2	coal	Rvc		16.8	19.2	black mudstone	Rvc	
	12.2	24.4	mudstone	Rvc		19.2	22.9	mudstone	Rvc	
59	0	0.61	topsoil	Q	22.9	27.1	sandstone	Rvc		
	0.61	3.05	sandy clay	Q	27.1	30.5	mudstone	Rvc		
	3.05	7.62	mudstone	Rvc	30.5	35	sandstone	Rvc		
	7.62	9.14	sandstone	Rvc	35	42.7	mudstone	Rvc		
60	0	1.5	topsoil	Q	69	0	1.2	topsoil	Q	
	1.5	3	clay/ironstone	Q		1.2	3.6	clay	Q	
	3	30.5	dolerite	Jd		3.6	8.5	coal	Rvc	
	30.5	36.6	shale	Rvc		8.5	10.7	sandstone	Rvc	
	36.6	37.2	coal	Rvc		10.7	18.9	coal	Rvc	
	37.2	42	shale	Rvc		18.9	24.4	mudstone	Rvc	
	42	43	coal	Rvc		24.4	25	coal	Rvc	
	43	45.7	shale	Rvc		25	34.7	mudstone	Rvc	
	45.7	67.1	baked mudstone	Rvc		34.7	36.6	coal	Rvc	
	67.1	82.3	sandstone	Rvc		36.6	39.6	mudstone	Rvc	
	61	0	0.45	topsoil		Q	70	0	0.3	topsoil
0.45		1.2	fractured sandstone	Rvc	0.3	3		clay	Q	
1.2		4.6	mudstone	Rvc	3	33.5		sandstone	Rvv	
4.6		24.4	sandstone	Rvc	71	0	0.04	topsoil	Q	
24.4		28.9	mudstone	Rvc		0.04	3.5	brown mudstone	Rvc	
28.9		33.5	sandstone	Rvc		3.5	4.6	grey mudstone	Rvc	
62	0	0.6	topsoil	Q	4.6	46.02	clay	Rvc		
	0.6	3.2	sandstone	Rvc	46.02	53	grey mudstone	Rvc		
	3.2	3.9	pug	Rvc	72	0	0.3	topsoil	Q	
	3.9	6.7	mudstone	Rvc		0.3	3	clay	Q	
	6.7	8.2	mudstone	Rvc		3	38.1	sandstone	Rvv	
	8.2	18.3	mudstone	Rvc	74	0	0.9	topsoil	Q	
	18.3	19.8	mudstone	Rvc		0.9	1.8	clay	Q	
	19.8	28.2	sandstone	Rvc		1.8	7.9	sandstone	Rvc	
	28.2	29.6	mudstone	Rvc		7.9	12.2	sandstone	Rvc	
	29.6	33.5	sandstone	Rvc		12.2	13.4	pug	Rvc	
	33.5	35.7	black mudstone	Rvc		13.4	29.1	mudstone	Rvc	
	35.7	44.2	mudstone	Rvc		29.1	54.8	sandstone	Rvc	
	44.2	49.4	black mudstone	Rvv		54.8	59.7	black mudstone	Rvc	
	49.4	55.8	mudstone	Rvv		59.7	65.5	sandstone	Rvc	
	55.8	57.3	black mudstone	Rvv		65.5	71.6	black mudstone	Rvc	
57.3	61	mudstone	Rvv	71.6		73.1	sandstone	Rvc		
61	63.1	black mudstone	Rvv	73.1		74.7	mudstone	Rvc		
63.1	64	mudstone	Rvv	75	0	0.6	topsoil	Q		
63	0	0.3	topsoil		Q	0.6	2.3	weathered dolerite	Jd	
	0.3	0.6	clay		Q	2.3	3	clay	Q	
	0.6	9.7	sandstone		Rvc	3	5.5	sandstone	Rvc	
	9.7	11.9	mudstone		Rvc	5.5	53.3	mudstone	Rvc	
	11.9	13.4	sandstone	Rvc	76	0	6.1	clay	Q	
	13.4	18.9	mudstone	Rvc		6.1	18.3	mudstone	Rvv	
	18.9	27.3	sandstone	Rvc	77	0	0.45	topsoil	Q	
	27.3	48.8	sandstone	Rvc		0.45	2.4	clay	Q	
64	0	42	mudstone	Rvc		2.4	7	sandstone	Rvc	
	65	0	55	mudstone	Rvc	7	7.3	dolerite	Jd	
66		0	3.65	clay	Q	78	0	0.6	topsoil	Q
		3.65	7.9	mudstone	Rvc		0.6	4.6	clay	Q
		7.9	17.6	sandstone	Rvc		4.6	7	dolerite boulders	Jd
		17.6	22.5	coal	Rvc	82	0	2.9	weathered dolerite	Jd
		22.5	24.7	mudstone	Rvc		2.9	3.7	hard dolerite	Jd
		24.7	29.3	coal	Rvc	83	0	0.5	topsoil	Q
		29.3	43.3	sandstone	Rvv		0.5	2.4	clay	Q
		43.3	51.8	mudstone	Rvv		2.4	4.6	lignite	Rvc
		67	0	6.1	clay		Q	4.6	23.2	shale/sandstone
	6.1		24.4	sandstone	Rvc		23.2	23.8	dolerite	Jd

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>
85	0	0.5	topsoil	Q	109	0	66.5	sandstone/mudstone	Rvc
	0.5	1.4	clay	Q		66.5	72	dolerite	Jd
	1.4	16.2	mudstone	Rvv	110	0	0.3	topsoil	Q
	16.2	16.8	fractured mudstone	Rvv		0.3	1.1	clay	Q
87	0	0.6	topsoil	Q	111	1.1	25.9	sandstone	Rvc
	0.6	3.04	clay	Q	112	0	2.5	gravel and clay	Q
	3.04	33.5	dolerite	Jd		2.5	54	mudstone/coal measures	Rvc
88	0	33.52	sandstone	Rvc	54	73	dolerite	Jd	
	33.52	61	dolerite	Jd	113	0	0.5	topsoil	Q
89	0	3	clay	Q		0.5	22.6	sandstone/shale	Rvc
	3	49	mudstone	Rvc		22.6	25.6	carbonaceous shale	Rvc
91	0	0.3	topsoil	Q		25.6	38.1	sandstone and shale	Rvc
	0.3	3.7	dolerite/clay	Q	114	0	0.8	topsoil/clay	Q
	3.7	29	hard dolerite	Jd		0.8	30.5	sandstone	Rvc
94	0	3.8	topsoil/clay	Q	115	0	3.4	river washed stone	Q
	3.8	12.2	clay	Rvc		3.4	3.5	dolerite	Jd
	12.2	39.6	sandstone	Rvc	116	0	3.7	topsoil/clay	Q
95	0	0.6	topsoil	Q		3.7	4.4	gravel	Q
	0.6	3.1	clay	Q		4.4	15.2	sandstone	Rvc
	3.1	15.2	dolerite	Jd		15.2	18.3	shale	Rvc
96	0	1.4	topsoil/clay	Q	18.3	21.3	sandstone	Rvc	
	1.4	15.2	sandstone	Rvc	21.3	22.9	shale	Rvc	
	15.2	18.3	carbonaceous shale	Rvc	118	0	2	clay	Q
	18.3	38.1	shale/sandstone	Rvc		2	24	dolerite	Jd
98	0	0.3	topsoil	Q	119	0	1.4	topsoil/clay	Q
	0.3	1.5	clay	Q		1.4	8.5	sandstone	Rvc
	1.5	19.8	sandstone	Rvc		8.5	14.6	shale	Rvc
	19.8	26.5	shale	Rvc		14.6	27.4	sandstone	Rvc
99	0	1.5	brown drift	Q	120	0	1.2	topsoil/clay	Q
	1.5	9.8	sandstone	Rvc		1.2	2.4	dolerite boulders	Q
	9.8	35.7	mudstone	Rvc		2.4	9.1	shale/sandstone	Rvc
	35.7	36	dolerite	Jd		9.1	12.2	carbonaceous shale	Rvc
100	0	0.6	topsoil	Q		12.2	15.2	shale/sandstone	Rvc
	0.6	1.8	clay	Q	15.2	17.7	carbonaceous shale	Rvc	
	1.8	30.5	clay/sandstone	Rvc	17.7	30.5	shale/sandstone	Rvc	
	30.5	30.8	coal	Rvc	122	0	0.6	clay	Q
	30.8	36.6	clay and sandstone	Rvc		0.6	24.4	basalt	Tb
	36.6	51.8	dolerite	Jd	124	0	1.4	topsoil/clay	Q
102	0	0.3	topsoil	Q		1.4	5.9	dolerite boulders	Q
	0.3	5.5	clay	Q		5.9	12.2	shale	Rvc
	5.5	13.7	sandstone	Rvc		12.2	27.4	sandstone/shale	Rvc
103	0	2.1	brown clay	Q	127	0	3.7	clay	Q
	2.1	19.2	sandstone	Rvc		3.7	33.5	weathered dolerite	Jd
104	0	0.6	topsoil	Q	128	0	0.6	topsoil	Q
	0.6	2.4	clay	Q		0.6	13.4	dirt/pebbles	Q
	2.4	6.1	sandstone	Rvc		13.4	14.9	mud/clay	Q
	6.1	21.3	shale	Rvc		14.9	21	sandstone	Rq
105	0	36.6	clay	Ts	129	0	0.6	soil	Q
106	0	0.6	topsoil	Q		0.6	2	clay	Q
	0.6	1.8	clay	Q		2	3.7	dolerite boulders	Q
	1.8	15.2	sandstone	Rvc		3.7	5.6	dolerite	Jd
15.2	45.7	dolerite	Jd	130	0	0.3	topsoil	Q	
107	0	33.5	felspathic sandstone/shale		Rvc	0.3	1.5	clay	Q
	33.5	61	dolerite		Jd	1.5	6.1	dolerite	Jd
108	0	1.4	topsoil/clay	Q	6.1	30.5	clay	Jd	
	1.4	3.1	gravel	Q	131	0	0.3	topsoil	Q
	3.1	3.7	clay	Q		0.3	4.6	clay	Q
	3.7	18.3	sandstone	Rvc		4.6	33.5	dolerite	Jd
	18.3	32	shale and sandstone	Rvc		132	0	2	topsoil/clay
	32	36.6	carbonaceous shale	Rvc	2		24.4	sandstone	Rq
36.6	39.6	shale and sandstone	Rvc						

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>
133	0	7.6	clay	Q	160	0	0.3	topsoil	Q
	7.6	33.5	basalt	Tb		0.3	6.1	weathered dolerite	Jd
134	0	4	clay	Q	161	6.1	9.1	hard dolerite	Jd
	4	7.6	dolerite/clay	Ts		0	0.3	topsoil	Q
	7.6	10.7	clay/gravel	Ts		0.3	2.1	weathered dolerite	Jd
138	10.7	12.2	clay	Ts	162	2.1	12.2	dolerite	Jd
	0	0.3	topsoil	Q		0	0.9	sand/clay	Q
	0.3	12.2	clay	Q		0.9	3.7	clay/boulders	Q
139	12.2	29	clay	Q	163	3.7	12.8	weathered sandstone	Rq
	0	9.1	hard dolerite	Jd		12.8	13.1	dolerite	Jd
140	0	0.3	topsoil	Q	164	0	12.2	clay	Q
	0.3	1.8	clay	Q		12.2	12.8	hard mudstone	Rvc
	1.8	22.9	basalt	Tb	166	0	0.3	topsoil	Q
	22.9	24.4	clay	Ts		0.3	5.8	weathered dolerite	Jd
141	0	0.3	topsoil	Q	167	5.8	12.2	hard dolerite	Jd
	0.3	4.3	clay	Q		0	0.3	topsoil	Q
	4.3	29	dolerite	Jd		0.3	12.2	dolerite	Jd
142	0	36.6	weathered dolerite	Jd	169	0	0.3	topsoil	Q
143	0	0.3	topsoil	Q		0.3	6.1	white clay	Ts
	0.3	19.8	grey clay	Ts		6.1	11.3	brown clay	Ts
144	19.8	29	red clay	Ts	170	11.3	12.2	dolerite	Jd
	0	1.5	clay	Q		0	0.3	topsoil	Q
	1.5	3.1	weathered dolerite	Q		0.3	3.7	weathered dolerite	Jd
145	3.1	15.2	weathered dolerite	Jd	171	3.7	15.2	hard dolerite	Jd
	0	1.8	clay	Q		0	22.8	clay	Q
	1.8	4.3	dolerite boulders	Q		172	0	16.7	clay
4.3	21	weathered dolerite	Jd	0	9.1		clay	Q	
146	0	16	gravel	Q	173	9.1	11.7	weathered dolerite	Jd
	0	0.3	topsoil	Q		11.7	22.8	dolerite	Jd
	0.3	3.1	weathered dolerite	Jd		174	0	1.2	sand
3.1	18.3	hard dolerite	Jd	1.2	3.1		clay	Q	
18.3	30.5	dolerite	Jd	3.1	9.1		clay/sandstone	Q	
148	0	0.9	topsoil	Q	9.1		18.3	claystone	Rq
	0.9	18.3	dolerite gravel	Q	18.3	25.9	sandstone	Rq	
	0	43	felspathic sandstone	Rvv	175	0	0.6	topsoil	Q
150	0	0.3	topsoil	Q		0.6	10.4	sandstone	Rvc
	0.3	3.1	clay	Q		10.4	11.3	shale	Rvc
	3.1	6.1	weathered dolerite	Jd	11.3	42.7	sandstone	Rvc	
152	6.1	11.3	sandy clay	Q	176	0	18.3	clay	Ts
	0	0.3	topsoil	Q		18.3	25.9	blue clay	Ts
	0.3	10.1	clay	Q	177	0	0.3	dolerite boulders	Q
10.1	24.4	dolerite	Jd	0.3		1.5	sand	Q	
154	0	0.3	topsoil	Q		1.5	9.1	clay	Q
	0.3	6.4	clay	Q	9.1	29	fractured dolerite	Jd	
	6.4	24.4	weathered dolerite	Jd	178	0	1.5	sand	Q
24.4	33.5	hard dolerite	Jd	1.5		9.1	weathered dolerite	Jd	
155	0	0.3	topsoil	Q		9.1	12.2	brown mudstone	
	0.3	2.1	clay	Q	12.2	18.3	green rock		
	2.1	12.2	weathered dolerite	Jd	18.3	29	dolerite	Jd	
156	12.2	15.2	clay	Jd	179	0	6.1	white sand	Q
	0	0.3	topsoil	Q		6.1	12.2	clay	Q
	0.3	5.2	clay	Q		180	0	0.3	topsoil
5.2	10.7	weathered dolerite	Jd	0.3	3.7		white clay	Q	
10.7	12.2	hard dolerite	Jd	3.7	11.3		brown clay	Q	
157	0	0.3	topsoil	Q	11.3		12.2	weathered dolerite	Jd
	0.3	1.5	weathered dolerite	Jd	158	0	0.3	topsoil	Q
	1.5	51.8	dolerite	Jd		0.3	10.4	clay	Q
159	0	0.3	topsoil	Q		10.4	38.1	basalt	Jd
	0.3	10.4	clay	Q	160	0	0.3	topsoil	Q
	10.4	38.1	basalt	Jd		0.3	6.1	weathered dolerite	Jd

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>
182	0	0.9	sand	Q	204	0	0.9	sand	Q
	0.9	5.2	sandy clay	Ts		0.9	3.1	clay/basalt boulders	Q
	5.2	17.7	decomposed rock	Ts		3.1	3.7	hard basalt	Tb
	17.7	36.6	shale	Rvc	205	0	1.8	sand	Q
183	0	0.3	topsoil	Q		1.8	2.4	sand and clay	Q
	0.3	4.6	weathered dolerite	Jd		2.4	3.1	clay/basalt boulders	Q
	4.6	12.2	hard dolerite	Jd		3.1	9.6	hard basalt	Tb
184	0	0.3	topsoil	Q	206	0	0.3	topsoil	Q
	0.3	3.1	clay	Rq		0.3	15.2	clay	Ts
	3.1	5.8	clay	Rq		15.2	15.8	brown sand	Ts
	5.8	19.8	sandstone	Rq		15.8	16.5	lignite	Ts
185	0	0.3	topsoil	Q		16.5	21.3	black clay	Ts
	0.3	0.6	broken sandstone	Rq	209	0	3.1	white mudstone	P
	0.6	39.9	sandstone	Rq		3.1	30.5	mudstone/shale	P
	39.9	59.4	?	Rq	210	0	4.7	weathered dolerite	Q
186	0	0.3	topsoil	Q		4.7	16.7	dolerite	Jd
	0.3	10.7	clay	Ts	213	0	16.7	sand	Q
	10.7	29	clay, sandstone deeper	Ts	214	0	1.2	soft dolerite	Jd
187	0	6.1	clay/dolerite boulders	Q		1.2	35.1	hard dolerite	Jd
	6.1	18.3	clay	Ts	216	0	11.7	clay/sandstone	Rq
	18.3	30.5	basalt	Ts		11.7	25.9	dolerite	Jd
	30.5	38.1	dolerite	Jd	218	0	0.5	sandy clay	Q
188	0	0.3	topsoil	Q		0.5	0.9	iron stone gravel	Q
	0.3	10.7	clay	Ts		0.9	1.8	clayey sand	Ts
	10.7	29	clay, sandstone deeper	Ts		1.8	3.6	medium sand	Ts
190	0	12.2	clay	Q		3.6	4.5	medium and coarse sand	Ts
	12.2	26.8	sandstone	Rq		4.5	6.3	medium sand	Ts
	26.8	27.4	dolerite	Jd		6.3	7.2	clay and sandy clay	Ts
191	0	9.1	claystone	Q		7.2	9	sand and clay sand	Ts
	9.1	18.3	dolerite	Jd	219	0	0.3	topsoil	Q
	18.3	27.4	sandstone	Rvc		0.3	1.8	clay	Rq
	27.4	27.7	coal	Rvc		1.8	29	mudstone to dolerite	Rq
	27.7	30.5	sandstone	Rvc	222	0	0.05	sand	Q
192	0	0.3	topsoil	Q		0.05	0.5	sandy clay	Q
	0.3	6.7	weathered dolerite	Jd		0.5	0.9	gritty sandy clay	Q
194	0	0.15	sand	Q		0.9	1.8	sand and clayey sand	Q
	0.15	2.1	clay	Q		1.8	2.7	fine sandy clay	Ts
	2.1	36.6	mudstone	Rq		2.7	3.6	clayey sand/sandy clay	Ts
195	0	0.3	topsoil	Q		3.6	6.3	sandy clay	Ts
	0.3	3.1	clay	Rq	223	0	0.9	sandy gravel	Q
	3.1	21.3	sandstone ?	Rq		0.9	1.8	sand and sandy gravel	Q
196	0	0.3	topsoil	Q		1.8	4.5	clay	Ts
	0.3	4.3	clay	Q	225	0	0.9	clay	Q
	4.3	21.3	weathered shale ?	Rvc		0.9	1.8	sandy clay	Q
	21.3	29	dolerite	Jd		1.8	2.7	sand and clayey sand	Q
197	0	21.3	sandstone	Rv		2.7	3.6	clayey sand	Q
	21.3	22	dolerite	Jd		3.6	5.4	clayey sand and sand	Q
198	0	0.3	topsoil	Q	226	0	0.9	grey sand	Q
	0.3	19.8	clay	Ts		0.9	1.3	yellow sand	Q
200	0	1.2	clay	Q		1.3	1.8	green clayey sand	Q
	1.2	7.6	clay/dolerite boulders	Q		1.8	2.7	white clayey sand	Q
	7.6	15.2	mudstone	Rq		2.7	3.6	coarse gritty sand	Q
	15.2	18.8	dolerite	Jd	228	0	0.5	brown sand	Q
201	0	0.3	topsoil	Q		0.5	0.9	sandy clay	Q
	0.3	29	clay, sandstone deeper	Ts		0.9	1.8	clayey sand	Q
202	0	2.4	topsoil and dolerite	Q		1.8	2.7	gritty sand/minor clay	Q
203	0	3.7	clay	Q		2.7	5.4	sandy clay	Q
	3.7	9.1	sandstone	Rq		5.4	7.2	gritty clay with nodules	Q
	9.1	10.1	dolerite	Jd		7.2	8.1	clayey sand	Ts
						8.1	8.8	sand and clayey sand	Ts

Bore	Start	End	Lithology	Unit	Bore	Start	End	Lithology	Unit	
231	0	0.2	sand and sandy clay	Q	255	0	1.5	dolerite gravel	Q	
	0.2	0.8	sandy clay	Q		1.5	3.6	grey clay	Q	
	0.8	0.9	gritty clay	Q		3.6	4.9	mud	Q	
	0.9	1.8	coarse sand, and clay	Q		4.9	18.3	mudstone	Rvv	
	1.8	2.7	clay and sandy clay	Ts	256	0	0.6	topsoil/basalt stones	Q	
	2.7	3.6	clayey sand	Ts		0.6	1.8	clay	Q	
	3.6	4.5	sand and sandy clay	Ts		1.8	21.3	decomposed basalt	Tb	
4.5	6.3	sandy clay	Ts	21.3	22	fractured basalt	Tb			
232	0	0.3	sandy soil	Q	22	25.9	clay	Ts		
	0.3	0.9	clay and sandy clay	Q	258	0	0.3	topsoil	Q	
	0.9	1.8	clayey sand	Ts		0.3	1.4	clay	Q	
	1.8	3.6	sand	Ts		1.4	4.6	dolerite	Jd	
	3.6	6.3	clayey sand	Ts	261	0	39.6	sandstone and shale	Rq	
	6.3	7.2	sandy clay	Ts		262	0	15.2	baked sandstone/shale	Rq
	7.2	8.1	clay with sand bands	Ts	263		0	30.5	sandstone/shale	Rq
8.1	9	stiff clay	Ts	264		0	1.2	clay	Q	
233	0	0.9	sandy clay		Q	1.2	32	basalt and clay intervals	Tb	
	0.9	1.8	clay and sandy clay	Ts	265	0	0.6	topsoil	Q	
	1.8	7.2	sandy clay	Ts		0.6	6.1	weathered basalt	Tb	
	7.2	9	clay	Ts		6.1	9.1	weathered basalt	Tb	
234	0	4.3	sand	Q	9.1	10.4	hard basalt	Tb		
	4.3	12.2	weathered dolerite	Jd	266	0	27.4	dolerite	Jd	
	12.2	29	hard dolerite	Jd		268	0	0.6	topsoil	Q
235	0	0.9	sand	Q	0.6		10.7	weathered basalt	Tb	
	0.9	1.6	sandy clay and clay	Q	10.7		14	soft basalt	Tb	
	1.6	2	sandy clay and gravel	Q	14		15.8	dolerite	Jd	
	2	2.7	clayey sand	Q	269		0	30	sandstone	Rp
	2.7	4.5	clayey sand	Ts			272	0	2.1	boulders/clay
	4.5	7.2	stiff clay	Ts	2.1			29	sandstone	Rq
	7.2	8.8	sandy clay	Ts	273	0	3.1	boulders/clay	Q	
236	0	0.9	clay and sandy clay	Q		3.1	38.1	sandy clay	Q	
	0.9	1.8	sandy clay and clay	Q		38.1	44.2	clay	Q	
	1.8	2.7	sand and sandy clay	Q	275	0	0.3	topsoil	Q	
	2.7	3.6	sandy clay and clay	Q		0.3	1.2	sandy clay	Q	
	3.6	4.5	sandy clay	Q		1.2	15.2	vesicular basalt	Tb	
239	0	30	sandstone/dolerite	Rq	277	0	0.3	topsoil	Q	
240	0	0.5	sandy soil	Q		0.3	2.4	sand	Q	
	0.5	1.3	sandy clay	Q	2.4	4.9	sandy clay	Q		
	1.3	1.8	sand and clay	Q	4.9	8.2	decomposed material	Q		
	1.8	2.7	clayey sand	Ts	8.2	8.8	gravel	Q		
	2.7	4.5	sand and clay	Ts	8.8	14.6	dolerite	Jd		
	4.5	7.2	sandy clay	Ts	279	0	0.3	topsoil	Q	
	7.2	8.1	clay	Ts		0.3	4.6	clay	Q	
241	0	0.15	topsoil	Q	4.6	15.3	sandstone	Rq		
	0.15	0.4	clay	Q	283	0	0.6	sand	Q	
	0.4	6	weathered dolerite	Jd		0.6	5.5	clay	Q	
	6	26.2	dolerite and sandstone	Jd		5.5	12.2	jointed basalt	Tb	
242	0	0.1	topsoil	Q	12.2	38.1	basalt	Tb		
	0.1	30	grey mudstone	P	284	0	0.6	sand	Q	
	30	84	grey mudstone	P		0.6	5.5	clay	Q	
243	0	13.7	sand/clay/sandstone	Rq	5.5	12.2	jointed basalt	Tb		
	13.7	30.4	sandstone	Rq	285	0	10.7	weathered basalt	Tb	
245	0	0.3	topsoil	Q		10.7	20.4	hard basalt	Tb	
	0.3	3	dolerite	Jd	286	0	4.6	topsoil and clay	Q	
	3	54.9	dolerite	Jd		4.6	10.7	weathered basalt	Tb	
250	0	0.3	topsoil	Q	10.7	11.3	basalt	Tb		
	0.3	40	grey mudstone	P	287	0	2.1	topsoil	Q	
	40	76	grey mudstone	P		2.1	6.7	dolerite, sand and clay	Jd	
253	0	4	clay	Q	6.7	8.5	weathered dolerite	Jd		
	4	30	sandstone and mudstone	P	8.5	22.9	hard dolerite	Jd		

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>
288	0	1.2	topsoil	Q	305	0	14.6	decomposed basalt	Q
	1.2	4.9	jointed basalt	Tb		14.6	20.1	hard basalt	Tb
	4.9	6.7	sandy clay	Ts		20.1	22.6	white sandstone	Rq
	6.7	74.7	weathered dolerite	Jd		22.6	37.5	fine sandy grit	Rq
290	0	0.6	sand	Q		37.5	39.6	mudstone	Rq
	0.6	1.8	clay	Q	306	0	16.8	weathered basalt	Tb
	1.8	4.9	doleritic gravel	Q		16.8	21.3	vesicular basalt	Tb
	4.9	18.3	clay and sand	Ts		21.3	35.1	sandy clay	Ts
	18.3	36.6	grey clay	Ts		35.1	36.6	coarse sand	Ts
	36.6	39.6	doleritic clay and gravel	Ts	308	0	1.5	brown clay	Q
	39.6	42.7	sandstone and clay	Rq		1.5	15.2	clay/sandy clay	Ts
291	0	0.6	surface soil	Q		15.2	27.4	sand/fine gravel	Ts
	0.6	7.6	clay	Q		27.4	30.5	sandy clay	Ts
	7.6	15.2	soft sandstone	Ts		30.5	38.1	sandy gravel	Ts
	15.2	16.8	basalt	Tb		38.1	45.7	grey sand	Ts
	16.8	20.7	basalt	Tb		45.7	47.2	sandy gravel	Ts
	20.7	27.4	weathered basalt	Tb		47.2	57.9	sandy clay	Ts
292	0	0.6	topsoil	Q	309	0	0.5	sand	Q
	0.6	7.6	clay	Q		0.5	18	sandy clay	Ts
	7.6	15.2	soft sandstone	Ts		18	20	weathered dolerite	Jd
	15.2	16.8	dolerite or basalt	Tb		20	55	dolerite	Jd
	16.8	20.7	dolerite or basalt	Tb	312	0	0.6	topsoil	Q
	20.7	22.9	weathered sandstone	Ts		0.6	16.8	clay	Ts
293	0	10.7	clayey sand/sand	Q		16.8	22.9	coarse sand	Ts
	10.7	19.8	clay/gravel fragments	Ts	313	0	0.3	topsoil	Q
	19.8	32	sandy clay	Ts		0.3	13.4	clay	Ts
	32	42.7	doleritic conglomerate	Ts		13.4	18.3	coarse sand	Ts
294	0	16.2	loam clay	Ts	314	0	12	clay	Ts
	16.2	17.1	yellow sandstone	Ts		12	17	gravel	Ts
	17.1	20.7	basalt	Tb		17	18	clay	Ts
	20.7	22	pumice	Tb	315	0	1.5	fine sand	Q
	22	36.6	basalt	Tb		1.5	59.4	clay/sandy clay	Ts
	36.6	42.7	grey sandstone	Rq		59.4	128	sandy clay/sand	Ts
295	0	0.3	topsoil	Q		128	192	clay/sandy clay	Ts
	0.3	4.9	clay wash	Q		192	196.9	dolerite	Jd
	4.9	8.2	dirt	Q	316	0	0.3	topsoil	Q
	8.2	12.2	fine sand	Q		0.3	3.1	clay	Q
	12.2	34.1	dirt	Q		3.1	15.9	mudstone	Rv
297	0	18.3	sand with some clay	Q	317	0	0.6	topsoil	Q
	18.3	79.2	clay with some sand	Ts		0.6	6.7	soft clay/sandstone	Ts
	79.2	83.8	doleritic conglomerate	Ts		6.7	9.1	black clay	Ts
298	0	2.4	sand	Q		9.1	24.4	brown clay	Ts
	2.4	28.7	sandstone	Rq		24.4	34.4	grey mudstone	Rv
	28.7	29	dolerite	Jd	318	0	3.1	sand/grit/gravel	Q
299	0	0.6	topsoil	Q		3.1	61	clay/some wood fragments	Ts
	0.6	2.4	clay	Q		61	65.5	doleritic conglomerate	Ts
	2.4	5.2	sand	Q	319	0	3.1	topsoil	Q
	5.2	6.1	ironstone	Q		3.1	4.6	gravel	Ts
	6.1	7.6	weathered dolerite	Jd		4.6	53.3	clay/clayey sand	Ts
	7.6	80.8	dolerite	Jd		53.3	153	sand/clay	Ts
300	0	0.3	topsoil	Q	320	0	0.9	topsoil	Q
	0.3	44.2	sandy clay	Ts		0.9	44.1	sandstone	Rp
	44.2	44.6	dolerite boulders	Ts		44.1	59.5	fractured grey sandstone	Rp
303	0	0.5	sandy soil	Q	322	0	0.3	topsoil	Q
	0.5	33	clay	Ts		0.3	7.6	orange sandstone	Rq
	33	60	coarse sandstone	Rq		7.6	24.4	grey sandstone	Rq
304	0	14.6	decomposed basalt	Q		24.4	25.9	yellow clay	Rq
	14.6	20.1	hard basalt	Tb		25.9	27.4	grey sandstone	Rq
	20.1	22.6	white sandstone	Rq		27.4	36.6	green clay	Rq
	22.6	36.6	fine sandy grit	Rq					

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>
324	0	0.2	topsoil	Q	338	0	18.3	clay and sand	Ts
	0.3	0.9	clay	Q		18.3	27.4	clay/bands of quartz gravel	Ts
	0.9	5.2	gravel	Q		27.4	29	clay/wood fragments	Ts
	5.2	11.6	mudstone and clay	SD		29	35.1	gravel	Ts
	11.6	16.8	organic clay	SD		35.1	44.2	sand/clay	Ts
325	0	0.6	topsoil	Q	339	0	18.9	clay	Ts
	0.6	1.8	clay	Q		18.9	24.4	clay/occasional pebbles	Ts
	1.8	21.3	weathered basalt	Tb		24.4	32	gravel and clay	Ts
	21.3	21.9	fractured basalt	Tb		32	32.3	sandstone ?	Ts
	21.9	25.9	clay	Ts		340	0	19	clay
326	0	0.3	topsoil	Q	19		30	sand white quartz gravel	Ts
	0.3	1.2	brown clay	Q	341	0	0.3	topsoil	Q
	1.2	4.6	gravel (large)	Q		0.3	19.8	sticky brown clay	Ts
327	0	0.2	topsoil	Q	342	0	19.8	yellow clay	Q
	0.2	4.3	yellow sandy clay	Q		343	0	0.6	topsoil
	4.3	6.7	gravel (basalt)	Q	0.6		3.1	broken basalt	Tb
	6.7	15.2	decomposed granite	Q	3.1		24.4	hard basalt	Tb
	15.2	16.8	granite	D	24.4		25.9	coal	Rvc
328	0	0.2	top soil	Q	25.9		29	grey and green clay	Rvc
	0.2	1.5	clay	Q	344	0	6.1	brown clay	Q
	1.5	4.9	gravel (coarse)	Q		6.1	21.3	orange/blue clay	Ts
330	0	0.3	clay	Q		21.3	22.6	coal	Rvc
	0.3	24.4	orange sandstone	Ts		22.6	23.2	claystone	Rvc
	24.4	25.9	yellow clay	Ts		23.2	24.4	coal	Rvc
	25.9	27.4	green sandstone	Ts	24.4	41.2	grey clay	Rvc	
27.4	38.1	green clay	Ts	345	0	0.3	topsoil	Q	
331	0	1.2	clay		Q	0.3	3.1	broken dolerite	Ts
	1.2	7.6	orange sandstone		Rq	3.1	15.2	sticky yellow clay	Ts
	7.6	47.3	green/blue sandstone	Rq	346	0	12.2	clay	Q
332	0	6.1	clay/dolerite	Q		12.2	22.9	sand/gravel/some clay	Ts
	6.1	13.7	clay	Q		22.9	28.4	coarse sand/gravel	Ts
	13.7	18.3	clay/sandstone	Rq		28.4	28.7	clay	Ts
	18.3	25.9	grey sandstone	Rq	347	0	31	clay	Ts
333	0	1.5	brown sand	Q		31	45	dolerite	Jd
	1.5	18.3	lateritic sandy clay	Ts	348	0	0.3	topsoil	Q
	18.3	33.5	coarse pebbly sand/sand	Ts		0.3	9.1	clay	Ts
	33.5	36.5	grey sandy clay	Ts		9.1	18.3	basalt	Tb
334	0	0.2	topsoil	Q		18.3	19.8	dolerite	Jd
	0.2	1.5	yellow sandy clay	Q	349	0	1.5	basalt fragments	Q
	1.5	4.6	gravel and clay	Q		1.5	27.4	clayey sand/clay	Ts
	4.6	9.1	soft mudstone	P		27.4	30.5	sand/gravel	Ts
	9.1	30.5	grey mudstone	P		30.5	53.3	clay/some sand	Ts
335	0	4.5	oxidised sand	Q		352	0	16.8	clay/clayey sand
	4.5	6.1	clay	Ts	16.8		22.9	sand/fine gravel	Ts
	6.1	22.9	clayey sand/sand/pebbles	Ts	22.9		25.9	sandy clay	Ts
	22.9	33.5	coarse sand/pebbles	Ts	25.9		27.4	grit	Ts
	336	0	4.6	black clay	Q		27.4	35.1	clayey sand/gravel
4.6		6.1	grey sandstone	Rvc	35.1	45.7	grit/fine gravel	Ts	
6.1		13.7	black clay	Rvc	45.7	46.6	sandy clay	Ts	
13.7		15.2	coal	Rvc	354	0	10.7	topsoil, decomposed basalt	Q
15.2		18.3	grey mudstone	Rvc		355	0	2	clay
18.3		24.4	dolerite	Jd	2		14.5	basalt	Tb
337	0	6.1	clay	Q	14.5		30	quartz sand	Tb
	6.1	9.1	claystone	Ts	356	0	15.2	topsoil/gravel/ basalt	Ts
	9.1	15.2	green stone	Ts		15.2	25.9	sand/some gravel	Ts
	15.2	24.4	broken green rock	Ts		25.9	29	gravel	Ts
	24.4	30.5	clay	Ts		29	30	clay	Ts
338	0	43	sandstone	SD		357	0	43	sandstone

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	
358	0	0.3	topsoil	Q	374	0	4.6	gravely/sandy clay	Ts	
	0.3	16.8	clay	Q		4.6	6.1	clay	Ts	
	16.8	21.3	decomposed basalt	Tb		6.1	12.2	sand/gravel	Ts	
	21.3	39.6	white clay	Ts		12.2	54.9	clayey sand/sandy clay	Ts	
	39.6	44.2	sand & gravels	Ts		375	0	4.6	clay	Q
359	0	16.8	clay	Ts	4.6		13.7	coarse sand/gravel	Q	
	16.8	19.8	sandy clay	Ts	13.7		47.2	sandy clay/clay	Ts	
	19.8	25.9	coarse sand	Ts	376	0	4.6	sandy clay	Q	
	25.9	57.9	clay	Ts		4.6	12.2	coarse sand/pebbles	Ts	
12.2	50.3	clayey sand	Ts	377		0	1.5	topsoil	Q	
360	0	33	sandstone		SD	1.5	9.1	sand/gravel	Ts	
	361	0	42		sandstone	Rq	9.1	21.3	sand/clayey sand	Ts
2		16	basalt		Tb	21.3	25.9	clay	Ts	
362	0	2	clay		Q	25.9	51.8	sand, some clay	Ts	
	2	16	basalt	Tb	51.8	65.5	brown clay	Ts		
363	0	3.4	basalt	Tb	65.5	73.5	dolerite conglomerate	Ts		
	3.4	30	sandy clay/gravel	Tb	378	0	8	clay/dolerite scree	Q	
364	0	0.3	topsoil	Q		8	27	grey mudstone	P	
	0.3	5.5	hardpan	Ts		379	0	3	clay	Q
	5.5	6.7	sand	Ts	3		30		P	
	6.7	12.5	clay	Ts	380	0	3	clay	Q	
	12.5	14.6	gravel	Ts		3	30		P	
14.6	15.2	broken clay	Ts	381	0	0.3	topsoil	Q		
365	0	0.3	topsoil		Q	0.3	15.2	doleritic clay	Q	
	0.3	9.1	clay		Ts	15.2	51.8	mudstone	P	
	9.1	15.2	sand	Ts	382	0	0.3	top soil	Q	
366	0	4.6	gravel/grit/clay	Q		0.3	12.2	clay	Q	
	4.6	15.2	sandy clay/clayey sand	Ts		12.2	30.5	dolerite	Jd	
	15.2	21.3	coarse sand/grit	Ts	30.5	33.5	mudstone	P		
	21.3	29	coarse clayey sand	Ts	383	0	0.3	topsoil	Q	
	29	42.7	clayey sand	Ts		0.3	12.2	clay	Q	
42.7	45.7	coarse angular sand	Ts	12.2		30.5	mudstone	P		
45.7	53.3	clayey sand/gritty clay	Ts	384	0	0.3	top soil	Q		
367	0	0.3	topsoil		Q	0.3	6.1	clay	Q	
	0.3	9.1	clay		Ts	6.1	12.2	river gravel	Ts	
	9.1	19.8	sand	Ts	12.2	15.2	grey clay	Ts		
368	0	0.3	topsoil	Q	385	0	0.3	topsoil	Q	
	0.3	9.1	clay	Ts		0.3	1.5	clay	Q	
	9.1	15.2	sand	Ts		1.5	9.1	decomposed rock	SD	
369	0	4	fine clay	Q	9.1	24.4	mudstone	SD		
	4	7.3	fine yellow sand	Ts	387	0	3	clay (brown/grey)	Q	
	7.3	10.7	white sandy clay	Ts		3	39	mudstone (grey)	P	
	10.7	15.9	sand and gravel fragments	Ts		39	45	sandstone (sticky)	P	
15.9	16.2	clay	Ts	389	0	3	clay	Q		
370	0	0.3	topsoil		Ts	3	15	clay/gravel	Ts	
	0.3	19.8	soft clay	Ts	391	0	4	sandy clay	Q	
	371	0	3	soil/broken clay		Q	4	30	mudstone	P
		3	8.2	brown clay		Ts	392	0	5.5	gravely and sandy clay
8.2	15	sand	Ts	5.5	16	mudstone and coal		Rvc		
15	17.4	clay	Ts	16	19	fractured basalt		Rvc		
372	0	0.3	topsoil	Q	19	22		carbonaceous sandstone	Rvc	
	0.3	9.1	dolerite	Jd	22	25		mudstone and coal	Rvc	
	9.1	15.2	sand	Ts	25	37		fractured mudstone, coal	Rvc	
	15.2	29	brown clay	Ts	37	41		green sandstone	P	
29	33.5	sand	Ts	41	45	limestone		P		
373	0	13.7	clay	Q	45	49	calcareous sandstone	P		
	13.7	15.2	clayey sand	Ts	393	0	12	clay gravel	Q	
	15.2	38.1	sand/coarse sand/ sandy clay	Ts		12	36	mudstone and coal	P	
	38.1	48.8	sandy clay	Ts						
	48.8	53.3	fine sand	Ts						

<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>	<i>Bore</i>	<i>Start</i>	<i>End</i>	<i>Lithology</i>	<i>Unit</i>
394	0	3	clay	Q	397	0	0.6	topsoil	Q
	3	8	clay/gravel	Q		0.6	4.6	clay	Q
	8	15	grey mudstone	P		4.6	7.5	slate	Q
395	0	12	basalt	Tb		7.5	15.2	shale	SD
	12	52	sandstone/mudstone	P		15.2	79.2	mudstone	SD
396	0	6	sandy clay and gravel	Q	398	0	6	clay with basalt gravel	Q
	6	16	carbonaceous siltstone	P		6	9	weathered mudstone	Rvc
	16	20	grey sandstone	P		9	22	carbonaceous mudstone	Rvc
	20	23	carbonaceous mudstone	P		22	32	mudstone	Rvc
	23	25	fractured mudstone	P		32	43	green sandstone	P
	25	31	carbonaceous mudstone	P		43	49	grey limestone	P
	31	34	weathered sandstone	P		49	55	fractured mudstone	P
	34	37	calcareous sandstone	P	401	0	24	granite	D
	37	40	calcareous siltstone	P					
	40	55	calcareous sandy siltstone	P					

KEY TO ROCK SYMBOLS

Q	Quaternary sediments
Ts	Dominantly non-marine Tertiary sequences
Rp	Triassic freshwater quartz sandstone
Rq	Triassic, dominantly quartz sandstone
Rv	Triassic, dominantly lithic sandstone with felsic volcanoclastic rocks
Rvc	Triassic, upper sequence with coal measures and basal quartz sandstone
Rvv	Triassic, lower sequence
P	Permian sedimentary rocks
Pj	Permian feldspathic freshwater sandstone
SD	Silurian-Devonian shallow marine quartz sandstone, siltstone and shale
Tb	Tertiary basalt
Jd	Jurassic dolerite
D	Devonian granite

APPENDIX 3

Chemical analyses of groundwater samples collected within the study area, including those collected in this study

Bore	Date	pH	NO ₂	NO ₃	CO ₃	HCO ₃	Cl	SO ₄	SiO ₂	Ca	Mg	Fe	Al	K	Na	F	TDS	Na%	SAR	ESP	RSC	Hardness
13					156		208	21	21	71	25	15	15		135	0	686	51	11.1	13.1	0.0	
16	01/03/1975	6.9				700	990	5	24	130	150	0.1	0.2	2	400		2460	48	17.9	20.1	1.2	940
59	10/03/1975	7.2	0	0		510	3880	95	11	300	580	0.1	0.2	7	1100		7650	43	27.0	27.8	0.3	3135
67	08/11/1999	7.2	0	0	0	620	420	62		93	64	1.2	0.2	1.3	260	0.4	1240	53	16.1	18.3	2.1	500
91	03/11/1999	7.1			0	700	720	100	42	130	72	0.1	0.2	25	390		2090	59	21.5	23.4	1.8	
101					297		2672	123	0	147	266	140			984	0	5196	59	35.4	33.8	0.0	
106		7.1	0	0	0	360	430	30		79	56	0.8	0.3	2.2	200	0.3	1140	51	13.3	15.5	1.4	425
107					167		715	25	28	108	102	16	16		318	0	1707	50	16.7	18.9	0.0	
111					198		1047	62	36	154	96	80	80		495	0	2468	58	24.4	25.8	0.0	
117	03/11/1999	7.4	0	50	0	440	580	67		77	77	0.2	0.2	2.3	340	0.5	1490	59	20.7	22.7	1.4	510
118	03/11/1999	7.3	0	15	0	500	170	23		61	55	0.1	0.2	1.4	130	0.3	776	43	9.2	10.9	2.2	380
121	01/01/1995	7.7		100	5	400	120	51		29	33	0.1	0.2	3.8	185		700	66	17.6	19.8	3.2	215
123	03/11/1999	6.9	10	5	0	480	1100	64		87	125	0.3	0.2	3	560	0.6	2520	63	28.5	28.9	1.1	
125		7.2	0	25	214.5		689	25	12	51	129	28	28		333	0	1680	52	17.9	20.0	0.0	
126		7.3	0	50		630	659	45	33	136	54	11			247	0	1679	49	14.3	16.6	1.8	
127	25/03/1980	7.4	0	45	0	470	225	5	36	48	63	0.1	0.2	8.3	145		790	46	10.2	12.2	2.0	765
131	20/03/1980	8.0	0	25	0	555	380	28	14	62	80	0.1	0.2	4	225		1070	51	14.1	16.3	1.9	910
133	03/11/1999	7.9	0	30	12	470	380	9.4	60	73	70	0.2	0.2	4.1	220	0.3	1130	51	14.0	16.2	1.6	472
135	01/01/1995	7.4		10	5	145	3490	110		510	320	0.1	0.2	12.5	1990		9270	63	53.8	43.8	0.1	2580
136					170		173	21	328	56	35	72	72		169	0	1036	56	13.8	16.0	0.0	
137					248		1143	99	124	129	100	60	60		630	0	2592	65	32.0	31.5	0.0	
146	03/11/1999	7.7		10	5	125	125	5		30	32	0.1	0.2	1.4	52		470	36	5.0	5.7	1.0	205
149					76		535	35	7.98	59.46	64.31	0	0		244.13	0	1260	56	16.5	18.8	0.0	
150					381		2817	153	36	183	273	40	40		1293	0	5438	64	44.7	39.3	0.0	
151	03/11/1999	7.2	0	25	0	590	220	47		42	61	0.1	0.2	1	220	0.5	956	57	16.0	18.3	2.7	350
152		7.3			0	170	350	7	40	54	65	0.3	0.2	2.3	110		960	38	7.5	9.0	0.7	305
161	01/01/1980	7.2			0	540	130	21	58	31	23	0.1	0.2	2.3	110		520	58	11.5	13.6	5.1	170
164	01/01/1980	7.7			0	400	1850	13	2.4	60	190	0.1	0.2	16	960		3950	69	43.3	38.5	0.7	930
165	01/01/1995	7.5		10	5	600	2430	190		36	280	0.1	0.2	11.5	1450		5220	72	56.6	45.1	0.8	1250
177	08/11/1999	7.5	0	5	0	470	3600	165		165	320	1.1	0.2	15.5	1650	0.3	7350	68	54.6	44.2	0.4	1730

Bore	Date	pH	NO ₂	NO ₃	CO ₃	HCO ₃	Cl	SO ₄	SiO ₂	Ca	Mg	Fe	Al	K	Na	F	TDS	Na%	SAR	ESP	RSC	Hardness
183	01/01/1980	7.3			0	395	820	24	5	25	54	0.1	0.2	15	555		1680	81	45.2	39.6	2.3	285
211	03/11/1999	6.6	0	0	0	440	5200	530		200	550	35	0.2	18	2600	0.3	10400	67	68.0	49.8	0.3	610
212		7.6		10	0	280	1200	135		145	210	<0.1	<0.2	6.8	480	<0.3	2810	46	18.9	21.0	0.4	1220
214	08/11/1999	7.5			0	540	260	28		75	68	0.1	0.2	2	145	0.3	944	41	9.2	11.0	1.9	466
215		7.2		10	0	150	2900	100		510	175	<0.1	<0.2	34	1100	<0.3	5980	55	33.9	32.8	0.1	2020
217	03/11/1999	7.2	0	0	0	790	1850	115		175	230	7.3	0.2	8.3	820	0.3	4080	56	30.3	30.3	0.9	1390
220		7.9		25	0	570	910	115		67	115	<0.1	<0.2	10.5	590	<0.3	2140	67	32.1	31.5	1.5	630
229		7.9		10	0	320	450	13.5		53	74	<0.1	<0.2	7.3	220	<0.3	1210	53	14.5	16.7	1.2	435
243	08/11/1999	5.8	0	0	0	54	570	30		66	70	19.5	0.3	7.4	165	0.3	1300	45	10.7	12.6	0.2	495
248	01/01/1995	7.4		10	5	165	1310	50		175	130	0.1	0.2	8.8	530	0.3	5220	54	23.4	24.9	0.3	1250
249		7.5		10	0	220	820	30		93	97	<0.1	<0.2	10	290	<0.3	1730	50	15.9	18.1	0.6	630
254		7.8		10	0	200	370	48		78	14	<0.1	<0.2	6.1	220	<0.3	982	66	19.0	21.2	1.3	250
257		7.7		10	0	290	310	5.9		68	57	<0.1	<0.2	4.3	110	<0.3	808	38	7.5	9.0	1.2	410
260		7.8		10	0	310	770	46		74	91	0.2	<0.2	6.1	380	<0.3	1900	60	22.1	23.9	0.9	560
267		7.2		10	0	470	210	340		210	260	<0.1	<0.2	13.5	340	<0.3	3270	32	11.7	13.8	0.5	1640
270		7.8		10	0	430	370	15.5		42	59	<0.1	<0.2	7.1	220	<0.3	1050	58	16.2	18.5	2.0	350
271		7.8		10	0	380	850	45		67	125	<0.1	<0.2	8.9	390	<0.3	2020	56	20.5	22.5	0.9	680
274		8.3		10	<5	430	250	14.5		45	63	<0.1	<0.2	9.7	135	<0.3	789	45	9.6	11.5	1.9	374.5
275	19/11/1970	8.0				430	800	42	50	79	160	0.4	0.2	13	320		1980	45	15.0	17.3	0.8	860
276		8.6		10	<5	125	190	17		43	18.5	<0.1	<0.2	5.7	90	<0.3	560	53	9.1	10.9	1.1	186
278		8.4		10	<5	56	350	29		69	16	<0.1	<0.2	10	150	<0.3	856	59	13.4	15.6	0.4	239
280		8.0		10	0	540	260	10.5		20	90	<0.1	<0.2	3.1	140	<0.3	932	42	9.4	11.2	2.1	420
281		7.5		10	0	340	820	40		125	93	0.2	<0.2	15	350	<0.3	2050	53	18.3	20.4	0.8	700
282		7.7		10	0	400	920	43		93	135	<0.1	<0.2	13.5	370	<0.3	2380	51	18.1	20.3	0.8	780
284	04/05/1966	7.6				221	928	35	36	110	120	0.4	0	2	460		1985	57	22.8	24.5	0.5	769
285	14/10/1968	6.9			0	582	2430	122	52	165	385	0	0	8	9.5		5120	2	0.3	-0.8	0.5	2170
287	28/05/1969	7.9			0	687	3600	133	71	440	540	0.4	0	15	1290		6990	46	30.8	30.6	0.3	3365
292	09/11/1951	6.9			0	223	789	35	82	80	140	0.3	0	8	275		1480	44	13.6	15.8	0.5	770
293	12/12/1969	7.8				115	205	17	28	30	22	0.1	0	5	106		535	59	11.3	13.4	1.1	175
297	03/12/1969	8.4			4	220	350	63	30	39	53	0	0	1.2	190		900	57	14.7	17.0	1.1	320
299	25/05/1969	7.9			0	547	557	17	53	80	50	0.8	0	3.5	420		1230	69	28.7	29.1	2.2	448
302		7.7		10	0	470	1800	67		175	220	<0.1	<0.2	6.5	700	<0.3	4180	53	26.3	27.3	0.6	1330
304	29/06/1997				77.6		391.5	20.5	67.9	18.4	20.2	9.9			22.9		884	28	2.8	2.8	0.0	
305					77.5		391.5	20.5	67.9	18.4	30.2	9.9			229.3		884	75	24.2	25.6	0.0	

Bore	Date	pH	NO ₂	NO ₃	CO ₃	HCO ₃	Cl	SO ₄	SiO ₂	Ca	Mg	Fe	Al	K	Na	F	TDS	Na (%)	SAR	ESP	RSC	Hardness
306	13/09/1968	6.2				18	176	31	31.6	1	0.8	4	116	4	143		1815	98	81.7	54.4	5.1	
308	05/07/1968	8.0			0	11	790	40	38	11	96	0		14	380		1830	67	25.4	26.6	0.0	422
312	05/06/1967	6.9			0	365	631	38	30	65	40	0.8	0	15	405		1480	73	30.8	30.6	1.8	327
313	08/06/1967	7.9			0	380	353	9	33	70	65	0.4	0	2	190		1035	48	12.4	14.6	1.4	440
315	25/11/1969	8.4			4	150	1300	65	9	240	140	0	0	23	410		2500	44	16.4	18.7	0.2	1140
319	09/02/1970	8.4			2.5	87	305	16	18	38	33	0.1	0	8	126		730	55	11.4	13.5	0.6	230
321		8.0		10	0	350	490	68		45	56	<0.1	<0.2	17	320	0.7	1230	68	23.8	25.3	1.7	348
329		7.7		10	0	610	1300	115		85	170	<0.1	<0.2	19	760	1.7	3100	65	34.6	33.2	1.1	900
333	01/01/1970	6.7				130	1600	150	38	78	200	0		0	760		3340	62	32.8	32.0	0.2	1020
335	01/01/1968	8.0				11	1740	33	34	45	190	0			740	0.2	3485	64	34.0	32.9	0.0	894
338	13/11/1963				104		450	21	28	57.2	42.2	0			237		1011	62	18.3	20.5	0.0	
339	01/01/1974	7.1			0	290	370	23	28	32	42	0.1	0.2	0.6	260		880	69	22.5	24.2	1.9	253
346	01/01/1967	7.1	0	0	0	443	1150	133	42	65	95	0.3		16	785		2370	76	45.9	39.9	1.3	391
347	01/01/1997			0.04						159.4	321.4	6.5		17.5	1803			70	59.8	46.5	0.0	1721
349	30/10/1968	7.1				189	423	41	12.5	50	60	0.1		8	250		1077	60	17.8	20.0	0.8	372
352	19/11/1968	7.8			0	12.4	352	13	28	23	32	0.1	0	8	192		725	69	19.2	21.3	0.1	189
353		7.1		10	0	34	3700	280		190	290	0.1	0.2	9.8	1950	<0.3	7880	72	65.7	48.9	0.0	1678
356	27/11/1968	7.1				396	1210	0	17	85	180	41		12	515		2795	54	22.9	24.6	0.7	741
366	14/12/1968	6.7			0	18	317	37	18	23	22	0.1	0	9	124		580	66	14.0	16.3	0.2	148
369	05/06/1967	7.3			0	252	482	29	47	18	75	0.3	0	5	250		1805	61	18.3	20.5	1.2	309
373	23/01/1969	5.2			0	43	3200	186	19	260	294	14	0	12	1210		5645	59	38.6	35.8	0.0	1860
374		3.8			0	0	1990	20	58	84	202	19	10	15	960	0	3560	67	40.9	37.1	0.0	1040
375		8.6			7	590	2080	210	49	130	230	0	0	12	1110	0	4370	66	42.8	38.2	0.8	1260
376		8.4			8	250	1460	56	31	190	200	0	0	5	480	0	3030	45	18.3	20.5	0.3	1300
377		7.4			0	140	36	3	28	8	17	0	0	2	30	0	180	43	4.4	4.9	2.6	88
386		7.6		10	0	320	125	52		37	33	<0.1	<0.2	3.3	76	<0.3	547	43	6.9	8.2	2.3	230

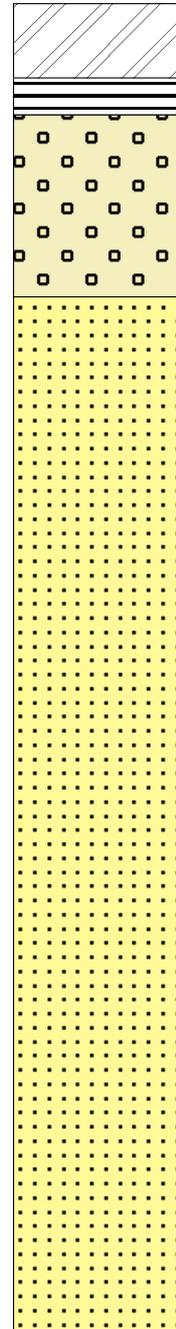
APPENDIX 4

Bore logs of holes drilled in this study

Bore Number: 207
Owner: J Von Bibra
Property: Beaufront
Date: 01-Mar
Depth (m): 37

Bore Diameter (mm): 203
Casing Length (m): 0
Casing Diameter (mm): 0
Collar Length (m): 0
Standing Water Level (m): Unknown

Aquifer	Total
Depth (m)	no data
Flow (GPH)	0
Flow (l/s)	0
pH	no data
Conductivity (µS/cm)	no data
Analysis (mg/l)	
CO3	no data
HCO3	no data
Cl	no data
SO4	no data
Ca	no data
Mg	no data
Diss. Fe	no data
Susp. Fe	no data
Al	no data
K	no data
Na	no data
NH4	no data
F	no data
NO3	no data
NO2	no data
TDS	no data
Tot. Hard	no data
Perm. Hard	no data
Temp. Hard	no data
Alkalinity	no data



Vertical scale — 10 mm = 2 metres

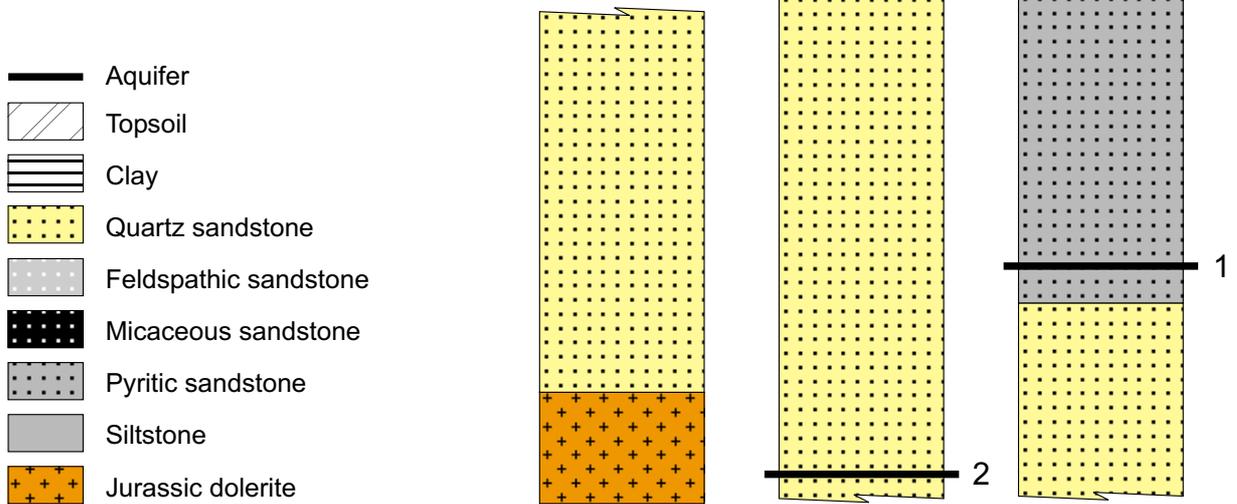
-  Aquifer
-  Topsoil
-  Clay
-  Clay and weathered rock
-  Quartz sandstone

Bore Number: 212
Owner: J Von Bibra
Property: Beaufront
Date: 02-Mar
Depth (m): 109

Bore Diameter (mm): 190
Casing Length (m): 5
Casing Diameter (mm): 225
Collar Length (m): 0
Standing Water Level (m): Unknown

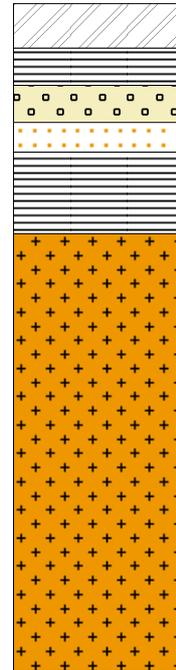
Aquifer	1	2	Total
Depth (m)	25	100	
Flow (GPH)	360	2440	2800
Flow (l/s)	0.45	3.08	3.54
pH	7.6		7.6
Conductivity (µS/cm)	4110	4156	4150
Analysis (mg/l)			
CO3	0	0	0
HCO3	600	233	280
Cl	1200	1200	1200
SO4	120.0	137.2	135
Ca	145	145	145
Mg	210	210	210
Diss. Fe	0.10	0.1	0.1
Susp. Fe	0	0	
Al	0.2	0.2	0.2
K	13.0	5.9	6.8
Na	450	484	480
NH4	0	0	
F	0.3	0.3	0.3
NO3	10	10	10
NO2	0	0	
TDS	2790	2813	2810
Tot. Hard	1210	1221	1220
Perm. Hard	720	743	740
Temp. Hard	490	479	480
Alkalinity	490	479	480

Main water bearing unit — Lower Triassic
 Vertical scale — 10 mm = 2 metres



Bore Number:	215	<i>Bore Diameter (mm):</i>	171
<i>Owner:</i>	J Von Bibra	<i>Casing Length (m):</i>	0.5
<i>Property:</i>	Beaufront	<i>Casing Diameter (mm):</i>	225
<i>Date:</i>	30-Jan	<i>Collar Length (m):</i>	0
<i>Depth (m):</i>	19	<i>Standing Water Level (m):</i>	Unknown

Aquifer	Total
<i>Depth (m)</i>	no data
<i>Flow (GPH)</i>	5
<i>Flow (l/s)</i>	0.01
<i>pH</i>	no data
<i>Conductivity (µS/cm)</i>	no data
<i>Analysis (mg/l)</i>	
CO3	no data
HCO3	no data
Cl	no data
SO4	no data
Ca	no data
Mg	no data
<i>Diss. Fe</i>	no data
<i>Susp. Fe</i>	no data
Al	no data
K	no data
Na	no data
NH4	no data
F	no data
NO3	no data
NO2	no data
TDS	no data
<i>Tot. Hard</i>	no data
<i>Perm. Hard</i>	no data
<i>Temp. Hard</i>	no data
<i>Alkalinity</i>	no data

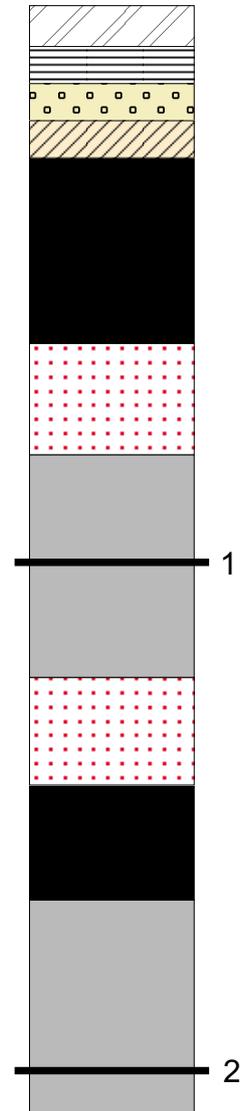


Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay
-  Clay and weathered rock
-  Lithic sandstone (volcanic)
-  Jurassic dolerite

Bore Number:	220	<i>Hole size (mm):</i>	171
<i>Owner:</i>	J Von Bibra	<i>Casing Length (m):</i>	0
<i>Property:</i>	Beaufront	<i>Casing Width (mm):</i>	0
<i>Date:</i>	25-Jan	<i>Collar Length (m):</i>	0
<i>Depth (m):</i>	31	<i>Standing Water Level (m):</i>	Unknown

Aquifer	1
<i>Depth (m)</i>	30
<i>Flow (GPH)</i>	360
<i>Flow (l/s)</i>	0.45
<i>pH</i>	7.2
<i>Conductivity (µS/cm)</i>	8170
<i>Analysis (mg/l)</i>	
CO3	0
HCO3	150
Cl	2900
SO4	100
Ca	510
Mg	175
Diss. Fe	0.1
Susp. Fe	0
Al	0.2
K	34
Na	1100
NH4	0
F	0.3
NO3	10
NO2	0
TDS	5980
<i>Tot. Hard</i>	2020
<i>Perm. Hard</i>	1900
<i>Temp. Hard</i>	120
<i>Alkalinity</i>	120



Main water bearing unit — Upper Triassic
 Vertical scale — 10 mm = 2 metres

- Aquifer
- Topsoil
- Clay
- Clay and weathered rock
- Lithic sandstone (quartz rich)
- Mudstone
- Siltstone
- Coal, silicified wood, carbonaceous

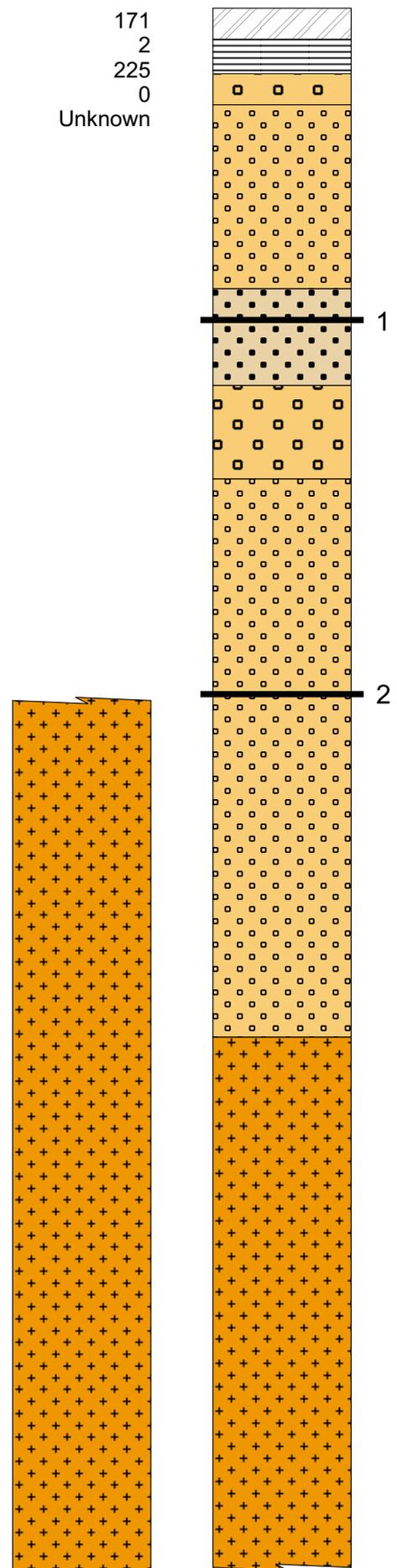
Bore Number: 221
Owner: J Von Bibra
Property: Beaufront
Date: 09-Feb
Depth (m): 79

Hole size (mm): 171
Casing Length (m): 2
Casing Width (mm): 225
Collar Length (m): 0
Standing Water Level (m): Unknown

Aquifer	1	2	3	Total
Depth (m)	10	22	22	
Flow (GPH)	50	240	430	720
Flow (l/s)	0.06	0.30	0.54	0.91
pH	7.6			7.9
Conductivity (µS/cm)	3930	3145	3364	3330
Analysis (mg/l)				
CO3	0	0	0	0
HCO3	450	583	577	570
Cl	1200	813	930	910
SO4	85.0	109.2	121.7	115
Ca	150	69	56	67
Mg	210	113	105	115
Diss. Fe	0.10	0.1	0.1	0.1
Susp. Fe	0	0	0	
Al	0.2	0.2	0.2	0.2
K	9.9	10.6	10.5	10.5
Na	340	582	624	590
NH4	0	0	0	
F	0.3	0.3	0.3	0.3
NO3	25	6.88	10	10
NO2	0	0	0	
TDS	3090	2087	2059	2140
Tot. Hard	1220	652	549	630
Perm. Hard	850	173	89	170
Temp. Hard	370	479	460	460
Alkalinity	370	479	460	460

Main water bearing unit — Tertiary basalt
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay
-  Gravel
-  Basalt — vesicular
-  Basalt — partially vesicular
-  Jurassic dolerite



Bore Number:	224	<i>Bore Diameter (mm):</i>	203
<i>Owner:</i>	R Riggall	<i>Casing Length (m):</i>	0
<i>Property:</i>	Somercotes	<i>Casing Diameter (mm):</i>	0
<i>Date:</i>	22-Feb	<i>Collar Length (m):</i>	0
<i>Depth (m):</i>	19	<i>Standing Water Level (m):</i>	Unknown

Aquifer	Total
<i>Depth (m)</i>	no data
<i>Flow (GPH)</i>	0
<i>Flow (l/s)</i>	0
<i>pH</i>	no data
<i>Conductivity (µS/cm)</i>	no data
<i>Analysis (mg/l)</i>	
CO3	no data
HCO3	no data
Cl	no data
SO4	no data
Ca	no data
Mg	no data
Diss. Fe	no data
Susp. Fe	no data
Al	no data
K	no data
Na	no data
NH4	no data
F	no data
NO3	no data
NO2	no data
TDS	no data
Tot. Hard	no data
Perm. Hard	no data
Temp. Hard	no data
Alkalinity	no data



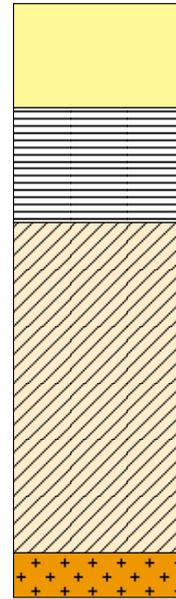
Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Sand
-  Mudstone
-  Jurassic dolerite

Bore Number: 227
Owner: R Riggall
Property: Somercotes
Date: 22-Feb
Depth (m): 19

Bore Diameter (mm): 203
Casing Length (m): 0
Casing Diameter (mm): 0
Collar Length (m): 0
Standing Water Level (m): Unknown

Aquifer	Total
Depth (m)	no data
Flow (GPH)	50
Flow (l/s)	0.06
pH	no data
Conductivity (µS/cm)	no data
Analysis (mg/l)	
CO3	no data
HCO3	no data
Cl	no data
SO4	no data
Ca	no data
Mg	no data
Diss. Fe	no data
Susp. Fe	no data
Al	no data
K	no data
Na	no data
NH4	no data
F	no data
NO3	no data
NO2	no data
TDS	no data
Tot. Hard	no data
Perm. Hard	no data
Temp. Hard	no data
Alkalinity	no data



Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Clay
-  Sand
-  Mudstone
-  Jurassic dolerite

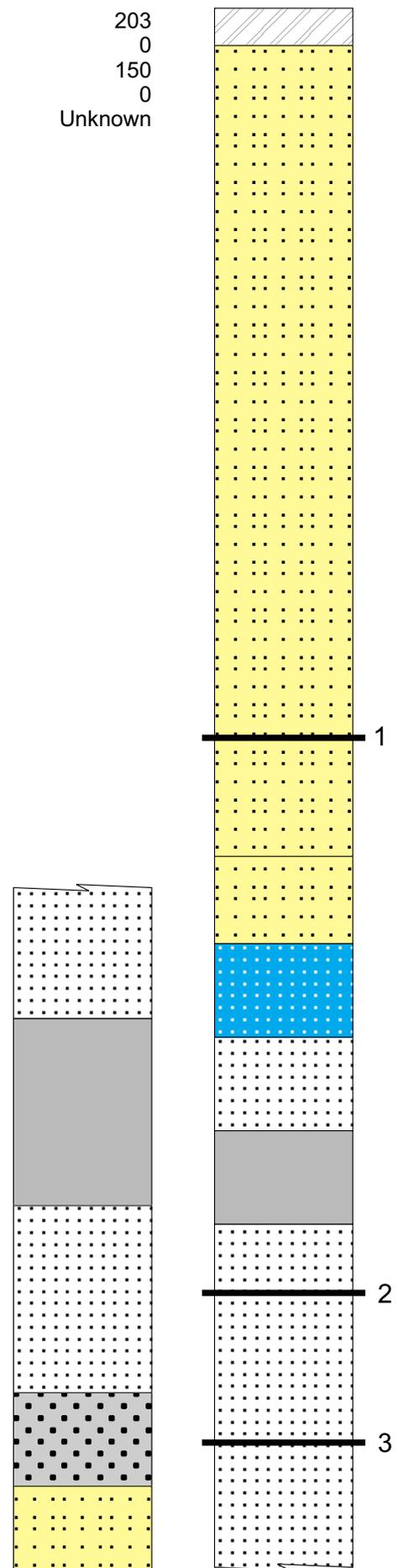
Bore Number: 229
Owner: R Riggall
Property: Somercotes
Date: 23-Feb
Depth (m): 73

Bore Diameter (mm): 203
Casing Length (m): 0
Casing Diameter (mm): 150
Collar Length (m): 0
Standing Water Level (m): Unknown

Aquifer	1	2	3	Total
Depth (m)	23	41	46	
Flow (GPH)	360	240	1200	1800
Flow (l/s)	0.45	0.30	1.52	2.27
pH	7.5			7.9
Conductivity (µS/cm)	2870	720	1560	1710
Analysis (mg/l)				
CO3	0	0	0	0
HCO3	220	295	355	320
Cl	910	60	390	450
SO4	24.0	24.0	8.3	13.5
Ca	64	19	57	53
Mg	105	2	79	74
Diss. Fe	0.10	0.1	0.1	0.1
Susp. Fe	0	0	0	
Al	0.2	0.2	0.2	0.2
K	17.0	12.0	3.5	7.3
Na	420	70	190	220
NH4	0	0	0	
F	0.3	0.3	0.3	0.3
NO3	10	10	10	10
NO2	0	0	0	
TDS	2070	445	1105	1210
Total. Hardness	585	60	465	435
Temp. Hardness	185	160	303	260
Alkalinity	185	160	303	260

Main water bearing unit — Permian
 Vertical scale — 10 mm = 2 metres

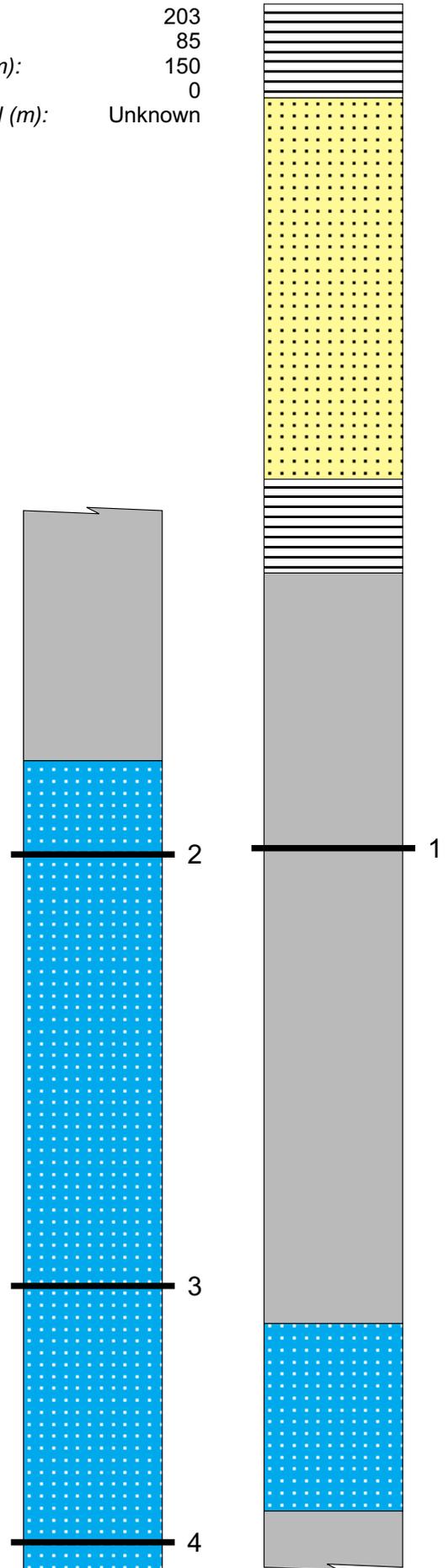
-  Aquifer
-  Topsoil
-  Quartz sandstone
-  Micaceous sandstone
-  Graphite-rich quartz sandstone
-  Garnet-rich sandstone
-  Siltstone



Bore Number: 249
Owner: N Whelan
Property: Frankston
Date: 08-Mar
Depth (m): 85

Bore Diameter (mm): 203
Casing Length (m): 85
Casing Diameter (mm): 150
Collar Length (m): 0
Standing Water Level (m): Unknown

Aquifer	1	2	3	4	Total
Depth (m)	27	63	75	83	
Flow (GPH)	600	800	400	600	2400
Flow (l/s)	0.76	1.01	0.51	0.76	3.03
pH	6.2				7.5
Conductivity (µS/cm)	6100	1970	1130	1000	2620
Analysis (mg/l)					
CO3	0	0	0	0	0
HCO3	44	256	300	295	220
Cl	2200	538	80	310	820
SO4	58.0	24.8	30.0	9.0	30
Ca	155	129	50	12	93
Mg	260	33	40	58	97
Diss. Fe	0.10	0.1	0.1	0.1	0.1
Susp. Fe	0	0	0	0	
Al	0.2	0.2	0.2	0.2	0.2
K	18.0	20.6	19.5	-18.5	10
Na	700	175	130	140	290
NH4	0	0	0	0	
F	0.3	0.3	0.3	0.3	0.3
NO3	10	10	10	10	10
NO2	0	0	0	0	
TDS	4120	1233	805	620	1730
Tot. Hard	1436	472	323	240	630
Perm. Hard	1400	263	-2355	1620	450
Temp. Hard	36	209	248	240	180
Alkalinity	36	209	248	240	180



Main water bearing unit — Lower Triassic
 Vertical scale — 10 mm = 2 metres

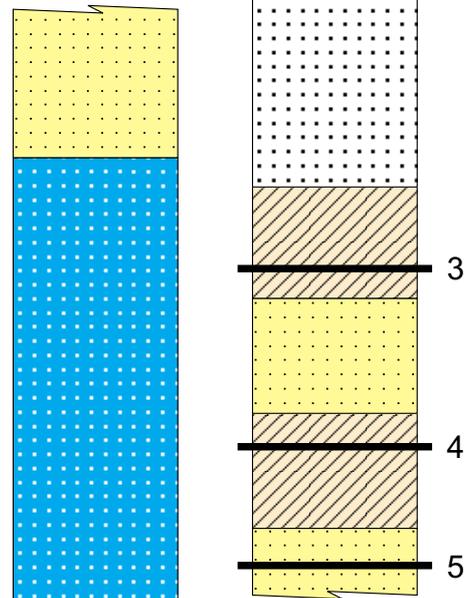
-  Aquifer
-  Clay
-  Quartz sandstone
-  Micaceous sandstone
-  Siltstone

Bore Number: 257 *Bore Diameter (mm):* 203
Owner: R Bennett *Casing Length (m):* 67.5
Property: Ashby *Casing Diameter (mm):* 225
Date: 29-Feb *Collar Length (m):* 1
Depth (m): 73 *Standing Water Level (m):* 3.70

Aquifer	1	2	3	4	5	Total
<i>Depth (m)</i>	15	30	41	45	50	
<i>Flow (GPH)</i>	720	1680	1200	1800	800	6200
<i>Flow (l/s)</i>	0.91	2.12	1.52	2.27	1.01	7.83
<i>pH</i>	7.6					7.7
<i>Conductivity (µS/cm)</i>	1010	1139	980	1540	1530	1260
<i>Analysis (mg/l)</i>						
CO3	0	0	0	0	0	0
HCO3	280	266	270	300	358	290
Cl	210	267	220	390	445	310
SO4	17	3.57	17.8	-4.6	6.58	5.9
Ca	56	64.6	41	85	88.3	68
Mg	35	49.3	42	77	70.5	57
Diss. Fe	0.1	0.1	0.1	0.1	0.1	0.1
Susp. Fe	0	0	0	0	0	0
Al	0.2	0.2	0.2	0.2	0.2	0.2
K	5.8	2.66	9.9	9.6	-13.9	4.3
Na	110	94.3	72	165	76.3	110
NH4	0	0	0	0	0	0
F	0.3	0.3	0.3	0.3	0.3	0.3
NO3	10	10	10	10	10	10
NO2	0	0	0	0	0	0
TDS	594	730	578	1045	977	808
Tot. Hard	280	359	281	521	579	410
Perm. Hard	50	143	61	271	271	170
Temp. Hard	230	216	220	250	308	240
Alkalinity	230	216	220	250	308	240

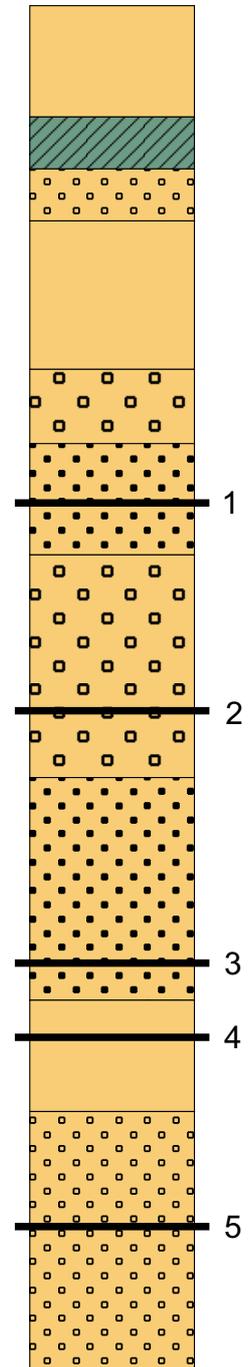
Main water bearing unit — Lower Triassic
 Vertical scale — 10 mm = 2 metres

- Aquifer
-  Topsoil
-  Sand
-  Clay
-  Clay and weathered rock
-  Quartz sandstone
-  Micaceous sandstone
-  Graphite-rich quartz sandstone
-  Mudstone



Bore Number: 260 *Bore Diameter (mm):* 215
Owner: A Hitchens *Casing Length (m):* 36
Property: Chiswick *Casing Diameter (mm):* 150
Date: 10-Feb *Collar Length (m):* 0
Depth (m): 37 *Standing Water Level (m):* 2.98

Aquifer	1	3	4	5	6	Total
<i>Depth (m)</i>	11	19	26	28	33	
<i>Flow (GPH)</i>	1800	1800	-700	12100	4000	19000
<i>Flow (l/s)</i>	2.27	2.27	-0.88	15.28	5.05	24.00
<i>pH</i>	7.9					7.8
<i>Conductivity (µS/cm)</i>	2410	2290	2184	2539	2890	2590
<i>Analysis (mg/l)</i>						
CO3	0	0	0	0	0	0
HCO3	300	280	249	300	348	310
Cl	690	650	504	735	920	770
SO4	44.0	46.0	32.6	48.0	38.5	46
Ca	69	59	52	71	89	74
Mg	79	87	87	96	84	91
Diss. Fe	0.10	0.1	0.1	0.35	-0.18	0.2
Susp. Fe	0	0	0	0	0	
Al	0.2	0.2	0.2	0.2	0.2	0.2
K	6.0	5.6	4.6	6.3	5.4	6.1
Na	370	350	360	397	343	380
NH4	0	0	0	0	0	
F	0.3	0.3	0.3	0.3	0.3	0.3
NO3	10	10	10	10	10	10
NO2	0	0	0	0	0	
TDS	1730	1530	1423	1829	2275	1900
<i>Tot. Hard</i>	500	500	500	574	560	560
<i>Perm. Hard</i>	250	270	260	322	310	310
<i>Temp. Hard</i>	250	230	240	252	250	250
<i>Alkalinity</i>	250	230	240	252	250	250



Main water bearing unit — Tertiary basalt
 Vertical scale — 10 mm = 2 metres

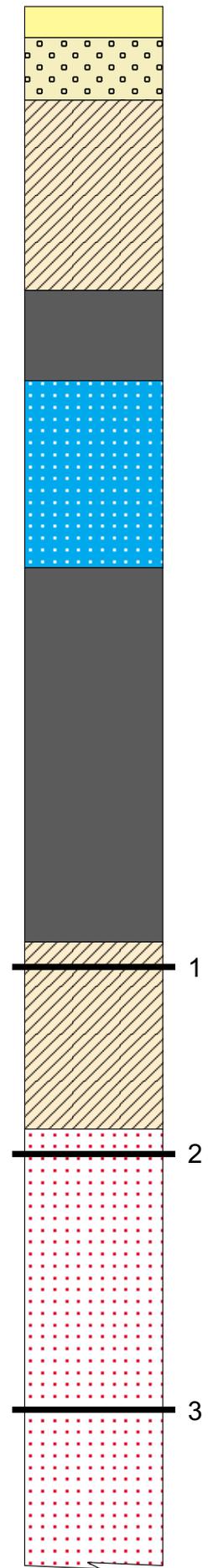
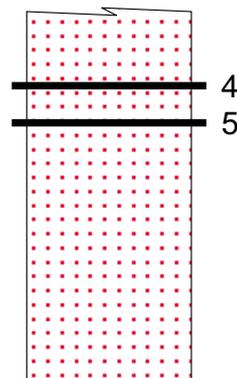
- Aquifer
- Basalt – densely vesicular
- Basalt – vesicular
- Basalt – partially vesicular
- Basalt – non vesicular
- Soapstone

Bore Number: 267 *Bore Diameter (mm):* 203
Owner: S Foster *Casing Length (m):* 47
Property: Bloomfield *Casing Diameter (mm):* 150
Date: 07-Mar *Collar Length (m):* 0.7
Depth (m): Unknown *Standing Water Level (m):* Unknown

Aquifer	1	2	3	4	5	Total
<i>Depth (m)</i>	33	37	45	52	52	
<i>Flow (GPH)</i>	800	300	1800	2500	1800	7200
<i>Flow (l/s)</i>	1.01	0.38	2.27	3.16	2.27	9.09
<i>pH</i>	7.4					7.2
<i>Conductivity (µS/cm)</i>	6890	7220	5643	3601	3570	4620
<i>Analysis (mg/l)</i>						
CO3	0	0	0	0	0	0
HCO3	640	493	503	497	320	470
Cl	2300	2300	1817	1028	-3810	210
SO4	74	70.3	63.3	21.6	1222	340
Ca	300	300	-154	497	120	210
Mg	140	1203	527	58	170	260
Diss. Fe	0.1	0.1	0.1	0.1	0.1	0.1
Susp. Fe	0	0	0	0	0	0
Al	0.2	0.2	0.2	0.2	0.2	0.2
K	25	21.3	15.1	9.86	10.5	13.5
Na	620	583	417	231	250	340
NH4	0	0	0	0	0	0
F	0.3	0.3	0.3	0.3	0.3	0.3
NO3	10	10	10	10	10	10
NO2	0	0	0	0	0	0
TDS	4890	5183	4019	2522	2520	3270
Tot. Hard	2430	2650	2168	1188	1220	1640
Perm. Hard	1900	2267	1758	770	950	1250
Temp. Hard	530	383	409	418	270	390
Alkalinity	530	383	409	418	270	390

Main water bearing unit — Lower Triassic
 Vertical scale — 10 mm = 2 metres

- Aquifer
- Sand
- Clay and weathered rock
- Lithic sandstone (quartz rich)
- Micaceous sandstone
- Mudstone
- Red beds

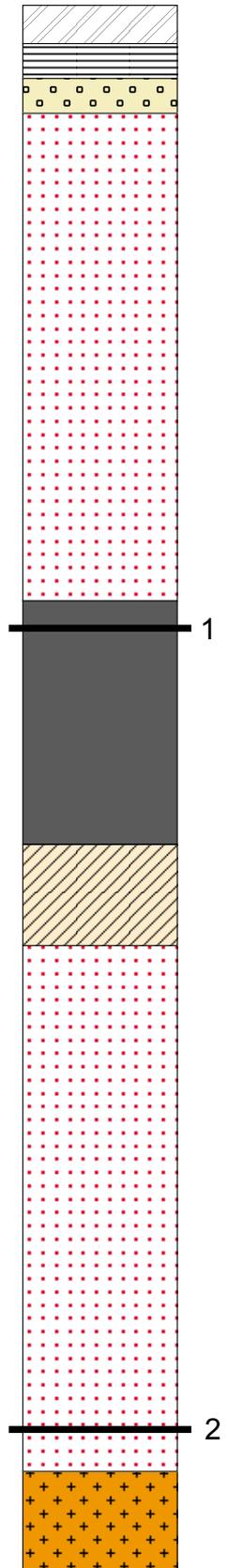


Bore Number: 270 *Bore Diameter (mm):* 171
Owner: M Littlechild *Casing Length (m):* 0.5
Property: Downward *Casing Diameter (mm):* 225
Date: 25-Jan *Collar Length (m):* 2
Depth (m): 47 *Standing Water Level (m):* Unknown

Aquifer	1	2	Total
<i>Depth (m)</i>	18	44	
<i>Flow (GPH)</i>	100	200	300
<i>Flow (l/s)</i>	0.13	0.25	0.38
<i>pH</i>	8		
<i>Conductivity (µS/cm)</i>	2260	1315	1630
<i>Analysis (mg/l)</i>			
CO3	0	0	0
HCO3	500	395	430
Cl	570	270	370
SO4	20.0	13.3	15.5
Ca	67	30	42
Mg	85	46	59
<i>Diss. Fe</i>	0.10	0.1	0.1
<i>Susp. Fe</i>	0	0	
Al	0.2	0.2	0.2
K	10.0	5.7	7.1
Na	290	185	220
NH4	0	0	
F	0.3	0.3	0.3
NO3	10	10	10
NO2	0	0	
TDS	1480	835	1050
<i>Tot. Hard</i>	515	268	350
<i>Perm. Hard</i>	105	-53	0
<i>Temp. Hard</i>	410	320	350
<i>Alkalinity</i>	410	320	350

Main water bearing unit — Lower Triassic
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay
-  Clay and weathered rock
-  Lithic sandstone (quartz rich)
-  Mudstone
-  Red beds
-  Jurassic dolerite

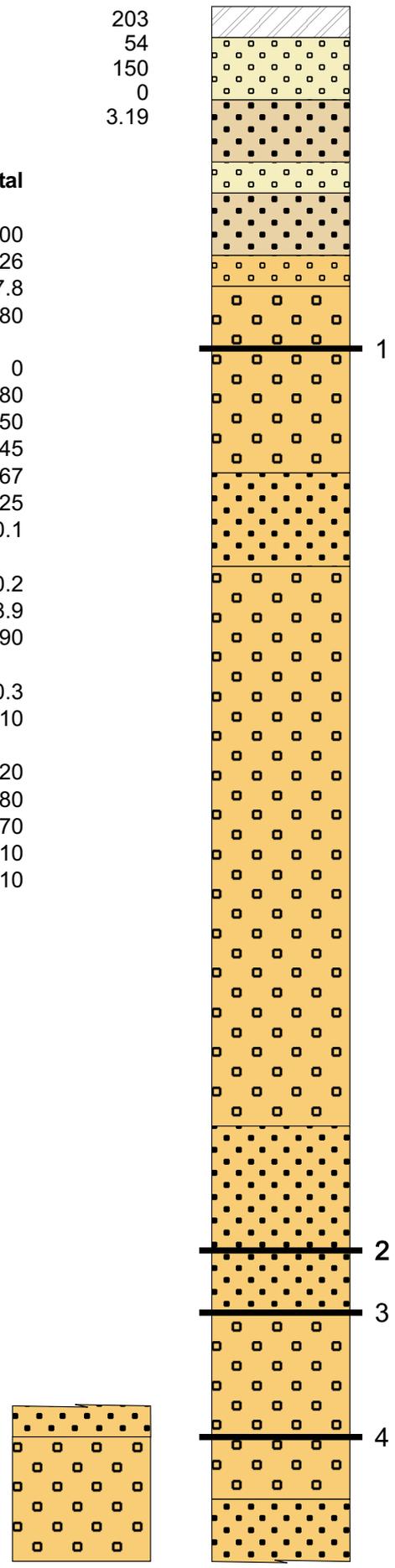


Bore Number: 271 *Bore Diameter (mm):* 203
Owner: F Chester *Casing Length (m):* 54
Property: Camelford *Casing Diameter (mm):* 150
Date: 13-Mar *Collar Length (m):* 0
Depth (m): 54 *Standing Water Level (m):* 3.19

Aquifer	1	2	4	Total
<i>Depth</i>	11	40	46	
<i>Flow (GPH)</i>	520	4980	14500	20000
<i>Flow (l/s)</i>	0.657	6.29	18.31	25.26
<i>pH</i>	7.7			7.8
<i>Conductivity (µS/cm)</i>	5650	2315	2975	2880
<i>Analysis (mg/l)</i>				
CO3	0	0	0	0
HCO3	530	386.4	372.4	380
Cl	1850	624.1	891.7	850
SO4	48	40.27	46.52	45
Ca	180	61.83	64.72	67
Mg	240	107.5	126.9	125
Diss. Fe	0.1	0.1	0.1	0.1
Susp. Fe	0	0	0	
Al	0.2	0.2	0.2	0.2
K	11	11.55	7.914	8.9
Na	680	260.3	424.1	390
NH4	0	0	0	
F	0.3	0.3	0.3	0.3
NO3	10	10	10	10
NO2	0	0	0	
TDS	3290	1534	2141	2020
Tot. Hard	1430	590.6	683.8	680
Perm. Hard	1000	271.1	381.4	370
Temp. Hard	430	319.6	302.4	310
Alkalinity	430	319.6	302.4	310

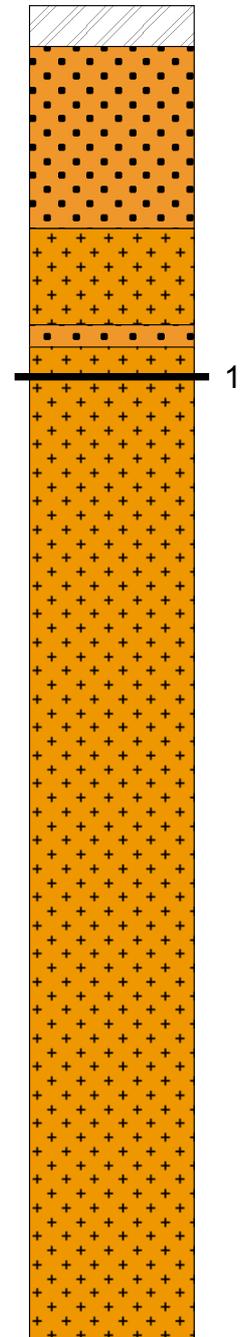
Main water bearing unit — Tertiary basalt
 Vertical scale — 10 mm = 2 metres

- Aquifer
-  Topsoil
-  Clay and weathered rock
-  Gravel
-  Basalt — densely vesicular
-  Basalt — vesicular
-  Basalt — partially vesicular



Bore Number:	274	<i>Bore Diameter (mm):</i>	203 (140)
<i>Owner:</i>	H Foster	<i>Casing Length (m):</i>	18
<i>Property:</i>	Fosterville	<i>Casing Diameter (mm):</i>	225
<i>Date:</i>	10-Mar	<i>Collar Length (m):</i>	0.7
<i>Depth (m):</i>	36	<i>Standing Water Level (m):</i>	Unknown

Aquifer	Total
<i>Depth</i>	10
<i>Flow (GPH)</i>	150
<i>Flow (l/s)</i>	0.19
<i>pH</i>	8.3
<i>Conductivity (µS/cm)</i>	1300
<i>Analysis (mg/l)</i>	
CO3	5
HCO3	430
Cl	250
SO4	14.5
Ca	45
Mg	63
<i>Diss. Fe</i>	0.10
<i>Susp. Fe</i>	0
Al	0.2
K	9.7
Na	135
NH4	0
F	0.3
NO3	10
NO2	0
TDS	789
<i>Tot. Hard</i>	375
<i>Perm. Hard</i>	15
<i>Temp. Hard</i>	360
<i>Alkalinity</i>	360

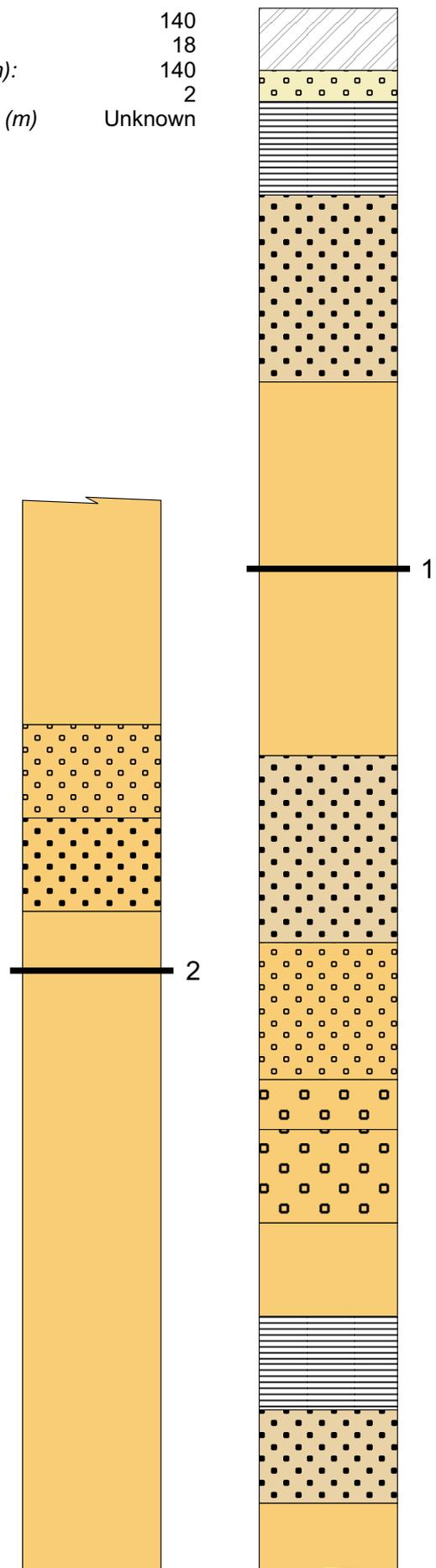


Main water bearing unit — Dolerite
 Vertical scale — 10 mm = 2 metres

- Aquifer
-  Topsoil
-  Jurassic dolerite (weathered)
-  Jurassic dolerite

Bore Number: 276 **Bore Diameter (mm):** 140
Owner: T Clarke **Casing Length (m):** 18
Property: Quorn Hall **Casing Diameter (mm):** 140
Date: 27-Jan **Collar Length (m):** 2
Depth (m): 85 **Standing Water Level (m)** Unknown

Aquifer	1	2	Total
Depth (m)	18	65	
Flow (GPH)	300	300	600
Flow (l/s)	0.38	0.38	0.76
pH	7.4	8.6	
Conductivity (µS/cm)	718	854	786
Analysis (mg/l)			
CO3	0	10	5
HCO3	155	95	125
Cl	170	210	190
SO4	6.1	27.9	17
Ca	42	44	43
Mg	26	11	18.5
Diss. Fe	0.10	0.1	0.1
Susp. Fe	0	0	
Al	0.2	0.2	0.2
K	1.6	9.8	5.7
Na	65	115	90
NH4	0	0	
F	0.3	0.3	0.3
NO3	10	10	10
NO2	0	0	
TDS	568	552	560
Tot. Hard	212	160	186
Perm. Hard	87	65	76
Temp. Hard	125	95	110
Alkalinity	125	95	110



Main water bearing unit — Basalt
 Vertical scale — 10 mm = 2 metres

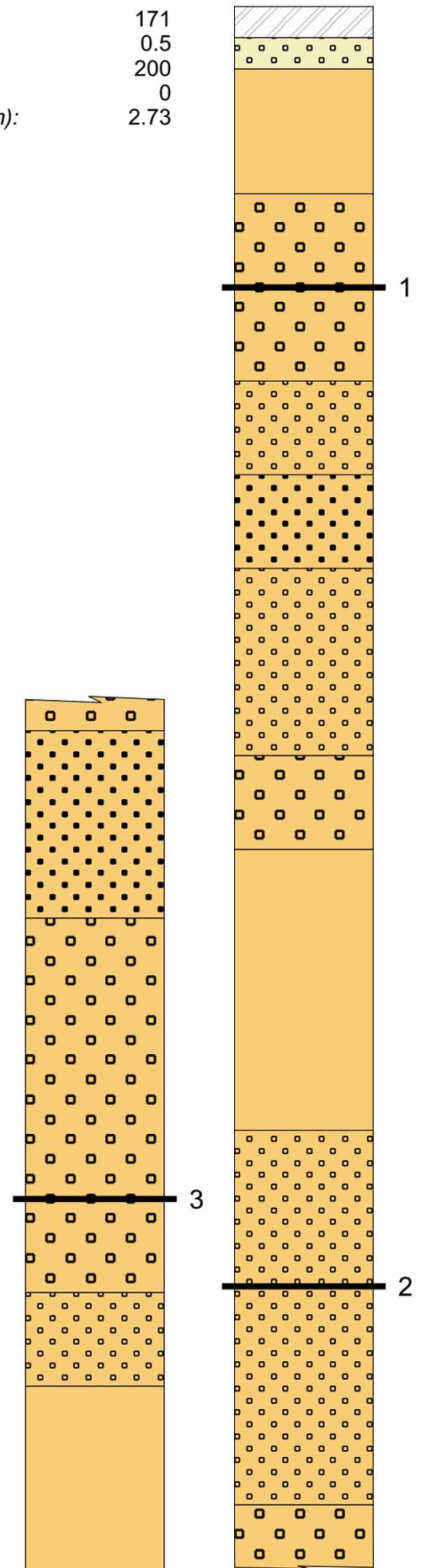
- Aquifer
- Topsoil
- Clay
- Clay and weathered rock
- Gravel
- Basalt – densely vesicular
- Basalt – vesicular
- Basalt – partially vesicular
- Basalt – non vesicular

Bore Number: 278 *Bore Diameter (mm):* 171
Owner: C Lyne *Casing Length (m):* 0.5
Property: Riccarton *Casing Diameter (mm):* 200
Date: 13-Mar *Collar Length (m):* 0
Depth (m): 78 *Standing Water Level (m):* 2.73

Aquifer	1	2	3	Total
<i>Depth (m)</i>	9	41	66	
<i>Flow (GPH)</i>	1100	300	200	1600
<i>Flow (l/s)</i>	1.39	0.38	0.25	2.02
<i>pH</i>	8			7.5
<i>Conductivity (µS/cm)</i>	3330	2163	1080	2830
<i>Analysis (mg/l)</i>				
CO3	0	0	0	0
HCO3	500	33	-80	340
Cl	950	670	330	820
SO4	45.0	35.7	19.0	40
Ca	87	171	265	125
Mg	170	-40	-131	93
Diss. Fe	0.10	0.57	0.2	0.2
Susp. Fe	0	0	0	
Al	0.2	0.2	0.2	0.2
K	8.0	38.3	18.5	15
Na	420	233	140	350
NH4	0	0	0	
F	0.3	0.3	0.3	0.3
NO3	10	10	10	10
NO2	0	0	0	
TDS	2350	1697	930	2050
Tot. Hard	920	220	210	700
Perm. Hard	510	230	210	420
Temp. Hard	410	-10	0	280
Alkalinity	410	-10	0	280

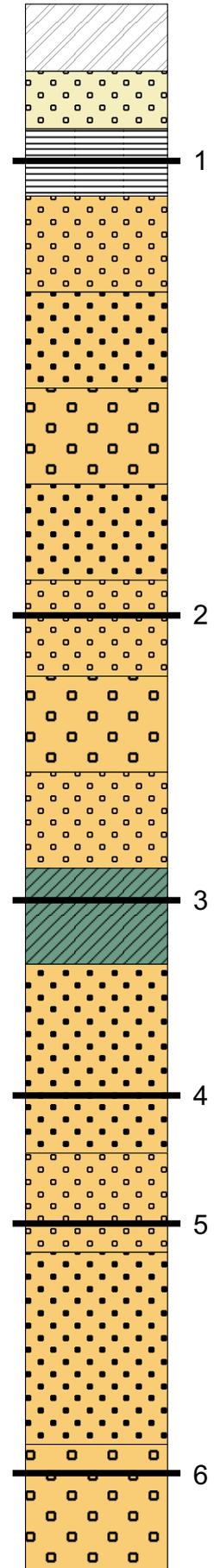
Main water bearing unit — Tertiary basalt
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay and weathered rock
-  Basalt — densely vesicular
-  Basalt — vesicular
-  Basalt — partially vesicular
-  Basalt



Bore No.: 280 **Bore Diameter (mm):** 215
Owner: R Jones **Casing Length (m):** 48
Property: Douglas Park **Casing Diameter (mm):** 225 (150 @ 45m)
Date: 03-Feb **Collar Length (m):** 0
Depth (m): 49 **Standing Water Level (m):** 3.27

Aquifer	1	2	3	4	5	6	Total
Depth (m)	5	19	28	34	38	46	
Flow (GPH)	300	600	540	7200	1860	4500	15000
Flow (l/s)	0.38	0.76	0.68	9.09	2.35	5.68	19
pH	7.5						8
Conductivity (µS/cm)	2120	2075	1823	1282	1513	1353	1400
Analysis (mg/l)							
CO3	0	0	0	0	0	0	0
HCO3	520	550	567	538	540	540	540
Cl	510	510	403	206	306	260	260
SO4	15.5	6.8	9.7	10.7	10.5	10.5	11
Ca	69	87	25	52	-54	-13	20
Mg	110	133	125	78	109	90	90
Diss. Fe	0.10	0.1	0.1	0.1	0.1	0.1	<0.1
Susp. Fe	0	0	0	0	0	0	
Al	0.2	0.2	0.2	0.2	0.2	0.2	<0.2
K	2.6	2.0	2.2	3.3	4.2	2.6	3
Na	250	153	145	134	140	140	140
NH4	0	0	0	0	0	0	
F	0.3	0.3	0.3	0.3	0.3	0.3	<0.3
NO3	10	10	10	10	10	10	<10.0
NO2	0	0	0	0	0	0	
TDS	1480	1600	1267	834	514	1095	932
Tot. Hard	620	770	533	456	361	314	420
Perm. Hard	190	310	83	18	-130	-39	0
Temp. Hard	430	460	450	438	440	373	420
Alkalinity	430	460	450	438	440	440	440



Main water bearing unit — basalt
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay
-  Clay and weathered rock
-  Basalt – densely vesicular
-  Basalt – vesicular
-  Basalt – partially vesicular
-  Soapstone

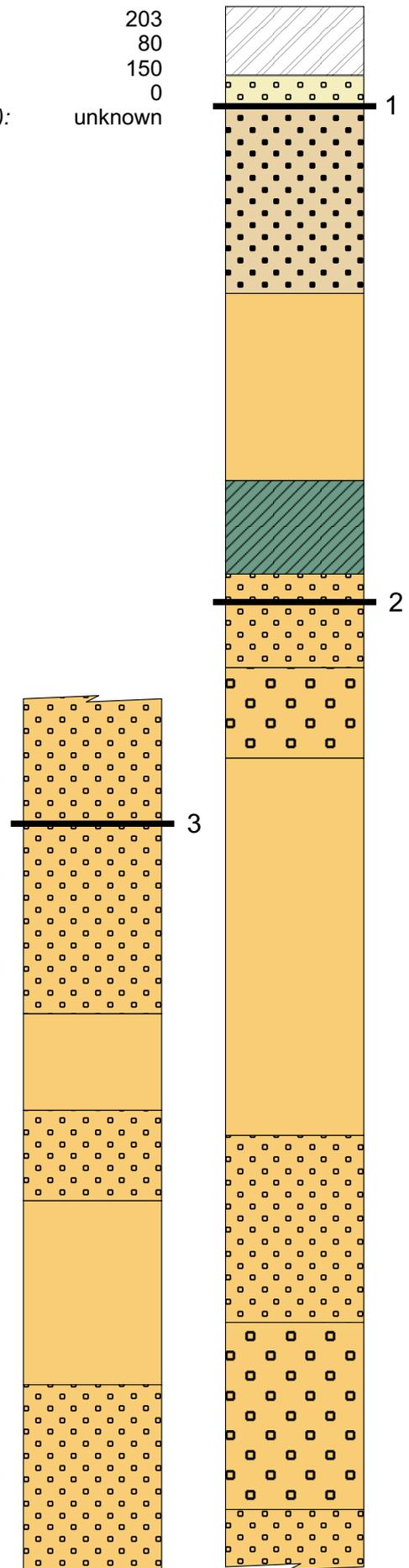
Bore Number: 281
Owner: C Lyne
Property: Riccarton
Date: 08-Feb
Depth (m): 79

Hole size (mm): 203
Casing Length (m): 80
Casing Width (mm): 150
Collar Length (m): 0
Standing Water Level (m): unknown

Aquifer	1	2	3	Total
Depth (m)	3	19	59	
Flow (GPH)	50	240	2110	2400
Flow (l/s)	0.06	0.30	2.66	3.03
pH	7.5			8.4
Conductivity (µS/cm)	2700	2350	952	1128
Analysis (mg/l)				
CO3	0	0	6	5
HCO3	240	264	28	56
Cl	850	681	301	350
SO4	24.0	13.7	30.9	29
Ca	99	85	67	69
Mg	135	111	2	16
Diss. Fe	0.10	0.1	0.1	0.1
Susp. Fe	0	0	0	
Al	0.2	0.2	0.2	0.2
K	2.7	7.2	10.5	10
Na	150	204	144	150
NH4	0	0	0	
F	0.3	0.3	0.3	0.3
NO3	10	10	10	10
NO2	0	0	0	
TDS	2150	1848	713	856
Tot. Hard	810	665	177	239
Perm. Hard	610	453	150	190
Temp. Hard	200	212	27	49
Alkalinity	200	212	27	49

Main water bearing unit — Tertiary basalt
 Vertical scale — 10 mm = 2 metres

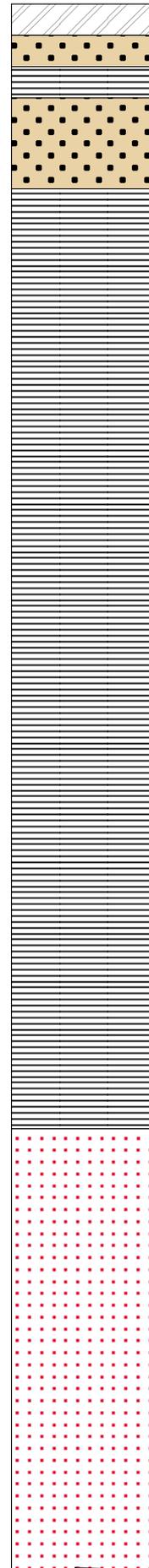
-  Aquifer
-  Topsoil
-  Gravel
-  Clay and weathered rock
-  Basalt – vesicular
-  Basalt – partially vesicular
-  Basalt – non vesicular
-  Soapstone



Bore Number: 289
Owner: J Taylor
Property: Kenilworth
Date: 11-Feb
Depth (m): 54

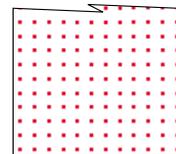
Bore Diameter (mm): 203
Casing Length (m): 42
Casing Diameter (mm): 150
Collar Length (m): 3
Standing Water Level (m): Unknown

Aquifer	Total
Depth (m)	no data
Flow (GPH)	400
Flow (l/s)	0.51
pH	no data
Conductivity (µS/cm)	no data
Analysis (mg/l)	
CO3	no data
HCO3	no data
Cl	no data
SO4	no data
Ca	no data
Mg	no data
Diss. Fe	no data
Susp. Fe	no data
Al	no data
K	no data
Na	no data
NH4	no data
F	no data
NO3	no data
NO2	no data
TDS	no data
Tot. Hard	no data
Perm. Hard	no data
Temp. Hard	no data
Alkalinity	no data



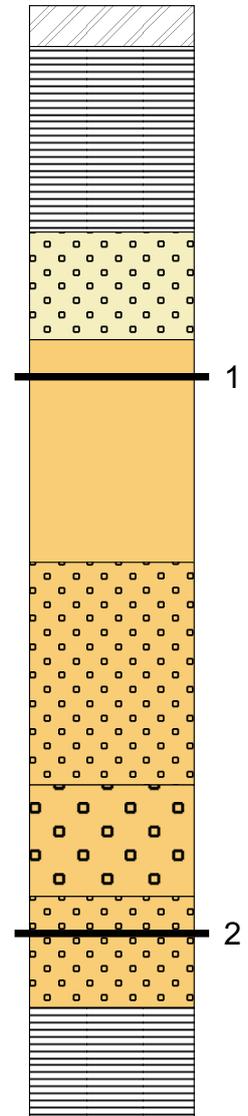
Main water bearing unit — Tertiary sediments
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay
-  Gravel
-  Lithic sandstone (quartz rich)



Bore Number:	302	<i>Bore Diameter (mm):</i>	203
<i>Owner:</i>	D Atkinson	<i>Casing Length (m):</i>	31
<i>Property:</i>	Meadow Bank	<i>Casing Diameter (mm):</i>	150
<i>Date:</i>	22-Feb	<i>Collar Length (m):</i>	0
<i>Depth (m):</i>	31	<i>Standing Water Level (m):</i>	Unknown

Aquifer	1	2	Total
<i>Depth (m)</i>	10	25	
<i>Flow (GPH)</i>	550	1250	1800
<i>Flow (l/s)</i>	0.69	1.58	2.27
<i>pH</i>	7.7		7.7
<i>Conductivity (µS/cm)</i>	4950	5584	5390
<i>Analysis (mg/l)</i>			
CO3	0	0	0
HCO3	420	492	470
Cl	1600	1888	1800
SO4	65.0	67.9	67
Ca	140	190	175
Mg	180	238	220
Diss. Fe	0.10	0.1	0.1
Susp. Fe	0	0	
Al	0.2	0.2	0.2
K	7.2	6.2	6.5
Na	780	665	700
F	0.4	0.256	0.3
NO3	10	10	10
NO2	0	0	
TDS	3750	4369	4180
Tot. Hard	1100	1431	1330
Perm. Hard	760	1034	950
Temp. Hard	340	398	380
Alkalinity	340	398	380



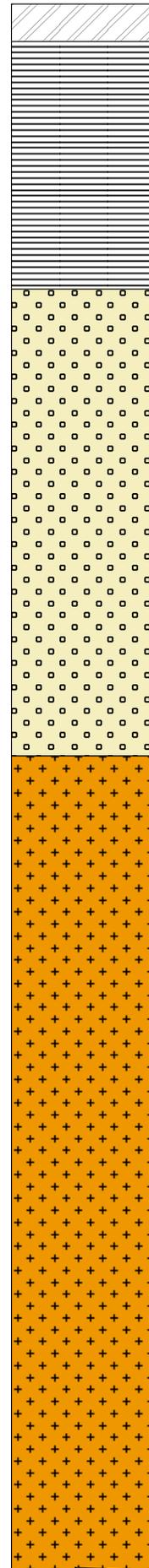
Main water bearing unit — Tertiary basalt
 Vertical scale — 10 mm = 2 metres

- Aquifer
- Topsoil
- Clay
- Clay and weathered rock
- Basalt – vesicular
- Basalt – partially vesicular
- Basalt – non vesicular

Bore Number: 307
Owner: H Skerritt
Property: Quarry Hill
Date: 03-Feb
Depth (m): 69

Bore Diameter (mm): 171
Casing Length (m): 0
Casing Diameter (mm): n/a
Collar Length (m): 1
Standing Water Level (m): Unknown

Aquifer	Total
Depth (m)	no data
Flow (GPH)	400
Flow (l/s)	0.51
pH	no data
Conductivity (µS/cm)	no data
Analysis (mg/l)	
CO3	no data
HCO3	no data
Cl	no data
SO4	no data
Ca	no data
Mg	no data
Diss. Fe	no data
Susp. Fe	no data
Al	no data
K	no data
Na	no data
NH4	no data
F	no data
NO3	no data
NO2	no data
TDS	no data
Tot. Hard	no data
Perm. Hard	no data
Temp. Hard	no data
Alkalinity	no data



Vertical scale — 10 mm = 2 metres

- Aquifer
- Topsoil
- Clay
- Clay and weathered rock
- Jurassic dolerite

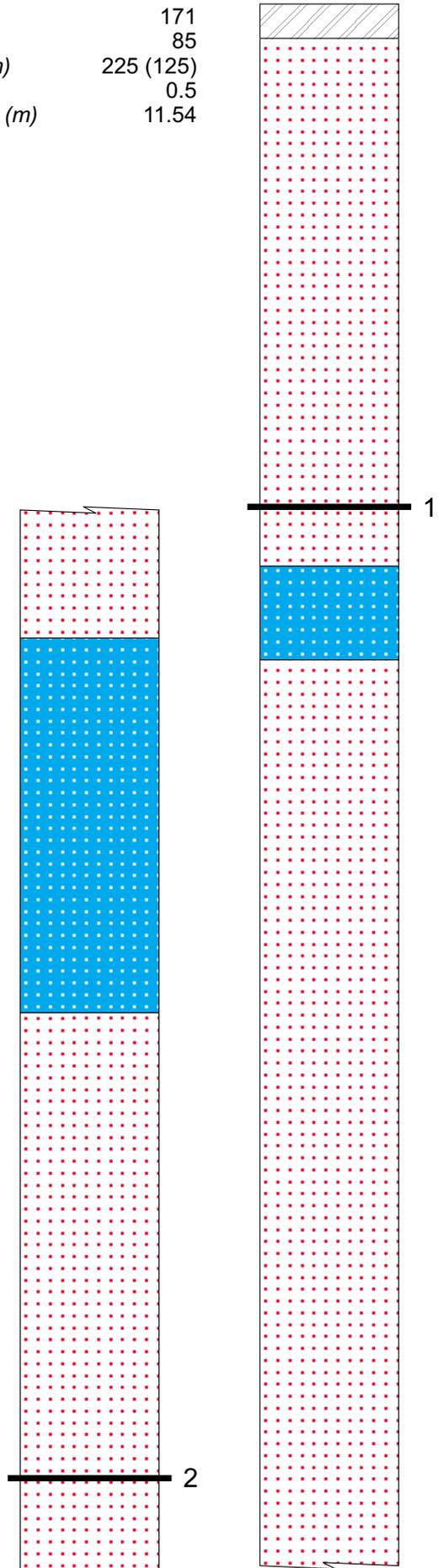


Bore Number: 321 *Bore Diameter (mm):* 171
Owner: W O'Connor *Casing Length (m):* 85
Property: Windfalls *Casing Diameter (mm):* 225 (125)
Date: 28-Jan *Collar Length (m):* 0.5
Depth (m): 85 *Standing Water Level (m):* 11.54

Aquifer	1	2	Total
<i>Depth (m)</i>	16	81	
<i>Flow (GPH)</i>	300	5700	6000
<i>Flow (l/s)</i>	0.38	7.2	7.58
<i>pH</i>	7.5		8
<i>Conductivity (µS/cm)</i>	10100	1521	1950
<i>Analysis (mg/l)</i>			
CO3	0	0	0
HCO3	800	326	350
Cl	3400	337	490
SO4	165	62.9	68
Ca	175	38.2	45
Mg	360	40	56
Diss. Fe	0.1	0.1	0.1
Susp. Fe	0	0	
Al	0.2	0.2	0.2
K	52	15.2	17
Na	1650	250	320
NH4	0	0	
F	0.7	0.7	0.7
NO3	10	10	10
NO2	0	0	
TDS	7140	919	1230
Tot. Hard	1910	266	348
Perm. Hard	1250	-4.74	58
Temp. Hard	660	271	290
Alkalinity	660	271	290

Main water bearing unit — Permian
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Lithic sandstone (quartz rich)
-  Micaceous sandstone



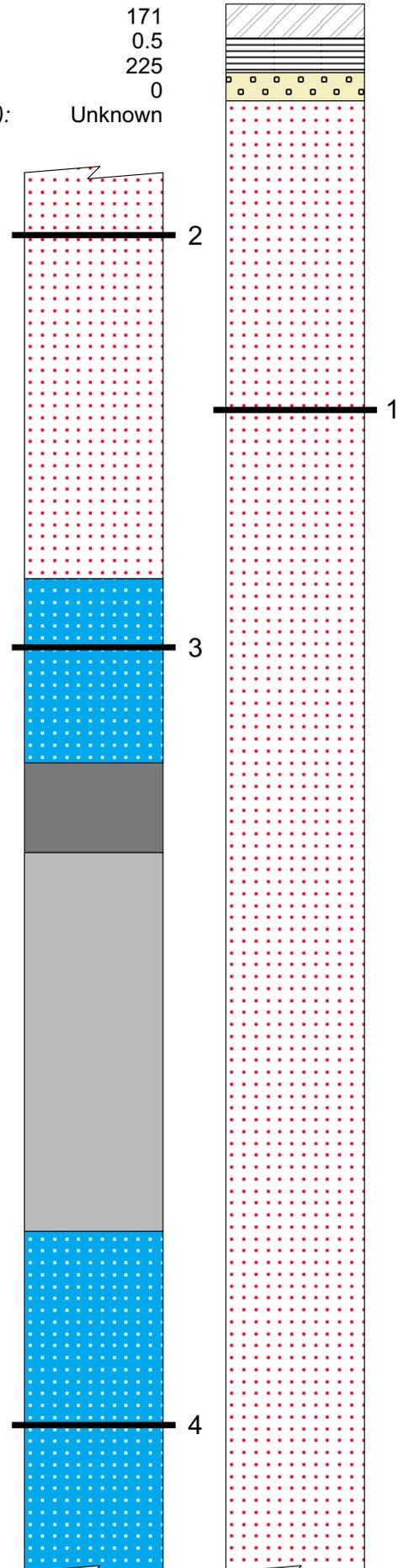
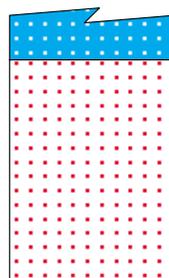
Bore Number: 329
Owner: F O'Connor
Property: Benham
Date: 02-Feb
Depth (m): 103

Bore Diameter (mm): 171
Casing Length (m): 0.5
Casing Diameter (mm): 225
Collar Length (m): 0
Standing Water Level (m): Unknown

Aquifer	1	2	3	4	Total
Depth (m)	13	52	65	90	
Flow (GPH)	50	400	270	240	960
Flow (l/s)	0.06	0.51	0.34	0.30	1.21
pH	7.9				7.7
Conductivity (µS/cm)	7610	6553	1817	3290	4460
Analysis (mg/l)					
CO3	0	0	0	0	0
HCO3	1100	830	193	610	610
Cl	2400	2063	367	850	1300
SO4	110.0	104.4	158.3	85.0	115
Ca	82	57	95	121	85
Mg	360	360	-93	110	170
Diss. Fe	0.10	0.1	0.1	0.1	0.1
Susp. Fe	0	0	0	0	0
Al	0.2	0.2	0.2	0.2	0.2
K	26.0	11.9	52.2	-8.0	19
Na	1200	1200	0	790	760
NH4	0	0	0	0	0
F	0.3	0.41	5.47	-0.1	1.7
NO3	10	10	10	10	10
NO2	0	0	0	0	0
TDS	5410	4746	553	2740	3100
Tot. Hard	1700	1621	-130	690	900
Perm. Hard	820	944	-297	190	400
Temp. Hard	880	678	167	500	500
Alkalinity	880	678	167	500	500

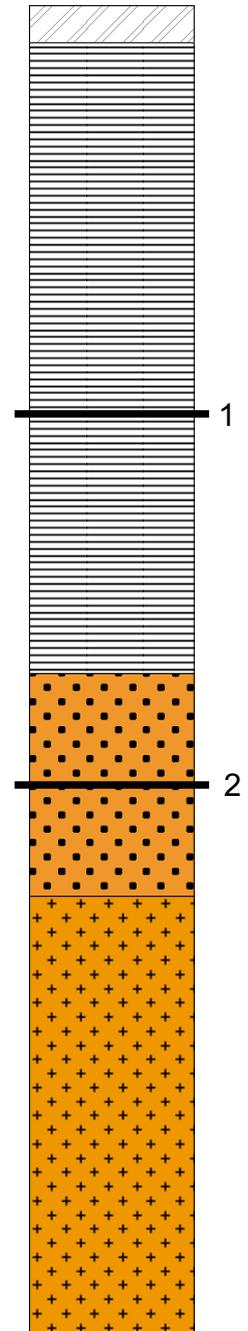
Main water bearing unit — Lower Triassic
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay
-  Clay and weathered rock
-  Lithic sandstone (quartz rich)
-  Micaceous sandstone
-  Red beds
-  Siltstone



Bore Number:	353	<i>Bore Diameter (mm):</i>	171
<i>Owner:</i>	S Hanson	<i>Casing Length (m):</i>	0
<i>Property:</i>		<i>Casing Diameter (mm):</i>	225
<i>Date:</i>	18-Feb	<i>Collar Length (m):</i>	0.5
<i>Depth (m):</i>	31	<i>Standing Water Level (m):</i>	Unknown

Aquifer	1	2	Total
<i>Depth (m)</i>	11	19	
<i>Flow (GPH)</i>	50	200	250
<i>Flow (l/s)</i>	0.06	0.25	0.32
<i>pH</i>	5.2		7.1
<i>Conductivity (µS/cm)</i>	10200	10825	10700
<i>Analysis (mg/l)</i>			
<i>CO3</i>	0	0	0
<i>HCO3</i>	5	41	34
<i>Cl</i>	4000	3625	3700
<i>SO4</i>	270.0	282.5	280
<i>Ca</i>	280	168	190
<i>Mg</i>	260	298	290
<i>Diss. Fe</i>	0.10	0.1	0.1
<i>Susp. Fe</i>	0	0	
<i>Al</i>	0.2	0.2	0.2
<i>K</i>	18.5	7.6	9.8
<i>Na</i>	1750	2000	1950
<i>NH4</i>	0	0	
<i>F</i>	0.5	0.25	0.3
<i>NO3</i>	10	10	10
<i>NO2</i>	0	0	
<i>TDS</i>	7990	7853	7880
<i>Tot. Hard</i>	1800	1648	1678
<i>Perm. Hard</i>	1	2062	1650
<i>Temp. Hard</i>	1	35	28
<i>Alkalinity</i>	1	35	28



Main water bearing unit — Tertiary sediments
 Vertical scale — 10 mm = 2 metres

-  Aquifer
-  Topsoil
-  Clay
-  Weathered dolerite
-  Jurassic dolerite

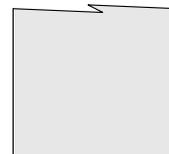
Bore Number:	386	Bore Diameter (mm):	140
Owner:	R Gee	Casing Length (m):	18
Property:	Kooringa	Casing Diameter (mm):	150
Date:	01-Feb	Collar Length (m):	0.5
Depth (m):	55	Standing Water Level (m):	22.60

Aquifer	1
Depth (m)	49
Flow (GPH)	3000
Flow (l/s)	3.79
pH	7.6
Conductivity (µS/cm)	880
Analysis (mg/l)	
CO3	0
HCO3	320
Cl	125
SO4	52.0
Ca	37
Mg	33
Diss. Fe	0.10
Susp. Fe	0
Al	0.2
K	3.3
Na	76
NH4	0
F	0.3
NO3	10
NO2	0
TDS	547
Tot. Hard	230
Perm. Hard	0
Temp. Hard	230
Alkalinity	270



Main water bearing unit — Permian
 Vertical scale — 10 mm = 2 metres

- Aquifer
- Topsoil
- Clay
- Clay and weathered rock
- Lithic sandstone (quartz rich)
- Mudstone
- Shale



1

APPENDIX 5

Drawdown/recovery graphs, raw data, and calculations of transmissivity (T), storage coefficients (S), and optimum yield (Q) for the six pump-tested bores

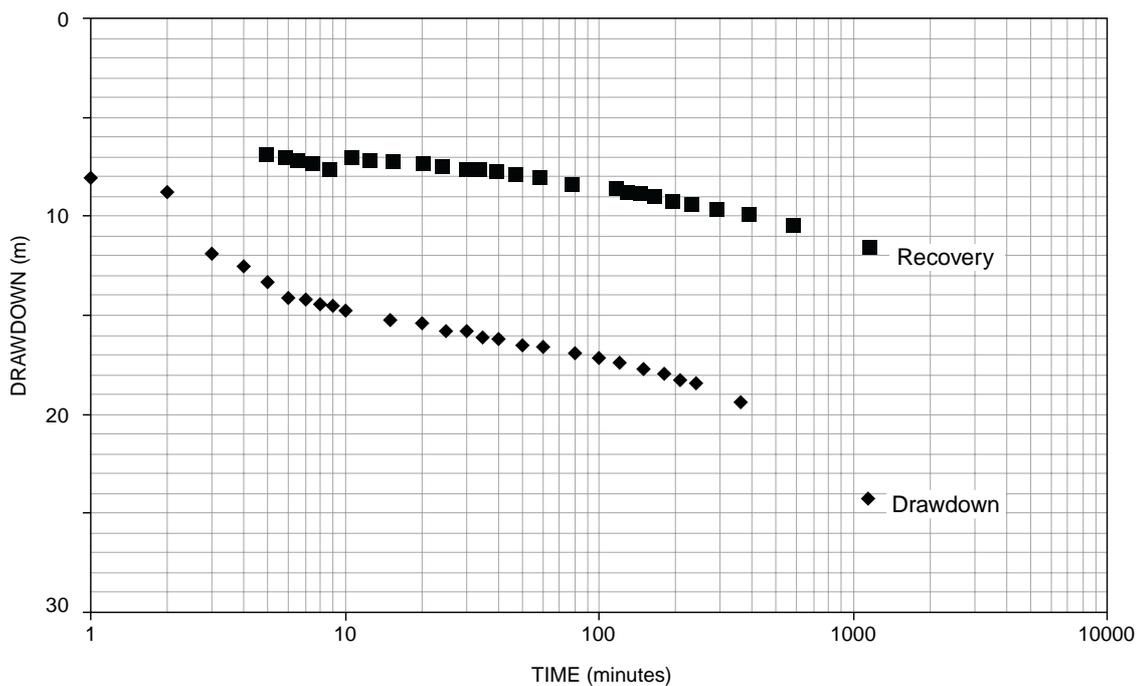
Property name: WINDFALLS (AVOCA)
 SWL: 11.54 metres

Bore Number: WIND (5)
 Pump set at: 75 metres

Date: 6-7 April 2000

Time	Minutes since start	Rate (gph)	Depth to water (m)	Drawdown (m)	Time	t1	t	t/t1	Depth to water (m)	Drawdown (m)
11:13	0				06:23	1	1142	1142.00	23.05	11.51
11:14	1	5280	19.63	8.09	06:24	2	1143	571.50	21.90	10.36
11:15	2		20.35	8.81	06:25	3	1144	381.33	21.39	9.85
11:16	3		23.45	11.91	06:26	4	1145	286.25	21.09	9.55
11:17	4		24.08	12.54	06:27	5	1146	229.20	20.85	9.31
11:18	5		24.87	13.33	06:28	6	1147	191.17	20.69	9.15
11:19	6		25.63	14.09	06:29	7	1148	164.00	20.45	8.91
11:20	7		25.73	14.19	06:30	8	1149	143.63	20.34	8.80
11:21	8		25.95	14.41	06:31	9	1150	127.78	20.26	8.72
11:22	9		26.09	14.55	06:32	10	1151	115.10	20.11	8.57
11:23	10		26.27	14.73	06:37	15	1156	77.07	19.81	8.27
11:28/11:36	15	BREAK	26.75	15.21	06:42	20	1161	58.05	19.50	7.96
11:41	20		26.96	15.42	06:47	25	1166	46.64	19.33	7.79
11:46	25		27.36	15.82	06:52	30	1171	39.03	19.20	7.66
11:51	30	5280	27.37	15.83	06:57	35	1176	33.60	19.12	7.58
11:56	35		27.62	16.08	07:02	40	1181	29.53	19.10	7.56
12:01	40		27.76	16.22	07:12	50	1191	23.82	18.98	7.44
12:11	50		28.03	16.49	07:22	60	1201	20.02	18.83	7.29
12:21	60		28.11	16.57	07:42	80	1221	15.26	18.74	7.20
12:41	80		28.45	16.91	08:02	100	1241	12.41	18.65	7.11
13:01	100		28.67	17.13	08:22	120	1261	10.51	18.47	6.93
13:21	120		28.90	17.36	08:52	150	1291	8.61	18.99	7.54
13:51	150		29.25	17.71	09:22	180	1321	7.34	18.77	7.23
14:21	180		29.50	17.96	09:52	210	1351	6.43	18.61	7.07
14:51	210		29.85	18.31	10:22	240	1381	5.75	18.50	6.96
15:21	240	4800	30.00	18.46	11:22	300	1441	4.80	18.36	6.82
17:21	360	4800	30.91	19.37						
06:22	1141	4800	35.80	24.26						

DRAWDOWN AND RECOVERY vs TIME — WINDFALLS



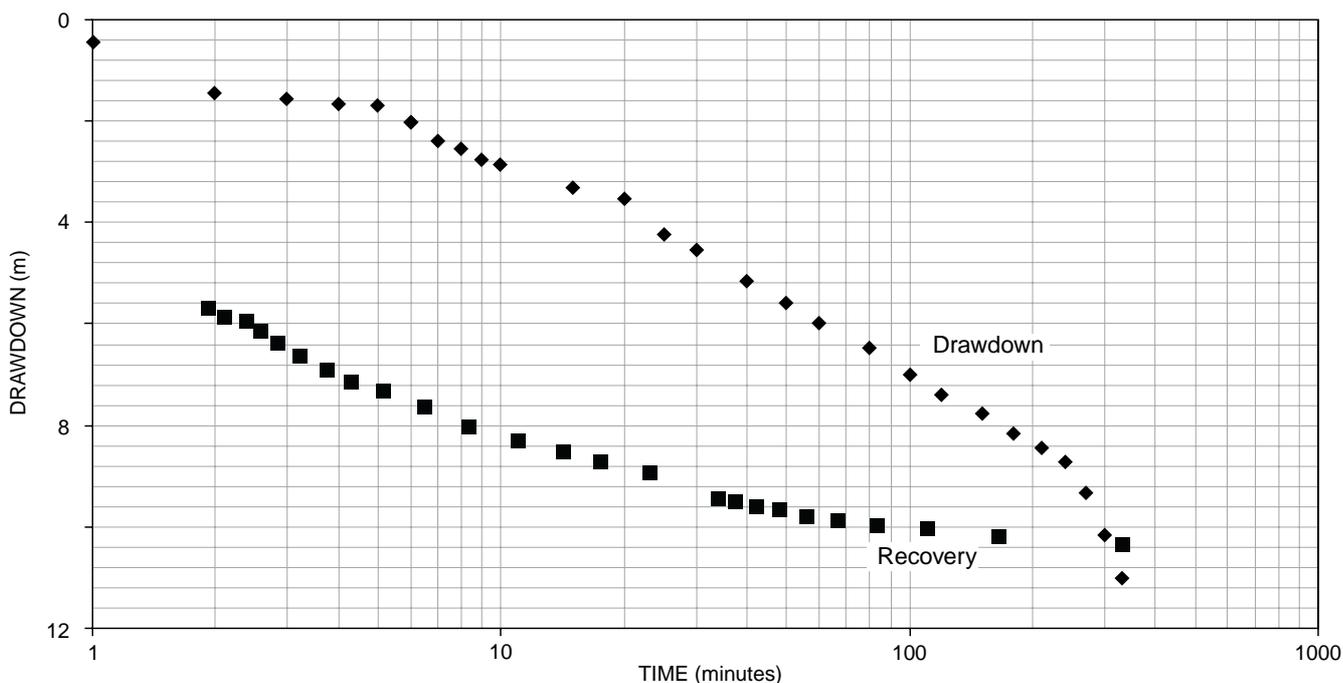
Property name: KOORINGA (FINGAL)
 SWL: 22.6 metres

Bore Number: KOORING (6)
 Pump set at: 50 metres

Date: 10-11 April 2000

Time	Minutes since start	Rate (gph)	Depth to water (m)	Drawdown (m)	Time	t1	t	t/t1	Depth to water (m)	Drawdown (m)
12:26	0				06:31	1	331	331.00	32.90	10.30
12:27	1	2980	23.01	0.41	06:32	2	332	166.00	32.76	10.16
12:28	2		24.02	1.42	06:33	3	333	111.00	32.64	10.04
12:29	3		24.13	1.53	06:34	4	334	83.50	32.53	9.93
12:30	4		24.22	1.62	06:35	5	335	67.00	32.44	9.84
12:31	5		24.26	1.66	06:36	6	336	56.00	32.35	9.75
12:32	6		24.60	2.00	06:37	7	337	48.14	32.25	9.65
12:33	7		24.95	2.35	06:38	8	338	42.25	32.17	9.57
12:34	8		25.13	2.53	06:39	9	339	37.67	32.09	9.49
12:35	9		25.32	2.72	06:40	10	340	34.00	32.01	9.41
12:36	10		25.43	2.83	06:45	15	345	23.00	31.49	8.89
12:41	15	2980	25.89	3.29	06:50	20	350	17.50	31.30	8.70
12:46	20		26.10	3.50	06:55	25	355	14.20	31.10	8.50
12:51	25		26.79	4.19	07:03	33	363	11.00	30.89	8.29
12:56	30		27.10	4.50	07:15	45	375	8.33	30.60	8.00
13:06	40		27.72	5.12	07:30	60	390	6.50	30.22	7.62
13:16	50		28.14	5.54	07:50	80	410	5.13	29.91	7.31
13:26	60		28.54	5.94	08:10	100	430	4.30	29.72	7.12
13:46	80		29.04	6.44	08:30	120	450	3.75	29.48	6.88
14:06/14:45	100	2980	29.56	6.96	09:00	150	480	3.20	29.20	6.60
15:05	120	BREAK	29.96	7.36	09:30	180	510	2.83	28.96	6.36
15:35	150		30.34	7.74	10:00	210	540	2.57	28.71	6.11
16:05	180		30.72	8.12	10:30	240	570	2.38	28.53	5.93
16:35	210		31.01	8.41	11:30	300	630	2.10	28.42	5.82
17:05/21:30	240	BREAK	31.30	8.70	12:30	360	690	1.92	28.24	5.64
22:00	270	2980	31.90	9.30						
10:30/10:49	300	BREAK	32.74	10.14						
11:19	330		33.58	10.98						

DRAWDOWN AND RECOVERY vs TIME — KOORINGA



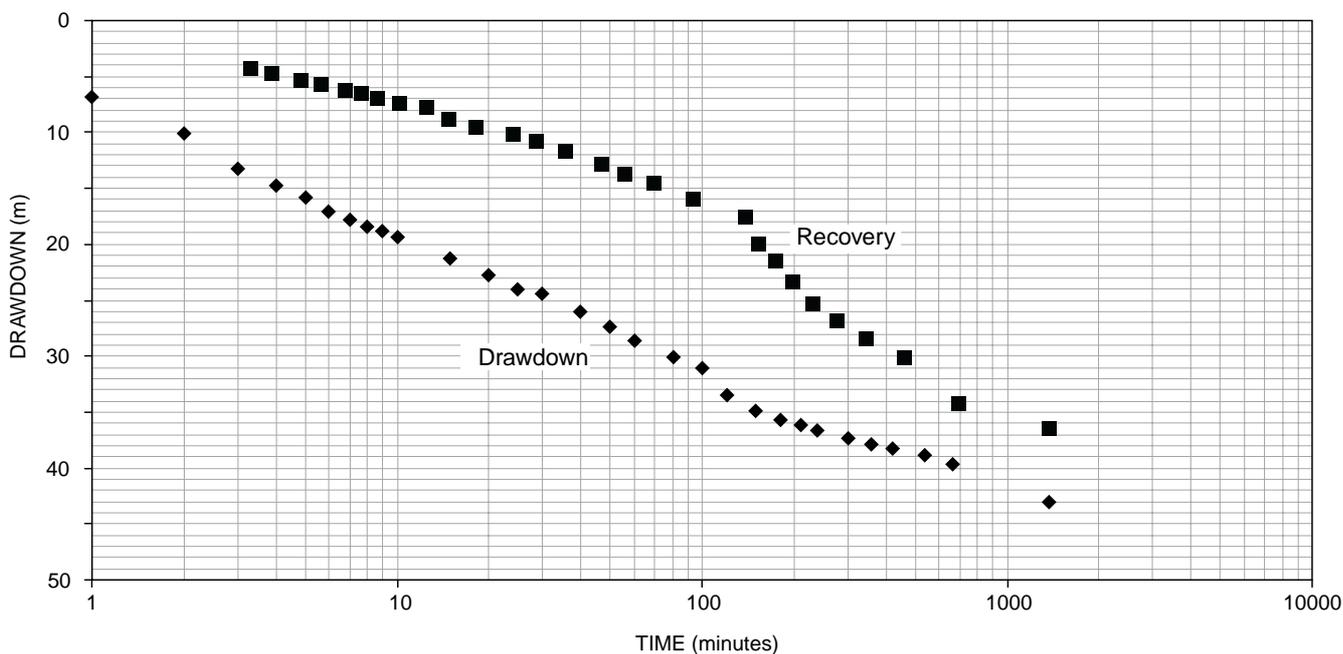
Property name: ASHBY (ROSS)
 SWL: 3.7 metres

Bore Number: ASH (22)
 Pump set at: 68 metres

Date: 12-13 April 2000

Time	Minutes since start	Rate (gph)	Depth to water (m)	Drawdown (m)	Time	t1	t	t/t1	Depth to water (m)	Drawdown (m)
05:35	0				05:28	1	1381	1381.00	40.20	36.50
05:36	1	4800	10.49	6.79	05:29	2	1382	691.00	37.88	34.18
05:37	2		13.82	10.12	05:30	3	1383	461.00	33.94	30.24
05:38	3		16.90	13.20	05:31	4	1384	346.00	32.12	28.42
05:39	4		18.43	14.73	05:32	5	1385	277.00	30.49	26.79
05:40	5		19.56	15.86	05:33	6	1386	231.00	28.98	25.28
05:41	6		20.76	17.06	05:34	7	1387	198.14	26.96	23.26
05:42	7		21.48	17.78	05:35	8	1388	173.50	35.24	21.54
05:43	8		22.03	18.33	05:36	9	1389	154.33	23.67	19.97
05:44	9		22.46	18.76	05:37	10	1390	139.00	21.10	17.60
05:45	10		23.02	19.32	05:42	15	1395	93.00	19.60	15.90
05:50	15	4800	25.01	21.31	05:47	20	1400	70.00	18.25	14.55
05:55	20		26.47	22.77	05:52	25	1405	56.20	17.45	13.75
06:00	25		27.62	23.92	05:57	30	1410	47.00	16.56	12.86
06:06	30		28.14	24.44	06:07	40	1420	35.50	15.39	11.69
06:15	40		29.78	26.08	06:17	50	1430	28.60	15.54	10.74
06:25	50		31.15	27.45	06:27	60	1440	24.00	13.79	10.09
06:35	60		32.30	28.60	06:47	80	1460	18.25	13.20	9.50
06:55	80	4800	33.81	30.11	07:07	100	1480	14.80	12.60	8.90
07:15 / 09:07	100	BREAK	34.77	31.07	07:27	120	1500	12.50	11.52	7.82
09:27	120		37.18	33.48	07:57	150	1530	10.20	11.11	7.41
09:57	150		38.54	34.84	08:27	180	1560	8.67	10.60	6.90
10:27	180		39.36	35.66	08:57	210	1590	7.57	10.23	6.53
10:57	210		39.76	36.06	09:27	240	1620	6.75	9.92	6.22
11:27	240		40.35	36.65	10:27	300	1680	5.60	9.41	5.71
12:27	300		41.06	37.36	11:27	360	1740	4.83	9.02	5.32
13:27	360		41.64	37.94	13:27	480	1860	3.88	8.44	4.74
14:27	420		41.97	38.27	15:27	600	1980	3.30	7.95	4.25
16:27	540		42.49	38.79						
18:27	660	3600	43.38	39.68						
05:27	1380	3600	46.71	43.01						

DRAWDOWN AND RECOVERY vs TIME — ASHBY



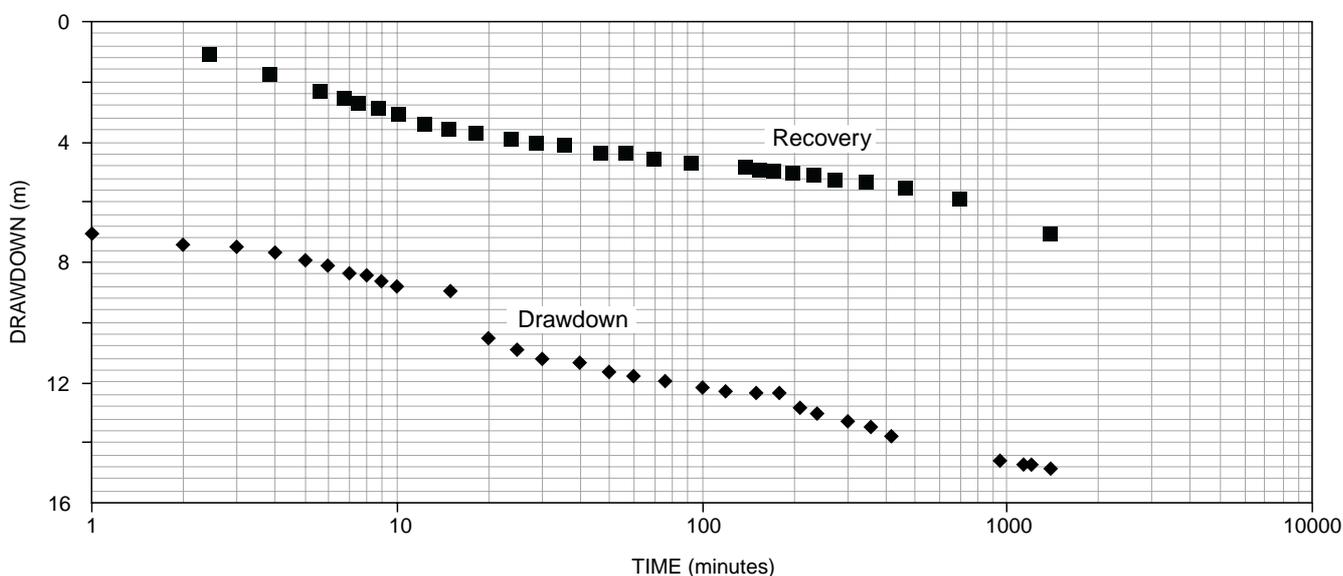
Property name: DOUGLAS PARK
 SWL: 3.36 metres

Bore Number: DOUG (9)
 Pump set at: 38 metres

Date: 7-8 May 2000

Time	Minutes since start	Rate (gph)	Depth to water (m)	Drawdown (m)	Time	t1	t	t/t1	Depth to water (m)	Drawdown (m)
13:55	0				13:31	1	1381	1381.0	10.71	7.07
13:56	1		10.67	7.03	13:32	2	1382	691.0	9.55	5.91
13:57	2		11.06	7.42	13:33	3	1383	461.0	9.18	5.54
13:58	3		11.12	7.48	13:34	4	1384	346.0	9.00	5.36
13:59	4		11.33	7.69	13:35	5	1385	277.0	8.92	5.28
14:00	5		11.56	7.92	13:36	6	1386	231.0	8.77	5.13
14:01	6		11.76	8.12	13:37	7	1387	198.1	8.67	5.03
14:02	7		12.00	8.36	13:38	8	1388	173.5	8.61	4.97
14:03	8		12.08	8.44	13:39	9	1389	154.3	8.54	4.90
14:04	9		12.25	8.61	13:40	10	1390	139.0	8.47	4.83
14:05	10	8818	12.43	8.79	13:45	15	1395	93.0	8.35	4.71
14:10	15		12.57	8.93	13:50	20	1400	70.0	8.21	4.57
14:15	20		14.15	10.51	13:55	25	1405	56.2	8.06	4.42
14:20	25		14.52	10.88	14:00	30	1410	47.0	8.00	4.36
14:25	30	9600	14.83	11.19	14:10	40	1420	35.5	7.75	4.11
14:35	40		14.96	11.32	14:20	50	1430	28.6	7.65	4.01
14:45	50		15.29	11.65	14:30	60	1440	24.0	7.53	3.89
14:55	60		15.42	11.78	14:50	80	1460	18.3	7.36	3.72
15:10	75		15.61	11.97	15:10	100	1480	14.8	7.20	3.56
15:35	100		15.79	12.15	15:30	120	1500	12.5	7.02	3.38
15:55	120		15.91	12.27	16:00	150	1530	10.2	6.72	3.08
16:25	150		15.98	12.34	16:30	180	1560	8.7	6.51	2.87
16:55	180		15.99	12.35	17:00	210	1590	7.6	6.34	2.70
17:25	210		16.50	12.86	17:30	240	1620	6.8	6.15	2.51
17:55	240		16.69	13.05	18:30	300	1680	5.6	6.00	2.36
18:55	300	9600	16.95	13.31	21:30	480	1860	3.9	5.38	1.74
19:55	360		17.10	13.46	05:30	960	2340	2.4	4.71	1.07
20:55	420		17.43	13.79						
05:55	960	8818	18.23	14.59						
08:55/09:30	1140	BREAK	18.38	14.74						
10:30	1200		18.4	14.76						
13:30	1380	9600	18.48	14.84						

DRAWDOWN AND RECOVERY vs TIME — DOUGLAS PARK



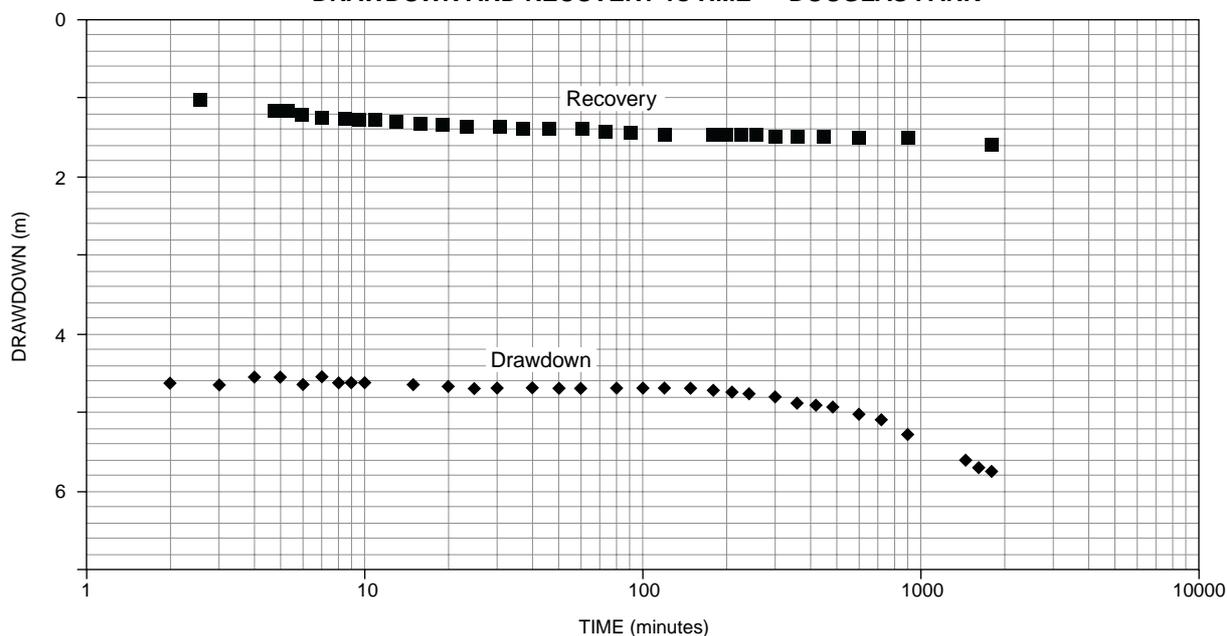
Property name: CAMELFORD
 SWL: 3.79 metres

Bore Number: CAMEL (29)
 Pump set at: 29 metres

Date: 9-10 May 2000

Time	Minutes since start	Rate (gph)	Depth to water (m)	Drawdown (m)	Time	t1	t	t/t1	Depth to water (m)	Drawdown (m)
06:35	0				12:36	1	1801	1801.0	5.36	1.57
06:36	1		8.05	4.26	12:37	2	1802	901.0	5.30	1.51
06:37	2		8.42	4.63	12:38	3	1803	601.0	5.29	1.50
06:38	3		8.44	4.65	12:39	4	1804	451.0	5.28	1.49
06:39	4		8.34	4.55	12:40	5	1805	361.0	5.27	1.48
06:40	5		8.33	4.54	12:41	6	1806	301.0	5.27	1.48
06:41	6		8.44	4.65	12:42	7	1807	258.1	5.26	1.47
06:42	7		8.34	4.55	12:43	8	1808	226.0	5.26	1.47
06:43	8		8.41	4.62	12:44	9	1809	201.0	5.25	1.46
06:44	9		8.40	4.61	12:45	10	1810	181.0	5.25	1.46
06:45	10	10243	8.42	4.63	12:50	15	1815	121.0	5.24	1.45
06:50	15		8.44	4.65	12:55	20	1820	91.0	5.22	1.43
06:55	20		8.45	4.66	13:00	25	1825	73.0	5.20	1.41
07:00	25		8.48	4.69	13:05	30	1830	61.0	5.19	1.40
07:05	30		8.47	4.68	01:15	40	1840	46.0	5.18	1.39
07:15	40		8.49	4.70	13:25	50	1850	37.0	5.17	1.38
07:25	50		8.49	4.70	13:35	60	1860	31.0	5.16	1.37
07:35	60		8.47	4.68	13:55	80	1880	23.5	5.15	1.36
07:55	80		8.47	4.68	14:15	100	1900	19.0	5.13	1.34
08:15	100		8.48	4.69	14:35	120	1920	16.0	5.11	1.32
08:35	120		8.47	4.68	15:05	150	1950	13.0	5.09	1.30
09:05	150		8.48	4.69	15:35	180	1980	11.0	5.07	1.28
09:35	180		8.50	4.71	16:05	210	2010	9.6	5.06	1.27
10:05	210		8.53	4.74	16:35	240	2040	8.5	5.05	1.26
10:35	240		8.56	4.77	17:35	300	2100	7.0	5.03	1.24
11:35	300	10243	8.59	4.80	18:35	360	2160	6.0	5.00	1.21
12:35	360		8.66	4.87	19:35	420	2220	5.3	4.95	1.16
13:35	420		8.70	4.91	20:35	480	2280	4.8	4.95	1.16
14:35	480		8.72	4.93	07:35	1140	2940	2.6	4.8	1.01
16:35	600		8.8	5.01						
18:35	720		8.89	5.10						
21:35	900		9.06	5.27						
06:35	1440		9.4	5.61						
09:35	1620	10243	9.49	5.70						
12:35	1800		9.54	5.75						

DRAWDOWN AND RECOVERY vs TIME — DOUGLAS PARK



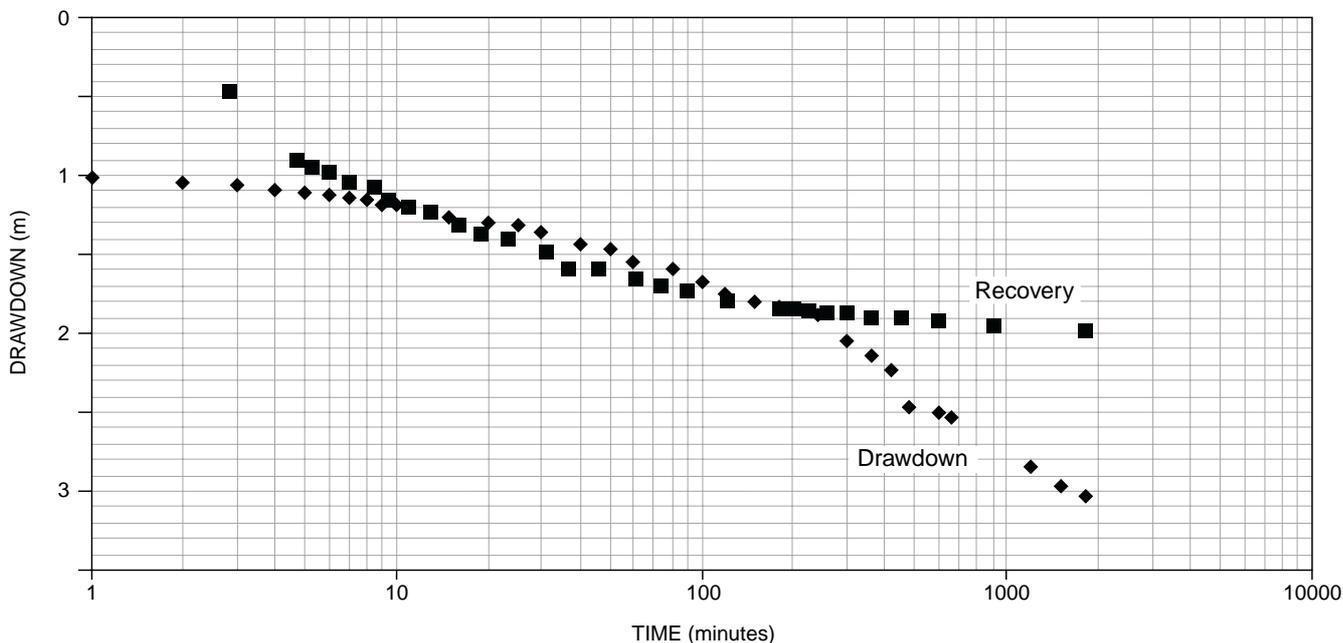
Property name: CHISWICK (ROSS)
 SWL: 3.38 metres

Bore Number: CHIS (13)
 Pump set at: 29 metres

Date: 11/5-13/5/2000

Time	Minutes since start	Rate (gph)	Depth to water (m)	Drawdown (m)	Time	t1	t	t/t1	Depth to water (m)	Drawdown (m)
10:15	0				16:16	1	1801	1801.0	5.37	1.99
10:16	1		4.40	1.02	16:17	2	1802	901.0	5.34	1.96
10:17	2		4.42	1.04	16:18	3	1803	601.0	5.30	1.92
10:18	3		4.44	1.06	16:19	4	1804	451.0	5.29	1.91
10:19	4	6706	4.48	1.10	16:20	5	1805	361.0	5.28	1.90
10:20	5		4.49	1.11	16:21	6	1806	301.0	5.26	1.88
10:21	6		4.50	1.12	16:22	7	1807	258.1	5.25	1.87
10:22	7		4.52	1.14	16:23	8	1808	226.0	5.24	1.86
10:23	8		4.54	1.16	16:24	9	1809	201.0	5.23	1.85
10:24	9		4.56	1.18	16:25	10	1810	181.0	5.22	1.84
10:25	10		4.57	1.19	16:30	15	1815	121.0	5.18	1.80
10:30	15		4.65	1.27	16:35	20	1820	91.0	5.12	1.74
10:35	20		4.67	1.29	16:40	25	1825	73.0	5.08	1.70
10:40	25		4.70	1.32	16:45	30	1830	61.0	5.04	1.66
10:45	30		4.74	1.36	16:55	40	1840	46.0	4.98	1.60
10:55	40		4.81	1.43	17:05	50	1850	37.0	4.97	1.59
11:05	50		4.85	1.47	17:15	60	1860	31.0	4.86	1.48
11:15	60		4.92	1.54	17:35	80	1880	23.5	4.79	1.41
11:35	80	6706	4.98	1.60	17:55	100	1900	19.0	4.75	1.37
11:55	100		5.05	1.67	18:15	120	1920	16.0	4.70	1.32
12:15	120		5.13	1.75	18:45	150	1950	13.0	4.62	1.24
12:45	150		5.17	1.79	19:15	180	1980	11.0	4.59	1.21
13:15	180		5.21	1.83	19:45	210	2010	9.6	4.53	1.15
14:15	240		5.25	1.87	20:15	240	2040	8.5	4.46	1.08
15:15	300		5.43	2.05	21:15	300	2100	7.0	4.43	1.05
16:15	360		5.52	2.14	22:15	360	2160	6.0	4.37	0.99
17:15	420		5.62	2.24	23:15	420	2220	5.3	4.33	0.95
18:15	480		5.85	2.47	00:15	480	2280	4.8	4.28	0.90
20:15	600		5.88	2.50	08:15	960	2760	2.9	3.85	0.47
21:15	660	6706	5.91	2.53						
06:15	1200		6.23	2.85						
11:15	1500	6706	6.35	2.97						
16:15	1800		6.41	3.03						

DRAWDOWN AND RECOVERY vs TIME — CHISWICK



APPENDIX 6

Formulae used to calculate ionic ratios and conversions Calculations of transmissivity and storage coefficients using Jacobs Method*

* All calculations assume that aquifers pumped were non-leaky and confined. The bores pumped were assumed to have a radial influence of 50 metres, except for aquifers in basalt where 25 metres was used.

Pump test 1, Windfalls — Late Permian (Cygnet Coal Measures)

$$\begin{aligned}
 Q &= \text{pump rate in m}^3/\text{day} \\
 &= 5000 \text{ gph} \times 0.10916 \\
 &= 545.5 \text{ m}^3/\text{day} \\
 \\
 \Delta s &= \text{Drawdown for 1 log cycle} \\
 &= 9.5 \text{ m} \\
 \\
 \text{Transmissivity (T)} &= 2.3 \times Q/4\pi \times \Delta s \\
 &= 2.3 \times 545.4/4\pi \times 9.5 \\
 &= 105.1 \text{ m}^2/\text{day} \\
 \\
 t_0 &= \text{x intercept of drawdown graph (in days)} \\
 &= 3 \text{ minutes} \times 6.944 \times 10^{-4} \\
 &= 2.08 \times 10^{-3} \text{ days} \\
 \\
 r &= 50 \text{ m} \\
 \\
 \text{Storage coefficient (S)} &= 2.25 \times T \times t_0/r^2 \\
 &= 2.25 \times 105.1 \times 2.08 \times 10^{-3}/50^2 \\
 &= 0.419868/2500 \\
 &= 1.97 \times 10^{-4}
 \end{aligned}$$

Pump test 2, Kooringa — Permian

$$\begin{aligned}
 Q &= \text{pump rate in m}^3/\text{day} \\
 &= 2980 \text{ gph} \times 0.10916 \\
 &= 325.1 \text{ m}^3/\text{day} \\
 \\
 \Delta s &= \text{Drawdown for 1 log cycle} \\
 &= 17.5 \text{ m} \\
 \\
 \text{Transmissivity (T)} &= 2.3 \times Q/4\pi \times \Delta s \\
 &= 2.3 \times 325.1/4\pi \times 17.5 \\
 &= 3.40 \text{ m}^2/\text{day} \\
 \\
 T_0 &= \text{x intercept of drawdown graph (in days)} \\
 &= 75 \text{ minutes} \times 6.944 \times 10^{-4} \\
 &= 0.0521 \text{ days} \\
 \\
 r &= 50 \text{ m} \\
 \\
 \text{Storage coefficient (S)} &= 2.25 \times T \times t_0/r^2 \\
 &= 2.25 \times 3.4 \times 0.0521/50^2 \\
 &= 0.398565/2500 \\
 &= 1.59 \times 10^{-5}
 \end{aligned}$$

Pump test 3, Ashby — Early Triassic

$$\begin{aligned}
 Q &= \text{pump rate in m}^3/\text{day} \\
 &= 4200 \text{ gph} \times 0.10916 \\
 &= 458.2 \text{ m}^3/\text{day} \\
 \\
 \Delta s &= \text{Drawdown for 1 log cycle} \\
 &= 9 \text{ m} \\
 \\
 \text{Transmissivity (T)} &= 2.3 \times Q/4\pi \times \Delta s \\
 &= 2.3 \times 458.2/4\pi \times 9 \\
 &= 37.27 \text{ m}^2/\text{day} \\
 \\
 t_0 &= \text{x intercept of drawdown graph (in days)} \\
 &= 0.015 \text{ minutes} \times 6.944 \times 10^{-4} \\
 &= 1.042 \times 10^{-5} \text{ days} \\
 \\
 r &= 50 \text{ m} \\
 \\
 \text{Storage coefficient (S)} &= 2.25 \times T \times t_0/r^2 \\
 &= 2.25 \times 37.27 \times 1.042 \times 10^{-5}/50^2 \\
 &= 0.0008738/2500 \\
 &= 3.50 \times 10^{-7}
 \end{aligned}$$

Pump test 4, Douglas Park — Tertiary basalt

$$\begin{aligned}
 Q &= \text{pump rate in m}^3/\text{day} \\
 &= 9000 \text{ gph} \times 0.10916 \\
 &= 981.9 \text{ m}^3/\text{day} \\
 \\
 \Delta s &= \text{Drawdown for 1 log cycle} \\
 &= 42.8 \text{ m} \\
 \\
 \text{Transmissivity (T)} &= 2.3 \times Q/4\pi \times \Delta s \\
 &= 2.3 \times 981.9/4\pi \times 2.8 \\
 &= 64.2 \text{ m}^2/\text{day} \\
 \\
 t_0 &= \text{x intercept of drawdown graph (in days)} \\
 &= 0.006 \text{ minutes} \times 6.944 \times 10^{-4} \\
 &= 4.16 \times 10^{-3} \text{ days} \\
 \\
 r &= 25 \text{ m} \\
 \\
 \text{Storage coefficient (S)} &= 2.25 \times T \times t_0/r^2 \\
 &= 2.25 \times 64.2 \times 4.16 \times 10^{-3}/25^2 \\
 &= 0.600912/625 \\
 &= 9.61 \times 10^{-4}
 \end{aligned}$$

Pump test 5, Camelford — Tertiary basalt

$$\begin{aligned} Q &= \text{pump rate in m}^3/\text{day} \\ &= 10253 \text{ gph} \times 0.10916 \\ &= 1118.7 \text{ m}^3/\text{day} \end{aligned}$$

$$\begin{aligned} \Delta s &= \text{Drawdown for 1 log cycle} \\ &= 1.6\text{m} \end{aligned}$$

$$\begin{aligned} \text{Transmissivity (T)} &= 2.3 \times Q/4\pi \times \Delta s \\ &= 2.3 \times 1118.7/4\pi \times 1.6 \\ &= 128.0 \text{ m}^2/\text{day} \end{aligned}$$

$$\begin{aligned} t_0 &= x \text{ intercept of drawdown graph (in days)} \\ &= 0.45 \text{ minutes} \times 6.944 \times 10^{-4} \\ &= 3.125 \times 10^{-4} \text{ days} \end{aligned}$$

$$r = 25 \text{ m}$$

$$\begin{aligned} \text{Storage coefficient (S)} &= 2.25 \times T \times t_0/r^2 \\ &= 2.25 \times 128.0 \times 3.125 \times 10^{-4}/25^2 \\ &= 0.351140625/625 \\ &= 5.62 \times 10^{-4} \end{aligned}$$

Pump test 6, Chiswick — Tertiary basalt

$$\begin{aligned} Q &= \text{pump rate in m}^3/\text{day} \\ &= 6700 \text{ gph} \times 0.10916 \\ &= 731.0 \text{ m}^3/\text{day} \end{aligned}$$

$$\begin{aligned} \Delta s &= \text{Drawdown for 1 log cycle} \\ &= 1.3 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Transmissivity (T)} &= 2.3 \times Q/4\pi \times \Delta s \\ &= 2.3 \times 731/4\pi \times 1.3 \\ &= 102.9 \text{ m}^2/\text{day} \end{aligned}$$

$$\begin{aligned} t_0 &= x \text{ intercept of drawdown graph (in days)} \\ &= 8 \text{ minutes} \times 6.944 \times 10^{-4} \\ &= 0.00555 \text{ days} \end{aligned}$$

$$r = 25 \text{ m}$$

$$\begin{aligned} \text{Storage coefficient (S)} &= 2.25 \times T \times t_0/r^2 \\ &= 2.25 \times 102.9 \times 0.00555/25^2 \\ &= 1.2861214/625 \\ &= 2.06 \times 10^{-3} \end{aligned}$$

Optimum yield calculations for each of the six pump-tested bores

The calculation of optimum yields for the pumped bores were derived by using two alternative methods:

Method A

$Q = \text{Pump Discharge} \times \text{Available Drawdown}/s_{1440}$, where:

$Q = \text{Optimum long-term yield (in litres per second)}$

$Q_t = \text{Pump discharge (in litres per second)}$

$\text{Available drawdown} = \text{pump depth} - \text{standing water level (in metres)}$

$s_{1440} = \text{drawdown at 1440 minutes}$

Method B

$Q = \text{Pump Discharge} \times \text{Available Drawdown}/(2 \times \Delta s + s_{100})$, where:

$Q = \text{Optimum long-term yield (in litres per second)}$

$Q_t = \text{Pump discharge (in litres per second)}$

$\text{Available drawdown} = \text{pump depth} - \text{standing water level (in metres)}$

$\Delta s = \text{drawdown per cycle of time (in metres)}$

$s_{100} = \text{drawdown at 100 minutes}$

The expressions above are based on a number of assumptions including:

- Water level will not be affected by seasonal conditions or pumping from other bores;
- the bore will not be pumped continuously for more than a few days;
- the bore has no significant entry losses or other efficiencies.

It is rare for all of the above conditions to be satisfied, and the formulae should only be used as a broad indication of the yield that might be available. Because of the relatively short duration of the pump tests in this study, it would be prudent to select the more conservative value of Q in each case.

Windfalls — Late Permian (Cygnet Coal Measures)

Method A:

$$Q = Q_t \times \text{available drawdown/s (@1440 minutes)} \\ = 6.67 \times (75-11.54)/24.5$$

Optimal Yield = 17.28 litres/second

Method B:

$$Q = Q_t \times \text{available drawdown}/(2 \times \Delta s + s_{100}) \\ = 6.67 \times 63.46/33.5$$

Optimal Yield = 12.64 litres/second

Kooringa — Permian

Method A:

$$Q = Q_t \times \text{available drawdown/s (@1440 mins)} \\ = 3.76 \times 27.4/12.15$$

Optimal Yield = 8.48 litres/second

Method B:

$$Q = Q_t \times \text{available drawdown}/(2 \times \Delta s + s_{100}) \\ = 3.76 \times 27.4/37$$

Optimal Yield = 2.78 litres/second

Ashby — Early Triassic

Method A:

$$Q = Q_t \times \text{available drawdown/s (@1440 minutes)} \\ = 5.30 \times 64.3/24.5$$

Optimal Yield = 13.91 litres/second

Method B:

$$Q = Q_t \times \text{available drawdown}/(2 \times \Delta s + s_{100}) \\ = 5.30 \times 64.3/51$$

Optimal Yield = 6.68 litres/second

Douglas Park — Tertiary basalt

Method A:

$$Q = Q_t \times \text{available drawdown/s (@1440 minutes)} \\ = 11.37 \times 34.64/15.2$$

Optimal Yield = 25.91 litres/second

Method B:

$$Q = Q_t \times \text{available drawdown}/(2 \times \Delta s + s_{100}) \\ = 11.37 \times 34.64/17.6$$

Optimal Yield = 22.38 litres/second

Camelford — Tertiary basalt

Method A:

$$Q = Q_t \times \text{available drawdown/s (@1440 minutes)} \\ = 12.93 \times 25.21/5.5$$

Optimal Yield = 59.27 litres/second

Method B:

$$Q = Q_t \times \text{available drawdown}/(2 \times \Delta s + s_{100}) \\ = 12.93 \times 25.21/6$$

Optimal Yield = 54.33 litres/second

Chiswick — Tertiary basalt

Method A:

$$Q = Q_t \times \text{available drawdown/s (@1440 minutes)} \\ = 8.47 \times 25.62/2.95$$

Optimal Yield = 73.56 litres/second

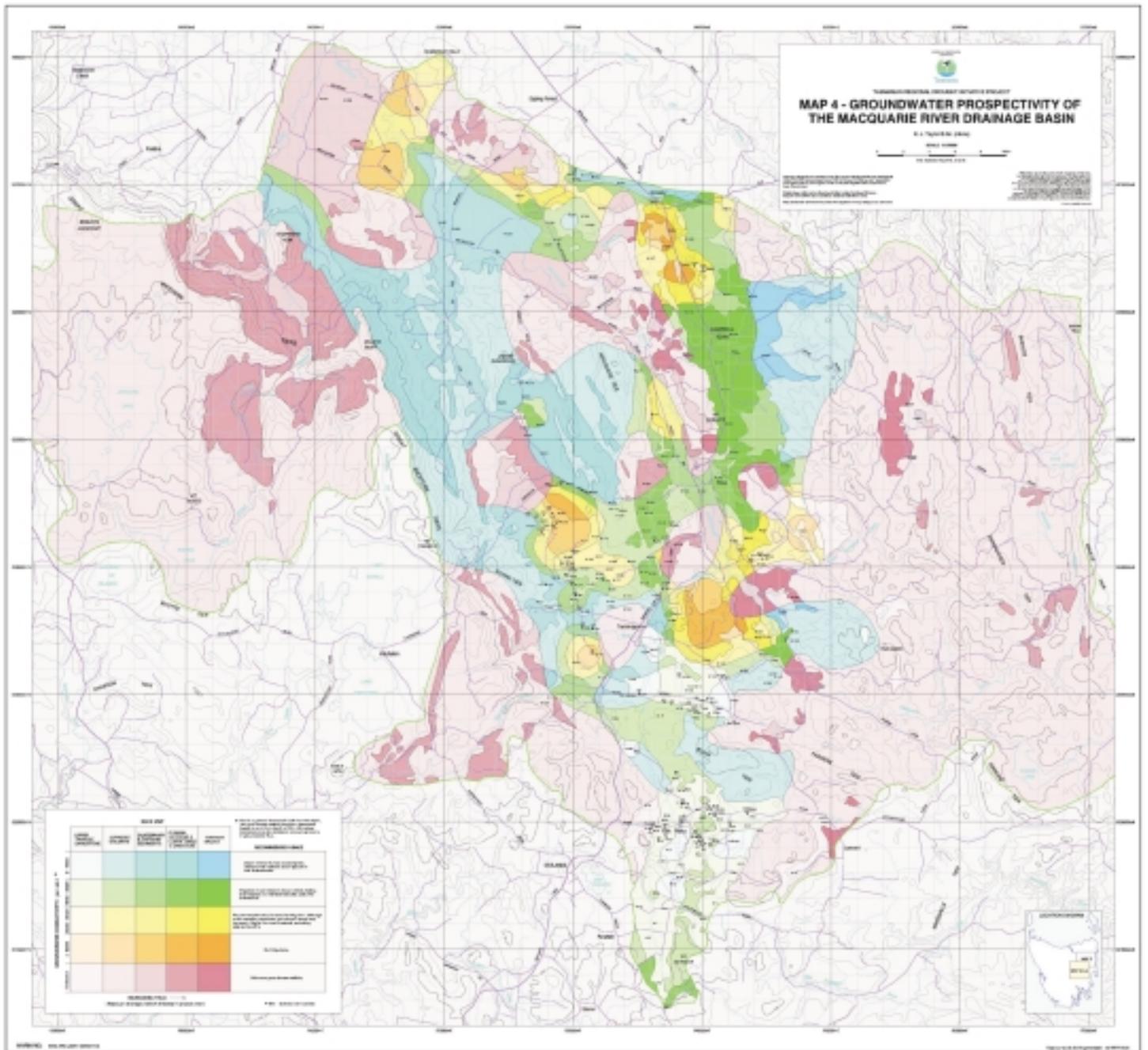
Method B:

$$Q = Q_t \times \text{available drawdown}/(2 \times \Delta s + s_{100}) \\ = 8.47 \times 25.62/4.5$$

Optimal Yield = 48.22 litres/second



Map 1
Study area and borehole locations



Map 4
Groundwater prospectivity of the Macquarie River Drainage Basin