# GROUNDWATER EXPLORATION, QUORN TOWNSHIP WATER SUPPLY WELLFIELD

DWLBC Report

2002/28

The Department of Water, Land and Biodiversity Conservation

Government of South Australia

The Department of
Water, Land and
Biodiversity
Conservation

# GROUNDWATER EXPLORATION - QUORN TOWNSHIP WATER SUPPLY WELLFIELD


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*Groundwater Assessment*
*Department of Water, Land and Biodiversity Conservation*


*July 2002*


*Report DWLBC 2002/28*


Government
of South Australia

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K. Osei-Bonsu and S. Evans, 2002. Groundwater Exploration – Quorn Township Water Supply Wellfield. South Australia. *Department of Water, Land and Biodiversity Conservation. Report,* DWLBC 2002/28.

# FOREWORD

South Australia's natural resources are fundamental to the economic and social wellbeing of the State. One of the State's most precious natural resources, water is a basic requirement of all living organisms and is one of the essential elements ensuring biological diversity of life at all levels. In pristine or undeveloped situations, the condition of water resources reflects the equilibrium between rainfall, vegetation and other physical parameters. Development of these resources changes the natural balance and may cause degradation. If degradation is small, and the resource retains its utility, the community may assess these changes as being acceptable. However, significant stress will impact on the ability of a resource to continue to meet the needs of users and the environment. Understanding the cause and effect relationship between the various stresses imposed on the natural resources is paramount to developing effective management strategies. Reports of investigations into the availability and quality of water supplies throughout the State aim to build upon the existing knowledge base enabling the community to make informed decisions concerning the future management of the natural resources thus ensuring conservation of biological diversity.

**Bryan Harris**

Acting Director, Knowledge and Information Division

Department of Water, Land and Biodiversity Conservation

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# ABSTRACT

Desktop studies and drilling of two exploratory wells were undertaken during hydrogeological investigations in Quorn Town Water Supply Wellfield. The two wells, 6533-864 (PN 58571) and 6533-865 (PN 58572), were drilled through soft sandstone formation to depths of 80 m and 120 m, respectively. While no significant water bearing zones were intercepted in well 6533-864, water-bearing fractures were intercepted between the depth of 82 and 108 m below ground surface with standing water level of 58.8 m in well 6533-865. Well 6533-865 was airlifted at 6 m intervals as drilling progressed with increasing airlift yield from 120 m of 1 L/sec. Three water samples were collected during airlifting from 120 m for salinity analysis. An average salinity of 903 mg/L was determined. Well 6533-864 was abandoned and backfilled. Information gained from well 6533-865 indicates the likelihood of existence of water bearing zones below the current depth of Quorn 1 water supply well. There is a potential that drilling of a well adjacent to Quorn 1 to a depth of 150 m may provide a yield adequate to meet the water supply requirement of Quorn.

# INTRODUCTION

The Quorn Township depends primarily on groundwater pumped from three wells that are completed in a fractured aquifer system. Groundwater development in the area started in 1957 when water from the town reservoir became polluted. Quorn 1 was drilled in 1957 as the town water supply source to replace the reservoir. As demand for potable water increased three additional wells were drilled between 1968 and 1987 to meet the demand with the total withdrawal from the major water supply well Quorn 1 increasing from 21 594 kL in 1987 to 169 235 kL in 2001. Currently the operator of the wellfield, South Australia Water Corporation (SA Water), is most concerned about the wellfield yield during peak demand over the summer periods when the wellfield is under most stress. In 2002 SA Water contracted the Department of Water, Land and Biodiversity Conservation (DWLBC), to explore for more groundwater within the current well field. The objectives of the study were to explore the possibility of obtaining a potable water supply from an interpreted fault zone and from fracture zones, which occur deeper than the current production wells.

The information used and presented in this report was obtained from unpublished Mines and Energy of South Australia (MESA) reports, data provided by SA Water Quorn Office and data collected by DWLBC during fieldwork. Data obtained from these sources includes drilling depth, lithologic log, well yields, weekly extraction volume from production wells, water levels, salinity, and rainfall from two metrological stations. A listing of wells used in this study is presented in Appendix1. Summary information provided in the listing include well unit number; easting and northing; well depth; latest static water level; well status and use; latest salinity; and latest yield. Depth measurements used in this report refer to metres below ground surface. Data from all the wells used in this report is stored in the corporate database SA_GEODATA. The well data was used to assist in determining the aquifer type, the depth to the aquifers, salinity, yield distribution and selection of the drilling sites. Additional data for some wells, which includes transmissivity and long-term yield is presented in publications by Bleys (1969), Sibenaler (1979) and Read (1987).

# APPROACH TO INVESTIGATION

The purpose of this report is to present the work conducted in investigating the possibility of obtaining groundwater of good quality in sufficient quantity from within the Quorn wellfield. Desktop study of existing well information and fieldwork was undertaken to help in the selection of sites for drilling of exploratory wells. The desktop study included

- Review of previous work done by Read (1987); Sibenaler (1979); Bleys (1969); Hillwood (1965); Gibson (1968); and Shepherd and Thatcher (1956).
- Studying the geological, structural, hydrological and hydrogeological framework of the site – interpretation of the site physical geology, structural geology and hydrogeology was based on the borehole logs within the area and work of Shepherd and Thatcher (1956) and Hillwood, (1965).
- Analysis of the hydraulics of the existing production wells and aquifer response to long term pumping – interpretation of the hydraulics of the wells and the aquifer is based on studying the behaviour of drawdowns observed during pumping tests, response of water levels to rainfall.

## PREVIOUS WORK

The desktop study involved a review of previous studies and analysis of drillers' logs and reports to determine the aquifer system, groundwater flow regime, well yields and salinity distribution in the area. Studies that have been conducted at the study area as part of exploiting groundwater for Quorn town water supply are found in Hillwood (1965), Gibson (1968), Bleys (1969), Sibenaler (1979), and Read (1987).

Hillwood (1965) studied the possibility of obtaining additional supply of groundwater for Quorn township and concluded that the Sturtian feldspathic sandstone is the best aquifer in the area and suggested that a site near the main road and in close proximity to the Stony Creek crossing be selected for drilling. Hillwood recommended drilling to a depth of 90 m in the feldspathic sandstone in order to obtain a supply of 5 – 6 L/sec. The well (6533-176) drilled at the site recommended by Hillwood to a depth of 69 m yielded a maximum supply of 0.5 L/sec of poor quality water, Gibson (1968).

Gibson (1968) examined the area between the Stony Creek and the reservoir and found that the rocks were sound and not weathered and considered none suitable as good aquifers. Gibson therefore concluded that the large fault separating the Sturtian feldspathic sandstone from the Cambrian quartzite offers the best prospect of obtaining a large supply of fair quality water. A site on the western bank of the Ingaree Creek and close to the current pipeline was selected for drilling. Gibson recommended a 0.2 m diameter well drilled to a depth of 90 m.

Bleys (1969) drilled and constructed a well (6533-177; Quorn 2) to a depth of 56 m at the site recommended by Gibson (1968) and encountered very hard quartzite at the depth of 12 m in this well. Bleys conducted a 3-stage aquifer test of 100 minutes with recovery test. A 3-day continuous aquifer test and a 24-hour recovery test followed the step stage testing. The well was aquifer tested at a maximum rate of 5.89 L/s with a pump setting at 55 m below surface. Transmissivity was estimated at 240 $m^2$/day. Bleys concluded that the maximum drawdown expected after 3 years of continuous pumping at a rate of 5.89 L/s would be 6.2 m. Bleys recommended a pumping rate of 3.75 L/s. It was calculated that at a rate of 3.75 L/s the expected drawdown in the well after 3 years of continuous pumping would not be more than 4.4 m.

Sibenaler (1979) drilled a production well (6533-179; Quorn 3) and a scout hole (6533-212) in 1978. The production well was sited near a major fault zone and Stony Creek and was completed in quartzite. The scout hole was sited near a major fault in quartzite and a major tributary of Capowie Creek. Sibenaler conducted a 48 hour well discharge test which consisted of a 5-stage step drawdown test followed by a constant discharge test of 41 hours. A transmissivity value of 70 $m^2$/day was calculated for the production well. The long-term yield from the production well was estimated at 6.9 L/s. The scout hole was airlifted at a rate of 3.82 L/sec for 1 hour.

Read (1987) drilled one production well (6533-626 Quorn 4) and four scout wells (6533-627, 6533-628, 6533-629 and 6533-630) around Quorn township. The production well has a low long-term yield and none of the scout wells showed any potential for town water supply. Read estimated a long-term yield for Quorn 4 to be 2.9 L/s for 10 days of continuous pumping and recommended that Quorn 4 be replaced by a deeper well. Read reported that Quorn 4 intercepted a dry fault zone at 30 m.

Read (1987) found that good yields appear to be restricted to within a few hundred metres of the major north-south fault and concluded that the area west and north of the existing well field appears to have low salinity and well fractured. Read recommended future exploration should be directed to the west of existing well-field where salinity of groundwater is less than 1500 mg/L. Read further recommended that any new production well be drilled about 20 m west of Quorn 4 to a depth of 150 m with the expectation that a yield of 5 L/s with salinity of 1600 mg/L would be obtained. Read was of opinion that since in other parts of the Flinders Ranges sandstones similar to those found at the Quorn Water Supply Wellfield have fracture permeability to depths of about 150 m any well to be drilled in Quorn wellfield in future should be 150 m deep.

Existing well information indicates that the locally prominent fracture zone that dips to the west is the likely source of groundwater to the Quorn 1 production well. The target of the drilling project was to explore the extent and water bearing nature of this fracture zone and the water bearing potential of the strata below this fault to the south of Quorn 1.

# PHYSIOGRAPHY, CLIMATE AND GEOLOGY

## Physiography

Quorn Township, which is about 334 km north of Adelaide (Fig. 1), is located in the mid-north of South Australia at the southern end of the main Flinders Ranges. The study area, Quorn Wellfield, is located about 8 km north of Quorn town and is reached by the Arden Vale Road.

The study area could be divided into two physiographic units – undulating valley and ridges (Fig. 1). The valley is covered with recent alluvium of clays, sandy mottled clays, clayey sands, silt, gravels and pebbles of sandstone quartzite and siltstone. The ridges surrounding the study site comprise the exposed fracture rock strata of the Adelaidean. These ridges range in altitude from about 380 m (Mount Arden) to about 500 m (Mount Benjamin). Depth to the top of the bedrock within the study area is less than 12 m below ground surface.

The study area is drained by multi-branched Ingaree, Nathaltee and Stony creek systems (Fig. 1). The general movement of surface water is southwards from the surrounding ridges and eventually enters the Willochra Creek system. The Mount Arden Reservoir, situated in the well field, was built to supply water to Quorn Township. Surface water has been diverted from the upper catchment of the creek system through concrete channels into the reservoir. Water discharges from the reservoir through evaporation as no water is currently being utilised for reticulation. There is no evidence that significant recharge from the reservoir infiltrates to the aquifer system at the site.

## Climate

The climate of the study area is semi-arid with low average summer monthly rainfall and high average summer temperature. Summer temperature ranges from about 28°C to 40°C and winter temperatures from 6°C to 22°C. Fig. 2 and Fig. 3 indicate rainfall data obtained from two nearby stations – Arden Vale and Quorn Post Office respectively. The wet period occurs between May and October and the dry period extends from November though to April. Annual rainfall in the study area ranges from less than 5 mm to about 115 mm.

## Geology

The study area is bordered on the north, east and west by ridges of Precambrian sandstone, Cambrian quartzite, shales, siltstone and slates, which also underlie the valley (Fig. 4). The most important feature of the wellfield is a large westerly dipping fault zone which strikes north-south and a gently north plunging syncline which lies immediately east of the fault. The quartzite is well exposed in the northern bank of Stony Creek. The beds of the quartzite dip to the west and exhibits little jointing. The quartzite is underlain to the east by shales. On the west the quartzite is terminated against the north-south striking fault. Adjacent to the fault is the felspathic sandstone, which is interbedded with thin quartzite. Slates overlie the felspathic sandstone. The felspathic sandstone with the thin interbedded quartzite and the slates are all dipping westerly.

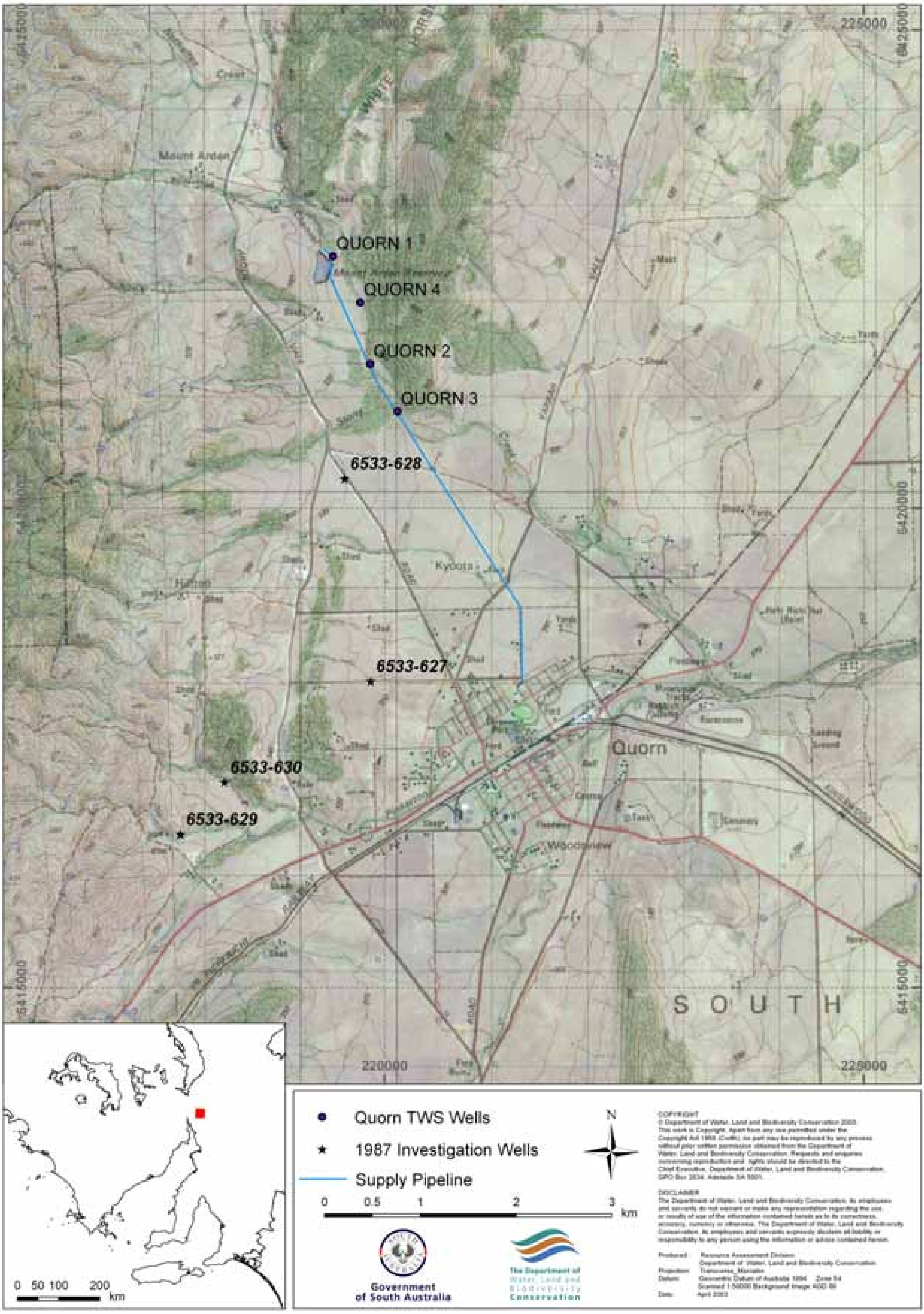
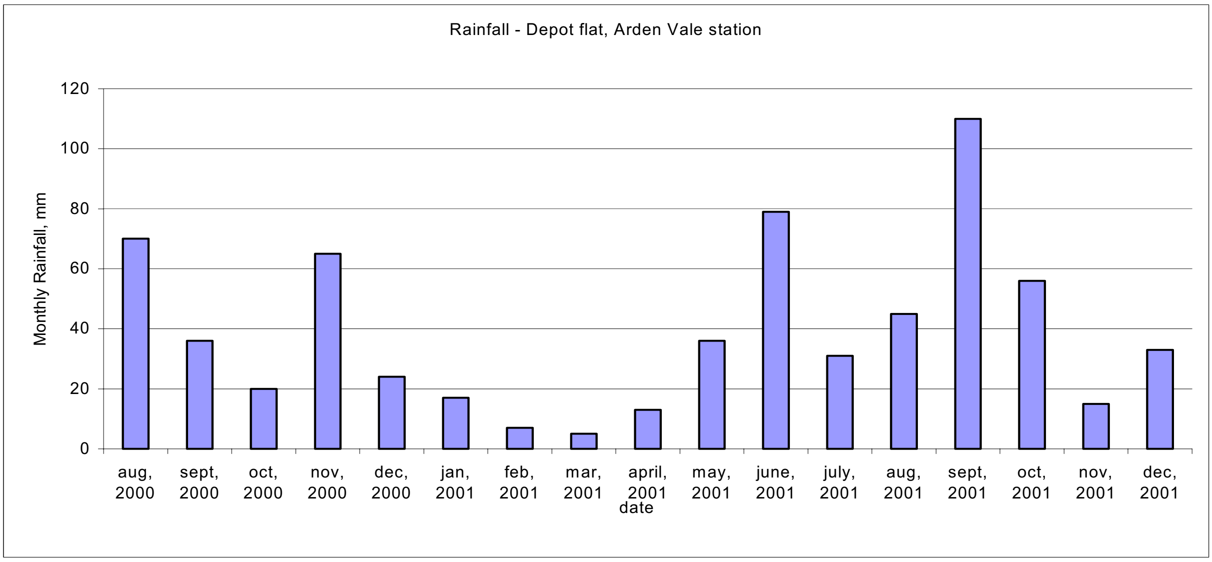
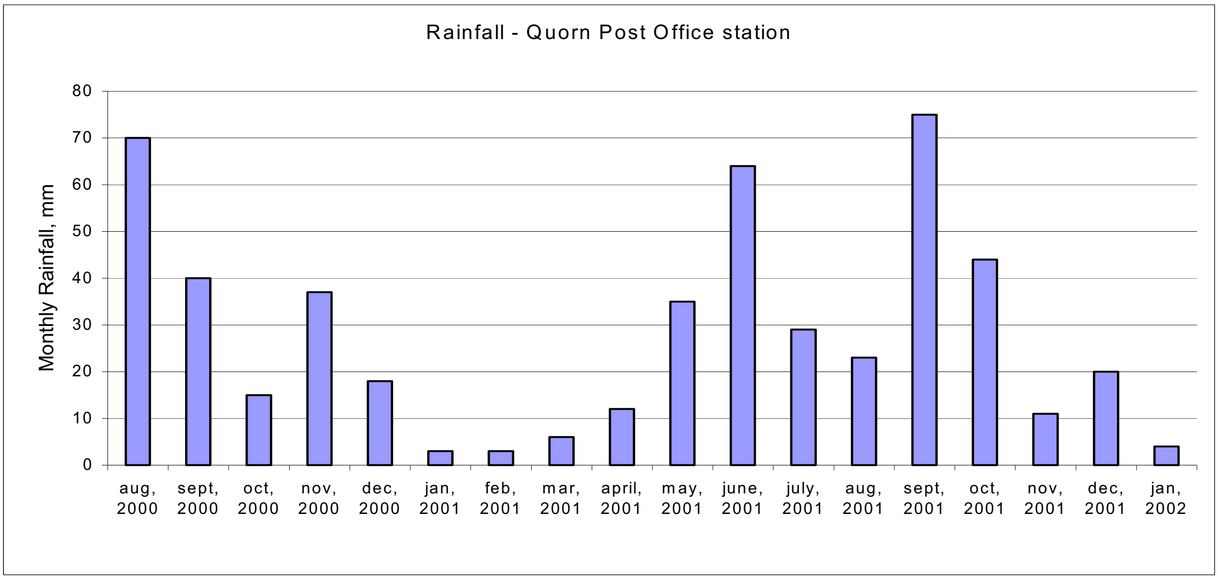



**Figure 1. Site locality and physiology**




## Figure 2. Depot Flat monthly rainfall




## Figure 3. Quorn Post Office monthly rainfall

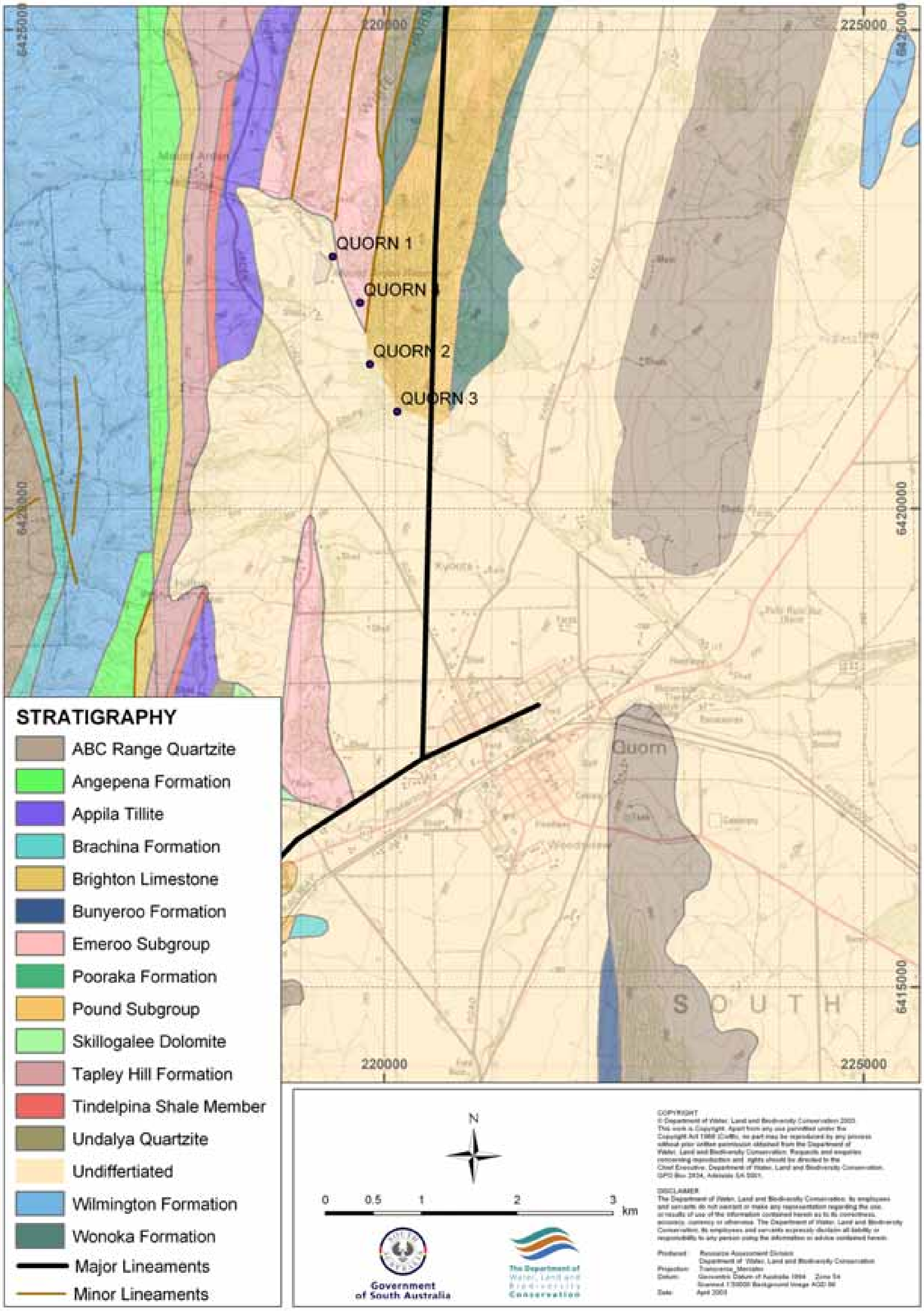



**Figure 4. Site geology**

# GROUNDWATER RESOURCES OF QUORN WELL-FIELD

The geologic formation underlying the wellfield consists of slates, quartzite and felspathic sandstone. The basement rock is covered with recent alluvium ranging in thickness between 3 and 12 m. The shallow depth to the basement and the nature of the alluvium suggest a limited volume of groundwater in storage and low hydraulic properties of the alluvium. The rocks of the surrounding ridges and basement rocks underlying the study area are poorly permeable. The basement rocks have little, if any, primary permeability and groundwater resides and flows through openings developed through fractured sandstones and quartzite. Where the fractured basement rocks are saturated the openings form important aquifers for low to medium yielding wells suitable for supply of water for the Quorn Township. The range in yields from existing wells reflects the variation in aquifer characteristics. Reported yields of the existing wells in the study area ranges from less than 0.5 L/s to about 9 L/s (Appendix 1). Of the wells studied 71% have yield less than 1.5 L/s (Appendix 2). The well yield distribution map (Fig. 5) indicates that yields are commonly between 1 and 5 L/sec in areas to the south of the well field. A number of pumping tests, ranging between 48 and 72 hours were carried out on some of the wells located in the study area. Analysis of the behaviour of drawdowns observed during aquifer tests of the wells indicate two types of flow in the aquifers: radial flow (Sibenaler, 1979) and double boundary or linear-flow (Read, 1987). The hydraulic properties of the aquifers are low and vary from one spot to another. Transmissivity values of 70 $m^2$/day and 240 $m^2$/day were reported for two of the wells (Bleys, 1969 and Sibenaler, 1979).

Depth of wells in study area ranges from 1.5 to 207 m below ground surface. Of these wells 19% have total depth less than 25.0 m, 27% have depth between 25 and 50 m and 54% have depth greater than 50 m. Water levels in wells located in the study area ranges from 0.8 to 69 m below ground surface. The shallowest water level occurs in wells to the east of the wellfield. The deepest water level occurs in well (6533-628) at a depth of 69 m below ground surface. Lateral groundwater movement beneath the study area primarily occurs within fractures and other opening in the basement rocks. The degree of connection between the openings is not known at present but may vary from site to site. A map of water table was prepared by Read (1987). The altitude and configuration of the groundwater level contours indicate that the general direction of groundwater flow is from the west to the east. Being a fractured rock environment the contours may not necessarily indicate actual groundwater flow direction.

In the study area little water quality information is available. Drilling reports generally describe the water quality in terms of total dissolved-solid concentration (salinity). The salinity of groundwater in the study area varies from place to place and it ranges from 300 mg/L to over 18 000 mg/L. Salinities of most production wells exceed 1500 mg/L (Appendix 1). Out of 128 salinity data analysed only 27 (21%) is less than or equal to 1500 mg/L. Generally salinities of groundwater in the area increase to the east, south and southeast of the well field (Fig. 6). The salinity of groundwater to the west of the existing well field is generally less than 1500 mg/L.

The groundwater in the basement rocks originates from rainfall. Recharge is assumed to occur through fault openings in the ridges and drainage lines that expose fault zones, although no direct measurement is available. There is no evidence that water from the reservoir recharge to the aquifer system at the site.

The Quorn Township wellfield consists of three production wells along the pipeline from Mount Arden Reservoir to the town (Fig. 7). These wells are denoted as Quorn 1, Quorn 2 and Quorn 3. Quorn 1 was constructed in 1948 and is 80 m deep below ground surface. It was completed with a slotted screen from 61 – 65 m below ground surface. Quorn 2 and Quorn 3 were completed as open-holes in 1969 and 1978 respectively. Quorn 2 is 56 m and Quorn 3 is 69 m deep below ground surface. A fouth well [Quorn 4], which extends to 76 m below ground surface with a slotted screen completion from 58 – 76 m, is not equipped as a production well.

Extraction of groundwater from the wellfield first began in 1950 when Quorn 1 was put into operation. Between 1969 and 1985 Quorn 2 and Quorn 3 production wells were commissioned to meet the increasing demand of water in Quorn Township. Currently the Quorn Township is served by groundwater pumped from all three wells. Both Quorn 2 and Quorn 3 are use to supplement demand when the capacity of Quorn 1 is insufficient. The fourth well is being used as an observation well. The highest percentage of water is extracted from Quorn 1. This relatively high volume of extraction indicates that the formation penetrated by this well has a higher storativity and transmissivity than the formation penetrated by the other production wells. It is not known how much water was extracted from Quorn 1 prior to 1987. Available data indicate that about 21 600 kL was extracted from Quorn 1 in 1987, 122 000 kL in 1991, 130 000 kL in 1995, 150 000 kL in 2000 and 169 000 kL in 2001. Fig .8 indicates the annual extraction volume from Quorn 1. Weekly extraction volume from Quorn 1 is summarised in Appendix 3 and shown in Fig. 9. Groundwater extraction from Quorn 1 exceeds 3000 kL per week during periods of peak demand (Fig. 9). Weekly measurements of water levels have been made at two observation wells and the production well Quorn 1 during 19 months period from August 2000 through February 2002. Water level hydrograph for Quorn 1 is shown in Fig. 10. SA Water monitor the water levels. It is not known when extraction of water from Quorn 2 and Quorn 3 began. Apart from a rise in water level between 09/08/2000 and 07/09/2000 and between 01/08/2001 and 05/09/2001 there is a general drop in water level in Quorn 1. Between September 2000 and February 2002 the groundwater level in Quorn 1 fell by about 0.30 m. If all the three wells, Quorn 1, Quorn 2 and Quorn 3, were in operation at the same time then, it shows either there is no interference between the wells or the wells are extracting water from separate fracture zones or compartments.

The comparision of volume extracted and measured water level in Quorn 1 (Fig. 11) indicates a reduction in volume of water extracted from Quorn 1 between May and October, a period during which rainfall was relatively (Figs. 2 and 3). The water level in Quorn 1 was expected to rise in response to the combined effect of the low volume extracted and high rainfall. However, there was no net positive response from Quorn 1 apart from a small rise in water level from 69.49 m to 69.64 m between 01/08/2001 and 05/09/2001. This small water level rise of 0.15 m indicates either recharge to the aquifer was small, or slow movement of winter rainfall from recharge areas towards Quorn 1. The highest water level rise in Quorn 1 occurred in 07/11/2001, when weekly extraction was reduced from 4384 kL to 2875 kL. This could mean a delayed recharge to the aquifer. That is, most of May – October rainfall recharge reached Quorn 1 in November.

Observed water level from observation well Quorn 4 (Fig. 11), as observed in Quorn 1, indicates a rise in water level during August and September 2001.

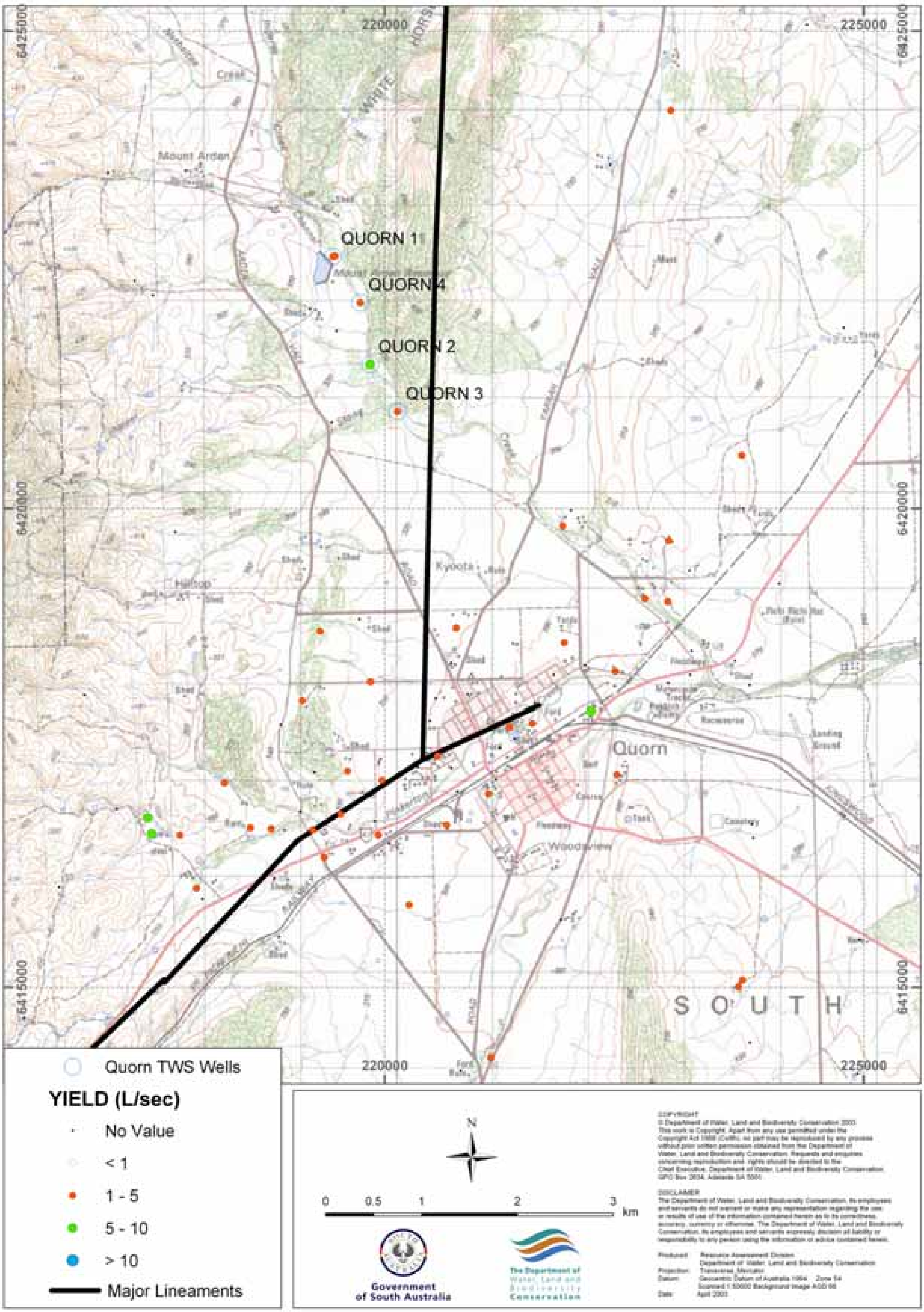



**Figure 5. Distribution of well yield**

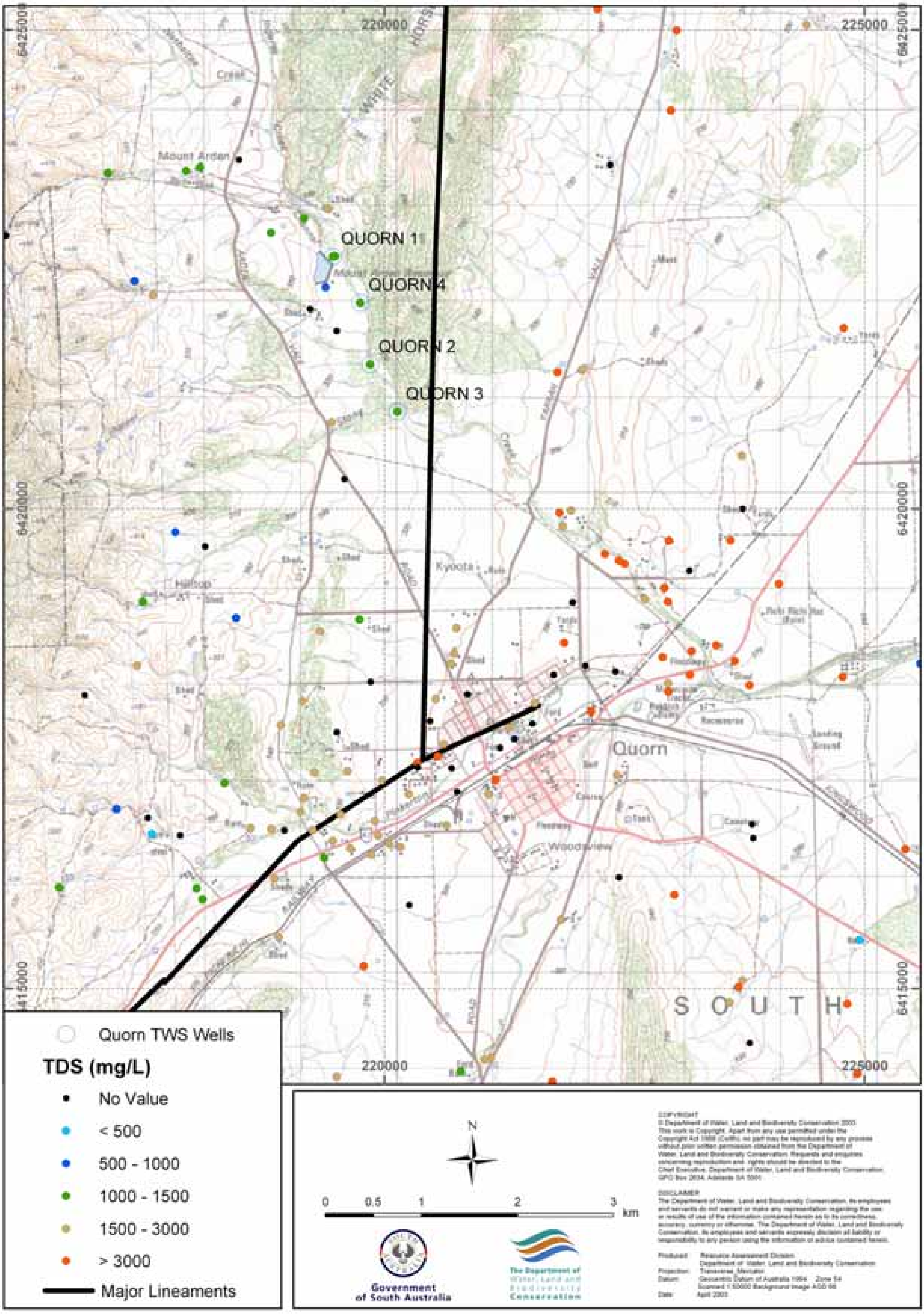



**Figure 6. Distribution of well salinity**

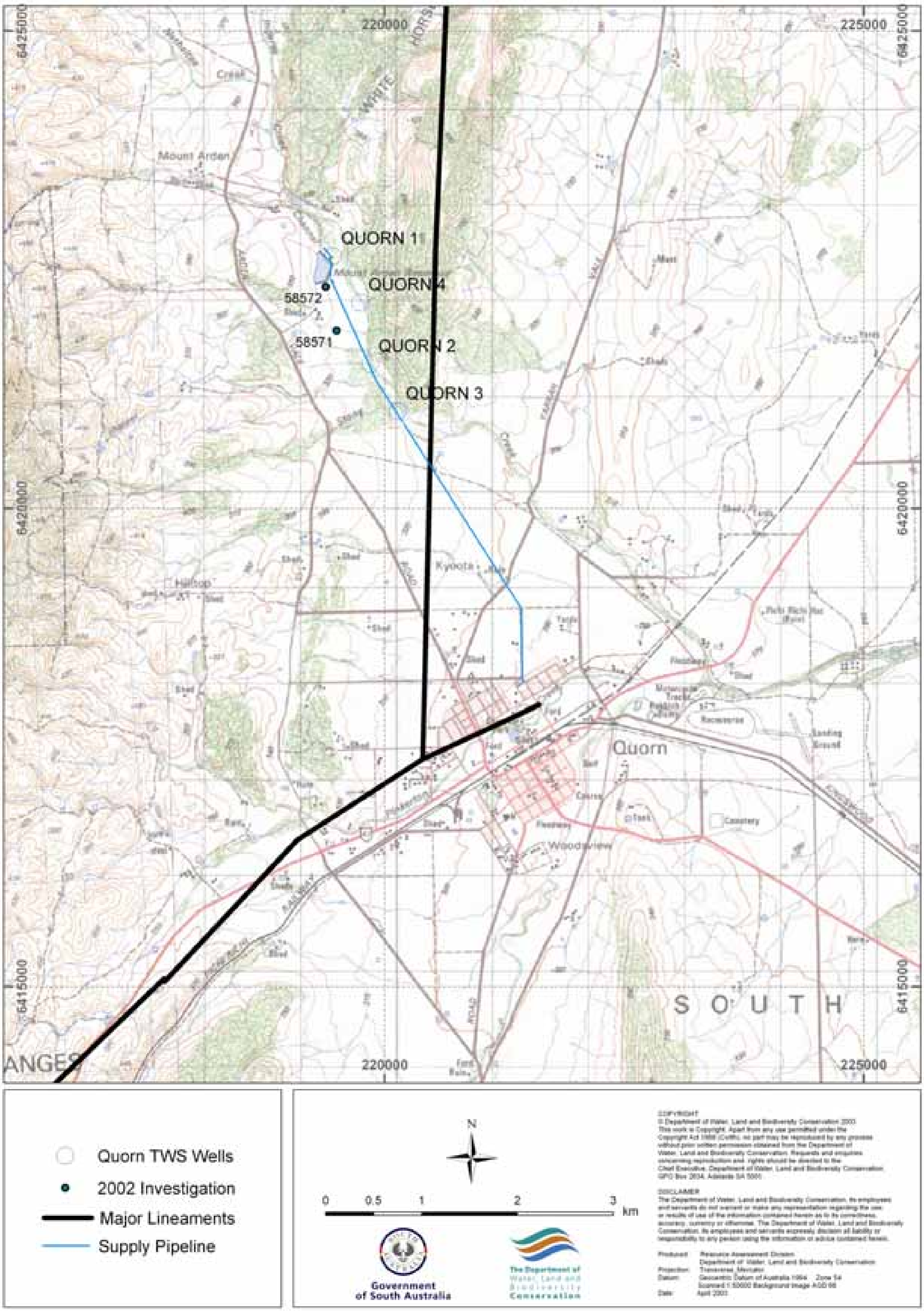



**Figure 7. Proposed investigation sites**

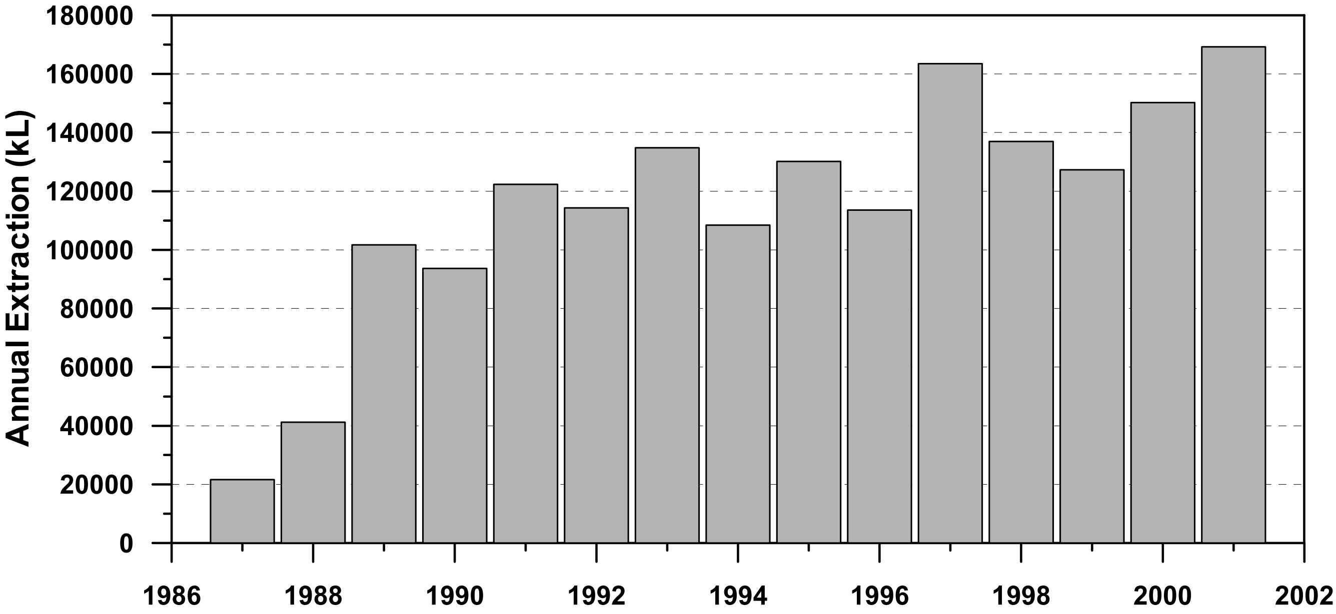



**Figure 8. Annual volume of groundwater extracted from Quorn 1**

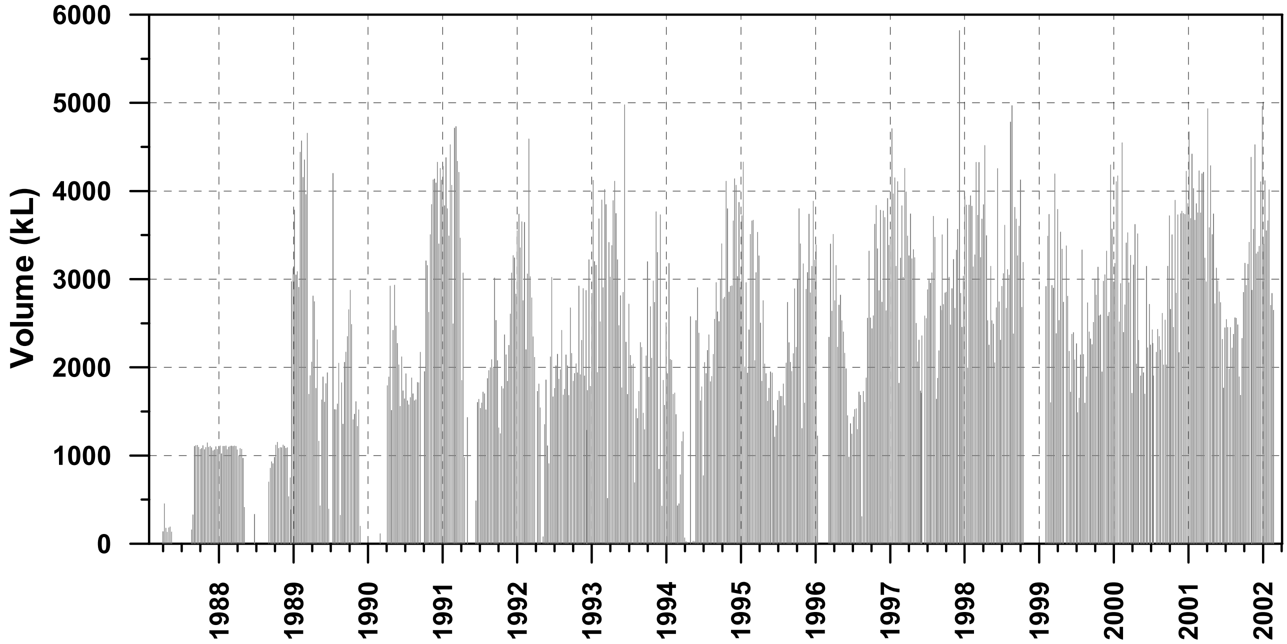



**Figure 9. Volume of ground water weekly extracted from Quorn 1**

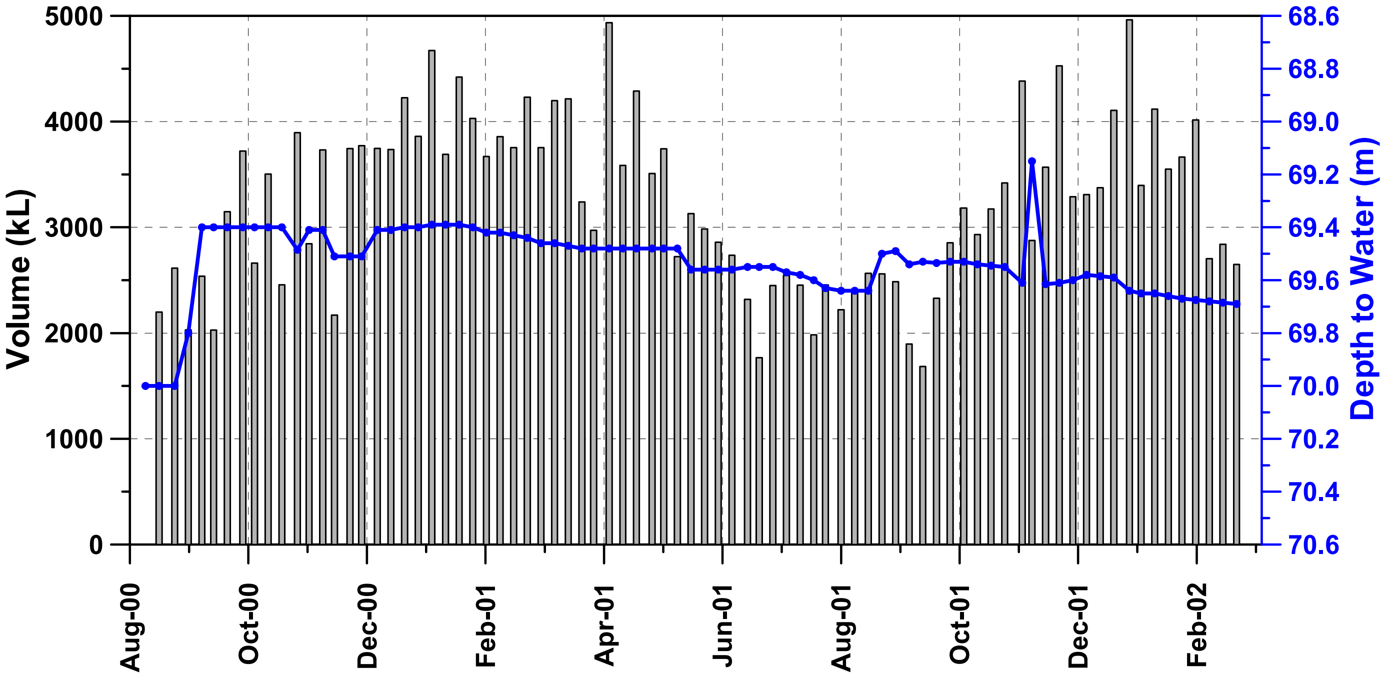



**Figure 10. Weekly extraction volume and observed water level from Quorn 1**

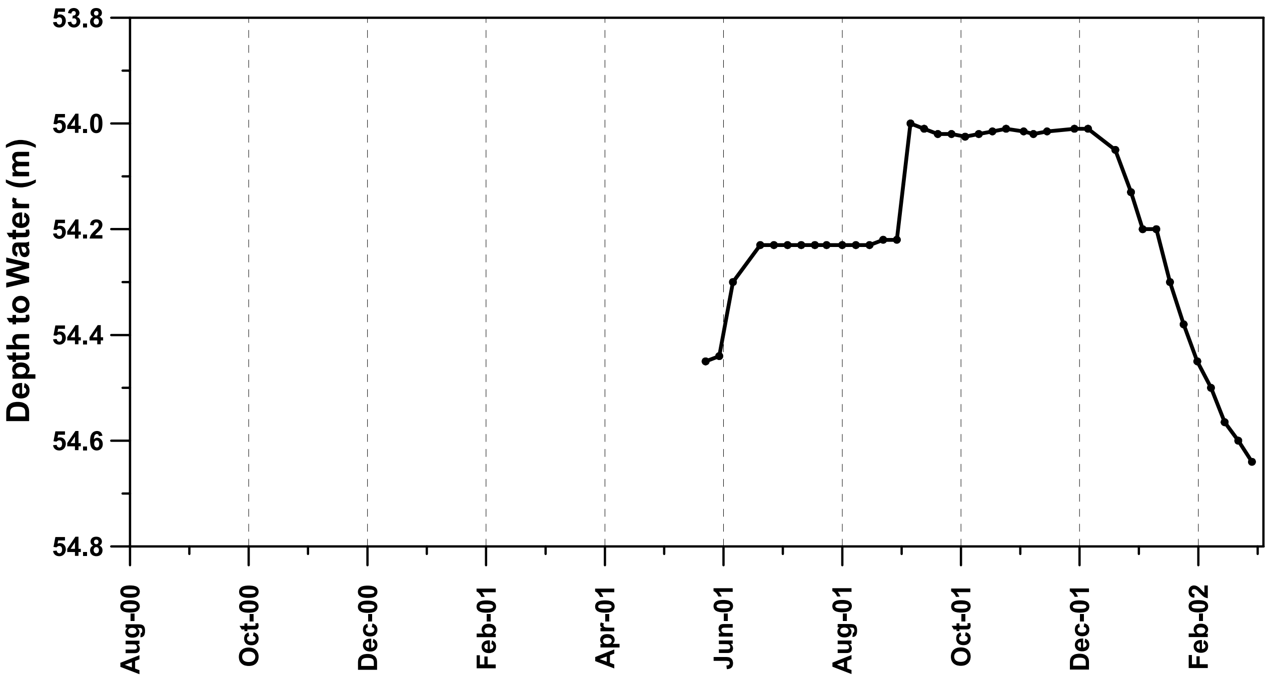



**Figure 11. Depth to water level in observation well Quorn 4**

# METHODOLOGY

## Field work

The fieldwork included site selection, drilling of two exploratory wells, collection and description of drill-cutting samples, airlifting of water from water bearing intervals to determine aquifer yield and collection of water samples for determination of total dissolved-solids concentration.

## Site selection

The aim was to drill wells to investigate the fault/fractured zones estimated to be at 65 – 75 m depth at the proposed drill sites and investigate the water bearing potential below the present production zone of Quorn 1. Selection of sites for drilling exploratory wells was determined on the basis of the following factors:

- structural geology of the site,
- location of existing production wells,
- responses of wells Quorn 1, Quorn 2, Quorn 3 and observation well [Quorn 4] to pumping,
- distribution of groundwater salinity,
- yield of wells drilled in the study area, and
- the location of pipe and power lines and underground cables.

The sites were selected to minimise any potential well interference and to be in close proximity to pipe and power lines. The client, SA Water, requested the location of any new production well to be within 500 m from the existing pipe and power lines.

It has been deduced that the north-south fault passing through the study area is dipping to the west, Read (1978). Study of existing geologic and hydrogeologic data indicates that Quorn 1 intercepted fractures at 61 m and Quorn 4 intercepted fault/fracture zones at 30 m and 57 m. Good yields appear to be restricted to within a few hundred metres of the major north-south fault (Fig. 5). And also the salinity of groundwater in areas to the west of existing well field is less than 1500 mg/L (Fig. 6). Based on these observations and the constraints, two sites were selected for drilling exploratory wells. Figure 7 shows the well field, the pipeline and selected sites for exploration. Site 1 is situated adjacent to the reservoir and about 900 m south of Quorn 1, about 55 m from the pipeline and about 25 m from an underground cable. The well at this site was drilled to a depth of 120 m below ground surface. Site 2 is located 1750 m to the south of Quorn 1 and about 190 m from the pipeline. The well at Site 2 was drilled to a depth of 80 m below ground surface.

## Drilling and sample collection

The exploratory wells were drilled using down hole hammer with air circulation method and the drill-cuttings were collected every 3 m. The water-bearing zone was airlifted at 6 m intervals to initially estimate aquifer yield. Appendix 4 provides a summary of drilling details. The lithological logs for the wells are presented in Appendixes 5 and 6. The drill-cutting samples indicate both wells were drilled through predominantly quartz sandstone.

**BOREHOLE 1 – WELL UNIT NO. 6533-864 (PN 58571)**

This well, located at Site 2 (E 219503, N 6421855, Z 54) was drilled on 23 May 2002 to a depth of 80 m. The drill-cutting samples indicate that sandstone was intersected throughout drilling, Appendix 5. The surface sediments consist of silt, pebbles, clay and clayey sand. Sandstone, which is poorly cemented (soft), begins at a depth of 11.5 m below ground surface and extends to 75 m. The interval between 75 and 80 m is hard and comprises quartzite and sandstone. At the interval between 54 and 63 m the drill-cuttings were damp. No fractures or faults nor water bearing zones were encountered in this well. The well was backfilled on 24 May 2002.

**BOREHOLE 2 – WELL UNIT NO. 6533-865 (PN 58572)**

This well, located at Site 1 (E 219388, N 6422314, Z 54) was drilled on 24 May 2002 to a depth of 120 m below ground surface. Appendix 6 shows the lithology of this well. Sandstone was intersected at 8.5 m below ground surface. At the interval between 18 and 72 m the sandstone was soft, (friable). The formation was relatively hard at the interval between 72 and 78 m. This interval was made up of sandstone and thin bands of quartzite. Between 78 and 82 m soft sandstone was intersected. The interval between 82 and 108 m is made up of fractured sandstone and quartzite with clay and silt. There was poor recovery of drill-cuttings at the intervals from 82 – 96 m and 105 – 108 m. Drill-cuttings from 84 – 87 m and 90 – 93 m intervals were made up of clayey sandstone. The interval between 96 – 108 m is made up of interbedded layers of silty quartzite and silty soft sandstone. Between the 108 – 120 m interval is sandstone. There was water cut at 82 m where fracture was intercepted. An increase in flow rate was noted by the driller at the depth of 115 m below ground surface. There was increased in airlift yield as drilling progressed through the interval between 82 and 120 m (Fig. 12). The final airlift yield at 120 m was 1 L/sec and the salinity of groundwater was 903 mg/L. The depth to standing water level in this well was 58.85 m below ground surface.

The size of the quartz particles forming the sandstone in the flow zone ranges between 0.1 mm to 0.6 mm, (fine to medium), and is sub-rounded to rounded.

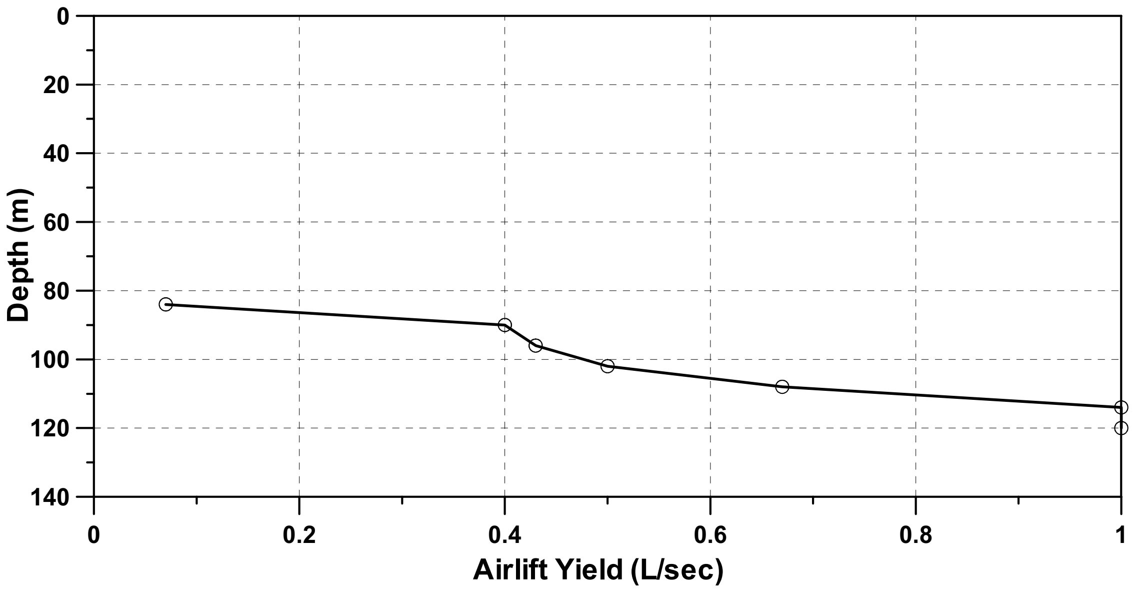



**Figure 12. Airlift yield versus depth graph - Well 6533 865 (PN 58572)**

## CONCLUSION AND RECOMMENDATIONS

Two exploratory boreholes were drilled in Quorn Town Water Supply Wellfield between 23 and 24 May 2002 with the aim of investigating the depth to fractures in the geologic formation and groundwater resources potential at deeper depth. Soft quartz sandstone composed the rock at the drilled sites.

The first borehole (6533-864) was drilled on 23 May 2002 to a depth of 80 m below ground surface. No fault or fracture zones were intercepted in this borehole. This well was dry and it was backfilled on 24 May 2002. The fracture zone was not intersected in this well (as indicated by the second borehole). It is anticipated that the potential water-bearing fracture zone is deeper than 80 m at this location.

The second borehole (6533-864) was drilled on 24 May 2002 to a depth of 120 m below ground surface. Fractured zones were intercepted at interval between 82 and 108 m below ground surface. The fracture zone(s) are made up of clayey and silty sandstone and quartzite. It appeared that adjacent to the fracture zone the sandstone is interbedded with bands of quartzite. The fractured interval was the water-bearing zone in this borehole. Estimate of the overall yield of the aquifer intercepted in borehole 6533-865 was obtained by airlifting after completion of drilling. A yield of 1 L/sec was obtained when the well was airlifted from a depth of 120 m below ground surface. Aquifer yield of 1 L/sec is not of sufficient quantity for the town water supply. An average salinity of 903 mg/L was determined from 3 water samples collected during airlifting from 120 m. This borehole (6533-865) was not backfilled at this stage as there is the potential to investigate the hydraulic parameters of the fractured rock aquifer system, specifically if continuity exists between the fracture system in this borehole and Quorn 1. Furthermore, this borehole could be utilised as an observation well within the Quorn Town Water Supply Wellfield.

From the information gained from the second borehole (6533-865), it is likely that water-bearing zones may exist below the original depth of 80 m of production well Quorn 1. There is potential therefore that drilling of a well adjacent to Quorn 1 to a depth of perhaps 150 m may intercept a water bearing zone (separated from the current production zone of Quorn 1) that could yield at least the 5 to 7 L/s currently experienced from Quorn 1. Associated with the potential of intersecting water-bearing fracture systems, the deeper well would enable the placing of the pump intake at a greater depth to further insure continual water supply during future periods of prolonged low regional water levels.

## SI UNITS COMMONLY USED WITHIN TEXT

| Name of unit | Symbol | Definition in terms of other metric units | |
|---|---|---|---|
| Millimetre | Mm | $10^{-3}$ m | length |
| Metre | M | | length |
| Kilometre | Km | $10^{3}$ m | length |
| Hectare | Ha | $10^{4}$ $m^{2}$ | area |
| Microlitre | µL | $10^{-9}$ $m^{3}$ | volume |
| Millilitre | mL | $10^{-6}$ $m^{3}$ | volume |
| Litre | L | $10^{-3}$ $m^{3}$ | volume |
| Kilolitre | kL | 1 $m^{3}$ | volume |
| Megalitre | ML | $10^{3}$ $m^{3}$ | volume |
| Gigalitres | GL | $10^{6}$ $m^{3}$ | volume |
| Microgram | µg | $10^{-6}$ g | mass |
| Milligram | mg | $10^{-3}$ g | mass |
| Gram | g | | mass |
| Kilogram | kg | $10^{3}$ g | Mass |

## Abbreviations Commonly Used Within Text

| Abbreviation | | Name | Units of measure |
|---|---|---|---|
| TDS | = | Total Dissolved Solids *(milligrams per litre)* | mg/L |
| EC | = | Electrical Conductivity *(micro Siemens per centimetre)* | µS/cm |
| pH | = | Acidity | |
| | | | |
| $\delta D$ | = | Hydrogen isotope composition | $^{o}/_{oo}$ |
| CFC | = | Chlorofluorocarbon *(parts per trillion volume)* | pptv |
| $\delta^{18}O$ | = | Oxygen isotope composition | $^{o}/_{oo}$ |
| $^{14}C$ | = | Carbon-14 isotope *(percent modern Carbon)* | pmC |
| | | | |
| ppm | = | Parts per million | |
| ppb | = | Parts per billion | |

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# APPENDIX A

## WELL DATA

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 653300590 | | 218079 | 6423564 | | | 1132 | 0.51 | 8.23 | 32 |
| 643300161 | | 782176 | 6423525 | | Stock | 1130 | - | - | - |
| 643300162 | | 782176 | 6423524 | Operational | Stock | 716 | - | 1 | 3.45 |
| 653300241 | | 217933 | 6423527 | Operational | Domestic | 1418 | - | 1.85 | 10 |
| 653300166 | | 222352 | 6423592 | | | - | - | - | 76 |
| 653300172 | | 219408 | 6423131 | Operational | Domestic | 1586 | 0.63 | 59.44 | 67.36 |
| 653300739 | RH 2 | 242002 | 6423698 | Plugged | | - | - | - | 44 |
| 643300487 | DDR 4 | 776159 | 6423172 | Unknown | | - | - | - | 61.06 |
| 653300602 | | 219165 | 6423032 | | | 1127 | 0.75 | 68.5 | 78.6 |
| 643300163 | | 781081 | 6422932 | Operational | | - | 0.4 | 3.35 | 8.23 |
| 653300173 | | 218817 | 6422882 | | | 1028 | 0.38 | 57.91 | 74.68 |
| 643300485 | DDR 2 | 776069 | 6422952 | Unknown | | - | - | - | 105.46 |
| 643300484 | DDR 1 | 776069 | 6422952 | Unknown | | - | - | - | 58.52 |
| 643300486 | DDR 3 | 776199 | 6422872 | Unknown | | - | - | - | 158.32 |
| 653300174 | QUORN 1 | 219459 | 6422704 | | | 1183 | 3.54 | 50.29 | 80.47 |
| 643300166 | | 782389 | 6422386 | Operational | | 986 | - | 0.8 | 1.45 |
| 643300164 | | 780091 | 6422420 | Operational | | 1701 | - | - | 8.53 |
| 643300510 | | 780692 | 6422326 | | Domestic | - | 0.35 | 5.5 | 60 |
| 653300823 | | 217588 | 6422229 | Operational | Stock | 1664 | - | 6.7 | 29.6 |
| 653300626 | | 219747 | 6422149 | | | 1311 | 4.5 | 53.86 | 76.5 |
| 653300175 | | 219226 | 6422085 | | | - | - | - | - |

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 653300167 | | 224785 | 6421888 | | | 18205 | - | 8.04 | 19.6 |
| 653300177 | QUORN 2 | 219710 | 6421551 | Operational | Town Water Supply (Public/Muncipal) | 1149 | 6.32 | 45.29 | 56.39 |
| 653300600 | | 222058 | 6421450 | | | 2767 | 0.6 | 34 | 64 |
| 653300168 | | 221802 | 6421425 | | | 4548 | 0.25 | 51.82 | 67 |
| 653300179 | QUORN 3 | 219942 | 6421146 | Rehabilitated | Domestic | 1289 | 4 | 42 | 69 |
| 643300165 | E & W S | 775709 | 6421108 | | | 1056 | - | - | - |
| 653300176 | | 219452 | 6420901 | Abandoned | | 1770 | - | 60.05 | 69.49 |
| 653300671 | | 223724 | 6420555 | Operational | Domestic | 2008 | 3 | 21.4 | 97.5 |
| 653300628 | | 219584 | 6420310 | Operational | Observation | - | 0.25 | 69.06 | 81 |
| 653300178 | | 221944 | 6419980 | Backfilled | | 1914 | - | - | 105 |
| 653300753 | | 221822 | 6419959 | | Irrigation | 3035 | 0.5 | - | 32.3 |
| 653300170 | | 223734 | 6420001 | | | - | - | 19.51 | 20.73 |
| 653300180 | | 217822 | 6419758 | Operational | Stock | 899 | - | 3.8 | 11.2 |
| 653300169 | | 221858 | 6419820 | Operational | Stock | 2295 | 1.89 | - | 39.62 |
| 653300675 | | 218133 | 6419606 | Operational | Domestic | - | 0.15 | 8.4 | 32.4 |
| 653300614 | | 222963 | 6419666 | | | 4354 | 1.25 | 36 | 74 |
| 653300601 | | 223605 | 6419671 | | | 3943 | 0.4 | 42 | 79 |
| 653300724 | | 222297 | 6419529 | | Irrigation | 3460 | 0.5 | 16.2 | 94.5 |
| 653300762 | | 222443 | 6419459 | Abandoned | Irrigation | 5010 | 0.3 | 35 | 79.2 |
| 653300763 | | 222503 | 6419429 | | Irrigation | 7289 | 0.5 | 26.2 | 64 |
| 653300171 | | 223176 | 6419353 | | | - | - | - | - |
| 643300481 | PX 5 | 777329 | 6419192 | Unknown | | - | - | - | 62.18 |
| 643300479 | PX 3 | 777329 | 6419192 | Unknown | | - | - | - | 62.18 |
| 643300478 | PX 2 | 777329 | 6419192 | Unknown | | - | - | - | 62.18 |
| 643300482 | PX 6 | 777329 | 6419192 | Unknown | | - | - | - | 56.69 |

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 643300477 | PX 1 | 777329 | 6419192 | Unknown | | - | - | - | 82.3 |
| 643300483 | PX 8 | 777329 | 6419192 | Unknown | | - | - | - | 146.3 |
| 643300480 | PX 4 | 777329 | 6419192 | Unknown | | - | - | - | 91.44 |
| 653300674 | | 224109 | 6419218 | Operational | Domestic | 4600 | - | 36.5 | 77 |
| 643300168 | | 782286 | 6419037 | Operational | Stock | 1357 | 0.2 | 21 | 46 |
| 653300595 | | 222917 | 6419175 | | | 3712 | 0.13 | 20 | 46 |
| 653300650 | | 222714 | 6419060 | | | 1748 | 1.25 | 6 | 19 |
| 653300835 | | 221959 | 6419021 | | Irrigation | - | 0.6 | 18.2 | 61 |
| 653300663 | | 222953 | 6419030 | | | 4043 | 2 | 24.3 | 91.4 |
| 653300662 | | 222952 | 6419025 | Backfilled | | - | - | - | 118 |
| 653300676 | | 218454 | 6418861 | Operational | Stock | 861 | 0.75 | 20.6 | 113.6 |
| 653300181 | | 219740 | 6418845 | | | 1390 | - | - | 85 |
| 653300822 | | 219332 | 6418719 | | Domestic | 1653 | 4 | 42.5 | 84 |
| 653300619 | | 220751 | 6418757 | Operational | Irrigation | 1698 | 2.27 | 29.2 | 72.2 |
| 653300664 | | 221874 | 6418602 | Operational | Domestic | 3612 | 2 | 18 | 61.9 |
| 653300299 | | 228397 | 6418742 | | | 7654 | 8.84 | 12.19 | 19.81 |
| 653300227 | | 223456 | 6418575 | | | 4700 | 0.76 | 13.11 | 68.58 |
| 653300182 | | 220728 | 6418491 | Operational | Stock | 2251 | 0.45 | 22.56 | 31.39 |
| 643300169 | | 782192 | 6418373 | Operational | Stock | 1552 | 0.05 | 1.85 | 7.9 |
| 653300226 | | 223199 | 6418514 | | | 4291 | - | 10 | 77 |
| 653300820 | | 222897 | 6418449 | | Irrigation | 6395 | 0.5 | 8.2 | 48.7 |
| 653300668 | | 220696 | 6418388 | Backfilled | | - | - | 41 | 78 |
| 653300670 | | 220696 | 6418388 | Backfilled | | 2025 | 0.63 | 25 | 74 |
| 653300228 | | 223651 | 6418412 | | | 3667 | - | 9.05 | 23.8 |
| 653300221 | | 222093 | 6418363 | | | - | - | 4.6 | 4.57 |

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 653300223 | | 222405 | 6418300 | | | - | 1.1 | - | 457.2 |
| 653300220 | | 221763 | 6418266 | | | - | - | - | 7.62 |
| 653300627 | | 219855 | 6418192 | Operational | Observation | - | 1.2 | 40 | 96 |
| 653300225 | | 223183 | 6418266 | | | 5512 | - | 5.72 | 6.71 |
| 643300170 | | 781627 | 6418097 | Operational | Stock | - | - | 6.1 | 24.4 |
| 653300230 | | 224774 | 6418243 | | | 4167 | 0.45 | 3 | 100.5 |
| 653300224 | | 222956 | 6418179 | | | 2941 | - | - | 10.67 |
| 653300229 | | 223804 | 6418158 | | | 6212 | - | - | - |
| 653300839 | | 220865 | 6418063 | Abandoned | Domestic | - | - | - | 64 |
| 653300646 | | 219144 | 6417995 | | | 1692 | 1.25 | 60 | 100 |
| 653300698 | | 222959 | 6418090 | Operational | Stock | 6124 | 0.5 | 9 | 24 |
| 653300183 | | 220536 | 6418017 | | | 1884 | - | - | - |
| 653300219 | | 221564 | 6417974 | | | 1942 | - | - | 67.06 |
| 653300222 | | 222154 | 6417888 | | | 9624 | 5.3 | 18 | 55 |
| 653300704 | | 218921 | 6417751 | Operational | Irrigation | 1800 | - | 69 | 96 |
| 653300184 | | 220473 | 6417793 | Abandoned | | - | - | 22.4 | 27.4 |
| 653300584 | | 221541 | 6417765 | | | - | 3.35 | 9 | 75 |
| 653300216 | | 221303 | 6417726 | | | 1685 | 1.26 | 13.72 | 92.96 |
| 653300609 | | 219504 | 6417675 | | | - | 0.5 | 43.9 | 67.5 |
| 653300218 | QUORN SILO | 221355 | 6417605 | Abandoned | | - | - | - | 7.47 |
| 653300185 | | 220619 | 6417553 | | | 2999 | 0.01 | 7.01 | 8.23 |
| 653300217 | QUORN SILO | 221204 | 6417513 | Abandoned | | - | - | - | 4.17 |
| 653300573 | | 220554 | 6417426 | | | 3667 | 1.52 | 23 | 56.92 |
| 653300752 | | 220342 | 6417359 | | Domestic | 3920 | 1 | - | 51.8 |
| 653300186 | | 220348 | 6417307 | | | - | - | - | - |

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 653300588 | | 219618 | 6417267 | | | 1524 | 3.16 | 41.15 | 71.93 |
| 653300728 | | 219272 | 6417253 | | Domestic | 1878 | - | - | 85.3 |
| 653300630 | | 218333 | 6417145 | | | 1240 | 4.5 | 21.1 | 103 |
| 653300620 | | 219974 | 6417172 | Operational | Irrigation | 2171 | 1.51 | 33 | 60 |
| 653300766 | | 222422 | 6417229 | | Irrigation | 1743 | 1.5 | 15 | 55 |
| 653300195 | | 221158 | 6417178 | Operational | Industrial | 6255 | - | 9.14 | 27.43 |
| 653300197 | | 220757 | 6417053 | | | - | - | - | 60.05 |
| 653300749 | | 220252 | 6417029 | | Irrigation | 2716 | 0.6 | - | 42.6 |
| 653300623 | | 219161 | 6416991 | Operational | Domestic | 2642 | 1 | 21.3 | 48 |
| 653300196 | | 221085 | 6417030 | | | 2387 | 1.89 | 16.76 | 88.39 |
| 643300171 | PATERSONS WELL | 781893 | 6416897 | Operational | Stock | 882 | - | 0.2 | 4.55 |
| 653300189 | | 219125 | 6416844 | | | 1742 | - | - | - |
| 643300507 | | 782214 | 6416788 | | Irrigation | - | 6.2 | 8 | 34 |
| 653300637 | | 219545 | 6416816 | Operational | Domestic | 1906 | 1.25 | 8.5 | 30 |
| 653300187 | | 219900 | 6416747 | | | 2128 | - | - | - |
| 653300192 | | 218606 | 6416676 | Operational | Stock | 1751 | 1.9 | - | 18 |
| 653300190 | | 218821 | 6416667 | | | 1605 | 2.53 | - | 7.05 |
| 653300669 | | 220649 | 6416705 | | | 2909 | 5 | 20 | 32 |
| 643300172 | | 782245 | 6416620 | Operational | | 430 | 8 | 5.05 | 21.3 |
| 653300191 | | 218960 | 6416650 | | | - | - | 1.8 | 2.2 |
| 653300645 | | 219254 | 6416654 | | | 2188 | 1.26 | 12 | 63 |
| 653300618 | | 219253 | 6416652 | Operational | Irrigation | - | 0.76 | - | 9.45 |
| 653300629 | | 217872 | 6416599 | Operational | Town Water Supply (Public/Muncipal) | - | 2.5 | 12.4 | 56 |
| 653300232 | | 223830 | 6416713 | | | - | - | - | 24.38 |
| 653300613 | | 219935 | 6416597 | | | 2064 | 1.12 | 18.2 | 32 |

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 653300188 | | 219463 | 6416545 | | | 2008 | 0.16 | 11 | 207 |
| 653300198 | | 220049 | 6416513 | | | 1732 | - | - | 33 |
| 653300200 | | 219644 | 6416466 | | | 1945 | 0.75 | 6 | 45.9 |
| 653300621 | | 220167 | 6416478 | | | 2141 | 0.63 | 10 | 59.44 |
| 653300233 | | 223842 | 6416571 | | | - | - | 0.3 | 45.72 |
| 653300199 | | 219862 | 6416400 | Operational | Domestic | 1681 | 0.26 | - | 26.21 |
| 653300201 | | 219372 | 6416368 | Operational | Domestic | 1278 | 2.53 | 14.6 | 34.5 |
| 653300231 | | 225427 | 6416455 | | | 4757 | 0.08 | 16.15 | 92 |
| 653300202 | | 218856 | 6416150 | Operational | Stock | 1706 | - | - | - |
| 643300173 | | 781251 | 6416116 | Operational | Stock | 1413 | - | 3 | 18.3 |
| 653300193 | | 218044 | 6416045 | | | 1027 | 3.79 | 6.71 | 30.48 |
| 653300760 | | 222442 | 6416159 | | | - | 0.5 | 27.4 | 92 |
| 653300194 | | 218105 | 6415933 | Operational | Domestic | 1334 | - | - | 30.5 |
| 653300745 | | 223022 | 6415979 | | Irrigation | 12650 | 0.3 | - | 71.6 |
| 653300829 | | 220260 | 6415871 | | Irrigation | - | 4 | 36 | 114 |
| 653300204 | | 221837 | 6415715 | | | 2866 | - | 12.65 | 41.5 |
| 653300203 | | 218901 | 6415535 | Operational | Stock | 2866 | - | 8.9 | 14.2 |
| 653300235 | | 224947 | 6415507 | | | 297 | - | 21.6 | 64 |
| 653300205 | | 219786 | 6415234 | Abandoned | | 4085 | 0.1 | 14.95 | 40.2 |
| 653300240 | | 223729 | 6415087 | Operational | Domestic | 2950 | 1.87 | 44.8 | 82.9 |
| 653300678 | | 223689 | 6415016 | | | 3299 | 1.25 | 42.6 | 92 |
| 653300149 | | 245769 | 6415511 | Operational | Stock | 2950 | - | - | 18 |
| 643300174 | | 780810 | 6414768 | Operational | Stock | 2909 | - | 27 | 30 |
| 653300239 | | 223595 | 6414854 | Operational | Domestic | 2747 | 0.03 | 26.2 | 28.3 |
| 653300234 | | 224822 | 6414841 | | | 4555 | 0.13 | 24.38 | 30.48 |

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 653300238 | | 223805 | 6414431 | | | - | - | - | 30.48 |
| 653300206 | | 221109 | 6414276 | Operational | Stock | 1745 | 1.26 | 21 | 67 |
| 653300742 | | 221042 | 6414259 | | Stock | 1889 | 0.5 | - | 42.6 |
| 653300597 | | 238046 | 6414633 | | | 2539 | 5 | 9.7 | 91 |
| 653300207 | | 220796 | 6414139 | | | 1442 | - | - | 42.67 |
| 653300750 | | 219503 | 6414078 | | Stock | 2574 | 1 | - | 67 |
| 653300725 | | 221747 | 6414029 | | Stock | 3654 | 1 | - | 41.4 |
| 653300236 | | 224927 | 6414109 | Operational | Stock | 6786 | - | 24 | 29.9 |
| 653300208 | | 221892 | 6413854 | | | 6212 | - | - | - |
| 653300840 | | 224776 | 6413930 | | Stock | - | 0.6 | 21.3 | 41 |
| 643300175 | E & WS DEPT | 775995 | 6413074 | | | 2171 | - | - | - |
| 653300237 | | 224356 | 6412997 | Operational | Domestic | 3359 | - | 55 | 65 |
| 653300157 | | 248550 | 6413620 | | | 13495 | - | - | 28.35 |
| 653300323 | | 229223 | 6413118 | Operational | Stock | 4501 | - | 19.3 | 95.85 |
| 653300153 | | 241772 | 6413423 | | | 1600 | - | 11.3 | 36.58 |
| 653300212 | | 218743 | 6412767 | Operational | Town Water Supply (Public/Muncipal) | 1692 | 1.25 | 30 | 49 |
| 653300209 | | 220460 | 6412790 | Dry | | 10182 | - | - | 76.2 |
| 653300707 | | 224322 | 6412879 | | Stock | 4100 | 0.75 | 51.8 | 70.7 |
| 653300607 | | 224226 | 6412797 | | | 3827 | 0.44 | 57 | 66 |
| 653300210 | | 221056 | 6412669 | Operational | Domestic | 921 | - | 34.3 | 46 |
| 643300176 | | 780581 | 6412242 | Operational | Stock | 1636 | - | - | 150 |
| 643300185 | | 782165 | 6411621 | Operational | Irrigation | 4437 | 0.57 | - | 87 |
| 653300211 | | 218488 | 6411451 | | | - | - | - | 60 |
| 653300215 | | 221647 | 6411528 | Operational | Domestic | 3301 | - | 62.2 | 63 |
| 653300156 | | 246659 | 6412131 | | | 12544 | - | 7.5 | 18.8 |

| Unit_no | Name | Easting | Northing | Status | Use | Tds, mg/L | Yield, L/sec | Swl, m | Depth, m |
|---|---|---|---|---|---|---|---|---|---|
| 653300326 | | 231738 | 6411633 | | | 4355 | - | 10.06 | 13.11 |
| 653300213 | | 220979 | 6411303 | | | 2109 | - | - | 89 |
| 653300214 | | 221478 | 6411190 | Operational | Stock | 2950 | 0.32 | 67 | 73 |
| 643300177 | | 779413 | 6410631 | Operational | Domestic | 1245 | - | 0.85 | 8.7 |

# APPENDIX B

## WELL YIELD

| Well Yield L/s | No. of wells | % |
|---|---|---|
| < 1.5 | 67 | 71 |
| 1.5 – 3.0 | 13 | 14 |
| 3.0 – 5.0 | 10 | 11 |
| > 5.0 | 4 | 4 |
| **TOTAL** | **94** | **100** |

# APPENDIX C

## Weekly extraction volume from Quorn 1

| DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL |
|---|---|---|---|---|---|
| 1.4.87 | 139 | 30.3.88 | 1066 | 5.4.89 | 2811 |
| 8.4.87 | 454 | 6.4.88 | 997 | 12.4.89 | 2747 |
| 15.4.87 | 178 | 13.4.88 | 1081 | 19.4.89 | 1764 |
| 22.4.87 | 133 | 20.4.88 | 1074 | 26.4.89 | 2315 |
| 29.4.87 | 181 | 27.4.88 | 972 | 3.5.89 | 1165 |
| 6.5.87 | 191 | 4.5.88 | 414 | 10.5.89 | 431 |
| 13.5.87 | 134 | 22.6.88 | 336 | 17.5.89 | 1632 |
| 19.8.87 | 158 | 31.8.88 | 701 | 24.5.89 | 1894 |
| 26.8.87 | 329 | 7.9.88 | 858 | 31.5.89 | 1609 |
| 2.9.87 | 1,105 | 14.9.88 | 932 | 7.6.89 | 1817 |
| 9.9.87 | 1114 | 21.9.88 | 909 | 14.6.89 | 1939 |
| 16.9.87 | 1116 | 28.9.88 | 981 | 21.6.89 | 395 |
| 23.9.87 | 1095 | 5.10.88 | 1119 | 12.7.89 | 4202 |
| 30.9.87 | 1071 | 12.10.88 | 1152 | 19.7.89 | 1523 |
| 7.10.87 | 1082 | 19.10.88 | 1083 | 26.7.89 | 1521 |
| 14.10.87 | 1114 | 26.10.88 | 1092 | 2.8.89 | 1588 |
| 21.10.87 | 1069 | 2.11.88 | 1090 | 9.8.89 | 2048 |
| 28.10.87 | 1092 | 9.11.88 | 1122 | 16.8.89 | 323 |
| 4.11.87 | 1145 | 16.11.88 | 1108 | 23.8.89 | 1826 |
| 11.11.87 | 1094 | 23.11.88 | 1084 | 30.8.89 | 1358 |
| 18.11.87 | 1107 | 30.11.88 | 1091 | 6.9.89 | 2059 |
| 25.11.87 | 1091 | 7.12.88 | 536 | 13.9.89 | 2175 |
| 2.12.87 | 1056 | 14.12.88 | 748 | 20.9.89 | 2351 |
| 9.12.87 | 1067 | 16.12.88 | 386 | 27.9.89 | 2657 |
| 16.12.87 | 1102 | 21.12.88 | 2973 | 4.10.89 | 2876 |
| 23.12.87 | 1072 | 28.12.88 | 3121 | 11.10.89 | 2488 |
| 30.12.87 | 1105 | 4.1.89 | 3785 | 18.10.89 | 1408 |
| 6.1.88 | 1111 | 11.1.89 | 3051 | 25.10.89 | 1471 |
| 13.1.88 | 1024 | 18.1.89 | 3088 | 1.11.89 | 1614 |
| 20.1.88 | 1106 | 25.1.89 | 2909 | 8.11.89 | 1333 |
| 27.1.88 | 1107 | 1.2.89 | 4442 | 15.11.89 | 1520 |
| 3.2.88 | 1110 | 8.2.89 | 4570 | 22.11.89 | 201 |
| 10.2.88 | 1069 | 15.2.89 | 4157 | 28.2.90 | 116 |
| 17.2.88 | 1097 | 22.2.89 | 4354 | 4.4.90 | 1794 |
| 24.2.88 | 1107 | 1.3.89 | 3962 | 11.4.90 | 1891 |
| 2.3.88 | 1111 | 8.3.89 | 4656 | 18.4.90 | 2923 |
| 9.3.88 | 1106 | 15.3.89 | 1695 | 24.4.90 | 1516 |
| 16.3.88 | 1110 | 22.3.89 | 1908 | 2.5.90 | 2421 |
| 23.3.88 | 1105 | 29.3.89 | 2061 | 9.5.90 | 2935 |

| DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL |
|---|---|---|---|---|---|
| 16.5.90 | 2472 | 13.3.91 | 4339 | 5.2.91 | 3647 |
| 23.5.90 | 2272 | 20.3.91 | 4213 | 12.2.92 | 2204 |
| 30.5.90 | 2030 | 27.3.91 | 3469 | 19.2.92 | 3060 |
| 6.6.90 | 1558 | 3.4.91 | 1852 | 26.2.92 | 4591 |
| 13.6.90 | 2120 | 10.4.91 | 3071 | 4.3.92 | 3030 |
| 20.6.90 | 1736 | 17.4.91 | 980 | 11.3.92 | 2788 |
| 27.6.90 | 1646 | 1.5.91 | 1432 | 18.3.92 | 2349 |
| 4.7.90 | 1928 | 12.6.91 | 487 | 25.3.92 | 2117 |
| 11.7.90 | 1623 | 19.6.91 | 1605 | 8.4.92 | 1728 |
| 18.7.90 | 1576 | 26.6.91 | 1640 | 15.4.92 | 1814 |
| 25.7.90 | 1660 | 3.7.91 | 1537 | 22.4.82 | 1543 |
| 1.8.90 | 1881 | 10.7.91 | 1598 | 29.4.92 | 0 |
| 8.8.90 | 1702 | 17.7.91 | 1722 | 6.5.92 | 81 |
| 15.8.90 | 1625 | 24.7.91 | 1703 | 13.5.92 | 1354 |
| 22.8.90 | 1636 | 31.7.91 | 1519 | 20.5.92 | 1860 |
| 29.8.90 | 1831 | 7.8.91 | 1875 | 27.5.92 | 1113 |
| 5.9.90 | 1827 | 14.8.91 | 1966 | 3.6.92 | 911 |
| 12.9.90 | 2172 | 21.8.91 | 1998 | 10.6.92 | 2121 |
| 3.10.90 | 1954 | 28.8.91 | 2091 | 17.6.92 | 3022 |
| 10.10.90 | 3210 | 4.9.91 | 1992 | 24.6.92 | 1668 |
| 17.10.90 | 3156 | 11.9.91 | 3015 | 1.7.92 | 1763 |
| 24.10.90 | 2626 | 18.9.91 | 2534 | 8.7.92 | 2020 |
| 31.10.90 | 3508 | 25.9.91 | 2080 | 15.7.92 | 2151 |
| 7.11.90 | 3850 | 2.10.91 | 1314 | 22.7.92 | 1867 |
| 14.11.90 | 4128 | 9.10.91 | 1250 | 29.7.92 | 1974 |
| 21.11.90 | 4139 | 16.10.91 | 1785 | 5.8.92 | 2420 |
| 28.11.90 | 4092 | 23.10.91 | 1758 | 12.8.92 | 1687 |
| 5.12.90 | 4327 | 30.10.91 | 2371 | 19.8.92 | 1754 |
| 12.12.90 | 3400 | 6.11.91 | 2145 | 26.8.92 | 2143 |
| 19.12.90 | 4258 | 13.11.91 | 1844 | 2.9.92 | 2020 |
| 26.12.90 | 4126 | 20.11.91 | 2252 | 9.9.92 | 1683 |
| 2.1.91 | 4280 | 27.11.91 | 2605 | 16.9.92 | 2675 |
| 9.1.91 | 3835 | 4.12.91 | 3072 | 23.9.92 | 2160 |
| 16.1.91 | 4380 | 11.12.91 | 3270 | 30.9.92 | 1843 |
| 23.1.91 | 3802 | 18.12.91 | 3243 | 7.10.92 | 1934 |
| 30.1.91 | 3493 | 24.12.91 | 2833 | 14.10.92 | 2043 |
| 6.2.91 | 4526 | 31.12.91 | 3551 | 21.10.92 | 1939 |
| 13.2.91 | 4067 | 8.1.92 | 3740 | 28.10.92 | 2924 |
| 20.2.91 | 2495 | 15.1.92 | 3356 | 4.11.92 | 1919 |
| 27.2.91 | 4715 | 22.1.92 | 3653 | 11.11.92 | 2308 |
| 6.3.91 | 4732 | 29.1.92 | 2758 | 18.11.92 | 2895 |

| DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL |
|---|---|---|---|---|---|
| 25.11.92 | 1906 | 1.9.93 | 2228 | 15.6.94 | 1622 |
| 2.12.92 | 2874 | 8.9.93 | 1483 | 22.6.94 | 1780 |
| 7.12.92 | 1288 | 15.9.93 | 1296 | 29.6.94 | 772 |
| 9.12.92 | 1740 | 22.9.93 | 2131 | 6.7.94 | 2058 |
| 16.12.92 | 3222 | 29.9.93 | 3201 | 13.7.94 | 1930 |
| 23.12.92 | 1787 | 6.10.93 | 1889 | 20.7.94 | 2195 |
| 30.12.92 | 2842 | 13.10.93 | 2690 | 27.7.94 | 2370 |
| 6.1.93 | 4122 | 20.10.93 | 2106 | 3.8.94 | 1840 |
| 13.1.93 | 3202 | 27.10.93 | 2981 | 10.8.94 | 1898 |
| 20.1.93 | 3159 | 3.11.93 | 2739 | 17.8.94 | 2148 |
| 27.1.93 | 1944 | 10.11.93 | 3766 | 24.8.94 | 2548 |
| 3.2.93 | 3685 | 17.11.93 | 3305 | 31.8.94 | 2964 |
| 10.2.93 | 2519 | 24.11.93 | 846 | 7.9.94 | 2632 |
| 17.2.93 | 3899 | 1.12.93 | 3731 | 14.9.94 | 2521 |
| 24.2.93 | 2907 | 8.12.93 | 429 | 21.9.94 | 2999 |
| 3.3.93 | 4018 | 15.12.93 | 1854 | 28.9.94 | 3402 |
| 10.3.93 | 3849 | 22.12.93 | 1571 | 5.10.94 | 2778 |
| 17.3.93 | 517 | 29.12.93 | 2509 | 12.10.94 | 2797 |
| 24.3.93 | 3418 | 5.1.94 | 1930 | 19.10.94 | 4112 |
| 31.3.93 | 3027 | 12.1.94 | 3181 | 26.10.94 | 3802 |
| 7.4.93 | 3384 | 19.1.94 | 2093 | 2.11.94 | 2856 |
| 14.4.93 | 3892 | 25.1.94 | 2081 | 9.11.94 | 2922 |
| 21.4.93 | 4113 | 2.2.94 | 1696 | 16.11.94 | 2927 |
| 28.4.93 | 3746 | 9.2.94 | 1711 | 23.11.94 | 3661 |
| 5.5.93 | 3223 | 16.2.94 | 1467 | 30.11.94 | 4140 |
| 12.5.93 | 2475 | 23.2.94 | 430 | 7.12.94 | 4067 |
| 19.5.93 | 2816 | 2.3.94 | 454 | 14.12.94 | 3032 |
| 26.5.93 | 1769 | 9.3.94 | 783 | 21.12.94 | 3873 |
| 2.6.93 | 2852 | 16.3.94 | 1161 | 28.12.94 | 2906 |
| 9.6.93 | 4979 | 23.3.94 | 1269 | 4.1.95 | 3720 |
| 16.6.93 | 2288 | 30.3.94 | 67 | 11.1.95 | 4330 |
| 23.6.93 | 1696 | 6.4.94 | 25 | 18.1.95 | 2007 |
| 30.6.93 | 2719 | 13.4.94 | 17 | 25.1.95 | 2962 |
| 7.7.93 | 2138 | 20.4.94 | 0 | 1.2.95 | 1938 |
| 14.7.93 | 2022 | 27.4.94 | 2578 | 8.2.95 | 2428 |
| 21.7.93 | 2039 | 4.5.94 | 0 | 15.2.95 | 3510 |
| 28.7.93 | 695 | 11.5.94 | 31 | 22.2.95 | 3661 |
| 4.8.93 | 1532 | 18.5.94 | 27 | 1.3.95 | 3671 |
| 11.8.93 | 1424 | 25.5.94 | 2535 | 8.3.95 | 2079 |
| 18.8.93 | 1729 | 1.6.94 | 2907 | 15.3.95 | 3077 |
| 25.8.93 | 2283 | 8.6.94 | 2391 | 22.3.95 | 3534 |

| DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL |
|---|---|---|---|---|---|
| 29.3.95 | 3266 | 10.1.96 | 1224 | 11.12.96 | 2644 |
| 5.4.95 | 2505 | 6.3.96 | 2345 | 18.12.96 | 3917 |
| 12.4.95 | 1844 | 13.3.96 | 3401 | 24.12.96 | 3385 |
| 19.4.95 | 2758 | 20.3.96 | 2638 | 31.12.96 | 3455 |
| 26.4.95 | 2041 | 27.3.96 | 3510 | 8.1.97 | 4708 |
| 3.5.95 | 1930 | 3.4.96 | 2758 | 15.1.97 | 3969 |
| 10.5.95 | 1620 | 10.4.96 | 3157 | 22.1.97 | 4152 |
| 17.5.95 | 1765 | 17.4.96 | 2231 | 29.1.97 | 3149 |
| 24.5.95 | 1951 | 24.4.96 | 2708 | 5.2.97 | 4108 |
| 2.6.95 | 1938 | 1.5.96 | 2821 | 12.2.97 | 1823 |
| 8.6.95 | 1513 | 8.5.96 | 2531 | 19.2.97 | 3241 |
| 14.6.95 | 1210 | 15.5.96 | 2404 | 26.2.97 | 3834 |
| 21.6.95 | 1338 | 22.5.96 | 2161 | 5.3.97 | 3023 |
| 28.6.95 | 1629 | 29.5.96 | 1985 | 12.3.97 | 4258 |
| 6.7.95 | 1730 | 5.6.96 | 1454 | 19.3.97 | 3990 |
| 12.7.95 | 1674 | 12.6.96 | 983 | 26.3.97 | 3492 |
| 19.7.95 | 1672 | 19.6.96 | 1366 | 2.4.97 | 3267 |
| 26.7.95 | 1813 | 26.6.96 | 1246 | 9.4.97 | 3743 |
| 2.8.95 | 1567 | 3.7.96 | 1438 | 16.4.97 | 3234 |
| 9.8.95 | 2050 | 10.7.96 | 1523 | 23.4.97 | 3338 |
| 16.8.95 | 2739 | 17.7.96 | 1533 | 30.4.97 | 3246 |
| 23.8.95 | 2282 | 23.7.96 | 1298 | 7.5.97 | 2502 |
| 30.8.95 | 2059 | 31.7.96 | 1722 | 14.5.97 | 2064 |
| 6.9.95 | 1954 | 7.8.96 | 1684 | 21.5.97 | 2311 |
| 13.9.95 | 2157 | 14.8.96 | 309 | 28.5.97 | 1736 |
| 20.9.95 | 2893 | 21.8.96 | 1728 | 2.6.97 | 1710 |
| 27.9.95 | 2229 | 28.8.96 | 1604 | 4.6.97 | 2360 |
| 4.10.95 | 3004 | 4.9.96 | 1880 | 11.9.97 | 3504 |
| 11.10.95 | 3802 | 11.9.96 | 2561 | 18.6.97 | 2585 |
| 18.10.95 | 3402 | 18.9.96 | 3319 | 25.6.97 | 2556 |
| 25.10.95 | 1308 | 25.9.96 | 2563 | 2.7.97 | 2882 |
| 1.11.95 | 3177 | 2.10.96 | 2441 | 9.7.97 | 2990 |
| 8.11.95 | 1598 | 9.10.96 | 2587 | 16.7.97 | 2957 |
| 15.11.95 | 2887 | 16.10.96 | 3625 | 23.7.97 | 3074 |
| 22.11.95 | 3078 | 23.10.96 | 3839 | 30.7.97 | 3713 |
| 29.11.95 | 3741 | 30.10.96 | 3347 | 7.8.97 | 3476 |
| 6.12.95 | 2848 | 6.11.96 | 2871 | 14.8.97 | 1642 |
| 13.12.95 | 3147 | 13.11.96 | 3784 | 20.8.97 | 1879 |
| 20.12.95 | 3885 | 20.11.96 | 2741 | 26.8.97 | 2191 |
| 27.12.95 | 3218 | 27.11.96 | 3774 | 3.9.97 | 2697 |
| 3.1.96 | 3389 | 4.12.96 | 3700 | 10.9.97 | 2648 |

| DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL |
|---|---|---|---|---|---|
| 17.9.97 | 2714 | 1.7.98 | 2919 | 4.8.99 | 2148 |
| 25.9.97 | 2845 | 8.7.98 | 3066 | 11.8.99 | 1595 |
| 1.10.97 | 2855 | 15.7.98 | 3615 | 18.8.99 | 1893 |
| 8.10.97 | 3687 | 22.7.98 | 2672 | 25.8.99 | 2735 |
| 15.10.97 | 3025 | 29.7.98 | 3110 | 1.9.99 | 2403 |
| 22.10.97 | 2485 | 5.8.98 | 3047 | 8.9.99 | 2325 |
| 29.10.97 | 2895 | 12.8.98 | 4786 | 15.9.99 | 2259 |
| 6.11.97 | 3227 | 19.8.98 | 4970 | 22.9.99 | 2513 |
| 12.11.97 | 2671 | 26.8.98 | 2382 | 29.9.99 | 2992 |
| 20.11.97 | 3331 | 2.9.98 | 3817 | 6.10.99 | 2822 |
| 26.11.97 | 3567 | 9.9.98 | 3684 | 14.10.99 | 3139 |
| 5.12.97 | 5821 | 16.9.98 | 3267 | 20.10.99 | 2586 |
| 11.12.97 | 2842 | 23.9.98 | 3604 | 27.10.99 | 2597 |
| 17.12.97 | 2455 | 30.9.98 | 4128 | 3.11.99 | 1950 |
| 24.12.97 | 3037 | 6.10.98 | 2682 | 10.11.99 | 2978 |
| 31.12.97 | 3940 | 13.10.98 | 3191 | 17.11.99 | 3052 |
| 8.1.98 | 3842 | 10.2.99 | 3490 | 26.11.99 | 3320 |
| 14.1.98 | 1995 | 17.2.99 | 3735 | 2.12.99 | 2582 |
| 21.1.98 | 3843 | 24.2.99 | 1603 | 8.12.99 | 2625 |
| 28.1.98 | 3946 | 3.3.99 | 2930 | 15.12.99 | 4297 |
| 4.2.98 | 3829 | 10.3.99 | 2901 | 22.12.99 | 3573 |
| 11.2.98 | 3142 | 17.3.99 | 4196 | 30.12.99 | 2969 |
| 18.2.98 | 3276 | 24.3.99 | 2384 | 5.1.00 | 3180 |
| 25.2.98 | 4325 | 31.3.99 | 3792 | 12.1.00 | 4109 |
| 4.3.98 | 3727 | 7.4.99 | 2535 | 19.1.00 | 4173 |
| 11.3.98 | 4325 | 14.4.99 | 3536 | 27.1.00 | 2517 |
| 18.3.98 | 3249 | 22.4.99 | 3342 | 2.2.00 | 2952 |
| 25.3.98 | 3684 | 28.4.99 | 2742 | 10.2.00 | 4547 |
| 1.4.98 | 3846 | 2.2.99 | 2919 | 16.2.00 | 2400 |
| 8.4.98 | 4517 | 12.5.99 | 3379 | 23.2.00 | 2711 |
| 16.4.98 | 3497 | 19.5.99 | 2809 | 1.3.00 | 3412 |
| 22.4.98 | 2531 | 26.5.99 | 2183 | 8.3.00 | 3530 |
| 29.4.98 | 2255 | 2.6.99 | 1722 | 14.3.00 | 2960 |
| 7.5.98 | 3148 | 9.6.99 | 2377 | 22.3.00 | 3273 |
| 13.5.98 | 2531 | 16.6.99 | 2396 | 29.3.00 | 1706 |
| 20.5.98 | 2493 | 23.6.99 | 2085 | 5.4.00 | 3164 |
| 27.5.98 | 2052 | 1.7.99 | 2271 | 13.4.00 | 3622 |
| 3.6.98 | 2678 | 7.7.99 | 1490 | 19.4.00 | 2040 |
| 10.6.98 | 4256 | 14.7.99 | 1652 | 26.4.00 | 3516 |
| 17.6.98 | 2745 | 21.7.99 | 2145 | 1.5.00 | 2308 |
| 24.6.98 | 2312 | 28.7.99 | 3333 | 10.5.00 | 1905 |

| DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL | DATE | VOLUME PUMPED kL |
|---|---|---|---|---|---|
| 17.5.00 | 1994 | 28.2.01 | 3753 | 12.12.01 | 3375 |
| 24.5.00 | 1941 | 7.3.01 | 4198 | 19.12.01 | 4106 |
| 31.5.00 | 1698 | 14.3.01 | 4214 | 27.12.01 | 4961 |
| 8.6.00 | 3149 | 21.3.01 | 3241 | 2.1.02 | 3397 |
| 14.6.00 | 2223 | 27.3.01 | 2972 | 9.1.02 | 4118 |
| 22.6.00 | 2716 | 4.4.01 | 4935 | 16.1.02 | 3551 |
| 28.6.00 | 2255 | 11.4.01 | 3585 | 23.1.02 | 3665 |
| 6.7.00 | 2427 | 18.4.01 | 4289 | 30.1.02 | 4014 |
| 12.7.00 | 1906 | 26.4.01 | 3508 | 6.2.02 | 2703 |
| 9.7.00 | 2273 | 2.5.01 | 3743 | 13.0.02 | 2840 |
| 26.7.00 | 2172 | 9.5.01 | 2724 | 20.2.02 | 2649 |
| 2.8.00 | 2432 | 16.5.01 | 3129 | | |
| 9.8.00 | 2352 | 23.5.01 | 2984 | | |
| 16.8.00 | 2199 | 30.5.01 | 2859 | | |
| 24.8.00 | 2614 | 6.6.01 | 2736 | | |
| 31.8.00 | 2030 | 14.6.01 | 2318 | | |
| 7.9.00 | 2538 | 20.6.01 | 1767 | | |
| 13.9.00 | 2029 | 27.6.01 | 2450 | | |
| 20.9.00 | 3147 | 4.7.01 | 2545 | | |
| 28.9.00 | 3721 | 11.7.01 | 2453 | | |
| 4.10.00 | 2661 | 18.7.01 | 1983 | | |
| 11.10.00 | 3504 | 24.7.01 | 2454 | | |
| 18.10.00 | 2456 | 1.8.01 | 2220 | | |
| 26.10.00 | 3896 | 8.8.01 | 2378 | | |
| 1.11.00 | 2844 | 15.8.01 | 2565 | | |
| 8.11.00 | 3731 | 22.8.01 | 2559 | | |
| 14.11.00 | 2170 | 29.8.01 | 2485 | | |
| 22.11.00 | 3745 | 5.9.01 | 1895 | | |
| 28.11.00 | 3772 | 12.9.01 | 1684 | | |
| 6.12.00 | 3746 | 19.9.01 | 2330 | | |
| 13.12.00 | 3735 | 26.9.01 | 2853 | | |
| 20.12.00 | 4226 | 3.10.01 | 3182 | | |
| 27.12.00 | 3861 | 10.10.01 | 2931 | | |
| 3.1.01 | 4671 | 17.10.01 | 3173 | | |
| 10.1.01 | 3691 | 24.10.01 | 3420 | | |
| 17.1.01 | 4421 | 2.11.01 | 4384 | | |
| 24.1.01 | 4030 | 7.11.01 | 2875 | | |
| 31.1.01 | 3670 | 14.11.01 | 3569 | | |
| 7.2.01 | 3857 | 21.11.01 | 4526 | | |
| 14.2.01 | 3754 | 28.11.01 | 3290 | | |
| 21.2.01 | 4230 | 5.12.01 | 3310 | | |

# APPENDIX D

### Summary of Drilling Details

| Unit Number | 6533-864 | 6533-865 |
|---|---|---|
| Permit Number | 58571 | 58572 |
| Date drilled | 23/05/2002 | 24/05/2002 |
| Drilling method | Rotary hammer with air circulation | Rotary hammer with air circulation |
| Well diameter (m) | 0.14 | 0.14 |
| Depth (m) | 80.0 | 120.0 |
| Water cut depth (m) | Damp at 56.0-63.0 m | 82.0 |
| Yield [airlift] (L/sec) | - | 1.0 |
| Comments | Well was dry. It was assumed that the fracture zone was poorly developed in the vicinity of the 60.0 m zone. The well was abandoned and backfilled on 24/05/2002 | Well intercepted fractures at interval between 82.0 and 108.0 m. There was increased in airlift yield as drilling progressed through the interval between 82 and 120 m. |

# APPENDIX E

## Borehole Log for Well 6533-864 (P/N 58571)

| | |
|---|---|
| Unit_no: | 6533-864 |
| Total depth (m): | 80.00 |
| Depth to water cut (m): | - |
| Depth to standing water level (m): | - |
| Supply (L/sec): | - |

| DEPTH (m) | | SEDIMENT/ROCK NAME | GEOLOGICAL DESCRIPTION |
|---|---|---|---|
| From | To | | |
| 0.0 | 3.0 | Loam soil and pebbles | Silty loamy soil |
| 3.0 | 7.0 | Clay | Pale red clay |
| 7.0 | 9.0 | Clay | Greyish orange pink |
| 9.0 | 11.5 | Clayey sand | Reddish brown. Sand particle size: 0.2 – 0.5 mm, rounded. |
| 11.5 | 17.0 | Sandstone | Soft, pale orange sandstone |
| 17.0 | 20.0 | Sandstone | Soft, pale orange sandstone. |
| 20.0 | 59.0 | Sandstone | Soft, very light grey to white sandstone. Drill-cuttings were damp at the interval between 54.0 – 63.0 m. |
| 59.0 | 75.0 | Sandstone | Yellow grey to light olive in colour. |
| 75.0 | 79.5 | Quartzite | Quartzite |
| 79.5 | 80.0 | Sandstone | Soft sandstone. |

# APPENDIX F

## Borehole Log for Well 6533-865 (PN 58572)

| | |
|---|---|
| Unit_no: | 6533-865 |
| Total depth (m): | 120.00 |
| Depth to water cut (m): | 82.00 |
| Depth to standing water level (m): | 58.85 |
| Supply (L/sec): | 1.00 |

| DEPTH (m) From | DEPTH (m) To | SEDIMENT/ROCK NAME | GEOLOGICAL DESCRIPTION |
|---|---|---|---|
| 0.0 | 3.0 | Loam soil | Silty |
| 3.0 | 8.0 | Clay | Reddish brown clay |
| 8.0 | 8.5 | Sandstone | White, soft, friable |
| 8.5 | 9.0 | Sandstone and Clay | Overall moderately reddish brown in colour. |
| 9.0 | 12.0 | Sandstone | Soft, overall moderate orange pink in colour |
| 12.0 | 18.0 | Sandstone | Soft, overall very pale orange in colour. Fine to medium (0.1 – 0.6 mm) grained sandstone. Subrouded to rounded. |
| 18.0 | 72.0 | Sandstone | White and soft. Fine to medium grained sandstone. |
| 72.0 | 78.0 | Quartzite and sandstone | Band of quartzite interbedded with sandstone |
| 78.0 | 82.0 | Sandstone | Soft, fine to medium (0.2 – 0.6 mm) subrounded to rounded quartz grained sandstone. |
| 82.0 | 96.0 | Sandstone | Water cut at 82.0 m. Fracture zone. Small amount of drill-cuttings was recovered from this interval. Clayey Sandstone at intervals between 84.0 – 87.0 and 90 – 93.0 m. Overall colour of drill-cuttings is very pale orange to greyish orange. |
| 96.0 | 102.0 | Quartzite | Silty quartzite. Light olive grey in colour. |
| 102.0 | 105.0 | Sandstone | Silty sandstone. Predominantly medium grained sandstone. |
| 105.0 | 108.0 | Quartzite | Light olive grey in colour. Small amount of drill cuttings was recovered from this interval. |
| 108.0 | 120.0 | Sandstone | Soft. Fine to medium (0.1 – 0.6 mm) grained sandstone. Driller noted fair increase in flow rate at 115.0 m . |