Report

Desktop Hydrogeological Assessment - Tarrone Power Station

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Prepared for

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Abbreviations

Abbreviation	Description
BCL	Bore Construction License
CMA	Catchment Management Authority
DSE	Department of Sustainability and Environment
EC	Electrical Conductivity (µS/cm)
GDE	Groundwater Dependent Ecosystem
GEL	Groundwater Extraction Licence
GMA	Groundwater Management Area
GMS	Groundwater Management System
ML/year	1,000,000 litres per year
NV	Newer Volcanics
PCV	Permissible Consumptive Volume
PCL	Port Campbell Limestone
SWL	Standing Water Level
SRW	Southern Rural Water
TDS	Total Dissolved Solids (mg/L) – measurement of salinity in groundwater
UA	Unincorporated Area
URS	URS Australia Pty Ltd
TPS	Tarrone Power Station
WSPA	Water Supply Protection Area

1

Introduction

1.1 Background

AGL Energy Limited (AGL) engaged URS Australia Pty Ltd (URS) to undertake a desktop hydrogeological assessment of the groundwater environments beneath and surrounding Tarrone, near Hamilton in southwest Victoria.

AGL is proposing the development of an open-cycle gas turbine peaking power plant ultimately consisting of three or four turbines, with an associated substation to connect to the high voltage transmission lines that cross the site, and onsite infrastructure including a pipeline corridor to supply natural gas from the nearby SEA Gas pipeline to the proposed power station.

The proposed Tarrone Power Station (TPS) is located on a site of approximately 75 ha in area on Tarrone North Road, Tarrone in the municipality of Moyne Shire and is described as Lot 2 on Plan of Subdivision 218923A, Volume 9933, Folio 939. The proposed power station footprint is approximately 15 ha in area.

As part of the evaporative cooling operations of the proposed TPS, AGL will require up to 15 ML of water per year and groundwater has been identified as one potential source for this water.

1.2 Aims and Objectives

The principal aim of this hydrogeological assessment is to identify any potential impacts the extraction of 15ML/year may have on surface water bodies and other users of groundwater in the area. To achieve this, the assessment aims to determine the following:

- hydrogeological setting and groundwater conditions beneath the site;
- the physical parameters of the target aquifer(s), including; depth, thickness, depth to groundwater, saturated thickness, transmissivity (T) and storativity (S), and;
- assess the potential impacts groundwater extraction may have on neighbouring groundwater users and to local creeks and rivers.

1.3 Scope of Works

The scope of works undertaken as part of this hydrogeological investigation included the following:

- review of background data, local and regional geological and hydrogeological information, including; web databases, maps and reports, and;
- analysis of data and reporting.

2

Site Setting

2.1 Location

The TPS site is located in southwest Victoria, approximately 250km from Melbourne (Figure 1). The site is located on the Tarrone North Road, Tarrone and is described as Lot 2 on Plan of Subdivision 218923A, Volume 9933, Folio-939 in the municipality of Moyne Shire.

The proposed development comprises an open-cycle gas turbine peaking power plant ultimately consisting of three or four turbines, with an associated substation and onsite infrastructure, including an 8 km east/west pipeline corridor to provide a gas supply from the SEA Gas Pipeline to the proposed TPS.

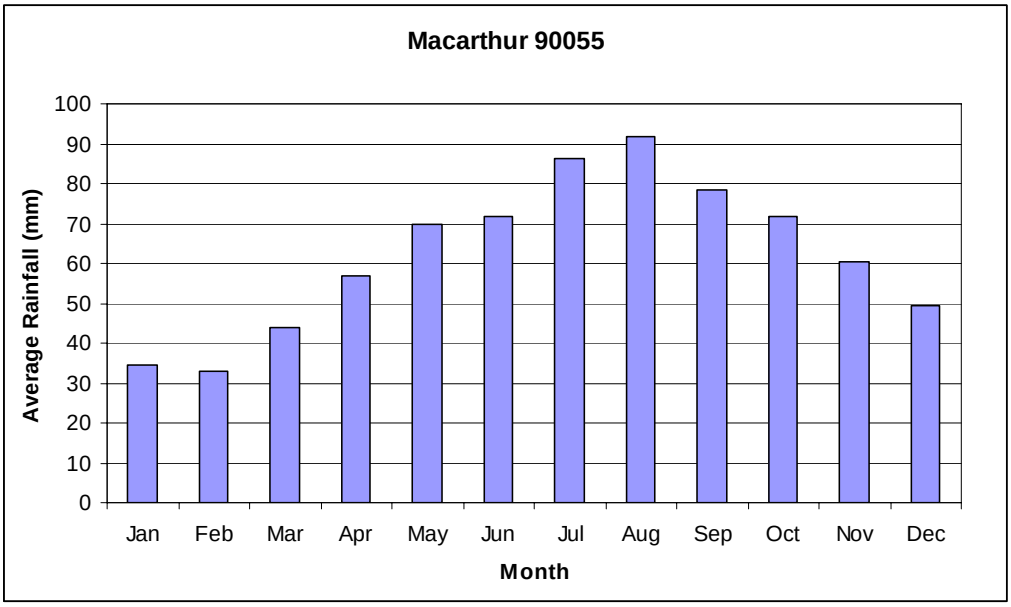
The local government is the Moyne Shire Council, and the local catchment management authority is the Glenelg Hopkins Catchment Management Authority (CMA). The rural water authority for the area which includes the site is Southern Rural Water (SRW).

The project area is currently zoned as farming zone, with the predominant land use consisting of freehold agricultural land, including perennial grasses and some irrigated crops. There are significant areas of hardwood timber plantations extending from approximately 4 km southwest of the site (Figure 2).

2.2 Climate

The area has a temperate climate with hot, dry summers and cool, wet winters. The nearest metrological station is Macarthur (22km to north west), which shows a mean yearly rainfall total of 749mm (Chart 2-1).

Chart 2-1 Mean Monthly Rainfall Totals –Station: 90055 Macarthur



2.3 Hydrology

The TPS site is relatively flat, with elevation of 90m AHD in the north to 75m AHD in the southwest corner.

The surface geology has created poorly developed and disordered drainage on the site, characterised by a shallow 5,000 m^2 wetland and shallow ephemeral drainage (Biosis, 2008). Three designated surface water bodies exist within or in the immediate vicinity of the study area. Back Creek and Moyne River are located east of the site and Shaw River is located to the west. Back Creek which flows south towards the coast is the closest to TPS and is located approximately 2 km from the eastern site boundary. Figure 4 illustrates the location of the creeks relative to TPS.

None of the surface water features within the study area registered are by Department of Sustainability and Environment (DSE) as Groundwater Dependent Ecosystems (GDEs). Further, the GMS information on the bores in the vicinity of the site suggest that depth to groundwater is greater than 10m below ground level which is below wetland and creek/river levels.

2.4 Geology

The TPS site is regionally located within the Otway Geological Basin. The geological profile within this part of the basin, in the order of youngest to oldest, is summarised in Table 2-1.

Table 2-1 Geological Summary

Geological Age	Lithological Unit/Group	Description
Quaternary	Recent Alluvium	Stream alluvium, flood plain and low level terrace deposits, sand, silt, clay and gravel (Qra and Qrs)
Quaternary	Newer Volcanics	Basalt, valley flows, stony rises (Qvh) Olivine basalt, limburgite, scoria and minor tuff (Qvn)
Miocene	Port Campbell Limestone	Limestone, marl, limey marl, marly limestone, chert concretions, dolomite, limestone with this siliceous sand cover, polyzoan fossils (Tmg, and Tmc)
Late Oligocene – Early Miocene	Gellibrand Marl	Marl, limestone, marly limestone, glauconitic marl (Tmi)
Oligocene	Clifton Formation	Limestone, sandy limestones and sandy marls
Middle Palaeocene – Lower Eocene	Dilwyn Formation	Sand, sandy siltstone, shale, sandy gravel, dolomitic mudstone, claystone and coal (Tad)

The two uppermost geological units; the Newer Volcanics (NV) and the Port Campbell Limestone (PCL) are relevant to this investigation and are discussed in detail below.

Newer Volcanics - NV

The NV forms the predominant geological surface feature across much of southwest Victoria. They comprise olivine basalt, limburgite, scoria and minor tuff olivine basalts, tuff, valley flows and stony rises deposits. In the Hawkesdale GMA area the NV are commonly less than 60 metres thick, often consisting of multiple lava flows generally 2-10 metres in thickness (Birch 2003). The TPS site is situated entirely on the Newer Volcanics with the basalt being described as ‘stony rises’ landform, which are characterised by rocky mounds and undulating landscapes with little or no soil and no surface drainage development (Birch 2003). Stony rises are the youngest lava landscapes of the Newer Volcanics.

Port Campbell Limestone - PCL

The Port Campbell Limestone (PCL) outcrops in areas to the southwest of the site. The PCL is middle to late Miocene in age and was deposited in a continental shelf environment. Major rock types include; limestone, marl, limey marl, marly limestone, chert concretions, dolomite, limestone with this siliceous sand cover, polyzoan fossils.

2.5 Hydrogeology

2.5.1 Groundwater Management Area

The consumption of groundwater from Victoria's aquifers is managed by geographical area. In Victoria, groundwater units are identified as Groundwater Management Areas (GMA), Water Supply Protection Areas (WSPA) or Unincorporated Areas (UA).

Groundwater Management Areas (GMA) or Water Supply Protection Areas (WSPA) have been identified by DSE as areas which have been intensively developed (or have the potential to be developed) for groundwater extraction. Groundwater extraction in areas classified as GMA or WSPAs is metered, and carefully monitored under DSE's State Observation Bore Network (SOBN). All of these areas have been allocated a Permissible Consumptive Volume (PCV). A PCV specifies the volume of water that may be extracted.

The TPS is located within the Hawkesdale GMA which is 1,412 km^2 in size and is situated between Port Fairy in the South and Mt Eccles National Park in the northwest (Figure 3). The site is located within Zone 2 of the GMA which includes all groundwater resources to a depth of 200 metres, including both the NV and PCL aquifers.

2.5.2 Registered Groundwater Users

A search of the Department of Sustainability and Environments (DSE) Groundwater Management System (GMS) was conducted of registered bores within a 5km radius of the TPS. Bore locations, including use category are presented in Figure 4. All the relevant data from the GMS search is presented in Appendix B.

In total 38 registered bores are located within 5km of the TPS site. Their uses are summarised as follows:

- 32 domestic and stock;
- 2 dairy;
- 1 registered for non-groundwater purposes (drilled on behalf of Department of Energy and Minerals);
- 1 irrigation; and
- 2 did not have a registered use listed.

2.5.3 Hydrostratigraphy

The following key hydrogeological units have been mapped in the Hawkesdale GMA;

- Newer Volcanics (NV);
- Port Campbell Limestone (PCL);
- Gellibrand Marl (regional aquitard);

- Clifton Formation aquifer;
- Narrawaturk Marl (regional aquitard), and
- Dilwyn Formation aquifer.

Newer Volcanics (NV)

The NV immediately underlies the TPS site. The NV is a fractured rock aquifer. The hydrogeological characteristics are generally highly variable, dependant on the frequency, size and degree of interconnection between fractures, vesicles and joints. The unit typically makes up multiple aquifers, separated by clay layers (tuff and/or palaeosols) which form hydraulic boundaries between water bearing zones.

Drillers logs from registered bores in the Groundwater Management System (GMS) located within a 5 km radius around the TPS site, indicate the NV varies in thickness from 15 to 37 metres with the closest 3 bores to the west of the site indicating a thickness of 17 to 20 metres.

Port Campbell Limestone (PCL)

The PCL aquifer occurs across the entire Hawkesdale GMA where it is generally confined beneath the NV, including the TPS site. The aquifer becomes unconfined where it outcrops in the south western portion of the GMA. The aquifer has both primary and secondary porosity, is karstic in part and is mostly high yielding (GHD 2005).

Using the logs from 305 database bores, SKM (2007) estimated the PCL to have thickness ranging from less than 20 metres in the northwest part of the GMA to more than 200 metres where it outcrops along the coast. The SKM (2007) report indicates the PCL is 80-100 metres thick in the TPS study area.

Although a regional aquitard is not formally mapped between the NV and PCL, SKM (2007) suggest that there is only limited hydraulic connection between the aquifers. Logs from the GMS bores search (within 5 km of the TPS site) appear to confirm this assumption, with 10 bores identified in the bore search that show some form of confining layer ranging from 0.5 to 10 metres thick.

2.5.4 Aquifer Characteristics

Table 2-2 and 2-3 summarise the key parameters of the NV and PCL aquifer's respectively based on a review of the relevant literature.

Table 2-2 Summary of NV Aquifer Characteristics

Aquifer Characteristic	Value	Comments
Depth to Groundwater	17m	Two registered bores with groundwater levels are interpreted to be screened in the NV aquifer, with values of 10 m and 16.46 m below surface.
Groundwater Flow Direction	South	Groundwater flow within the NV in the area of the site is assumed to be to the south, mirroring the surface topography. However, this may vary locally dependant on basalt layering, groundwater extraction and surface water features such as lakes and rivers.

2 Site Setting

Aquifer Characteristic	Value	Comments
Aquifer Parameters	K = 5 m/day T = 50 m2/day S = 0.03	No specific hydrogeological parameters have been reported for the NV in the immediate area of the site. SKM (2007) adopted a hydraulic conductivity of 5 m/day based on works undertaken on the NV aquifer in other GMA's. Dahlhaus (2002) reported transmissivity values ranging from 50 – 200 m^2/day and a storativity of <0.03 for the NV in the area of the Glenelg Hopkins Catchment Management Authority.

Table 2-3 Summary of PCL Aquifer Characteristics

Aquifer Characteristic	Value	Comments
Depth to Groundwater	10m	Bore 69403 appears to be screened in the PCL and reported a water level at 12.19m (measured in 1980). Given a potential decline in levels of 2m over the last decade, a water level in the order to 10m below surface is assumed.
Groundwater Flow Direction	South	Recharge to the aquifer is considered to be predominantly from rainfall in areas where the PCL outcrops and also from vertical leakage from the NV where it is confined. Regionally, discharge is to the coast, with groundwater flow to the south.
Aquifer Parameters	T = 120 m2/day S = 0.0001	SKM (2007) references two investigations in which pumping tests were conducted in bores located in the PCL aquifer. One investigation conducted by GHD in early 2006 included pumping tests in three production bores on Allanvale Farms, which reported transmissivity values ranging from 30 – 190 m^2/day with an average of 120 m^2/day and a storativity of 0.1. The second involved a bore interference assessment in Orford in 2006 which reported average transmissivity values of 230 m^2/day. Although the pumping test at Allanvale reported a storage of 0.1, it is considered more conservative to use a confined storage value (0.0001) for use in estimating extent of drawdown impacts.

It is noted that four geotechnical holes drilled on the site to a maximum depth of 8 metres reported water levels ranging from 1.8 to 3.4 metres in May 2010. The difference in levels between the geotechnical holes and the GMS bores suggests that there may be a local perched aquifer system at the site, which is not uncommon in this geological environment. Given the high potential for recharge in the 'stony rises' the occurrence of a perched system is feasible, particularly where there are relatively thin (2-10 metre) lava flows overlying comparatively impervious confining layers of clay material (palaeosols or tuff), which are common in the NV aquifer.

The closest State Observation Bores (SOB) to the study area are 111522 and 111523. The bores are located at the same site, 5.8 km north of the TPS and screened across a silty green marl (111522 - assumed to be PCL aquifer) and basalt (111523).

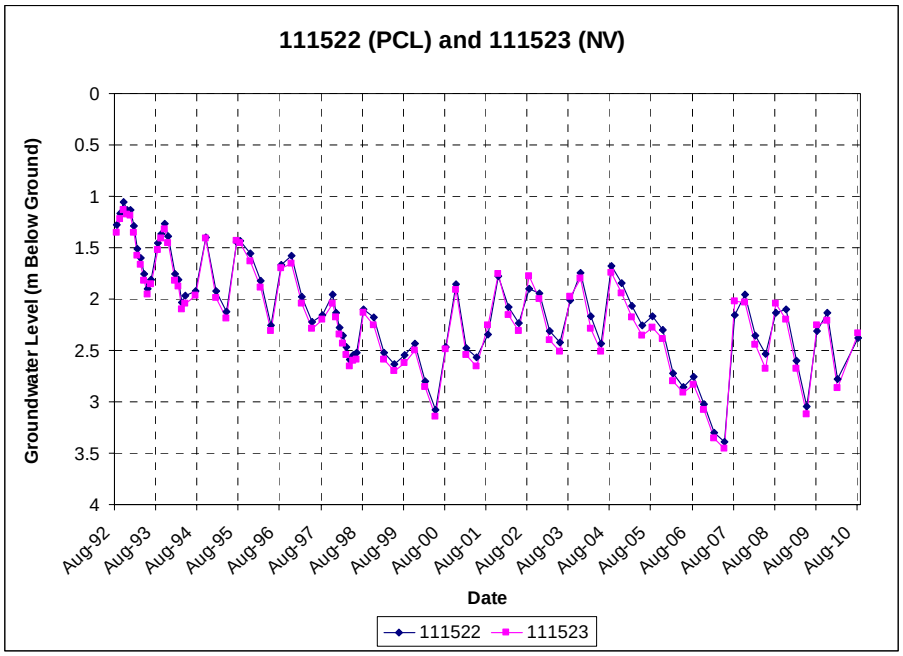
The depth to groundwater in August 2010 was 2.38 m below surface for 111522 and 2.33 m below surface for 111523.

The hydrographs of the 2 bores (Chart 2-2) indicate a strong connection between the two aquifers and pronounced seasonal variation in groundwater levels.

2 Site Setting

The hydrograph indicates there has been a steady decline in groundwater levels of approximately 1.4 metres since monitoring commenced in 1992. This trend has been assumed to represent the regional groundwater level decline for both the NV and PCL.

Chart 2-2 SOB Hydrographs



2.5.5 Groundwater Salinity

No groundwater chemistry data is available for the bores identified in the bore search. However, SKM (2007) have published regional salinity maps for the NV and PCL aquifers (Figure 2-1 and 2-2) in the Hawkesdale GMA using data drawn from bores across the GMA.

The TPS site is located at the centre of the red circle, which suggests that the estimated TDS of groundwater beneath the site is 1,000-2,000 mg/L and 2,000-3,000 mg/L for the NV and PCL respectively.

2 Site Setting

Figure 2-1 Regional PCL Salinity

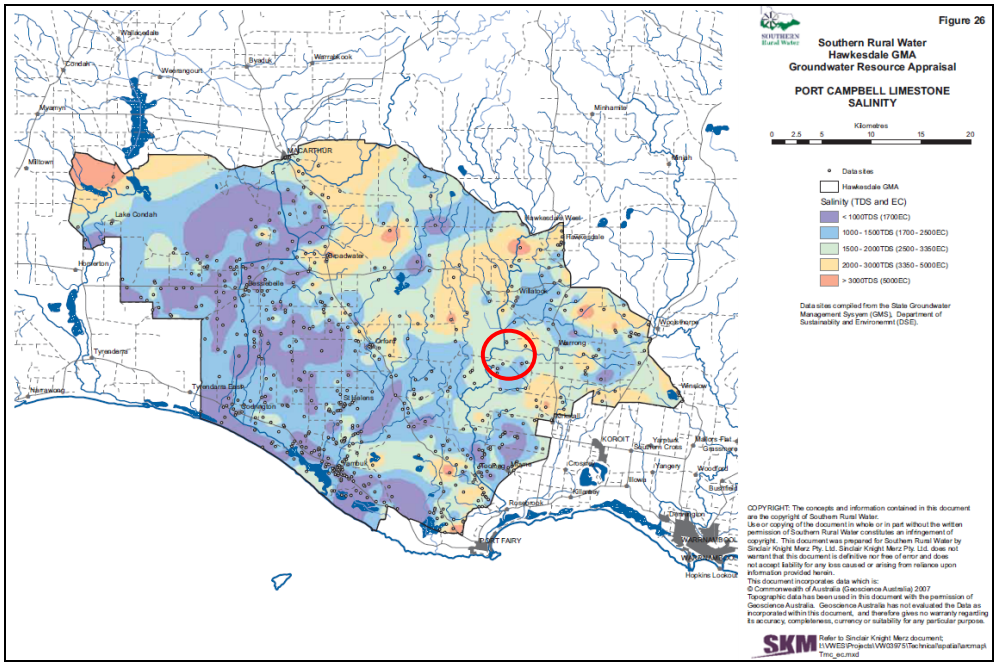
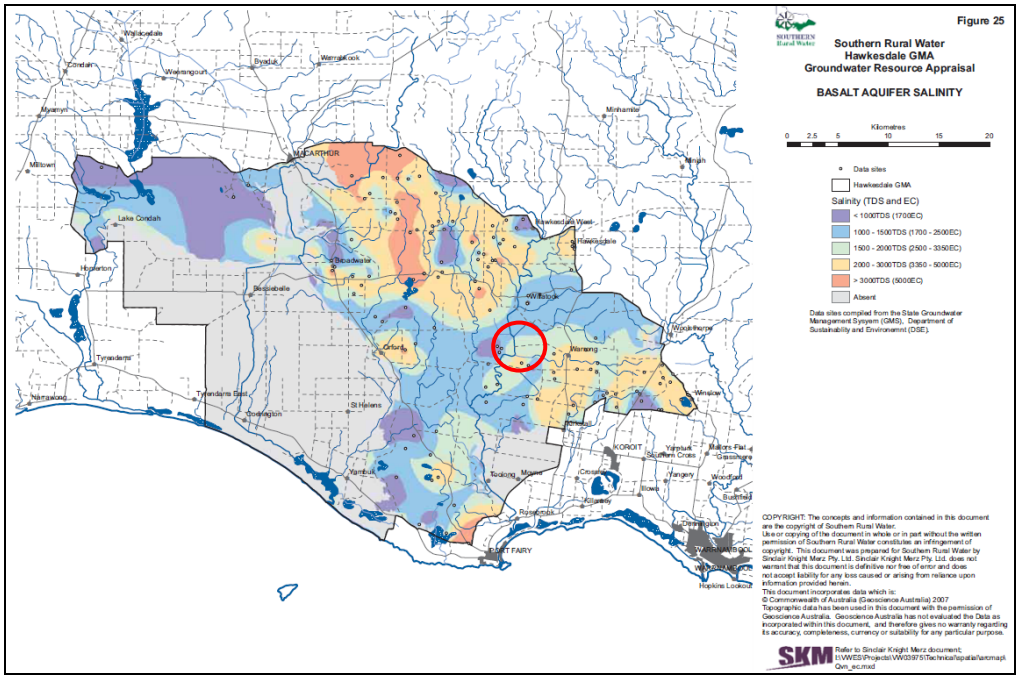


Figure 2-2 Regional NV Salinity



The State Environment Protection Policy (Groundwaters of Victoria) (1997) (SEPP(GoV) identifies the beneficial uses of groundwater to be protected on the basis of background groundwater salinity as concentration TDS in mg/L. On the basis of the above indicated groundwater salinity range of 1,000 to 3,000 mg/L TDS for both aquifers, groundwater would correspond to Segment B (defined as TDS range of 1,001 mg/L and 3,500 mg/L).

2 Site Setting

Protected beneficial uses designated by the SEPP (GoV) for Segment B groundwater include the following:

- Potable water supply (acceptable);
- Maintenance of ecosystems;
- Potable mineral water supply;
- Agricultural parks and gardens (Irrigation);
- Stock watering;
- Industrial water use;
- Primary contact recreation (e.g. swimming); and
- Buildings and structures.

3

Groundwater Extraction

3.1 TPS Water Requirements

It is understood that AGL will require a water source of up to 15 ML/year for its evaporative cooling operations at the TPS. Demand will vary throughout the year, peaking during the summer months when a maximum volume of up to 5.25 ML/month is likely to be required.

Three possible sources for this water have been identified, including;

- groundwater;
- tanked in potable water; and
- recycled water from Port Fairy.

If groundwater is chosen as the preferred source of water it has been assumed that all 15ML/year will be taken from either the Newer Volcanics or Port Campbell Limestone aquifers.

The application process to seek a licence to extract groundwater from these aquifers is outlined below.

3.2 Groundwater Management

3.2.1 Water Act 1989

Groundwater, like surface water, is administered under the *Water Act 1989*, and anyone wishing to drill for groundwater is required to apply to the relevant rural water corporation for a Bore Construction Licence (BCL). BCL licences are issued with conditions to ensure that:

- the bore is constructed to protect the groundwater resource;
- information from the bores is obtained for future reference; and
- the bore is located to minimise extraction interference with other users or the environment.

The Water Act 1989 requires that all persons who wish to extract groundwater (except domestic and stock users) apply for a groundwater licence, also known as a take and use licence.

Groundwater licences are issued to protect the rights of licence holders; ensure that water is shared amongst users; and to ensure that environmental requirements are protected.

3.2.2 Groundwater Licences

Rural Water Corporations have been delegated the responsibility for issuing groundwater licences, and in the study area the relevant authority is Southern Rural Water (SRW).

Licences are typically issued for between 1 year and 15 years with conditions relating to the exact location and depth from which groundwater can be extracted, the annual volume of water that can be pumped and the rate at which pumping can occur. These conditions ensure that:

- the bore is constructed in a way that protects the groundwater resource;
- information and data obtained in relation to the bore is recorded for future reference; and
- the bore is located so as to minimise extraction interference with other users or the environment.

When making a licence application, applicants may be required to undertake investigations commensurate with the volume applied for. These investigations may include pumping tests and environmental impact reports to ensure the extraction will have no adverse effects.

3 Groundwater Extraction

Hawkesdale GMA

The TPS is located within Zone 2 of the Hawkesdale GMA which includes all groundwater resources to a depth of 200 metres, including both the NV and PCL aquifers and has a fully allocated cap of 11,752 ML/year (2008 data) (http://gmu.geomatic.com.au). The permissive consumptive volume (PCV) was declared at 16,161 ML/year in 2006 due to the belief that the current licence allocations were at or above the sustainable extraction volumes for the aquifer. As a result, no new licences are being issued. Therefore, in order to obtain a license, an existing allocation must be traded.

It is understood from initial enquires made by AGL to SRW (Mick Fennessy[1]) that the purchase/trade of a 15 ML/year Groundwater Extraction Licence (GEL) from within the Hawkesdale GMA should be relatively easy to obtain.

3.3 Target Aquifer for TPS

Both the NV and PCL aquifers have been assessed for the potential impacts from groundwater extraction. However, a review of the local hydrogeology suggests that the optimal target for a 15 ML/year supply would be the PCL due to its yield potential and saturated thickness (available drawdown).

3.4 Application Process

Any proposal to extract groundwater at the site must be in accordance with SRW requirements, including Bore Construction Licence (BCL), and possibly a hydrogeological assessment in accordance with SRW guidelines. Although, the initial indication from Mick Fennesy (SRW) was that this may not be required.

As the TPS is located within a GMA, has a wetland feature on the site and is located within 1 km of a registered bore (not owned by the applicant), it would be classified as a Tier 3 application.

To meet the expectations of a Tier 3 application, the following investigation works (outside those covered in this report) may need to be completed:

- drill and install proposed groundwater production bore;
- step and constant rate pumping tests and detailed analysis, and;
- desktop numerical modelling to predict extent of drawdown based on anticipated extraction rates over the TPS operation period.

[1] Manager Licensing Administration - West

4

Impact Assessment

4.1 Introduction

One of the aims of this desktop hydrogeological assessment is to identify any potential impacts groundwater extraction may have on surface water bodies and to other users of groundwater in the area surrounding the TPS site.

4.2 Surface Water Systems

A 5,000 m^2 wetland area is located on the western side of the TPS site. URS was engaged by AGL to investigate the hydrological regime of the wetland and concluded (URS, 2009a) that the wetland is entirely surface water controlled with no groundwater input.

The nearest creek to the TPS site is Back Creek which flows south approximately 2.5 km at its closest point to the site boundary. It is assumed that the base of this creek is at an elevation of approximately 68mAHD (based on topographic map), which is above an assumed water table elevation beneath the site of 65m AHD (based on a depth to water of 10m).

This conceptual model of the local creek discharging (losing) to groundwater is supported by the head differential diagram reported in SKM (2007) which demonstrates a downward hydraulic gradient of 2-10 metres exists from the NV aquifer to the PCL aquifer along Back Creek to the east of the TPS site.

In summary, the available information shows that all the surface water features in the near vicinity of the site are above the groundwater table, and wherever this is the case any reduction in water table from groundwater extraction will not have an impact.

4.3 Registered Groundwater Users

The bore search of the GMS in the study area shows that the closest groundwater users to the proposed extraction bore are;

- 69410 screened in the NV aquifer approximately 1,800 metres the east; and
- 69403 screened in the PCL aquifer approximately 750 metres to the north west.

Figure 4 presents the location of all the registered groundwater users within and surrounding TPS.

In order to determine the impact on these bores an estimation was made of the potential extent of drawdown on the local water table. This was undertaken using a numerical equation[2], which calculates drawdown at varying distances at certain times from the commencement of pumping. The validity of the Theis solution is dependent on the aquifer acting in a homogeneous and isotropic manner. On a local scale the PCL (or NV) aquifer is likely to be more heterogenic (variable), but for broader scale predictions of drawdown effects the equation and assumptions are considered appropriate.

The Theis equation has been used to estimate the likely drawdown of groundwater levels at the closest registered bores identified in the GMS bore search.

[2] the non-equilibrium Theis (1936) solution to the well equation

4 Impact Assessment

4.3.1 Extraction Scenarios

Based on the proposed water supply requirements for the TPS operations, three scenarios were used for estimating the level of drawdown at these locations, including;

1. 15 ML/year for 1 year (41 m^3/day for 365 days);
2. 5.25 ML/month for peak summer demand (175 m^3/day for 90 days); and
3. 15 ML/year for 5 years (41 m^3/day for 1,825 days); and

The following inputs for the PCL aquifer were used in the Theis calculations;

- Transmissivity – 120 m^2/day (GHD 2006) & 230 m^2/day (SKM 2007);
- Storage – 0.0001 (estimated confined aquifer value); and
- No leakage.

Due to the limited information available to establish accurate hydraulic properties for the aquifers, conservative values from the range available have been used for the Theis equation inputs. Therefore, the actual drawdown is likely be less than those reported in the drawdown estimates below.

4.3.2 Drawdown Estimates

The recommended guideline limit for loss of available drawdown from interference effects is 10%. Above this value SRW may either reject the licence application or require mitigation measures to ensure no impact on neighbouring bores.

Tables 4-1 summarises the results of the estimate drawdown at the closest registered bores screened in PCL aquifer.

Table 4-1 Estimate of Drawdown (metres) at 69403

Aquifer	Parameters T	Parameters S	Scenario 1 - 15ML in 1 year (41m^3 day)	Scenario 2 - 15ML 3 months (175m^3 day)	Scenario 3 - 15ML/yr 5 years (41m^3 day)
PCL	120	0.0001	0.21 m	0.70 m	0.25 m
	230	0.0001	0.16 m	0.41 m	0.14 m

The bore search results indicate bore 69403 has a screened interval from 30-38 metres and a reported SWL of 12.19 (measured in 1980). Assuming these details remain valid there is 26 metres of available drawdown for this bore. However, if it was assumed that the declining trend in groundwater levels as observed in SOB 111522 (Chart 2-2) is occurring over the entire study area, including the seasonal fluctuation, then the available drawdown would be reduced by approximately 2 metres.

Therefore, for the worst case scenario, the estimated drawdown of 0.7 metres (an extraction rate of 175 m^3 over a 90 day period), represents less than 3% of that available. This level of drawdown on a neighbouring bore is not considered to represent an unacceptable impact.

5

Conclusions

The conclusions of the desktop assessment are the following:

- The aquifers beneath the TPS include the Newer Volcanics basalt and the underlying Port Campbell Limestone. Although regionally reported to be hydraulically separate, it is considered likely that the aquifers are connected to some degree at or in the near vicinity of the site.
- The depth to groundwater appears to be in the order of 10 to 15m below ground, with minimal difference between groundwater levels in the NV and PCL aquifers. However, it is noted that there is potentially a perched or local groundwater system that has groundwater levels of less than 3m below ground based on a number of holes drilled recently for geotechnical purposes.
- The majority of groundwater extraction in the immediate area of TPS is reported to be from the PCL, with the exception of a number of Stock and Domestic bores that appear to be screened in the overlying basalts.
- Any extraction of groundwater for the use at TPS is likely to target the PCL. However, given that the NV and PCL aquifers are connected and the groundwater levels are the effectively the same, the impact assessment has considered them as one aquifer.
- The surface water system of Back Creek and the wetland located on the TPS site are interpreted to be above the local groundwater table and unlikely to receive any groundwater contributions in the immediate area of the site. Therefore, any drawdown created from groundwater extraction will not impact on the surface water systems that surround the TPS site.
- Predictions on the extent of drawdown from a maximum extraction of up to 15ML/year, or from a maximum extraction of up to 5.25 ML/month for the peak summer demand, suggest that there will be no unacceptable impacts on any registered bores surrounding the TPS.

6

Recommendations

The following recommendations are made to ensure the optimal management of groundwater extraction. The recommendations are not considered necessary for the application of the licence transfer.

- survey of the neighbouring bores to confirm their, existence, use, location and construction details; and
- conduct a pumping test in the constructed production bore to assess well efficiency and confirm the aquifer characteristics assumed herein and the appropriate pumping regime.

7

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8

Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of AGL Energy Limited and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated November 2010.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between November 2010 and January 2011 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the frequency and method of sampling, and the uniformity of conditions as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.

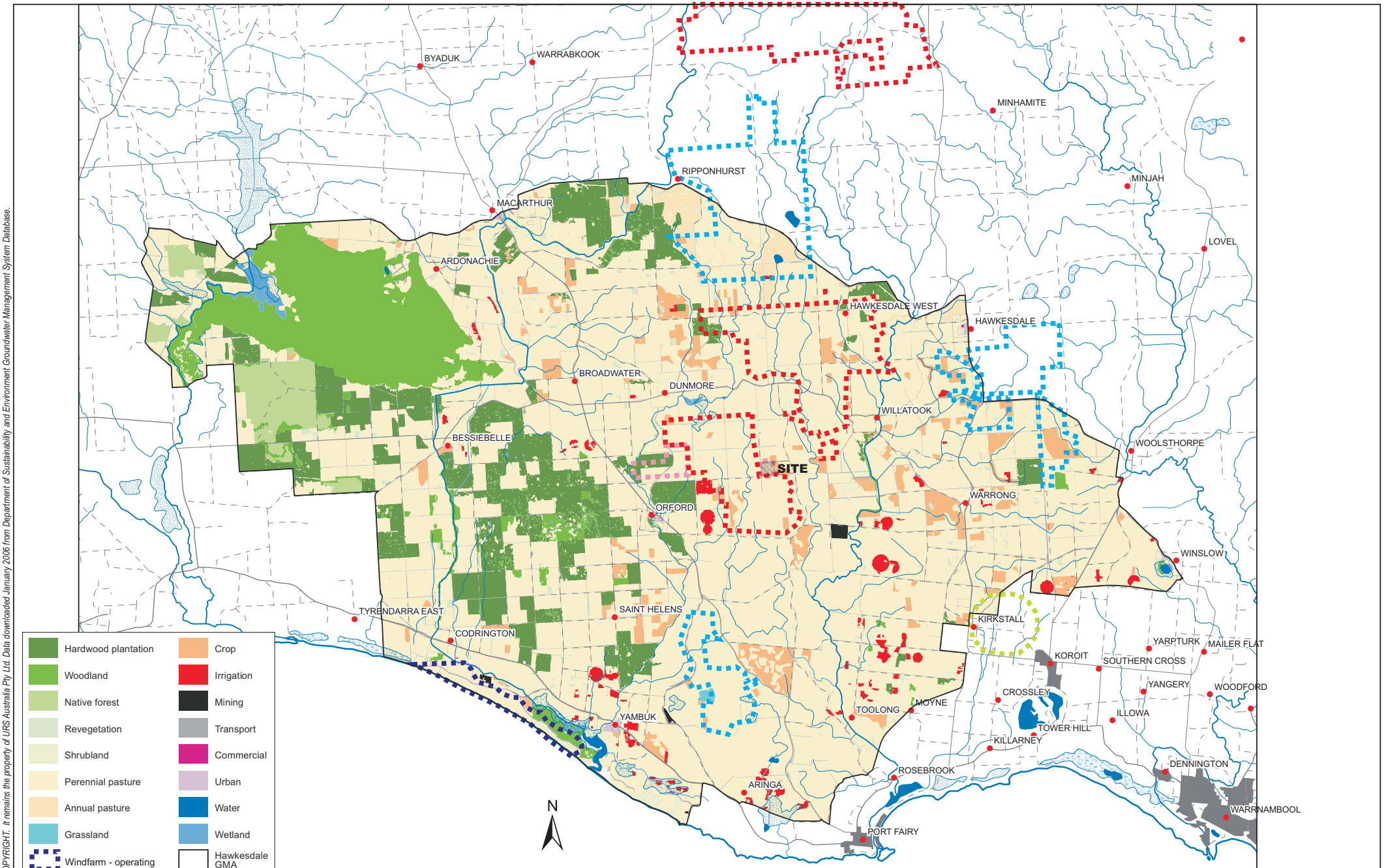
A

Appendix A Figures

Source: VicRoads

Client: AGL ENERGY LIMITED	Project: DESKTOP HYDROGEOLOGICAL ASSESSMENT - TARRONE POWER STATION		Title: **SITE MAP**
URS	Designed: MH / Drawn: LLB	Checked: / Approved:	Date: Dec. 2010 / Status: Draft	File No. Fig 1.cdr / Job No.: **43283491**	Figure: **1**	Rev. A / A4

J:\JOBS\43283491\5 Works\Groundwater\Hydro Report\Figures



Source: SKM - Fig. 11 Southern Rural Water Hawkesdale GMA Groundwater Resource Appraisal and Moyne Shire Energy Sites - August 2009

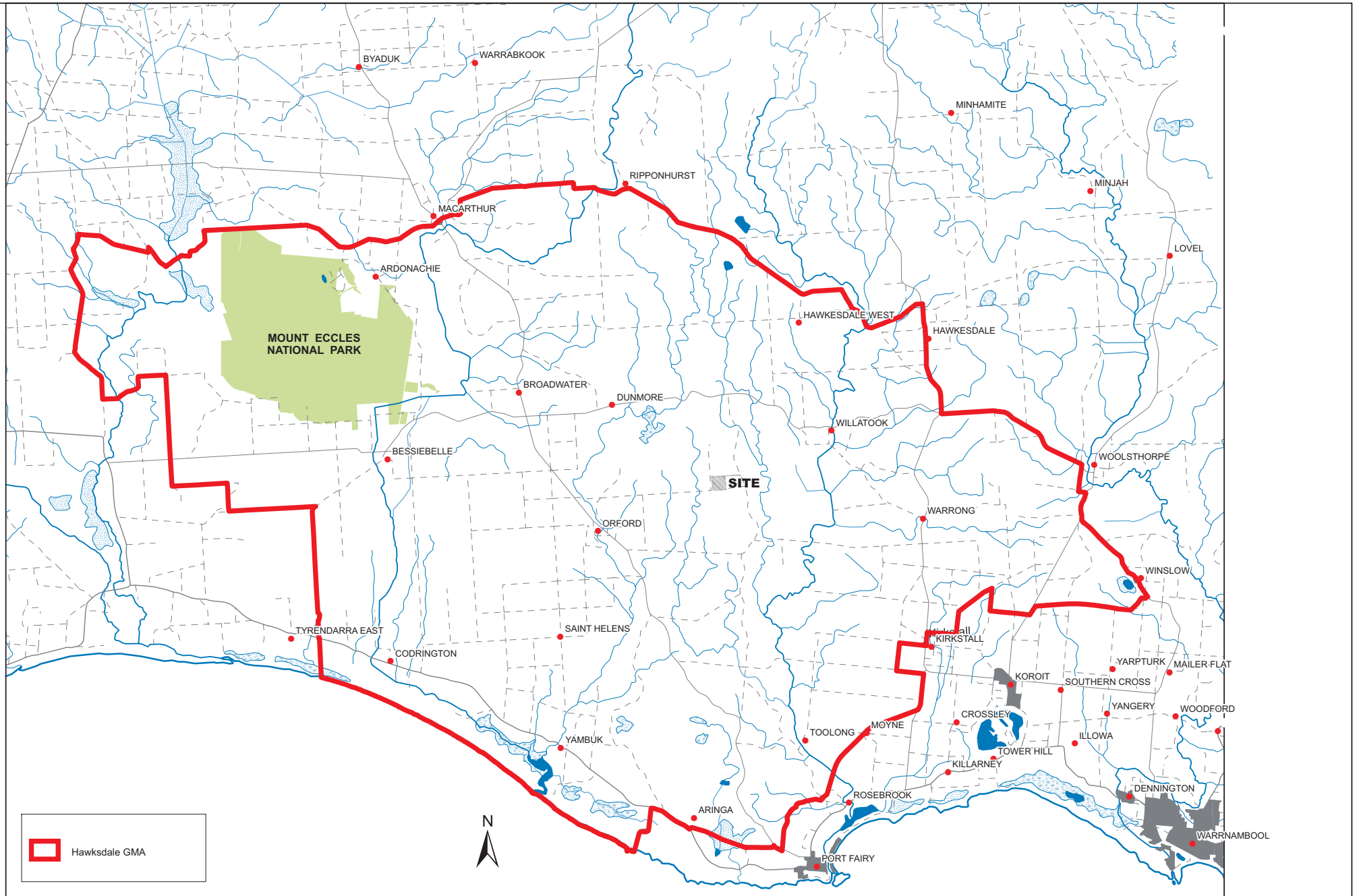
Client: AGL ENERGY LIMITED

Project: DESKTOP HYDROGEOLOGICAL ASSESSMENT - TARRONE POWER STATION

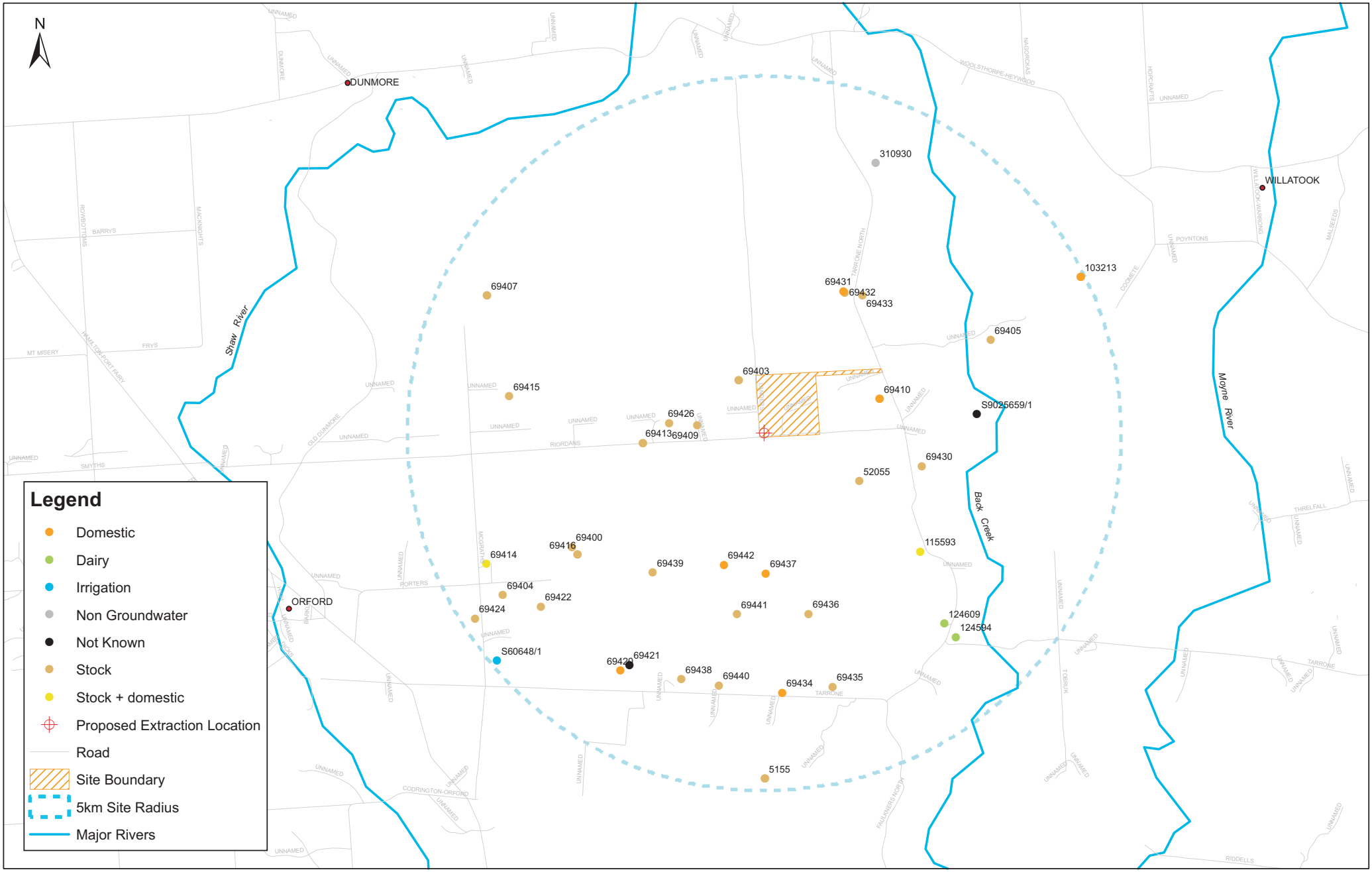
Title: REGIONAL DEVELOPMENT PROJECTS

URS

Designed: MR / KH	Checked:	Date: Dec. 2010	Job No.: 43283491	FIGURE 2	Rev. A
Drawn: JLL	Approved:	Status: Draft	File No.: Figure 2.cdr		A3



Client: AGL ENERGY LIMITED	Project: DESKTOP HYDROGEOLOGICAL ASSESSMENT - TARRONE POWER STATION	Title: HAWKSDALE GMA	
URS	Designed: MR / KH; Drawn: JLL; Checked:; Approved:; Date: Dec. 2010; Status: Draft; Job No.: 43283491; File No.: Figure 3.cdr	FIGURE 3	Rev. A; A3



Client: AGL ENERGY LIMITED	Project: DESKTOP HYDROGEOLOGICAL ASSESSMENT - TARRONE POWER STATION	Title: REGISTERED BORES	
URS	Designed: MR / KH; Drawn: JLL; Checked:; Approved:; Date: Dec. 2010; Status: Draft; Job No.: 43283491; File No.: Figure 4.cdr	FIGURE 4	Rev. A; A3

B

Appendix B GMS Bore Search Results

Aquifer Test Report

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Date	Interval (m) From	To	Activity	Lithology	Drawdown (m)	Yield	Static level	Reduced level	Pump Rate	Pump Depth
Bore No: 103213										
18/04/1974	22.6	24.7	DEV	NOT	15.240	0.883	3.040 m	m		m
Bore No: 115593										
5/05/1993	38.4	53.3	DEV				m	m	60	m
Bore No: 51155										
21/02/1984	29.8	35	DEV	LMST		0.253	4.520 m	m		m
Bore No: 69403										
5/05/1980	30.5	38.1	DEV	LMST	6.100	1.263	12.190 m	m		m
Bore No: 69404										
17/07/1982	19.5	26.5	DEV	LMST	6.710	1.010	15.850 m	m	120	m
Bore No: 69405										
29/05/1982	24.4	42.7	DEV	NOT	4.830	1.010	17.680 m	m	180	m
Bore No: 69407										
9/12/1982	2.13	32.9	DEV	BASA	3.610	1.010	16.460 m	m	60	m
Bore No: 69409										
7/05/1983	22	28.7	DEV	MARL	4.520	1.010	11.540 m	m	60	m
Bore No: 69410										
17/01/1984	30	40	DEV	CLAY		1.000	10.000 m	m		m
Bore No: 69413										
5/03/1984	28.0	40.7	DEV	LMST	4.220	1.010	11.540 m	m	60	m
Bore No: 69414										
2/02/1984	25	37.8	DEV	LMST	3.300	1.010	16.660 m	m	120	m
Bore No: 69415										
7/07/1985	36.6	45.7	DEV	LMST	2.740	1.010	25.600 m	m	120	m
Bore No: 69416										
13/12/1985	38.1	42.7	DEV	LMST		1.263	m	m		m
Bore No: 69430										
20/12/1990	35.3	39.6	DEV	LMST	7.620	1.263	13.710 m	m		m

Chemistry Report

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Bore No **103213**

Date *24.04.1974*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
409.000		116.00000							2.500	479.0000	

Bore No **115593**

Date *05.05.1993*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*

Bore No **51155**

Date *21.02.1984*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
378.049		50.000000	310.00000						2.700	250.0000	

Bore No **69400**

Date *15.04.1975*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
440.000	21.000	81.000000							0.300	296.0000	

Bore No **69403**

Date *05.05.1980*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
503.000		81.000000								305.0000	

Bore No **69404**

Date *17.07.1982*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
533.000		219.00000							1.000	661.0000	

Bore No **69405**

Date *29.05.1982*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
1140.00		141.00000							3.000	248.0000	

Bore No **69407**

Date *09.12.1982*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
463.000		46.000000								120.0000	

Bore No **69409**

Date *07.05.1983*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*

Date *07.05.1983 01:00:00*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*

Bore No **69410**

Date *17.01.1984*

HCO3 (mg/L)	CO3 (mg/L)	CA (mg/L)	ALK (mg/L)	DO (mg/L)	EH (mV-3)	EC (uS/cm)	PH Field	AL (mg/L)	FE (mg/L)	NA (mg/L)	PB (mg/L)
439.023		140.00000	360.00000						0.250	690.0000	

Bore No 69413

Date *05.03.1984*

HCO3 (mg/L)	CO3 (mg/L)	CA (mg/L)	ALK (mg/L)	DO (mg/L)	EH (mV-3)	EC (uS/cm)	PH Field	AL (mg/L)	FE (mg/L)	NA (mg/L)	PB (mg/L)
609.755		100.00000	500.00000						0.170	400.0000	

Bore No 69414

Date *02.02.1984*

HCO3 (mg/L)	CO3 (mg/L)	CA (mg/L)	ALK (mg/L)	DO (mg/L)	EH (mV-3)	EC (uS/cm)	PH Field	AL (mg/L)	FE (mg/L)	NA (mg/L)	PB (mg/L)
463.415		130.00000	380.00000						0.380	460.0000	

Date *02.02.1984 01:00:00*

HCO3 (mg/L)	CO3 (mg/L)	CA (mg/L)	ALK (mg/L)	DO (mg/L)	EH (mV-3)	EC (uS/cm)	PH Field	AL (mg/L)	FE (mg/L)	NA (mg/L)	PB (mg/L)
463.415		130.00000	380.00000						0.380	460.0000	

Bore No 69415

Date *07.07.1985*

HCO3 (mg/L)	CO3 (mg/L)	CA (mg/L)	ALK (mg/L)	DO (mg/L)	EH (mV-3)	EC (uS/cm)	PH Field	AL (mg/L)	FE (mg/L)	NA (mg/L)	PB (mg/L)

Bore No 69416

Date *13.12.1985*

HCO3 (mg/L)	CO3 (mg/L)	CA (mg/L)	ALK (mg/L)	DO (mg/L)	EH (mV-3)	EC (uS/cm)	PH Field	AL (mg/L)	FE (mg/L)	NA (mg/L)	PB (mg/L)

402.438		53.000000	330.00000						100.0	230.0000	

Bore No **69430**

Date *20.12.1990*

HCO3 (mg/L)	*CO3 (mg/L)*	*CA (mg/L)*	*ALK (mg/L)*	*DO (mg/L)*	*EH (mV-3)*	*EC (uS/cm)*	*PH Field*	*AL (mg/L)*	*FE (mg/L)*	*NA (mg/L)*	*PB (mg/L)*
487.804		120.00000	400.00000							480.0000	

Construction 1 Report

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Bore Number 103213 **start date** 18/04/1974

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
22.6	24.7	SCREEN	NKN							NOT	
0	24.7	CASING	NKN	127.000							

Bore Number 115593 **start date** 5/05/1993

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
-0.3	38.4	CASING	STL	139.000							
38.4	53.3	SCREEN	STL								

Bore Number 51155 **start date** 21/02/1984

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	29.8	CASING	PVC	127.000							
29.8	35	SCREEN	PVC				N			LMST	

Bore Number 69400 **start date** 8/04/1975

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	10.7	CASING	NKN	152.000							

Bore Number 69403 **start date** 5/05/1980

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	30.5	CASING	PVC	127.000							
30.5	38.1	SCREEN	PVC				N			LMST	

Bore Number 69404 **start date** 17/07/1982

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	19.5	CASING	MST	140.000							
19.5	26.5	SCREEN	MST				N			LMST	

Bore Number 69405 **start date** 29/05/1982

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	24.4	CASING	PVC	165.000							
24.4	42.7	SCREEN	PVC				N			NOT	

Bore Number 69407 **start date** 9/12/1982

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
2.13	32.9	SCREEN	STL				N			BASA	
0	2.13	CASING	STL	152.000							

Bore Number 69409 **start date** 7/05/1983

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	22	CASING	STL	127.000							
22	28.7	SCREEN	STL				N			MARL	

Bore Number 69410 **start date** 17/01/1984

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0.5	30	CASING	PVC	127.000							
30	40	SCREEN	PVC				N			CLAY	

Bore Number 69413 **start date** 5/03/1984

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	28.0	CASING	NKN	140.000							
28.0	40.7	SCREEN	NKN				N			LMST	

Bore Number 69414 **start date** 2/02/1984

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
25	37.8	SCREEN	STL				N			LMST	
0	25	CASING	STL	165.000							

Bore Number 69415 **start date** 7/07/1985

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	36.6	CASING	PVC	140.000							
36.6	45.7	SCREEN	PVC				N			LMST	

Bore Number 69416 **start date** 13/12/1985

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
0	38.1	CASING	MST	127.000							
38.1	42.7	SCREEN	MST				N			LMST	

Bore Number 69430 **start date** 20/12/1990

interval from	to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
-0.3	35.3	CASING	STL	127.000							
35.3	39.6	SCREEN	STL				N			LMST	

Bore Number	S60648/1	start date	3/04/2003

interval from	interval to	type	lining material	inner diameter	outer diameter	aperture	filter sock	length	width	lithology	trade name
25	76	OPENH									
-5	25	CASING	STL	250	274						

Construction 2 Report

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Bore No	**69400**	*start_date*	8/04/1975

material	*interval from*	*to*	*gravel size*	*packing method*	*seal diametre*	*seal_type*
CEM	0	3.66				

Bore No	**S60648/1**	*start_date*	3/04/2003

material	*interval from*	*to*	*gravel size*	*packing method*	*seal diametre*	*seal_type*
CEM	0	15				

Drillers' Logs

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Bore No	Date	From (m)	To (m)	Material
103213	18/04/1974	0.3	1.52	ORANGE CLAY
103213	18/04/1974	1.52	16.46	WEATHERED BASALT
103213	18/04/1974	16.46	22.55	ORANGE CLAY
103213	18/04/1974	22.55	24.68	LIMESTONE
103213	18/04/1974	0	0.3	EARTH
115593	5/05/1993	35	53.33	LIMESTONE
115593	5/05/1993	0	13.71	CLAY
115593	5/05/1993	13.71	26.2	DECOMPOSED STONE
115593	5/05/1993	26.2	28.95	YELLOW CLAY
115593	5/05/1993	28.95	35	CLAY & STONE
51155	21/02/1984	26.51	35	LIMESTONE
51155	21/02/1984	23.76	26.51	YELLOW CLAY
51155	21/02/1984	20.71	23.76	BROWN CLAY
51155	21/02/1984	19.5	20.71	SAND
51155	21/02/1984	0	0.61	RUBBLY STONE
51155	21/02/1984	0.61	19.5	BASALT
69400	8/04/1975	10	18.8	LIMESTONE
69400	8/04/1975	0	10	CLAYS
69403	5/05/1980	28.65	38.1	LIME STONE

Bore No	Date	From (m)	To (m)	Material
69403	5/05/1980	18.28	28.65	GREEN SANDY CLAY
69403	5/05/1980	0	2.13	RUBBLY STONE
69403	5/05/1980	13.71	18.28	BROWN ROCK AND CLAY
69403	5/05/1980	2.13	13.71	BASALT
69404	17/07/1982	16.46	26.51	LIMESTONE
69404	17/07/1982	0	0.61	TOP SOIL
69404	17/07/1982	0.61	2.44	CLAY
69404	17/07/1982	2.44	7.93	STONE
69404	17/07/1982	7.93	16.46	CLAY
69405	29/05/1982	40.8	42.67	MARL
69405	29/05/1982	37.49	40.8	LIMESTONE
69405	29/05/1982	37.19	37.49	CLAY
69405	29/05/1982	17.07	37.19	STONE
69405	29/05/1982	0	7.93	STONE
69405	29/05/1982	7.93	17.07	CLAY
69407	9/12/1982	0	32.92	STONE (BASALT?)
69409	7/05/1983	20.73	27.12	LIMESTONE
69409	7/05/1983	17.07	20.73	CLAY
69409	7/05/1983	27.12	28.65	MARL
69409	7/05/1983	0	17.07	STONE
69410	17/01/1984	0	11	CLAY

Bore No	Date	From (m)	To (m)	Material
69410	17/01/1984	11	33	BASALT
69410	17/01/1984	33	40	CLAY
69413	5/03/1984	26.82	37.8	LIMESTONE
69413	5/03/1984	37.8	40.7	MARL
69413	5/03/1984	19.51	26.82	CLAY
69413	5/03/1984	0.3	19.51	BASALT
69413	5/03/1984	0	0.3	TOP SOIL
69414	2/02/1984	0.61	10.32	CLAY
69414	2/02/1984	10.32	19.2	CLAY AND STONE
69414	2/02/1984	19.2	23.78	CLAY
69414	2/02/1984	23.78	35.92	LIMESTONE
69414	2/02/1984	35.92	37.8	MARL
69414	2/02/1984	0	0.61	TOP
69415	7/07/1985	0	0.3	TOP SOIL
69415	7/07/1985	33.48	45.72	LIMESTONE
69415	7/07/1985	32	33.48	CLAY
69415	7/07/1985	0.3	1.83	CLAY
69415	7/07/1985	1.83	32	STONE
69416	13/12/1985	36.58	42.67	LIMESTONE
69416	13/12/1985	0	0.61	RUBBLY STONE
69416	13/12/1985	0.61	9.71	BASALT

Bore No	Date	From (m)	To (m)	Material
69416	13/12/1985	9.71	13.71	RED CLAY
69416	13/12/1985	13.71	32	BROWN CLAY
69416	13/12/1985	32	36.58	YELLOW CLAY
69430	20/12/1990	32.3	39.58	LIMESTONE
69430	20/12/1990	25.6	32.3	BROWN CLAY
69430	20/12/1990	0	0.91	BROWN CLAY
69430	20/12/1990	0.91	25.6	BROWN STONE
S60648/1	3/04/2003	69.5	76	MARL
S60648/1	3/04/2003	0	0.3	TOP SOIL
S60648/1	3/04/2003	0.3	19.2	CLAY
S60648/1	3/04/2003	19.2	23	CLAY AND LIMESTONE
S60648/1	3/04/2003	23	69.5	LIMESTONE

Location Report

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
103213	18/04/1974		MGA Zone	54	607494.352
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5775096.467	81780.281	5765029.637	18/04/1974	24.68	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
103213	18/04/1974		MGA Zone	54	607494.352
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5775096.467	81780.281	5765029.637	18/04/1974	24.68	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
115593	18/03/1994		MGA Zone	54	605001.346
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771406.454	79526.934	5761178.116	05/05/1993	53.33	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
115593	18/03/1994		MGA Zone	54	605001.346
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771406.454	79526.934	5761178.116	05/05/1993	53.33	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
124594	1/06/1995		MGA Zone	54	605421.348
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770176.451	80026.772	5759975.464	01/01/1800	35	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST	DY	N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
124594	1/06/1995		MGA Zone	54	605421.348
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770176.451	80026.772	5759975.464	01/01/1800	35	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST	DY	N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
124594	1/06/1995		MGA Zone	54	605421.348
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770176.451	80026.772	5759975.464	01/01/1800	35	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST	DY	N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
124609	1/06/1995		MGA Zone	54	605271.348
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770376.451	79863.795	5760165.711	01/01/1800	16	DY
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
310930	31/12/1985		MGA Zone	54	604728.343
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5776876.471	78899.011	5766630.108	31/12/1985	2608	NG
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
51155	21/02/1984		MGA Zone	54	602621.34
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5768376.444	77343.826	5757993.689	21/02/1984	35	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
52055	21/11/1995		MGA Zone	54	604211.343
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5772449.457	78669.268	5762169.776	01/01/1970	17	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69400	8/04/1975		MGA Zone	54	600131.331
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771785.453	74632.463	5761240.924	08/04/1975	18.8	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69403	5/05/1980		MGA Zone	54	602615.338
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5773967.461	76974.804	5763584.137	05/05/1980	38.1	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69404	17/07/1982		MGA Zone	54	599121.328
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771176.451	73661.996	5760566.339	17/07/1982	26.51	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69405	29/05/1982		MGA Zone	54	606176.349
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5774299.464	80514.092	5764147.19	29/05/1982	42.67	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69407	9/12/1982		MGA Zone	54	599171.327
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5775376.464	73439.384	5764769.663	09/12/1982	32.92	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69409	7/05/1983		MGA Zone	54	601994.336
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5773371.459	76392.497	5762947.848	07/05/1983	28.65	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69410	17/01/1984		MGA Zone	54	604571.344
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5773576.461	78956.104	5763320.085	17/01/1984	40	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69410	17/01/1984		MGA Zone	54	604571.344
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5773576.461	78956.104	5763320.085	17/01/1984	40	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69413	5/03/1984		MGA Zone	54	601221.334
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5773176.458	75632.163	5762702.679	05/03/1984	40.7	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69414	2/02/1984		MGA Zone	54	598921.328
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771626.452	73432.773	5761003.36	02/02/1984	37.8	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69414	2/02/1984		MGA Zone	54	598921.328
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771626.452	73432.773	5761003.36	02/02/1984	37.8	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69415	7/07/1985		MGA Zone	54	599391.328
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5773952.46	73751.791	5763359.911	07/07/1985	45.72	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69416	13/12/1985		MGA Zone	54	600201.331
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771676.453	74709.54	5761136.469	13/12/1985	42.67	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69420	1/01/1988		MGA Zone	54	600697.334
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770016.448	75313.335	5759508.68	01/01/1988	54	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69420	1/01/1988		MGA Zone	54	600697.334
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770016.448	75313.335	5759508.68	01/01/1988	54	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69421	1/01/1988		MGA Zone	54	600830.334
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770085.448	75441.853	5759586.318	01/01/1988	7.6	NKN
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69422	1/01/1988		MGA Zone	54	599645.33
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770979.451	74198.795	5760403.362	01/01/1988	17.8	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69424	1/01/1988		MGA Zone	54	598711.327
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770875.45	73271.534	5760238.709	01/01/1988	24.4	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69426	1/01/1988		MGA Zone	54	601605.335
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5773431.459	75999.608	5762982.6	01/01/1988	24.4	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69430	20/12/1990		MGA Zone	54	605101.346
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5772596.458	79549.679	5762374.537	20/12/1990	39.58	ST
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69431	1/01/1988		MGA Zone	54	604161.342
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5775116.465	78446.199	5764833.41	01/01/1988	24	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69431	1/01/1988		MGA Zone	54	604161.342
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5775116.465	78446.199	5764833.41	01/01/1988	24	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69432	1/01/1988		MGA Zone	54	604181.342
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5775096.465	78467.496	5764814.708	01/01/1988	60	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69433	1/01/1988		MGA Zone	54	604421.343
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5775036.465	78711.377	5764770.282	01/01/1988	12	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69434	1/01/1988		MGA Zone	54	602941.341
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5769556.448	77587.165	5759194.435	01/01/1988	23	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69434	1/01/1988		MGA Zone	54	602941.341
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5769556.448	77587.165	5759194.435	01/01/1988	23	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69435	1/01/1988		MGA Zone	54	603651.343
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5769596.448	78294.538	5759280.547	01/01/1988	36	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69436	1/01/1988		MGA Zone	54	603381.342
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770636.451	77957.01	5760302.969	01/01/1988	33	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69437	1/01/1988		MGA Zone	54	602821.34
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771236.453	77358.071	5760866.585	01/01/1988	27	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69437	1/01/1988		MGA Zone	54	602821.34
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771236.453	77358.071	5760866.585	01/01/1988	27	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69438	1/01/1988		MGA Zone	54	601541.336
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5769836.448	76169.016	5759383.498	01/01/1988	28	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69439	1/01/1988		MGA Zone	54	601241.335
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771356.453	75770.313	5760883.995	01/01/1988	30	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69440	1/01/1988		MGA Zone	54	602061.338
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5769716.448	76696.799	5759297.274	01/01/1988	28	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69441	1/01/1988		MGA Zone	54	602381.339
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770696.451	76953.147	5760298.031	01/01/1988	28	ST
Use Code2	**Use Code3**	**Lithological Data**			
		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69442	1/01/1988		MGA Zone	54	602241.338
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771396.453	76767.698	5760988.923	01/01/1988	28	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
69442	1/01/1988		MGA Zone	54	602241.338
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5771396.453	76767.698	5760988.923	01/01/1988	28	DM
Use Code2	**Use Code3**	**Lithological Data**			
ST		N			

Site	Date Effective	Date Retired	Area Type	Area No	Zone 54 Easting
S60648/1	22/10/2004		MGA Zone	54	598983.189
Zone 54 Northing	**Zone 55 Easting**	**Zone 55 Northing**	**Date Completed**	**Drilled Depth**	**Use Code**
5770266.122	73582.971	5759647.027	03/04/2003	76	IR
Use Code2	**Use Code3**	**Lithological Data**			
		Y			

Stratigraphy

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Bore No	Date Logged	From	To	Method	Formation Description	End Formation

Water Levels

(data downloaded from GMS: March 2010 and provided to URS by DSE March 2010)

Bore No	*Date*	*Method*	*Elevation (mAHD)*	*RWL (mAHD)*	*DBNS (m)*	*WLDP (m)*	*Condition*

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