



Hy-Tec Industries Pty Limited

ABN: 90 070 100 702

**Austen Quarry
Stage 2 Extension Project**

**Groundwater
Assessment**

Prepared by

Ground Doctor Pty Ltd

September 2014

**Specialist Consultant Studies Compendium
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Groundwater Assessment

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EXECUTIVE SUMMARY

The proposed Stage 2 Extension of the Austen Quarry involves increasing the size and depth of the Stage 1 extraction area by 17.7ha and overburden emplacement by 5.8ha. With the exception of increasing the size and depth of the extraction area, activities at the Quarry would remain largely unchanged from those currently approved under development consent DA 103/94.

An assessment of available data indicates that groundwater is present beneath the existing extraction area at a depth of approximately 730m AHD, which is the approximately elevation of the existing extraction area floor. The proposed extension would see the extraction area extended laterally to the east and to a maximum depth of 685m AHD, some 45m below the water table.

Groundwater would have to be removed from the extraction area as it extends below the water table, resulting in a lowering of the water table below the Site. Approximately 45m of drawdown would occur within the footprint of the extended extraction area, however, drawdown is not expected to propagate a significant distance from the extraction area due to the topographic setting of the extraction area and low permeability nature of the fractured rock surrounding the extraction area.

Potential groundwater losses associated with the Stage 2 Extension were estimated using analytical methods. It is estimated that proposed Quarrying activities would result in less than 10ML/yr of groundwater take from the Coxs River Fractured Rock groundwater management unit of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* (the WSP). This would be comprised of losses associated with physical removal of rock from below the pre-development water table and ongoing seepage losses to the Quarry.

As the Stage 2 Extension would intercept the water table, the annual rate of extraction of water should be estimated and allocated against a WAL for reporting this use. The Applicant should ensure discharge of surface water and groundwater from the Quarry is appropriately licenced with the NSW Office of Water. It is understood the Applicant has made application for a zero discharge WAL and intends on making an application for a controlled allocation of water from the Coxs River Fractured Rock groundwater management unit in accordance with Controlled Allocation Order (various Groundwater Sources) (No 1) 2014 (NSW Government, 2014).

The Stage 2 Extension is classified as an aquifer interference activity and is therefore subject to the provisions of the *NSW Aquifer Interference Policy*. A semi-quantitative groundwater impact assessment has found that potential aquifer drawdown and water quality impacts associated with the Stage 2 Extension would be minimal as defined by the *NSW Aquifer Interference Policy*. The Quarry floor would remain above the nearby Coxs River at all times and as a consequence would not alter the surface water and groundwater interaction affecting the Coxs River. Groundwater users have not been identified within the maximum possible extent of drawdown impacts.

There are no high priority groundwater dependant ecosystems or culturally significant groundwater receptors, as identified by the WSP, within the Study Area. Drawdown from the Stage 2 Extension may result in a small reduction in the discharge of groundwater to the gullies between the Quarry and the Coxs River. These impacts would be restricted to the slopes immediately surrounding the extraction area only and would be very minor given the majority of surface flows within these gullies is a result of surface runoff of rainfall, not groundwater discharge. Further, as the vegetation occurring within these gullies are not considered to be groundwater dependent (Niche, 2014), no adverse impact on vegetation is

expected. In addition, accumulated groundwater in the base of the Quarry (if present) will be redirected to the Coxs River, replicating pre-development natural processes at the Site.

The proposed activities present little opportunity for contaminants to enter groundwater. With the exception of fuel, hydraulic fluids, automotive chemicals and explosives, no chemicals would be introduced into the extraction area as part of the Stage 2 Extension. Risks posed by the presence of chemicals in the Quarry can be adequately addressed through implementation of an appropriate environmental management plan for activities that have potential to result in contamination of water. Processing of extracted rhyolite is restricted to crushing and screening only. Rock within and surrounding the extraction area has low sulphur content and therefore has little or no potential to generate acid upon oxidation. Existing water quality data for water accumulated in the extraction area indicates pH consistent with the in surrounding environment, supporting the conclusion that acid generation is not, and would not occur. Continued monitoring of surface water at the site would allow for implementation of contingency measures to address unforeseen water quality impacts.

In general, the Stage 2 Extension complies with the principles of relevant NSW water management policies and guidelines. The Quarry is located in a topographically isolated environment, which would limit the lateral extent of groundwater impacts. The Stage 2 Extension is not expected to reduce the quantity of groundwater available to other groundwater users located within the Coxs River Fractured Rock groundwater management unit. Whilst water processes at the Site would change as a result of extraction, provided water that falls or discharges into the extraction area is routed into the Coxs River, no significant changes to the site water balance are expected to occur.

1 INTRODUCTION

This report presents the findings of a groundwater assessment of a proposal to extend the extraction area and overburden emplacement of the existing Austen Quarry (“the Quarry”). The Quarry is located on Lot 1 DP1005511, owned by the Hartley Pastoral Corporation Pty Ltd (HPC), approximately 3.5km south-southwest of the village of Hartley and 10km south of Lithgow (see **Figure 1** of **Annex A**). The Quarry is currently operating under Development Consent No. 103/94 (DA 103/94), which is based on the current Quarry design and operations (“Stage 1”), is approved until March 2020.

Hy-Tec proposes an extension of the extraction area and overburden emplacement covering approximately 25.5ha within Lots 1 and 2, DP1005511 and Lot 31, DP1009967 (“Stage 2 Extension”). All existing and proposed extraction, processing, stockpiling and transportation operations are located in an area leased by Hy-Tec from HPC and referred to throughout this document as “the Site”

The report was prepared for R.W. Corkery and Co. Pty. Limited (RWC) on behalf of Hy-Tec to accompany an Environmental Impact Statement for the Stage 2 Extension.

1.1 STUDY AREA

The area that is the subject of this groundwater assessment (“the Study Area”) is the area within an approximate 5km radius from the Site.

1.2 GROUNDWATER ASSESSMENT OBJECTIVES

The objectives of this assessment were to:

- identify and describe legislation and guidelines that are relevant to the protection of groundwater resources in NSW;
- identify and describe the groundwater resources within the Study Area;
- assess existing groundwater data to establish baseline conditions within the Study Area;
- identify and assess activities associated with the proposed development that have potential to impact on the quality and/or quantity of groundwater available within the Study Area; and
- estimate groundwater losses that may result from the proposed development.

1.3 SCOPE OF WORK

In order to meet the project objectives, Ground Doctor Pty Ltd (Ground Doctor) completed the following.

- Completed a review of legislation relevant to groundwater management at the Quarry to identify potential constraints on the Stage 2 Extension.
- Completed a review of available groundwater bore data and geological information to assess the location and characteristics of the fractured rock aquifers located beneath the Study Area, and to establish a conceptual model of groundwater processes within the Study Area.
- Identified existing groundwater users located within the Study Area from available groundwater bore data.
- Assessed the potential beneficial uses of groundwater within the Study Area.

- Estimated the volume of groundwater that may be lost from the extraction area as a result of the Stage 2 Extension using an analytical model.
- Conducted a qualitative assessment of the potential impacts on the availability of groundwater to other groundwater users posed by the Stage 2 Extension.
- Conducted a qualitative assessment of potential impacts to groundwater dependant ecosystems posed by the Stage 2 Extension.
- Conducted a qualitative assessment of the potential impacts to groundwater quality posed by the Stage 2 Extension.

1.4 LIMITATIONS OF THIS REPORT

The findings of this report are based on the Scope of Work outlined in *Section 1.2*. Ground Doctor performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental consulting profession. No warranties, express or implied are made.

The results of this assessment are based upon the information documented and presented in this report. All conclusions and recommendations regarding the site are the professional opinions of Ground Doctor personnel involved, subject to the qualifications made above. While normal assessments of data reliability have been made, Ground Doctor assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Ground Doctor, or developments resulting from situations outside the scope of the Stage 2 Extension.

The results of this assessment are based on the conditions of the Site identified at the time of the assessment and the Stage 2 Extension as described in *Section 2*. Ground Doctor will not be liable to revise this report to account for any changes in site characteristics, regulatory requirements, assessment criteria or the availability of additional information, subsequent to the issue date of this report. Changes to the subsurface conditions may occur subsequent to the assessment described herein, through natural processes or through human intervention. The conclusions reached in this report are based on the information obtained at the time of the assessment.

This report, including the data, findings and conclusions contained within it remains the intellectual property Ground Doctor Pty Ltd. A licence to use the report for the specific purpose identified is granted to RWC and Hy-Tec subject to full payment of the agreed project fees. Ground Doctor Pty Ltd accepts no liability for use or interpretation by any person or body other than RWC and Hy-Tec. The report should not be amended in any way without prior approval by Ground Doctor Pty Ltd. The report should not be relied upon by other parties, who should make their own enquires.

2 THE STAGE 2 EXTENSION

2.1 THE SITE

As noted in Section 1, the Site is located within private land owned by the Hartley Pastoral Corporation Pty Ltd (HPC) which is leased to Hy-Tec. The extent of HPC owned land and the boundary of the Quarry Site is shown in **Figure 1 of Annex A**. The extent of the HPC property provides a large buffer around the Site.

The Site incorporates the following component areas:

- An extraction area and associated overburden emplacement.
- A primary crushing station (within the extraction area).
- A secondary processing area and associated product stockpiling areas.
- A product stockpile area referred to as “Yorkeys Creek stockpile area”.
- Associated infrastructure including administration offices, amenities and weighbridges.
- Structures associated with sediment and erosion control.

These components of the existing Quarry are shown in **Figure 2 of Annex A**.

The Quarry Access Road provides access to the Site via Jenolan Caves Road. The Quarry Access Road is a purpose built sealed road and is the sole access to and from the Site for personnel and product transportation.

2.2 EXISTING OPERATION OF THE QUARRY

The existing approval (DA 103/94) permits the following activities:

- stripping of overburden and placement in an overburden emplacement adjoining the extraction area;
- extraction of rhyolite, an extrusive, volcanic rock, from the Stage 1 extraction area to a maximum depth of 730m AHD;
- primary crushing of extracted rhyolite in the northwest portion of the extraction area at an elevation of approximately 750m AHD;
- transfer of the primary crushed rhyolite by conveyor to a surge pile and secondary processing area which adjoins the Coxs River;
- secondary and tertiary crushing, screening and further processing of the rhyolite to produce high quality aggregates and road base products;
- stockpiling of processed and sorted product; and
- operation of administration and maintenance facilities at the Site.

2.3 PROPOSED STAGE 2 EXTENSION

The Stage 2 Extension involves increasing the size and depth of the Stage 1 extraction area by 17.7ha and overburden emplacement by 5.8ha. The footprint of the approved Stage 1 operations and Stage 2 Extension are shown in **Figure 3 of Annex A**. The primary aim of the extension is to allow access to additional rhyolite (45 million tonnes), which will extend the life of the Quarry by approximately 30 years.

Rhyolite extracted from the Quarry will continue to be crushed at the in-pit crushing station, conveyed to the secondary processing area and processed here by crushing, screening and blending. Operation of the processing areas, stockpiling areas and administration areas of the

Site are not expected to change as the Quarry transitions into Stage 2. Processing and stockpiling activities are approved under the existing development consent.

The assessment focusses primarily on the extension of the Quarry as no major changes to processing, stockpiling or transportation operations are proposed.

2.4 VERTICAL EXTENT OF EXTRACTION

The existing development consent allows extraction to a depth of 730m AHD. The Stage 2 Extension proposes to increase the maximum depth of the extraction area to approximately 685m AHD.

2.5 WATER SUPPLY

The Applicant obtains water for operational purposes from a combination of surface water and groundwater sources. Surface water is collected in designated water storages located over the Quarry, as well as that which collects within the base of the extraction area. Water that collects in the base of the extraction area and within a sump located adjacent to the primary crushing station is believed to be comprised of both surface water and groundwater seepage. Given the elevated positioning of the extraction area above the surrounding valleys, any groundwater seepage to the excavation is from the infiltration of precipitation falling in close proximity to the extraction area (on the ridgelines immediately adjacent), rather than draining of a regional groundwater resource, or nearby surface water features. This concept is discussed in more detail in **Section 5**.

The Applicant holds Water Access Licence (WAL) 25616 which allows them to extract water from the Coxs River (up to 20 units per year). In addition, the Quarry lease area (approximately 200 ha) allows for harvestable rights of up to 16ML/yr of surface water (0.08ML/ha from Farm Dams Calculator <http://www.farmdamscalculator.dnr.nsw.gov.au>, 18 December 2013). The Applicant also purchases up to 10ML of water annually for the purpose of drinking, ablutions and dust suppression. This water is used for dust suppression on the conveyors and screens when surface runoff may have a high concentration of suspended sediment which could clog spray nozzles.

The Applicant does not hold a WAL allowing use of groundwater within the Coxs River Fractured Rock groundwater management unit, however, has made application for a zero allocation WAL. In total there are eight WALs held within the Coxs River Fractured Rock groundwater management unit of the WSP, with total entitlement of 81.5 units. The WSP indicates that the long-term average annual extraction limit (LTAAEL) for the Coxs River Fractured Rock management unit is 6,806ML/yr. In recognition of the very small proportion of the LTAAEL currently allocated, the Minister for Water recently issued Controlled Allocation Order (various Groundwater Sources) (No 1) 2014 (NSW Government, 2014) which provides for the release of an additional 327 units within the Coxs River Fractured Rock groundwater management unit of the WSP. The Applicant has indicated it will apply for a portion of this controlled allocation equivalent to that which may be taken from the aquifer on an annual basis.

The Applicant does not monitor current water usage from the Quarry and primary processing area but it is estimated to be approximately 35ML/yr (pers. Comm., Malcom McDonnell, 2013).

Based on annual water consumption, and availability of water from harvested surface runoff and the Coxs River (under WAL 25616) there is likely to be more than sufficient water available to operate the Quarry. All water will continue to be accessed from the extraction area sumps and surface water storages located on the Site. It is considered reasonable to assume that the Applicant will be successful in obtaining an allocation for groundwater from the Minister in accordance with NSW Government (2014) to account for any groundwater taken as a result of the deepening of the extraction area.

3 GROUNDWATER LEGISLATION AND GUIDELINES

Ground Doctor completed an evaluation of legislation and regulatory instruments that may be relevant to the proposed development. These are as follows.

- *Water Management Act 2000*. The object of the *Water Management Act 2000* is the sustainable and integrated management of the state's water for the benefit of both present and future generations. Under this Act a WAL is required to extract or interfere with groundwater in areas where a Water Sharing Plan (WSP) is in place. The Quarry is located in an area covered by a WSP.
- Water Sharing Plan (WSP). At the time this report was prepared the Site was located within an area covered by the *Water Sharing Plan for the Greater Metropolitan Area Groundwater Sources 2011* (the WSP). The Site is located within the Coxs River Fractured Rock groundwater management unit. The WSP outlines rules for the equitable distribution of available water resources amongst WAL holders and the environment. The WSP sets rules for the determination of water allocations and trading of water within the Coxs River Fractured Rock groundwater management unit. The WSP details high value groundwater dependant ecosystems and groundwater dependant culturally sensitive sites located within the management area.
- *Guidelines for Groundwater Protection in Australia (ARMCANZ and ANZECC 1995)*. This guideline provides a framework for preventing groundwater contamination in Australia.
- *NSW State Groundwater Policy and Framework Document (NSW Department of Land and Water Conservation 1997)*. The Framework document sets out the overall direction of groundwater management in NSW and provides broad objectives and principles to guide groundwater management. The document refers to the specific policy documents listed below which outline the objectives and principles of minimising impacts to groundwater quality and quantity, and impacts to groundwater dependant ecosystems.
- *NSW State Groundwater Quantity Protection Policy (NSW Department of Land and Water Conservation 1998)*. Builds on the concepts outlined in the framework document (see above) and provides more detail and guidance on how to manage and protect groundwater quantity.
- *NSW State Groundwater Quality Protection Policy (NSW Department of Land and Water Conservation 1998)*. Builds on the concepts outlined in the framework document (see above) and provides more detail and guidance on how to manage and protect groundwater quality.
- *NSW State Groundwater Dependant Ecosystems Policy (NSW Department of Land and Water Conservation 2002)*. This policy is specifically designed to protect valuable ecosystems which rely on groundwater for survival. It aims to maintain or restore the ecological processes and biodiversity of groundwater dependent ecosystems for the benefit of present and future generations.
- *Guidelines for Fresh and Marine Water Quality (ANZECC 2000)*. These guidelines would be relevant in assessing groundwater quality, potential beneficial use of groundwater at the Project Site, and to assess potential impacts to groundwater quality from operation of the Quarry.
- *NSW Aquifer Interference Policy (Department of Primary Industries, 2012)*. This policy aims to ensure that all activities which interfere with aquifers are properly assessed with respect to potential groundwater and surface water impacts. The policy also aims to ensure that the direct or indirect take of water resulting from an aquifer interference activity is licenced appropriately for as long as the water is removed from an aquifer or connected surface water body. The policy outlines project impact considerations that should be considered when determining the level of detail required by an environmental assessment for a proposed aquifer interference activity.

4 EXISTING ENVIRONMENT

4.1 GEOLOGY AND SOILS

The Site is located within the Central Tablelands of NSW. Based on information published in the “*Sydney, 1:250,000 Geological Series Sheet S1 56-5 (1966)*” the Site is situated on volcanics of the Lower to Middle Devonian to Lower Carboniferous Period. These include “rhyolite and rhyo-dacites”, “adamellite, granite and granodiorite”, “gabbro and diorite” and “quartzite, sandstone, siltstone and claystone”.

The main rhyolitic assemblage consists of rhyolite flows interbedded with minor beds of rhyolitic tuff, volcanic breccias and felsites. The rhyolitic stratigraphy is also cross cut by two northeasterly trending intermediate to basic dykes.

To the east and west of the proposed quarry, metasediments that form part of the Lambie Group outcrop. These rocks consist of quartzite, sandstone, siltstone and claystone and all generally dip to the northeast. The Devonian Lambie Group and rhyolite sequence are surrounded by Lower Carboniferous granite and granodiorite. Permian sediments from the Berry Formation, consisting of sandstone, shale and conglomerate crop-out to the east and west of the proposed quarry.

The rhyolite is a feldspar/silica rich rock which contains 65% feldspar (both alkali feldspar and plagioclase feldspar), and 30% quartz all of which are geochemically inert materials. Minor minerals encountered in the investigative drilling, geological mapping and extensive petrological studies include biotite 1-2%, sericite 1%, carbonate 1%, along with trace levels of sphene, muscovite, leucoxene and magnetite.

Nil to a trace amount of pyrite is also recognised in the rock mass, although this volume of pyrite is not sufficient to cause any significant degree of acid generating potential, and is further buffered by the clays and the presence of calcium carbonate.

Based on the results of more than 600 water absorption tests (undertaken for quality compliance purposes on quarried produced) rhyolite source rock rocks typically have effective porosity of 0.4%. Based on assessment of exploration drilling cores, voids (fractures) account for approximately 0.7% of the overall rock volume.

The Site is characterised by steep terrain with outcropping rock and little or no topsoil. Further information on local soils can be reviewed in the Soils and Land Capability Assessment completed for the Stage 2 Extension (SEEC, 2014). The Site is bordered by the Coxs River to the north and east. Given the upland environment the Coxs River features large cobble and boulders and has little or no floodplain. Lower gullies at the Site appeared to feature accumulations of colluvium from the upper slopes. The gullies typically became wider and flatter further down slope.

4.2 TOPOGRAPHY

The Site is characterised by a series of ridges with general south west to north east orientation. Ridges typically reach an elevation of approximately 800m AHD. The surrounding gullies typically flatten out at an elevation of approximately 700m AHD, but continue to drain into the Coxs River, which has an elevation of approximately 660m AHD to the north of the extraction area and approximately 630m AHD to the east of the extraction area.

Areas along the Jenolan Caves Road to the west of the Site reach elevations in excess of 900m AHD. Slopes at the Site typically range between 20 and 30 degrees.

4.3 DRAINAGE

The Coxs River is the primary surface water drainage adjacent to the Site. With the exception of the Coxs River, Yorkeys Creek is the only substantial drainage close to the Site. Yorkeys Creek stretches over a distance of approximately 4km which is significant when compared to most gullies adjacent to the Site, which typically discharge surface water to the Coxs River within 1km of their headwaters. Yorkeys Creek runs in a southwest to northeast direction from Jenolan Caves Road to the Coxs River. Yorkeys Creek discharges into the Coxs River to the west of the administration area and product sorting and stockpiling area. Yorkeys Creek drains the elevated ridges along Jenolan Caves Road (in excess of 900m), however, in the vicinity of the Site, has an elevation less than 700m AHD. The Yorkeys Creek valley is a physical boundary which keeps surface water from the elevated western portion of the HPC property from the area immediately adjacent to the Quarry.

The elevated areas adjacent to the Quarry typically drain into surrounding gullies which typically discharge into the Coxs River in distances less than 1km from the ridge tops.

Gullies are typically too steep near the upper slopes to contain permanent water. Permanent water is present in the flatter gullies of the lower slopes adjacent to the Quarry Site, where colluvium is present.

Water falling within the existing Quarry is captured in a depression in the base of the Quarry where it is stored for later use. Excess water is pumped from the Quarry to several surface water polishing ponds located between the Quarry and the Coxs River. Water is discharged periodically into the Coxs River from the polishing ponds in accordance with Environment Protection Licence (EPL) 12323.

Surface water and groundwater seepage which accumulates in the depression adjacent to the primary crusher is periodically discharged to polishing ponds for settlement before being discharged to the Coxs River in accordance with EPL 12323.

4.4 CLIMATE

The Quarry is located on the Central Tablelands of NSW. Key climate statistics for Lithgow (Birdwood Street) the closest Bureau of Meteorology weather station to the Site, are presented in **Table 1** and are summarised below. The temperature data presented is mean data for the period 1912 to 2006. Mean rainfall data is for the period 1889 to 2006.

Evaporation data is not measured by the Bureau of Meteorology in Lithgow. Evaporation is measured at the Bathurst Agricultural Station. The Quarry sits approximately 55km east of Bathurst. Bathurst is at a similar elevation and a similar geographical location to the Site and is inferred to provide the most indicative evaporation data for the Site. The evaporation data is mean data for the period 1966 to 2013.

Table 1: Climate Statistics – Quarry Site

Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Max Temp (°C)	25.5	24.7	22.4	18.4	14.3	11.1	10.4	12	15.4	18.7	21.5	24.5	18.2
Mean Min Temp (°C)	11.9	12.1	10.1	6.7	3.9	1.8	0.7	1.3	3.4	6	8.1	10.4	6.4
Mean Month Rain (mm)	94.3	83.8	83.9	62.7	63	67.6	67.6	63.4	58.9	67.7	70	76.1	859
Daily Evap – Bathurst (mm)	6.8	5.7	4.5	2.9	1.7	1.1	1.2	1.8	2.8	4	5.2	6.5	1351

Key climate indicators are summarised below:

- Mean daily maximum temperatures range from 10.4 to 25.5°C.
- Mean daily minimum temperatures range from 0.7 to 12.1°C.
- Mean monthly rainfall totals range from 59mm to 94mm.
- Mean annual rainfall is 859mm.
- Mean annual evaporation is 1351mm (Bathurst Data).

All data quoted above was obtained from the Bureau of Meteorology website (www.bom.gov.au, 9 August 2013).

The Site has slightly summer dominant rainfall. The average annual rainfall at the Quarry is approximately 859mm/yr. The estimated annual evaporation rate at the site is 1,351mm/yr. This means there is an annual moisture deficit at the site of approximately 492mm.

4.5 SURROUNDING LAND USES

Land surrounding the Site is used predominantly for dryland grazing. Elevated rocky ridges in the vicinity of the Quarry retain remnant native vegetation and do not appear to be used for any commercial purpose.

5 HYDROGEOLOGY

Ground Doctor Pty Ltd completed a review of available groundwater information for the area located within a 5km radius of the Quarry. This included:

- a review of the geological setting;
- a review of the registered groundwater bore database maintained by NOW;
- an inspection of the Site;
- an assessment of Site topography; and
- an interview with the Applicant's personnel regarding observations of groundwater behaviour at the Quarry.

5.1 NSW OFFICE OF WATER REGISTERED BORE DATABASE

Ground Doctor conducted a search of the NSW Government Natural Resource Atlas (www.nratlas.nsw.gov.au, 8 August 2013) for registered groundwater works located within 5km of the approximate centre of the proposed Stage 2 Extension.

A total of 30 registered groundwater works were identified within the search area. **Table B1 of Annex B** provides a summary of the information available on the groundwater work summary forms for the identified bores. A copy of the Groundwater Work Summary forms for the identified bores is presented as **Annex C**. The locations of registered groundwater bores relative to the Quarry are shown in **Figure 5 of Annex A**.

Bore details are summarised as follows.

- Only one registered groundwater bore was located within 3km of the Quarry. The nearest registered bore to the Site was GW112395, which was located approximately 2.8km south of the Stage 2 Extension.
- The majority of the identified bores were located more than 4km from the Stage 2 Extension.
- Recorded bore depths ranged from 7m to 180m below ground level but most bores were between 30m and 70m deep.
- Recorded Standing Water Levels ranged from 3.6m to 70m below ground level. Using estimates of surface elevation at each bore location recorded standing water levels ranged from approximately 580m AHD and 930m AHD.
- Recorded bore yields ranged from 0.06L/s to 17.8L/s but were typically less than 0.5L/s.
- All identified bores encountered groundwater in either weathered rock or within fractured bedrock. Groundwater was encountered in granite, shale and sandstone.
- Where a description was provided groundwater quality was described as "good" or "fresh".
- The identified bores were registered for stock, domestic and/or monitoring purposes.

Driller's logs indicate that basement rocks to the west of the site consist of granite from near the surface. In the eastern portion of the search area some bores encountered sedimentary sandstone, shale and siltstone above underlying granite.

5.2 SITE INSPECTION

The Site was inspected by Mr James Morrow of Ground Doctor on Thursday 18 July 2013. Mr Morrow was accompanied by a representative of the Applicant, Mr Malcolm McDonnell.

There is limited groundwater data available from the existing Quarry operations. Several exploration boreholes had been drilled at the site to delineate the extent of the rhyolite resource. One of the recently drilled exploration holes was drilled vertically. During the site inspection the vertical borehole was gauged for the presence of water. Water was encountered at a depth of approximately 50m below ground level. The exploration borehole was drilled at an elevation of approximately 780m above ground level. The standing water level within the exploration hole was at a relative elevation of approximately 730m AHD.

The existing Quarry was located approximately 200m from the open exploration borehole. The base of the existing Quarry was estimated to be at an elevation of approximately 730m AHD (pers. comm. Malcolm McDonnell, 2013). Water was present in a depression in the base of the existing Quarry. Mr McDonnell indicated that the depression was used to catch rainfall that fell within the Quarry for future use and controlled release. Mr McDonnell indicated that the water level within the depression remained fairly constant as a result of inflow from surrounding disturbed rock. The extraction area floor was comprised of approximately 5m of compacted crushed rock from other parts of the Quarry.

Based on the observed water level within the open exploration borehole and the persistence of water in the base of the existing Quarry Ground Doctor believes that groundwater is likely to be present at a depth of approximately 730m AHD within the footprint of the existing Quarry and the Stage 2 Quarry.

Groundwater seepage was observed in a rock cutting adjacent to the primary crusher. Mr McDonnell indicated that water seeped from the rock at most times. The seepage point within the rock cutting was at an elevation of approximately 720m AHD. This observation provides further evidence that groundwater elevation in the vicinity of the Stage 2 Quarry is at an elevation of approximately 730m AHD. The groundwater elevation would be expected to decrease away from the Quarry corresponding to changes in surface elevation.

Ground Doctor inspected the main gullies located to the north of the Site. Water was present in colluvium along the drainage line within the main gully. It is likely that that groundwater within the fractured rock aquifer discharges to the surface in places along the lower slopes.

Based on the observed low rate of seepage adjacent to the primary crusher the transmissivity of the fractured rock is likely to be low. This inference is supported by the NOW registered bore data which indicates that groundwater yields in volcanic strata were usually less than 0.5L/s.

Rock outcrops on the walls of the extraction area were observed to be fractured, occurring in a range of directions without any bias.

5.3 STANDING WATER LEVELS

As outlined in **Section 5.1** and **Section 5.2** of this report the standing water level within the Stage 2 Extension is approximately 730m AHD.

Whilst there is little formal data available for the Site, standing water levels and the direction of groundwater flow can be inferred based on the topography of the surrounding landscape. The Coxs River is considered indicative of groundwater elevation to the north and east of the extraction area. The Coxs River has an elevation of approximately 660m AHD to the north of

the extraction area and approximately 630m AHD to the east of the extraction area. Yorkeys Creek is at an elevation of approximately 700m AHD to the west of the extraction area, so the standing water level in this location would be expected to be 700m AHD or less.

Similarly, an unnamed gully to the south of the proposed extraction area is predominantly less than 700m AHD, indicating the standing water level in this location is less than 700m AHD.

The presence of standing water at elevations above those of the surrounding gullies and river valley indicates that groundwater in hard rock adjacent to the extraction area is present as a direct result of infiltration of precipitation which falls on the elevated hilltops and ridges surrounding the extraction area, and is topographically isolated. The observations also indicate that the direction of groundwater flow is likely to be consistent with surface topography. That is, groundwater would flow from beneath the most elevated parts of the ridgeline toward the nearest gully, an ultimately to the Coxs River.

Estimates of relative standing water levels from information within borelogs for registered groundwater works located within 5km of the extraction area (refer to **Section 5.1**) ranged from 580m AHD to 930m AHD.

The large variation in standing water levels across the Study Area indicates the following:

- Standing water levels appear to correlate with changes in surface elevation. That is, they are higher in more elevated areas and lower in low points within the landscape.
- The bores identified are likely to be intersecting localised aquifers only with limited lateral connectivity. For example the estimated standing water level at the site (730m AHD) is higher than the surrounding valleys. This indicates that groundwater beneath the site is from recharge which occurs on the elevated ridges immediately surrounding the Site. Conversely some bores are installed in low points along gullies and appear to target water seepage at the base of weathered strata in gullies and valleys. Groundwater of this nature is unlikely to have any connection to the regional water sources in fractured bedrock.
- Water bearing fractures in rock have relatively low permeability which allows steep groundwater gradients within the subsurface. There appears to be mounding beneath ridgelines with steep gradient to discharge points in the adjacent valleys. At the Site the observed standing water level (730m AHD) is approximately 70m to 100m above the Coxs River, which is less than 500m from the Quarry at its closest point. Similarly groundwater elevations along Jenolan Caves Road (approximately 4km west of the Site) are as much as 190m above the standing water level within the Quarry. These observations demonstrate that the fractured rock supports relatively steep hydraulic gradients. For example, groundwater seepage was observed at an elevation of approximately 720m AHD adjacent to the primary crusher. The Coxs River is located approximately 400m to the north of the primary crusher at an elevation of approximately 660m AHD. This equates to an average hydraulic gradient of at least 15%. Similarly, the Coxs River is located approximately 500m to the east of the extraction area at an elevation of approximately 630m AHD. This equates to an average hydraulic gradient of approximately 20%.

5.4 AQUIFER PROPERTIES

As outlined above the large variation in observed groundwater elevation across the Study Area suggests that the fractured rock aquifers have low average permeability. This inference is supported by the relatively low groundwater yields (typically less than 0.5L/s) recorded for the identified registered groundwater bores within the Study Area.

5.5 AQUIFER BOUNDARIES

When comparing the elevation of the observed standing water level surrounding the extraction area and the valleys and gullies within the vicinity of the Site, it can be concluded that these valleys and gullies act as aquifer boundaries.

The Coxs River is the lowest part of the landscape in the vicinity of the Site. It is inferred that groundwater may discharge into the Coxs River from fractured rock aquifers located either side of the River. It is possible that the Coxs River may also recharge deeper groundwater bearing strata in some locations, however, these (if present) are not relevant to the assessment as the Quarry floor would remain 25m to 55m above the Coxs River.

Valleys and gullies within the vicinity of the Site are inferred to be groundwater discharge points. Based on available standing water level data, the valleys and gullies surrounding the Site are typically much lower than observed groundwater levels in adjacent fractured rock. This means that the valleys and gullies form a physical boundary which would limit the lateral movement of groundwater, and would be physical boundaries beyond which drawdown would not be observed.

The presence of the Coxs River to the north and west of the Site will mean that changes to the groundwater regime at the Site would not have an impact on groundwater resources on the northern and eastern side of the River. Similarly the presence of valleys such as the one occupied by Yorkeys Creek means that changes to groundwater which occur to the east of Yorkeys Creek are unlikely to have any impact on groundwater resources to the west of Yorkeys Creek.

5.6 SURFACE WATER / GROUNDWATER INTERACTION

Based on the observed standing water level and topography of the Site, groundwater in the vicinity of the extraction area is part of what is an isolated or closed system. Recharge to the ground occurs as a result of infiltration of precipitation from the immediate surrounds only. Groundwater discharges close to the area in which it fell as precipitation. Both surface water and groundwater discharge to the Coxs River.

Recharge (infiltration of precipitation to the subsurface) is likely to be a very small portion of precipitation due to the steep nature of the Site and the presence of shallow soils, or total absence of soil cover. A conservative estimate of recharge is less than 1% of precipitation. However, the actual percentage is of little relevance in evaluating the Site water balance, as both surface water and groundwater discharge to the Coxs River in close proximity to where precipitation falls.

Groundwater recharge occurs in elevated areas surrounding the Site and may discharge to the surface on the lower slopes and in particular near drainage lines. Groundwater is also likely to discharge into the adjacent Coxs River, which is the lowest point in the landscape within the vicinity of the Site.

Infiltration of rainfall on the elevated areas surrounding the Site results in mounding of groundwater beneath the elevated area. This storage of groundwater is isolated from adjacent aquifers due to the presence of low valleys (below the standing water level observed in the Quarry) in all directions from the Site. That is, the groundwater elevation beneath the existing Quarry (approximately 730m AHD) is above the surrounding valleys of Yorkeys Creek to the west (typically less than 700m AHD), the Coxs River to the north and east (typically less than 660m AHD), and an unnamed drainage to the south (typically less than 700m AHD).

Based on the conceptual understanding of water bearing strata beneath the existing Quarry and basic hydrogeological principles, over the long term groundwater discharge equals groundwater recharge. That is, in the equilibrium condition recharge equals discharge and standing water levels are unchanged. In reality, groundwater levels would be expected to fluctuate due to seasonal conditions. In wet periods, increased recharge would result in higher standing water levels, and subsequent increased discharge until conditions become dry. In dry periods, standing water levels would be lower and discharge would also be lower as a consequence. Standing water levels would continue to fall until recharge increased due to the return of wetter climatic conditions.

5.7 WATER QUALITY

Groundwater quality at the Site has not been assessed. Data provided in logs for registered groundwater bores (refer to **Section 5.1**) indicates that groundwater quality is “good” or “fresh”. Given the Site location within an elevated area of the Central Tablelands (an upland environment) surface water and groundwater quality in the vicinity of the Site is expected to be good, with water suitable for all potential beneficial uses, with respect to dissolved salt concentrations. That is electrical conductivity (EC) is expected to be below 1,400uS/cm.

6 ASSESSMENT OF POTENTIAL GROUNDWATER IMPACTS

6.1 CONCEPTUAL SITE MODELS

6.1.1 Existing Environment

A schematic cross section of the Study Area illustrating Ground Doctors conceptual interpretation of the groundwater environment and groundwater behaviour is presented as **Figure 6 of Annex A**.

Groundwater beneath the existing Quarry is mounded as a result of recharge which occurs on the elevated areas adjacent to the Quarry. This water discharges into the surrounding valleys. This pattern is likely to occur across the Study Area, with local mounding of groundwater beneath elevated areas and discharge along drainage gullies and valleys.

The Study Area is also likely to feature perched groundwater units where favourable architecture in bedrock allows local accumulations of rainwater infiltration above the regional water table.

As discussed in Section 5.5 and 5.6, the valleys between elevated areas form boundaries which limit lateral movement of groundwater.

At the time of reporting groundwater was encountered in the base of the existing Quarry, at an elevation of approximately 730m AHD.

The Site is comprised of steep rocky slopes and rocky plateaus of limited area. It is inferred that most rain falling within the extraction area would be lost to evaporation or would flow into surrounding gullies as surface runoff. Only a small portion of rainfall (less than 1%) would infiltrate the underlying fractured rock and become groundwater. The volume of rainfall infiltrating the subsurface would be offset by the volume of groundwater discharge occurring from the lower slopes or into the extraction area. Groundwater discharge from the vicinity of the site is inferred to drain into Coxs River either directly or indirectly.

With the exception of evapotranspiration losses, precipitation falling on the Site flows to the Coxs River, mostly overland with a small portion flowing through underlying fractured rock. The portion flowing through the subsurface is insignificant when compared to overland flow.

6.2 STAGE 2 QUARRY EXTENSION

A schematic cross section of the Study Area illustrating Ground Doctors conceptual interpretation of the groundwater environment and groundwater behaviour after the Stage 2 Extension is presented as **Figure 7 of Annex A**.

The main changes to the groundwater regime at the Site would occur as a result of:

- the physical removal of the aquifer (i.e. the extracted rhyolite); and
- groundwater drainage from surrounding fractured rock during excavation and from the post quarrying landscape.

The Stage 2 Extension would result in extraction to a depth of approximately 685m AHD (some 45m below the current groundwater elevation). The base of the final extraction area would remain well above the elevation of the Coxs River, which is below 660m AHD in the vicinity of the Site.

Once rhyolite and overburden / waste rock is removed from the extraction area, this section of the aquifer is removed and replaced by a void. Groundwater (in the form of moisture within the pore space of the quarried rock) would be lost during this process. Quarrying of aquifer material would therefore result in a one-off loss of this groundwater (i.e. groundwater that was formerly stored within the quarried rhyolite).

During and at the completion of extraction, the extraction area would act in a similar manner to natural drainages at and surrounding the Site. The extraction area would convey surface water and any groundwater seepage to the Coxs River, via a series of temporary storage and polishing ponds. This would result in a lowering of the water table in the vicinity of the extraction area.

Based on the conceptual Site model, drainage of groundwater into the extraction area would result in the establishment of a new post-extraction standing water level around the perimeter of the extraction area floor (at an elevation of approximately 685m AHD). This would result in permanent (one-off) draining of water from the aquifer within the surrounding zone of influence (cone of depression).

During and post Stage 2 extraction, the overall impacts on the Site water balance would be minimal, as groundwater draining into the extraction area would be allowed to drain to the Coxs River, as occurred in the pre-Stage 2 environment. The only major change being that some water that formerly flowed to the Coxs River as groundwater, would flow to the Coxs River on the surface. Some water would be lost to evaporation at the surface from temporary storage within the extraction area or within polishing ponds.

Elevated areas would remain around the periphery of the extraction area. Groundwater recharge would still occur in these areas as it does at present. Groundwater mounding is expected to occur in the undisturbed areas adjacent to the extraction area. Groundwater within the fractured rock adjacent to the extraction area would be expected to continue to seep into the extraction area and into surrounding valleys.

The lateral spread of any drawdown impacts would be limited by the low average permeability of the aquifer, which has been observed to support hydraulic gradients of at least 20% (refer to **Section 5.4**). Using these hydraulic gradients as a guide to what would establish at the completion of Stage 2, groundwater mounding is expected to occur between the excavation and surrounding gullies. In particular, groundwater would continue to flow toward Yorkeys Creek as a result of groundwater recharge occurring in the undisturbed area between the excavation and the Creek (see **Figure 7**).

In the worst case, drawdown impacts would be limited by the presence of physical topographical aquifer boundaries which include (Yorkeys Creek to the west, the Coxs River to the north and east, and an unnamed drainage south of the Site).

6.3 GROUNDWATER QUANTITY

6.3.1 Extractive and Drawdown Losses

There would be a one off loss of groundwater resulting from the removal of aquifer material (quarried rock) and drainage of groundwater from adjacent fractured rock. The volume lost would be equivalent to the saturated pore volume within the dewatered fractured rock.

In the absence of measured aquifer properties, Ground Doctor has used an analytical approach to estimate potential groundwater losses that would result from draining groundwater from the base of the excavation. This analytical approach has adopted conservative assumptions and is likely to overstate the indirect take of groundwater associated with the Stage 2 Extension.

The analytical model is based on the following assumptions.

- All water contained in quarried rhyolite and waste rock is considered a groundwater loss.
- The base of the final extraction area would be at an elevation of 685m AHD.
- The existing (pre-Stage 2) standing water level is 730m AHD and extends at this elevation away from the excavation. That is, the surface topography adjacent to the extraction area (which is likely to limit the extent of drawdown impacts in some directions) is ignored.
- It is assumed that 45m of drawdown would occur across the footprint of the extraction area.
- The base of the final extraction area has been approximated as a circle with a diameter of 350m.
- Drawdown would propagate away from the extraction area. In the absence of measured aquifer properties Ground Doctor has assumed that aquifer material would support an average hydraulic gradient of 20%. This is based on the minimum possible hydraulic gradient between the existing extraction area and the Coxs River, approximately 500m to the east. For ease of calculation and conservatism it is assumed that the hydraulic gradient would be linear away from the excavation. Assuming 45m drawdown, the cone of depression would propagate approximately 225m away from the outer walls of the extraction area.
- The average void space in rhyolite at the Site is 0.7% (i.e. fractures) and the rhyolite matrix has porosity of approximately 0.4% (refer to **Section 4.1**). It is assumed that rhyolite contains 1.1% water on average.
- Average rainfall at the site is 859mm/yr.
- Groundwater recharge is approximately 1% of total rainfall.

The volume of rock within the cone of depression can be estimated by calculating the volume of a conical cylinder with base diameter of 350m, upper diameter of 800m (estimated width of the cone of depression) and depth of 45m. This equates to a volume of 11,685,252m³. Assuming the total saturated porosity is 1.1% the volume of water removed from the aquifer is estimated to be 128,538m³, which equates to 128.5ML of water.

This loss would occur over the 35 year operating period of the Stage 2 Extension. The average yearly loss of groundwater attributable to removal of aquifer and drawdown would be 3.7ML/yr.

6.3.2 Seepage Losses

In addition to the one off drawdown losses, groundwater would continue to be lost from the aquifer as a result of seepage into the open extraction area. The average annual loss due to seepage would be equivalent to the amount of recharge which occurs within the cone of depression surrounding the excavation.

Based on an average hydraulic gradient of 20%, the cone of depression would extend approximately 225m from the outer walls of the excavation. The area over which recharge would be captured is estimated assuming the cone of depression is a circle with diameter of 800m (area of 502,655m²). Total average rainfall falling above the cone of depression would be 431,781m³ (assuming average rainfall is 859mm/yr).

Recharge is assumed to be approximately 1% of annual rainfall. So the average estimated annual recharge within the cone of depression would be 4,318m³, or 4.3ML/yr.

It should be noted that this estimate of seepage is based on the inferred maximum extent of drawdown associated with the Stage 2 Extension. In reality the cone of depression would increase in size gradually proportional to increased depth of the Quarry.

6.3.3 Evaporative Losses

Evaporative losses of groundwater are expected to occur from the extraction area during and following the completion of the Stage 2 Extension.

During operation, groundwater that seeps into the extraction area would drain to a sump in the lowest part of the extraction area where it would be stored temporarily prior to release to a series of downgradient polishing ponds. Evaporative losses would occur as a result of exposure of standing water to the elements.

Evaporative losses could be minimised by keeping the sump as small as possible. That is, by constructing a deeper sump with smaller exposed surface area, rather than a shallow sump with large exposed surface area.

Any loss of groundwater from evaporation would occur from accumulated seepage in the base of the excavation. That is, evaporative losses would be a portion of seepage losses estimated in **Section 6.2.2**. It is not necessary to account for evaporative losses separately.

6.3.4 Groundwater Use

The Applicant currently uses some water from the base of the existing extraction area, a mixture of surface run-off and groundwater seepage. The primary use of water at the Quarry is for dust suppression, of which an estimated 10ML/yr is drawn from extraction area sumps (pers. comm. Malcolm McDonald). As the extraction area is extended it is expected that this water would continue to be comprised of groundwater and rainwater.

Based on estimates of groundwater losses outlined in **Section 6.2.1** and Section **6.2.2** a WAL licencing use of up to 10ML of groundwater from the Coxs River Fractured Rock management unit would be appropriate to account for direct and indirect take of groundwater. In recognition of this small volume of groundwater that would be removed, the Applicant has made an application for a zero share Water Access Licence. Appropriate allocation will be sought on the commercial market, either from existing WALs or from a future controlled allocation of water from the Coxs River Fractured Rock groundwater management unit. It is noted that the NSW Government has issued a controlled allocation order for up to 327 units within the Coxs River Fractured Rock groundwater management unit (NSW Government, 2014). This

represents approximately 5% of the LTAAEL for the Coxs River Fractured Rock management unit (6,806ML/yr) identified in the WSP.

The removal of groundwater would be approved for commercial or industrial use by virtue of the development consent issued under Division 4.1 of the EP&A Act (for State Significant Development).

6.3.5 Potential for Drawdown Impacts

Approximately 45m of drawdown would occur within the footprint of the extraction area extension, however, the base of the final extraction area would remain well above the Coxs River and most surrounding natural drainage gullies. Drawdown is not expected to propagate a significant distance from the extraction area due to the low permeability nature of the fractured rock and the presence of aquifer boundaries in all directions from the extraction area (see **Section 5.5**). This is explained further as follows.

The lateral spread of any drawdown impacts adjacent to the excavation would be limited by the low average permeability of the aquifer, which has been observed to support hydraulic gradients of at least 20% (refer to **Section 5.4**).

Based on this observation drawdown impacts would be expected to be negligible a distance of approximately 225m from all sides of the extraction area. This is based on establishment of a hydraulic gradient of 20% adjacent to the extraction area and assuming pre-development standing water level of 730m AHD.

Groundwater recharge would continue to occur in the undisturbed areas surrounding the extraction area, resulting in mounding of groundwater between the extraction area and surrounding gullies, which are inferred to be potential groundwater discharge points (see **Figure 7**).

Based on observations from the Site standing water levels between the extraction area and surrounding gullies (which include Yorkeys Creek), the standing water level would remain more elevated than the gullies. A hydraulic gradient would therefore be maintained toward gullies, with potential for groundwater to continue to discharge, or to maintain pre-development conditions.

In the worst case, the presence of deep gullies in all directions from the proposed extraction area would limit the lateral spread of drawdown. No registered groundwater users have been identified within the maximum possible extent of drawdown impacts around the Site. Groundwater dependent ecosystems have also not been identified within the maximum possible extent of drawdown impacts (refer also to **Section 6.4**).

6.4 GROUNDWATER QUALITY

The Quarrying process involves blasting of rock and removal of rock with excavators and loaders and hauling with trucks.

The plant and equipment used consume diesel fuel, hydraulic oils, lubricants and common automotive chemicals. The risk of chemical spill and/or the consequences of a spill could be adequately managed by maintaining plant and equipment outside of the extraction area. Quarry vehicles could be refuelled beyond the active limit of the extraction area. If plant requires refuelling within the active extraction area, this could be completed away from any exposed groundwater, with appropriate controls on standby to contain and remove spills as soon as possible. In the event that a spill occurred within the extraction area, earth moving equipment could be used to contain impacts and to remove any impacted media for treatment.

Explosives are and would continue to be used within the extraction area. Explosives typically contain nitrate, which could potentially impact on groundwater quality. Based on the conceptual Site model for the Site, groundwater would seep into the extraction area at a slow rate, as opposed to flow from the extraction area to the surrounding groundwater. Any nitrate contamination would leave the extraction area within surface water. Surface water discharge quality would be managed in accordance with the existing Site Soil and Water Management Plan (RWC, 2006). If explosives are handled and used correctly at the site the risk of groundwater impacts are likely to be negligible and acceptable.

There is potential for salt to concentrate in water that accumulates in the base of the extraction area as a result of evaporation. This risk would be controlled by limiting accumulation of standing water within the extraction area. The extraction area would be maintained in a form which encourages drainage of water from the base of the extraction area, limiting potential for dissolved salts to accumulate to levels which could impact on aquatic ecosystems.

It should be noted that the Quarrying process does not introduce salt to the environment. Any increase in salt concentrations would only occur due to evaporative loss of water. The total mass of salt within water would not change.

Acid generation from oxidisation of sulphur is not of concern at the Site as the sulphur content of the targeted rhyolite is very low (trace) to absent.

The potentially contaminating activities described above have been occurring at the Site as part of the existing approved Quarry operation. The Stage 2 Extension poses no significant additional risk to groundwater quality at the Site.

6.5 GROUNDWATER DEPENDANT ECOSYSTEMS

Schedule 4 of the WSP lists Groundwater Dependiant Ecosystems (GDEs) located within the Greater Metropolitan Area Groundwater Sources. The WSP does not list any sites located within the Study Area.

A Terrestrial Ecology Assessment for the Austen Quarry Stage 2 Extension was completed by Niche Environment and Heritage (Niche, 2014). With respect to GDEs, Niche (2014) found:

“Of the vegetation units mapped by Niche, only the River Oak riparian forest along Coxs River is reliant on water availability for survival. In this respect, it is considered that, in such a steep landscape, seasonal flows and storm surges during high rainfall events are far more deterministic of the condition of this vegetation, rather than groundwater as defined in the statements above (for example river base flows). The River Oak riparian forest is dependent on the intermittently flowing Coxs River, is tolerant of a regular cycle of wetting and drying and does not constitute forested wetland or swamp in semi-permanent standing or sub-surface water.”

Based on the WSP and the findings of Niche (2014) there are no GDEs within the area that may be impacted by direct or indirect take of groundwater associated with the Stage 2 Extension.

6.6 CULTURALLY SIGNIFICANT GROUNDWATER SITES

The WSP does not identify any culturally significant groundwater sites within the Greater Metropolitan Area Groundwater Sources area.

6.7 SURFACE WATER QUALITY

Groundwater that seeps into the extraction area, other than that which evaporates, would eventually drain to the Coxs River. This process would replicate pre-development conditions in which groundwater discharges into the Coxs River both directly and indirectly from adjacent gullies.

The Stage 2 Extension is not expected to result in significant impacts to groundwater quality. As such, discharge of groundwater from the Quarry into the Coxs River catchment is not expected to result in unacceptable surface water quality impacts. Surface water discharge quality would continue to be managed in accordance with the existing Site Soil and Water Management Plan (RWC, 2006).

6.8 SEPARATION DISTANCES

The extraction area would intersect the water table. While Section 89J of the EP&A Act excludes the requirement for the extraction area to be licensed as a water management work or water supply (under Sections 89 and 90 of the WM Act), consideration as to the relevant separation distances referenced in the WSP for such works is provided in **Sections 6.7.1 to 6.7.4**.

6.8.1 Existing Licenced Groundwater Works

The WSP states that no water supply works are to be granted or amended within the following instances of existing bores:

- 400m from an aquifer access licence bore extracting greater than 20ML/yr on another landholding, or
- 200m from an aquifer access licence bore extracting less than 20ML/yr on another landholding, or
- 200m from a basic landholder rights bore on another landholding, or
- 100m from a property boundary (unless written consent from neighbour), or
- 500m from a local or major water utility bore, or
- 400m from a NSW Office of Water monitoring bore (unless written consent from NSW Office of Water).

The nearest registered groundwater work is located approximately 2.8km from the extraction area.

6.8.2 Groundwater Dependiant Ecosystems

The WSP states that no water supply works are to be granted or amended within the following distances of high priority GDEs (non Karst) as identified within the WSP:

- 100m for bores used solely for extracting basic landholder rights, or
- 200m for bores used for all other access licences.

The above distance restrictions for the location of works from high priority GDEs do not apply where the GDE is a high priority endangered ecological vegetation community and the work is constructed and maintained using an impermeable pressure cement plug from the surface of the land to a minimum depth of 30m.

No water supply works (bores) to be granted or amended within the following distances from these identified features:

- 500m of high priority karst environment GDEs, or
- a distance greater than 500m of a high priority karst environment GDE if the Minister is satisfied that the work is likely to cause drawdown at the perimeter of the high priority karst GDE, or
- 40m of a river or stream or lagoon (3rd order or above),
- 40m of a 1st or 2nd order stream, unless drilled into underlying parent material and slotted intervals commence deeper than 30m (30m may be amended if demonstrate minimal impact on base flows in the stream), or
- 100m from the top of an escarpment.

The WSP does not list any GDEs within the Study Area.

6.8.3 Groundwater Dependant Culturally Significant Sites

The WSP states that no water supply works are to be granted or amended within the following distances of groundwater dependent cultural significant sites as identified within the plan:

- 100m for bores used for extracting for basic landholder rights, or
- 200m for bores used for all other aquifer access licences

The WSP does not identify any groundwater dependant culturally significant sites within the Study Area.

6.8.4 Contaminated Areas

The WSP states that to protect users from contamination, water supply works are not to be granted or amended within:

- 250m of contamination as identified within the WSP, or
- 250m to 500m of contamination as identified within the WSP unless no drawdown of water will occur within 250m of the contamination source,
- a distance greater than 500m of contamination as identified within the WSP if necessary to protect the water source, the environment or public health and safety.

Contaminated land as defined in the WSP has not been identified within 500m of the Site.

6.9 AQUIFER INTERFERENCE CONSIDERATIONS

The proposed extraction area extension would intersect the water table and as such would be regarded as an aquifer interference activity under the *NSW Aquifer Interference Policy* (NSW DPI, 2012). *Section 3.2.3* of this policy outlines a number of considerations which need to be addressed by proponents of aquifer interference activities. These considerations are outlined in **Table 2**.

Table 2: Aquifer Interference Considerations

Aquifer Interference Consideration	Assessment of Consideration
Establish baseline groundwater conditions at the site.	Baseline groundwater conditions at the Site and within the study area are detailed in Section 5 .
Strategy for compliance with WSP.	The Applicant would obtain groundwater entitlement to cover its use or indirect take of groundwater from the extraction area. The WSP indicates that there is water entitlement available for commercial or industrial uses within the Coxs River Fractured Rock groundwater source, however, Ministerial approval (“controlled allocation”) is likely to be required.
Details of potential drawdown impacts on other water users and separation distances.	A semi-quantitative assessment of potential drawdown impacts has been presented in Section 6.2.4 . An assessment of separation distance is presented in Section 6.7 . This semi-quantitative assessment of impacts indicates that detailed analysis based on aquifer testing was not necessary as part of this assessment. This is in keeping with the NSW Aquifer Interference Policy which states: <i>“A risk management approach to assessing the potential impacts of aquifer interference activities will be adopted, where the level of detail required to be provided by the proponent is proportional to a combination of the likelihood of impacts occurring on water sources, users and dependent ecosystems and the potential consequences of these impacts.”</i>
Groundwater dependant ecosystems	Groundwater dependant ecosystems have not been identified in the WSP within the Study Area. Niche (2014) has not identified any GDE’s within the areas that could potentially be impacted by drawdown resulting from the proposed Stage 2 Extension. Niche (2014) indicates that the only potential GDEs within the vicinity of the site occur along the Coxs River corridor and are more reliant on surface water flows within the Coxs River, which would not be impacted by changes to groundwater processes at the Site.
Potential to impact on water quality in aquifers and surface water.	The potential for the Stage 2 Extension to impact on groundwater and surface water quality has been assessed in Section 6.3 .
Potential to cause or enhance hydraulic connection between aquifers.	The extraction area would intersect fractured rock located within the Coxs River catchment. No other aquifers or groundwater management units have been identified within the vicinity of the Quarry. As such, the Stage 2 Extension would not cause or enhance hydraulic connection between different aquifers or groundwater management units.
Potential to cause river bank instability.	The strata underlying the Coxs River is bedrock. As such, the Stage 2 Extension is not expected to cause river bank instability. In addition, the Stage 2 Extension remains a significant distance from, and elevation above, the nearest surface water features.
Details of the method of disposing of extracted water.	Water would be removed from the base of the extraction area as required. Water would be discharged to the Coxs River via existing sediment dams under EPL 12323. The amount of groundwater inflow to the extraction area, additional to that contained within the extracted rock, has been estimated at 4.3ML/yr. Given groundwater recharge represents a small portion of total rainfall (estimated to be approximately 1% of rainfall), surface water inflow is expected to dominate water inflow to the extraction area and the requirement for discharge to the Coxs River.

The *NSW Aquifer Interference Policy* characterises aquifers as “highly productive” or “less productive”. “Highly productive” aquifers are those capable of yielding in excess of 5L/s and that have a total dissolved solids concentration less than 1500mg/L. Based on this definition the fractured rock aquifer at the site would be classed as “less productive” as a bore advanced within the rock would not yield in excess of 5L/s.

Table 1 of the NSW Aquifer Interference Policy (NSW DPI, 2012) outlines “*Minimal Impact Considerations*” which need to be considered when determining the level of assessment required for an aquifer interference activity occurring within a “less productive” fractured rock aquifer. Where the minimal impact triggers are exceeded a greater level of detail is required in the groundwater assessment.

Ground Doctor assessed the likely impacts of the Stage 2 Extension against the considerations in *Table 1* of the *NSW Aquifer Interference Policy*. The assessment is summarised in **Table 3**.

Table 3: Minimal Impact Considerations

Impact	Impact Consideration
<p>Water Table and Water Pressure</p> <p>Less than or equal to 10% cumulative variation in the water table, allowing for typical climatic “post-water sharing plan” variations, 40m from any:</p> <p>(a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan.</p> <p>A maximum of a 2m decline cumulatively at any water supply work.</p> <p>If more than 10% cumulative variation in the water table, allowing for typical climatic “post-water sharing plan” variations, 40m from any:</p> <p>(a) high priority groundwater dependent ecosystem; or (b) high priority culturally significant site; listed in the schedule of the relevant water sharing plan if appropriate studies demonstrate to the Minister’s satisfaction that the variation will not prevent the long-term viability of the dependent ecosystem or significant site.</p> <p>If more than a 2m decline cumulatively at any water supply work then make good provisions should apply.</p>	<p>Drawdown impacts are not expected in identified registered groundwater supply works due to a large separation distance (more than 2.8km) and the presence of aquifer boundaries between the Site and all identified groundwater supply works.</p>
<p>Water Quality</p> <p>Any change in the groundwater quality should not lower the beneficial use category of the groundwater source beyond 40m from the activity.</p> <p>If the above condition is not met then appropriate studies will need to demonstrate to the Minister’s satisfaction that the change in groundwater quality will not prevent the long-term viability of the dependent ecosystem, significant site or affected water supply works.</p>	<p>Changes to groundwater quality at the Site are not expected to occur. The Stage 2 Extension would not introduce contaminants or salt to the aquifer.</p> <p>The rhyolite at the Site contains low sulphur and therefore has very little potential to generate acid when it is exposed to oxygen.</p> <p>In the event that water quality impacts did occur the potential for impacts to spread away from the excavation would be low, as drawdown in surrounding rock is expected to maintain an inward (i.e. towards the excavation) gradient.</p>

Based on a qualitative assessment of potential impacts to groundwater quantity and quality more detailed studies are considered unnecessary.

7 GROUNDWATER MANAGEMENT PLAN

The key steps of a Groundwater Management Plan are:

- identify potential hazards;
- assess the risk;
- implement controls to reduce risk to acceptable level; and
- monitor and evaluate to ensure risk is managed appropriately and that unforeseen hazards do not exist.

The two primary groundwater hazards of concern are potential impacts to water quantity (drawdown) and water quality. These hazards are assessed in Sections 7.1 and 7.2.

7.1 DRAWDOWN

Risks posed by drawdown are negligible due to the absence of receptors (other groundwater users, GDEs, culturally significant sites etc.) within the area likely to be impacted. Therefore, implementation of controls to manage drawdown impacts are not warranted.

Monitoring and evaluation would be undertaken to ensure there are no unforeseen drawdown impacts. If the Stage 2 Extension is approved the Applicant would install piezometers between Yorkeys Creek and Coxs River. The piezometers would be installed with the aim of verifying the conceptual groundwater model and/or better characterising groundwater levels prior to the commencement and during operation of Stage 2.

Piezometers would be arranged in a fashion which allows estimation of the extent of the cone of depression around the extraction area and allows monitoring of potential drawdown impacts adjacent to surface water.

Estimates of groundwater seepage would be revised based on the observed extent of the cone of depression around the Quarry.

7.2 WATER QUALITY

As outlined in **Section 6**, proposed quarrying activities pose little risk to groundwater quality, as the process is limited to blasting, excavation, crushing and screening of rock. The risk of chemical contamination to groundwater would be managed by employing industry standard environmental controls to eliminate, substitute and/or isolate, groundwater quality impacts.

The targeted rock has low sulphur content and has little potential to generate acid upon exposure to oxygen.

Monitoring and evaluation would be undertaken to ensure groundwater quality impacts remain acceptable throughout the operation of the Quarry.

Potential impacts to water quality would be best monitored by assessing surface water within the extraction area, and within down gradient surface water infrastructure for the following reasons.

- Potential impacts to groundwater quality associated with the Stage 2 Extension are isolated to activities occurring within the extraction area.

- Groundwater seepage would be expected to occur within the proposed extraction area creating a flow gradient toward the extraction area.
- Any groundwater that seeps into the extraction area would either evaporate or would be treated with surface water in down gradient treatment ponds. Groundwater seepage is expected to be a small component of the water captured within the extraction area, which would be comprised almost entirely of rainfall.
- The ultimate receptor of groundwater from the Site is the Coxs River, which is a surface water receptor.

The existing surface water monitoring protocols outlined in the “Soil and Water Management Plan for the Austen Quarry” (RWC, 2006) would be suitable for ongoing assessment of potential impacts to groundwater quality. If water quality impacts were identified, appropriate controls would be implemented to reduce risk to an acceptable level.

8 CONCLUSIONS AND RECOMMENDATIONS

The Stage 2 Extension is an extension of an existing extraction area for which development consent is held (DA 103/94). Activities at the Site would remain largely unchanged with the exception of increasing the size and depth of the extraction area.

An assessment of available data indicates that groundwater is present beneath the existing extraction area at a depth of approximately 730m AHD, which is the approximately elevation of the existing extraction area floor. The proposed extension would see the extraction area extended laterally to the east and to a maximum depth of 685m AHD, some 45m below the water table.

Groundwater would have to be removed from the extraction area as it extends below the water table, resulting in a lowering of the water table below the Site. Approximately 45m of drawdown would occur within the footprint of the extended extraction area. Drawdown is not expected to propagate a significant distance from to extraction area due to the low permeability nature of the fractured rock and the presence of aquifer boundaries in all directions from the Site.

It is estimated that the Stage 2 Extension would result in the loss of approximately 3.7ML/yr of groundwater on average as a result of excavation of rock below the water table. It is estimated that approximately 4.3ML/yr of groundwater on average would be lost as a result of ongoing seepage into the final extraction area void.

The Stage 2 Extension is classified as an aquifer interference activity, is therefore subject to the provisions of the *NSW Aquifer Interference Policy* (NSW DPI, 2012), and has been assessed accordingly. A semi-quantitative groundwater impact assessment has found that potential aquifer drawdown and water quality impacts associated with the Stage 2 Extension would be minimal, as defined by the *NSW Aquifer Interference Policy* (NSW DPI, 2012).

The proposed activities present little opportunity for contaminants to enter groundwater. With the exception of fuel, hydraulic fluids, automotive chemicals and explosives, no chemicals would be introduced into the Quarry as part of the Stage 2 Extension. Risks posed by the presence of these chemicals in the Quarry could be adequately addressed through implementation of an appropriate environmental controls. Processing of extracted rhyolite is restricted to crushing and screening only.

Groundwater dependant ecosystems and culturally significant groundwater receptors have not been identified within the Study Area.

In general, the Stage 2 Extension complies with the principles of relevant NSW water management policies and guidelines. The Quarry is located in a topographically isolated environment, which would limit the lateral extent of groundwater impacts. The Stage 2 Extension is not expected to reduce the quantity of groundwater available to other groundwater users located within the Coxs River Fractured Rock groundwater management unit. Whilst water processes at the Site would change as a result of extraction, no significant changes to the site water balance are expected to occur. The Applicant has made application for a zero discharge WAL and there is opportunity to obtain sufficient allocation for the predicted indirect take of groundwater from the Coxs River Fracture Rock groundwater management unit through a controlled allocation order issued by the Minister for Water in September 2014 (NSW Government, 2014).

The Stage 2 Extension would intercept the water table, however, Section 89J of the EP&A Act excludes the requirement for the extraction area to be licensed as a water management or water supply work (under Sections 89 and 90 of the WM Act). The annual rate of extraction of water from the Quarry for use on site should be estimated and allocated against a WAL for

reporting this use. The Applicant should ensure discharge of surface water and groundwater from the Quarry is appropriately licenced with the NSW Office of Water.

Ground Doctor recommends establishment of piezometer network that would allow monitoring of water levels around the extraction area, re-evaluation of drawdown risks and re-evaluation of ongoing groundwater losses associated with the Stage 2 Extension.

Further, surface water monitoring should continue in accordance with the “Soil and Water Management Plan for the Austen Quarry” (R. W. Corkery, 2006) to allow for identification, re-evaluation and control of any unforeseen water quality impacts associated with the Stage 2 Extension.

9 REFERENCES

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ANNEXURES

(Total No. of pages including blank pages = 78)

Annex A	Figures
Annex B	Registered Groundwater Bore Summary Table*
Annex C	Groundwater Work Summary Forms*

*Note: This Annexure is only available on the Project CD

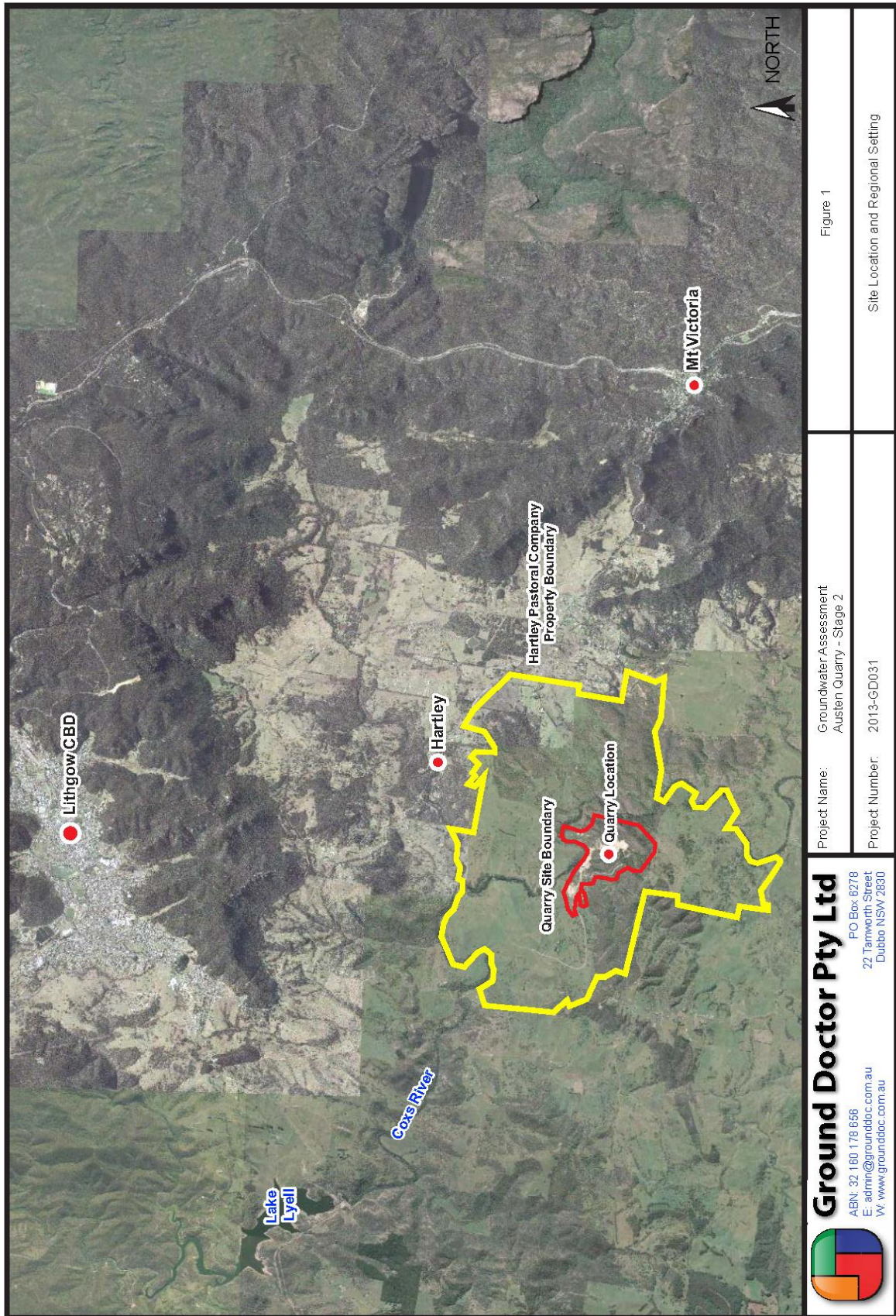
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Annex A

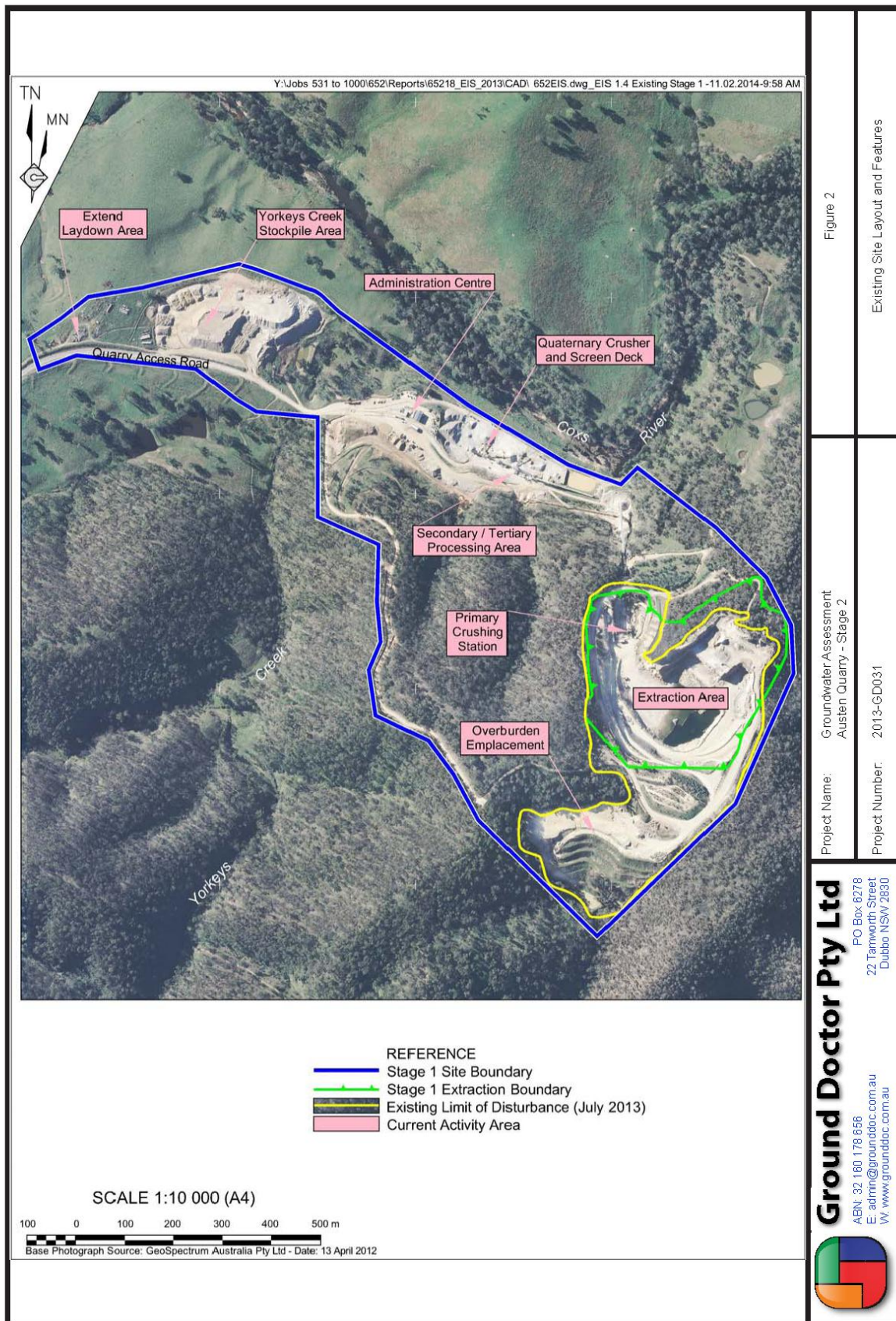
Figures

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 <p>Ground Doctor Pty Ltd ABN: 32 180 178 656 E: admin@grounddoc.com.au W: www.grounddoc.com.au</p>	Project Name: Groundwater Assessment Austen Quarry - Stage 2	Figure 1
	Project Number: 2013-GD031	Site Location and Regional Setting



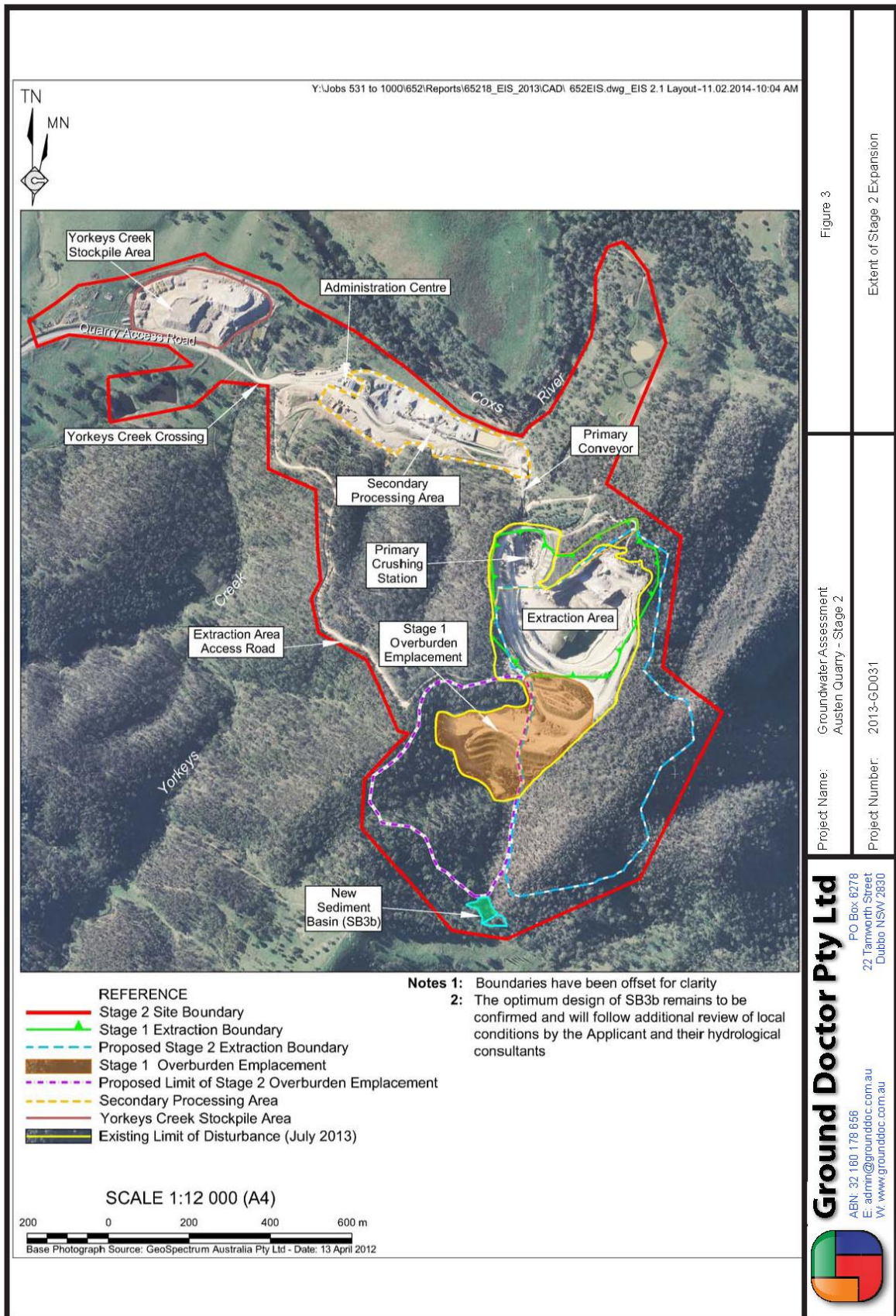


Figure 3
Extent of Stage 2 Expansion

Project Name: Groundwater Assessment
Austen Quarry - Stage 2

Project Number: 2013-GD031

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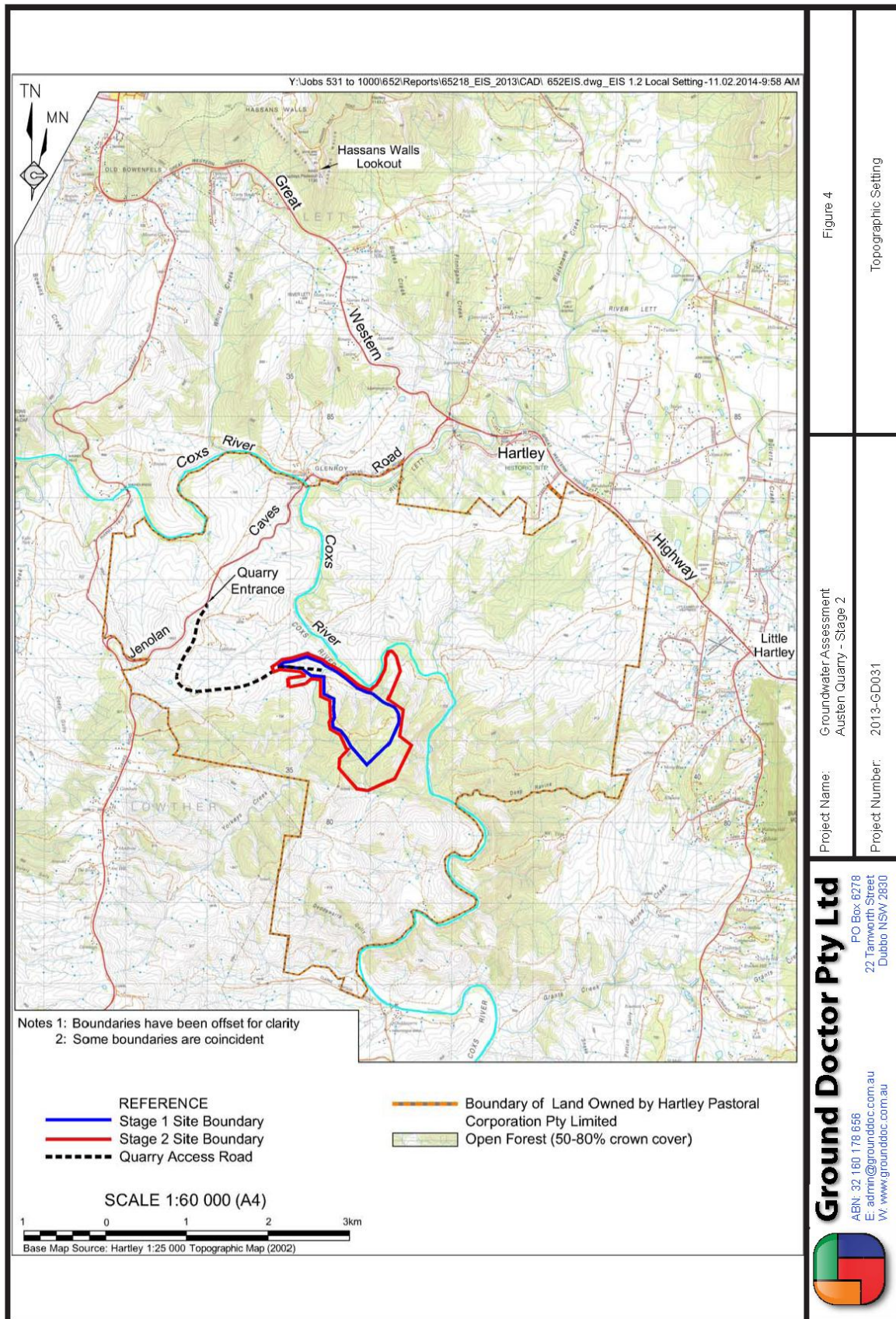


Figure 4

Topographic Setting

Project Name: Groundwater Assessment
 Austen Quarry - Stage 2

Project Number: 2013-GD031

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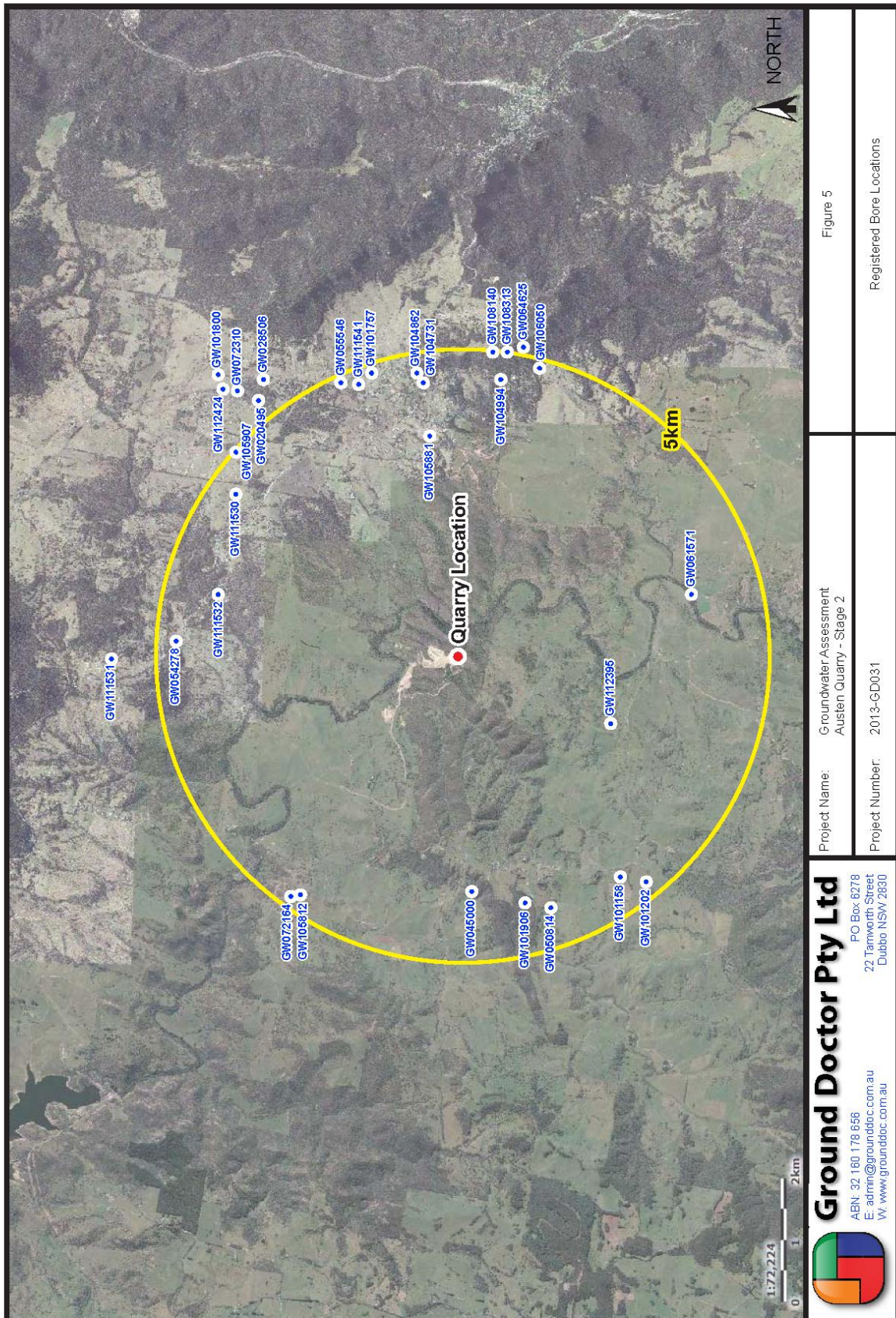
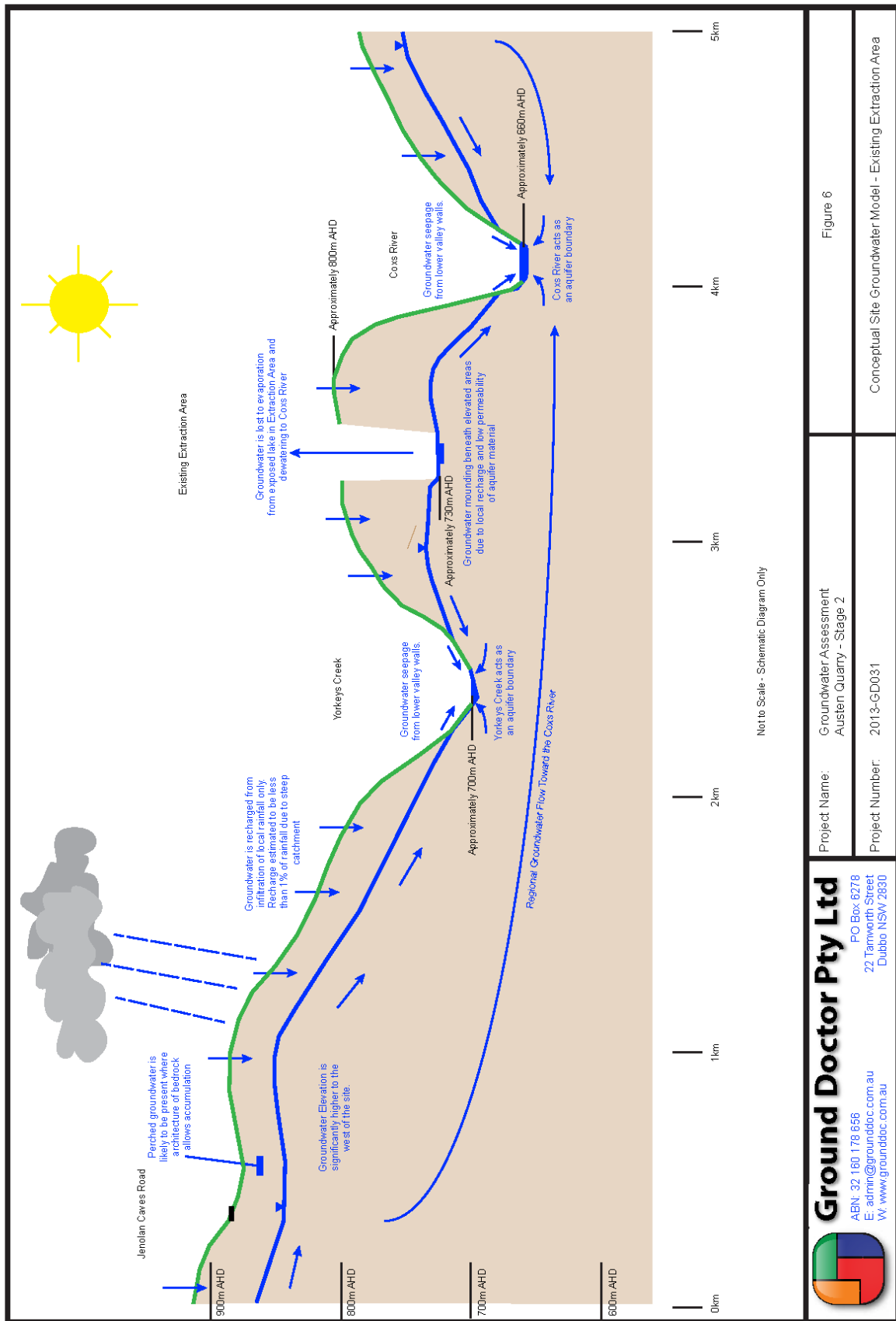
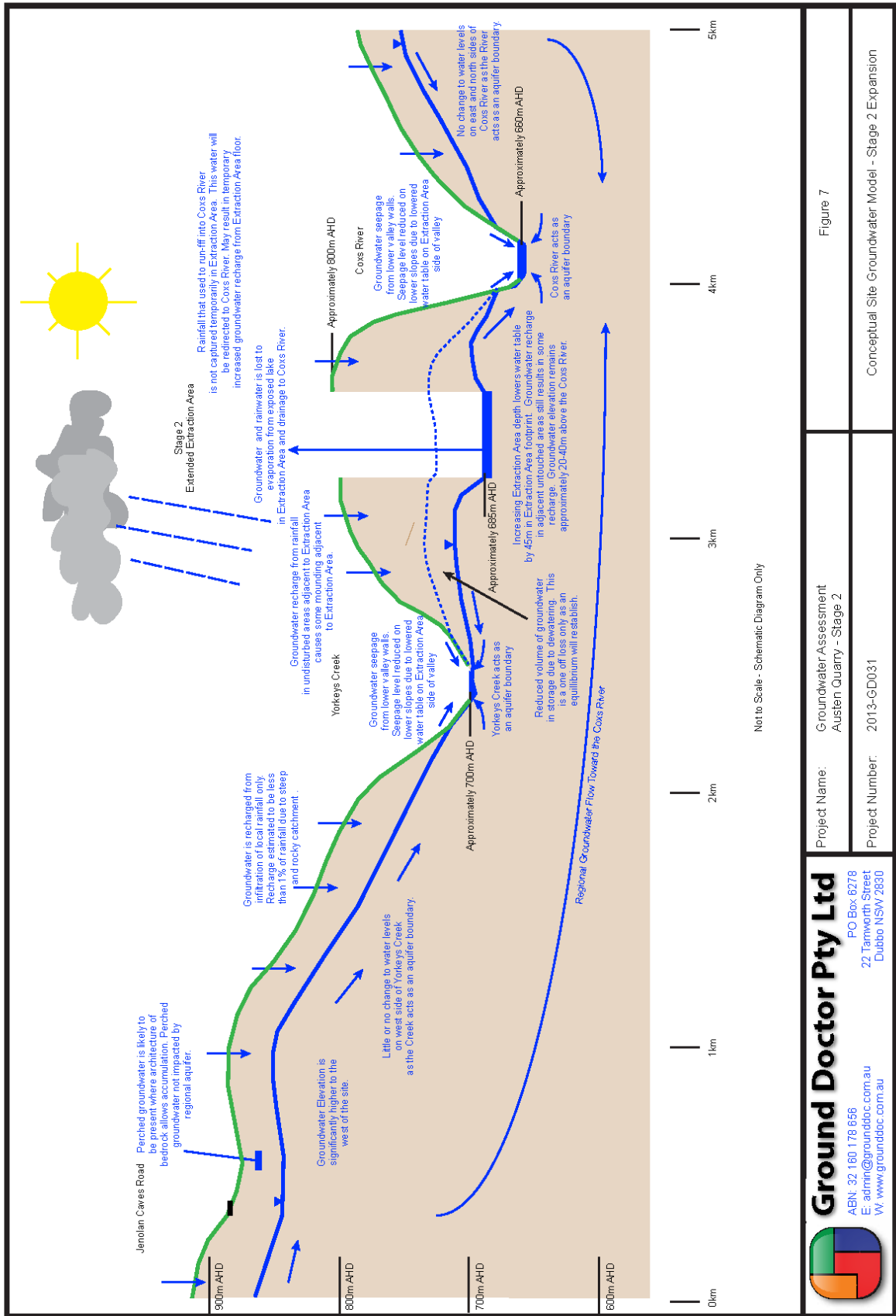


Figure 5
 Registered Bore Locations

Project Name: Groundwater Assessment
 Austen Quarry - Stage 2
 Project Number: 2013-GD031

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Annex B

Registered Groundwater Bore Summary Table*

(Total No. of pages including blank pages = 4)

*Note: This Annexure is only available on the Project CD

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Table B1 - Summary of Registered Groundwater Bore Details

Bore ID	Distance (m)	Direction	Registered Use	Depth (m)	Water Bearing Zones (10-12m (Gravel)	SWL (m STOC)	Approx. Surface Elevation (m AHD)	Approx. Groundwater Elevation (m AHD)	Yield (L/s)	Water Quality Geology	East	North	Date Installed	Status	Licence Number
397102945	2461	S	Stock and Domestic	61		3	851	841	0.22	0.1m Topsoil and 1m-3m Gravel	246245	4245497	2012		13WA112424
397105381	3160	E	Stock and Domestic	-		-	810	-	-	-	234657	4281461	2015		13WA112876
397105300	3278	W	Stock and Domestic	38	10-11m (Granulation)	10.4	920	910	0.76	Fresh 0.2m Clay 3-4m Granite and Weathered Granite	22914	428344	1975	Unknown	13WA112544
397101306	3753	SW	Stock and Domestic	60		-	-	-	-	-	332781	4275463	1978	Supply Obsolete	13WA112578
397104731	3950	E	Domestic	42	32-33m (Shale)	6	800	794	0.38	0.1m Topsoil and Clay 1-42m Shale	24009	4281027	2013	Supply Obsolete	13WA11025
397105814	3966	SW	Stock and Domestic	68.6	29m (Sandstone) 37m (Sandstone)	12.2	820	808	0.3	Unknown	23279	4285019	1979	Unknown	13WA112546
397104394	4009	E	Stock and Domestic	62	34-35m (Polyphy)	-	820	-	0.3	0.2m Topsoil and Clay 1-62m Shale 16-62m Polyphy	240301	4285324	2012	Supply Obsolete	13WA110206
397111552	4036	N	Monitoring	12.4		-	750	-	-	-	236918	4284919	2011	Equipped	10BEL624358
397101862	4058	E	Stock and Domestic	48	38-39m (Shale)	18.5	800	783	0.5	0.1m Topsoil 1-12m Gravel	210215	4281758	2013	Supply Obsolete	13WA11037
397111551	4188	E	Monitoring	12.4		-	800	-	-	-	210030	4282723	2011	Equipped	10BEL624937
397105712	4222	NE	Stock and Domestic	48	32-33m (Gravel)	25	740	754	0.12	0.15m Topsoil and Clay 1-48m Gravel	242747	4282800	2013	Supply Obsolete	13WA112520
397101571	4256	S	Stock and Domestic	36.5	27m (Sandstone) 36m (Shale)	19.3	800	800	1	Unknown	252763	4275821	1986	Unknown	13WA112532
397101757	4258	E	Stock and Domestic	36	34-37m (Shale)	3	820	811	1	0.2m Topsoil and Clay 2-5m Sand 5-36m Shale	24075	4282514	1915	Unknown	13WA110274
397101158	4277	SW	Stock and Domestic	122	15m (Sandstone) 28m (Sandstone)	6.1	900	924	0.25	Good 0.5m Topsoil and Clay 5-36m Sandstone 37-107m Granite	232243	4277891	1977	Supply Obsolete	13WA112530
397101164	4280	NE	Stock and Domestic	30.5	3-16m (Gravel)	10	800	820	-	0.2m Gravel and Weathered Granite	242721	4283393	1954	Unknown	13WA112561
397111550	4287	NE	Monitoring	14		-	750	-	-	-	243343	4284684	2011	Equipped	10EL063463
397105246	4307	NE	Stock and Domestic	38	12-20m (Shale) 26-28m (Shale)	15.2	870	797	0.5	Unknown 0.5m Topsoil and Clay 0.5-3m Shale 34-38m Granite	240715	4282011	1977	Unknown	13WA110189
397106350	4321	E	Stock and Domestic	180	140-141m ? 165-196m ?	70	750	690	1.12	-	343413	4279225	2012	Supply Obsolete	13WA110203
397108140	4376	E	Domestic	50		33	750	722	17.8	-	240531	4282064	2012	-	13WA110305

Table B1 - Summary of Registered Groundwater Bore Details

Bore ID	Distance (m)	Direction	Registered Use	Depth (m)	Water Bearing Zones	SWL (m BTOC)	Approx Surface Elevation (m AHD)	Approx Groundwater Elevation (m AHD)	Yield (L/s)	Water Quality	Geology	East	North	Date Installed	Status	Licence Number
GW10312	430	E	Stock and Domestic	52	-	-	760	-	-	-	-	240525	6279366	2004	-	107/AL16304
GW05425	4461	SE	Stock and Domestic	40.2	9-17m (Granite)	6.1	760	754	0.09	Good	0-1m Topsoil and Cav 1-1m Sandstone and shale 7-4um granite	240366	6279360	1588	Unknown	107/AL16233
GW10202	454	SW	Stock and Domestic	46	35-38m (granite)	9.9	300	331	0.1	Good	0-1m Topsoil 1-1m Metased sandstone 16-45m Granite	236202	6274232	1537	Supply Obtained	107/AL16260
GW10507	4562	NE	Domestic	-	-	-	810	-	-	-	-	239861	6284733	2005	-	107/AL16322
GW02495	4904	NE	Stock and Domestic	7	-	-	815	808	-	-	-	239684	6284421	-	Supply Obtained	107/AL16182
GW02505	5001	NE	Stock and Domestic	9.2	10-17m (Clay)	-	820	811	-	-	-	240000	6284436	-	Unknown	107/AL16183
GW07231	5210	NE	Stock and Domestic	33.6	27m (Granite)	5.1	810	801	0.5	Good	0-5m Topsoil and Cav 5-27m Silts and sandstone 27-45m Granite	236513	6284732	1584	Supply Obtained	107/AL16263
GW05273	5259	N	Stock	70.7	7-8m (Granite)	2.5	800	796	0.08	Good	0-1m Topsoil 1-7m Granite	235513	6286249	1580	Unknown	107/AL16181
GW11424	5423	NE	Stock and Domestic	37	30-37m (Sandstone)	-	800	776	0.17	-	0-1m Topsoil 1m-37m Sandstone	236833	6285075	2009	-	107/AL16275
GW10180	5830	NE	Stock and Domestic	37.2	13-28m (Sandstone)	3	780	774	2.15	Good	0-5m Topsoil and Cav 5-37m Sandstone	240043	6285091	1584	Unknown	107/AL16272
GW111531	6253	N	Monitoring	15.2	-	-	800	-	-	-	-	236253	6286882	2011	Enlarged	ICE 604903

Annex C

Groundwater Work Summary Forms*

(Total No. of pages including blank pages = 62)

*Note: This Annexure is only available on the Project CD

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
Document Generated on Thursday, August 8, 2013

[Print Report](#)

[Works Details](#) [Site Details](#) [Form A](#) [Licensed Construction](#) [Water Bearing Zones](#) [Drillers Log](#)

Work Requested -- GW020495

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW020495
LIC-NUM 10WA116182
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES IRRIGATION
WORK-TYPE Well
WORK-STATUS Supply Obtained
CONSTRUCTION-METHOD (Unknown)
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE
FINAL-DEPTH (metres) 7.00
DRILLED-DEPTH (metres) 0.00
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY GLENROCK
GWMA 606 - MANGROVE MOUNTAIN
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6284421.00
EASTING 239694.00
LATITUDE 33 32' 53"
LONGITUDE 150 11' 47"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW020495>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 38

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 1 831418

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	Masonry	0.00	0.00	1828			(Unknown)

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW028506

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW028506
LIC-NUM 10WA116183
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES IRRIGATION
WORK-TYPE Well
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD (Unknown)
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE
FINAL-DEPTH (metres) 9.10
DRILLED-DEPTH (metres) 9.20
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY VERNICE PARK
GWMA 603 - SYDNEY BASIN
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6284336.00
EASTING 240006.00
LATITUDE 33 32' 56"
LONGITUDE 150 11' 59"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW028506>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 346

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 346 1101306

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	Masonry	0.00	0.00	3658			(Unknown)

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	9.14	9.14	Clay	Water Supply	
9.14	9.15	0.01	Rock		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW045000

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW045000
LIC-NUM 10WA112544
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD Rotary Air
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 1975-07-01
FINAL-DEPTH (metres) 38.10
DRILLED-DEPTH (metres) 38.10
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY HALL-SMITH
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6280349.00
EASTING 232914.00
LATITUDE 33 34' 59"
LONGITUDE 150 7' 20"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWVID=GW045000>

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 1 870895

Licensed [\(top\)](#)

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 1 870895

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
10.40	11.30	0.90	Fractured	10.40		0.06			Fresh

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	Topsoil		
0.30	2.74	2.44	Clay		
2.74	3.35	0.61	Quartzite		
3.35	5.79	2.44	Granodiorite Decomposed		
5.79	38.10	32.31	Granodiorite		

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Work Requested -- GW050814

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW050814
LIC-NUM 10WA112546
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore open thru rock
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD Rotary Air
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 1979-12-01
FINAL-DEPTH (metres) 68.60
DRILLED-DEPTH (metres) 68.60
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY NOONAN
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6279019.00
EASTING 232770.00
LATITUDE 33 35' 42"
LONGITUDE 150 7' 13"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW050814>

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 100 655321

Licensed [\(top\)](#)

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 100 655321

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	P.V.C.	-0.20	5.00	152			Driven into Hole

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
25.00	25.30	0.30	Consolidated	12.20		0.10			(Unknown)
36.60	36.90	0.30	Consolidated	12.20		0.21			(Unknown)

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.60	0.60	Topsoil		
0.60	4.90	4.30	Sandstone Soft		
4.90	68.60	63.70	Sandstone Hard	Water Supply	

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Groundwater Works Summary

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Work Requested -- GW054278

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW054278
LIC-NUM 10WA116191
AUTHORISED-PURPOSES STOCK
INTENDED-PURPOSES STOCK
WORK-TYPE Bore open thru rock
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD Rotary Air
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 1980-05-01
FINAL-DEPTH (metres) 70.70
DRILLED-DEPTH (metres) 70.70
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY NOSBOR
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6286249.00
EASTING 235513.00
LATITUDE 33 31' 50"
LONGITUDE 150 9' 7"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW054278>

COUNTY COOK
 PARISH LETT
 PORTION-LOT-DP 155

Licensed [\(top\)](#)

COUNTY COOK
 PARISH LETT
 PORTION-LOT-DP P+ Port 155

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	Welded Steel	-0.30	8.20	165			Driven into Hole

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
7.90	8.20	0.30	Fractured	3.60		0.06			Good

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	Topsoil		
0.30	7.90	7.60	Clay Decomposed Granite		
7.90	8.50	0.60	Granite Water Supply		
8.50	48.80	40.30	Granite White		
48.80	70.10	21.30	Granite White		
70.10	70.70	0.60	Granite Grey Hard		

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Groundwater Works Summary

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Work Requested -- GW055246

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW055246
LIC-NUM 10WA116199
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD Rotary Air
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 1981-05-01
FINAL-DEPTH (metres) 38.10
DRILLED-DEPTH (metres) 38.10
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY VENICE CARAVAN PARK
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6283011.00
EASTING 240016.00
LATITUDE 33 33' 39"
LONGITUDE 150 11' 58"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW055246>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 59

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 1 1069254

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	P.V.C.	0.00	33.80	150			Driven into Hole
1	1	Opening	Slots - Vertical	16.70	30.40	150		1	Plastic; SL: 0mm; A: 0mm

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
18.20	19.80	1.60	Fractured	15.20		0.03			(Unknown)
25.90	27.40	1.50	Fractured	15.20		0.50			(Unknown)

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	Topsoil		
0.30	1.50	1.20	Clay Red		
1.50	6.10	4.60	Clay White		
6.10	33.50	27.40	Shale Soft Water Supply		
33.50	38.10	4.60	Granite White		

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Work Requested -- GW061571

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW061571
LIC-NUM 10WA112558
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD Rotary Air
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 1986-06-01
FINAL-DEPTH (metres) 36.50
DRILLED-DEPTH (metres) 36.50
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY N/A
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6276831.00
EASTING 237269.00
LATITUDE 33 36' 57"
LONGITUDE 150 10' 5"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW061571>

COUNTY COOK
 PARISH KANIMBLA
 PORTION-LOT-DP L1 DP565599 (5)

Licensed [\(top\)](#)

COUNTY COOK
 PARISH KANIMBLA
 PORTION-LOT-DP 1 565599

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	P.V.C.	-0.30	36.50	150			Seated on Bottom
1	1	Opening	Slots - Vertical	25.90	35.00	150		1	Mechanically Slotted; SL: 0mm; A: 3mm

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
27.40	27.70	0.30	Fractured			0.30			(Unknown)
33.50	33.80	0.30	Fractured	19.80		0.70			(Unknown)

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.60	0.60	Topsoil		
0.60	33.50	32.90	Granite Decomposed	Water Supply	
33.50	36.50	3.00	Granite	Water Supply	

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Groundwater Works Summary

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Work Requested -- GW064625

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW064625
LIC-NUM 10WA116233
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD Rotary Air
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 1988-02-01
FINAL-DEPTH (metres) 40.20
DRILLED-DEPTH (metres) 40.20
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY ORR
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6279850.00
EASTING 240566.00
LATITUDE 33 35' 22"
LONGITUDE 150 12' 16"
GS-MAP 0056A3
AMG-ZONE 56
COORD-SOURCE GD.,ACC.MAP
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW064625>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 5 709634

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 5 709634

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	Steel	-0.30	6.70	165			Driven into Hole

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
9.10	9.70	0.60	Fractured	6.10		0.09			Good

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	Topsoil		
0.30	4.60	4.30	Sandstone		
4.60	6.70	2.10	Shale		
6.70	40.20	33.50	Granite	Water Supply	

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Work Requested -- GW072164

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW072164
LIC-NUM 10WA112561
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore open thru rock
WORK-STATUS (Unknown)
CONSTRUCTION-METHOD
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 1994-01-13
FINAL-DEPTH (metres) 30.50
DRILLED-DEPTH (metres) 30.50
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY ECCLESBOURNE
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE
NORTHING 6283390.00
EASTING 232720.00
LATITUDE 33 33' 21"
LONGITUDE 150 7' 16"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW072164>

COUNTY WESTMORELAND
PARISH LOWTHER
PORTION-LOT-DP 3 620368

Licensed [\(top\)](#)

COUNTY WESTMORELAND
PARISH LOWTHER
PORTION-LOT-DP 3 620368

Construction [\(top\)](#)

Negative depths indicate Above Ground Level; H-Hole; P-Pipe; OD-Outside Diameter;
 ID-Inside Diameter; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1	1	Casing	P.V.C.	0.00	0.00	152			Driven into Hole
1	1	Opening	Slots	5.50	14.60	152	1		Sawn; SL: 0mm; A: 0mm

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	5.50	5.50	Soft Decomposed Granite		
5.50	14.60	9.10	Broken Granite		
14.60	30.50	15.90	Hard Red Granite		

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Groundwater Works Summary

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Work Requested -- GW072310

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW072310
LIC-NUM	10WA116263
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1994-05-26
FINAL-DEPTH (metres)	83.80
DRILLED-DEPTH (metres)	83.80
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	SMITH
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	9.10
SALINITY	
YIELD	0.50

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	8930-4N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6284732.00
EASTING	239813.00
LATITUDE	33 32' 43"
LONGITUDE	150 11' 52"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	Unidentified Location
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW072310>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 40//834866

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 40 834866

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	83.80	160			Rotary Air
1	1	Casing	PVC Class 9	0.00	12.10	160			

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
27.40	27.70	0.30		9.10		0.25	28.00		Good
62.50	62.70	0.20		9.10		0.25	63.00		Good

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.60	0.60	TOP SOIL		
0.60	5.50	4.90	CLAY & GRAVEL		
5.50	12.20	6.70	SOFT SHALE		
12.20	27.40	15.20	SHALE & WHITE SAND /ST		
27.40	83.80	56.40	GRANITE (RED)		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW101158

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW101158
LIC-NUM	10WA112593
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1997-12-14
FINAL-DEPTH (metres)	122.00
DRILLED-DEPTH (metres)	122.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	JOSEPH
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	6.10
SALINITY	
YIELD	0.25

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6277891.00
EASTING	233240.00
LATITUDE	33 36' 19"
LONGITUDE	150 7' 30"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW101158>

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 187 757063

Licensed [\(top\)](#)

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 187 757063

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	23.10	181			Rotary Air
1	1	Casing	PVC Class 9	-0.30	23.40		150		Glued; Driven into Hole
1	1	Opening	Slots - Vertical	15.20	23.40		150		PVC Class 9; Sawn; SL: 457mm; A: 2mm

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
15.20	15.80	0.60		6.10		0.19	15.80		Good
26.50	26.80	0.30		6.10		0.06	26.80		Good

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.60	0.60	TOP SOIL		
0.60	4.50	3.90	CLAY, BROWN		
4.50	23.10	18.60	SANDSTONE, YELLOW		
23.10	35.00	11.90	SANDSTONE, HARD, GREEN		
35.00	122.00	87.00	GRANITE, GREY		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW101202

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW101202
LIC-NUM	10WA112569
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1997-12-22
FINAL-DEPTH (metres)	45.00
DRILLED-DEPTH (metres)	45.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	FLATS HILL
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	19.00
SALINITY	
YIELD	0.10

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6277428.00
EASTING	233202.00
LATITUDE	33 36' 34"
LONGITUDE	150 7' 28"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW101202>

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP LOT63 DP76200

Licensed [\(top\)](#)

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 1 1120068

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	17.50	181			Rotary Air
1		Hole	Hole	17.50	45.00	125			Rotary Air
1	1	Casing	PVC Class 9	-0.30	18.20	125			Driven into Hole

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
35.00	36.00	1.00		19.00		0.10	36.00		Good

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	topsoil		
1.00	17.50	16.50	decomposed granite		
17.50	45.00	27.50	grey granite		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW101757

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW101757
LIC-NUM	10WA116274
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Rotary
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	1995-10-26
FINAL-DEPTH (metres)	36.00
DRILLED-DEPTH (metres)	36.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	WASS
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	9.00
SALINITY	
YIELD	1.00

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6282514.00
EASTING	240175.00
LATITUDE	33 33' 56"
LONGITUDE	150 12' 4"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW101757>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 22//840956

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 22 840956

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	36.00	178			Rotary Air
1	1	Casing	PVC Class 9	0.00	36.00	125			Glued; Seated on Bottom
1	1	Opening	Slots - Vertical	28.00	34.00	125			PVC Class 9; SL: 6000mm; A: .77mm

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
30.50	31.00	0.50		9.00		1.00	36.00	2.75	

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.50	0.50		Topsoil	
0.50	2.00	1.50		Clay	
2.00	5.00	3.00		Sand	
5.00	36.00	31.00		Shale	

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Groundwater Works Summary

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Work Requested -- GW101800

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW101800
LIC-NUM	10WA116272
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	(Unknown)
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	
COMMENCE-DATE	
COMPLETION-DATE	1994-12-19
FINAL-DEPTH (metres)	37.20
DRILLED-DEPTH (metres)	37.20
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	DENVER-STEVENSON
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	5.95
SALINITY	
YIELD	2.15

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6285091.00
EASTING	240043.00
LATITUDE	33 32' 32"
LONGITUDE	150 12' 1"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW101800>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 44//834866

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 44 834866

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	10.41	160			Rotary Air
1		Hole	Hole	10.41	37.20	150			Rotary Air
1	1	Casing	PVC Class 9	0.00	10.41	160			Glued; Seated on Bottom

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
13.39	29.16	15.77		5.95		2.15	37.20	1.00	Good

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.50	0.50	TOP SOIL		
0.50	4.76	4.26	CLAY AND BLUE SHALE		
4.76	37.20	32.44	SANDSTONE, WHITE		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW101906

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW101906
LIC-NUM	10WA112578
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	(Unknown)
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	1978-01-01
FINAL-DEPTH (metres)	60.00
DRILLED-DEPTH (metres)	60.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	30.00
SALINITY	
YIELD	0.13

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6279460.00
EASTING	232791.00
LATITUDE	33 35' 28"
LONGITUDE	150 7' 14"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	Map Interpretation
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWVID=GW101906>

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP LT 224 DP 757063

Licensed [\(top\)](#)

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 224 757063

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	60.00	125			(Unknown)
1	1	Casing	P.V.C.	0.00	15.00	125			

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW104731

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW104731
LIC-NUM	10WA116315
AUTHORISED-PURPOSES	DOMESTIC
INTENDED-PURPOSES	DOMESTIC
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Rotary
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2003-01-10
FINAL-DEPTH (metres)	42.00
DRILLED-DEPTH (metres)	42.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	6.00
SALINITY	
YIELD	0.38

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	8930-4N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6281627.00
EASTING	240109.00
LATITUDE	33 34' 24"
LONGITUDE	150 12' 0"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW104731>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP LT13 DP840956

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 13 840956

Construction [\(top\)](#)

Negative depths indicate Above Ground Level; H-Hole; P-Pipe; OD-Outside Diameter;
 ID-Inside Diameter; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	42.00	200			Down Hole Hammer
1	1	Casing	PVC Class 9	0.00	42.00	150			Glued PVC Class 9;
1	1	Opening	Slots - Horizontal	30.00	36.00	150			SL: 15mm; A: 3mm

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
32.00	32.50	0.50		6.00		0.38		2.00	

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	TOPSOIL		
0.20	1.30	1.10	CLAY		
1.30	42.00	40.70	SHALE		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW104862

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW104862
LIC-NUM	10WA116317
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Rotary
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2003-02-08
FINAL-DEPTH (metres)	48.00
DRILLED-DEPTH (metres)	48.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	16.50
SALINITY	
YIELD	0.50

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	8930-4N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6281758.00
EASTING	240215.00
LATITUDE	33 34' 20"
LONGITUDE	150 12' 5"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW104862>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP LT 14 DP 840956

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 14 840956

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	48.00	200			Down Hole Hammer
1	1	Casing	PVC Class 9	0.00	48.00	150			Glued; Seated on Bottom
1	1	Opening	Slots - Horizontal	36.00	42.00	150			PVC Class 9; SL: 15mm; A: 3mm
1		Annulus	Waterworm/Rounded	5.00	10.00				Graded; GS: 0-48mm; Q: 7m ³

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
38.10	38.50	0.40		16.50		0.50		2.00	

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.30	0.30	TOPSOIL		
0.30	1.00	0.70	CLAY		
1.00	48.00	47.00	SHALE		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW104994

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW104994
LIC-NUM 10WA116306
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS Supply Obtained
CONSTRUCTION-METHOD
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2002-01-20
FINAL-DEPTH (metres) 62.00
DRILLED-DEPTH (metres) 62.00
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY EDWARDS
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD 0.30

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6280324.00
EASTING 240201.00
LATITUDE 33 35' 7"
LONGITUDE 150 12' 3"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW104994>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP LT 20 DP 776589

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 20 776589

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	62.00	150			Rotary Air
1	1	Casing	Steel	-0.50	18.00	150	138		Welded; Suspended in Clamps

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
54.00	55.00	1.00				0.30		0.50	

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	TOPSOIL		
0.20	7.50	7.30	BROWN CLAY		
7.50	16.00	8.50	BROKEN BROWN SHALE		
16.00	62.00	46.00	PORPHYRY		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW105812

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW105812
LIC-NUM	10WA112580
AUTHORISED-PURPOSES	DOMESTIC STOCK
INTENDED-PURPOSES	DOMESTIC STOCK
WORK-TYPE	Bore
WORK-STATUS	Supply Obtained
CONSTRUCTION-METHOD	Rotary Air
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2003-09-19
FINAL-DEPTH (metres)	48.00
DRILLED-DEPTH (metres)	48.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	N/A
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	26.00
SALINITY	
YIELD	0.13

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	212 - HAWKESBURY RIVER
AREA-DISTRICT	
CMA-MAP	8930-4N
GRID-ZONE	56/1
SCALE	1:25,000
ELEVATION	
ELEVATION-SOURCE	(Unknown)
NORTHING	6283300.00
EASTING	232739.00
LATITUDE	33 33' 23"
LONGITUDE	150 7' 17"
GS-MAP	
AMG-ZONE	56
COORD-SOURCE	GIS - Geographic Information System
REMARK	

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW105812>

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 3//620368

Licensed [\(top\)](#)

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 3 620368

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	15.00	200			Rotary Air
1		Hole	Hole	15.00	48.00	170			Rotary - Percussion (Down Hole Hammer)
1	1	Casing	PVC Class 9	0.50	3.00	125	107		Seated on Bottom; Open End
1	1	Opening	Slots - Horizontal	32.00	32.50	125			PVC Class 9; Casing - Machine Slotted; SL: 70mm; A: 1.5mm; Riveted and Glued
1		Annulus	Waterworn/Rounded	31.00	48.00				Graded; GS: 5-7mm

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
32.00	32.50	0.50		26.00		0.13			

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	5.00	5.00		topsoil	
5.00	15.00	10.00		clay	
15.00	48.00	33.00		granite	

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW105881

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW105881
LIC-NUM 10WA116316
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE
COMMENCE-DATE
COMPLETION-DATE 2005-05-09
FINAL-DEPTH (metres)
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY N/A
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6281461.00
EASTING 239357.00
LATITUDE 33 34' 29"
LONGITUDE 150 11' 31"

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWVID=GW105881>

GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 5 1036076

Licensed [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 5 1036076

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW105907

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW105907
LIC-NUM 10WA116322
AUTHORISED-PURPOSES DOMESTIC
INTENDED-PURPOSES
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE
COMMENCE-DATE
COMPLETION-DATE 2005-05-12
FINAL-DEPTH (metres)
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY BENNETT
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6284733.00
EASTING 238961.00
LATITUDE 33 32' 43"
LONGITUDE 150 11' 19"

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWVID=GW105907>

GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 4 884878

Licensed [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 4 884878

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW106050

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW106050
LIC-NUM 10WA116303
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS Supply Obtained
CONSTRUCTION-METHOD Rotary Air
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2002-01-05
FINAL-DEPTH (metres) 180.00
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY MC GARRIGLE
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL 70.00
SALINITY
YIELD 1.10

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN 212 - HAWKESBURY RIVER
AREA-DISTRICT
CMA-MAP 8930-4N
GRID-ZONE 56/1
SCALE 1:25,000
ELEVATION
ELEVATION-SOURCE (Unknown)
NORTHING 6279725.00
EASTING 240418.00
LATITUDE 33 35' 26"
LONGITUDE 150 12' 10"
GS-MAP
AMG-ZONE 56
COORD-SOURCE GIS - Geographic Information System
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW106050>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 7//715471

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 7 715471

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	180.00	150			Rotary Air
1	1	Casing	Stainless Steel	-0.10	0.00	150	138		Suspended in Clamps, Open End

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
140.00	141.00	1.00		70.00		0.18		1.00	
165.00	166.00	1.00		70.00		0.94		1.00	

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW108140

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW108140
LIC-NUM 10WA116305
AUTHORISED-PURPOSES DOMESTIC
INTENDED-PURPOSES DOMESTIC
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE
COMMENCE-DATE
COMPLETION-DATE 2002-01-01
FINAL-DEPTH (metres) 50.00
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY DULLAARD
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL 38.00
SALINITY
YIELD 17.80

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6280084.00
EASTING 240531.00
LATITUDE 33 35' 15"
LONGITUDE 150 12' 15"

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWD=GW108140>

GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 3 709634

Licensed [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 3 709634

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW108313

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW108313
LIC-NUM 10WA116304
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE
COMMENCE-DATE
COMPLETION-DATE 2004-01-01
FINAL-DEPTH (metres) 52.00
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY MCGRAW
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL 16.00
SALINITY
YIELD 0.50

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6279986.00
EASTING 240525.00
LATITUDE 33 35' 18"
LONGITUDE 150 12' 15"

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWD=GW108313>

GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 4 709634

Licensed [\(top\)](#)

COUNTY COOK
PARISH HARTLEY
PORTION-LOT-DP 4 709634

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW111530

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW111530
LIC-NUM 10BL604693
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS Equipped - bore used for obs
CONSTRUCTION-METHOD Rotary - Coring
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2011-05-23
FINAL-DEPTH (metres) 14.00
DRILLED-DEPTH (metres) 14.00
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY MT VIC TO LITHGOW ROAD UPGRADE
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6284684.00
EASTING 238349.00
LATITUDE 33 32' 44"
LONGITUDE 150 10' 55"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW111530>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 1//195993

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 1 195993

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	14.00	122			Rotary - Coring
1	1	Casing	PVC Class 18	0.00	14.00	60	50		Screwed; Seated; End cap
1	1	Casing	GAB Monitoring Point	0.00	14.00				
1	1	Opening	Slots - Horizontal	11.00	14.00	60			PVC Class 18; Casing - Machine Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite/Grout	8.00	9.00				
1		Annulus	Waterworm/Rounded	9.00	14.00				Graded; GS: 2-3mm

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.50	1.50	SAND,ORANGE BROWN FG,MG SAND		
1.50	3.50	2.00	GRANITE,MC,CG,HIGHLY WEATHERED		
3.50	4.10	0.60	BASALT,BLUE GREY GREEN		
4.10	14.00	9.90	GRANITE,PINK GREY,WEATHERED		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW111531

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW111531
LIC-NUM 10BL604903
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS Enlarged
CONSTRUCTION-METHOD Rotary - Coring
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2011-05-30
FINAL-DEPTH (metres) 15.20
DRILLED-DEPTH (metres) 15.20
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY NOSBOR PTY LIMITED
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6286887.00
EASTING 235253.00
LATITUDE 33 31' 29"
LONGITUDE 150 8' 58"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW111531>

COUNTY COOK
 PARISH LETT
 PORTION-LOT-DP 29//751650

Licensed [\(top\)](#)

COUNTY COOK
 PARISH LETT
 PORTION-LOT-DP 29 751650

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	15.20	122			Rotary - Coring
1	1	Backfill	Bentonite	0.00	1.00				
1	1	Casing	PVC Class 18	0.00	15.20	60	50		Seated; End cap
1	1	Casing	GAB Monitoring Point	0.00	15.20				
1	1	Opening	Slots - Horizontal	12.20	15.20	60			PVC Class 18; Casing - Machine Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite/Grout	9.20	10.20				
1		Annulus	Waterworm/Rounded	10.20	15.20				Graded; GS: 2-3mm

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.50	0.50	SAND,BROWN FG,MG.		
0.50	1.50	1.00	CLAY,GREY,HIGH PLASTICITY		
1.50	2.55	1.05	SAND CLAYEY,GREY MG,CG,TRACE QUARTZ		
2.55	4.00	1.45	SANDSTONE,LT GREY,MG,IRON,STAINING		
4.00	15.20	11.20	GRANITE,GREY,BROWN,MG,CG.		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW111532

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW111532
LIC-NUM 10BL604858
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS Equipped - bore used for obs
CONSTRUCTION-METHOD Rotary - Coring
OWNER-TYPE Other Govt
COMMENCE-DATE
COMPLETION-DATE 2011-06-02
FINAL-DEPTH (metres) 12.35
DRILLED-DEPTH (metres) 12.35
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY RESERVE 68666
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6284919.00
EASTING 236918.00
LATITUDE 33 32' 35"
LONGITUDE 150 10' 0"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW111532>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 7032//1057700

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 7032 1057700

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	12.35	122			Rotary - Coring
1	1	Backfill	Bentonite	0.00	1.00				
1	1	Casing	PVC Class 18	0.00	12.35	60	50		Seated; End cap
1	1	Casing	GAB Monitoring Point	0.00	12.35				
1	1	Opening	Slots - Horizontal	9.30	12.30	60			PVC Class 18; Casing - Machine Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite/Grout	6.35	7.35				
1		Annulus	Waterworm/Rounded	7.35	12.35				Graded; GS: 2-3mm

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.85	0.85	SAND,ORANGE BROWN,FG-CG,QUARTZ PEBBLES		
0.85	12.35	11.50	GRANITE,ORANGE BROWN,FG-CG		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW111541

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW111541
LIC-NUM 10BL604867
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS Equipped - bore used for obs
CONSTRUCTION-METHOD Rotary - Coring
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2011-05-27
FINAL-DEPTH (metres) 12.40
DRILLED-DEPTH (metres) 12.40
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY BONNY HILLS PTY LTD
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6282723.00
EASTING 240030.00
LATITUDE 33 33' 49"
LONGITUDE 150 11' 58"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW111541>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 23//1067654

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 23 1067654

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	12.40	122			Rotary - Coring
1	1	Backfill	Bentonite	0.00	1.00				
1	1	Casing	PVC Class 18	0.00	12.40	60	50		Seated; End cap
1	1	Casing	GAB Monitoring Point	0.00	12.40				
1	1	Opening	Slots - Horizontal	9.40	12.40	60			PVC Class 18; Casing - Machine Slotted; SL: 20mm; A: 5mm; Screwed
1		Annulus	Bentonite/Grout	8.40	8.90				
1		Annulus	Waterworm/Rounded	8.90	12.40				Graded; GS: 2-3mm

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.50	1.50	CLAY,BROWN TO ORANGE,LOW-MED PLASTICITY		
1.50	5.70	4.20	SILTSTONE:MOTTLED,RED-BROWN,WHITE		
5.70	6.40	0.70	SANDSTONE/SILTSTONE,GREY W RED/WHITE		
6.40	9.46	3.06	SILTSTONE,MOTTLED,RED BROWN,WHITE		
9.46	12.40	2.94	SILTSTONE,GREY FG.MG.		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW112395

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW112395
LIC-NUM 10WA117924
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD Rotary - Percussion (Down Hole Hammer)
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2012-12-13
FINAL-DEPTH (metres) 60.00
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY Jones
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL 9.00
SALINITY
YIELD 0.32

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6278197.00
EASTING 235426.00
LATITUDE 33 36' 11"
LONGITUDE 150 8' 55"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWID=GW112395>

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 2//1068125

Licensed [\(top\)](#)

COUNTY WESTMORELAND
 PARISH LOWTHER
 PORTION-LOT-DP 2 1068125

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	13.00	170			Rotary - Percussion (Down Hole Hammer)
1		Hole	Hole	13.00	60.00	145			Rotary - Percussion (Down Hole Hammer)
1	1	Casing	PVC Class 9	0.00	13.00	136	125		Driven into small hole; Open End PVC Class 9; Casing - Machine Slotted; SL: 200mm; Glued
1	1	Opening	Slots	10.50	12.00	136	125		Graded; GS: 5-7mm
1		Annulus	Waterworn/Rounded	8.00	13.00	170	136		

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
10.50	12.00	1.50		9.00	10.00	0.32		1.00	

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	TOPSOIL		
1.00	10.50	9.50	GRANITE DECOMPOSED		
10.50	60.00	49.50	GRANITE GREY AND RED		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW112424

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW112424
LIC-NUM 10WA116376
AUTHORISED-PURPOSES DOMESTIC STOCK
INTENDED-PURPOSES DOMESTIC STOCK
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD Down Hole Hammer
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2009-09-19
FINAL-DEPTH (metres) 37.00
DRILLED-DEPTH (metres) 37.00
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY BENEDET
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD 0.17

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6285015.00
EASTING 239833.00
LATITUDE 33 32' 34"
LONGITUDE 150 11' 53"
GS-MAP
AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

Groundwater Works Summary

<http://is2.dnr.nsw.gov.au/proxy/dipnr/gwworks?GWWID=GW112424>

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 42//834866

Licensed [\(top\)](#)

COUNTY COOK
 PARISH HARTLEY
 PORTION-LOT-DP 42 834866

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE-NO	PIPE-NO	COMPONENT-CODE	COMPONENT-TYPE	DEPTH-FROM (metres)	DEPTH-TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	37.00	160			Down Hole Hammer
1	1	Casing	Concrete	0.00	3.00				
1	1	Casing	P.V.C.	0.00	4.00	160	150		Glued
1	1	Casing	P.V.C.	0.00	37.00	114	104		Glued
1	1	Opening	Slots - Vertical	30.00	37.00	114			PVC; SL: 6mm; A: 5mm

Water Bearing Zones [\(top\)](#)

FROM-DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK-CAT-DESC	S-W-L	D-D-L	YIELD	TEST-HOLE-DEPTH (metres)	DURATION	SALINITY
30.00	37.00	7.00				0.17		3.00	

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	TOPSOIL		
1.00	23.00	22.00	SANDSTONE BANDS		
23.00	33.00	10.00	IRONSTONE		
33.00	37.00	4.00	SANDSTONE		

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