UNIVERSITY OF QUEENSLAND EXPERIMENTAL MINE
DETAILED SITE INVESTIGATION

Volume 1 of 3

UNIVERSITY OF QUEENSLAND EXPERIMENTAL MINE
DETAILED SITE INVESTIGATION

Lot 3 on RP60248,
Lot 88, Lot 89, Lot 91, Lot 92, Lot 93,Lot 94, Lot 137 on RP23531
Lot 329 on SL7293,
Lot 334 on SL3873
Lot 40, Lot 41 on RP23699

University of Queensland, 40 Isles Road, Indooroopilly QLD 4068

Prepared for:
University of Queensland

Date:
4 April 2013
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Report Version: J122934-00/01

Prepared by:
Noel Arnold & Associates Pty Ltd

Report Approved by (name)…….

(signed)……

DOCUMENT CONTROL SHEET

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`Title:	University of Queensland Experimental Mine Detailed Site Investigation		
Project Manager:	John Iddles		
Author:	Steven Sherrington		
Client:	University of Queensland		
Client Contact:	Stuart Green		

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EXECUTIVE SUMMARY

Noel Arnold and Associates (NAA) on behalf of Greencap Ltd was commissioned by the University of Queensland (UQ) to undertake a Detailed Site Investigation (DSI) of their Experimental Mine premises located at 40 Isles Road, Indooroopilly QLD 4068 in order to investigate the presence and extent of suspected contamination at the site. The University was served a notice from the Department of Environment and Heritage Protection in October 2013 to undertake a site investigation.

The site that is the subject of this investigation include Lot 3 on RP 60248, Lots 88, 89, 91, 92, 93, 94, 137 on RP 23531, Lot 329 on SL 7293, Lot 334 on SL 3873, Lot 40, 41 on RP 23699.

The requirements for the detailed site investigation as specified by EHP were;

- *Conduct or commission a site investigation on Lot 3 on RP 60248, Lots 88, 89, 91, 92, 93, 94, 137 on RP 23531, Lot 329 on SL 7293, Lot 334 on SL 3873, Lot 40, 41 on RP 23699.*
- *Site investigation report must be prepared in accordance with Chapter 7 Part 8 of the Environmental Protection Act 1994 (Qld) (EP Act), the Guideline for Contaminated Land Professionals (DEHP 2012) and the Guideline for Assessing Qualified Persons (DEHP 2013).*
- *The investigation must specify that the land is suitable for the intended use or enable a statement of suitability with a Site Management Plan.*
- *The investigation must cover the entire area on which the notifiable activity was conducted.*
- *The investigation must include an assessment of lead bio-availability in the soil and the leachate.*

Within the site are historical mine workings, both open cut and underground, which together comprise a Declared Mine (the Mine) under the Mining and Quarrying Safety and Health Regulation 2001 (Qld) Schedule 4 Part 1. Note that there are no current mining tenures over the site (for example, Mining Lease), thus mining does not take place on the site.

Whilst the underground and open cut sections of the Mine are closed (restricted access exists for inspection and maintenance), the Faculty of Engineering, Architecture and Information Technology (EAIT), JKTech Pty Ltd, The Sustainable Minerals Institute's (SMI) Julius Kruttschnitt Mineral Research Centre and Property and Facilities (P&F) Grounds still operate out of buildings on the site.

Following a review of historical records, aerial photography and utilising the data collected during the preliminary site assessment, the potential sources of site contamination associated with past and present site uses are considered to include (but may not be restricted to):-

- *Mine tailings, overburden and other mine wastes;*
- *uncontrolled fill;*
- *unlicensed and uncontrolled disposal of wastes;*
- *bulk storage, use and disposal of chemicals during historical mining operations, and;*
- *Debris from current buildings and the demolition of former buildings.*

From the site history, there is mention of the incorporation into the pilot plant, facilities to handle radioactive ores, for the purpose of test work in the pilot plant. There are comprehensive details on the UQ file that indicates any residues from such ores were cleaned up and removed from site in 1986.

Twenty four soil bores (BH01 to BH24) and five groundwater wells (GW1 to GW5) were drilled to a maximum depth of 7mBGL.Where steep terrain and dense vegetation prevented the access of a drilling rig, a further sixteen soil bores (BH25 to BH40) were excavated using hand auger drilling techniques to a maximum depth of 1.6m using a hand auger.

The majority of borehole locations showed elevated levels of lead above the adopted assessment criteria (NEPM[1] 2013 HIL D) with a maximum concentration of 110,000mg/kg. Levels of selected metals (arsenic, copper, lead, zinc) exceed the ecological assessment criteria at a number of boreholes. Assessment of the soil materials and metal levels appears to indicate elevated levels of metals in both fill (mine waste materials) and natural soils. Limited testing for uranium returned results below laboratory detection levels.

Leach testing of selected materials with a neutral leach fluid has indicated levels of metals in excess of the ANZECC guideline levels. Leach testing of selected materials with an acidic leach fluid has indicated levels of lead that are well in excess of ANZECC guideline levels. Only lead was tested with acidic leach fluid.

Given there are no signs of impact to the site fauna and flora or the underlying groundwater it is likely that the elevated lead results observed in the leachate results are not indicative of actual risk. This is most likely because the local ecosystem has adapted to the local heavily mineralised geology of the broader area.

Shallow groundwater is present in generally thin, saturated clayey sand to fine gravel, in isolated pockets of the site, generally in the near vicinity to Witton Creek. Groundwater levels tend to indicate flow within this shallow aquifer towards Witton Creek and thence towards the Brisbane River. Assessment of groundwater chemistry appears to indicate little connection between the shallow groundwater across the site and with Witton Creek. Concentrations of dissolved Copper and Zinc in groundwater were above the ANZECC guideline levels but do not appear to correlate with elevated metal levels in soils.

It is recommended that a site management plan be prepared for this site, to manage the potential for impacts on human health and the environment from the elevated metals found in both mine wastes and natural soils on site.

[1] Reference: The National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999 (as amended in May 2013))

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1.0 INTRODUCTION

1.1 Background and Objectives

Noel Arnold and Associates (NAA) on behalf of Greencap Ltd was commissioned by the University of Queensland (UQ) to undertake a Detailed Site Investigation (DSI) of their Experimental Mine premises located at 40 Isles Road, Indooroopilly QLD 4068 in order to investigate the presence and extent of suspected contamination at the site.

A Preliminary Soil Assessment (PSA) was carried out at the site by Environmental & Licensing Professionals Pty Ltd (ELP) also part of the Greencap group of companies in August 2013. The assessment indicated that the site is impacted from mining wastes including overburden and tailings associated with the commercial mine operations historically located on site. Laboratory analysis of soil and water samples collected during the PSA indicated elevated levels of heavy metals namely lead, zinc, copper and cadmium.

The findings of the PSA were reported to the Department of Environment and Heritage Protection (EHP) in the '*Notification of Notifiable Activity and Contaminated Land Supporting Report*' produced and issued by UQ in September 2013. The PSA by definition is limited in extent; therefore, following notification of the initial findings, UQ was issued with a notice by EHP to conduct further investigations into the contaminated lots. The notice issued by EHP to conduct the investigation states; "The investigation must cover the entire area on which the notifiable activity was conducted and include an assessment of the lead bio-availability in the soil and the leachate". In response to this notice UQ, in consultation with EHP, nominated and agreed lots for further detailed investigation.

UQ commissioned NAA to undertake a detailed investigation at the site (supplementing the previous preliminary works) in order to investigate the presence and extent of heavy metal (or other) impacts at the site.

The objectives of the works were to:

- Determine the ground conditions at the site and assess the presence and extent of soil and groundwater contamination arising from the sites historical use and mine waste; and
- Undertake a bio-availability/leachability assessment of lead and other identified heavy metal contamination on selected soil samples to assess the leaching potential and assess the risks to human and environmental receptors.

1.2 Scope of Work

The requirements for the detailed site investigation as specified by EHP are;

- Conduct or commission a site investigation on Lot 3 on RP 60248, Lots 88, 89, 91, 92, 93, 94, 137 on RP 23531, Lot 329 on SL 7293, Lot 334 on SL 3873, Lot 40, 41 on RP 23699 (as presented in ***Figure 1***).

- Site investigation report must be prepared in accordance with Chapter 7 Part 8 of the *Environmental Protection Act 1994* (Qld) (EP Act), the Guideline for Contaminated Land Professionals (DEHP 2012) and the Guideline for Assessing Qualified Persons (DEHP 2013).
- The investigation must specify that the land is suitable for the intended use or enable a statement of suitability with a Site Management Plan.
- The investigation must cover the entire area on which the notifiable activity was conducted.
- The investigation must include an assessment of lead bio-availability in the soil and the leachate.
- The investigation report must be submitted to DEHP by 3 December 2013.

The timeframe for submission of the report was extended by DEHP to 20 December 2013. The draft report was submitted and reviewed by DEHP, with comments provided by way of a "Notice of decision to require additional information" reference 101/0002141-002. The timeframe for submission of the final report was defined as 11 April 2014.

A revised version of the report was prepared (Version C) and was submitted for review to an Auditor as defined in Section 573 of the EP Act. The Auditor is Mr Robin Wagland.

An amended version of the report has been prepared (this report) and is submitted to the DEHP to satisfy the scope of works and additional information request.

The Suitably Qualified Person (as defined in the EP Act) for the submission of this report is John Iddles.

Legend

UQ Site Parcels

Roads

Cadastre

Nominated Lots for Site Investigation

Note: Aerial Imagery Captured in 2011 © UQ

Site Location and Nominated Lots for Investigation		
Figure 1	**UQ**	
Date: *28/11/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	
G:\CLIENTS\T-TO-Z\University of Queensland\GIS\Maps\131122_Report\UQ_Figure_1_Location_141128.mxd		

The requirements for this detailed site investigation as specified by UQ are;

- Meet the requirements of the DEHP notice.
- Delineate the extent of contaminated material (a) on the lots nominated in the DEHP notice and (b) elsewhere on the lots owned by UQ at the UQEM site.
- Undertake the investigation in a way that protects health and safety of UQ employees and all persons on site.
- Expedite the assessment so that the DEHP timeframe can be met.

The Environmental Site Assessment has been prepared with reference to industry standards and national and state guidelines including:

- The National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 1999 (as amended in May 2013));
- Australian Standard "Guide to the investigation and sampling of potentially contaminated soil": AS4482.1-2005;
- Australian Standard "Water Quality Sampling. Part 11: Guidance on sampling of groundwater's" AS/NZS 5667.11:1998;
- Guideline for Contaminated Land Professionals (Department of Environment and Heritage, Queensland Government, 2012).

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Current Land Use

The University of Queensland Experimental Mine site (UQEM) is located at Indooroopilly and is owned by UQ. The site occupies approximately 5.9 ha (with the lots that are the subject of this investigation occupying an area of 2.25 ha) located in Isles Road Indooroopilly, approximately 500m west of the Indooroopilly Shopping Centre and less than 10km from the Brisbane CBD (see ***Figure 1***).

The site that is the subject of this investigation include Lot 3 on RP 60248, Lots 88, 89, 91, 92, 93, 94, 137 on RP 23531, Lot 329 on SL 7293, Lot 334 on SL 3873, Lot 40, 41 on RP 23699. These lots are referred to in this report as the "nominated lots".

The current land use zoning under the Brisbane City Plan is Community Use Area CU4 – Education Purposes. There are no plans to change this land use zoning.

Within the site are historical mine workings, both open cut and underground, which together comprise a Declared Mine (the Mine) under the Mining and Quarrying Safety and Health Regulation 2001 (Qld) Schedule 4 Part 1. Note that there are no current mining tenures over the site (for example, Mining Lease), thus mining does not take place on the site.

The Mine is managed by the Mine Manager, Mr Eric Muhling and the Site Senior Executive (SSE), Dr Brian White. It comprises a shallow open pit and underground workings with multiple levels and access points.

Whilst the underground and open cut sections of the Mine are closed (restricted access exists for inspection and maintenance), the Faculty of Engineering, Architecture and Information Technology (EAIT), JKTech Pty Ltd, The Sustainable Minerals Institute's (SMI) Julius Kruttschnitt Mineral Research Centre and Property and Facilities Division (P&F) still operate out of buildings on the site.

The Mine site is situated on a slope adjacent to Witton Creek, approximately 200m upstream (west) of the creek's confluence with the Brisbane River. The surrounding land use is predominantly comprised of residential properties with the Nudgee Junior College and Commercial properties located to the south of Witton Creek.

An inventory of chemicals stored on site was provided by UQ (ELP 2013), which confirmed only minor quantities of substances were kept on site. These consisted of:

- Oils, diesel, petrol (maximum 200L)
- Degreasers (maximum 40L)
- Glues, adhesives (maximum 2L)
- Paints, thinners, paint strippers (maximum 40L)
- Methanol (maximum 1L)
- Sodium hydroxide (maximum 0.5kg)
- Methyl, ethyl ketone (maximum 1L)
- Coolants (maximum 1L)

- Cleaners (maximum 20L)
- Gas Cylinders – Nitrogen, Argon, Oxygen, Acetylene (maximum 15 cylinders)
- Small quantities of various laboratory chemicals (maximum 20kg)
- Solvents (maximum 20L).

Previous site reviews (ELP 2013) have not identified any current or past underground storage tanks on site.

The University has a trade waste agreement for the site, which enables the disposal of the following wastes to sewer;

<10,000L per day of laboratory waste water, and seepage water.

Copies of the trade waste approval is included in **Appendix A**.

2.2 Regional Geology and Hydrogeology

The regional information was obtained from the review of the following documents:

- *University of Queensland. Experimental Mine Closure Plan. AMC Consultants, May 2013;*
- *Northern Link. Phase 2 – Detailed Feasibility Study. Chapter 7. Hydrology. SKM September 2008;*
- *Effects of rapidly Urbanising Environment on Groundwater, Brisbane, Queensland, Australia, by Malcolm E. Cox, Queensland University of Technology, 1996;*
- *South East Queensland Opportunity Assessment for Aquifer Storage and Recovery, CSIRO, April 2009; and*
- *The University Experimental Mine: Dept. of Mining and Metallurgical Engineering (1956). University of Queensland*

2.2.1 Fractured Rock

The primary rocks underlain the site area are representative of the Bunya Phyllite Formation of Devonian-Carboniferous age. The primary rock types are phyllites and greywackes. At the location of the mine, phyllites were intruded by rhyolites of Triassic age where the lead, silver and zinc mineralisation occurred. This mineralisation was mined by the historical mine (Finney's Lead and Silver Mine) in early 1900s. The ownership of the historical mine was transferred to the University of Queensland in the mid-1950s (see Section 2.4 and 2.5).

The Bunya Phyllite has very low primary porosity and any groundwater occurrence is likely to be limited to the secondary porosity of joints, fractures, fissures etc.

Based on the information provided in the AMC report the groundwater in the mine workings has been observed at approximately 2m AHD (Australian Height Datum). The estimated groundwater inflow into mine workings was 11.6 m^3/day (or 0.13 L/sec). More recent data on the groundwater pump out rates indicates a groundwater inflow of approximately 9 m^3/day, (S. Green, March 2014, pers. comm).

Based on the information included in the SKM report the hydraulic parameters for the Bunya Phyllite were inferred from a pumping test performed at the Botanical Gardens as part of the Brisbane Aquifer Project (Environmental Hydrology Associates, 2007). The average transmissivity value determined for the Bunya Phyllite was 9.5m^2/day. A groundwater yield obtained from a pilot hole was about 0.1 L/sec indicating that the rocks of the Bunya Phyllite do not generally contain a productive aquifer.

Recharge to the fractured rock aquifer likely occurs via infiltration of rain water at outcrop areas. This was assessed in the AMC reported indicating that the mine groundwater inflow increased after a significant rainfall event.

Groundwater flow likely follows the topography of the area, i.e. from the higher to the lower ground elevations.

2.2.2 Alluvial Material

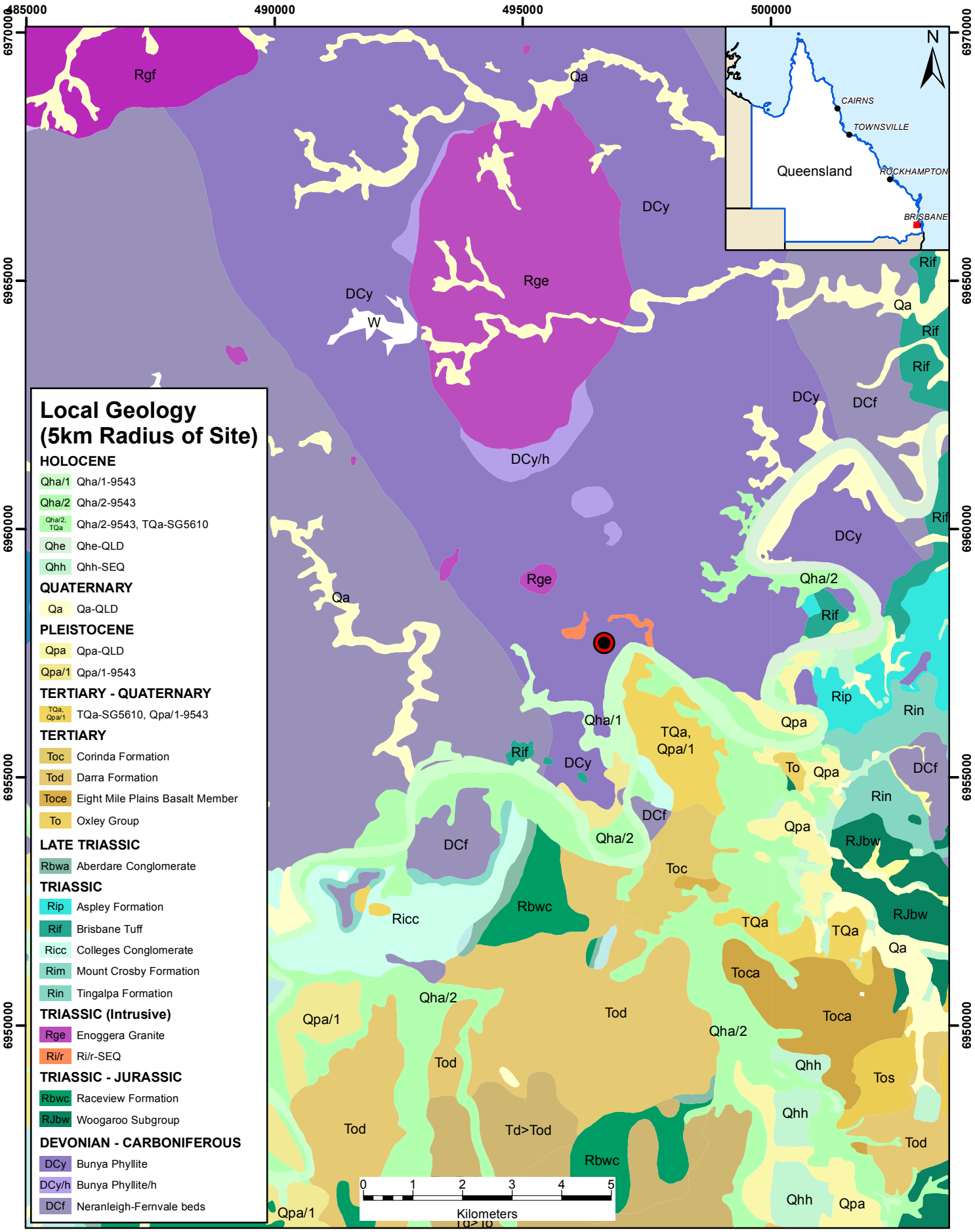
The Bunya Phyllite formation is covered by weathered material consisting of clays and sands and in low laying areas the rock material is covered by the Quaternary Brisbane River alluvium and alluvial deposit from the ephemeral creek system (such as Witton Creek) discharging into the Brisbane River.

As shown on the 1:500,000 Moreton geological map (see **Figure 2**) the Brisbane River alluvium has very limited extent along the northern river bank.

No information for the thickness, composition and permeable properties of the alluvial material deposited by the Brisbane River was available.

Quaternary alluvium within the ephemeral creeks' channels was reported by SKM to be limited to isolated pockets. In general, these alluvial sediments form unconfined and perched aquifers overlying less permeable weathered basement material, with groundwater occurrence primarily a function of matrix porosity, i.e. where more sandy/gravelly material is present. The recharge to these areas is likely to be a result of rain water infiltration. Also, as stated in the SKM report, upward seepage from the basement rocks into overlying alluvium may occur.

The above indicates that the groundwater in the alluvial material of the local creeks (e.g. Witton Creek) does not have a significant lateral extent and may also be a residual (trapped) saturation resulting from either infiltration or upward leakage from the lower aquifer.



Local Geology (5km Radius of Site)

HOLOCENE

- Qha/1 Qha/1-9543
- Qha/2 Qha/2-9543
- Qha/2, TQa Qha/2-9543, TQa-SG5610
- Qhe Qhe-QLD
- Qhh Qhh-SEQ

QUATERNARY

- Qa Qa-QLD

PLEISTOCENE

- Qpa Qpa-QLD
- Qpa/1 Qpa/1-9543

TERTIARY - QUATERNARY

- TQa, Qpa/1 TQa-SG5610, Qpa/1-9543

TERTIARY

- Toc Corinda Formation
- Tod Darra Formation
- Toce Eight Mile Plains Basalt Member
- To Oxley Group

LATE TRIASSIC

- Rbwa Aberdare Conglomerate

TRIASSIC

- Rip Aspley Formation
- Rif Brisbane Tuff
- Ricc Colleges Conglomerate
- Rim Mount Crosby Formation
- Rin Tingalpa Formation

TRIASSIC (Intrusive)

- Rge Enoggera Granite
- Ri/r Ri/r-SEQ

TRIASSIC - JURASSIC

- Rbwc Raceview Formation
- RJbw Woogaroo Subgroup

DEVONIAN - CARBONIFEROUS

- DCy Bunya Phyllite
- DCy/h Bunya Phyllite/h
- DCf Neranleigh-Fernvale beds

Legend

Approx Location of UQ Mine Site

UQ Mine Site Local Geology Map		
Figure 2	**UQ**	elp environmental and licensing professionals pty ltd
Date: *7/04/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:100,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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2.2.3 Groundwater Use

The registered bore search undertaken within 5 km buffer of the UQ experimental mine site (parcel boundary) identified 165 bores (the search results and a figure with bore locations are included in **Appendix B**. The bores appear to be installed in both the fractured rocks and alluvial aquifers. The quality of groundwater ranges between fresh (Total Dissolved Solids (TDS) <500 mg/L) to saline (TDS >10,000 mg/L).

Based on the information presented in the AMC report there are sixteen registered bores within the 5 km buffer.

Ten bores are constructed along the southern bank of the Brisbane River (potentially in the Quaternary alluvial material), approximately 450m south east of the UQ experimental mine site. These bores are unlikely to have any relation to the onsite groundwater as they were constructed within the alluvial material which does not extend to the northern bank of the Brisbane River (see **Figure 2** above).

Two bores are constructed within the fractured rock aquifer but located to the north (approximately 500m) of the site at the higher ground elevation and therefore may be considered to be up-gradient bores.

The remaining four bores are constructed in both Quaternary material and fractured rocks. Two of these bores (RNs 145327 and 145328) are located 100m east of the UQ experimental mine site and are listed as abandoned and therefore are not used for groundwater supply. The other two bores (RNs 138841 and 138842) are located 350m south west of the UQ experimental mine site and target the groundwater within the Quaternary aquifer (RN 138841) and the Bunya Phyllite (RN 138842) and are listed as existing bores. However these bores are located some 350 m to the south west of the site and unlikely to be influenced by the onsite activities.

The overall registered bore search results indicate that there are no groundwater bores in the vicinity of the site which are likely to be influenced by the onsite activities.

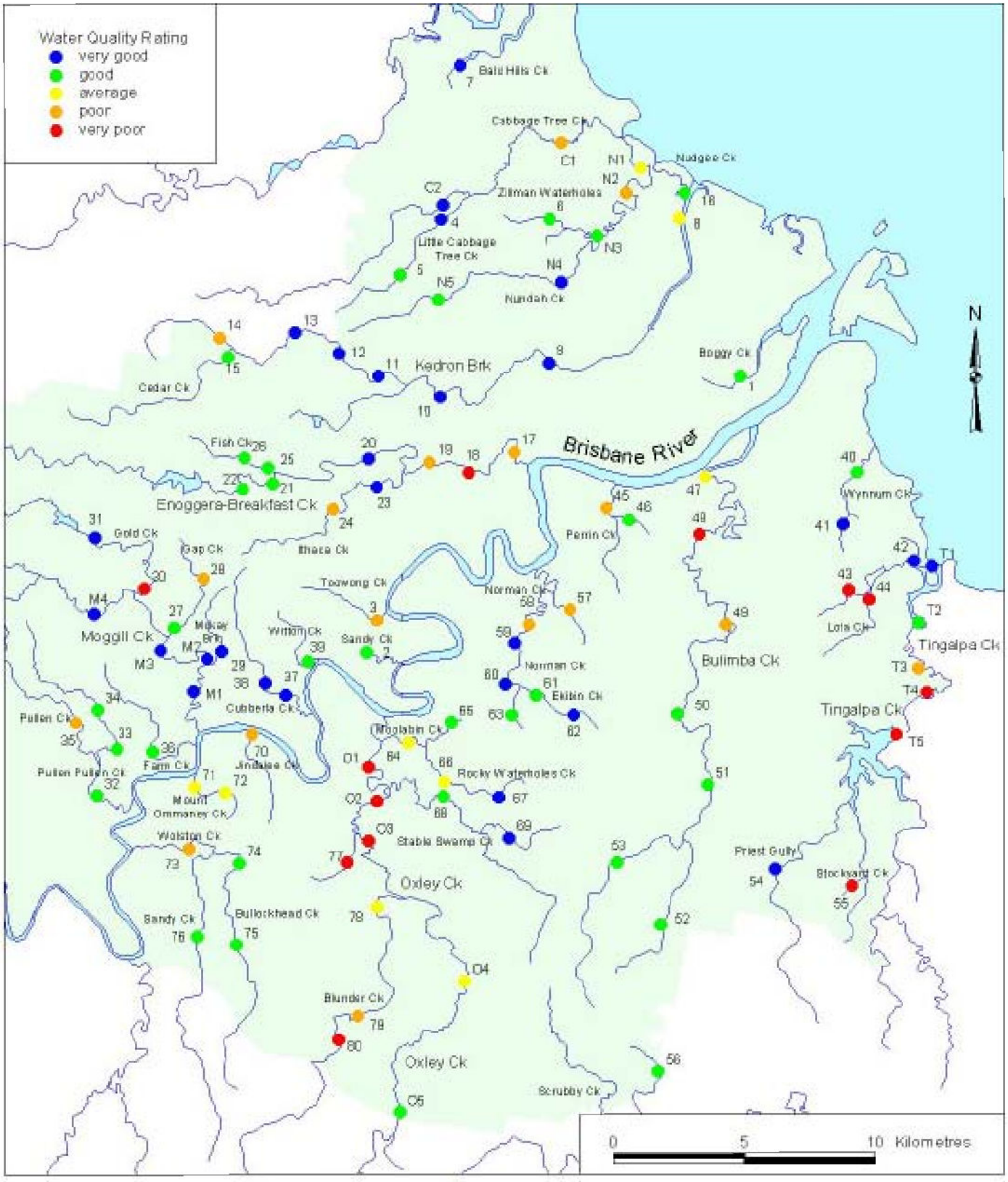
2.3 Hydrology

The major water courses identified within the project area are the Brisbane River (situated 250m southeast of the site), and its tributary the Witton Creek (adjacent, south) of the site.

The information obtained from the book “Citywide-assessment of water quality in Brisbane’s creeks October 1999-April 2000” by Graham Webb (2001) indicate that the water quality in the Witton Creek was rated ‘Good” indicating that the historical and concurrent onsite activities do not appear to be having an adverse impact on the water quality in the Creek (for the parameters measured in the study). A copy of the map presenting the creek rating is shown on ***Figure 3***.

In terms of flooding from the Brisbane River, the site history indicates that the lower levels of the underground workings were inundated by flood waters in January 2011 but the open pit was not affected. Flood events (historical and future) have a low potential to result in the surface erosion and offsite migration of contaminants for the following reasons;

- well established vegetation cover on the site reduces the potential for soil erosion
- the flooding mechanism from the Brisbane River on the site is via backflow up Witton Creek, rather than overtopping of the high bank of the Brisbane River. Therefore flow velocities of the flood waters are low.



Citywide Assessment of Water Quality		
Figure 3	**UQ**	environmental and licensing professionals pty ltd
Date: *27/02/2014*	**Author:** Christopher.Maddox	
Revision: R1		
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2.4 Historical Literature Review

The Queensland State Archives (QSA) holds three batch files directly relating to the site between 1952-1967 (ID601636, ID601819, ID129579). Additionally the QSA also holds one correspondence file containing a police report relating to industrial actions taken in 1925 (ID316648). The University has produced a number of reports (University of Queensland Dept. of Mining and Metallurgical Engineering, 1956, University of Queensland Dept. of Mining and Metallurgical Engineering, 1959, University of Queensland Dept. of Mining and Metallurgical Engineering, 1963), relating to the UQEM as well as numerous unpublished internal reports and records (particularly E. Muhling) and held by DNRM. Additionally, a large quantity of original documentation and reports are housed on site.

As part of this Detailed Site Investigation (DSI) a review was undertaken of previous reporting, plans, literature and anecdotal histories of the site including:

- Historical aerial photographs (1946, 1951, 1960, 1972, 1983, 1994 and 2011) and Mine Plans (see figures in ***Appendix C***).
- Historical and current land title information using the CITEC Confirm conveyancing database (see ***Appendix D***).
- Environmental Management Register (EMR) and Contaminated Land Register (CLR) search using the CITEC Confirm conveyancing database (see ***Appendix E***).
- Bell, L, C (1926) Interim Report on Indooroopilly Silver Lead Mining; Queensland Government Mining Journal.
- The University of Queensland; The University of Queensland Experimental Mine (1956); Department of Mining and Metallurgical Engineering
- White, F.T.M. (1958) “The University of Queensland Experimental Mine” in Queensland Government Mining Journal, Vol. 59, pp.703-706, (Queensland Department of Mines: Brisbane)
- The University of Queensland; The University of Queensland Experimental Mine and Pilot Plant; (1963); Department of Mining and Metallurgical Engineering.
- Prof. Napier-Munn, T., Prof. White, B., Dr. Rowlands, J., Meakin, R, (2000) University Experimental Mine at Indooroopilly: Site Development Plan; University of Queensland University.
- Mining and Quarrying Safety and Health Regulation 2001 (Qld) Schedule 4 Part 1. Draft Report on the University of Queensland Experimental Mine: Statutory Responsibilities, Recent Events and Future Usage (2009): Prof. Knights, P., Dr White, B., Muhling, E., Lester, D.
- University of Queensland Experimental Mine Closure Plan (2013) AMC Consultants Pty.
- Services Waste Radioactive Mine Indooroopilly – restricted access file held at UQ Records and Archive Management Services. File accessed by S. Green (Manager, Sustainability, UQ Property and Facilities), April 2014, with notes provided to the report authors.

The area known as Finney's Hill (constituting the area surrounding the UQEM) was a residential area comprising a large tract of land that was later sub-divided and sold to the Goldlesley estate in 1912.

Identification of the area's mineral potential was first made circa 1916 while sinking holes for the piles of a new residence for a Mr. Olsen. Exploratory open cuts by Mr. Olsen and a Mr. P.J.Madden (to 25ft.) produced approximately 20 tons of ore that comprised 25% lead and approximately 50 oz. of silver. Mineral Lease (ML) 24 held by Manners & Glover & Olsen (which absorbed the area covered by an earlier lease, ML 13) was the first mine at Indooroopilly to produce significant quantities of ore, the work began in November 1918. Subsequently; mineral leases were granted to a number of individuals in the area surrounding ML 24 (including MLs 21, 14, 23, 37) and to several start-up companies (including ML 18 under the Indooroopilly Silver Mines Company, ML 31 held by the Indooroopilly Silver-Lead Mines Company, and ML 22 held by the Indooroopilly Extended Silver-Lead Mining Syndicate).

Individual leases were abandoned or absorbed into larger leases like that held by Finney's Hill United Silver Mining Co. Ltd., who originally applied for mineral lease numbers 21, 27, and 57 over the area. Finney's Hill United Silver Mines Ltd began site construction between 1920 and 1921.

Circa 1923 a mill and tramway (from the pit to the mill) were constructed. Underground mining was conducted using filled square set stoping techniques. As the ore was mined from the inclined ore body, timber was used to reinforce the roof or "hanging wall" of the mine. The square set may then have been filled or partially filled with loose waste rock.

A small open pit mine was developed into the top of the earlier underground workings in the latter years of the mine (1925-29) to recover remaining shallow silver-lead ore reserves.

Peak production was in 1924 (88,844 oz. of silver and 726 tons of lead), with subsequent production decreasing significantly due to unanticipated changes in the level of mineralisation, drops in ore values, wage legislation and industrial action (in 1925) by workers at the mine.

In 1926 the operating company was liquidated and the mine bought by Mr P.J. Madden and lower scale operations continued until the mine closed in 1929 when all plant and equipment were sold.

Operations between 1919 and 1929 produced some 227,343 oz. silver and 1,796 tons of lead. Only silver-lead ore was mined, although zinc bearing ore shoots were located and investigated.

Between 1929 (when operations ceased) and 1951, the property was gazetted as a reserve of the Brisbane City Council. The University secured a long term lease in 1951, and the

Queensland Department of Mines proclaimed the area as one over which no further mining applications will be considered.

When the land lease was secured in 1951 to enable the mine to be used for teaching and research activities the mine was in a derelict state. Adits (horizontal access drives) and shafts were blocked by fallen ground and collapsed timbers. The collars of both shafts were badly collapsed and both adits were seriously collapsed (White 1958).

In 1956, the Queensland Government purchased the property for use by UQ, which assured permanent and exclusive surface and underground rights in perpetuity. The University gained ownership of the land in 1967. These land holdings included former crown land to the east of the site (Napier-Munn et al, 2000).

It is noted that on 18 June 1959 a letter from C. J. Connell (Registrar) to the Under-Secretary of the Department of Public Works in Brisbane indicated that a separate crushing plant (associated with the Pilot Plant, which was under construction at that time), was to be used to contain dust from uranium-bearing ores which were to be brought to the site for investigation into the processing of refractory uranium ores (see ***Appendix F***).

Review of the UQ archives (S Green, April 2014, pers. comm) has revealed the following about the storage of uranium bearing ores;

- 10 tonnes of very low grade uranium ore was brought to the site in 1959
- A radiation survey was undertaken in circa 1984
- Limited areas were affected by the storage of uranium bearing ores, with an area of approximately 300m^2 identified on the basis of radiation levels above background
- The areas affected include a small portion of the pilot plant laydown yard, and the adjacent downslope area
- It was noted that the radiation levels did not exceed the exposure level for miners based on a 40 hr week
- The radioactive material was cleaned up and removed from the site in July/August 1986
- The clean up was supervised and directed by officers of the Queensland Department of Health and the Queensland Department of Mines.
- A total of 700 tonnes of material was removed
- This material was transported to Mary Kathleen mine for disposal on 2nd August 1986.

Mining activities since acquisition in 1967 by UQ include the rehabilitation of the existing shafts and underground workings, the construction of an inclined shaft, and minor expansions to the underground excavations. Various services, including ventilation, dewatering, compressed air, electrical power and communications were re-established. The mine has been used for teaching and research purposes and not for the extraction of metalliferous ores.

The Mine is now maintained by the School of Mechanical and Mining Engineering, but the open pit and underground workings have been closed, except for inspection and maintenance, since 2008. The lower levels of the underground workings were inundated by flood waters in January 2011 but the open pit was not affected, other than by runoff from the heavy rainfall. Erosion of soil from site was not noted during this flood event (S. Green, March 2014, pers.comm.).

The surface area of the UQEM is currently used for a range of educational, research and related administrative purposes, encompassing several buildings and adjoining parking areas. These include offices, storage facilities and workshops. The University runs and maintains a small scale operational pilot plant for commercial research and educational purposes.

2.5 Historical Plans and Photography Review

Aerial photographs 1946, 1951, 1960, 1972, 1983, 1994, and 2011 and historical plans 1925, 1963, 1990, 2000 and 2009 were reviewed (refer ***Appendix C***). A summary of findings is provided in ***Table 1*** below. To aid identification and for description purposes the site has been divided into 4 areas based on current site functional zones and topography. These areas are broadly described as follows:

- Area 1 – Entrance level, and central buildings cluster areas
- Area 2 – Open Cut Pit area
- Area 3 – Pilot Plant area
- Area 4 – Lower grounds storage area and landscaped perimeter areas to the south, west and east.

These areas are marked on Figure C-7 in ***Appendix C***.

Table 1 Historical Aerial Photography and Mapping Summary

Details of Photo	Observations	
Date **1925** (Plan)	Site	Reference *Ball, L. C. (1925): Interim Report on Indooroopilly Silver Lead Mining.* (see ***Appendix D***) **Areas 1, 2 and 3** Centralised mine pit and buildings area including; • Open pit area • Main shaft • Experimental shaft (White's or Maddens Shaft) • Engine houses (west of open pit and south west of open pit) • Crushing mill • Concrete tank • Mine office and changing room (south of open pit)

Details of Photo	Observations	
		• Barnes 94 ft. adit • Site access and internal roads. **Area 4** • Not mapped
	Surrounds (to approximately 200m)	**Offsite** Not mapped however, to the west of the current alignment of Isles Road (west-northwest of the open cut) area is mapped Corbi's Adit. This Site Plan does not indicate any mining activities were being carried out on land outside of the boundary of the UQ Experimental Mine. This mapping was undertaken at the time when the mine site footprint was close to its maximum extent.
Note: Mine was closed in 1929 when 'all' plant and equipment was sold (reference historical literature review).		

Date
1946
(Aerial)
	Site	**Area 1**
		• Mine workings building (at approximate site of the current JKMRC Stage 4 building).
		• West site access via the current (approximate) access road alignment (via Isles Road)
		• South site access via Witton Road/Kinloch Street junction to south west of site.
		• Ground disturbance areas observed:
		  ○ South-east and east of the open pit area
		
		Area 2
		• Ground disturbance areas observed at:
		  ○ Open Pit area
		
		Area 3
		• Site internal road present between mine workings building and the current pilot plant location
		• Disturbed area (at location of current top level car park to west of site).
		
		Area 4
		• Internal site access roads and disturbance areas at the site of the current lower grounds storage area and landscaped areas at the sites southern and south-western boundary (bordering Vera Street).
		• Extensive disturbance to the sites eastern extent (in the area currently on and close to Lot 329 on SL7293).
		• Disturbed area to the far south of the site immediately north of Witton Creek (currently grassed area partly used and maintained as private amenity ground by an adjacent resident) immediately east of Vera Street (south).
		• These disturbed areas may represent historical filling of Witton Creek and adjacent

Details of Photo	Observations	
		low lying areas, as historical land title drawings indicate that Witton Creek followed an alignment to the north of the current channel.
	Surrounds (to approximately 200m)	**North** • Isles Road – Residential • Goldieslie Road – Residential **South** • Vera Street – Residential • Witton Road – Residential, (Allotments) • Twigg Street – Residential • Witton Creek – Watercourse • Brisbane River- Watercourse **West** • Ormond Terrace – Residential • Kate Street – Residential • Vera Street – Residential Note: disturbance area to the west of the current alignment of Isles Road (west-northwest of the open cut) area is consistent with the adit mapped in *Ball, L. C. (1925)* as Corbi's Adit. Road alignment of the current M5 motorway is evident. **East** • No residential dwellings to immediate east of site.
Note: University took on the mine site in 1951 (reference historical literature review).		
Date **1951** (Aerial)	Site	Discernable features as described above (reference 1946 aerial).
	Surrounds (to approximately 200m)	As above (reference 1946 aerial) except for slight intensification of residential development in the surrounding area, notably along Twigg Street and Isles Road.
Date **1960** (Aerial)	Site	*Buildings/Features added since 1951 (i.e. not evident in the 1951 aerial)* **Area 1** • Increased disturbance is evident around the existing mine workings building (shown spanning Lots 145 and 146 on RP23698). **Area 3** • Experimental Pilot Plant.
	Surrounds (to approximately 200m)	As above (reference 1951 aerial) except for slight intensification of residential development in the surrounding area, notably to the west of site along Isles Road and Kate Street.
Date **1963** (Plan)	Site	*Reference: after University of Queensland Dept. of Mining and Metallurgical Engineering Plan (1963) - extracted from AMC Experimental Mine Closure Plan (2013).*

Details of Photo	Observations	
		Existing structures **Areas 1 and 2** • Main Shaft • Experimental Shaft • Tramway (known to be built in 1923 from historical literature) **Area 3** • Experimental Pilot Plant. **Area 4** • 94 ft. and 116 ft. level adits (known to be existing from historical literature) *Buildings/Features added since 1960 (i.e. not evident in the 1960 aerial)* **Area 1** • Noise abatement anechoic chamber • Electrical switchgear room • Winder house • Compressor house (possibly the mine workings building shown spanning Lots 145 and 146 on RP23698). • General store (possibly the workings building shown spanning Lots 145 and 146 on RP23698). • Workshop (possibly the workings building shown spanning Lots 145 and 146 on RP23698). • Workshop and timber store • Research and project rooms • Mine survey office • Cap lamp room • Mine office, change room and residence (not evident in the 1951 aerial, however the building adopt a close alignment and position to part of the 'crushing mill' building depicted in the 1925 plan possibly rebuilt on existing footings or coincidental). • Coarse ore bins and crusher station (not evident in the 1951 aerial). • Water head tank (not discernable from the aerial imagery, however this is likely to be the 'concrete tank' depicted in the 1925 Plan) • Electrical substation and transformer (200 kVA). • Access Road named 'Mine Road' on the approximate current alignment. **Area 2** Open Cut Pit Area including: • Jet piercing laboratory • Ballistic mortar • Flame testing laboratory • Ventilation shaft **Area 3**

Details of Photo	Observations	
		• Experimental Pilot Plant and internal site access roads. • Fine Ore Bins. • Residue Thickener. • Internal site access road running from main shaft area down to the 'Experimental Pilot Plant' level.
	Surrounds (to approximately 200m)	Not available from the plan drawing.
Note: Spoil Dumps are described in the literature accompanying the plan, as having been established at both the 96ft level (from the adit running NE and exiting 230ft. off the main adit) and at the 116ft. level (from the adit running SW and exiting 200ft. east and 160ft. north of the main shaft) levels as well as dumping of spoil from the rehabilitation of the main shaft at depth into the open cut.		
Date **1972** (Aerial)	Site	*Buildings/Features added since 1963* **Area 1** • Building cluster at the approximate site of current main reception building including the Mining Laboratory (adjacent to the east of the open cut) *Buildings removed since 1963* **Area 1** • The new Mining Laboratory appears to replace the previously existing Noise Abatement Anechoic Chamber, Electrical Switchgear Room and Winder House, Compressor House and General Store buildings.
	Surrounds (to approximately 200m)	Residential intensification on Kate Street (west) and Twigg Street (east)
Date **1983** (Aerial)	Site	*Buildings/Features added since 1972* **Area 1** • Alteration to the central buildings cluster arrangement including addition of the caretakers house *Buildings Removed since 1972* **Area 1** • Removal of a building close to the current reception area.
	Surrounds (to approximately 200m)	• Slight residential intensification on Kate Street (west). • Notable changes to Witton Creek at the Kate Street/Bridge Street junction (at the site of the current bridge). The creek appears to have undergone significant engineering work (possibly associated with road drainage from the M5 motorway to the west).
Date **1990**	Site	*Reference: after GHD Mine Workings: Existing Conditions from University of Queensland Indooroopilly*

Details of Photo	Observations	
(Plan)		*Mine Site Development Plan (1990) extracted from AMC Experimental Mine Closure Plan (2013).* *Buildings Added since 1983* **Area 1** • Rock Mechanics Preparation Facility immediately adjacent to the south of the Open Cut (not evident in the earlier plans). • Mining laboratory. • Addition of buildings to the central cluster (Julius Kruttschnitt Mineral Research Centre (JKMRC) Stages) **Area 3** • New buildings immediately west of the Pilot Plant
	Surrounds (to approximately 200m)	Not available from the plan drawing.
Date **1994** (Aerial)	Site	*Buildings/Features added since 1990* **Area 1** • Addition of building to the central cluster area north of the current reception area. **Area 3** • Increased disturbance surrounding the pilot plant. *Buildings Removed since 1990* **Area 1** • Removal of building close to the current reception area.
	Surrounds (to approximately 200m)	**North** Slight intensification to residential area to the north of site. **South** Intensification of light industrial units to the immediate south of the site (off Witton Road). **West** Significant realignment of the M5 junction to the west of the site (including disturbance of the ground close to Corbi's Adit). **East** Significant ground disturbance and development of residential properties to the immediate east of the mine site Aaron Road/Aaron Place.
Date **2009** (Plan)	Site	*Reference: Prof. Knights, P., Dr White, B., Muhling, E., Lester, D. (2009):* *Draft Report on the University of Queensland Experimental Mine: Statutory Responsibilities, Recent Events and Future Usage.* No buildings additions or removals compared to the

Details of Photo	Observations	
		1994 aerial.
	Surrounds (to approximately 200m)	Not available from the plan drawing.
Date **2011** (Aerial)	Site	*Buildings removals since 1990/2009 Plan* **Area 1** • Caretakers House immediately adjacent to the south of the Open Cut appears to have been removed/modified in the construction of the Level 1 car parking areas (sometime after 2009).
	Surrounds (to approximately 200m)	As previously described - with the addition of light industrial land uses to the south of the site (along Witton Road), the continued intensification of residential development of residential properties to the east of the site along Aaron Road/Aaron Place. Intensification of buildings associated with Nudgee Junior College (south-east).

2.6 Historical Title Search

A CITEC search was undertaken for all land parcels to determine current land ownership; easements, previous title and other title information (see ***Appendix D***). Historical Title searches based on the Title Reference were also undertaken. The current and historical title information is summarised in ***Table 2***.

Table 2 Cadastral Summary by Lot/Plan (Current Title)

Parcel	Title Reference	Registered Proprietor	Date of Registration
Lot 3 on RP60248 Lot 40 on RP23699 Lot 41 on RP23699	13047213	University of Queensland	1 September 1967
		The Co-ordinator General of Public Works	4 April 1957
	12748121	The Co-ordinator General of Public Works	4 April 1957
		Brisbane City Council	25 June 1953
	12631222	The Co-ordinator General of Public Works	4 April 1957
		Brisbane City Council	31 March 1952
	12254081	The Co-ordinator General of Public Works	4 April 1957
		Brisbane City Council	28 July 1949
		Victor Harold Fox	28 August 1945
	12180031	The Co-ordinator General of Public Works	4 April 1957
		Brisbane City Council	19 May 1942
	11552194	The Co-ordinator General of Public Works	4 April 1957
		Brisbane City Council	3 January 1930
		Patrick Joseph Madden	16 October 1929
		Finney's Hill United Silver Mines Limited	23 March 1926
		Finney's Hill United Silver Mines Limited	14 April 1924
		Silver Lead Limited	24 May 1923
	11464126	The Co-ordinator General of Public Works	4 April 1957
		Brisbane City Council	3 January 1930
		Patrick Joseph Madden	16 October 1929
		Finney's Hill United Silver Mines Limited	23 March 1926
		Finney's Hill United Silver Mines Limited	7 October 1920
	11401048	The Co-ordinator General of Public Works	4 April 1957
		Bruce Cameron Staughter	20 February 1956
		Brisbane City Council	21 October 1942
		The Council of the Shire of Taringa	29 July 1918
	11294119 / 1129118	The Co-ordinator General of Public Works	4 April 1957

Parcel	Title Reference	Registered Proprietor	Date of Registration
		Brisbane City Council	22 August 1951
		George Somerfeldt	11 January 1944
		Patrick Joseph Madden	16 October 1929
		Finney's Hill United Silver Mines Limited	23 March 1926
		Finney's Hill United Silver Mines Limited	1 September 1920
		Felix O'Brien	18 March 1919
		Hereward Humfry Henchman	23 October 1914
	11284079	The Co-ordinator General of Public Works	4 April 1957
		Brisbane City Council	3 January 1930
		Patrick Joseph Madden	16 October 1929
		Finney's Hill United Silver Mines Limited	23 March 1926
		Finney's Hill United Silver Mines Limited	21 July 1920
		Charles Michael Robert Glover	11 March 1920
		George James Olsen	17 July 1914
	Deed of Grant No. 10145041	Charles Street	1 May 1869
Lot 88 on RP23531 Lot 89 on RP23531	12474233	University of Queensland	1 September 1967
		The Co-ordinator General of Public Works	12 November 1959
		Brisbane City Council	21 February 1950
	11329004	Brisbane City Council	29 August 1952
		Brisbane City Council	6 July 1949
		Edward James Protheroe	26 May 1948
		Iris May Edwards	19 November 1946
		Emily Mary Louisa July	19 November 1946
		Mary Ann Protheroe (wife of Sydney David Protheroe)	19 November 1946
		Patrick Joseph Madden	16 October 1929
		Finney's Hill United Silver Mines Limited	23 March 1926
		Finney's Hill United Silver Mines Limited	24 March 1921
		Mary O'Brien (wife of Felix O'Brien)	14 March 1919
		Hereward Humfry Henchman (Barrister at Law)	17 November 1915
	Deed of Grant No. 10005096	Henry Charles Rawnsley	25 September 1862
Lot 91 on RP23531	12309027	The University of Queensland	1 September 1967

Parcel	Title Reference	Registered Proprietor	Date of Registration
Lot 92 on RP23531		The Co-ordinator General of Public Works	12 November 1959
		Brisbane City Council	20 February 1951
		Iris May Edwards (wife of Robert William Edwards)	16 April 1947
	11329004	Mary O'Brien (wife of Felix O'Brien)	14 March 1919
		Hereward Humfry Henchman (Barrister at Law)	17 November 1915
	Deed of Grant No. 10005096	Henry Charles Rawnsley	25 September 1862
Lot 93 on RP23531 Lot 94 on RP23531 Lot 137 on RP23531	12708064	The University of Queensland	1 September 1967
		The Co-ordinator General of Public Works	12 November 1959
		Brisbane City Council	11 Demeber 1952
	11329004	Mary O'Brien (wife of Felix O'Brien)	14 March 1919
		Hereward Humfry Henchman (Barrister at Law)	17 November 1915
	Deed of Grant No. 10005096	Henry Charles Rawnsley	25 September 1862
Lot 329 on SL7293	49012028	The University of Queensland	Date gazetted - 3 July 1976
Lot 334 on SL3873	13555138	The University of Queensland	1 September 1967
		The Co-ordinator General of Public Works	27 February 1963
	13486177	The Co-ordinator General of Public Works	3 August 1962
	12409054	The Co-ordinator General of Public Works	1 November 1959
		Brisbane City Council	13 July 1949
		Edward James Protheroe	26 May 1948
	1307126	The Co-ordinator General of Public Works	12 November 1959
		Brisbane City Council	8 September 1949
		Francis James Swan and his wife Olga Maria Swan	23 October 1947
		Emily Mary Louisa July	19 November 1946
	Deed of Grant No. 13486177	The Co-ordinator General of Public Works	3 August 1962

2.7 Environmental Management and Contaminated Land Registers

The Environmental Management Register (EMR) maintained by EHP is a land-use planning and management register. Land that has been or is being used for a notifiable activity, and about which the department is notified, is recorded on the EMR.

The EMR provides information on historic and current land use—including whether the land has been or is currently used for a notifiable activity, or has been contaminated by a hazardous contaminant. Sites recorded on the EMR pose a low risk to human health and the environment under the current land use. Entry on the EMR does not mean the land must be cleaned up or that the current land use must stop.

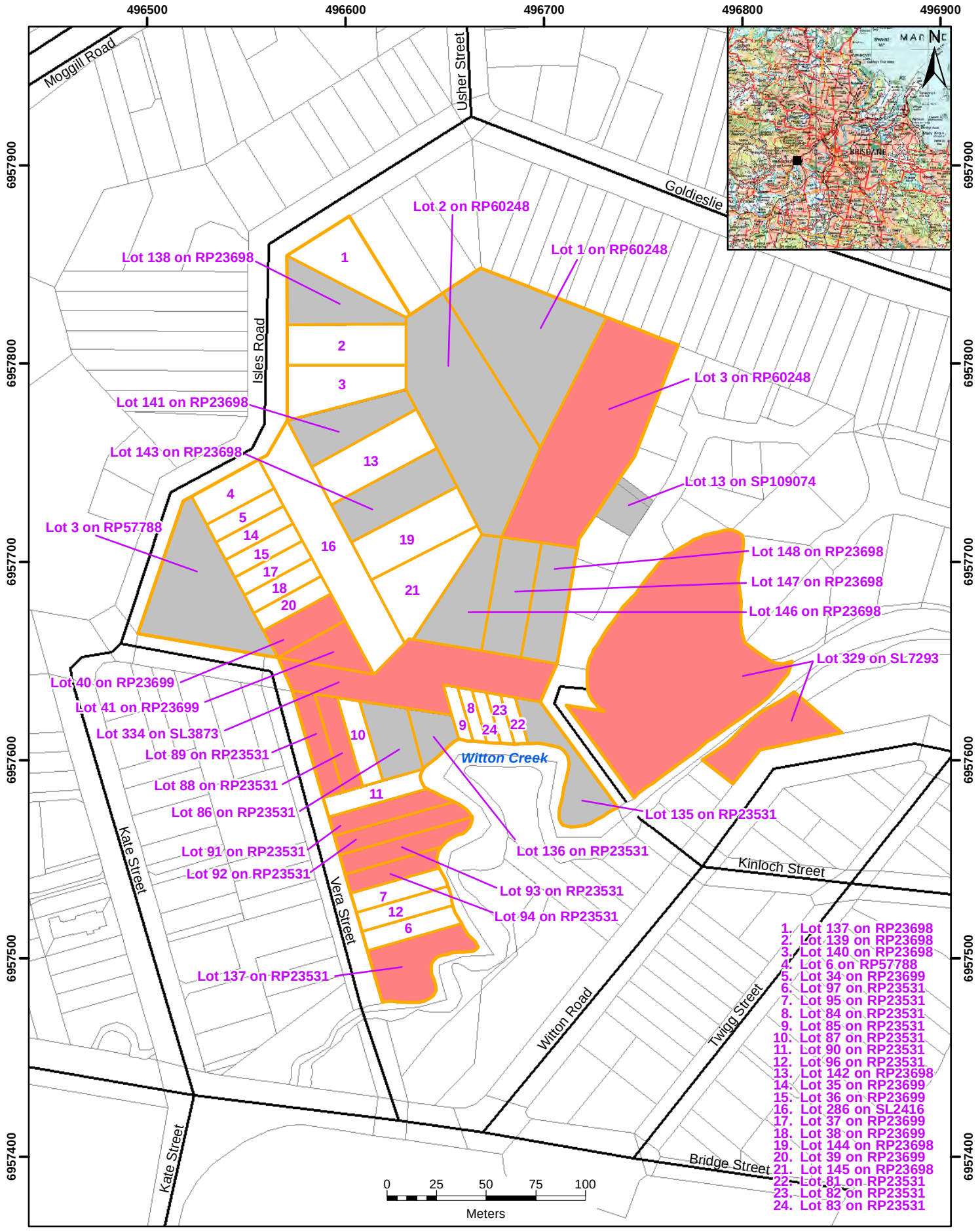
The Contaminated Land Register (CLR) is a register of 'risk' sites - proven contaminated land which is causing or may cause serious environmental harm. Land is recorded on the CLR when scientific investigation shows it is contaminated and action needs to be taken to remediate or manage the land. Actions could include:

- Technical measures to prevent migration of contaminants; or
- Full removal of contaminants and off-site treatment to prevent serious environmental harm or public health risks.

Figure 4 summarises the results of the searches, and the lots listed on the EMR.

Searches of both the Environmental Management Register (EMR) and Contaminated Land Register (CLR) were conducted for all nominated lots listed for the site investigation. All lots nominated for investigation are listed on the EMR. No lots are listed on the CLR.

In addition, an EMR/CLR database search of interspersed lots adjacent to the nominated lots was undertaken, providing coverage of 50% of the Lots adjacent to the nominated lots in total (see **Appendix D**). The extended search was intended to provide contextual information to inform the findings of the site investigation works.



Legend

- UQ Site Parcels
- Cadastre
- Roads

CLR/EMR Database Search

- CLR/EMR Negative Search Results
- CLR/EMR Positive Search Results

Summary of EMR Search

Figure 4	UQ	
Date: 19/12/2014	Author: Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	Coordinate System: GDA 1994 MGA Zone 56	

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Table 3 Environmental Management Register/ Contaminated Land Register searches

Lot	Plan	EMR Result	Notes
3 **(Parcel notified to DEHP)**	**RP60248**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 06/11/2013 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
88 **(Parcel notified to DEHP)**	**RP 23531**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 26/02/2014 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
89 **(Parcel notified to DEHP)**	**RP23531**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 06/11/2013 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
91 **(Parcel notified to DEHP)**	**RP23531**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 26/02/2014 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.

Lot	Plan	EMR Result	Notes
92 (Parcel notified to DEHP)	**RP23531**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 26/02/2014 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
93 (Parcel notified to DEHP)	**RP23531**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 26/02/2014 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
94 (Parcel notified to DEHP)	**RP23531**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 06/11/2013 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
137 (Parcel notified to DEHP)	**RP23531**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 06/11/2013 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
329	**SL7293**	Site **IS** on the Environmental Management Register	Search Conducted 26/02/2014

Lot	Plan	EMR Result	Notes
(Parcel notified to DEHP)		• 15 Aaron Place Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
334 **(Parcel notified to DEHP)**	**SL3873**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 07/11/2013 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
40	**RP23699**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 07/11/2013 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
41	**RP23699**	Site **IS** on the Environmental Management Register • 14 Ormond Terrace Indooroopilly QLD. • *Elevated levels of Lead and material consistent with mining waste.* Site **NOT** on the Contaminated Land Register	Search Conducted 07/11/2013 The site has been subject to the following notifiable activity pursuant to section 374 of the Environmental Protection Act 1994: Mines Waste (a) Storing hazardous mine or exploration wastes including for example tailings dams, overburden or waste rock dumps containing hazardous contaminants: or (b) exploring for, or mining or processing, minerals in a way that exposes faces or releases groundwater containing hazardous contaminants.
1	**RP60248**	Site NOT on the Environmental Management Register	Search Conducted 06/11/2013

Lot	Plan	EMR Result	Notes
		Site NOT on the Contaminated Land Register	
147	**RP23698**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
148	**RP23698**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
86	**RP23531**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
136	**RP23531**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
3	**RP57788**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
138	**RP23698**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
143	**RP23698**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
135	**RP23531**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
13	**SP109074**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 06/11/2013
2	**RP60248**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 04/10/2012
141	**RP23698**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 04/10/2012

Lot	Plan	EMR Result	Notes
146	**RP23698**	Site NOT on the Environmental Management Register Site NOT on the Contaminated Land Register	Search Conducted 04/10/2012

3.0 PREVIOUS SITE INVESTIGATIONS

3.1 ELP (2013) University of Queensland Experimental Mine Site Preliminary Soil Assessment

ELP was commissioned by UQ to undertake a preliminary soil assessment as part of a broader environmental assessment of the UQEM. The purpose of the Preliminary Soil Assessment (PSA) was to undertake an initial assessment of the soils on the land occupied by the UQEM to determine if any materials remained on site from historical mining activities.

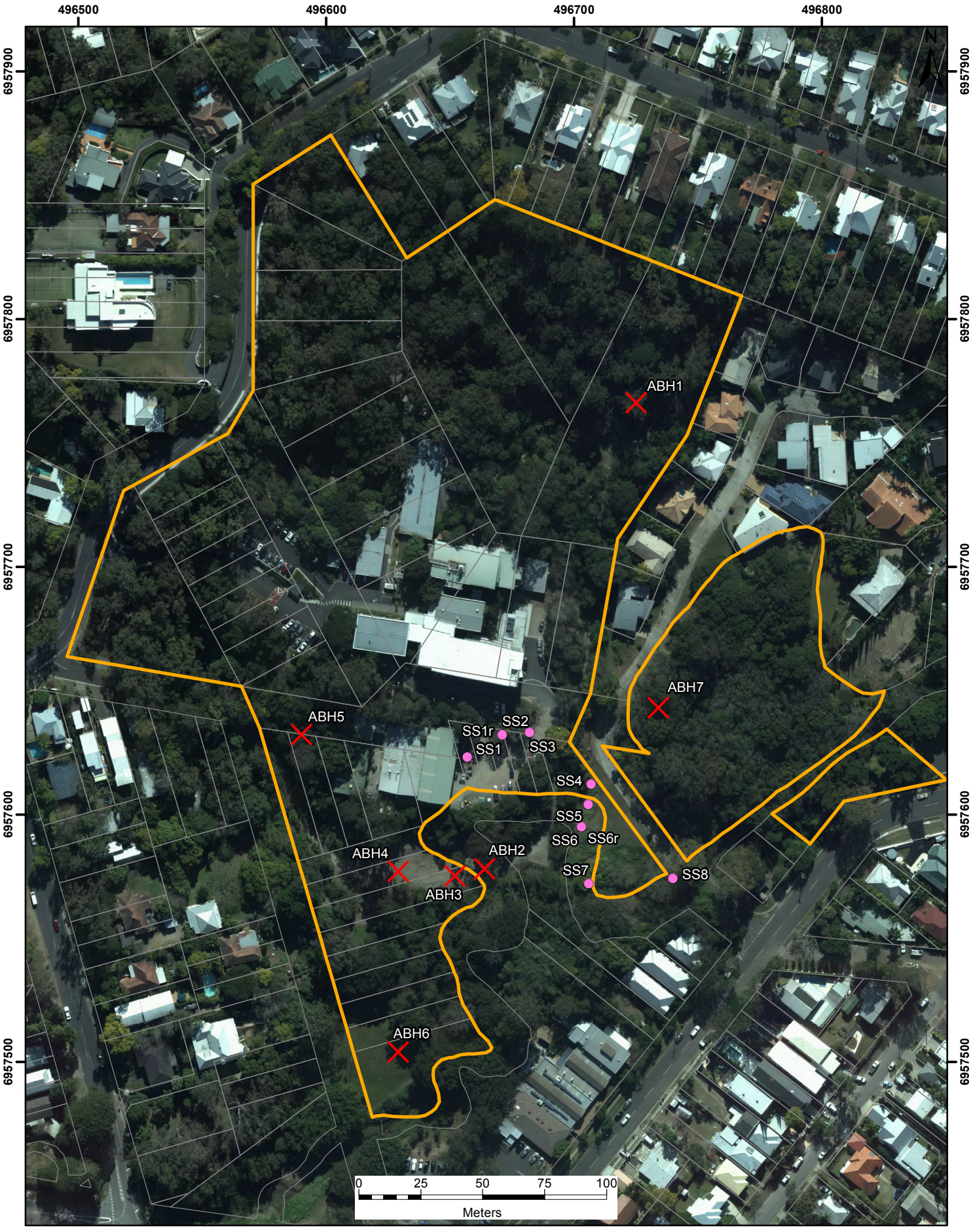
On the 21st August 2013 soil sampling was undertaken using a mechanical auger mounted on a 4WD vehicle. Seven borehole locations were chosen for investigation based upon current site activities, historical air photos and site observations. In addition to the soil samples collected from the boreholes a further eight surface soil samples were collected for laboratory analysis. The location of the collected soil samples taken are detailed in ***Table 4***.

Table 4 Preliminary Soil Sample Location Descriptions

Site	Easting	Northing	Total Depth (m)	Intervals Sampled (m)	Comment
ABH1	496,725	6,957,766	1.0	0.2, 0.6	Location at base of gully.
ABH2	496,664	6,957,578	1.0	0.2, 0.6	
ABH3	496,652	6,957,575	1.0	0.1, 0.2, 0.6	
ABH4	496,629	6,957,577	1.0	0.2, 0.4	
ABH5	496,590	6,957,632	1.0	0.1, 0.2, 0.8	
ABH6	496,629	6,957,504	2.0	0.2, 0.4, 0.6, 0.8, 1.0, 1.2	Depth extended due to intersection of fine sediments
ABH7	496,734	6,957,643	1.0		
SS1	496,671	6,957,632	0.1		Duplicate sample SS1r taken
SS2	496,657	6,957,623	0.1		
SS3	496,682	6,957,633	0.1		
SS4	496,707	6,957,612	0.1		
SS5	496,713	6,957,613	0.1		
SS6	496,703	6,957,595	0.1		Duplicate Sample SS6r taken
SS7	496,706	6,957,572	0.1		Water course sediment sample
SS8	496,740	6,957,574	0.1		Stream Sediment Sample, taken below water in active channel of Witton Creek

* Coordinates at GDA 1994, MGA Zone 56

Sample Locations are marked on ***Figure 5***



Legend

Cadastre

UQ Site Parcels

Auger to 1m

Sample to 300mm

Note: Aerial Imagery Captured in 2011 © UQ

Preliminary Soil Investigation
Sample Location Plan

Figure 5	**UQ**	environmental and licensing professionals pty ltd
Date: *7/04/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:2,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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The PSA encountered mine tailings and mining wastes at all drilled locations. The mine wastes consisted of a fine grained sandy material considered to be crushed phyllite and very soft plastic clay both of which of which possessed elevated levels of lead in excess of the applicable NEPM guideline chosen for the assessment (HIL C &D).

Leach testing of samples where total metal values exceeded the chosen HIL for the preliminary assessment was undertaken using the method Australian Standard 4439.3 with deionised water as the leach solution. Deionised water was chosen to simulate exposure of the samples to rainfall, which replicates the site environment. This leach testing indicated that the leachable metals (Lead and Zinc) exceeded the ANZECC 2000 Trigger values for freshwater (95% level of protection of species). The ANZECC 2000 levels are the water quality objectives for both Witton Creek and the adjacent Brisbane River defined in the *Environmental Protection (Water) Policy 2009 Brisbane River Estuary environmental values and water quality objectives (DEHP, July 2010)*. These values have also been adopted by NEPM 1999 (as amended May 2013) Groundwater Investigation Levels (GIL) for freshwater environments.

Soil samples collected from the pilot plant laydown area were slightly elevated for a range of metals but below the relevant NEPM guideline values. A soil sample collected from the stormwater drain showed elevated Chromium but below the NEPM guideline value. Soil samples collected in the stormwater sediment detention trench (reed bed area) showed elevated levels of lead and zinc, with lead (at 2,430mg/kg) exceeding the HIL C and D guideline level.

Sediment samples collected from the Witton Creek anabranch which directly receives discharge from the UQEM site showed elevated levels of metals and strongly elevated zinc (32 times the trigger value) when compared with the ANZECC sediment guideline levels. The levels of metals in the Witton Creek anabranch were all below the HIL C and D trigger values. The bed level of this anabranch is above the main Witton Creek channel, and likely only flows during flood events. The anabranch is otherwise dry.

Sediment sampling in Witton Creek (main channel) downstream of the stormwater discharge from the site indicated all metal values were below the ANZECC sediment guideline levels.

Leach testing using the method described in AS4439.3 of the stream sediment samples in the Witton Creek anabranch indicated leachable cadmium, copper, lead and zinc in excess of the ANZECC 2000 guideline trigger values for ecosystems. Deionised water was the leach solution, and was chosen to simulate exposure of the samples to rainfall, which replicates the site environment.

3.2 Surface Water Sampling

The University of Queensland has been undertaking weekly sampling of surface water in Witton Creek both upstream and downstream of the site since July 2013. The tabulated results have been provided for the purpose of this report (S. Green, email communication March 2014) and are included as **Appendix N**. Samples have been taken on a weekly basis from a location immediately upstream of the site and a location downstream of the site. A summary of these results are provided in **Table 5** below.

Table 5 Surface Water Sample Results Summary

Analyte		Water Quality Objectives	Upstream Location			Downstream Location		
	units		Maximum	Minimum	Average	Maximum	Minimum	Average
pH	pH units	*7.4 – 8.4*	7.9	7.1	7.60	7.8	7	7.5
Turbidity	NTU	*25*	11	1.1	4.0	**100**	1.8	8.3
Silver	mg/L	*0.0014*	0	0	-	0	0	-
Cadmium	mg/L	*0.0055*	0.0009	0.0002	0.0005	0.0026	0.0001	0.0012
Cobalt	mg/L	*0.001*	0	0	-	0	0	-
Chromium III	mg/L	*0.0274*	0.0095	0.002	0.0055	0.01	0.003	0.005
Chromium IV	mg/L	*0.0044*	0.007	0.002	0.0037	0.003	0.003	0.003
Copper	mg/L	*0.0013*	**0.01**	0.001	**0.0031**	**0.019**	0.001	**0.004**
Lead	mg/L	*0.0044*	0.0015	0.0015	0.0015	0.004	0.0036	0.0038
Zinc	mg/L	*0.015*	**0.15**	0.002	**0.023**	**0.45**	0.002	**0.037**
Electrical Conductivity	uS/cm	-	2100	340	1116	13000	320	2965

Note 1. Water quality objectives are defined chosen are the Brisbane River Estuary environmental values and water quality objectives, and ANZECC Marine triggers for metals.
Note 2 Only one upstream sample recorded lead above the laboratory detection limit
Note 3 Values exceeding the water quality objective are indicated in bold

From the review of **Table 5** and the full data table provided the following comments can be made;

- The downstream site shows influence of tides with high electrical conductivity during many sampling events (reaching a maximum 13,000 uS/cm)
- It is apparent that the detection of metals in surface water is irregular at both upstream and downstream sites. The overwhelming majority of analysis returned values below laboratory detection.
- Where metals were detected in upstream samples, the downstream sample on the same day generally also detected the same metal, but not always the same value.
- The main metals of significance (exceeding water quality objectives) detected were both copper and zinc. These exceedences were recorded at both upstream and downstream sites.
- The elevated copper and zinc values in surface water upstream and downstream of the site are interpreted to reflect the catchment provenance, being highly urbanised.

4.0 POTENTIAL CONTAMINATION ISSUES AND CONCEPTUAL SITE MODEL

4.1 Potential Sources of Contamination

Following a review of historical records, aerial photography and utilising the data collected during the PSA, the potential sources of site contamination associated with past and present site uses are considered to include (but may not be restricted to):-

- Mine tailings, overburden and other mine wastes;
- uncontrolled fill;
- unlicensed and uncontrolled disposal of wastes;
- bulk storage, use and disposal of chemicals during historical mining operations, and;
- Debris from current buildings and the demolition of former buildings.

From the site history, there is mention of the incorporation into the pilot plant, facilities to handle radioactive ores, for the purpose of test work in the pilot plant. File records (S Green, April 2014, pers. comm.) indicate that this material was cleaned up and removed from site in 1986.

Contaminants of concern include;

- metals (particularly zinc, lead)
- general wastes and demolition wastes
- chemicals.

4.2 Potential Exposure Routes and Exposed Populations

The potential exposure routes and exposed populations discussed in the following sections have been assessed with consideration of the site's existing human and ecological receptors;

4.2.1 Potential Human Receptors

The site has been investigated in relation to the sites current use as an experimental mine, pilot plant, laboratory and research facility which is classified as a Commercial and Industrial land use scenario in the NEPM 1999 (as amended May 2013) guidelines and is therefore assessed in accordance with Health Investigation Level (HIL) D. The guidelines consider the dominant users of industrial and commercial sites to be adult employees, who are largely involved in office-based or light indoor industrial activities. It is considered that the opportunities for direct access to soil by employees is likely to be minimal however, there may be potential for employees to inhale, ingest or come into direct dermal contact with dust

particles derived from the soil on site. Potential exposure pathways for personnel involved in site activities in the commercial/industrial land use scenario are outlined below:-

Current Site Occupants

- Indoor dust inhalation
- Outdoor dust inhalation
- Dermal contact with shallow soil and dust
- Incidental ingestion of shallow soil and dust
- Indoor inhalation of vapours derived from shallow soil
- Outdoor inhalation of vapours derived from shallow soil

Future Site Occupants

- There are no current plans to develop the site or reclassify the site for purposes other than a commercial or industrial land use scenario , as such the assessment criteria for future site users is considered consistent with those for current site occupants.

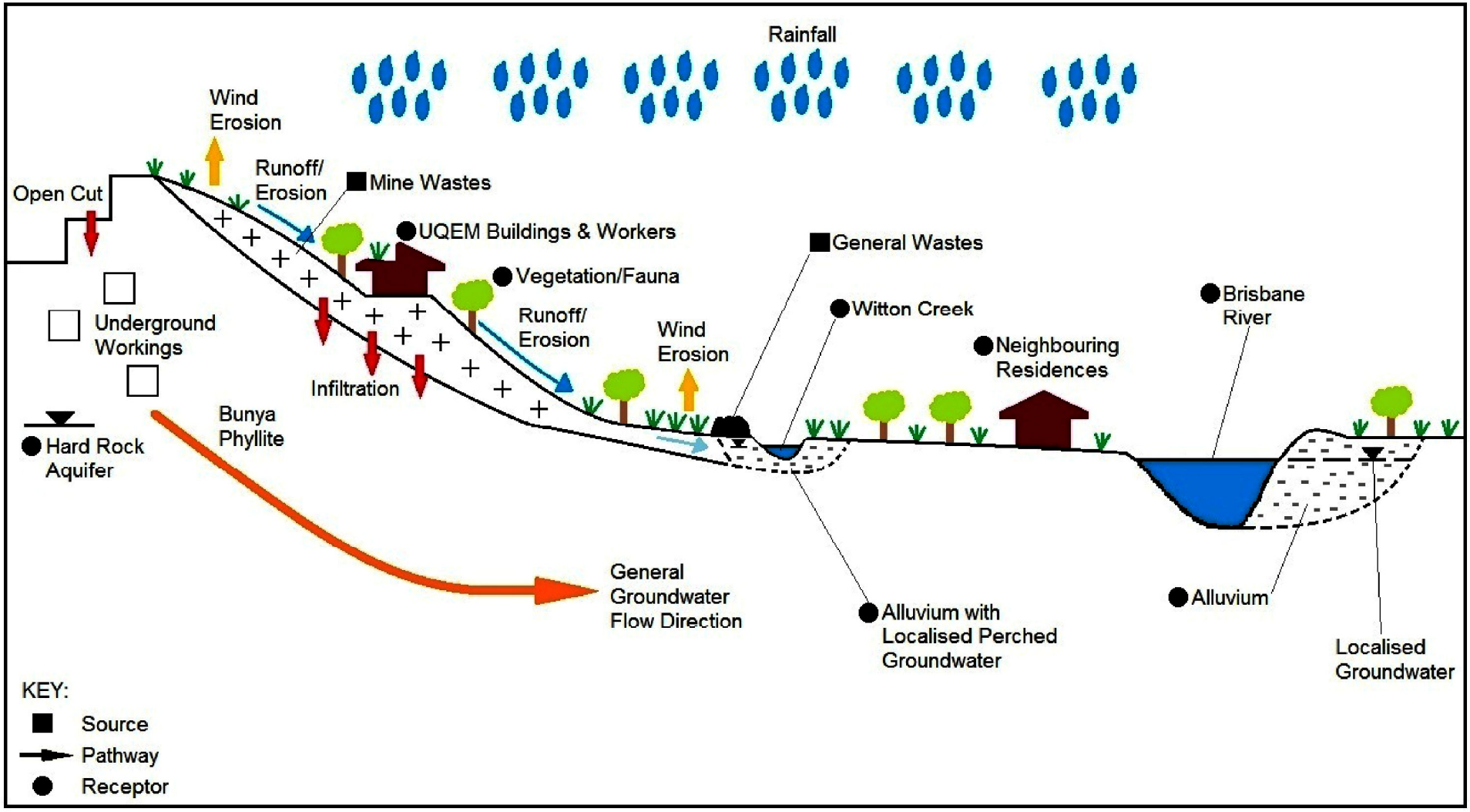
4.2.2 Potential Ecological Receptors

Potential ecological receptors have been considered based on current site environmental features and a review of local geology and hydrogeology and appear to be limited to the following:-

- The Witton Creek which runs to the southern boundary of the site. The Witton Creek is predominantly a freshwater ecosystem, although appears to be subject to some tidal influence in the vicinity of the site. Witton Creek is a tributary of the Brisbane River.
- The marine ecosystem of the Brisbane River. The confluence of the Witton Creek and Brisbane River is located approximately 200m downstream of the southern site boundary.
- The groundwater system. Soil contamination has the potential to cause elevated concentrations of contaminants in the shallow groundwater. As such, potential uses of the shallow groundwater system (including groundwater extraction and plant uptake) have been considered as potential risk receptors in relation to site contamination from the identified contaminating sources.

4.3 Conceptual Site Model

The conceptual site model described in sections 4.1 to 4.2 above is best illustrated in **Figure 6.**



Conceptual Site Model

Figure 6	UQ
Date: 3/04/2014	Author: Christopher Maddox
Revision: R1	

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5.0 SOIL INVESTIGATION

Following submission of the PSA to UQ and subsequent notification to EHP, a notice to conduct a site investigation was received from EHP. A detailed site investigation was undertaken by NAA between the 10th of October and the 30th October 2013 with additional soil, groundwater and surface water sampling carried out on the 2nd of December 2013.

Data quality objectives for this investigation are summarised in **Table 6** below.

Table 6 Data Quality Objectives

Step	Response
Step 1 – State the problem	The problem is that land contamination as a result of historical mining activities has been detected on the UQEM site. Levels of selected metals (lead, zinc) exceed the relevant trigger values. The project team includes John Iddles (project leader and suitably qualified person), Steve Sherrington (suitably qualified person for assessment of land contamination) and Alex Serada (suitably qualified person for assessment of groundwater and surface water contamination). The regulatory authority is the Queensland Department of Environment and Heritage Protection. The local government area is Brisbane City Council. The assessment and reporting must be completed before April 11, 2014 within the budget set by the University of Queensland.
Step 2 – Identify the goal of the study	The goal of the study is to determine if the levels of metals in soils, groundwater and surface water on site pose a hazard to human health and the environment.
Step 3 – Identify information inputs	Samples of soil and groundwater will need to be collected. Surface water samples have previously been obtained, tested at a NATA registered laboratory. Surface water monitoring by UQ is ongoing, and results can be used in this investigation if required. Soil samples will need to be tested at a NATA registered laboratory for contaminants of concern (selected samples only). Groundwater samples will need to be tested at a NATA registered laboratory for contaminants identified in the soil sample testing (likely to be metals only).
Step 4 – Define the study boundaries	The study is restricted to the Lots on Plan identified in the DEHP notice to investigate (Lot 3 on RP 60248, Lots 88, 89, 91, 92, 93, 94, 137 on RP 23531, Lot 329 on SL 7293, Lot 334 on SL 3873, Lot 40, 41 on RP 23699).
Step 5 – Develop the analytical approach / decision rule	If actual levels of metals in soil samples within 1m of surface exceed the chosen trigger levels (Health Investigation Level D) then assessment of bioavailability of metals must take place. If the bioavailability of metals in soil poses an unacceptable risk to human health and the environment then the soil must be remediated, otherwise the soil should remain in place.
Step 6 – Specify the performance or	The Environmental Site Assessment will be prepared with reference to industry standards and national and state

acceptable criteria	guidelines including: • The National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013); Analytical data collected will be compared to a range of guidelines including ecological, residential and on-going commercial uses. • Australian Standard "Guide to the investigation and sampling of potentially contaminated soil": AS4482.1-2005; • Australian Standard "Water Quality Sampling. Part 11: Guidance on sampling of groundwater's" AS/NZS 5667.11:1998; • Guideline for Contaminated Land Professionals (Department of Environment and Heritage, Queensland Government, 2012).
Step 7 – Develop the Plan for obtaining data	Soil samples shall be obtained from surface and subsurface using mechanical or hand soil auger. Depth of investigation is generally up to 1m, but can be deeper, at the discretion of the field sampler. Location of sample sites is broadly grid based, constrained by site access (steep slopes, structures, vegetation) with a site density of one sample site per 600m^2 area. Samples (minimum mass 100gm) will be obtained from each observed change in strata, or a minimum 0.5m sample interval. Groundwater samples will be obtained from shallow aquifers by installing groundwater monitoring wells at locations judged as suitable from site inspection. Groundwater samples will be obtained from these wells following purging of groundwater wells (minimum purge volume, 3 bore volumes, or until bore is dry whichever occurs first). Quality Assurance and Quality Control for both soil and groundwater samples will include the use of field duplicates at the rate of at least 1 duplicate for every 20 samples. In addition, laboratory QA/QC as per NATA requirements will be undertaken.

Twenty four soil bores (BH01 to BH24) and five groundwater wells (GW1 to GW5) were drilled to a maximum depth of 7mBGL using hand auger drilling technique to approximately 1.2m and then percussive push tube drilling equipment, where hollow tubes are drilled into the ground to obtain relatively undisturbed core soil samples. Following drilling GW1 to GW5 were converted into groundwater monitoring locations. Groundwater monitoring well installation drawings are presented in ***Appendix G***. Borehole and groundwater wells were placed in targeted lot locations, suspected to have been affected by mining activities and wastes. The targeted areas were identified by carrying out a review of historical literature, aerial photographs and onsite knowledge of UQ employees. **Figure 7** is a plan showing the location of the borehole and groundwater locations.

The bores were logged and soil samples collected under the guidance and supervision of the nominated suitably qualified person (SQP) from NAA. The soil samples were collected at regular depth intervals or at a change of strata. Borehole logs are included in ***Appendix H.*** The drilling rig was decontaminated between location by cleaning equipment with clean rags and rinsing with Decon 90 between sites.

Where steep terrain and dense vegetation prevented the access of a drilling rig, a further sixteen soil bores (BH25 to BH40) were excavated in alignment with best practice hand auger drilling techniques (equipment decontamination included cleaning of the auger with clean rags and rinsing with Decon 90 between samples). Excavation was to a maximum depth of 1.6m.

Soil samples were placed into acid-rinsed and solvent-washed screw top glass jars supplied by the testing laboratory. All soil samples were stored in an ice filled portable cooler immediately following sampling. Samples were delivered in a chilled portable cooler to the testing laboratory under chain of custody (COC) procedures. Samples were also collected for quality assurance / quality control (QA/QC) testing.

Legend

- UQ Site Parcels
- Cadastre

Preliminary Investigations

- Auger to 1m
- Sample to 300mm

Phase 2 - Detailed Site Investigations

- Drill Holes
- Additional Boreholes
- Groundwater Bores

Drill Hole and Groundwater Bore Locations

Figure 7	**UQ**	elp environmental and licensing professionals pty ltd
Date: *7/04/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:2,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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5.1 Soil Analytical Program

The primary laboratory used for the soil testing was MGT/Eurofins Environment Testing Australia Pty Ltd (Eurofins). Samples were also submitted to a secondary laboratory for QA/QC purposes with the secondary laboratory being ALS Environmental (ALS). Both laboratories are accredited by the National Association of Testing Authorities (NATA) for the analyses conducted.

The laboratory results from soils analysis are included in ***Appendix I***. Results of the soil analyses are discussed in **Section 5.7**. Analytical results summary tables are presented in ***Appendix J***. Results of QA/QC analyses are discussed in detail in **Section 7.0**.

5.2 Soil Assessment Criteria/Investigation Levels

Soil analytical results were compared with two distinct sets of investigation levels to allow assessment of risks to both ecological (e.g. water bodies, animals, plants) and human receptors.

Health Investigation Levels – Soil concentrations have been compared with Health Investigation Levels (HILs) outlined in NEPM 1999 (as amended May 2013). These investigation levels are derived using current toxicological information and generic exposure settings. The HILs used for this investigation are primarily those for commercial / industrial land use – exposure setting 'D' (HIL D).

The use of HIL D is considered appropriate when the following characteristics of the site use are taken into account;

- the site use is restricted to Adults (generally post graduate students or employees)
- the site use is generally carried out indoors in laboratories or office space
- outdoor use of the site is limited to meal break opportunities adjacent to the buildings, however designated areas for this purpose are covered by hard stand.
- Maintenance and gardening activities on site may involve limited contact with soil by Adults, who are required to wear protective gloves for OH&S reasons
- No playing fields or similar are maintained on site
- The areas of the site not covered by buildings or hard stand are well vegetated. These areas include designated walking paths covered with gravel

The more conservative exposure setting "C" (HIL C) is not considered appropriate for this site use, for the reasons stated above. However, they have been included in this report for comparison purposes.

Ecological Investigation and Screening Levels – Results have been compared with Ecological Investigation Levels (EILs) in accordance with the National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999 (as amended May 2013). NEPM 1999 (as amended May 2013) does not provide a direct EIL for Lead, Nickel or

Arsenic. The guidance states that for these metals the EIL should be calculated from summing the Ambient Background Concentration (ABC) and the Added Contaminant Level (ACL). This is summarised in NEPM 1999 (as amended May 2013) as *'the methodology assumes that the ecosystem is adapted to the ambient background concentrations for the locality and that it's only adding contaminants over and above this background concentration which has an adverse effect on the environment '*.

Observations made during this site investigation has indicated that all areas of the site which are not impacted by buildings, roads or hard stand are well vegetated. Many areas of the site have been actively landscaped with native species, with no impediments to active growth reported by site ground staff (S.Green, March 2014, pers. comm.). The University undertakes monthly fauna surveys on site, and the results indicate high species diversity, with no evidence of fauna being in poor health on site (C Ainsley, pers.comm. April 2014). A professional gardener/landscaper has been employed full time on site since 2009 and has not reported signs of vegetation dieback or inhibited vegetation growth (S. Green, pers.comm March 2014).

Assessment of the ecological condition of Witton Creek has previously been undertaken in 2013 for the University of Queensland. While the purpose of this investigation was to assess the potential impact from stormwater discharge from the UQEM site on Witton Creek, the conclusions of the assessment can be used to draw some information on the condition of the aquatic ecology in Witton Creek.

The summary of this assessment (FRC Environmental, 29 October 2013) was;

- Aquatic habitat was in moderate to good condition along Witton Creek
- Sediment quality was below ANZECC interim sediment quality guideline – low trigger values except for lead (at two sites), arsenic and zinc (one site) and nickel (one site)
- Water quality in terms of dissolved metals was below the chosen ANZECC trigger values at each site, except for copper and zinc at a site downstream of the UQEM site
- Fish species caught in Witton Creek were noted to be in good condition, with no signs of distress
- Taxonomic richness of bed and edge macro invertebrates was low, which is likely to be a function of the lack of suitable habitat and the tidal influence in the creek
- Based on the assessment it was concluded that there is no evidence to suggest discharges from the UQEM site have influenced the aquatic ecology of the receiving environment in Witton Creek.

It is noted that the selection of upstream reference sites for the aquatic ecology survey is limited by the change to the morphology of Witton Creek upstream of the UQEM site where it becomes significantly wider, and changes to be a man made concrete lined drainage channel. In the absence of suitable undisturbed and representative upstream reference sites, the qualifications and experience of the FRC aquatic ecologists is regarded as adequate to draw the conclusions made in their report regarding the impacts of site discharges on Witton Creek.

Based in the above, it is considered that the ecosystem is adapted to the ambient background concentrations. Therefore for the purposes of this DSI the ABC values for the site are currently unknown. In order to provide assessment criteria for these metals a conservative approach has been taken and the ACL for HIL D has been used.

Similarly, NEPM 1999 (as amended May 2013) states that the calculated EIL for Nickel should be based on the clay content of the soil. During investigation fieldworks the clay content of the soil was observed to vary greatly across the site area. Particle size distribution testing of soil samples was not undertaken. Therefore, in order to provide assessment criteria for Nickel a conservative approach has been taken and the most stringent value applied for the calculated EIL.

5.3 Soil Investigation Results

5.3.1 Subsurface Conditions

The maximum depth of the soil investigation was 7mBGL. Boreholes BH1 to BH24 and groundwater wells GW1 to GW5 were completed by Geoprobe drilling techniques. Whilst due to access restrictions BH25 to BH 40 were completed by hand auguring techniques.

The site has a number of buildings and areas of concrete and gravel hardstand associated with the facility. Outside the footprint of the UQEM infrastructure the site is generally vegetated. There were no visible signs of ecological stress or die back observed during the fieldworks. The surface cover generally comprises of leaf litter and decomposed plant material over a thin layer of clayey loam.

The immediate subsurface generally comprises the following materials:

- Fine to medium grained sandy material believed to be crushed phyllite;
- Very soft clay of low plasticity believed to be mine tailings;
- Heavily weathered and fractured parent rock.

Generally the mine wastes and overburden waste underlain by clays or heavily weathered parent rock. Hydrocarbon staining / discolouration were noted in soils in borehole BH24.

Groundwater was encountered between 2.8m and 6.8mBGL in the boreholes that were extended to this depth and beyond. Soil bore logs are included in ***Appendix H***.

5.3.2 Laboratory Testing Results

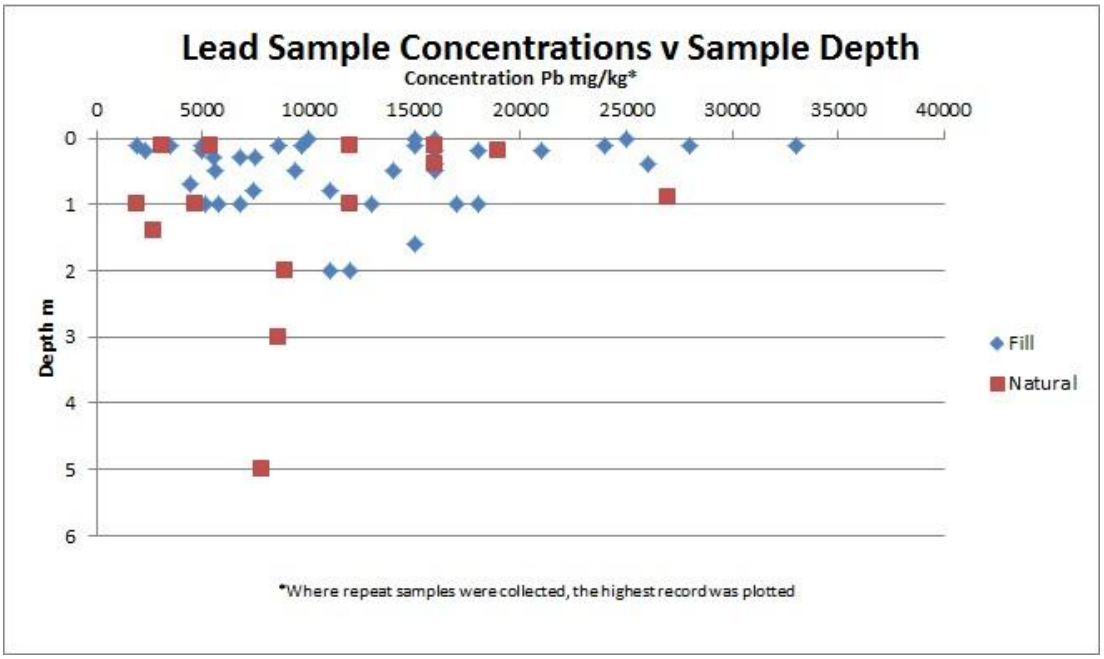
Results of the soil analyses are presented in summary tables, in ***Appendix J***. Laboratory certificates and chain of custody documentation are included in ***Appendix I***. Exceedences of the chosen exposure criteria are summarised in ***Table 7***.

Health Investigation Level (D&C)

The majority of borehole locations showed elevated levels of lead above the adopted assessment criteria. Of 45 sampling locations 27 locations exceeded the NEPM 1999 (as amended May 2013) HIL D value for lead in commercial and industrial premises with a maximum concentration of 110,000mg/kg. Of 45 sampling locations, 36 locations exceeded the NEPM 1999 (as amended May 2013) HIL C value for lead. **Figure 9** illustrates the maximum lead concentration in the top one metre. .

Assessment of the levels of lead in soil in material classed as fill versus material classed as natural soils was undertaken. The results are illustrated in **Figure 8**. These results appear to indicated elevated lead levels in both natural and fill materials. Note at this scale, the figure excludes the outlier result of 110,000 mg/kg in GW3 in fill at 1.5m below surface.

Figure 8 Soil Lead Levels in Fill and Natural Soils



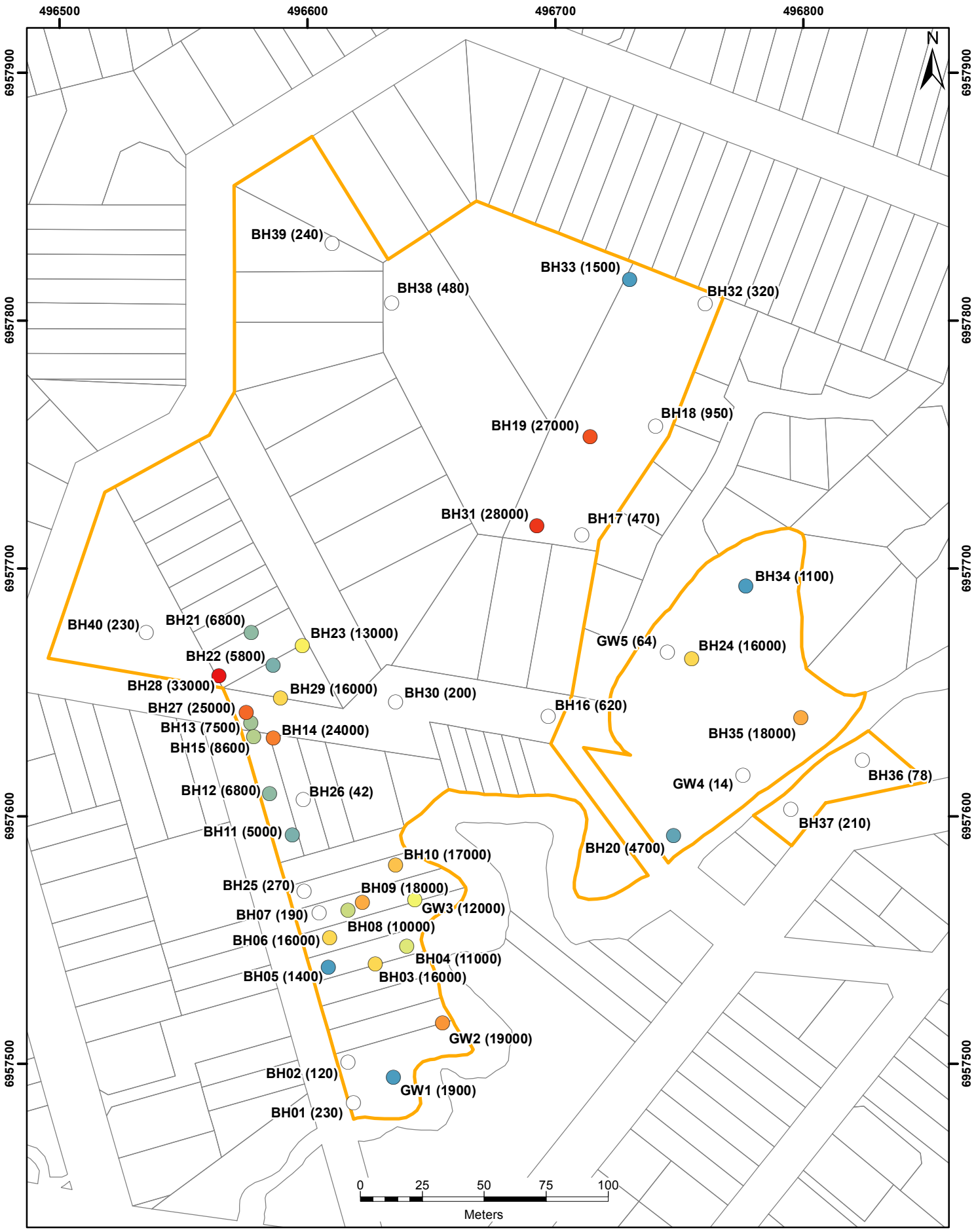
A single sample (BH13. 0.3m) exceeded the HIL C trigger value for zinc with a value of 38,000mg/kg (versus the HIL C trigger level of 30,000 mg/kg). A single sample (BH21, 0.5m) marginally exceeded the HIL C trigger value for arsenic with a value of 320 mg/kg (versus the HIL C trigger level of 300 mg/kg). A single sample (BH34, 0.1m) marginally exceeded the HIL C trigger value for cadmium with a value of 91 mg/kg (versus the HIL C trigger level of 90 mg/kg).

Location BH24 showed localised elevations of Poly Aromatic Hydrocarbons (PAH) with a maximum concentration of 10,000mg/kg (total PAH) associated with the wastes and waste oil observed at surface at this location during field work. Waste oils had apparently originated from the limited historical fly tipping of drums and other wastes including construction materials and other car parts at this location.

Visual examination of the area has indicated that the extent of elevated PAH is likely to be localised to an approximately 5m^2 area only and has showed no signs of migration (the viscous nature of the hydrocarbons and lack of detection in further boreholes (for example GW5) indicated that the contamination was localised). The elevated PAH is of very limited depth extent, with the sample taken 0.1m below the contaminated sample recording hydrocarbons below the level of detection. Black stained silt was found at this area containing inclusions of bricks, likely to have been from external dumping or spillage not

associated with the mine workings. It is likely these exceeded levels are associated with the visible deposited components in this area, (i.e. those associated with the localised hydrocarbon staining as mentioned above). Location BH24 also showed localised elevations of Total Petroleum Hydrocarbon (TPH) C16 to C34 fractions with a maximum value of 97,000mg/kg above the acceptable limit of 5,000mg/kg for the adopted HIL D criteria. The location of this material is in a vegetated portion of the site, away from site activities, Due to the limited areal and depth extent, and the limited opportunities for contact with the material from site workers the risk of this material to human health and the environment is considered low.

In terms of the potential for off site impacts it is noted that the soil results adjacent to the eastern boundary (Aaron Place residences) recorded surface lead values that were below the HIL C & D, however exceed HIL A (maximum 620mg/kg in BH16, versus 300mg/kg trigger value). The soil results adjacent to the western boundary (Vera Street reserve) exceed HIL C & D trigger levels for lead at surface. Examination of the 1946 historical air photo (refer section 2.5) identifies areas of bare earth (disturbed ground) in the vicinity of the Aaron Place residences. The cause of this bare earth is not clear from the photos. Examination of the 1946 historical air photo identifies limited surface disturbance at the Vera Street boundary.



Legend

- UQ Site Parcels
- Site Investigation Symbol
- Cadastre

Site Investigation Colour Ramp (Lead Value - mg/kg)

High : 33000

Low : 1000

Maximum Lead Concentrations to 1 Metre Below Ground Level

Figure 9	**UQ**	environmental and licensing professionals pty ltd
Date: *7/04/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:2,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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Table 7 Range of reported exceedences in relation to HIL D, HIL C and EIL for industrial/commercial and Recreational land use scenario's

Analytes	NEPM 2013 HIL D	NEPM 2013 HIL C	NEPM 2013 EIL Commercial	NEPM 2013 EIL Urban	NEPM 1999 EIL	Range of Reported Results Showing Exceedences in Related Colour
	Limit	Limit	Limit	Limit	Limit	
Arsenic	3000	500	160	100	20	2.4-1800
Cadmium	900	90	-		3	<0.5-170
Copper	240,000	17000	-	280	100	<5-720
Lead	1500	600	1800	1100	600	13-110,000
Manganese	60,000	19000	-		500	<5-4900
Nickel	1500	1200	-		200	<5-67
Zinc	400,000	30000	400	230	14,000	<20-38,000
TPH C10-C16	1000	1000	170	120	-	<50-6500
TPH C16-C34	5000	3500	1700	300	-	<100-9700
TPH C34-C40	10,000	10000	3300	2800	-	<100-1200
Sulphur as S	-	-	-		600	39-1300
Benzo (a)pyrene	-	-	0.7	0.7	-	<0.5-940
Carcinogenic PAH's as B(a) P TPE	40	3	-		-	0.995-1247
Naphthalene	-	-	370	170	-	<0.5-570

Ecological Investigation Levels

In terms of EIL's, a conservative approach has been taken, whereby the relevant added contaminant limit specified in NEPM 1999 (as amended in 2013) has been adopted as the EIL. When compared with the adopted and calculated EIL values the following observations can be made:

Lead concentrations were found to exceed the EIL criteria at 28 of 45 borehole locations with a maximum value of 110,000mg/kg at location GW 3.

Zinc levels were found to exceed the EIL criteria at 29 of 45 locations with a maximum value of 38,000mg/kg at BH13.

Copper concentrations were found to exceed the EIL criteria at 9 of 45 borehole locations with a maximum concentration of 720mg/kg at BH21.

Arsenic concentrations exceeded the adopted EIL at 7 of 45 locations with a maximum value of 1,800mg/kg at BH23.

Figures that illustrate these results have not been provided as they generally mirror the exceedences noted in **Figure 9** above.

Selected samples were analysed for the presence of uranium, from boreholes in the near vicinity to the pilot plant area (as this is the area identified in 1984 as being impacted by these radioactive ores). All results were below the detection limit, as summarised in **Table 8** below. These results support the outcomes of the site clean up supervised and directed by officers of the Queensland Department of Health and the Queensland Department of Mines in 1986.

Table 8 Soil Uranium Analysis

Sample **Number**	**Result (mg/kg)**
BH10 0.5	<10
BH13 0.3	<10
BH13 2.	<10
BH14 0.1	<10
BH15 0.1	<10
BH16 0.1	<10
BH16 1.4	<10
BH30 0.1	<10

5.4 Leach Testing Results

As part of the request for information discussed with DEHP during the initial consultation it was agreed that some preliminary assessment of bioavailability should be made. It was further discussed that for the purposes of this assessment that leachate assessment for both neutral pH and acidic conditions would apply. Following assessment of the results of the soil analysis, selected samples were chosen for leachate analysis based on a mix of soil types and concentrations (including some of the highest exceedences recorded). The laboratory certificates are included in ***Appendix L***. The leach testing was undertaken to assess the mobility of selected metals under site ambient rainfall conditions (neutral pH) and ingestion scenarios (acidic pH). The results under neutral conditions would reflect the available concentration of lead that could be taken up by site flora, whilst the acidic conditions would represent the available concentration that could be ingested into the blood stream by site fauna.

The leach procedure chosen was the Australian Standard Leaching Procedure (AS4439.3). The leach fluid chosen to represent site ambient conditions, with leaching by incipient rainfall was De-ionised water, with pH =7. The leach fluid chosen to represent potential ingestion by humans and absorption through the internal organs was pH = 2.9 (in alignment with the NATA standard for performing acid leach analysis).

For samples assessed by de-ionised water leach, metals analysis for Arsenic, Cadmium, Copper, Lead, Manganese and Zinc was undertaken. These metals represent the priority

metals of concern in the environment. For samples assessed with acidic leach, metals analysis for lead was undertaken, being the metal of most concern for potential ingestion scenarios. The results were compared against the ANZECC Marine Water Quality objectives (refer to **section 6.5** for a discussion of the assessment criteria).

A summary of the results of the neutral pH leach are included in **Table 9**, with a summary of acidic pH leach reported in **Table 10**.

Table 9 Summary of Neutral pH Leach Test Results

Sample	Arsenic (mg/L)	Cadmium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)
ANZECC 2000 Marine Waters 95% protection	-	0.0055	0.0013	0.0044	0.015
GW1 0.1	< 0.01	< 0.005	< 0.01	< 0.01	< 0.01
GW2 0.1	< 0.01	< 0.005	0.02	0.19	0.05
GW3 0.1	< 0.01	< 0.005	0.02	0.95	0.21
GW3 1.5	< 0.01	0.017	< 0.01	0.68	0.24
BH03 0.1	< 0.01	< 0.005	0.02	0.23	0.08
BH03 0.7	< 0.01	0.012	< 0.01	0.19	0.25
BH04 0.1	< 0.01	< 0.005	0.02	0.64	0.11
BH04 0.8	< 0.01	0.009	< 0.01	0.54	0.18
BH05 0.3	0.02	< 0.005	< 0.01	0.05	0.01
BH06 0.1	< 0.01	< 0.005	0.04	0.87	0.06
BH06 0.4	< 0.01	0.01	0.01	0.34	0.12
BH06 0.6	< 0.01	0.009	0.01	0.24	0.06
BH08 0.4	< 0.01	0.006	< 0.01	0.22	0.04
BH09 0.2	< 0.01	0.006	< 0.01	0.3	0.06
BH09 1.0	< 0.01	0.026	0.02	0.8	0.23
BH10 0.5	< 0.01	< 0.005	< 0.01	0.19	0.02
BH10 1.6	< 0.01	0.02	0.02	0.6	0.52
BH11 0.2	< 0.01	< 0.005	0.01	0.15	0.02
BH12 0.1	< 0.01	0.006	< 0.01	0.11	0.13
BH13 0.3	0.02	< 0.005	0.01	0.07	0.03
BH14 0.1	< 0.01	0.016	0.03	2.6	1.1
BH15 0.1	< 0.01	0.007	0.01	1.7	0.24
BH19 0.1	< 0.01	< 0.005	< 0.01	0.17	0.11
BH19 0.9	< 0.01	0.017	0.02	1.6	0.9
BH20 1.0	< 0.01	0.22	0.41	4.2	39
BH21 1.0	< 0.01	0.22	0.3	3.1	46
BH22 1.0	< 0.01	0.016	0.04	0.26	1.8
BH22 3.0	< 0.01	0.08	< 0.01	2.9	14
BH23 0.2	< 0.01	0.011	0.01	0.36	0.38

Sample	Arsenic (mg/L)	Cadmium (mg/L)	Copper (mg/L)	Lead (mg/L)	Zinc (mg/L)
GW5 1.4	< 0.01	< 0.005	< 0.01	< 0.01	0.06
BH27 0.1	0.01	< 0.005	0.03	0.3	0.08
BH28 0.1	< 0.01	< 0.005	< 0.01	0.28	0.08
BH28 0.5	< 0.01	0.007	< 0.01	0.99	0.21
BH29 0.1	< 0.01	0.007	0.01	0.54	0.25
BH31 0.1	< 0.01	< 0.005	< 0.01	0.88	0.13
BH35 0.1	< 0.01	< 0.005	< 0.01	0.03	0.03
BH33 0.1	< 0.01	< 0.005	< 0.01	0.05	0.03

Table 10 Summary of Acid Leach Test Results

Sample	Lead (mg/L)
ANZECC 2000 Marine Waters 95% protection	***0.0044***
GW1 0.1	< 0.01
GW2 0.1	3.2
GW3 0.1	21
GW3 1.5	270
BH03 0.1	2
BH03 0.7	35
BH04 0.1	43
BH04 0.8	43
BH05 0.3	0.88
BH06 0.1	23
BH06 0.4	96
BH06 0.6	130
BH08 0.4	50
BH09 0.2	160
BH09 1.0	140
BH10 0.5	230
BH10 1.6	200
BH11 0.2	5
BH12 0.1	8.3
BH13 0.3	40
BH14 0.1	150
BH15 0.1	93
BH19 0.1	4.8
BH19 0.9	780
BH20 1.0	0.09
BH21 1.0	19
BH22 1.0	11

Sample	Lead (mg/L)
BH22 3.0	38
BH23 0.2	10
GW5 1.4	0.42
BH27 0.1	5.7
BH28 0.1	46
BH28 0.5	79
BH29 0.1	43
BH31 0.1	390
BH33 0.1	0.16
BH35 0.1	1

The results from the leach analysis confirm that predominantly lead is the major contaminant of concern. Results from both the neutral pH and acidic pH exceeded the chosen ANZECC guideline level (although not on all occasions).

5.5 Soil Results Discussion

The reported results indicate that there are heavy metal impacts present in the soil at the site. The heavy metal impacts are present in both fill materials and natural soil and rock strata identified at the site.

The fill materials identified at the site consist of processed mining tailings, crushed phyllite and overburden associated with the sites historical mining operations.
No vegetation die back was observed in any location of the site, indicating that the plant species endemic to the site are adapted to tolerate the elevated heavy metal concentrations.

Very localised hydrocarbon impact has been identified at BH24 on land to the east of Aaron Place. This hydrocarbon contamination is at surface associated with historical uncontrolled waste disposal of limited extent (<5m^2 in area). Visual assessment of the surface materials indicates this is localised to this location only. The levels of contamination identified in the vicinity of BH24 are very localised and likely to be caused by a surface spill of machinery oil. Remediation of heavy end hydrocarbons as present in the PAH and TPH fractions present is very difficult and likely to be both time consuming and expensive for the contamination present. It is noted that remediation would likely require the excavation and transport of the impacted soil to a specialist facility for thermal destruction. As such it is recommended that the area is managed in situ as part of the site management plan being prepared. No observed impacts from the contaminated soil has been noted and the long chain length associated with these hydrocarbons reduces the potential for mobilisation in surface water.

The overall soil results and field observations recorded during the investigation indicate that the site is impacted from heavy metal contamination arising from both mining operations and the naturally elevated background levels in soil and rock strata located at the site.

The site is either covered in concrete and tarmac hardstand, buildings or heavily vegetated with no plants grown for human consumption at the site. Therefore whilst the heavy metals are in exceedences of HIL D & C, there exists minimal opportunities for direct soil contact, ingestion or inhalation from the majority of site users. The exceptions to this are ground staff and those excavating the soil such as service installation persons for example. Potential for offsite impact from these materials is considered very low, as the site is well vegetated restricting the opportunities for mobilisation of these materials as sediment in site runoff. The opportunity for offsite impact from airborne mobilisation of contaminants (i.e. dust) is similarly very low, with very limited areas of the site not covered by vegetation, hard stand or buildings.

The lack of observed visual die back in the flora at the site indicates that the exceedences of the adopted EIL's are not causing detrimental harm to the vegetation and site ecosystem.

5.5.1 Bioavailability Discussion

In order to assess the potential bioavailable impacts to site fauna and flora several lines of evidence have been used namely:

- Site Observations – no signs of distressed vegetation, also (based on site observations from across the area), no visible signs of fauna death were noted. Further there has been no recorded observations of fauna death noted by UQ ground staff since fauna monitoring commenced in 2009.
- Groundwater Results - analysis from groundwater samples collected across the site has confirmed that there are minimal exceedences recorded in groundwater from lead.
- Leachability Results – results indicate lead is leachable under both acidic and neutral pH conditions.

Our overall summary of this preliminary assessment of bioavailability is as follows (note this discussion is for lead as this is the dominant contaminant of concern):

It is known that high concentrations of lead are present across the site. The lead is naturally occurring and is indicative of the heavy mineralisation of the local geology in this area (hence the original mine site was constructed). Waste, overburden and tailings associated with the historical operations of the mine are evident across portions of the site. However, the naturally occurring concentration of lead is very similar to the concentrations observed in the fill.

The site vegetation is well established and is in a healthy condition (based on site observations); there are no signs on visible distress or increased observations of fauna mortality. Furthermore the groundwater results confirm that lead impacts from leaching of soil into the groundwater has not occurred as no observed lead in groundwater or minor exceedences were noted.

The results from the leachability assessment indicate that potential exists for lead to impact fauna and flora. However, it is necessary to acknowledge that the analytical methods used for the leachability procedure will lead to false positive results. Specifically, the acid leach

process extracts the lead in the soil, however it is unlikely that water with a pH of 2.9 would be present on the site. In accordance with the principles of the NEPM an assessment of site specific risk needs to be applied to the entire data set in order to state if actual risk is present. Given there are no signs of impact to the site fauna and flora or the underlying groundwater it is likely that the elevated lead results observed in the leachate results are not indicative of actual risk. This is most likely because the local ecosystem has adapted to the local heavily mineralised geology of the broader area.

There is limited potential for offsite migration of lead from surface water flows (as noted in section 5.5 above), however it is noted that the concentrations of lead in pH neutral conditions (rainfall) do exceed the ANZECC 2000 marine water quality objectives (95% protection level). It is recommended that where future excavations works are undertaken and surface soils are exposed, that appropriate sediment and erosion controls are put in place to minimise any risk.

It is recommended following the completion of this report to the satisfaction of the Auditor and DEHP that any risk present can be suitably managed and that an overall site management plan be prepared for endorsement by the Auditor. As a precautionary measure it will be recommended that consumable vegetation is not planted on site (or any produce from any present trees is consumed) and that any future excavation works are appropriately managed from a workplace health and safety perspective. The adoption of this strategy will mitigate any potential risk associated with the lead present on site.

5.5.2 Stormwater and Erosion Discussion

This discussion draws on the outcomes of the soil investigation documented in this section, together with the previous site investigations discussed in **Section 3**, and the aquatic ecology report (FRC Environmental, 29 October 2013).

There is very little exposed soil observed at the site. Exposed soil exists in the open cut workings, however these are internally draining and no sediment is released from the open cut. The other area of exposed soil is the lower grounds storage area. This area is flat and covers a limited area (<1,000 m^2). Stormwater runoff from this lower ground storage area drains into a heavily vegetated area, and as such any mobilised sediment would be retained on site. Visual inspection of this part of the site does not indicate signs of significant erosion or deposition of sediment.

The majority of the site is well vegetated, covered by hardstand (asphalt or quarry gravel) or occupied by buildings.

Stormwater runoff (that is not overland flow) from the site is sourced from roadways, hardstand areas and roof drainage. This stormwater is directed to a sediment detention trench / reed bed in the southern portion of the site. Overflow from this sediment detention trench is directed into an anabranch of Witton Creek. Stormwater flows downstream in the anabranch to Witton Creek main channel.

Metal levels in the sediments captured by the sediment detention trench indicate lead in one sample at 2,430mg/kg, exceeding the HIL C & D trigger value. Metal levels in sediments of the anabranch of Witton Creek exceed the ANZECC sediment quality trigger value for cadmium, lead, nickel and zinc (but were below the HIL C & D trigger value). However metal levels in the main channel of Witton Creek below the confluence with the anabranch did not record any metal values above the ANZECC sediment quality trigger value.

While design drawings or engineering calculations do not appear to have been prepared for the construction of the sediment detention trench, it appears to be satisfactorily detaining sediment from stormwater runoff. There is however opportunity to improve the efficiency of this sediment detention trench by engaging a suitably qualified and experienced engineer to assess and amend the design, as appropriate.

The results appear to indicate that there is limited opportunity for the mobilisation of sediment off site and into Witton Creek. The sediment detention trench appears to be detaining sediment from the main stormwater flow off site, with Witton Creek downstream not recording metals in sediment above the relevant trigger values.

6.0 Groundwater Investigation

The groundwater investigations conducted on site included the installation of five groundwater monitoring wells (GW1 to GW5) and sampling of four groundwater wells GW1, GW2, GW4 and GW5 (GW3 was found to be dry). The details of well installations and sampling are presented in the sections below.

6.1 Groundwater Well Locations & Rationale

A groundwater investigation was conducted to assess the contamination status of shallow groundwater beneath the area where the mine waste from the historical mining activities (occurred in early 1900s) was deposited. The soil tests conducted within this area have identified the presence of elevated metals, predominantly lead with concentrations reported to be above HIL D & C as presented in the NEPM 1999 (as amended).

The locations for the groundwater wells have been selected based on the following:

- The wells were positioned on the mine site (north) bank of the creek;
- The wells were positioned in areas reported as impacted by the presence of mine waste soils; and
- The wells were positioned near the Witton Creek to assess potential for groundwater discharge into the creek.
- Two water samples from Witton Creek at upstream and downstream locations were also collected to assess potential interconnection between groundwater and surface water.

The well locations are shown in **Figure 7.**

6.2 Groundwater Well Installation

The procedure for the construction of the groundwater monitoring wells was as follows:

- The boreholes for the wells were drilled using solid flight auger drilling technique (100mm nominal hole diameter);
- The drilling was generally stopped at two metres below the encountered ground water level ;
- The wells were completed with a 50mm internal diameter machine slotted threaded Class 12 PVC casing interval (screen) installed at the base of the borehole;
- The slotted interval was gravel packed. The well annuluses above the gravel pack were filled with bentonite for at least 0.5m, then backfilled with bentonite/grout mix to surface to prevent any surface water ingress into the well screens;
- The wells were completed with a lockable standpipe that was cemented in place;
- After completion the wells were developed with a down hole submersible pump to remove fines from the screen and gravel pack and to achieve an appropriate connectivity between the screened intervals and the aquifer material. The bores pumped dry generally after removing <10L of water, so multiple episodes of pumping were required to sufficiently develop each well. Bores were generally satisfactory after pumping 80 – 100L of water from the each well.

- Wells were capped on completion, and a lockable steel monument cover enclosed the piezometer.

The geological logs for these wells are included in ***Appendix H*** and well construction details are included in ***Appendix G***.

6.3 Sampling Methodology

Groundwater
The groundwater was monitored in accordance with Monitoring and Sampling Manual (2009), Environmental Protection (Water) Policy (2009) and AS/NZS 5667.11:1998, Water quality-sampling Part 11: Guidance on sampling of groundwaters.

Standing water level was measured from the top of the well casing. Measurements were also taken to check for any separate phase (free) product present in the wells using an oil / water interface probe.

The wells were pumped dry twice prior to collection of the samples to ensure that the water tested was fresh formation water. The volume pumped from each well was at least two well volumes. The low recharge rate of the aquifer ensured that after pumping the well dry at least twice, the formation water sampled was representative of fresh formation water. The 12V submersible pump used to purge wells was decontaminated between each well and dedicated tubing was used for each well.

All groundwater samples collected from the wells were placed in containers provided by the analytical laboratory used. Samples for dissolved metal analysis were filtered in the field through a disposable filter (0.45 micron) prior to filling containers supplied by the testing laboratory. Quality control samples were also collected for testing.

Surface Water
Surface water samples were collected as “grab” samples, using an extension pole mounted with a sampling container.
Field water quality parameters were measured prior to the sampling using a calibrated water quality meter (a YSI Quattro Pro Plus). The calibration was undertaken by the company providing the water quality meter rental and is included in **Appendix M**. Samples analysed for dissolved analytes were filtered through a 0.45µm filter in the field prior to filling the sampling containers.

Decontamination of equipment was undertaken between sampling events using a phosphate free detergent and deionised water. Equipment was washed once and then rinsed three times.

The samples were stored in an ice filled portable cooler immediately following sampling and were delivered under similar conditions to the analytical laboratory with accompanying chain of custody documentation.

6.4 Groundwater Analytical Program

Groundwater samples were analysed for physical parameters and a range of chemicals of potential concern identified during the site history and the soil investigations and assessment.

Three groundwater sampling events were conducted as follows:

- Groundwater wells GW1 and GW2 were sampled on 28 October 2013. The samples were tested for total metals (arsenic, cadmium, chromium, copper, lead, nickel and zinc);
- Groundwater wells GW4 and GW5 were sampled on 1 November 2013. The samples were tested for total recoverable hydrocarbons (TRH) and naphthalene, benzene, toluene, ethylbenzene and xylene (BTEX), Organochlorine Pesticides, Organophosphorous Pesticides and total metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc);
- GW1, GW2, GW4 and GW5 were sampled on 2 December 2013. The samples were tested for pH, Total Dissolved Solids (TDS) and Electrical Conductivity (EC) major cations (calcium, magnesium, sodium and potassium) and major anions (chloride sulphate and alkalinities) and dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc); and
- Witton Creek water samples collected on 2 December 2013 from the upstream and downstream locations were tested for pH, Total Dissolved Solids (TDS) and Electrical Conductivity (EC) major cations (calcium, magnesium, sodium and potassium) and major anions (chloride sulphate and alkalinities) and dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc).

The laboratory used for the groundwater testing in October and November 2013 was Eurofins and the laboratory used in December 2013 was ALS Environmental (ALS). Both laboratories are accredited by the National Association of Testing Authorities (NATA) for the analyses conducted.

Results of the analysis program are discussed in detail in **Section 6.6** and results of QA/QC analyses are discussed in **Section 7.0**. The laboratory certificates for groundwater and surface water samples are included in ***Appendix K***.

6.5 Groundwater Assessment Criteria

The primary guideline for this project was adopted to be the *Environmental Protection (Water) Policy 2009. Brisbane River Estuary environmental values and water quality objectives Basin No. 143 (part), including all creeks of the Brisbane River estuary, other than Oxley Creek, dated July 2010 (EPP).*

The EPP (Table 1 Environmental values (EVs) for Brisbane River estuary catchment waters) lists the recommended environmental values (EV) for each creek and river system covered by this policy as follows:

- Brisbane River (estuary): Aquatic Ecosystem, Human Consumer, Primary, Secondary and Visual recreation, Industrial Use and Cultural and Spiritual values; and

- Brisbane River (tidal creeks and drains): Aquatic Ecosystem, Secondary and Visual recreation and Cultural and Spiritual values

Note that the plan WQ1431 associated with the EPP notes that Witton Creek adjacent to the site is classified as mid to upper estuary waters. Thus, the EV's for this section of Witton Creek has been assigned under "Brisbane River (tidal creeks and drains)".

Site observations, supported by the report by FRC Environmental (2013), indicate that Witton Creek is tidal adjacent to the site. The tidal influence is greatest in the eastern sections of the site. The boundary between the non-tidal and tidal section of Witton Creek is difficult to define and to some extent depends on the tidal cycles.

The EPP (Table 1 Environmental values (EV's) for Brisbane River estuary catchment waters) also lists the recommended EV's for groundwater covered by the policy as;

Aquatic Ecosystems, Irrigation, Farm Supply/Use, Stock Water, Drinking Water.

The water quality objectives to protect the EVs are designated in the EPP, and are stated as "where groundwaters interact with surface waters, groundwater quality should not compromise identified EV's and WQO's for those waters" (EPP, 2009). For the purpose of this study, a conservative approach has been adopted for developing WQO for groundwater and it has been assumed that groundwater may interact with the surface waters in Witton Creek. Thus, the WQO's for the groundwater on site, are the WQO's that are defined in the EPP for the surface water on site.

The EPP also lists the water quality objectives (WQO) either developed for specific EVs or the source documents where the criteria for EVs are listed.
E.g.:

- the Australian and New Zealand Guidelines for Freshwater Water Quality (ANZECC & ARMCANZ 2000) should be used for the fresh and marine ecosystems and recreational water quality and aesthetics;
- the Australian Government National Health and Medical Research Council (NHMRC) 2008 should be used for primary, secondary and visual recreation:
- the Australian Drinking Water Guideline (ADWG) for protection of drinking water sources.

The water quality objectives defined by the EPP for the purpose of this assessment are listed in **Table 11** and **Table 12** below.

Table 11 Water Quality Objectives for the Site

Parameter	Units	Brisbane River Estuary environmental values and water quality objectives	
		Mid estuary	Upper estuary
water temperature	°C	–	–
pH	pH units	7.0–8.4	7.4–8.4
electrical conductivity	µS/cm	–	–
dissolved oxygen	% saturation	85–105	85–105
turbidity	NTU	<8	<25

The EPP does not specify WQO's for metals. Marine water trigger values were used as each site was considered to be estuarine based on Plan WQ1431 under the EPP Water, and the marine trigger values are applicable for estuarine waters (ANZECC & ARMCANZ 2000).

Table 12 Marine Water Quality Objectives

Parameter	Units	Trigger Value
aluminium	µg/L	ID
antimony	µg/L	ID
arsenic (AsV)	µg/L	ID
barium	µg/L	NA
beryllium	µg/L	ID
boron	µg/L	ID
cadmium	µg/L	0.7
chromium (CrVI)	µg/L	4.4
cobalt	µg/L	1
copper	µg/L	1.3
iron	µg/L	ID
lead	µg/L	4.4
manganese	µg/L	ID
mercury (inorganic)	µg/L	0.1
molybdenum	µg/L	ID
nickel	µg/L	7
selenium (total)	µg/L	ID
silver	µg/L	1.4
tin	µg/L	ID
uranium	µg/L	ID
vanadium	µg/L	100
zinc	µg/L	15

NA data not available, ID insufficient data

The risk based approach for assessing groundwater contamination outlined in Schedule B(6) of the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) is based on the protection of relevant (i.e. current or realistic future) uses of groundwater. The guidance presented in Schedule B(6) was used to assess risks to the recommended EVs.

6.6 Groundwater Investigation Results

As discussed in **Section 6.1** five shallow groundwater monitoring bores have been installed to assess the water quality of the shallow (potentially perched, refer **Section 2.2**) aquifer identified along the banks of Witton Creek. The locations of the bores are shown on **Figure 7.** The monitoring bore GW3 was found to be dry during all sampling rounds referred in **Section 6.3.**

Surface water samples were obtained from Witton Creek, both upstream and downstream of the site. The results of groundwater and surface water sampling are discussed in the following sections.

The aquifer intersected was generally a thin, saturated clayey sand to fine gravel, that is overlain and underlain by clay. In some areas (for example GW3) the sand is absent and the groundwater bore installed made no water. This shallow aquifer appears best developed in the near vicinity to Witton Creek and thins out a short distance away from the creek.

6.6.1 Groundwater Level Data and Flow Direction

Levels of groundwater in the monitoring wells were gauged twice in October and December 2013. The gauging results are presented in ***Table 13*** below.

Table 13 Groundwater level data

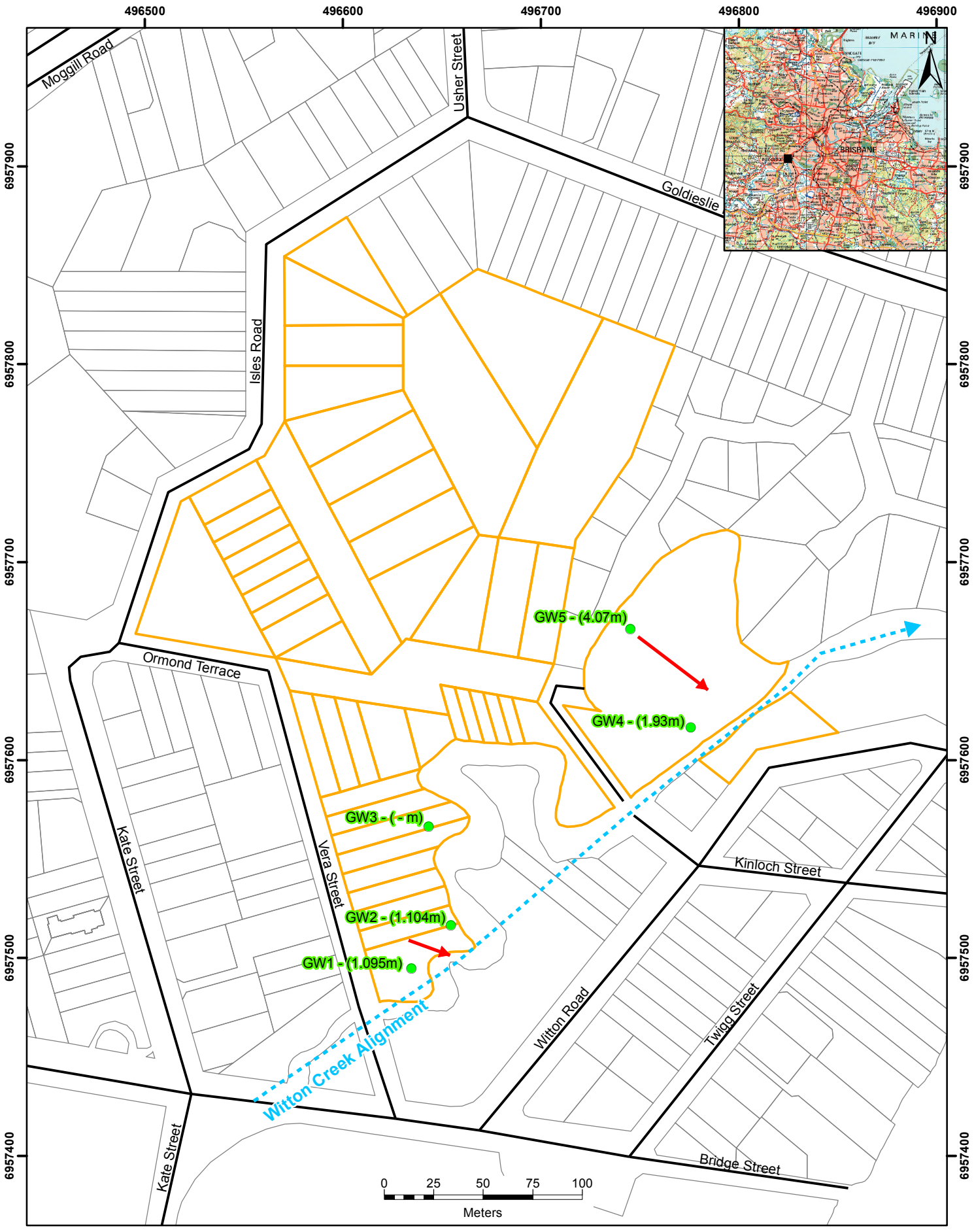
Bore#	Easting	Northing	Top of Casing (mAHD)	October 2013		December 2013	
				Depth to water (m)	SWL (mAHD)	Depth to water (m)	SWL (mAHD)
GW1	496634.68	6957494.6	4.135	3.035	1.1	3.04	1.095
GW2	496654.57	6957516.4	3.894	2.847	1.047	2.79	1.104
GW3	496643.31	6957566.2	6.115	3.81*	2.305*	-	-
GW4	496775.75	6957616.5	8.452	6.82	1.632	6.52	1.932
GW5	496745.26	6957666	6.19	2.78	3.41	2.12	4.07

*Note: mAHD – metres above Australian Height Datum, * well was dry, data presents the depth of the well, SWL – standing water level. Depth to water measured from top of casing.*

December 2013 groundwater level gauging results are noted on **Figure 10**. **Figure 10** also shows approximate locations of upstream and downstream Witton Creek water sampling

conducted in December 2013. Note that due to the number and distribution of groundwater wells, it was not meaningful to construct contours of the groundwater level data.

The ground water level data appear to indicate that the groundwater flow in this shallow aquifer would generally follow topography and flow towards Witton Creek and thence towards the Brisbane River. Surface water level in Witton Creek was not surveyed.



Legend

- UQ Site Parcels
- Cadastre
- Roads
- Groundwater Bores (Surface Water Level in Australian Height Datum)
- Interpreted Flow Direction

Groundwater Level Data

Figure 10	**UQ**	environmental and licensing professionals pty ltd
Date: *7/04/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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6.6.2 Field Measured Water Quality Parameters

The stabilised field parameters measured using a hand held water quality meter during the groundwater and surface water sampling conducted in December 2013 are shown in ***Table 14***.

Table 14 Field Groundwater Quality Parameters

Well ID	Sampling Date	pH (pH Unit)	Temp (Deg C)	Electrical Conductivity (µS/cm)	Oxidation-Reduction Potential (mV)	Dissolved Oxygen (% sat.)
GW1	Dec 2013	6.32	20.2	1,060	-14.4	36
GW2	Dec 2013	6.15	20.1	2,202	-37.0	30
GW4	Dec 2013	6.75	20.6	2,147	73.4	35
GW5	Dec 2013	6.77	21.3	1,394	-40.0	37
SW1	Dec 2013	**7.45**	**19.6**	**753**	**-60.9**	23.5
SW2	Dec 2013	7.29	20.4	2,155	93.7	170.5

Table 14 shows that groundwater in the uppermost aquifer is relatively fresh and slightly acidic. Reduction-oxidation potential was measured to be negative in all wells with the exception of GW4.

Table 14 also shows that the water in the Witton Creek is slightly alkaline and fresher at the upstream location than in the downstream location. It was also noted that reduction-oxidation potential is negative at the upstream and positive at the downstream locations.

Surface water conductivity results from Witton Creek demonstrate a tidal influence, at least at the downstream site (refer to information presented in **section 3.2** above).

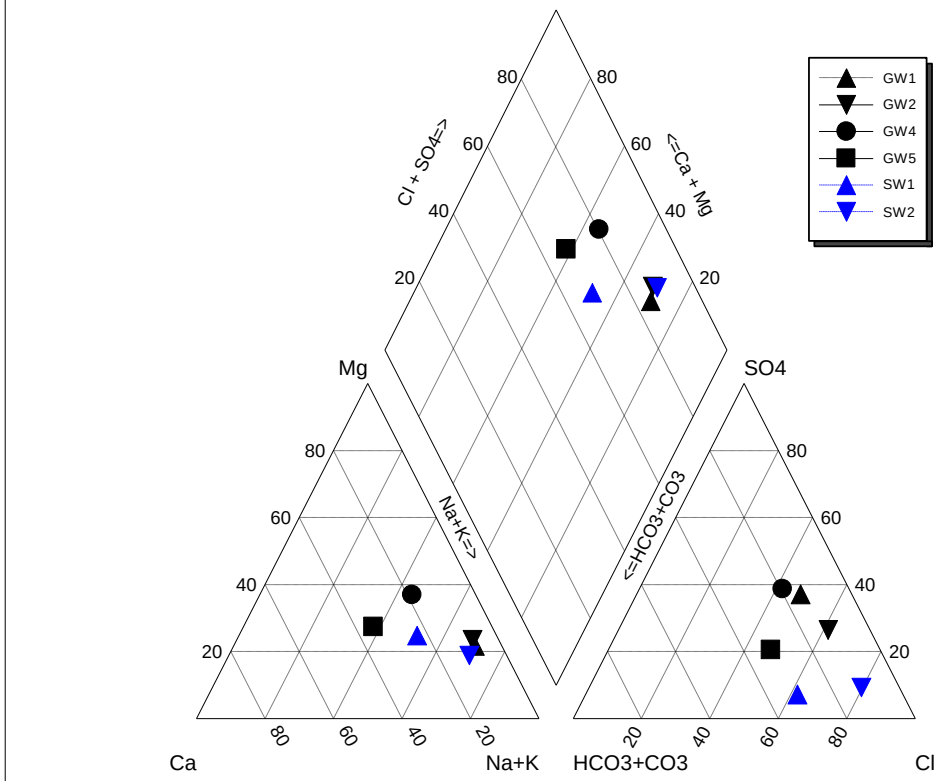
6.6.3 Major Cations and Anions

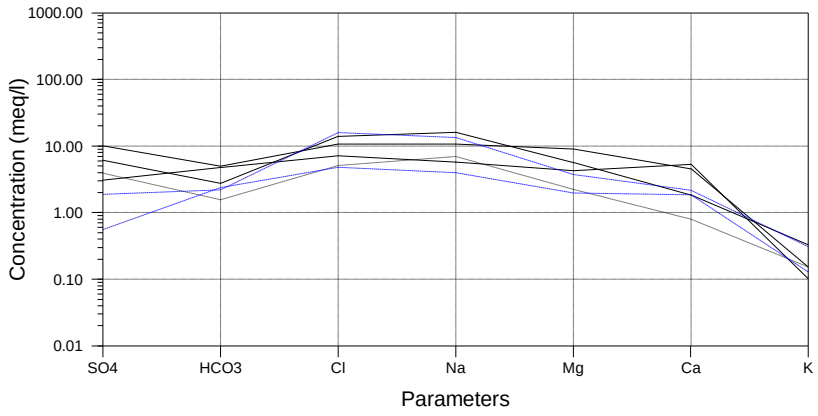
Analyses for major anions and cations were conducted for samples collected from all onsite groundwater monitoring bores (in addition to surface water samples) during the December 2013 monitoring round.

Assessment of major cation/anion ratios was undertaken using Piper and Schoeller plots.

The major cation/anion results plotted on Piper and Schoeller plots are shown on *Figure 11* below.

Figure 11 Piper and Schoeller Plots (December 2013)





DESCRIPTION: Piper and Scoeller Plots December 2013 data		
	PROJECT: UQ EXPERIMENTAL MINE	PROJECT NO: J122934
	CLIENT: University of Queensland	DATE: 13 February 2014

Figure 11 demonstrates that the chemicals signatures for groundwater and surface water samples are different, possibly indicating the following:

- Groundwater wells have been installed in separate pockets of alluvial material where perched aquifer systems have been formed (refer **Section 2.2.2**). These perched aquifer pockets may have very limited or no interaction between them;
- Sources of surface water in various parts of Witton Creek may also differ as a result of receiving stormwater runoff from different areas.
- There may also be some interaction between surface water and groundwater at some locations, but influence from groundwater on surface waters appears to be limited considering the difference in major cations/anions signatures shown in ***Figure 11***.

6.6.4 Laboratory Analytical Results

The laboratory certificates are included in ***Appendix K***.

Assessment of the results indicates that the majority of laboratory analyses were reported below the adopted guideline values or below the laboratory limits of reporting including total recoverable hydrocarbons (TRH) and naphthalene, benzene, toluene, ethylbenzene and xylene (BTEX), Organochlorine Pesticides, Organophosphorous Pesticides. This was with the exception of metals which are discussed below.

It should be noted that the groundwater samples collected in October 2013 were tested for total metals and the samples collected in December 2013 were tested for dissolved metals, therefore the metal results in these samples cannot be directly compared.

The reported total concentrations of metals (samples were not filtered in the field due to issues with the filtering equipment on the day of sampling) in groundwater samples are shown in ***Table 15***.

Table 15 Total Metal Concentrations

Well Name	Date	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
GW1	28/10/2013	0.026	0.0002	0.029	0.05	0.058	-	0.018	0.043
GW2	28/10/2013	0.029	0.0059	0.058	0.075	0.75	-	0.034	0.12
GW4	1/11/2013	0.003	<0.0002	0.12	0.075	0.36	0.0007	0.092	<0.001
GW5	1/11/2013	0.007	0.0032	0.13	0.42	54	-	0.098	0.16

Note: units are mg/L.

The key metals present in total groundwater analysis were copper, lead and zinc. These results likely reflect the adsorption of metals to clay particles suspended in the groundwater column. Mercury was analysed for the sample GW4, as this was part of the wide screen testing requested for this water sample.

During December 2013, additional sampling events were undertaken for groundwater samples which were field filtered to assess dissolved metal concentrations. The December

2013 water sampling results have been compared against the water quality criteria for marine aquatic ecosystem (Brisbane River) as required by the adopted Environmental Protection (Water) Policy 2009, referenced in **Section 6.5.**

The analytical results reported to exceed the above guidelines are summarised in ***Table 16*** below.

Table 16 Dissolved Metal Concentrations

Well Name	Date	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
ANZECC 2000 Marine Waters 95%			0.0055		0.0013	0.0044	0.0004	0.007	0.015
	Groundwater								
GW1	2/12/2013	0.025	<0.0001	<0.0001	0.002	<0.0001	<0.0001	0.008	0.065
GW2	2/12/2013	0.004	0.0002	<0.0001	0.002	<0.0001	<0.0001	0.003	0.038
GW4	2/12/2013	0.001	<0.0001	<0.0001	0.002	<0.0001	<0.0001	0.008	0.017
GW5	2/12/2013	0.013	0.0002	<0.0001	0.001	0.003	<0.0001	0.002	0.022
	Surface Water								
SW1	2/12/2013	0.006	<0.0001	<0.0001	0.002	<0.0001	<0.0001	0.001	0.016
SW2	2/12/2013	0.004	<0.0001	<0.0001	0.003	<0.0001	<0.0001	0.001	0.031

Note: units are mg/L.

The comparison of ***Table 15*** (total) and ***Table 16*** (dissolved) shows that the concentrations of the dissolved metal were reported to be significantly less than total metals. This indicates that the metals adsorbed on or formed suspended material particles are not significantly soluble.

The dissolved metal results indicate that only copper and zinc were reported to exceed the adopted guidelines in both surface and groundwaters. It is noted (refer **section 3.2** above) that the longer term monitoring of surface water in Witton Creek has also indicated occasional exceedences of copper and zinc in waters both upstream and downstream of the site.

6.7 Groundwater Results Discussion

6.7.1 Groundwater Investigation Results

Based on the information provided in **Section 6.6** the following major observations have been made:

1. The groundwater levels presented in **Figure 10** were plotted assuming that all groundwater monitoring wells have been installed in the same aquifer system.
2. The groundwater flow direction was assessed to be to the south following the ground surface slope towards the Witton Creek and thence towards the Brisbane River;
3. This direction of groundwater flow may potentially indicate that the shallow groundwater may discharge into Witton Creek. However, the assessment of hydrochemical signatures of the Creek water and groundwater show some

differences indicating that the creek water and groundwater may have originated from different sources.

4. Further analysis of the hydrochemical signatures using Piper and Schoeller plots demonstrate that hydrochemical signature for each well and upstream and downstream creek water samples are also different. This was interpreted as that there is no continuous alluvial aquifer but rather discontinued groundwater pockets and up and downstream creek waters may also originate from different sources (e.g. stormwater runoff from different sub-catchments).
5. Based on the above it is concluded that there is very limited interaction between the creek waters and groundwater pockets. This is supported by the results of groundwater sampling showing low groundwater inflow during groundwater purging, i.e. the wells were purged dry after removing approximately one well volume of groundwater.
6. Groundwater chemical analysis showed that although metals are presented in the aquifer material (i.e. suspended material entered sampling containers unfiltered) the solubility and mobility of these metals are relatively low.
7. The key metals, concentrations of which were reported to exceed the adopted criteria for fresh and marine aquatic ecosystems, were copper and zinc.
8. The concentrations of copper were reported to be marginally above the guideline values and were similar for all surface and groundwater samples. This is interpreted that that copper may be representative of ambient (natural) water quality in the area.
9. The concentrations of zinc were reported to be higher in groundwater than in the surface water and it was higher at the downstream than in the upstream sampling locations at the Witton Creek. This may indicate that the reported impacts are locally restricted.
10. However, comparing the metal concentrations in the soil samples with the concentrations of metals in groundwater and surface water samples no direct correlation between the soils and water results has been observed. No guideline exceedences were reported for zinc in the soil samples collected from the vicinity of GW1 and GW2, where the highest concentration of zinc in groundwater was reported. Also, the lowest concentration of zinc was reported for groundwater in GW4 and GW5, the soils testing results in the area surrounding these wells showed elevated reported zinc concentrations (most above NEPM EILs).
11. Based on the above it is concluded that although presence of zinc in groundwater and surface water may be a result of interaction with the impacted onsite soils, the reported impacts would likely have very limited distribution i.e. limited to isolated pockets of perched groundwater, or limited to some areas within the Witton Creek which receive stormwater runoff containing some dissolved metals (which may or may not be associated with the impacted onsite soils).

6.7.2 Groundwater Result Summary

Based on the observations presented in the above section the following conclusions have been drawn:

- Groundwater within the hard rock (Bunya Phyllite) is hosted in faults and fractures, and the SWL has been estimated at approximately 2m AHD from observations in the underground workings (AMC 2013). The SWL in the hard rock aquifer has not been intersected by any monitoring wells on site and so can not be confirmed. The depth to the Bunya Phyllite beneath the shallow alluvial aquifer is at least 6m (based on the deepest hole drilled into the Witton Creek Alluvium (GW1)).
- The groundwater wells were likely installed within separated pockets of alluvial material contained some perched groundwater;
- These pockets of perched groundwater have limited interaction between each other.
- These perched water pockets have limited or no interaction with Witton Creek waters;
- The reported concentrations of copper is likely to be representative of ambient (natural) quality of waters in the area;
- Presence of zinc in groundwater and surface water may be associated with the onsite contaminated soils, however the zinc impacts were considered to be localised and unlikely caused regional impacts which may influence on water quality of Brisbane River.

7.0 QUALITY ASSURANCE AND QUALITY CONTROL

7.1 Field QA/QC Measures

Quality Assurance and Control (QA/QC) measures for this investigation included:-

- Use of sampling methods that minimise the risk of cross contamination between samples;
- Appropriate decontamination measures were carried out between sample locations;
- Appropriate sample labelling, preservation, storage and transport under chain of custody procedures;
- Laboratory analyses conducted within appropriate holding times;
- Use of laboratories that hold NATA accreditation for the analyses undertaken;
- Collection and analysis of field duplicate QA/QC samples (field triplicates were not obtained during this assessment); and
- Analysis of laboratory QA/QC samples including duplicate, blanks, matrix spikes, matrix spike duplicates, and surrogates.

The following sections detail results of the QA/QC analyses and consider the analytical data quality.

7.1.1 Duplicate Analyses - Soil

Field duplicate soil samples were collected and submitted for analyses at a NATA accredited laboratory at a minimum rate of 1 per 20 samples and were selected to represent a range of the different material types identified and varying depths (refer **Table 17** below).

Table 17 Summary of Soil Duplicate Analyses

Total Collected Soil Samples	178
Total Duplicate Analyses	27
Total Duplicate Frequency	1 in 6.6

7.1.2 Duplicate Analyses – Groundwater

Field duplicate groundwater samples were collected and submitted for analyses at a NATA accredited laboratory at a minimum rate of 1 per 20 samples (refer **Table 18** below).

Table 18 Groundwater Duplicate Analyses

Total Collected Water Samples	11
Total Duplicate Analyses	3
Total Duplicate Frequency	1 in 3.7

7.2 Laboratory QA/QC Measures

Laboratory QA/QC measures for this investigation included:

- Use of laboratories that hold NATA accreditation for the analyses undertaken;
- Analysis of laboratory QA/QC samples including duplicates, blanks, matrix spikes, matrix spike duplicates, and surrogates.

Details of the internal laboratory QA/QC procedures are provided with the laboratory certificates included as ***Appendix I*** and ***Appendix K***. These include copies of chain of custodies, details of the analytical methods used, holding times, summaries of the spike and surrogate samples and laboratory duplicate and blank samples.

QA/QC details provided in ***Appendix I*** and ***Appendix K*** reveal:

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Laboratory Control outliers occur (with the exception of copper and zinc analyses for soil samples collected 2 December 2013, refer to laboratory report 402030-S).
- For all matrices, no Matrix Spike outliers occurred (with the exception of barium, beryllium, boron, chromium, cobalt, nickel and vanadium analyses for soil samples collected 24 October 2013, refer to laboratory report 397576-S).
- All samples were analysed within the specified holding time (with the exception of pH analysis for a groundwater sample collected 2 December 2013, refer to laboratory report EB1329650).

7.3 QA/QC Data Review

7.3.1 Laboratory Duplicate Analyses

Eurofins and ALS, the NATA accredited laboratories used for soil and groundwater analyses, undertake duplicate analysis as part of their internal quality control to provide information regarding method precision and sample heterogeneity. The method involves determining if the Relative Percent Deviation (RPD) of duplicates is within the permitted range. RPD is calculated using the following formula:

*RPD % = ((original result – duplicate result) / ((original result + duplicate result) / 2))*100*

The permitted range of the RPD is dependent on the magnitude of results in comparison to the limit of reporting (LOR). What is defined as an acceptable RPD % differs slightly between Eurofins and ALS as shown in the tables below.

Table 19 Eurofins Acceptable RPD %

Result	Acceptable RPD%
< 10 times LOR	No limit
10 – 20 times LOR	0 – 50%
>20 times LOR	0 – 30%

Table 20 ALS Acceptable RPD %

Result	Acceptable RPD%
< 10 times LOR	No limit
10 – 20 times LOR	0 – 50%
>20 times LOR	0 – 20%

Laboratory duplicate results were within the permitted range of RPD for all analytes with the exception of TRH C29 – C36 (RPD was 36% versus the acceptable limit of 30%, analysed for soil samples collected 22 October 2013 (refer to laboratory report 397394-S), and arsenic (RPD 33%), chromium (RPD 37%) and vanadium (RPD 43%) analysed for soil samples collected 31 October 2013 (refer to laboratory report 398155-S) which were marginally outside the permitted range (RPD 30%). The laboratory reported that these exceedences were acceptable based on the analysis results being close to the limit of detection.

7.3.2 Field Soil Duplicate Analyses

The method described above was used for determining acceptability of RPD for field duplicate soil samples. The acceptable RPD ranges defined by Eurofins were adopted for the purpose of this assessment. Results of the assessment are provided in **Table 21** to **Table 27** below. It should be noted that where a result is reported as a less than (<) value, the half value was used for RPD calculations.

Table 21 RPD Calculations for Laboratory Report Reference 396797S

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
			GW1 1	**GW1 1R**			
Arsenic	mg/kg	2	20	19	5	0 – 50%	Y
Cadmium	mg/kg	0.5	0.7	0.7	0	No limit	Y
Chromium	mg/kg	5	23	24	4	No limit	Y
Copper	mg/kg	5	80	68	16	0 – 50%	Y
Lead	mg/kg	5	1900	900	71	0 – 30%	**N**
Nickel	mg/kg	5	26	25	4	No limit	Y
Zinc	mg/kg	5	100	91	9	0 – 50%	Y
% Moisture	%	1	19	18	5	0 – 50%	Y

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
			GW2 0.2*	**GW2 0.2R***			
Benzo(a)pyrene TEQ	mg/kg	0.5	0.6	0.6	0	No limit	Y
Sulphate (as S)	mg/kg	10	36	35	3	No limit	Y
Phosphorus	mg/kg	5	190	190	0	0 – 30%	Y
Sulphur	mg/kg	5	54	50	8	0 – 50%	Y
% Moisture	%	0.1	23	20	14	0 – 30%	Y
Arsenic	mg/kg	2	25	37	39	0 – 50%	Y
Barium	mg/kg	5	94	110	16	0 – 30%	Y
Cadmium	mg/kg	0.5	4.1	3.5	16	No limit	Y
Chromium	mg/kg	5	5.3	6.5	20	No limit	Y
Copper	mg/kg	5	460	540	16	0 – 30%	Y
Lead	mg/kg	5	19000	19000	0	0 – 30%	Y
Manganese	mg/kg	5	1300	940	32	0 – 30%	**N**
Mercury	mg/kg	0.1	0.1	<1	133	No limit	Y
Nickel	mg/kg	5	13	11	17	No limit	Y
Vanadium	mg/kg	10	29	33	13	No limit	Y
Zinc	mg/kg	5	520	380	31	0 – 30%	**N**
Chromium (trivalent)	mg/kg	5	5.3	6.5	20	No limit	Y
			BH04_0.1	**BH0_0.1R**			
Arsenic	mg/kg	2	8.7	4.9	56	No limit	Y
Cadmium	mg/kg	0.5	<0.5	26	196	0 – 30%	**N**
Chromium	mg/kg	5	32	35	9	No limit	Y
Copper	mg/kg	5	26	30	14	No limit	Y
Lead	mg/kg	5	42	1400	188	0 – 30%	**N**
Nickel	mg/kg	5	12	18	40	No limit	Y
Zinc	mg/kg	5	38	260	149	0 – 30%	**N**
% Moisture	%	1	21	19	10	0 – 50%	Y
			BH05_0.1	**BH05_0.1 R**			
Arsenic	mg/kg	2	34	18	62	No limit	Y
Cadmium	mg/kg	0.5	0.9	1.2	29	No limit	Y
Chromium	mg/kg	5	15	12	22	No limit	Y
Copper	mg/kg	5	26	21	21	No limit	Y
Lead	mg/kg	5	57	71	22	0 – 50%	Y
Nickel	mg/kg	5	13	11	17	No limit	Y
Zinc	mg/kg	5	110	73	40	0 – 50%	Y
% Moisture	%	1	2.1	2.6	21	No limit	Y
			BH06_0.1	**BH06_0.1 R**			
Arsenic	mg/kg	2	39	31	23	0 – 50%	Y

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
Cadmium	mg/kg	0.5	11	10	10	0 – 50%	Y
Chromium	mg/kg	5	15	16	6	No limit	Y
Copper	mg/kg	5	170	150	13	0 – 30%	Y
Lead	mg/kg	5	15000	14000	7	0 – 30%	Y
Nickel	mg/kg	5	<5	5.3	72	No limit	Y
Zinc	mg/kg	5	320	320	0	0 – 30%	Y
% Moisture	%	1	13	14	7	0 – 50%	Y
			BH06_0.4	**BH06_0.4 R**			
Arsenic	mg/kg	2	38	31	20	0 – 50%	Y
Cadmium	mg/kg	0.5	11	12	9	0 – 30%	Y
Chromium	mg/kg	5	15	17	13	No limit	Y
Copper	mg/kg	5	210	160	27	0 – 30%	Y
Lead	mg/kg	5	16000	15000	6	0 – 30%	Y
Nickel	mg/kg	5	<5	<5	0	No limit	Y
Zinc	mg/kg	5	470	1600	109	0 – 30%	N
% Moisture	%	1	12	12	0	0 – 50%	Y
			BH06_0.6	**BH06_0.6 R**			
Arsenic	mg/kg	2	42	40	5	0 – 50%	Y
Cadmium	mg/kg	0.5	12	12	0	0 – 30%	Y
Chromium	mg/kg	5	17	16	6	No limit	Y
Copper	mg/kg	5	210	200	5	0 – 30%	Y
Lead	mg/kg	5	14000	15000	7	0 – 30%	Y
Nickel	mg/kg	5	<5	<5	0	No limit	Y
Zinc	mg/kg	5	1300	900	36	0 – 30%	N
% Moisture	%	1	11	12	9	0 – 50%	Y

* These samples were also analysed for the following, however results were reported as below the LOR for both the original and duplicate samples and are therefore within the permitted range of RPD: Beryllium, Boron, Cobalt, Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons (other than Benzo(a)pyrene TEQ), Organochlorine Pesticides, Polychlorinated Biphenyls, Phenols (Halogenated), Phenols (non-Halogenated), Chromium (hexavalent), Cyanide (free), Cyanide (total)

Table 22 RPD Calculations for Laboratory Report Reference 397394-S

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
			BH07_0.5	**BH07_0.5R**			
Arsenic	mg/kg	2	85	73	15	0 – 30%	Y
Cadmium	mg/kg	0.5	0.6	<0.5	82	No limit	Y
Chromium	mg/kg	5	23	14	49	No limit	Y
Copper	mg/kg	5	53	44	19	No limit	Y

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
Lead	mg/kg	5	60	33	58	No limit	Y
Nickel	mg/kg	5	16	12	29	No limit	Y
Zinc	mg/kg	5	250	180	33	0 – 30%	N
% Moisture	%	1	4.2	3.0	33	No limit	Y
			BH08_0.4	**BH08_0.4R**			
Arsenic	mg/kg	2	29	33	13	0 – 50%	Y
Cadmium	mg/kg	0.5	11	10	10	0 – 50%	Y
Chromium	mg/kg	5	22	20	10	No limit	Y
Copper	mg/kg	5	120	140	15	0 – 30%	Y
Lead	mg/kg	5	8200	10000	20	0 – 30%	Y
Nickel	mg/kg	5	14	10	33	No limit	Y
Zinc	mg/kg	5	620	620	0	0 – 30%	Y
% Moisture	%	1	9.9	7.3	30	No limit	Y
			BH09_0.2	**BH09_0.2R**			
Arsenic	mg/kg	2	47	43	9	0 – 30%	Y
Cadmium	mg/kg	0.5	11	9	20	0 – 50%	Y
Chromium	mg/kg	5	15	14	7	No limit	Y
Copper	mg/kg	5	190	190	0	0 – 30%	Y
Lead	mg/kg	5	16000	16000	0	0 – 30%	Y
Nickel	mg/kg	5	<5	<5	0	No limit	Y
Zinc	mg/kg	5	910	1200	27	0 – 30%	Y
% Moisture	%	1	17	16	6	0 – 50%	Y
			BH11_0.2	**BH11_0.2R**			
Arsenic	mg/kg	2	18	17	6	No limit	Y
Cadmium	mg/kg	0.5	0.8	1.2	40	No limit	Y
Chromium	mg/kg	5	25	25	0	No limit	Y
Copper	mg/kg	5	63	34	60	No limit	Y
Lead	mg/kg	5	5000	1700	99	0 – 30%	N
Nickel	mg/kg	5	12	14	15	No limit	Y
Zinc	mg/kg	5	240	200	18	0 – 30%	Y
% Moisture	%	1	14	13	7	0 – 50%	Y
			BH12_1.5	**BH12_1.5R**			
Arsenic	mg/kg	2	4.5	8.9	66	No limit	Y
Cadmium	mg/kg	0.5	0.8	0.6	29	No limit	Y
Chromium	mg/kg	5	33	29	13	No limit	Y
Copper	mg/kg	5	12	17	34	No limit	Y
Lead	mg/kg	5	100	95	5	0 – 50%	Y
Nickel	mg/kg	5	5.6	9.9	55	No limit	Y
Zinc	mg/kg	5	99	110	11	0 – 30%	Y
% Moisture	%	1	18	20	11	0 – 50%	Y

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
			BH13_0.3	**BH13_0.3R**			
Arsenic	mg/kg	2	93	37	86	0 – 50%	N
Cadmium	mg/kg	0.5	170	13	172	0 – 30%	N
Chromium	mg/kg	5	26	5	135	No limit	Y
Copper	mg/kg	5	610	120	134	0 – 30%	N
Lead	mg/kg	5	7500	4600	48	0 – 30%	N
Nickel	mg/kg	5	13	7.3	56	No limit	Y
Zinc	mg/kg	5	38000	1600	184	0 – 30%	N
% Moisture	%	1	6.8	4.6	39	No limit	Y

Table 23 RPD Calculations for Laboratory Report Reference 397424-S

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
			BH17_0.5	**BH17_0.5R**			
Arsenic	mg/kg	2	14	16	13	No limit	Y
Cadmium	mg/kg	0.5	1	1.2	18	No limit	Y
Chromium	mg/kg	5	28	28	0	No limit	Y
Copper	mg/kg	5	22	25	13	No limit	Y
Lead	mg/kg	5	430	470	9	0 – 30%	Y
Nickel	mg/kg	5	12	12	0	No limit	Y
Zinc	mg/kg	5	200	230	14	0 – 20%	Y
% Moisture	%	1	9.1	11	19	0 – 50%	Y
			BH20_0.6	**BH20_0.6R**			
Arsenic	mg/kg	2	8.7	6.7	26	No limit	Y
Cadmium	mg/kg	0.5	1.1	<0.5	126	No limit	Y
Chromium	mg/kg	5	21	11	63	No limit	Y
Copper	mg/kg	5	17	<5	149	No limit	Y
Lead	mg/kg	5	230	28	157	No limit	Y
Nickel	mg/kg	5	14	5.3	90	No limit	Y
Zinc	mg/kg	5	110	26	124	No limit	Y
% Moisture	%	1	7	8.9	24	No limit	Y

Table 24 RPD Calculations for Laboratory Report Reference 397576-S

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
			BH23_1.0	**BH23_1.0R**			
Arsenic	mg/kg	2	1800	1200	40	0 – 30%	N
Cadmium	mg/kg	0.5	14	7.4	62	0 – 50%	N

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
Chromium	mg/kg	5	6.6	5.5	18	No limit	Y
Copper	mg/kg	5	100	110	10	0 – 30%	Y
Lead	mg/kg	5	13000	5900	75	0 – 30%	N
Nickel	mg/kg	5	13	6.9	61	No limit	Y
Zinc	mg/kg	5	2200	1500	38	0 – 30%	N
% Moisture	%	1	6.2	3.7	51	No limit	Y
			BH23_5.0	**BH23_5.0R**			
Arsenic	mg/kg	2	130	130	0	0 – 30%	Y
Cadmium	mg/kg	0.5	3.8	3.3	14	No limit	Y
Chromium	mg/kg	5	19	17	11	No limit	Y
Copper	mg/kg	5	28	25	11	No limit	Y
Lead	mg/kg	5	280	210	29	0 – 30%	Y
Nickel	mg/kg	5	14	13	7	No limit	Y
Zinc	mg/kg	5	260	250	4	0 – 30%	Y
% Moisture	%	1	6.8	7.4	8	No limit	Y
			GW2 0.2*	**GW2 0.2R***			
Benzo(a)pyrene TEQ	mg/kg	0.5	0.6	0.6	0	No limit	Y
Phosphorus	mg/kg	5	160	140	13	0 – 30%	Y
Sulphur	mg/kg	5	39	170	125	0 – 30%	N
% Moisture	%	0.1	9.5	9.9	4	0 – 30%	Y
Arsenic	mg/kg	2	29	30	3	0 – 50%	Y
Barium	mg/kg	5	25	25	0	No limit	Y
Cadmium	mg/kg	0.5	2.9	4.2	37	No limit	Y
Chromium	mg/kg	5	7.6	7.8	3	No limit	Y
Cobalt	mg/kg	5	6.7	<5	91	No limit	Y
Copper	mg/kg	5	320	300	6	0 – 30%	Y
Lead	mg/kg	5	16000	13000	21	0 – 30%	Y
Manganese	mg/kg	5	2000	1600	22	0 – 30%	Y
Nickel	mg/kg	5	6.3	5.9	7	No limit	Y
Vanadium	mg/kg	10	15	15	0	No limit	Y
Zinc	mg/kg	5	1300	1800	32	0 – 30%	N
Chromium (trivalent)	mg/kg	5	7.6	7.8	3	No limit	Y

* These samples were also analysed for the following, however results were reported as below the LOR for both the original and duplicate samples and are therefore within the permitted range of RPD: Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons (other than Benzo(a)pyrene TEQ), Organochlorine Pesticides, Polychlorinated Biphenyls, Phenols (Halogenated), Phenols (non-Halogenated), Chromium (hexavalent), Cyanide (free), Cyanide (total), Sulphate, Beryllium, Boron and Mercury

Table 25 RPD Calculations for Laboratory Report Reference 397743-S

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
			BH25_0.1	**BH25_0.1R**			
Arsenic	mg/kg	2	82	67	20	0 – 30%	Y
Cadmium	mg/kg	0.5	1	1.1	10	No limit	Y
Chromium	mg/kg	5	28	27	4	No limit	Y
Copper	mg/kg	5	160	130	21	0 – 30%	Y
Lead	mg/kg	5	190	180	5	0 – 30%	Y
Nickel	mg/kg	5	14	16	13	No limit	Y
Zinc	mg/kg	5	150	190	24	0 – 30%	Y
% Moisture	%	1	11	15	31	0 – 50%	Y
			BH27_0.3	**BH27_0.3R**			
Arsenic	mg/kg	2	36	67	-60	0 – 30%	**N**
Cadmium	mg/kg	0.5	8.2	6.4	25	0 – 50%	Y
Chromium	mg/kg	5	22	16	32	No limit	Y
Copper	mg/kg	5	180	160	12	0 – 30%	Y
Lead	mg/kg	5	12000	25000	-70	0 – 30%	**N**
Nickel	mg/kg	5	<5	2.7	-8	No limit	Y
Zinc	mg/kg	5	590	540	9	0 – 30%	Y
% Moisture	%	1	7.1	9.4	-28	No limit	Y
			BH28_0.5	**BH28_0.5R**			
Arsenic	mg/kg	2	31	28	10	0 – 50%	Y
Cadmium	mg/kg	0.5	6.7	6	11	0 – 50%	Y
Chromium	mg/kg	5	18	16	12	No limit	Y
Copper	mg/kg	5	260	230	12	0 – 30%	Y
Lead	mg/kg	5	14000	13000	7	0 – 30%	Y
Nickel	mg/kg	5	7.7	8.3	8	No limit	Y
Zinc	mg/kg	5	550	630	14	0 – 30%	Y
% Moisture	%	1	7.2	8.7	19	No limit	Y

Table 26 RPD Calculations for Laboratory report reference 398155-S

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
			BH33_0.2	**BH33_0.2R**			
Arsenic	mg/kg	2	46	48	4	0 – 30%	Y
Cadmium	mg/kg	0.5	0.9	0.9	0	No limit	Y
Chromium	mg/kg	5	200	180	11	0 – 30%	Y
Copper	mg/kg	5	46	49	6	0 – 50%	Y

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
Lead	mg/kg	5	1200	1300	8	0 – 30%	Y
Nickel	mg/kg	5	62	60	3	0 – 50%	Y
Zinc	mg/kg	5	450	480	6	0 – 30%	Y
% Moisture	%	1	5.5	5.4	2	No limit	Y
			BH34_0.4*	**BH34_0.4R***			
TRH C10-C14	mg/kg	20	72	100	33	No limit	Y
TRH C10-36 (Total)	mg/kg	50	72	180	86	No limit	Y
TRH >C10-C16	mg/kg	50	64	97	41	No limit	Y
TRH >C10-C16 less Naphthalene (F2) N01	mg/kg	50	64	97	41	No limit	Y
Benzo(a)pyrene TEQ	mg/kg	0.5	0.6	0.6	0	No limit	Y
Phosphorus	mg/kg	5	84	110	27	0 – 30%	Y
Sulphur	mg/kg	5	1300	1300	0	0 – 30%	Y
% Moisture	%	0.1	42	43	2	0 – 30%	Y
Arsenic	mg/kg	2	4.5	5.7	24	No limit	Y
Barium	mg/kg	5	19	16	17	No limit	Y
Boron	mg/kg	10	42	36	15	No limit	Y
Cadmium	mg/kg	0.5	3.6	8.1	77	0 – 50%	N
Chromium	mg/kg	5	5.4	6.8	23	No limit	Y
Copper	mg/kg	5	17	23	30	No limit	Y
Lead	mg/kg	5	190	220	15	0 – 30%	Y
Manganese	mg/kg	5	240	360	40	0 – 30%	N
Nickel	mg/kg	5	6.5	7.4	13	No limit	Y
Zinc	mg/kg	5	690	830	18	0 – 30%	Y
Chromium (trivalent)	mg/kg	5	5.4	6.8	23	No limit	Y
			BH36_0.2	**BH36_0.2R**			
Arsenic	mg/kg	2	4.3	3.8	12	No limit	Y
Cadmium	mg/kg	0.5	<0.5	<0.5	0	No limit	Y
Chromium	mg/kg	5	32	32	0	No limit	Y
Copper	mg/kg	5	17	16	6	No limit	Y
Lead	mg/kg	5	78	50	44	0 – 50%	Y
Nickel	mg/kg	5	22	22	0	No limit	Y
Zinc	mg/kg	5	77	61	23	0 – 50%	Y
% Moisture	%	1	16	16	0	0 – 50%	Y
			BH37_0.5	**BH37_0.5R**			
Arsenic	mg/kg	2	4.1	4.3	5	No limit	Y
Cadmium	mg/kg	0.5	<0.5	<0.5	0	No limit	Y
Chromium	mg/kg	5	34	31	9	No limit	Y

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
Copper	mg/kg	5	17	17	0	No limit	Y
Lead	mg/kg	5	210	60	111	0 – 50%	N
Nickel	mg/kg	5	23	22	4	No limit	Y
Zinc	mg/kg	5	80	72	11	0 – 50%	Y
% Moisture	%	1	14	15	7	0 – 50%	Y

* These samples were also analysed for the following, however results were reported as below the LOR for both the original and duplicate samples and are therefore within the permitted range of RPD: Total Recoverable Hydrocarbons (other than those reported above), Polycyclic Aromatic Hydrocarbons (other than Benzo(a)pyrene TEQ), Organochlorine Pesticides, Polychlorinated Biphenyls, Phenols (Halogenated), Phenols (non-Halogenated), Chromium (hexavalent), Cyanide (free), Cyanide (total), Sulphate, Beryllium, Cobalt, Mercury and Vanadium

Table 27 RPD Calculations for laboratory report reference 402030-S

Analyte	Unit	LOR	Original Result	Duplicate Result	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
			BH39 0.1	**BH39 0.1R**			
Arsenic	mg/kg	2	68	72	6	0 – 30%	Y
Cadmium	mg/kg	0.5	<0.5	<0.5	0	No limit	Y
Chromium	mg/kg	5	12	13	8	No limit	Y
Copper	mg/kg	5	31	38	20	No limit	Y
Lead	mg/kg	5	240	320	29	0 – 30%	Y
Nickel	mg/kg	5	9.4	8.9	5	No limit	Y
Zinc	mg/kg	5	110	120	9	0 – 30%	Y
% Moisture	%	1	10	18	57	0 – 50%	N
			BH40 0.5	**BH40 0.5R**			
Arsenic	mg/kg	2	150	130	14	0 – 30%	Y
Cadmium	mg/kg	0.5	0.7	1.2	53	No limit	Y
Chromium	mg/kg	5	28	28	0	No limit	Y
Copper	mg/kg	5	54	53	2	0 – 50%	Y
Lead	mg/kg	5	210	180	15	0 – 30%	Y
Nickel	mg/kg	5	18	15	18	No limit	Y
Zinc	mg/kg	5	150	120	22	0 – 30%	Y
% Moisture	%	1	11	9.4	16	No limit	Y

As shown in the tables above, field duplicate results were within the permitted range of RPD for most duplicates. The RPD for duplicate results for some analytes were outside of the permitted range, generally for zinc and lead. Some field duplicates have multiple elements (for example Arsenic, Cadmium, Lead, Zinc) outside the permitted range of RPD. The RPD for some duplicates can be as high as 100 to 188%. It is noted that the mineralisation at the site is related to sulphide mineralisation that is vein and fracture hosted. These very high RPD are likely to be related to the heterogeneous nature of the zinc/lead/silver mineralisation at the site. It is not considered that these RPD results reflect QA issues at the laboratory.

7.3.3 Field Groundwater Duplicate Analyses

The method described above was used for determining acceptability of RPD for field duplicate groundwater samples. The acceptable RPD ranges defined by Eurofins were adopted for the purpose of this assessment. Results of the assessment are provided in **Table 29** to **Table 30** below. It should be noted that where a result is reported as a less than (<) value, the half value was used for RPD calculations.

Table 28 RPD Calculations for laboratory report reference 397966-W

Analyte	Unit	LOR	Original Result (GW1)	Duplicate Result (GW1R)	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
Arsenic	mg/L	0.001	0.026	0.027	4	0 – 30%	Y
Cadmium	mg/L	0.0002	0.0002	0.0003	40	No limit	Y
Chromium	mg/L	0.001	0.029	0.045	43	0 – 30%	N
Copper	mg/L	0.001	0.050	0.069	32	0 – 30%	N
Lead	mg/L	0.001	0.058	0.095	48	0 – 30%	N
Nickel	mg/L	0.001	0.018	0.023	24	0 – 30%	Y
Zinc	mg/L	0.001	0.043	0.057	28	0 – 30%	Y

Table 29 RPD Calculations for laboratory report reference 398568-W

Analyte*	Unit	LOR	Original Result (GW4)	Duplicate Result (GW4R)	RPD%	Acceptable RPD%	Acceptable RPD range? Y/N
Arsenic	mg/L	0.001	0.003	0.003	0	No limit	Y
Chromium	mg/L	0.001	0.12	0.13	8	0 – 30%	Y
Copper	mg/L	0.001	0.075	0.079	5	0 – 30%	Y
Lead	mg/L	0.001	0.36	0.51	34	0 – 30%	N
Mercury	mg/L	0.0001	0.0007	0.0010	35	0 – 50%	Y
Nickel	mg/L	0.001	0.092	0.092	0	0 – 30%	Y

* Results for the following analytes were reported as below the LOR for both the original and duplicate samples and are therefore within the permitted range of RPD: Total Recoverable Hydrocarbons, BTEX, Organochlorine Pesticides, Organochlorine Pesticides, Cadmium and Zinc

Table 30 RPD Calculations for laboratory report reference EB1329650

Analyte	Unit	LOR	Original Result (GW5)	Duplicate Result (GW5R)	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
pH	pH unit	0.01	7.70	7.70	0	0 – 30%	Y
Electrical Conductivity	µS/cm	0.01	1380	1380	0	0 – 30%	Y
Total Dissolved Solids	mg/L	1	925	935	1	0 – 30%	Y
Hydroxide Alkalinity as CaCO3	mg/L	10	<1	<1	0	No limit	Y
Carbonate Alkalinity as	mg/L	1	<1	<1	0	No limit	Y

Analyte	Unit	LOR	Original Result (GW5)	Duplicate Result (GW5R)	RPD %	Acceptable RPD%	Acceptable RPD range? Y/N
CaCO3							
Bicarbonate Alkalinity as CaCO3	mg/L	1	292	294	1	0 – 30%	Y
Total Alkalinity as CaCO3	mg/L	1	292	294	1	0 – 30%	Y
Sulfate as SO4 - Turbidimetric	mg/L	1	149	169	13	0 – 30%	Y
Chloride	mg/L	1	254	253	0	0 – 30%	Y
Dissolved Calcium	mg/L	1	108	104	4	0 – 30%	Y
Dissolved Magnesium	mg/L	1	52	55	6	0 – 30%	Y
Dissolved Sodium	mg/L	1	133	127	5	0 – 30%	Y
Dissolved Potassium	mg/L	1	4	3	29	No limit	Y
Dissolved Arsenic	mg/L	0.001	0.013	0.013	0	0 – 50%	Y
Dissolved Cadmium	mg/L	0.0001	0.0002	0.0002	0	No limit	Y
Dissolved Chromium	mg/L	0.001	<0.001	<0.001	0	No limit	Y
Dissolved Copper	mg/L	0.001	0.001	0.001	0	No limit	Y
Dissolved Nickel	mg/L	0.001	0.002	0.002	0	No limit	Y
Dissolved Lead	mg/L	0.001	0.003	0.003	0	No limit	Y
Dissolved Zinc	mg/L	0.005	0.022	0.019	15	No limit	Y
Dissolved Mercury	mg/L	0.0001	<0.0001	<0.0001	0	No limit	Y
Total Anions	meq/L	0.01	16.1	16.5	2	0 – 30%	Y
Total Cations	meq/L	0.01	15.6	15.3	2	0 – 30%	Y
Ionic Balance	%	0.01	1.72	3.80	75	0 – 30%	Y

Review of the field duplicate results for the groundwater samples (refer to tables above) has indicated the RPD for duplicates for unfiltered groundwater samples exceeded the permitted range for some metals. The RPD for duplicates for the filtered groundwater samples were all within the permitted RPD ranges.

It is interpreted that the RPD exceedences for the unfiltered samples is related to the turbidity of the samples taken direct from the groundwater wells. While the wells were developed prior to sampling, the sandy – clay composition of the aquifer means that the bores were not able to be developed to a clear sample. It is not considered that these RPD results reflect QA issues at the laboratory.

7.3.4 Overall Data Quality

An assessment of data quality has been undertaken in general accordance with NEPM 1999 and is documented in **Table 31**.

Table 31 Data Quality Indicators

Completeness		
Field Considerations	Laboratory Considerations	Comments
All critical sample locations were sampled. All planned drill hole locations were drilled. Sufficient sample was obtained from each sample site and lithological interval Internal sampling procedures were followed. The sampler was suitably experienced for the assessment. Field documentation and logging was complete and correct.	All samples were analysed as per the instructions provided to the laboratory. Methods appropriate to the contaminants of concern, and the limits of reporting were appropriate to the trigger levels chosen for comparison. Documentation including sample receipt advice, certificate of analysis, quality control results were complete. Sample holding times were complied with.	It is determined that 100% of the sample data is useable for this report
Comparability		
Field Considerations	Laboratory Considerations	Comments
Internal sampling procedures were followed. The sampler was suitably experienced for the assessment. Weather conditions were fine and dry during all sampling events. Sufficient sized samples were obtained at each sample point for adequate laboratory analysis. For the two groundwater sampling events, the first round of samples were unfiltered, and the second round of samples were field filtered. The samples between the two rounds are not directly comparable to each other, but provided information regarding the form of the metals detected in the laboratory analysis.	All soil samples were analysed at the same laboratory, using the same analytical methods, the same detection limits and reported using the same units. The unfiltered and filtered groundwater samples were analysed by different laboratories. Surface water samples were analysed at the same laboratory as the filtered groundwater samples.	There is a high degree of confidence that the data from the soil samples may be considered comparable. There is a high degree of confidence that the filtered groundwater and surface water samples may be considered comparable. The filtered and unfiltered groundwater samples are not considered to be comparable with each other due to the different field techniques applied to both.
Representativeness		
Field Considerations	Laboratory Considerations	Comments
A suitably qualified and experienced person observed the soil drilling and	All samples were analysed by the laboratory in accordance with the	There is a high degree of confidence that the data is representative of the soils

logged the samples, to ensure that samples collected on site represented the materials intersected and were appropriate to the assessment. Soil (both fill and natural) was sampled. Groundwater and surface water samples were obtained. Stream sediment samples were not obtained during this study, but results from assessments by others were relied upon.	instructions provided.	(fill and natural), shallow groundwater and Witton Creek surface water on the site.
Precision		
Field Considerations	Laboratory Considerations	Comments
Internal sampling procedures were followed. Field duplicates were obtained at a rate of 1 in 7, which is better than required frequency	The laboratory undertook analysis of field duplicates The laboratory undertook analysis of laboratory duplicates in accordance with their NATA accreditation.	Assessment of field duplicate was undertaken by calculating RPD. 100% of field duplicate RPDs' were within acceptable limits Assessment of laboratory duplicates was undertaken by calculating RPD. 100% of laboratory duplicate RPD's were within acceptable limits.
Accuracy		
Field Considerations	Laboratory Considerations	Comments
Internal sampling procedures were followed.	The laboratory undertook analysis of method blanks, laboratory control spike, matrix spikes, in accordance with their NATA accreditation	100% of the laboratory analysis of method blanks, laboratory control spike, and matrix spikes returned acceptable results.

Overall, the analytical data is of acceptable quality for the purposes of this investigation.

8.0 CONCLUSIONS AND RECOMMENDATIONS

In conclusion;

- The site history supports the previous use of the site for the mining and processing of silver and lead.
- Examination of historical air photographs identifies areas of disturbance both within the lots nominated for this detailed site investigation and outside the lots nominated for this site investigation.
- The soil investigation results indicated the presence of mine waste rock (fill materials) across the areas subject to this investigation. The thickness of this fill material is variable from <1m to 6 metres thick.
- This investigation has concluded that both mine waste (fill material) and natural soils/weathered rock contain levels of Lead in excess of the chosen Health Investigation Level D and C.
- This investigation has concluded that some mine waste (fill material) and natural soils/weathered rock contain levels of metals (arsenic, copper, lead, zinc) in excess of the chosen Ecological Investigation Levels.
- Based on surface disturbances on the historical aerial photographs and the soil investigations on site it is likely that elevated levels of metals in soils are present beyond the investigation site boundaries. However, these elevated levels may be present in mine wastes from the historic (1920's era) mining activities which is a legacy issue for local land in the area and/or natural metal levels of the soils in this locality. If the findings of the site investigation were to be considered representative of metal levels beyond the investigation site boundaries, then these levels would be elevated against other relevant investigation levels, such as HIL A (residential). HIL A has not been documented or discussed within this report.
- Leach testing of selected materials with a neutral leach fluid has indicated levels of metals in excess of the ANZECC guideline levels.
- Leach testing of selected materials with an acidic leach fluid has indicated levels of lead that are well in excess of ANZECC guideline levels. Only lead was tested with acidic leach fluid.
- Given there are no signs of impact to the site fauna and flora or the underlying groundwater it is likely that the elevated lead results observed in the leachate results are not indicative of actual risk. This is most likely because the local ecosystem has adapted to the local heavily mineralised geology of the broader area.
- Shallow groundwater is present in generally thin, saturated clayey sand to fine gravel, in isolated pockets of the site, generally in the near vicinity to Witton Creek.
- Local groundwater levels tend to indicate flow within this shallow aquifer towards the south east.
- Assessment of groundwater chemistry appears to indicate little connection between the shallow groundwater across the site and with Witton Creek.
- Groundwater analysis indicates levels of dissolved copper and zinc in excess of the ANZECC guideline.

- The concentrations of copper in groundwater were marginally above the guideline values and were similar for all surface and groundwater samples. This is interpreted that copper may be representative of ambient (natural) water quality in the area.

- The concentrations of zinc in groundwater were higher than in the surface water and it was higher at the downstream than in the upstream sampling locations at the Witton Creek. Comparing the metal concentrations in the soil samples with the concentrations of metals in groundwater and surface water samples there appears to be no direct correlation. This may indicate that the elevated zinc levels are locally restricted.

In summary whilst it is acknowledged that impacts from several contaminants are present at the site, it is not considered that active remediation works are required. This statement is based on:

- The contaminants are present at similar levels in both fill and natural materials;
- Impacts to the existing environs are not being observed (fauna, flora or groundwater)
- Wholescale earthworks would significantly impact the natural on-site ecosystem; and
- The costs of completing such works would be prohibitive.

As such, it is concluded that the site is suitable for the current use with the preparation of a site management plan, to manage the potential for impacts on human health and the environment from the elevated metals found in both mine wastes and natural soils on site. By controlling future excavation and landscaping works the risk from the elevated contaminants can be appropriately managed.

9.0 REFERENCES

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10.0 LIMITATIONS OF THIS REPORT

This environmental site assessment report has been prepared in accordance with industry recognised standards and procedures at the time of the work. The report presents the results of the assessment based on the quoted scope of works (unless otherwise agreed in writing) for the specific purposes of the commission. No warranties expressed or implied are offered to any third parties and no liability will be accepted for use of this report by any third parties.

Information provided by third parties has been assumed to be correct and complete. NAA does not assume any liability for misrepresentation of information by third parties or for matters not visible, accessible or present on the subject property during any site inspections conducted during the time of the work.

The first stage in the site assessment process generally involves site history research and/or a site inspection. This stage is intended to establish whether there is a likelihood of site contamination. Depending on the location of the site and surrounding land use, there could be contamination present which could not have been identified by preliminary investigation of this nature - for example, if there had been dumping of waste liquids which has left no visual evidence and past owners were not aware of. If recommendations have been made on whether or not to conduct further investigation, these have been based on the likelihood of site contamination, and are generally based on the sensitivity of the proposed future use of the site. A more conservative approach is generally adopted for a sensitive future use such as residential or a child care centre. Subsequent stages of soil or groundwater investigation may follow. The site assessment process is often ongoing, with additional stages of investigation being required to resolve issues raised in previous stages of the investigation. In cases where sampling and analysis of soil and/or groundwater has been conducted, then the following standard limitations apply:-

- The results presented in the report apply only to the specific locations and the time the sampling was conducted. The nature and extent of contaminants present on a site can change due to physical disturbance or removal, chemical or biological transformation, or due to the migration of the contaminants to different areas.
- The borehole or test pit logs indicate the approximate subsurface conditions only at the specified test locations. Soil and rock formations are variable, and conditions in areas not sampled may differ from those at the actual sampling locations due to natural subsurface variation.
- The precision with which subsurface conditions are indicated depends largely on the frequency and method of sampling and investigation, and the degree of subsurface variation. There can be no complete guarantee that contaminants are not present at significant concentrations in some areas, even with the most thorough site assessment.
- Any conclusions or recommendations are based solely on the land use assumptions stated in the report. These conclusions or recommendations do not apply to any other land use for the site.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. Opinions and judgements expressed herein are based on NAA's understanding of current regulatory standards and should not be construed as legal opinions.

Appendix A Trade Waste Approvals

TRADE WASTE APPROVAL

Trade Waste Approval Number: 4690

The Central SEQ Distributor-Retailer Authority (Trading As Queensland Urban Utilities ABN 86 673 835 011) ("Queensland Urban Utilities") Hereby Gives Approval To:

University Of Queensland
Chief Financial Officer
Business Services Division
THE UNIVERSITY OF QUEENSLAND QLD 4072

('the Approved Person')

to discharge certain trade waste into Queensland Urban Utilities' Sewerage Infrastructure from land at ('the land'):

14 ORMOND TERRACE, INDOOROOPILLY

of Real Property Description:

L.81/97&135/137 RP.23531 & L.137/148 RP.23698 & L.34/41 RP.23699 & L.3&6 RP.57788 & L.1/3 RP.60248 & L.286 SL.2416 & L.334 SL.3873 PAR I'PILLY FINNEYS HILL MINE & PILOT PLANT

subject to the following terms and conditions:

1) The approved discharge cannot commence prior to 18 October 2013 and cannot continue after 11.59 p.m. on 04 August 2016 ; and
2) The Approved Person will fully and properly perform and carry out its duties, responsibilities and obligations contained in the SPECIFIC CONDITIONS and SCHEDULE 1 STANDARD CONDITIONS (Schedule 1); and
3) At any time and after negotiation with the Approved Person, Queensland Urban Utilities may amend the specific conditions and re-issue this approval; and
4) The Approved Person must allow Queensland Urban Utilities, trade waste officers appointed under the South East Queensland Water (Distribution and Retail Restructuring) Act 2009 access to the Land to conduct trade waste related duties.

This Trade Waste Approval replaces and cancels any trade waste approval or permit previously issued in respect of the discharge of trade waste from the Land into Queensland Urban Utilities' sewerage infrastructure. This Trade Waste Approval may not be transferred or assigned without the written permission of Queensland Urban Utilities.

DATED this: 18 October 2013

Mitchell Brennan

Trade Waste Officer Queensland Urban Utilities

SPECIFIC CONDITIONS

1.1 Industry Type

Only trade waste generated by the following industry type(s) may be discharged to Queensland Urban Utilities' sewerage infrastructure from the land under this Trade Waste Approval:

* Other Mining Support Services

1.2 Trade Waste Generating Processes

Only trade waste generated by the following trade waste generating process(es) may be discharged to Queensland Urban Utilities' sewerage infrastructure from the land under this approval:

* General laboratory operations;
* Seepage water

1.3 Pre-treatment Systems

Subject to clause 1.9, all trade waste must be treated on site using the following trade waste pretreatment system(s) ("PS"). Such pretreatment systems must be kept in good working order at all times and must be routinely serviced and cleaned at the frequency detailed below for each system. Residual wastes must be transported off-site by a DERM licenced contractor for disposal at an DERM licenced regulated waste disposal facility.

Waste transport and disposal dockets must be retained on-site (ie at the land) for a minimum period of 2 years.

1.3.1

PS ID:	**5942**	Category:	**Other basic pre-treatment systems**
Manufacturer:	**Existing Traps**		
Model:	**UNK-SLT1000 / Silt Trap 1000**		
Capacity:	**1000 L**	Servicing Frequency:	**13 WEEKS**

1.3.2

PS ID:	**7021**	Category:	**Other basic pre-treatment systems**
Manufacturer:	**Existing Traps**		
Model:	**UNK-SLT1000 / Silt Trap 1000**		
Capacity:	**1000 L**	Servicing Frequency:	**13 WEEKS**

1.3.3

PS ID:	**9405**	Category:	**No pre-treatment system required**
Manufacturer:	**NA**		
Model:	**NA / NA**		
Capacity:	**N/A**	Servicing Frequency:	**See Section 1.9 Other Conditions**

1.4 Discharge Category

Category B .

1.5 Quantity Measurement

If the Trade Waste Category detailed in Schedule 1.4 above is not Category A, the following formula will be applied to determine the annual quantity (in kilolitres (kL) = 1000 litres) of trade waste discharged from the land.

Quantity = (Water Consumption - [No. of Toilets x 75 kilolitres]) x Trade Waste Fraction

This formula will apply to each of the following water meter(s) and/or effluent flowmeter(s):

Meter Serial Number	Fraction	Number of Toilets

1.6 Quantity Limits

The maximum daily quantity of trade waste discharged to Queensland Urban Utilities' sewerage infrastructure must not exceed 10 kilolitres per working day.

The maximum permissible rate of discharge of trade waste must not exceed 2 litres per second.

1.7 Discharge Times

The discharge of trade waste to Queensland Urban Utilities' sewerage infrastructure may occur seven days per week during the following working day hours:- not limited .

1.8 Quality Limits

Subject to Clause 1.8.1, the quality of trade waste discharged from the land must conform to Queensland Urban Utilities' Trade Waste Sewer Acceptance Criteria detailed in Schedule 2. Any site specific variations to Queensland Urban Utilities' Trade Waste Sewer Acceptance Criteria are detailed in Clause 1.8.1 below.

1.8.1 Quality Limit Variations

The following table(s) detail the approved variations to Queensland Urban Utilities' Trade Waste Sewer Acceptance Criteria for trade waste effluent discharged via each specified discharge location. Trade waste effluent quality must not exceed the contaminant mass load and/or concentration limits during the specified time periods as detailed in the following table(s). At the expiry of each variation, trade waste effluent quality must not exceed the contaminant mass load and/or concentration limits specified in Queensland Urban Utilities' Trade Waste Sewer Acceptance Criteria detailed in Schedule 2.

Discharge Location: #1 - Seepage Water tank

ID	Contaminant Description	Concentration (mg/L)		Mass Load (kg/day)		Effective From	Expiry Date
		Lower	Upper	Lower	Upper		
2843	Zinc				.3	18/10/2013	04/08/2016

1.9 Other Conditions

The following conditions also apply to this Trade Waste Approval:

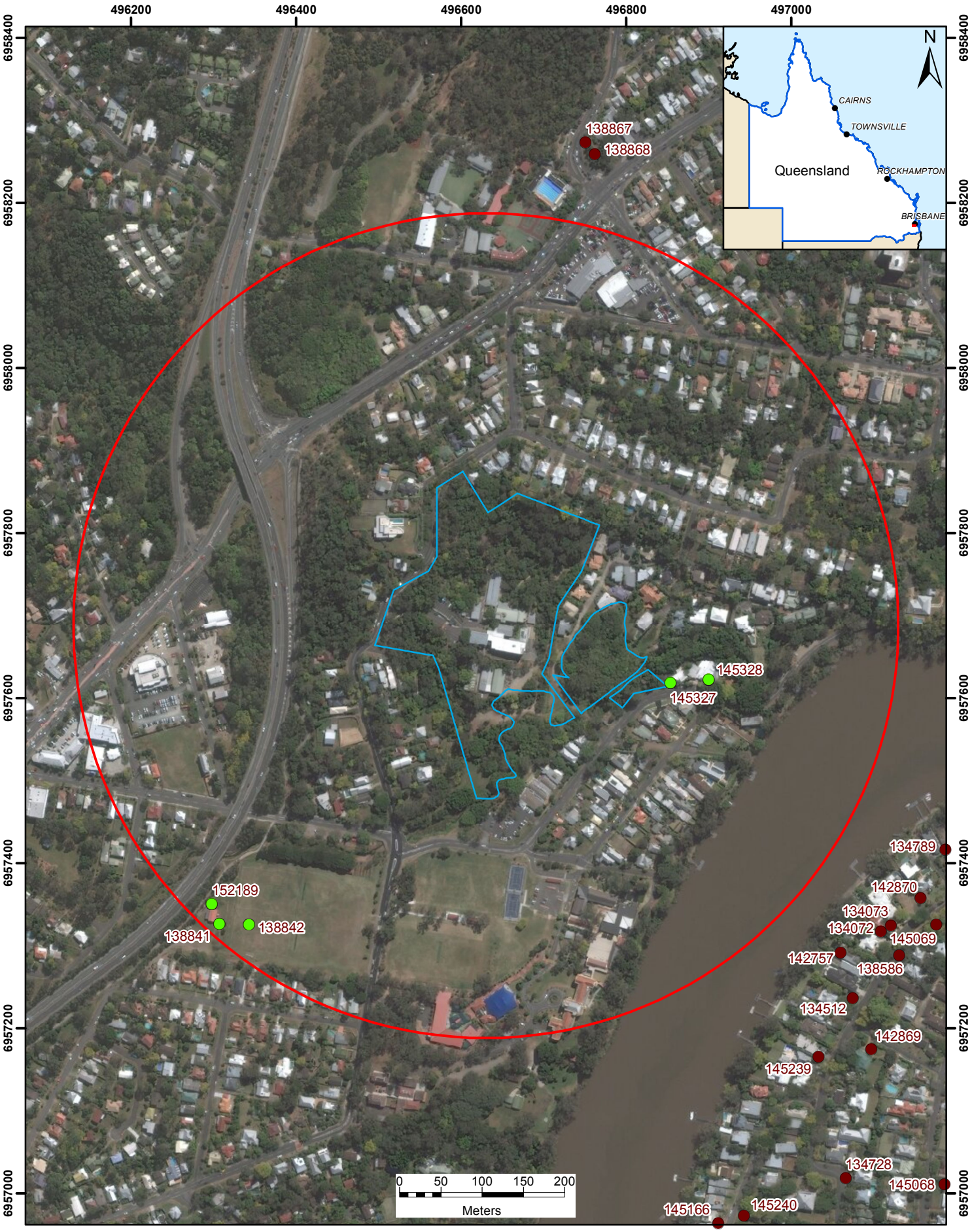
1) Pretreatment devices referred to in Section1.3 of this approval are relevant to the treatment of waste from the following generators:
   (a) PS ID 5942 Laboratories
   (b) PS ID 7021 Laboratories
   (c) PS ID 9405 Seepage Water

2) Seepage Water Facility
   - Queensland Urban Utilities' accepts that no pre-treatment is required for this trade waste. Should further testing establish that the activities or operation of the business generate a trade waste that exceeds the Queensland Urban Utilities' Sewer Acceptance Criteria, the approval holder will be required to install appropriate pre-treatment devices.
   - Should the activities UQ is undertaking on the site requires UQ or any tenant to have a mining lease, prospecting permit, or mining claim, the discharge of seepage water is to cease and an alternative disposal method is to be sourced

3) Seepage Water Metering and Sample Point
   - The volume of seepage water discharged is to be metered with a meter able to maintain a totalised volume.
   - The meter type ,size, serial number and intial reading is requiresd to be provided to Urban Utilities prior to the commencement of discharge.
   - The meter is be accessible to Urban Utilities meter readers.
   - A sample point is to be provided to allow sampling of the seepage water discharge

DATED This: 18 October 2013

Appendix B Registered Bore Search



Legend

- UQ Site Parcel Boundary
- 500 Metre Buffer of Mine Site
- Registered Bore within 500m of Mine Site
- Registered Bore

Registered Water Bore Locations

Appendix B	**UQ**	elp environmental and licensing professionals pty ltd
Date: *1/04/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:6,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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"RN"	"REC"	"CONDITION"	"TOP"	"BOTTOM"	"CONTR"	"FLOW"	"QUALITY"	"YIELD"	"SWL"	"RDATE"	"FORM_DESC"
120306	1	UC	19.5		Y	N		0.62	-2	8/03/2004	
120307	1	FR	16.5		Y	N		2.12	-3	9/03/2004	
120571	1	UC	8			N			-8	2/07/2004	
120572	1	UC	15.3			N			-7.5	13/07/2004	
124053	1	UC	30		Y		SALTY	1.18			
124173	1	UC	80		Y	N	POTABLE	0.5	-10	24/08/2004	
124277	1	UC	130		Y	N		0.06	-19	27/10/2004	
124312	1	UC	5.2								
124313	1	UC	8.5								
133122	1	UC	4		Y	N			-4	9/04/2010	TERTIARY - UNDEFINED
133115	1	UC	7.8		Y	N					TERTIARY - UNDEFINED
133116	1	PS	6		Y	N					CORINDA FORMATION
133120	1	UC	5.5		Y	N			-4	8/04/2010	TERTIARY - UNDEFINED
133121	1	UC	7		Y	N			-6	8/04/2010	TERTIARY - UNDEFINED
124556	1	UC	16		Y	N	BRACKISH	0.75	-6	8/04/2005	
124800	1	UC	18		Y	N		0.25	-10	18/07/2005	
133034	1	FR	0	180	N		4650 US/CM	0.1			BUNYA PHYLLITE
133075	1	FR	48	64	Y	Y		44	0	1/12/2006	BUNYA PHYLLITE
133153	1	SC	11	20	Y	N	1300	1.25	-11	26/05/2010	BRISBANE RIVER ALLUVIUM
133198	1	PS	42	50	Y	N		0.18	-6	28/05/2008	BUNYA PHYLLITE
133208	1	UC	22		Y	N	BRACKISH	0.05	-12	25/08/2005	
133254	1	UC	27		Y	N	SALTY	0.11	-23	16/08/2005	
133254	2	UC	34.8		Y	N	SALTY	0.11	-30	16/08/2005	
133294	1	UC	43		Y	N		0.06	-30	3/11/2005	
133321	1	UC	3	22	Y	N		0.39	-3	12/10/2005	
133323	1	WZ	6				NOT MEASURED				
133324	1	UC	3		Y	N		0.57	-2.5	14/10/2005	
133366	1	UC	36		Y	N	POTABLE	0.31	-12	29/05/2006	
134150	1	FR	42		Y	N		0.21	-20	9/08/2006	
133826	1	FR	13	14	Y	N			-6	27/08/2007	BUNYA PHYLLITE
133827	1	FR	15	17	Y	N			-6	28/08/2007	BUNYA PHYLLITE
133828	1	FR	13	15	Y	N			-6	29/08/2007	BUNYA PHYLLITE
133405	1	PS	25	26	Y	N	1250	0.13	-11	22/10/2007	NERANLEIGH-FERNVALE BEDS
133405	2	PS	37	38	Y	N	1250	0.32	-11	22/10/2007	NERANLEIGH-FERNVALE BEDS
133433	1	UC	10		Y	N	6000USCM	0.19	-6	18/04/2008	BRISBANE RIVER ALLUVIUM
133433	2	UC	17.5		Y	N	16000USCM	0.19	-6	18/04/2008	BRISBANE RIVER ALLUVIUM
133742	1	UC	66			N	POTABLE		-5	20/03/2006	
133799	1	UC	55		Y	N	POTABLE	0.18	-10	17/02/2006	
133900	1	UC	10		Y	N	POTABLE	0.75	-3	17/02/2006	
133803	1	FR	30	32	Y	N	3125	0.19	-25	26/04/2007	BUNYA PHYLLITE
133878	1	UC	54		Y	N	POTABLE	0.04	-11	29/06/2006	
133976	1	UC	54		Y	N	POTABLE	0.26	-15.5	24/05/2006	
134031	1	UC	26		Y		POTABLE	0.45			
134032	1	UC	8		Y	N	POTABLE	0.58	-3.8	20/07/2006	
134034	1	UC	30		Y		POTABLE	0.43			
134049	1	FR	10		N	N		0.13	-9.5	5/04/2007	
134049	2	FR	11.5		N	N		0.25	-9.5	5/04/2007	
134058	1	FR	19.3		N		1500PPM TDS	0.03			
134058	2	FR	40		N		1500PPM TDS	0.06			
134058	3	FR	64		N		1500PPM TDS	0.09			
134072	1	UC	22		Y	N	POTABLE	1.96	-8.5	3/08/2006	
134073	1	UC	16		Y	N	POTABLE	1.7	-7.5	8/08/2006	
134119	1	FR	58		Y	N		0.38	-14	24/07/2006	
134120	1	FR	39		Y	N		0.32	-17	25/07/2006	
134152	1	UC	6		Y	N		0.38	-1.5	10/08/2006	
134161	1	UC	13		Y	N	POTABLE	0.18	-5	19/09/2006	
134369	1	FR	21		Y	N		3	-11	18/10/2005	
134379	1	FR	35		Y	N		0.2	-20	2/11/2006	
134431	1	UC	29		Y		BRACKISH	0.44			
134465	1	UC	12.1		Y	N	POTABLE	0.23	-9	6/09/2006	
134497	1	UC	18		Y	N		0.13	-8	1/11/2006	
134512	1	UC	7				POTABLE				
134515	1	UC	20		Y		BRACKISH (VERY)	0.53			
134569	1	UC	32		Y	N	POTABLE	0.5	-12	17/11/2006	
134644	1	UC	23		Y	N		0.96	-12	27/11/2006	
134645	1	UC	25		Y	N		0.89	-12	28/11/2006	
134646	1	UC	24		Y	N		0.84	-12	28/11/2006	
134706	1	UC	21		Y		POTABLE	0.61			
134709	1	UC	20		Y		SALTY	0.32			
134710	1	UC	14		Y	N	POTABLE	0.22	-12.6	8/02/2007	
134728	1	UC	12		Y	N	POTABLE	0.14	-16	20/12/2006	
134780	1	UC	10		Y	N		0.75	-10	19/02/2007	
134789	1	UC	10	15	Y	N	"POTABLE"	0.33			
134790	1	UC	18	23	N	N	SALTY		-18	27/03/2007	

"RN"	"REC"	"CONDITION"	"TOP"	"BOTTOM"	"CONTR"	"FLOW"	"QUALITY"	"YIELD"	"SWL"	"RDATE"	"FORM_DESC"
134961	1	FR	18	19	N	N	10000PPM SALT	0.25	-6	15/03/2007	
134961	2	FR	39	40	N	N	10000PPM SALT	0.25	-6	15/03/2007	
134791	1	PS	6	38	N	N		0.05			
134982	1	PS	31		N		BRACKISH	0.19			
134984	1	PS	24		N		POTABLE	0.61			
138692	3	FR	70.5	71	Y	N	1000PPM	0.25	-28	2/01/2008	BUNYA PHYLLITE
138834	1	FR	7	8.5	Y	N		0.03			DAGUILAR BLOCK
138834	2	FR	43	44.2	Y	N	1700COND	0.12	-7	16/09/2008	DAGUILAR BLOCK
138586	1	UC	11	24	Y	N	507 PPM	0.4			BRISBANE RIVER ALLUVIUM
138692	1	FR	34	34.5	Y	N					BUNYA PHYLLITE
138692	2	FR	61	61.5	Y	N					BUNYA PHYLLITE
138821	1	UC	20	22	Y	N		0.37	-16	1/01/2007	BRISBANE RIVER ALLUVIUM
138804	1	FR	18.5	18.7	Y	N		0.13	-12	28/11/2006	BUNYA PHYLLITE
138844	1	FR	41	41.5	Y	N		0.06			DAGUILAR BLOCK
138841	1	UC	3	8.5	Y	N	1169USCM	0.63	-2	6/08/2008	BUNYA PHYLLITE
138842	1	UC	3	7	Y	N		0.38			BUNYA PHYLLITE
138842	2	UC	11	12	Y	N	2170 USCM	0.91	-2	6/08/2008	BUNYA PHYLLITE
138844	2	FR	47	47.5	Y	N	5500USCM	0.12	-20	17/06/2008	DAGUILAR BLOCK
138845	1	UC	20	21	N	N	1840USCM	0.63	-15	1/07/2008	BRISBANE RIVER ALLUVIUM
138868	1	FR	12	18	Y	N	COND 1400US/CM	0.25	-7	26/08/2009	NERANLEIGH-FERNVALE BEDS
138879	1	PS	30	72	Y	N	BRACKISH	0.19	-24	21/01/2009	BUNYA PHYLLITE
138982	1	UC	19.5	21.5	Y	N		1.5	-6.6	24/05/2010	BRISBANE RIVER ALLUVIUM
142757	1	UC	22	30	Y	N	9 COND 9.4PH	1.96	-8.8	17/09/2006	BRISBANE RIVER ALLUVIUM
145003	3	PS	39.3	39.6	N	N	750PPM TDS	0.16	-17	16/05/2007	
145017	1	UC	14		N	N	8000PPM TDS	1.26	-8	24/05/2007	
145003	1	PS	20	20.3	N			0.06			
145003	2	PS	33	33.3	N			0.13			
142869	1	UC	8	15	Y	N	740USCM PH7	0.35			BRISBANE RIVER ALLUVIUM
142870	1	UC	10	13	Y	N	935USCM PH7	0.55	-9.55	26/02/2007	BRISBANE RIVER ALLUVIUM
142905	1	FR	8.8	9.1	Y	N	5800	1.6	-8.8	5/12/1999	BUNYA PHYLLITE
142914	1	WZ	5.5	12.2	Y	N					BUNYA PHYLLITE
142914	2	WZ	29	29.9	Y	N					BUNYA PHYLLITE
142914	3	FR	39.6	40.5	Y	N		0.34			BUNYA PHYLLITE
145013	1	UC	12.8		N	N	760PPM TDS	0.32	-7	22/05/2007	
145016	1	PS	23		N		16000PPM TDS	200			
145022	1	FR	35	35.3	N	N	480PPM TDS	0.06	-26	9/08/2007	
145022	2	FR	36	36.3	N	N	900PPM TDS	0.32	-26	9/08/2007	
145096	1	PS	29	41	N	N	1200PPM SALT	0.45	-17	23/07/2007	
145068	1	SC	18	21	N		SALTY	0.14			
145069	1	UC	6		N		POTABLE	0.34			
145070	1	PS	10	11	N		POTABLE	0.73			
145098	1	SC	14	23	N		POTABLE	0.62			
145099	1	SC	14	15	N		SALTY	0.31			
145164	1	PS	12	17	N		POTABLE	0.19			
145165	1	PS	20	24	N	N	POTABLE	0.48	-17.2	15/06/2007	
145166	1	PS	8		N		POTABLE	0.28			
145218	1	PS	75	82	N	N	BRACKISH	0.1	-23.1	21/03/2007	
145218	2	PS	99	10.2	N	N	BRACKISH	0.14	-23.1	21/03/2007	
145218	3	PS	115	119	N	N	BRACKISH	0.23	-23.1	21/03/2007	
145239	1	UC	5.5		N		POTABLE	0.53			
145240	1	SC	4	8	N		POTABLE	0.5			
145301	1	PS	18	23.5	N		POTABLE	0.43			
145302	1	PS	16	24	N		SALTY	0.56			
145303	1	PS	20	21	N		POTABLE	0.13			
145469	2	PS	59.4		N		3200PPM SALT	0.06			
145392	1	PS	55		N	N	POTABLE	0.14	-5	18/10/2007	
145465	1	PS	23.5		N	N		0.03	-12	27/11/2007	
145465	2	PS	30		N	N		0.06	-12	27/11/2007	
145465	3	PS	41		N	N		0.13	-12	27/11/2007	
145469	1	PS	47		N		3200PPM SALT	0.03			
145627	1	PS	9	10	N	N	POTABLE	0.04	-8	2/08/2007	
145581	1	PS	18		N		BRACKISH	0.32			
145614	1	FR	15		N	N	BRACKISH	0.01	-14	25/09/2007	
145614	2	FR	23		N	N	BRACKSIH	0.19	-14	25/09/2007	
145614	3	FR	26		N	N	BRACKISH	0.23	-14	25/09/2007	
145614	4	FR	29		N	N	BRACKSIH	0.25	-14	25/09/2007	
145627	2	FR	20	21	N	N	POTABLE	0.06	-8	2/08/2007	
145716	1	PS	5		N						
145691	1	FR	13.7		N	N	BRACKSIH	0.63	-8	7/02/2008	
145714	1	XX	4.5		N						
145715	1	PS	6		N	N			-3.5	16/01/2008	
145981	2	WZ	34.7	39.4	Y		650 PPM	0.3			NERANLEIGH-FERNVALE BEDS
145982	1	UC	22	24.4	Y	N	13000 COND	1.3	-8.8	10/07/2007	BRISBANE RIVER ALLUVIUM
145870	1	UC	7		N		BRACKISH	0.07			

"RN"	"REC"	"CONDITION"	"TOP"	"BOTTOM"	"CONTR"	"FLOW"	"QUALITY"	"YIELD"	"SWL"	"RDATE"	"FORM_DESC"
145981	1	FR	7.6	10.7	Y						NERANLEIGH-FERNVALE BEDS

"RN"	"PIPE"	"RDATE"	"REC"	"MATERIAL_DESC"	"MATERIAL_SIZE"	"SIZE_DESC"	"OUT_DIAMETER"	"TOP"	"BOTTOM"
120212	A	19/12/2003	1	GROU			175	0	2.5
120306	A	8/03/2004	1	PVC	9	WT	140	0	21.2
120306	A	8/03/2004	2	PERF	2	AP		18.2	21.2
120306	A	8/03/2004	3	GRAV	5	GR		17	21.2
120306	A	8/03/2004	4	BNSL				16	17
120306	A	8/03/2004	5	FILL				0	16
120306	A	8/03/2004	6	GROU			200	0	6
120307	A	9/03/2004	1	PVC	9	WT	140	0	22.7
120307	A	9/03/2004	2	STEL	4.8	WT	219	0	3
120307	A	9/03/2004	3	PERF	2	AP		15	21
120307	A	9/03/2004	4	GRAV	5	GR		14	22.7
120307	A	9/03/2004	5	BNSL				13	14
120307	A	9/03/2004	6	FILL				0	13
120307	A	9/03/2004	7	GROU			200	0	6
120571	A	2/07/2004	4	GROU			225	0	5
120571	A	2/07/2004	1	STEL	4.8	WT	168	0	17.4
120571	A	2/07/2004	2	PERF	2.5	AP		13.2	17.4
120571	A	2/07/2004	3	GRAV				5	
120572	A	13/07/2004	1	STEL	4.8	WT	168		
120572	A	13/07/2004	2	PERF	2.5	AP		9.3	15.3
120572	A	13/07/2004	3	FILL				5	7.5
120572	A	13/07/2004	4	GROU			225	0.6	5
133153	A	26/05/2010	4	GROU			250	0	5
133153	A	26/05/2010	1	PVC	7.6	WT	140	0	19
133153	A	26/05/2010	2	PERF	5	AP	140	15	18
133153	A	26/05/2010	3	GRAV	5	GR	250	5	22
124173	A	24/08/2004	5	GROU			175	0	104
124116	A	16/09/2004	1	FILL				0	42
124173	A	24/08/2004	1	PVC	6	WT	220	0	6
124173	A	24/08/2004	2	PVC	6	WT	150	0	104
124173	A	24/08/2004	3	PERF	1.5	AP		90	104
124173	A	24/08/2004	4	GROU			250	0	6
124277	A	27/10/2004	4	GROU			200	0	6
124277	A	27/10/2004	1	PVC	10	WT	150	0	151
124277	A	27/10/2004	2	PERF	1.5	AP		127	145
124277	A	27/10/2004	3	GRAV	6	GR		6	151
124312	A	27/01/2005	4	GROU				0	0.03
124312	A	27/01/2005	1	PVC			60	1	7
124312	A	27/01/2005	2	SCRN	0.5	AP	60	1	7
124312	A	27/01/2005	3	GRAV	3	GR		0.7	7
124312	A	27/01/2005	5	BNSL				0.03	0.7
124313	A	28/01/2005	1	PVC			60	0	10.5
124313	A	28/01/2005	2	SCRN	0.5	AP	60	1.5	10.5
124313	A	28/01/2005	3	GRAV				1	10.5
124313	A	28/01/2005	4	GROU				0	0.5
124313	A	28/01/2005	5	BNSL				0.5	1
124556	A	8/04/2005	4	GROU			170	0	5
124556	A	8/04/2005	1	PVC	5	WT	125	0	19
124556	A	8/04/2005	2	PERF	2	AP		13	19
124556	A	8/04/2005	3	GRAV	5	GR		5	19
124800	A	18/07/2005	4	FILL				5	6
124800	A	18/07/2005	1	PVC	9	WT	140	0	22
124800	A	18/07/2005	2	PERF	4	AP		16	22
124800	A	18/07/2005	3	GRAV	5	GR		6	22
124800	A	18/07/2005	5	GROU			200	0	5
133034	X	22/11/2006	3	BNSL			250	5	6
124911	X	30/10/2009	1	GROU			190	0	5
124911	X	30/10/2009	2	FILL			190	5	10.8
124911	X	30/10/2009	3	FILL			152	10.8	17
133034	A	22/11/2006	1	STEL	6.4	WT	219	0	6
133034	X	22/11/2006	2	GROU			250	0	5
133034	X	22/11/2006	4	BNSL			165	6	7

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133034	X	22/11/2006	5	FILL			165	7	180
133075	X	1/12/2006	4	GROU			375	0	6
133075	A	1/12/2006	1	STEL	6.4	WT	219	0	38.5
133075	A	1/12/2006	2	STEL	6.4	WT	168	0	70
133075	A	1/12/2006	3	PERF		AP	168	48	64
133075	X	1/12/2006	5	GROU			300	6	12
133075	X	1/12/2006	6	GROU			250	12	38
133075	X	1/12/2006	7	BNSL			250	38	38.5
133075	X	1/12/2006	8	OPEN			250	38.5	70
133115	X	25/02/2010	4	BNSL			150	5.5	6.5
133115	A	25/02/2010	1	PVC			50	0	7
133115	A	25/02/2010	2	SCRN	0.4	AP	50	7	10
133115	X	25/02/2010	3	GROU			150	0	5.5
133115	X	25/02/2010	5	GRAV			150	6.5	10
133116	A	26/02/2010	1	PVC			50	0	5
133116	A	26/02/2010	2	SCRN	0.4	AP	50	5	8
133116	X	26/02/2010	3	GROU			150	0	3.5
133116	X	26/02/2010	4	BNSL			150	3.5	4.5
133116	X	26/02/2010	5	GRAV			150	4.5	8
133120	A	8/04/2010	1	PVC			50	0	1
133120	A	8/04/2010	2	SCRN	0.4	AP	50	1	8.5
133120	X	8/04/2010	3	GROU			150	0	0.5
133120	X	8/04/2010	4	BNSL			150	0.5	0.75
133120	X	8/04/2010	5	FILL			150	0.75	8.5
133121	A	8/04/2010	1	PVC			50	0	1
133121	A	8/04/2010	2	SCRN	0.4	AP	50	1	8
133121	X	8/04/2010	3	GROU			150	0	0.5
133121	X	8/04/2010	4	BNSL			150	0.5	1
133121	X	8/04/2010	5	FILL			150	1	97
133122	A	9/04/2010	1	PVC			50	0	1
133122	A	9/04/2010	2	SCRN	0.4	AP	50	1	7
133122	X	9/04/2010	3	GROU			150	0	0.5
133122	X	9/04/2010	4	BNSL			150	0.5	1
133122	X	9/04/2010	5	FILL			150	1	7
133198	A	28/05/2008	4	PERF	0.7	AP	140	44	50
133323	A	12/10/2005	1	FILL				0	66
133323	A	12/10/2005	2	GROU			182	0	6
133198	A	28/05/2008	1	PVC	5	WT	140	0	50
133198	A	28/05/2008	2	PERF	0.7	AP	140	20	26
133198	A	28/05/2008	3	PERF	0.7	AP	140	32	38
133198	A	28/05/2008	5	GRAV	5	GR	175	5	50
133198	A	28/05/2008	6	GROU			175	0	5
133208	A	25/08/2005	4	GROU			200	0	6
133208	A	25/08/2005	1	PVC	5.9	WT	124	0	27
133208	A	25/08/2005	2	PERF	3	AP		15	26
133208	A	25/08/2005	3	GRAV	5	GR		6	27
133254	A	16/08/2005	4	FILL				5	23
133254	A	16/08/2005	1	PVC	6	WT	125	0	37.2
133254	A	16/08/2005	2	PERF	3	AP	150	25.2	37.2
133254	A	16/08/2005	3	GRAV	5	GR		24	37.2
133254	A	16/08/2005	5	GROU			200	0	5
133254	A	16/08/2005	6	GROU			200	23	24
133294	A	3/11/2005	4	GROU			175	0	5
133294	A	3/11/2005	1	PVC	9	WT	140	0	54
133294	A	3/11/2005	2	PERF	4	AP		42	54
133294	A	3/11/2005	3	BNSL				5	6
133321	A	12/10/2005	2	PERF	3	AP		6	18
133321	A	12/10/2005	1	PVC	5.9	WT		0	60
133321	A	12/10/2005	3	PERF	3	AP		36	48
133321	A	12/10/2005	4	GRAV	5	GR		3	60
133321	A	12/10/2005	5	GROU			219	0	3
133324	A	14/10/2005	1	PVC	5.9	WT	125	0	30

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133324	A	14/10/2005	3	PERF	3	AP		3	24
133324	A	14/10/2005	4	GROU			219	0	2
133366	A	29/05/2006	4	GRAV	5	GR		6	48
133366	A	29/05/2006	1	PVC	9	WT	125	0	48
133366	A	29/05/2006	2	SCRN	2	AP	125	30	48
133366	A	29/05/2006	3	PERF	2	AP		30	48
133366	A	29/05/2006	5	GROU			172	0	6
133742	A	20/03/2006	4	PERF	2	AP		66	90
133742	A	20/03/2006	1	PVC	9	WT	125	0	102
133742	A	20/03/2006	2	SCRN	2	AP	125		
133742	A	20/03/2006	3	PERF	2	AP		96	102
133742	A	20/03/2006	5	GRAV	5	GR		60	102
133742	A	20/03/2006	6	GROU			172	0	6
133405	A	22/10/2007	4	GRAV	5	GR	200	5	41
133405	A	22/10/2007	1	PVC	5.9	WT	140	0	41
133405	A	22/10/2007	2	PERF	2	AP	140	23	29
133405	A	22/10/2007	3	PERF	2	AP	140	35	41
133405	A	22/10/2007	5	GROU			200	0	5
133433	X	18/04/2008	1	GROU			160	1	5
133433	X	18/04/2008	2	BNSL			160	5	6
133433	X	18/04/2008	3	FILL			160	6	11.5
133433	X	18/04/2008	4	FILL			125	11.5	18.25
133704	A	19/01/2006	1	FILL				5	72
133704	A	19/01/2006	2	GROU			200	0	5
133735	A	8/03/2006	1	GROU				0	6
133741	A	16/02/2006	1	GROU				0	6
133878	A	29/06/2006	4	SCRN	2	AP	125	36	42
133878	A	29/06/2006	1	PVC	9	WT	125	0	66
133878	A	29/06/2006	2	SCRN	2	AP	125	54	66
133878	A	29/06/2006	3	SCRN	0	AP	125	42	54
133878	A	29/06/2006	5	SCRN	0	AP	125	0	36
133878	A	29/06/2006	6	GRAV	5	GR		6	66
133878	A	29/06/2006	7	GROU			173	0	6
133799	A	17/02/2006	4	GROU			200	0	5
133799	A	17/02/2006	1	PVC	5	WT	125	0	60
133799	A	17/02/2006	2	PERF				48	60
133799	A	17/02/2006	3	GRAV	5	GR		5	60
133803	A	26/04/2007	4	GROU			180	0	5
133803	A	26/04/2007	1	PVC	5.9	WT	140	0	42
133803	A	26/04/2007	2	PERF	2	AP	140	30	42
133803	A	26/04/2007	3	GRAV	5	GR	180	20	42
133803	A	26/04/2007	5	FILL			180	5	20
133826	X	27/08/2007	4	BNSL			114	9.5	11
133826	A	27/08/2007	1	PVC			60	0	12
133826	A	27/08/2007	2	PERF	0.5	AP	60	12	15
133826	X	27/08/2007	3	GROU			114	0	9.5
133826	X	27/08/2007	5	GRAV	2	GR	114	11	15
133827	A	28/08/2007	1	PVC			60	0	15
133827	A	28/08/2007	2	SCRN	0.5	AP	60	15	18
133827	X	28/08/2007	3	GROU			114	0	13
133827	X	28/08/2007	4	BNSL			114	13	14
133827	X	28/08/2007	5	GRAV			114	14	18
133828	A	29/08/2007	1	PVC			60	0	13
133828	A	29/08/2007	2	SCRN	0.5	AP	60	13	16
133828	X	29/08/2007	3	GROU			119	0	8
133828	X	29/08/2007	4	GROU			114	8	9.5
133828	X	29/08/2007	5	BNSL			114	9.5	11
133828	X	29/08/2007	6	GRAV	3	GR	114	11	16
133900	A	17/02/2006	1	PVC	5	WT	125	0	12
133900	A	17/02/2006	2	PERF				6	12
133900	A	17/02/2006	3	GRAV	5	GR		5	12

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133900	A	17/02/2006	4	GROU			200	0	5
133853	A	23/06/2006	1	GROU			173	0	6
133864	A	12/05/2006	1	FILL				5	21
133864	A	12/05/2006	2	GROU			200	0	5
134031	A	11/07/2006	4	PERF	2	AP		24	36
134031	A	11/07/2006	1	PVC	9	WT	125	0	36
134031	A	11/07/2006	2	SCRN	2	AP	125	24	36
134031	A	11/07/2006	3	SCRN	0	AP	125	0	24
134031	A	11/07/2006	5	GRAV	5	GR		6	36
134031	A	11/07/2006	6	GROU			173	0	6
133976	A	24/05/2006	4	GRAV	5	GR		6	60
133948	A	21/04/2006	1	FILL				5	60
133948	A	21/04/2006	2	GROU			200	0	5
133976	A	24/05/2006	1	PVC	9	WT	125	0	60
133976	A	24/05/2006	2	PVC	2	AP	125	48	60
133976	A	24/05/2006	3	PERF	2	AP		48	60
133976	A	24/05/2006	5	GROU			172	6	60
134032	A	20/07/2006	1	STEL	3	WT	204	0	4
134032	A	20/07/2006	2	PVC	9	WT	125	0	18
134032	A	20/07/2006	3	SCRN	2	AP	125	6	18
134032	A	20/07/2006	4	SCRN	0	AP	125	0	6
134032	A	20/07/2006	5	PERF	2	AP		6	18
134032	A	20/07/2006	6	GRAV	5	GR		6	18
134032	A	20/07/2006	7	GROU			173	0	6
134034	A	23/08/2006	1	PVC	9	WT	125	0	48
134034	A	23/08/2006	2	SCRN	2	AP	125	36	48
134034	A	23/08/2006	3	PERF	2	AP		30	48
134034	A	23/08/2006	4	GRAV	5	GR		5	48
134034	A	23/08/2006	5	GROU			173	0	5
134049	A	5/04/2007	4	PERF	4	AP		8	13
134049	A	5/04/2007	1	PVC	4.85	WT	114	0	13
134049	A	5/04/2007	2	GROU				0	5
134049	A	5/04/2007	3	GRAV				5	13
134058	A	28/04/2007	1	PVC	4.85	WT	114	0	58
134058	A	28/04/2007	2	PVC	6.3	WT	114	58	76.3
134058	A	28/04/2007	3	GROU				0	5
134058	A	28/04/2007	4	GRAV	5	GR		5	76.3
134058	A	28/04/2007	5	PERF	4	AP		16	22
134058	A	28/04/2007	6	PERF	4	AP		40	46
134058	A	28/04/2007	7	PERF	4	AP		70	76
134072	A	3/08/2006	3	SCRN	0	AP	125	1	17
134119	A	24/07/2006	1	PVC	9	WT	140	0	66
134119	A	24/07/2006	2	PERF	4	AP		60	66
134119	A	24/07/2006	3	GROU			200	0	7
134072	A	3/08/2006	1	PVC	9	WT	125	0	29
134072	A	3/08/2006	2	SCRN	0.4	AP	125	17	29
134072	A	3/08/2006	4	PERF	0.4	AP		17	29
134072	A	3/08/2006	5	GRAV	5	GR		6	29
134072	A	3/08/2006	6	GROU			175	0	6
134073	A	8/08/2006	4	PERF	0.4	AP		16	28
134073	A	8/08/2006	1	PVC	9	WT	125	0	28
134073	A	8/08/2006	2	SCRN	0.4	AP	125	16	28
134073	A	8/08/2006	3	SCRN	0	AP	125	1	16
134073	A	8/08/2006	5	GRAV	5	GR		6	28
134073	A	8/08/2006	6	GROU			175	0	6
134120	A	25/07/2006	4	FILL				5	8
134120	A	25/07/2006	1	PVC	9	WT	140	0	48
134120	A	25/07/2006	2	PERF	4	AP		42	48
134120	A	25/07/2006	3	GRAV	5	GR		8	48
134120	A	25/07/2006	5	GROU			200	0	5
134150	A	9/08/2006	4	GROU			200	0	5
134150	A	9/08/2006	1	PVC	9	WT	140	0	54

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134150	A	9/08/2006	3	BNSL				5	6
134152	A	10/08/2006	1	PVC	9	WT	140	0	22
134152	A	10/08/2006	2	PERF	4	AP		16	22
134152	A	10/08/2006	3	PERF	4	AP		9	12
134152	A	10/08/2006	4	GRAV	5	GR		6	22
134152	A	10/08/2006	5	FILL				5	6
134152	A	10/08/2006	6	GROU			200	0	6
134161	A	19/09/2006	4	GROU			172	0	5
134216	A	28/09/2006	1	FILL				5	48
134216	A	28/09/2006	2	GROU			200	0	5
134161	A	19/09/2006	1	PVC	9	WT	125	0	36
134161	A	19/09/2006	2	PERF	2	AP		12	36
134161	A	19/09/2006	3	GRAV	5	GR		5	36
134180	A	26/09/2006	1	GROU				0	6
134243	A	11/10/2006	1	GROU				0	6
134369	A	18/10/2006	2	PVC	9	WT	140	0	29
134502	A	9/11/2006	1	FILL				5	114
134502	A	9/11/2006	2	GROU			200	0	5
134289	A	19/10/2006	1	FILL				5	18
134289	A	19/10/2006	2	GROU			200	0	5
134343	A	4/10/2006	1	FILL				6	85
134343	A	4/10/2006	2	GROU			195	0	6
134365	A	12/10/2006	1	FILL				5	42
134365	A	12/10/2006	2	GROU			200	0	5
134369	A	18/10/2006	1	STEL	4.8	WT	219	0	2
134369	A	18/10/2006	3	PERF	2	AP		20	26
134369	A	18/10/2006	4	GRAV	5	GR		10	29
134369	A	18/10/2006	5	FILL				5	10
134369	A	18/10/2006	6	GROU			200	0	2
134369	A	18/10/2006	7	GROU			180	2	5
134379	A	2/11/2006	4	FILL				6	20
134379	A	2/11/2006	1	PVC	9	WT	140	0	42
134379	A	2/11/2006	2	PERF	2	AP		33	39
134379	A	2/11/2006	3	GRAV	5	GR		20	42
134379	A	2/11/2006	5	GROU			200	0	6
134431	A	16/11/2006	4	GROU			171	0	5
134431	A	16/11/2006	1	PVC	9	WT	125	0	42
134431	A	16/11/2006	2	PERF	2	AP		30	42
134431	A	16/11/2006	3	GRAV	5	GR		5	42
134465	A	6/09/2006	4	FILL				5	6
134465	A	6/09/2006	1	PVC	6	WT	125	0	14.5
134465	A	6/09/2006	2	PERF	3	AP		8.5	14.5
134465	A	6/09/2006	3	GRAV	5	GR		7	14.5
134465	A	6/09/2006	5	GROU			200	0	5
134465	A	6/09/2006	6	GROU			200	6	7
134497	A	1/11/2006	4	BNSL				5	7
134488	A	27/11/2006	1	FILL				5	46
134488	A	27/11/2006	2	GROU			200	0	5
134497	A	1/11/2006	1	PVC	9	WT	140	0	30
134497	A	1/11/2006	2	PERF	4	AP		18	30
134497	A	1/11/2006	3	GRAV	5	GR		7	30
134497	A	1/11/2006	5	GROU			200	0	5
134512	A	9/12/2006	4	GROU			187	0	5
134512	A	9/12/2006	1	PVC	9	WT	125	0	24
134512	A	9/12/2006	2	PERF	0.4	AP		12	24
134512	A	9/12/2006	3	GRAV	5	GR		5	24
134515	A	16/12/2006	1	PVC	9	WT	125	0	30
134515	A	16/12/2006	2	PERF	0.4	AP		18	30
134515	A	16/12/2006	3	GRAV	5	GR		5	30
134515	A	16/12/2006	4	GROU			187	0	5
134569	A	17/11/2006	4	GROU			175	0	6

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134569	A	17/11/2006	2	PERF	2	AP		32	44
134569	A	17/11/2006	3	GRAV	5	GR		6	44
134710	A	8/02/2007	4	GROU			187	0	5
134710	A	8/02/2007	1	PVC	9	WT	125	0	36
134710	A	8/02/2007	2	PERF	2	AP		12	36
134710	A	8/02/2007	3	GRAV	5	GR		5	36
134644	A	27/11/2006	4	FILL				6	20
134644	A	27/11/2006	1	PVC	9	WT	125	0	22
134644	A	27/11/2006	2	SSL	10	AP	125	22	24
134644	A	27/11/2006	3	GRAV				20	27
134644	A	27/11/2006	5	GROU			185	0	6
134645	A	28/11/2006	1	PVC	9	WT	125	0	21
134645	A	28/11/2006	2	SSL	10	AP	125	21	23
134645	A	28/11/2006	3	GRAV	2	GR		19	26
134645	A	28/11/2006	4	FILL				6	19
134645	A	28/11/2006	5	GROU			185	0	6
134646	A	28/11/2006	1	PVC	9	WT	125	0	22
134646	A	28/11/2006	2	SSL	10	AP	125	22	24
134646	A	28/11/2006	3	GRAV	2	GR		20	24
134646	A	28/11/2006	4	FILL				6	20
134646	A	28/11/2006	5	GROU			185	0	6
134706	A	23/01/2007	4	GROU			171	0	5
134706	A	23/01/2007	1	PVC	9	WT	125	0	31
134706	A	23/01/2007	2	PERF	2	AP		19	31
134706	A	23/01/2007	3	GRAV	5	GR		5	31
134709	A	5/02/2007	1	PVC	9	WT	125	0	24
134709	A	5/02/2007	2	PERF	2	AP		12	24
134709	A	5/02/2007	3	GRAV	5	GR		5	24
134709	A	5/02/2007	4	GROU			197	0	5
134728	A	20/12/2006	4	GROU			187	0	5
134728	A	20/12/2006	1	PVC	9	WT	125	0	24
134728	A	20/12/2006	2	PERF	0.4	AP		12	24
134728	A	20/12/2006	3	GRAV	5	GR		5	26
134780	A	19/02/2007	2	PERF	2	AP		11	17
134729	A	18/01/2007	1	GROU				0	5
134730	A	13/02/2007	1	GROU				0	6
134779	A	16/02/2007	1	FILL				5	60
134779	A	16/02/2007	2	GROU			175	0	5
134780	A	19/02/2007	1	PVC	9	WT	140	0	17
134780	A	19/02/2007	3	GRAV	5	GR		9	17
134780	A	19/02/2007	4	FILL				5	9
134780	A	19/02/2007	5	GROU			200	0	5
138844	X	17/06/2008	4	GROU			160	1	5
138844	A	17/06/2008	1	PVC	4.85	WT	105	0	51
138844	A	17/06/2008	2	PERF	4	AP	105	45	51
138844	X	17/06/2008	3	GROU			170	0	1
138844	X	17/06/2008	5	GRAV	5	GR	160	5	51
134789	A	5/04/2007	4	GROU			187	0	5
134789	A	5/04/2007	1	PVC	5.9	WT	140	0	22
134789	A	5/04/2007	2	PERF				10	22
134789	A	5/04/2007	3	GRAV	5	GR		5	22
134790	A	27/03/2007	4	PERF	1	AP		18	23
134790	A	27/03/2007	1	PVC	5.9	WT	140	0	23
134790	A	27/03/2007	2	GROU				0	5
134790	A	27/03/2007	3	GRAV	5	GR		5	23
134961	A	15/03/2007	5	PERF	2	AP		18	24
134791	A	23/03/2007	1	GROU			171	0	6
134944	A	6/03/2007	1	GROU				0	5
134944	A	6/03/2007	2	FILL				5	18
134961	A	15/03/2007	1	PVC	5.9	WT	140	0	46
134961	A	15/03/2007	2	GROU				0	6

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134961	A	15/03/2007	3	FILL				6	15
134961	A	15/03/2007	4	GRAV	5	GR		15	46
134961	A	15/03/2007	6	PERF	2	AP		40	46
134982	A	31/07/2007	4	PERF	2	AP		30	60
134982	A	31/07/2007	1	PVC	5.9	WT	140	0	60
134982	A	31/07/2007	2	GROU				0	5
134982	A	31/07/2007	3	GRAV	5	GR		5	60
134984	A	13/08/2007	1	PVC	5.9	WT	140	0	55
134984	A	13/08/2007	2	GROU				0	5
134984	A	13/08/2007	3	GRAV	5	GR		5	55
134984	A	13/08/2007	4	PERF	2	AP		25	55
138692	A	2/12/2008	2	PVC	6.3	WT	125	60	78
138505	X	3/11/2008	1	GROU			230	0	5
138505	X	3/11/2008	2	FILL			230	5	5.8
138505	X	3/11/2008	3	FILL			190	5.8	51
138586	A	9/07/2007	1	PVC	5.9	WT	125	0	20
138586	A	9/07/2007	2	PERF	0.5	AP	125	8	20
138586	X	9/07/2007	3	GROU			185	0	5
138586	X	9/07/2007	4	GRAV	5	GR	185	5	20
138692	A	2/12/2008	1	PVC	4.85	WT	125	0	60
138692	X	2/12/2008	3	GROU			170	0	5
138692	X	2/12/2008	4	FILL			170	5	78
138804	X	28/11/2006	4	GROU			145	2	5
138804	A	28/11/2006	1	PVC			100	0	33
138804	A	28/11/2006	2	PERF	4	AP	100	27	33
138804	X	28/11/2006	3	GROU			150	0	2
138804	X	28/11/2006	5	GRAV			145	5	33
138821	X	1/01/2007	4	GRAV	5	GR	130	5	22
138821	A	1/01/2007	1	PVC	4.85	WT	100	0	21
138821	A	1/01/2007	2	SCRN			100	21	22
138821	X	1/01/2007	3	GROU			130	0	5
138841	A	6/08/2008	1	PVC	4.85	WT	105	0	8.5
138841	A	6/08/2008	2	PERF	4	AP	105	6	8.5
138841	X	6/08/2008	3	GROU			180	0	5
138841	X	6/08/2008	4	GRAV	5	GR	180	5	8.5
138842	A	6/08/2008	1	PVC	4.85	WT	105	0	27
138842	A	6/08/2008	2	PERF	4	AP	105	6	10
138842	A	6/08/2008	3	PERF	4	AP	105	21	27
138842	X	6/08/2008	4	GROU			180	0	5
138842	X	6/08/2008	5	GRAV	5	GR	180	5	27
138845	A	1/07/2008	1	PVC	4.85	WT	105	0	21
138845	A	1/07/2008	2	SCRN			105	20	21
138845	X	1/07/2008	3	GROU			180	0	5
138845	X	1/07/2008	4	GRAV	5	GR	180	5	21
138867	X	26/08/2009	3	GROU			125	0	8
138834	A	16/09/2008	1	PVC	5.9	WT	125	0	60
138834	A	16/09/2008	2	PERF	2	AP	125	54	60
138834	X	16/09/2008	3	GROU			170	0	6
138867	A	26/08/2009	1	PVC			60	0	34
138867	A	26/08/2009	2	PERF	4	AP	60	28	34
138867	X	26/08/2009	4	GRAV	5	GR	125	8	34
138868	A	26/08/2009	1	PVC			60	0	18
138868	A	26/08/2009	2	PERF	4	AP	60	12	18
138868	X	26/08/2009	3	GROU			125	0	6
138868	X	26/08/2009	4	GRAV	5	GR	125	6	18
138879	A	21/01/2009	4	PERF	0.7	AP	125	66	72
138879	A	21/01/2009	1	PVC	5	WT	125	0	72
138879	A	21/01/2009	2	PERF	0.7	AP	125	30	42
138879	A	21/01/2009	3	PERF	0.7	AP	125	54	60
138879	X	21/01/2009	5	GROU			175	0	5
138879	X	21/01/2009	6	GRAV	5	GR	175	5	72
145017	A	24/05/2007	4	SCRN				12.8	15.3

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145017	A	24/05/2007	2	GROU				0	5
145017	A	24/05/2007	3	GRAV	5	GR		5	15.3
138982	A	24/05/2010	1	PVC	7	WT	140	0	22.5
138982	A	24/05/2010	2	PERF	8	AP	140	19	22
138982	X	24/05/2010	3	GROU			250	0	6
138982	X	24/05/2010	4	FILL			250	6	8.5
138982	X	24/05/2010	5	BNSL			250	8.5	9
138982	X	24/05/2010	6	GRAV	3	GR	250	9	22.5
142757	X	17/09/2006	4	BNSL			175	6	7
142757	A	17/09/2006	1	PVC	5.9	WT	125	0	29
142757	A	17/09/2006	2	PERF	0.25	AP	125	23	29
142757	X	17/09/2006	3	GROU			175	0	6
142757	X	17/09/2006	5	GRAV	5	GR	175	7	39
142757	X	17/09/2006	6	OPEN			175	29	30
142869	X	20/02/2007	2	GRAV	5	GR	185	5	20
142869	A	20/02/2007	1	PVC	5.9	WT	125	0	20
142869	A	20/02/2007	2	PERF	0.4	AP	125	8	20
142869	X	20/02/2007	1	GROU			185	0	5
142869	X	20/02/2007	3	OPEN			85	20	24
142870	A	26/02/2007	1	PVC	5.9	WT	125	0	25
142870	A	26/02/2007	2	PERF	0.4	AP	125	13	25
142870	X	26/02/2007	3	GROU			185	0	5
142870	X	26/02/2007	4	GRAV	5	GR	185	5	25
142906	A	7/12/1999	1	PVC	5.9	WT	125	0	36.6
142905	A	5/12/1999	1	PVC	5.9	WT	125	0	27.4
142905	A	5/12/1999	2	PERF	3	AP	125	21.3	27.4
142905	X	5/12/1999	3	GRAV	5	GR	165	0	27.4
142906	A	7/12/1999	2	PERF	3	AP	125	30.5	36.6
142906	X	7/12/1999	3	GRAV	5	GR	165	0	36.6
145003	A	16/05/2007	3	GRAV				5	41
142914	A	1/05/1999	1	PVC	5.9	WT	125	0	42.7
142914	A	1/05/1999	2	PERF			125	30.5	36.6
142914	A	1/05/1999	3	PERF			125	41.1	42.7
145003	A	16/05/2007	1	PVC	4.85	WT	114	0	41
145003	A	16/05/2007	2	GROU				0	5
145003	A	16/05/2007	4	PERF	4	AP		29	41
145013	A	22/05/2007	1	PVC	4.85	WT	114	0	14
145013	A	22/05/2007	2	GROU				0	5
145013	A	22/05/2007	3	GRAV	5	GR		5	14
145013	A	22/05/2007	4	SCRN			12	12.8	14
145016	A	24/05/2007	1	GROU				0	5
145016	A	24/05/2007	2	GRAV	5	GR		5	24.4
145022	A	9/08/2007	4	PERF	4	AP		32.1	38.1
145022	A	9/08/2007	1	PVC				0	38.1
145022	A	9/08/2007	2	GROU				0	5
145022	A	9/08/2007	3	GRAV	5	GR		5	38.1
145032	A	22/06/2007	1	GROU				0	5
145032	A	22/06/2007	2	FILL				5	98
145068	A	28/06/2007	4	PERF	0.46	AP		15	27
145068	A	28/06/2007	1	PVC	5.9	WT	140	0	27
145068	A	28/06/2007	2	GROU				0	5
145068	A	28/06/2007	3	GRAV	5	GR		5	27
145069	A	20/07/2007	1	PVC	5.9	WT	140	0	18
145069	A	20/07/2007	2	GROU				0	5
145069	A	20/07/2007	3	GRAV	5	GR		5	18
145069	A	20/07/2007	4	PERF	0.46	AP		6	18
145070	A	18/07/2007	1	PVC	5.9	WT	140	0	21
145070	A	18/07/2007	2	GROU				0	5
145070	A	18/07/2007	3	GRAV	5	GR		5	21
145070	A	18/07/2007	4	PERF	0.46	AP		9	21
145071	A	25/07/2007	1	GROU				0	5

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145158	A	16/11/2006	1	GROU				0	5
145158	A	16/11/2006	2	FILL				5	15.5
145096	A	23/07/2007	1	PVC	5.9	WT	140	0	50
145096	A	23/07/2007	2	GROU				0	6
145096	A	23/07/2007	3	BNSL				6	8
145096	A	23/07/2007	5	PERF	4	AP		26	50
145098	A	20/06/2007	1	PVC	5.9	WT	140	0	24
145098	A	20/06/2007	2	GROU				0	5
145098	A	20/06/2007	3	GRAV	5	GR		5	24
145098	A	20/06/2007	4	PERF	0.46	AP		12	24
145099	A	25/06/2007	1	PVC	5.9	WT	140	0	24
145099	A	25/06/2007	2	GROU				0	5
145099	A	25/06/2007	3	GRAV	5	GR		5	24
145099	A	25/06/2007	4	PERF	0.46	AP		12	24
145164	A	5/06/2007	1	PVC	5.9	WT	140	0	24
145164	A	5/06/2007	2	GROU				0	5
145164	A	5/06/2007	3	GRAV	5	GR		5	25
145164	A	5/06/2007	4	PERF	0.46	AP		12	24
145165	A	15/06/2007	1	PVC	5.9	WT	140	0	30
145165	A	15/06/2007	2	GROU				0	5
145165	A	15/06/2007	3	GRAV	5	GR		5	30
145165	A	15/06/2007	4	PERF	0.46	AP		18	30
145166	A	13/06/2007	1	PVC	5.9	WT	140	0	19.5
145166	A	13/06/2007	2	GROU				0	5
145166	A	13/06/2007	3	GRAV	5	GR		5	19.5
145166	A	13/06/2007	4	PERF	0.46	AP		7.5	19.5
145303	A	10/05/2007	4	PERF	0.4	AP		9	21
145303	A	10/05/2007	1	PVC	5.9	WT	140	0	21
145303	A	10/05/2007	2	GROU				0	5
145303	A	10/05/2007	3	GRAV	5	GR		5	21
145218	A	21/03/2007	4	PERF	1.5	AP		97	103
145218	A	21/03/2007	1	PVC	7.65	WT	140	0	121
145218	A	21/03/2007	2	GROU				0	6
145218	A	21/03/2007	3	PERF	1.5	AP		73	85
145218	A	21/03/2007	5	PERF	1.5	AP		115	121
145239	A	18/05/2007	4	PERF	0.4	AP		5.5	17.5
145239	A	18/05/2007	1	PVC	5.9	WT	140	0	17.5
145239	A	18/05/2007	2	GROU				0	5
145239	A	18/05/2007	3	GRAV	5	GR		5	17.5
145240	A	16/05/2007	1	PVC	5.9	WT	140	0	16
145240	A	16/05/2007	2	GROU				0	4
145240	A	16/05/2007	3	GRAV	5	GR		4	16
145240	A	16/05/2007	4	PERF	0.4	AP		4	16
145301	A	3/05/2007	1	PVC	5.9	WT	140	0	23.5
145301	A	3/05/2007	2	GROU				0	5
145301	A	3/05/2007	3	GRAV	5	GR		5	23.5
145301	A	3/05/2007	4	PERF	0.5	AP		17.5	23.5
145302	A	8/05/2007	1	PVC	5.9	WT	140	0	26.5
145302	A	8/05/2007	2	GROU				0	5
145302	A	8/05/2007	3	GRAV	5	GR		5	26.5
145302	A	8/05/2007	4	PERF	0.4	AP		14.5	26.5
145327	A	29/03/2007	2	FILL				5	46.5
145326	A	28/03/2007	1	GROU				0	5
145326	A	28/03/2007	2	FILL				5	45
145327	A	29/03/2007	1	GROU				0	5
145328	A	29/03/2007	1	GROU				0	5
145328	A	29/03/2007	2	FILL				5	28.5
145392	A	18/10/2007	4	GRAV	5	GR		6	85
145392	A	18/10/2007	1	PVC	5.9	WT	140	0	85
145392	A	18/10/2007	2	GROU				0	5
145392	A	18/10/2007	3	BNSL				5	6

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145627	A	2/08/2007	4	PERF	2	AP		6	12
145627	A	2/08/2007	1	PVC	4.85	WT	114	0	36
145627	A	2/08/2007	2	GROU				0	9
145627	A	2/08/2007	3	GRAV	5	GR		9	36
145627	A	2/08/2007	5	PERF	2	AP		30	36
145465	A	27/11/2007	4	PERF	4	AP		25	31
145465	A	27/11/2007	1	PVC	4.85	WT	114	0	49
145465	A	27/11/2007	2	GROU				0	6
145465	A	27/11/2007	3	GRAV	5	GR		6	49
145465	A	27/11/2007	5	PERF	4	AP		43	49
145469	A	16/12/2007	1	FILL				0	2
145469	A	16/12/2007	2	GROU				2	7
145469	A	16/12/2007	3	FILL				7	30
145469	A	16/12/2007	4	GRAV	5	GR		30	110
145581	A	8/11/2007	4	GRAV	5	GR		6	31
145581	A	8/11/2007	1	PVC	5.9	WT	140	0	31
145581	A	8/11/2007	2	FILL				0	5
145581	A	8/11/2007	3	BNSL				5	6
145581	A	8/11/2007	5	PERF	0.76	AP		19	31
145614	A	25/09/2007	1	PVC	4.85	WT	114	0	33
145613	A	4/12/2007	1	GROU				0	5
145613	A	4/12/2007	2	BNSL				5	6
145613	A	4/12/2007	3	FILL				6	80
145614	A	25/09/2007	2	GROU				0	14
145614	A	25/09/2007	3	GRAV	5	GR		14	33
145614	A	25/09/2007	4	PERF	2	AP		27	33
145716	A	21/01/2008	4	GRAV	1.5	GR		3	7
145716	A	21/01/2008	1	PVC				0	7
145716	A	21/01/2008	2	GROU				0	2
145716	A	21/01/2008	3	BNSL				2	3
145716	A	21/01/2008	5	BNSL				7	9
145716	A	21/01/2008	6	PERF	2.5	AP		3	7
145691	A	1/02/2008	4	PERF	2	AP		9.2	15.2
145691	A	1/02/2008	1	PVC	4.85	AP	114	0	15.2
145691	A	1/02/2008	2	GROU				0	5
145691	A	1/02/2008	3	GRAV	5	GR		5	15.2
145691	A	1/02/2008	5	PERF	2	AP		73	79
145714	A	16/01/2008	1	PVC				0	9
145714	A	16/01/2008	2	GROU				0	2
145714	A	16/01/2008	3	BNSL				2	3
145714	A	16/01/2008	4	GRAV	1.5	GR		3	6
145714	A	16/01/2008	5	BNSL				6	9
145714	A	16/01/2008	6	PERF	0.25	AP		3	6
145715	A	16/01/2008	1	PVC				0	7
145715	A	16/01/2008	2	GROU				0	3
145715	A	16/01/2008	3	BNSL				3	4
145715	A	16/01/2008	4	GRAV	1.5	GR		4	7
145715	A	16/01/2008	5	BNSL				7	9
145715	A	16/01/2008	6	PERF	2.5	AP		4	7
145717	A	22/01/2008	1	PVC				0	7
145717	A	22/01/2008	2	GROU				0	3
145717	A	22/01/2008	3	BNSL				3	4
145717	A	22/01/2008	4	GRAV	1.5	GR		4	7
145717	A	22/01/2008	5	FILL				7	8
145717	A	22/01/2008	6	PERF	0.25	AP		4	7
145718	A	24/01/2008	1	PVC				0	7
145718	A	24/01/2008	2	GROU				0	1.5
145718	A	24/01/2008	3	BNSL				1.5	2.5
145718	A	24/01/2008	4	GRAV	1.5	GR		2.5	7
145718	A	24/01/2008	5	BNSL				7	8
145718	A	24/01/2008	6	PERF	0.25	AP		2.5	7

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145719	A	24/01/2008	2	GROU				0	0.5
145719	A	24/01/2008	3	FILL				2	8
145719	A	24/01/2008	4	GRAV	1.5	GR			
145719	A	24/01/2008	5	PERF	0.25	AP		0.5	2
145720	A	24/01/2008	1	PVC				0	3.7
145720	A	24/01/2008	2	GROU				0	0.4
145720	A	24/01/2008	3	BNSL				0.4	1.4
145720	A	24/01/2008	4	GRAV	1.2	GR		1.4	3.7
145720	A	24/01/2008	5	BNSL				3.7	4
145720	A	24/01/2008	6	PERF	0.25	AP		1.4	3.7
145721	A	24/01/2008	1	PVC				0	6
145721	A	24/01/2008	2	GROU				0	0.5
145721	A	24/01/2008	3	BNSL				0.5	1.5
145721	A	24/01/2008	4	GRAV	1.5	GR		1.5	6
145721	A	24/01/2008	5	PERF	0.25	AP		2	6
145981	A	4/05/2007	4	PERF	1	AP	140	34	39.4
145988	X	29/10/2009	1	GROU			200	0	6
145745	A	6/03/2008	1	GROU				0	5
145745	A	6/03/2008	2	GRAV				5	60
145870	A	31/08/2007	1	PVC	5.9	WT	140	0	13
145870	A	31/08/2007	2	GROU				0	5
145870	A	31/08/2007	3	GRAV	5	GR		5	13
145870	A	31/08/2007	4	PERF	0.46	AP		7	13
145981	A	4/05/2007	1	PVC	5.9	WT	140	0	39.4
145981	A	4/05/2007	2	PERF	1	AP	140	7	11
145981	X	4/05/2007	5	GROU			230	0	1.2
145981	X	4/05/2007	6	GROU			190	1.2	5
145981	X	4/05/2007	7	FILL			190	5	6
145981	X	4/05/2007	8	GRAV	4	GR	190	6	39.4
145981	X	4/05/2007	9	CENT			190	7	39.4
145982	X	10/07/2007	4	GRAV	0.625	GR	185	20	34.4
145982	A	10/07/2007	1	PVC	9	WT	185	0	24.4
145982	A	10/07/2007	2	SCRN	0.2	AP	125	24.4	25.9
145982	X	10/07/2007	3	GROU			185	0	5
145982	X	10/07/2007	6	FILL			185	5	20

"RN"	"PIPE"	"RDATE"	"MEAS_POINT"	"PRECISION"	"DATUM"	"ELEVATION"	"SURVEY_SOURCE"
134789	X	5/04/2007	N	GPS	AHD	18	
134791	X	23/03/2007	N	GPS	AHD	48	

"RN"	"PIPE"	"RDATE"	"SAMP_METHOD"	"SOURCE"	"DEPTH"	"CONDUCT"	"DO2"	"EH"	"NO3"	"PH"	"TEMP"	"ALKALINITY"
120306	A	8/03/2004	PU	GB		1100						
120307	A	9/03/2004	PU	GB		2500						
124053	A	8/09/2004	PU	GB		4600						
124800	A	18/07/2005	PU	GB		3200						
133153	A	26/05/2010	AI	GB	11	1300						
133208	A	25/08/2005	PU	GB		4500						
133254	A	16/08/2005	PU	GB		2550						
133294	A	3/11/2005	PU	GB		1500						
133321	A	12/10/2005	PU	GB		1400						
133324	A	14/10/2005	PU	GB		1400						
133405	A	22/10/2007	AI	GB	37	1250						
133742	A	20/03/2006	PU	GB		4000				2.4		
133803	A	26/04/2007	AI	GB	30	3125						
133853	A	23/06/2006	PU	GB		3850				9.5		
133878	A	29/06/2006	PU	GB		1220				7		
134150	A	9/08/2006	PU	GB		2400						
134072	A	3/08/2006	PU	GB		1205				7		
134073	A	8/08/2006	PU	GB		470				8		
134031	A	11/07/2006	PU	GB		1790				7		
134032	A	20/07/2006	PU	GB		890				7		
134034	A	23/08/2006	PU	GB		2050				7		
134119	A	24/07/2006	PU	GB		1300						
134120	A	25/07/2006	PU	GB		2100						
134152	A	10/08/2006	PU	GB		700						
134161	A	19/09/2006	PU	GB		1580				8		
134369	A	18/10/2006	PU	GB		500						
134379	A	2/11/2006	PU	GB		2000						
134431	A	16/11/2006	PU	GB		2060				7		
134497	A	1/11/2006	PU	GB		1800						
134512	A	9/12/2006	PU	GB		627				7		
134515	A	16/12/2006	PU	GB		10280				7		
134709	A	5/02/2007	PU	GB		5390				7		
134710	A	8/02/2007	PU	GB		980				7		
134644	A	27/11/2006	PU	GB		3000						
134645	A	28/11/2006	PU	GB		3000						
134646	A	28/11/2006	PU	GB		3000						
134706	A	23/01/2007	PU	GB		912				8		
134728	A	20/12/2006	PU	GB		305				6		
134780	A	19/02/2007	PU	GB		300						
134789	A	5/04/2007	PU	GB	10	441				6.5		

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79381					2	RP179844	496736	6954675	56	UNKN		-27.5316	152.967
120212	19/12/2003	N.SCELLS	S.H.SCELLS	ROTARY AIR	2	RP93668	492811	6959258	56			-27.4903	152.9273
120306	8/03/2004	STEVEN MATHAMS	SR & JL MATHAMS	ROTARY AIR	1	RP63970	498683	6954675	56			-27.5318	152.9868
120307	9/03/2004	STEVEN MATHAMS	SR & JL MATHAMS	ROTARY AIR	1	RP67919	498629	6954799	56			-27.5305	152.9862
120571	2/07/2004	M.KIRCHNER	M.V.E KIRCHNER	CABLE TOOL	56	RP223391	500631	6955106	56	UNKN		-27.5277	153.0063
120572	13/07/2004	M.KIRCHNER	M.V.E KIRCHNER	CABLE TOOL	56	RP223391	500631	6955106	56	UNKN		-27.5277	153.0063
124053	8/09/2004	MAX RITTER	AARMAX DRILLING P/L	ROTARY AIR	2	RP146859	497285	6952983	56	GPS	10	-27.547	152.9724
124116	16/09/2004	S.MATHAMS	SR & JL MATHAMS	ROTARY AIR	1	RP103660	496952	6954918	56	GPS	10	-27.5295	152.9691
124173	24/08/2004	CALING, DESMOND LESLIE	ABUNDANT WATER SOLUTIONS	ROTARY AIR	8	RP79086	495689	6957524	56	UNKN		-27.5059	152.9564
124266	16/12/2004	JOHNSON, MAURICE JOHN	BROOKFIELD DRILLING	ROTARY AIR	16	RP70289	492206	6958357	56	GPS	10	-27.4984	152.9211
124277	27/10/2004	CALING, DESMOND LESLIE	ABUNDANT WATER SOLUTIONS	ROTARY AIR	2	RP71078	494273	6955469	56	GPS	10	-27.5245	152.942
124312	27/01/2005	DICKSON, KEITH JOHN	BELLDALE ENTERPRISES	ROTARY AIR	2	RP116686	499388	6959151	56	GPS	10	-27.4913	152.9938
124313	28/01/2005	DICKSON, KEITH JOHN	BELLDALE ENTERPRISES	ROTARY AIR	1	RP71381	499408	6959214	56	GPS	10	-27.4907	152.994
124556	8/04/2005	BEIL, GARRY IAN	JUST DRILLING	ROTAYR AIR	4	RP37949	501087	6955655	56	UNKN		-27.5228	153.011
124800	18/07/2005	SCHUMACHER, EVAN LYALL	DRILLPOWER QLD	ROTARY AIR	2	RP101929	496816	6955567	56	GPS	10	-27.5236	152.9678
124911	30/10/2009		KA & LC DIPPEL	CABLE TOOL	0	BUP9746	500365	6958947	56	GPS	10	-27.4931	153.0037
133034	22/11/2006	HOFFMANN, GRAEME ASHLEY	HOFFMAN DRILLING	ROTARY AIR	6	RP18899	497920	6960725	56	GPS	10	-27.4771	152.9789
133075	1/12/2006	HOFFMAN	HOFFMAN DRILLING	ROTARY AIR	6	RP18899	498001	6960764	56	GPS	10	-27.4767	152.9798
133115	25/02/2010		NUMAC DRILLING	AUGER	1	RP129954	498354	6954522	56	GPS	10	-27.5331	152.9833
133116	26/02/2010		NUMAC DRILLING	AUGER & ROTARY AIR	1	RP129954	498373	6954554	56	GPS	10	-27.5328	152.9835
133120	8/04/2010			AUGER	1	RP129954	498325	6954550	56	SKET	10	-27.5328	152.983
133121	8/04/2010			AUGER	1	RP129954	498319	6954520	56	SKET	10	-27.5331	152.983
133122	9/04/2010			AUGER	1	RP129954	498355	6954538	56	SKET	10	-27.5329	152.9833
133153	26/05/2010	WAYNE RICHTER	WAYNE RICHTER DRILLING	ROTARY AIR	1	RP71959	496795	6955737	56	GPS	4	-27.5221	152.9675
133198	28/05/2008	GARRY BEIL	JUST DRILLING	ROTARY AIR	2	RP814505	495003	6958293	56			-27.499	152.9494
133208	25/08/2005	JOHNSON, MAURICE JOHN	BROOKFIELD DRILLING	ROTARY MUD	3	RP172219	500323	6955270	56	GPS	10	-27.5263	153.0033
133254	16/08/2005	COOPER, PATRICK	BUSHMENS DRILLING	ROTARY AIR	1	RP103660	496918	6954914	56	GPS	10	-27.5295	152.9688
133294	3/11/2005	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	8	RP150355	494587	6958505	56	GPS	10	-27.4971	152.9452
133321	12/10/2005	JOHNSON, MAURICE JOHN	BROOKFIELD DRILLING	ROTARY AIR	11	RP817676	494773	6957543	56	GPS	10	-27.5058	152.9471
133323	12/10/2005	JOHNSON, MAURICE JOHN	BROOKFIELD DRILLING	ROTARY AIR	11	RP89216	494732	6957561	56	GPS	10	-27.5056	152.9467
133324	14/10/2005	JOHNSON, MAURICE JOHN	BROOKFIELD DRILLING	ROTARY AIR	11	RP89216	494755	6957562	56	GPS	10	-27.5056	152.9469
133366	29/05/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING CO.	ROTARY AIR	1	RP176994	497299	6955426	56	UNKN		-27.5249	152.9726
133405	22/10/2007	STEV MATHAMS	DRILLPOWER	ROTARY AIR	1722	RP123764	492950	6954623	56			-27.5321	152.9286
133433	18/04/2008	N SCELLS	SH SCELLS	CABLE TOOL	102	RP29418	499090	6955568	56	GPS	10	-27.5236	152.9908
133704	19/01/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	3	RP104025	496379	6956583	56	GPS	10	-27.5144	152.9633
133735	8/03/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING CO.	ROTARY AIR	5	SP146655	498652	6957246	56	GPS	10	-27.5085	152.9864
133741	16/02/2006	JOHNSON, MAURICE JOHN	BROOKFIELD WATER DRILLING	ROTARY AIR	6	RP95353	496950	6952768	56	GPS	10	-27.5489	152.9691
133742	20/03/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD WATER DRILLING	ROTARY AIR	20	RP80726	493064	6959373	56	UNKN		-27.4892	152.9298
133799	17/02/2006	BEIL, GARRY IAN	JUST DRILLING	ROTARY AIR	1	RP73651	492828	6959635	56	UNKN		-27.4869	152.9274
133803	26/04/2007	S MATHAMS	DRILLPOWER	ROTARY AIR	1	SP213850	500055	6958178	56	GPS	4	-27.5001	153.0006
133826	27/08/2007		GEOPROBE	ROTARY AIR	1	RP18743	499124	6959730	56			-27.486	152.9911
133827	28/08/2007		GEOPROBE	ROTARY AIR	30	RP18712	499122	6959691	56	GPS	10	-27.4864	152.9911
133828	29/08/2007		GEOPROBE	ROTARY AIR	30	RP18712	499149	6959691	56	GPS	10	-27.4864	152.9914
133853	23/06/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING CO.	ROTARY AIR	47	RP23406	498119	6957469	56	GPS	10	-27.5064	152.981
133864	12/05/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	95	RP29380	497131	6956524	56	GPS	10	-27.515	152.971
133878	29/06/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING	ROTARY AIR	89	RP127450	494015	6955596	56	GPS	10	-27.5233	152.9394
133900	17/02/2006	BEIL, GARRY IAN	JUST DRILLING	ROTARY AIR	1	RP73651	492835	6959636	56	UNKN		-27.4869	152.9275

"RN"	"DRILLED_DATE"	"DRILLER_NAME"	"DRILLING_COMP"	"METHOD_CONST"	"LOT"	"PLAN"	"EASTING"	"NORTHIN(	"ZONE"	"ACCURAC	"GPS_ACC(	"GIS_LAT"	"GIS_LNG"
133948	21/04/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	11	SP178019	496789	6955259	56	UNKN		-27.5264	152.9675
133976	24/05/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMP.	ROTARY AIR	7	RP905752	497036	6954995	56	GPS	10	-27.5288	152.97
134031	11/07/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY AIR	6	RP87287	494622	6957508	56	GPS	10	-27.5061	152.9455
134032	20/07/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING CO.	ROTARY AIR	1	RP93497	497012	6962603	56	GPS	10	-27.4601	152.9698
134034	23/08/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING CO.	ROTARY AIR	20	RP113595	498333	6957102	56	SKET		-27.5098	152.9831
134049	5/04/2007	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	2	RP106099	499333	6959449	56			-27.4886	152.9933
134058	28/04/2007	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	9	RP19753	498641	6960322	56			-27.4807	152.9862
134072	3/08/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY MUD	24	RP29355	497109	6957317	56	GPS	10	-27.5078	152.9707
134073	8/08/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY MUD	2	RP40770	497121	6957324	56	GPS	10	-27.5078	152.9708
134119	24/07/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	1	SP163132	495584	6955598	56	GPS	10	-27.5233	152.9553
134120	25/07/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	27	SP169761	496557	6954941	56	UNKN		-27.5293	152.9651
134150	9/08/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	16	RP89216	494761	6957841	56	UNKN		-27.5031	152.947
134152	10/08/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	2	RP842225	494513	6957813	56	GPS	10	-27.5033	152.9444
134161	19/09/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING CO.	ROTARY AIR	1	RP87287	494420	6957466	56	GPS	10	-27.5065	152.9435
134163	5/09/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING CO.	ROTARY AIR	11	RP87922	492589	6958664	56	GPS	10	-27.4956	152.925
134180	26/09/2006	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY MUD	1	RP112964	496891	6956824	56	SKET		-27.5123	152.9685
134216	29/09/2006	SCHUMACHER, EVAN LYALL	DRILLPOWER	ROTARY AIR	4	RP29720	497634	6953949	56	GPS	10	-27.5382	152.976
134243	11/10/2006	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY MUD	18	RP880312	495262	6955102	56	GPS	10	-27.5278	152.952
134289	19/10/2006	SCHUMACHER, EVAN L	DRILLPOWER	ROTARY AIR	17	SP154502	494982	6954836	56	UNKN		-27.5302	152.9492
134343	4/10/2006	CROWSON, MARK ANTHONY	AAA WATER BORES	ROTARY AIR	9	SP128757	500254	6955494	56	UNKN		-27.5243	153.0026
134365	12/10/2006	MATHAMS, STEVEN R	DRILLPOWER	ROTARY AIR	3	RP54441	498171	6959179	56	GPS	10	-27.491	152.9815
134369	18/10/2006	MATHAMS, STEVEN R	DRILLPOWER	ROTARY AIR	4	RP119278	496968	6962077	56	GPS	10	-27.4648	152.9693
134379	2/11/2006	MATHAMS, STEVEN R	DRILLPOWER	ROTARY AIR	17	RP106213	499186	6957368	56	GPS	10	-27.5074	152.9918
134431	16/11/2006	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY AIR	1	RP71593	496577	6954797	56	GPS	10	-27.5306	152.9653
134465	6/09/2006	COOPER, PATRICK	BUSHMENS DRILLING	ROTARY AIR	1	RP89775	492335	6956308	56	GPS	10	-27.5169	152.9224
134488	27/11/2006	MATHAMS, STEVEN R	DRILLPOWER	ROTARY AIR	18	RP106213	499232	6957370	56	GPS	10	-27.5073	152.9922
134497	1/11/2006	SCHUMACHER, EVAN L	DRILLPOWER	ROTARY AIR	21	RP70506	498636	6957145	56	GPS	10	-27.5094	152.9862
134502	9/11/2006	SCHUMACHER, EVAN L	DRILLPOWER	ROTARY AIR	42	RP802755	494114	6958996	56	UNKN		-27.4926	152.9404
134512	9/12/2006	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY MUD	32	RP29355	497075	6957236	56	SKET		-27.5085	152.9704
134515	16/12/2006	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY MUD	93	RP29370	497126	6956813	56	GPS	10	-27.5124	152.9709
134569	17/11/2006	BEIL, GARRY IAN	JUST DRILLING	ROTARY AIR	18	RP20541	498360	6961493	56	GPS	10	-27.4701	152.9834
134644	27/11/2006	CROWSON, MARK A	AAA WATER BORES	ROTARY MUD	2	RP98782	497566	6957260	56	SKET		-27.5083	152.9754
134645	28/11/2006	CROWSON, MARK A	AAA WATER BORES	ROTARY MUD	7	RP221646	497591	6957264	56	UNKN		-27.5083	152.9756
134646	28/11/2006	CROWSON, MARK A	AAA WATER BORES	ROTARY MUD	2	RP88304	497546	6957280	56	SKET		-27.5082	152.9751
134706	23/01/2007	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY AIR & ROTARY I	1	RP160565	493346	6955281	56	GPS	10	-27.5262	152.9326
134709	5/02/2007	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY AIR	51	RP890364	501245	6955899	56	GPS	10	-27.5206	153.0126
134710	8/02/2007	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY AIR	16	RP109134	494534	6956154	56	GPS	10	-27.5183	152.9447
134728	20/12/2006	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO	ROTARY MUD	1	RP99852	497066	6957018	56	SKET		-27.51	152.97
134729	18/01/2007	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY AIR	6	SP161441	492967	6955691	56	GPS	10	-27.5225	152.9288
134730	13/02/2007	KROEHNERT, STEPHEN W	BROOKFIELD DRILLING CO.	ROTARY AIR	50	RP81610	493961	6956905	56	SKET		-27.5115	152.9389
134779	16/02/2007	MATHAMS, STEVEN R	DRILLPOWER	ROTARY AIR	5	RP89818	496622	6955838	56	GPS	10	-27.5212	152.9658
134780	19/02/2007	MATHAMS, STEVEN R	DRILLPOWER	ROTARY AIR	5	RP89818	496717	6955865	56	GPS	10	-27.5209	152.9668
134789	5/04/2007	KROEHNERT, SW	BROOKFIELD DRILLING CO	ROTARY MUD	6	SP141283	497187	6957416	56	GPS	200	-27.5069	152.9715
134790	23/03/2006	STEPHEN KROEHNERY	BROOKFIELD DRILLING CO	ROTARY AIR	6	RP89006	496734	6955508	56			-27.5241	152.9669
134791	23/03/2007	KROEHNERT, SW	BROOKFIELD DRILLING CO	HAMMER	80	RP837688	491749	6957195	56	GPS	200	-27.5089	152.9165
134944	6/03/2007	EVAN SCHUMACHER	DRILLPOWER	ROTARY AIR	12	RP23485	497680	6958694	56			-27.4954	152.9765
134961	15/02/2007	STEVEN MATHAMS	DRILLPOWER	ROTARY AIR	1	RP59120	496884	6955433	56			-27.5248	152.9684

"RN"	"DRILLED_DATE"	"DRILLER_NAME"	"DRILLING_COMP"	"METHOD_CONST"	"LOT"	"PLAN"	"EASTING"	"NORTHIN"	"ZONE"	"ACCURAC	"GPS_ACC"	"GIS_LAT"	"GIS_LNG"
134982	31/07/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING CO.	ROTARY AIR	6	RP61512	500770	6957122	56			-27.5096	153.0078
134984	13/08/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING CO.	ROTARY AIR	28	SP173807	493705	6957592	56			-27.5053	152.9363
138505	3/11/2008	DIPPEL, KENNETH ALLAN	KA & LC DIPPEL	ROTARY AIR	381	SL7069	495446	6956367	56	GPS	10	-27.5164	152.9539
138586	9/07/2007	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY MUD	77	RP29355	497131	6957288	56	SKET		-27.5081	152.9709
138692	2/12/2008	COWLEY, GRAHAM MICHAEL	CORING DRILLING	ROTARY AIR	9	RP11232	500988	6959660	56	GPS	10	-27.4867	153.01
138804	28/11/2006	COWLEY, GRAHAM MICHAEL	CORING DRILLING	ROTARY AIR	3	RP54988	498798	6962095	56			-27.4647	152.9878
138821		COWLEY, GRAHAM MICHAEL	CORING DRILLING	ROTARY AIR	715	RP109858	493485	6955008	56	GPS	10	-27.5286	152.934
138834	16/09/2008	GRAFFUNDER, STUART	CORING DRILLING	ROTARY AIR	2	RP106099	499342	6959447	56	GPS	10	-27.4886	152.9933
138841	6/08/2008	GRAFFUNDER, TREVOR	CORING DRILLING	ROTARY AIR	1	RP912904	496307	6957326	56	GPS	10	-27.5077	152.9626
138842	6/08/2008	GRAFFUNDER, TREVOR	CORING DRILLING	ROTARY AIR	1	RP912904	496343	6957325	56	SKET		-27.5077	152.963
138844	17/06/2008	GRAFFUNDER, TREVOR	CORING DRILLING	ROTARY AIR	325	RP73583	499904	6958197	56	GPS	10	-27.4999	152.999
138845	1/07/2008	GRAFFUNDER, TREVOR	CORING DRILLING	ROTARY AIR	708	RP109858	493658	6955001	56	GPS	10	-27.5287	152.9358
138867	26/08/2009	MATHAMS, STEVEN ROBERT	DRILLPOWER	ROTARY AIR	423	SL9930	496751	6958273	56	UNKN		-27.4992	152.9671
138868	26/08/2009	MATHAMS, STEVEN ROBERT	DRILLPOWER	ROTARY AIR	423	SL9930	496762	6958259	56	UNKN		-27.4993	152.9672
138879	21/01/2009	BEIL, GARRY IAN	JUST DRILLING	ROTARY AIR	16	RP23470	497829	6957598	56	UNKN		-27.5053	152.978
138982	24/05/2010	CZISLOWSKI, ALAN	CZISO DRILLING & BORE CLEANING	ROTARY MUD	2	RP149808	499262	6956328	56			-27.5167	152.9925
142757	17/09/2006	B SAINSBURY	WIZARD DRILLING	ROTARY MUD	28	SP157303	497060	6957291	56	GPS	10	-27.5081	152.9702
142869	20/02/2007	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY MUD	67	RP29355	497097	6957174	56	GPS	10	-27.5091	152.9706
142870	26/02/2007	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY MUD	1	RP113170	497157	6957357	56	GPS	10	-27.5075	152.9712
142905	5/12/1999	REAVES, LESTER JOHN	REAVES DRILLING	ROTARY AIR	1	RP191082	497783	6958872	56			-27.4938	152.9776
142906	7/12/1999	REAVES, LESTER JOHN	REAVES DRILLING	ROTARY AIR	1	RP191082	497786	6958872	56			-27.4938	152.9776
142907	7/12/1999	REAVES, LESTER JOHN	REAVES DRILLING	ROTARY AIR	1	RP191082	497790	6958872	56			-27.4938	152.9776
142914	1/05/1999	KOWALTZKE, JASON BEVAN IVAN	KOWALTZKE DRILLING	ROTARY AIR	537	RP23342	500100	6957933	56			-27.5023	153.001
145003	16/05/2007	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	21	RP20106	498761	6962039	56			-27.4652	152.9875
145013	22/05/2007	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	1	RP47766	500312	6958995	56			-27.4927	153.0032
145016	24/05/2007	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	1	RP37738	499108	6955189	56			-27.527	152.991
145017	24/05/2007	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	2	RP95650	499429	6955148	56			-27.5274	152.9942
145022	9/08/2007	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	10	RP11232	500977	6959659	56			-27.4867	153.0099
145032	22/06/2007	MAURICE JOHNSON	AUSTFLO WATER	ROTARY AIR	4	RP97267	498451	6953238	56			-27.5446	152.9843
145068	28/06/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	1	RP98973	497186	6957010	56			-27.5106	152.9715
145069	20/07/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	83	RP29355	497176	6957325	56			-27.5077	152.9714
145070	18/07/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	B	RP125124	497260	6957442	56			-27.5067	152.9723
145071	25/07/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	2	RP102006	497440	6955320	56			-27.5258	152.9741
145096	23/07/2007	EVAN SCHUMACHER	DRILLMARK	ROTARY AIR	6	RP68891	497087	6961839	56			-27.467	152.9705
145098	20/06/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	1	RP122004	497722	6957154	56			-27.5093	152.9769
145099	25/06/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	132	RP29380	497276	6956485	56			-27.5153	152.9724
145158	16/11/2006	GRAHAM COWLEY	CORING DRILLING	ROTARY AIR	715	RP109858	493481	6954997	56			-27.5287	152.934
145164	5/06/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	11	SP173514	496884	6956627	56			-27.514	152.9685
145165	15/06/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	57	RP29380	497030	6956540	56			-27.5148	152.9699
145166	13/06/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	7	RP111086	496912	6956963	56			-27.511	152.9687
145218	21/03/2007	JASON SUTTON	AAA WATER BORES	ROTARY AIR	56	RP187367	499165	6956945	56			-27.5112	152.9915
145239	18/05/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	39	RP29355	497033	6957165	56			-27.5092	152.97
145240	16/05/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	1	RP111086	496943	6956972	56			-27.5109	152.969
145301	3/05/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	17	RP101975	496915	6956531	56			-27.5149	152.9688
145302	8/05/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	2	RP121212	496888	6956743	56			-27.513	152.9685
145303	10/05/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY MUD	3	RP121212	496903	6956730	56			-27.5131	152.9686
145326	28/03/2007	STEVEN MATHAMS	DRILLPOWER	ROTARY AIR	6	RP95353	497080	6952792	56			-27.5487	152.9704

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145327	29/03/2007	STEVE MATHAMS	DRILLPOWER	ROTARY AIR	140	RP23531	496854	6957618	56			-27.5051	152.9681
145328	29/03/2007	STEVE MATHAMS	DRILLPOWER	ROTARY AIR	140	RP23531	496900	6957622	56			-27.5051	152.9686
145392	18/10/2007	STEPHEN KROEHNERT	BROOKFIELD DRILLING COMPANY	ROTARY AIR	10	RP228420	491982	6956438	56			-27.5157	152.9188
145465	27/11/2007	COWLEY, GRAHAM MICHAEL	COR-ING DRILLING	ROTARY AIR	12	RP23285	499547	6959189	56			-27.4909	152.9954
145469	16/12/2007	GRAFFUNDER, STUART	COR-ING DRILLING	ROTARY AIR	19	SP108381	500477	6956552	56			-27.5147	153.0048
145581	8/11/2007	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY AIR	2	RP179844	496711	6954728	56			-27.5312	152.9667
145613	4/12/2007	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY AIR	56	RP108370	495268	6956386	56			-27.5162	152.9521
145614	25/09/2007	GRAFFUNDER, STUART	CORING DRILLING	ROTARY AIR	19	RP187363	499426	6957074	56			-27.51	152.9942
145627	2/08/2007	GRAFFUNDER, STUART	CORING DRILLING	ROTARY AIR	14	RP23285	499564	6959182	56			-27.491	152.9956
145691	7/02/2008	GRAFFUNDER, STUART	CORING DRILLING	ROTARY AIR	0	BUP10145	500862	6959042	56			-27.4922	153.0087
145714	16/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494105	6957347	56			-27.5075	152.9403
145715	16/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494100	6957347	56			-27.5075	152.9403
145716	21/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494112	6957340	56			-27.5076	152.9404
145717	22/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494119	6957340	56			-27.5076	152.9405
145718	24/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494138	6957351	56			-27.5075	152.9406
145719	24/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494149	6957356	56			-27.5075	152.9408
145720	24/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494135	6957342	56			-27.5076	152.9406
145721	24/01/2008	TYNDALL, ROY MARTIN		ROTARY AIR	406	SL8848	494118	6957338	56			-27.5076	152.9404
145745	6/03/2008	COWLEY, GRAHAM MICHAEL	CORING DRILLING	ROTARY AIR	356	RP105229	493992	6954522	56			-27.533	152.9392
145870	31/08/2007	KROEHNERT, STEPHEN WILLIAM	BROOKFIELD DRILLING COMPANY	ROTARY MUD	66	RP29383	497933	6956362	56			-27.5164	152.9791
145981	4/05/2007	DIPPEL, KENNETH ALLAN	KA & LC DIPPLE	ROTRAY AIR	5	RP77666	492016	6956024	56			-27.5195	152.9192
145982	10/07/2007	BIRD, GEOFFREY CLARENCE	BURNETT & GLADSTONE DRILLING	ROTARY MUD	6	RP187663	496859	6956464	56	GPS	10	-27.5154	152.9683
145988	29/06/2009	MATHAMS, STEVEN ROBERT	DRILLPOWER		6	SP219639	493096	6958238	56			-27.4995	152.9301

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
120212	1	BROWN MOD STIFF CLAY & WEATHERED	0	2
120212	2	LIGHT GREY ROCK	1.75	2.5
120212	3	DARK BLUE SOFT SCHIST TYPE ROCK	2.5	11
120212	4	DARK BLUE MOD DAMP-HARD SCHIST ROCK	11	48
120306	1	BROWN CLAY	0	2
120306	2	YELLOW BROWN CLAY	2	8
120306	3	GRAVELLY CLAY YELLOW AND PINK	8	15
120306	4	BLACK GREY CLAY	15	19.5
120306	5	BLUE SAND *	19.5	21.2
120307	1	GRAVELLY CLAY (FILL)	0	3
120307	2	YELLOW CLAY	3	7.5
120307	3	GREY WHITE SHALE	7.5	16.5
120307	4	FRACTURED SHALE *	16.5	21.2
120307	5	HARD SHALE	21.2	22.7
120571	4	BROWN CLAY	3	6
120571	1	DARK BROWN TOP SOIL	0	1
120571	2	BROWN CLAY WITH YELLOW STREAKS	1	2
120571	3	SILTY LOAM	2	3
120571	5	VERY SANDY LOAM	6	11.4
120571	6	DIRTY SMALL GRAVEL	11.4	13
120571	7	CLEAN GRAVEL *	13	16
120571	8	LARGE CLAY BOUND GRAVEL	16	17.4
120572	1	LOAMY TOPSOIL	0	1
120572	2	SANDY LOAM	1	7.5
120572	3	SAND/GRAVEL *	7.5	15.3
124053	5	YELLOW CLAY *	30	31
124053	1	TOP SOIL	0	3
124053	2	BROWN CLAY	3	20
124053	3	BROWN SANDSTONE	20	23
124053	4	RED CLAY	23	30
124053	6	RED CLAY	31	33
124173	4	GREY WACKYE *	20	85
133115	1	ROCKY CLAY	0	10
124116	1	SANDY CLAY YELLOW ORANGE	0	6
124116	2	GREY CLAY	6	12
124116	3	GREY SHALE	12	42
124173	1	LOOSE SOIL	0	4
124173	2	PHORPHYRY	4	6
124173	3	PHORPHYRY	6	20
124173	5	GREY WACKYE	85	104
124266	4	GREY SHALE	18	33
124266	1	TOPSOIL	0	0.5
124266	2	BROWN WEATHERED	0.5	7
124266	3	GREY SHALE SMALL SOAK *	7	18
124266	5	BLACK SHALE	33	35
124266	6	GREY SHALE	35	37
124266	7	BLACK SHALE	37	72
124277	4	QUARTZ AND BASALT	40	100
124277	1	PHONTRY	0	10
124277	2	GREY WACKIE	10	30
124277	3	BLACK ASH	30	40
124277	5	BASALT	100	125
124277	6	QUARTZ AND BASALT	125	150
124312	4	BROWN CLAY *	2.6	4
124312	1	BASALT	0	0.3
124312	2	RUBBLE AND BROWN CLAY FILL	0.3	1
124312	3	BROWN SANDY CLAY	1	2.6
124312	5	DARK GREY CLAY	4	7

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
124313	1	TOPSOIL	0	0.2
124556	4	BROWN CLAY	3	4
124313	2	BROWN SANDY CLAY	0.2	5.8
124313	3	DARK GREY CLAY *	5.8	10.5
124556	1	BROWN CLAY	0	1
124556	2	BROWN CLAY	1	2
124556	3	BROWN CLAY	2	3
124556	5	BROWN CLAY	4	5
124556	6	BROWN CLAY	5	6
124556	7	STONEY BROWN CLAY	6	7
124556	8	STONEY BROWN CLAY	7	8
124556	9	STONEY BROWN CLAY	8	9
124556	10	GRAVELY STONEY CLAY	9	10
124556	11	GRAVEL AND STONE CLAY	10	11
124556	12	GRAVEL AND STONE CLAY	11	12
124556	13	GRAVEL AND STONE CLAY	12	16
124556	14	GRAVEL AND STONE CLAY	16	18
124556	15	BROWN HARD CLAY STONE AQUIFIER AT 16M	18	19
124911	3	SILTY	5	8.8
124800	1	TOP SOIL	0	1
124800	2	CLAY	1	9
124800	3	BLUE ROCK *	9	22
124911	1	SANDY TOPSOIL	0	0.8
124911	2	CLAY	0.8	5
124911	4	FINE SILTY GREY SAND	8.8	10.8
124911	5	FINE SILTY GREY SAND WITH SMALL FLOW	10.8	11
124911	6	GREY CLAY	11	13.3
124911	7	BROWN SILTY CLAY	13.3	14.4
124911	8	BROWN FIRM SAND WITH LARGER FLOW	14.4	14.8
124911	9	BROWN CLAY	14.8	17
124911	10	BORE DCOMMISSIONED - TOO SALTY		
133116	1	GRAVELLY CLAY	0	3.8
133116	2	SANDSTONE	3.8	8
133120	1	GRAVELLY CLAY	0	3
133120	2	CALCRETE	3	3.5
133120	3	GRAVELLY CLAY	3.5	8.5
133121	1	GRAVELLY SAND	0	3.5
133121	2	CALCRETE	3.5	4
133121	3	GRAVELLY SAND	4	9
133122	1	GRAVELLY CLAY	0	3
133122	2	CALCRETE LAYER	3	5
133122	3	GRAVELLY CLAY	5	7
133741	4	GREY CLAY	14	25
133741	1	TOPSOIL	0	1
133741	2	BROWN CLAY	1	8
133741	3	BLACK CLAY	8	14
133741	5	RED CLAY SMALL HARD BANDS	25	54
133034	4	SCHISTY BLUE ROCK DARK GREY HARD, WIITH QUARTZ STRINGERS VERY HARD	13	118
133034	1	BROWN CLAY	0	1
133034	2	WEATHERED SCHIST BROWN	1	7
133034	3	BROWN AND GREY SCHIST, WEATHERED FIRM	7	13
133034	5	BLUE METAL DARK GREY AND QUARTZ SOFTER	118	121
133034	6	BLUE METAL AND QUARTZ STRINGERS VERY HARD	121	156
133034	7	SMOKEY QUARTZ AND BLUE METAL GREY	156	168
133034	8	BLUE METAL WITH SMOKEY QUARTZ BANDS	168	180
133075	4	SHALE, BROWN/ GREY	11	12
133034	901	SUPPLY OF 0.1 L/S OBTAINED LOCATION OF WATER BED NOT SPECIFIED		
133034	902	HOLE ABANDONED		

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
133075	1	CLAY, BROWN	0	1
133075	2	GRAVEL WITH QUARTZ PEBBLES, LOOSE	1	6
133075	3	CLAY, GREY, INCLUDING SHALE/ SCHIST, LOOSE	6	11
133075	5	SCHIST, LIGHT GREY/ GREY	12	18
133075	6	DARK GREY FINE GRAINED SCHIST WITH QUARTZ GRAINS HARD	18	45
133075	10	QUARTZ AND SCHIST, QUARTZ IS SMOKEY COLOURED	67	70
133153	3	FINE BROWN SANDY LOAM	5.5	20
133075	7	LIGHT GREY FINE GRAINED SCHIST WITH LARGE QUARTZ PEBBLES & PYRITE GRAINS	45	48
133075	8	LIGHT GREY AND GREENISH SCHIST WITH MINOR QUARTZ STRINGERS	48	61
133075	9	DARK GREY SCHIST AND QUARTZ STRINGER FRACTURED	61	67
133153	1	RED BROWN LOAMY SOIL	0	4
133153	2	DARK BROWN LOAMY SOIL	4	5.5
133153	4	STIFF BROWN CLAY	20	22
133208	4	CONGLOMERATE *	22	36
133208	1	RED CLAY	0	2
133208	2	BROWN CLAY	2	12
133208	3	GRAVEL	12	22
133254	4	SOFT BROWN ROCK	8.4	19.6
133254	1	BROWN CLAY	0	1
133254	2	CLAYEY LOAM	1	4
133254	3	GREY CLAYEY GRAVEL	4	8.4
133254	5	BLUE ROCK *	19.6	27.2
133254	6	YOUNG BASALT *	27.2	37.2
133294	4	QUARTZY SHALE *	42	54
133294	1	TOP SOIL	0	1
133294	2	CLAY	1	2
133294	3	BLACK SHALE	2	42
133321	4	BLACK SHALE *	6	12
133321	1	TOPSOIL	0	1
133321	2	CLAY WITH GRAVEL	1	3
133321	3	GRAVEL	3	6
133321	5	BLACK SHALE *	12	54
133321	6	GREY SHALE WITH QUARTZ	54	60
133323	1	TOPSOIL	0	1
133323	2	BROWN CLAY WITH SMALL GRAVEL	1	4
133323	3	WEATHERED SHALE *	4	8
133323	4	BLACK SHALE	8	58
133323	5	GREY SHALE	58	66
133324	1	TOPSOIL	0	1
133324	2	CLAY AND GRAVEL *	1	3
133324	3	GRAVEL *	3	6
133324	4	BLACK AND SHALE *	6	30
133366	4	SHALE (GREY) *	10	36
133366	1	TOPSOIL	0	1
133366	2	CLAY (BROWN)	1	8
133366	3	CLAY (GRAVEL)	8	10
133366	5	SHALE (BLUE)	36	48
133405	4	FRACTURE IN SHALE WB	25	26
133405	1	TOPSOIL	0	4
133405	2	YELLOW CLAY	4	11
133405	3	SHALE	11	25
133405	5	SHALE	26	37
133405	6	FRAZCTURE IN SHALE WB	37	38
133433	5	LIGHT BROWN VERY SANDY CLAY TRACES OF CLAYEY SAND	10	10.5
133405	7	SHALE	38	41
133433	1	FILL DARK GREY STIFF CLAY	0	0.5
133433	2	DARK BROWN MODERATELY STIFF CLAY	0.5	2
133433	3	DARK BROWN MODERATELY STIFF TO STIFF MOTTLEY CRUMBLY CLAY	2	7.5

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
133433	4	LIGHT BROWN MOTTLEY MODERATELY STIFF CLAY	7.5	10
133433	6	DARK BROWN STIFF CLAY	10.5	12.75
133433	7	LIGHT BROWN MOTTLEY MODERATELY STIFF CLAY	12.75	17.5
133433	8	LIGHT BROWN VERY CLAYEY FINE AND MEDIUM SAND TRACES OF FINE GRAVEL	17.5	18.25
133433	901	HOLE BACKFILLED AFTER HIGHLY SALINE WATER FOUND		
133735	3	GRAVEL AND CLAY	3	4
133704	1	TOPSOIL	0	1
133704	2	GRAVELY CLAY	1	3
133704	3	SHALE BLUE	3	72
133735	1	TOPSOIL	0	1
133735	2	CLAY AND GRAVEL	1	3
133735	4	CLAY	4	9
133735	5	BLUE SHALE	9	60
133742	1	TOPSOIL	0	1
133742	2	CLAY BROWN	1	2
133742	3	CLAY	2	4
133742	4	BLUE SHALE	4	52
133742	5	GREY SHALE *	52	102
133827	4	GREY CLAY	6	7
133827	1	BITUMEN ROAD BASE	0	0.4
133827	2	BROWN & RED CLAY	0.4	3
133827	3	BROWN CLAY	3	6
133827	5	WHITE & YELLOW CLAY	7	8
133827	6	DECOMPOSED BASALT	8	9.5
133827	7	HARD BASALT	9.5	14
133827	8	FRACTURED BASALT	14	17
133827	9	HARD BASALT	17	18
133799	4	SHALE BLUE	10	12
133799	1	CLAY SHALE	0	1
133799	2	BROWN CLAY	1	6
133799	3	BROWN CLAY	6	10
133799	5	SHALE BLUE	12	54
133799	6	AQUIFIER *	54	55
133799	7	SHALE BLUE	55	60
133803	4	SHALE	32	42
133803	1	BROKEN ROCK	0	15
133803	2	HARD SHALE	15	30
133803	3	FRACTURED SHALE WB	30	32
133826	1	BITUMEN ROAD BASE	0	0.4
133826	2	RED STICKY CLAY	0.4	2
133826	3	RED & GREY CLAY	2	6
133826	4	GREY CLAY & DECOMPOSED BASALT	6	8
133826	5	DECOMPOSED BASALT	8	9
133826	6	HARD BASALT	9	12
133826	7	FRACTURED BASALT	12	14
133826	8	HARD BASALT	14	15
133828	1	BITUMEN & ROAD BASE	0	0.5
133828	2	RED & BROWN CLAY	0.5	3
133828	3	BROWN CLAY	3	6
133828	4	WHITE & YELLOW CLAY	6	7
133828	5	BECOMPOSED BASALT	7	8
133828	6	HARD BASALT	8	12
133828	7	FRACTURED BASALT	12	15
133828	8	BASALT	15	16
133900	1	CLAY AND SHALE	0	1
133900	2	SHALEY AND CLAY BROWN	1	4
133900	3	SMALL GRAVEL	4	6
133900	4	RIVER GRAVEL *	6	10

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
133900	5	SHALE BLUE	10	12
133853	4	SHALE *	17	96
133853	1	TOP SOIL	0	1
133853	2	SHALE	1	6
133853	3	CLAY	6	17
133878	3	SHALE (GREY)	10	42
133864	1	BLACK CLAY	0	3
133864	2	YELLOW SANDY CLAY	3	17
133864	3	SAND/GRAVEL	17	21
133878	1	TOPSOIL	0	1
133878	2	CLAY (BROWN)	1	10
133878	4	SHALE (BLUE) *	42	66
134049	4	SCHIST	2	7
134049	1	TOPSOIL	0	0.3
134049	2	CLAY, SANDY	0.3	1
134049	3	SCHIST, DECO	1	2
134049	5	FRACTURE	7	7.5
134049	6	SCHIST	7.5	10
134049	7	FRACTURE	10	10.5
134049	8	SCHIST	10.5	11.5
134049	9	FRACTURE	11.5	12
134049	10	SCHIST	12	13
133948	4	QUARTZ SHALE	30	42
133948	1	FILL	0	6
133948	2	CLAY	6	12
133948	3	SHALE	12	30
133948	5	HARD SHALE	42	60
134031	3	CLAY	4	16
133976	1	TOP SOIL	0	1
133976	2	CLAY BROWN	1	18
133976	3	SHALE GREY *	18	60
134031	1	LANDFILL	0	3.5
134031	2	TOPSOIL	3.5	4
134031	4	SHALE (GREY) *	16	36
134032	1	TOPSOIL	0	0.5
134032	2	BUILDING RUBBLE	0.5	3.5
134032	3	CLAY	3.5	6
134032	4	SHALE *	6	14
134032	5	SHALE (BLUE)	14	18
134034	1	TOPSOIL	0	0.5
134034	2	CLAY	0.5	1
134034	3	HARD SANDSTONE	1	1.3
134034	4	SANDY CLAY	1.3	4
134034	5	WHITE CLAY	4	13
134034	6	GREY SHALE *	13	30
134034	7	GREY SHALE (SOFT)	30	48
134058	4	SCHIST	1.5	17
134058	1	TOPSOIL	0	0.3
134058	2	CLAY	0.3	0.6
134058	3	SCHIST, DECO	0.6	1.5
134058	5	FRACTURE	17	17.3
134058	6	SHALE, GREY, HARD	17.3	19.3
134058	7	COAL, FRACTURE	19.3	19.6
134058	8	SHALE, GREY	19.6	21
134058	9	FRACTURE	21	21.3
134058	10	SHALE, GREY	21.3	30
134058	11	FRACTURE	30	30.3
134058	12	SHALE, GREY	30.3	40

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
134058	13	FRACTURE	40	40.3
134058	14	SHALE, GREY	40.3	55
134058	15	FRACTURE	55	55.3
134058	16	SHALE, GREY	55.3	64
134058	17	FRACTURE	64	64.3
134058	18	SHALE, GREY	64.3	73
134058	19	FRACTURE	73	73.3
134058	20	SHALE, GREY	73.3	76.3
134120	4	SHALE (BROKEN)	19	35
134120	1	GRAVELY CLAY	0	4
134120	2	SOFT BLUE SHALE	4	13
134120	3	HARD BLUE SHALE	13	19
134120	5	BROKEN SHALE WITH QUARTZ *	35	48
134072	4	CLAY	7	17
134072	1	TOPSOIL	0	1
134072	2	CLAY	1	3
134072	3	FINE SAND	3	7
134072	5	FINE SAND *	17	22
134072	6	GRAVEL	22	30
134073	1	TOPSOIL	0	1
134073	2	CLAY	1	3
134073	3	FINE SAND	3	5
134073	4	CLAY	5	15
134073	5	SAND *	15	16
134073	6	GRAVEL AND SAND	16	28
134119	1	YELLOW CLAY	0	5
134119	2	HARD BLUE SHALE	5	36
134119	3	SOFTER SHALE	36	57
134119	4	BROKEN SHALE *	57	66
134163	4	SHALE	22	66
134163	1	SAND	0	0.5
134163	2	FILL (LAND)	0.5	3
134163	3	CLAY WITH GRAVEL	3	22
134150	4	HARD BLACK SHALE	19	42
134150	1	GRAVELY CLAY	0	3
134150	2	SHALE CLAY	3	13
134150	3	HARD BLUE SHALE	13	19
134150	5	BROKEN SHALE *	42	49
134150	6	HARD BLUE SHALE	49	54
134152	4	HARD BLUE SHALE	8	25
134152	1	CLAY	0	2
134152	2	GRAVELY CLAY	2	6
134152	3	GRAVEL *	6	8
134152	5	HARD BLACK SHALE	25	48
134161	1	TOPSOIL	0	0.5
134161	2	CLAY AND GRAVEL	0.5	1.5
134161	3	CLAY (YELLOW)	1.5	11
134161	4	SANDY CLAY WITH GRAVEL *	11	18
134161	5	GREY SHALE	18	36
134180	4	GREY SHALE	28	30
134180	1	TOPSOIL	0	1
134180	2	BROWN CLAY	1	26
134180	3	BLACK CLAY	26	28
134502	4	HARD SHALE	19	47
134502	1	GRAVEL CLAY	0	2
134502	2	GREY SHALE CLAY	2	5
134502	3	FIRM SHALE	5	19
134502	5	SANDSTONE	47	73

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
134502	6	BLACK SHALE CLAY	73	95
134502	7	HARD BLACK SHALE	95	114
134216	4	SOFT SANDSTONE CLAY	13	26
134216	1	RED SOIL	0	2
134216	2	HARD RED CLAY	2	7
134216	3	HARD BROWN CLAY	7	13
134216	5	BLUE CLAY SHALE	26	48
134243	4	GREY SHALE	11	16
134243	1	TOPSOIL	0	2
134243	2	BROWN CLAY	2	9
134243	3	SANDY CLAY	9	11
134243	5	GREY SHALE WITH QUARTZ	16	28
134243	6	GREY SHALE	28	48
134343	6	BROKEN CHARCOAL ROCK *	54	85
134289	1	FILL	0	4
134289	2	YELLOW SAND	4	18
134343	1	RED BROWN CLAY	0	14
134343	2	ORANGE CREAMY SANDSTONE	14	19
134343	3	LIGHT GREY ROCK	19	37
134343	4	DARKER GREY ROCK	37	49
134343	5	FRACTURED GREY ROCK	49	54
134369	3	BROKEN BASALT *	21	23
134365	1	YELLOW CLAY	0	3
134365	2	BROKEN SHALE	3	15
134365	3	HARD SHALE	15	42
134369	1	LOOSE GRAVEL	0	2
134369	2	BASALT	2	21
134369	4	HARD BASALT	23	29
134431	3	CLAY WITH SMALL HARD BANDS OF SHALE	3	20
134379	1	GREY CLAY	0	7
134379	2	GRAVELLY CLAY	7	15
134379	3	SHALE	15	35
134379	4	FRACTURE *	35	36
134379	5	HARD SHALE	36	42
134431	1	TOPSOIL	0	0.5
134431	2	GRAVEL & TOPSOIL	0.5	3
134431	4	GREY SHALE *	20	42
134488	3	HARD BLUE METAL	21	46
134465	1	BROWN CLAY	0	1
134465	2	YELLOW SHALE	1	7
134465	3	BASALT *	7	14.5
134488	1	GRAVELLY CLAY	0	4
134488	2	BROKEN ROCK	4	21
134497	1	GREY CLAY	0	5
134497	2	YELLOW CLAY	5	10
134497	3	BLUE SHALE CLAY	10	17
134497	4	BLUE QUARTZ SHALE *	17	30
134512	4	SANDY CLAY *	6	9
134512	1	BLACK TOPSOIL	0	1
134512	2	BROWN CLAY	1	2
134512	3	RED CLAY	2	6
134512	5	SANDY CLAY & GRAVEL *	9	14
134512	6	SAND *	14	18
134512	7	SAND CLAY & GRAVEL *	18	26
134515	4	CLAY (GREY)	8	12
134515	1	TOPSOIL (BLACK)	0	1
134515	2	CLAY (YELLOW)	1	2
134515	3	CLAY (BROWN)	2	8

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
134515	5	CLAY (LIGHT GREY)	12	20
134515	6	SAND WITH BANDS OF CLAY *	20	29
134515	7	GRAVEL 8MM	29	30
134646	4	COURSE SAND & SMALL GRAVEL *	20	24
134646	1	ROCKY BROWN CLAY	0	12
134646	2	FINE SILT SAND	12	14
134646	3	MED FINE SAND	14	20
134644	1	BROWN ROCKY CLAY	0	12
134644	2	FINE SILTY SAND	12	14
134644	3	MED TO FINE BROWN CLAY & SILTY SAND	14	15
134644	4	FINE SAND	15	23
134644	5	COARSE RIVER SAND *	23	24
134644	6	FINE SILTY SAND	24	26
134644	7	COARSE SMALL RIVER GRAVEL	26	27
134645	1	ROCKY BROWN CLAY	0	12
134645	2	FINE SILT SAND	12	14
134645	3	MED FINE SAND	14	23
134645	4	COURSE RIVER SAND *	23	26
134569	5	SOFT LIGHT BLUE SHALE	32	44
134569	1	DRY SOFT SHALE	0	6
134569	2	LIGHT BLUE SHALE	6	12
134569	3	SOFT LIGHT BLUE SHALE	12	26
134569	4	DECOMPOSED SHALE WITH AQUIFIER *	26	32
134710	4	SHALE *	6	14
134710	1	TOPSOIL	0	0.5
134710	2	RED CLAY	0.5	2
134710	3	SANDY CLAY AND SMALL GRAVEL	2	6
134710	5	GREY SHALE	14	36
134706	4	CLAY	7	13
134706	1	TOPSOIL	0	0.2
134706	2	SAND	0.2	4
134706	3	CLAY WITH GRAVEL	4	7
134706	5	GREY SHALE *	13	31
134709	1	TOPSOIL	0	1
134709	2	SANDSTONE	1	5
134709	3	SANDSTONE WITH CLAY BANDS	5	10
134709	4	SANDSTONE *	10	24
134728	4	SAND WITH SMALL CLAY BANDS	14	18
134779	1	GRAVEL	0	2
134779	2	SHALE	2	60
134728	1	TOPSOIL	0	1
134728	2	CLAY	1	11
134728	3	SANDY CLAY *	11	14
134728	5	SAND	18	20
134728	6	GRAVEL	20	26
134729	1	TOPSOIL	0	0.5
134729	2	GRAVEL	0.5	0.8
134729	3	CLAY & GRAVEL	0.8	2
134729	4	SOFT GREY SHALE	2	19
134729	5	GREY SHALE	19	42
134729	6	HARD GREY SHALE	42	86
134730	1	TOPSOIL	0	0.4
134730	2	CLAY	0.4	3
134730	3	SANDY CLAY	3	5
134730	4	GREY SHALE	5	16
134730	5	BLACK SHALE	16	19
134730	6	GREY SHALE	19	49
134780	1	GRAVELLY FILL	0	1.5

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
134780	2	SANDY LOAM BROWN	1.5	10
134780	3	GREY CLAY SANDY *	10	17
134789	4	CLAY, PUGGY, DARK BROWN	15	18
134789	1	SAND	0	4
134789	2	SANDY CLAY	4	10
134789	3	SAND; GRAVEL	10	15
134789	5	SANDY CLAY; GRAVEL	18	22
134789	6	HARD ROCK	22	22
134791	3	SHALE, GREY	6	38
134790	1	CLAY, BROWN	0	4
134790	2	CLAY, BROWN, BLACK	4	18
134790	3	GRAVEL	18	23
134791	1	GRAVEL; TOPSOIL	0	0.5
134791	2	CLAY, YELLOW	0.5	6
134791	4	SHALE, BLACK	38	41
134791	5	SHALE GREY	41	86
138868	4	BLUE METAL	15	18
138868	1	CLAY FILL	0	3
138868	2	BLUE METAL	3	15
138868	3	FRACTURE*		15
134944	4	SHALE, BLUE, HARD	4	18
134944	1	FILL	0	0.5
134944	2	CLAY, YELLOW	0.5	3
134944	3	SHALE, SOFT	3	4
134961	4	FRACTURE	39	40
134961	1	CLAY, BROWN; LOAM	0	18
134961	2	SHALE, FRACTURED	18	19
134961	3	SHALE	19	39
134961	5	SHALE	40	46
134984	1	CLAY, BROWN	0	3
134982	1	LANDFILL, CEMENT AND BRICKS	0	1.5
134982	2	CLAY	1.5	3
134982	3	SHALE, GREY	3	60
134984	2	CLAY, BROWN; GRAVEL	3	5
134984	3	SHALE, GREY	5	55
138505	4	BROWN ROCK	6	7.4
138505	1	SANDY TOPSOIL	0	0.5
138505	2	SANDY WITH SOME GRAVEL	0.5	3.7
138505	3	DECOMPOSED ROCK	3.7	6
138505	5	GREY ROCK	7.4	14.6
138505	6	DARK GREY, SOME QUARTZY ROCK	14.6	42
138505	7	LIGHT GREY AND GREEN ROCK WITH CLAY CONTENT WHEN GROUND UP	42	51
138586	4	LIGHT BROWN SANDY CLAY	9	11
138586	1	FILL	0	1
138586	2	BROWN CLAY	1	3
138586	3	LIGHT BROWN CLAY	3	9
138586	5	MEDIUM SAND	11	22
138586	6	SAND & GRAVEL	22	24
138586	7	HARD BANDS	24	24.5
138692	11	BLACK SHALE	71	78
138692	4	FRACTURE	19	19.5
138692	1	CONCRETE	0	0.3
138692	2	SCHIST DECO	0.3	10
138692	3	SCHIST	10	19
138692	5	SCHIST	19.5	34
138692	6	FRACTURE	34	34.5
138692	7	BLACK SHALE	34.5	61
138692	8	FRACTURE	61	61.5

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
138692	9	BLACK SHALE	61.5	70.5
138692	10	FRACTURE	70.5	71
138804	4	BASALT	2	5
138804	1	TOPSOIL	0	0.5
138804	2	BROWN CLAY	0.5	1
138804	3	DECO	1	2
138804	5	FRACTURES	5	5.5
138804	6	BASALT	5.5	13
138804	7	FRACTURES	13	13.5
138804	8	BASALT	13.5	18.5
138804	9	FRACTURES	18.5	18.7
138804	10	BASALT	18.7	28
138804	11	FRACTURES	28	28.3
138804	12	BASALT	28.3	33
138821	4	SANDY LOAM	8.5	14
138821	1	TOPSOIL	0	0.5
138821	2	FILL	0.5	2.5
138821	3	CLAY BOUND SAND	2.5	8.5
138821	5	ALLUVIAL	14	22
138834	4	SCHIST GREY	3.6	7
138834	1	TOPSOIL	0	0.3
138834	2	GREY CLAY	0.3	0.9
138834	3	DECO SCHIST GREY	0.9	3.6
138834	5	SCHIST BROWN	7	8.5
138834	6	SCHIST GREY AND QUARTZ	8.5	11.6
138834	7	CARBONATED SHALE	11.6	12
138834	8	BASALT GREY	12	19.8
138834	9	BASALT AND QUARTZ	19.8	43
138834	10	BASALT AND CALCITE FRACTURED	43	44.2
138834	11	BASALT AND QUARTZ	44.2	53
138834	12	BASALT GREY	53	58
138834	13	BASALT AND QUARTZ	58	60
138841	4	ALLUVIAL	3	8.5
138841	1	TOPSOIL	0	0.3
138841	2	CLAY	0.3	2
138841	3	CLAY BOUND ALLUVIAL	2	3
138842	1	FILL	0	2
138842	2	CLAY BROWN	2	3
138842	3	ALLUVIAL	3	7
138842	4	CLAY BROWN	7	11
138842	5	SCHIST	11	12
138842	6	SCHIST	12	27
138844	1	TOPSOIL	0	0.3
138844	2	CLAY BROWN	0.3	1
138844	3	DECO SCHIST	1	12
138844	4	SCHIST	12	27
138844	5	BLACK SHALE	27	41
138844	6	FRACTURE	41	41.5
138844	7	BLACK SHALE	41.5	47
138844	8	FRACTURE	47	47.5
138844	9	BLACK SHALE	47.5	51
138845	1	TOPSOIL	0	0.3
138845	2	FILL	0.3	2.5
138845	3	CLAY BROWN	2.5	4
138845	4	SANDY CLAY BROWN	4	7
138845	5	ALLUVIAL	7	21
138867	1	CLAY FILL	0	7
138867	2	BLUE METAL	7	34

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
138879	4	BASALT WITH SMALL AMOUNT OF WATER	30	36
138879	1	LIGHT BROWN SHALE	0	6
138879	2	BROWN SHALE	6	24
138879	3	LIGHT BLUE BASALT	24	30
138879	5	BLUE BASALT	36	54
138879	6	BASALT WITH SMALL AQUIFER*	54	60
138879	7	BLUE BASALT	60	72
145017	4	CLAY. BROWN	3.3	6.7
145017	1	TOPSOIL	0	0.3
145017	2	CLAY, BROWN	0.3	3
145017	3	LOAM, BROWN	3	3.3
145017	5	CLAY, DARK GREY	6.7	12.2
145017	6	LOAM, BROWN	12.2	13.7
145017	7	CLAY, SANDY, BROWN	13.7	14
145017	8	SAND, ALLUVIUM	14	15.3
138982	4	SANDY LOAM	4.5	17.8
138982	1	CLAY	0	0.3
138982	2	SAND & CLAY	0.3	4
138982	3	DARK CLAY	4	4.5
138982	5	MEDIUM TO COARSE SAND	17.8	21
138982	6	CLAY - CLAYEY SAND	21	21.5
138982	7	SHALE	21.5	22.5
142757	4	CLAY GREY AND BROWN	7	17
142757	1	SANDY CLAY	0	1
142757	2	CLAY	1	3
142757	3	SANDY CLAY	3	7
142757	5	SANDY CLAY	17	22
142757	6	COARSE GRAVEL	22	30
142869	4	SAND	5	15
142869	1	TOPSOIL	0	0.4
142869	2	RED CLAY	0.4	1
142869	3	BROWN CLAY	1	5
142869	5	SANDY CLAY	15	17
142869	6	SAND	17	19
142869	7	SANDY GRAVEL	19	22
142869	8	CLAY	22	24
142870	1	TOPSOIL	0	0.5
142870	2	BROWN CLAY	0.5	3
142870	3	RED CLAY	3	10
142870	4	SANDY CLAY	10	13
142870	5	SAND WITH SMALL CLAY BANDS	13	25
142905	4	WEATHERED SANDSTONE	2.1	5.5
142905	1	LOAM	0	0.3
142905	2	SANDY CLAY	0.3	1.5
142905	3	DECOMPOSED BASALT	1.5	2.1
142905	5	GREY SANDSTONE	5.5	8.8
142905	6	BROKEN SANDSTONE	8.8	9.1
142905	7	GREY SANDSTONE	9.1	21.9
142905	8	WATERBEARING SANDSTONE	21.9	27.4
142906	1	LOAM	0	0.3
142906	2	WEATHERED SANDSTONE	0.3	3.7
142906	3	GREY SANDSTONE	3.7	4
142906	4	YELLOW SANDSTONE	4	5.5
142906	5	GREY SANDSTONE	5.5	22.3
142906	6	SOAK	22.3	22.6
142906	7	GREY SANDSTONE WITH CARBONACEOUS SHALE LAYERS	22.6	31.1
142906	8	WATERBEARING SANDSTONE	31.1	35.7
142906	9	GREY SANDSTONE	35.7	39.6

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
142907	1	TOPSOIL	0	0.3
142907	2	WEATHERED SANDSTONE & CLAY	0.3	6.7
142907	3	GRAVELLY CLAY & SANDSTONE	6.7	8.5
142907	4	YELLOW SANDSTONE	8.5	9.8
142907	5	GREY SANDSTONE	9.8	32
142907	6	CARBONACEOUS SHALE	32	32.3
142907	7	GREY SANDSTONE	32.3	34.1
142907	8	CREAM SANDSTONE (SOAK)	34.1	35.7
142907	9	BROKEN SANDSTONE	35.7	36.6
142907	10	DARK GREY SANDSTONE	36.6	52.7
142907	11	CREAM SANDSTONE WITH CARBONACEOUS SHALE LAYERS	52.7	57.9
142914	4	BASALT	12.2	29
142914	1	TOPSOIL	0	0.6
142914	2	BROWN CLAY	0.6	5.5
142914	3	WEATHERED BASALT	5.5	12.2
142914	5	WEATHERED BASALT	29	29.9
142914	6	BASALT	29.9	39.6
142914	7	BROKEN BASALT	39.6	40.5
142914	8	BASALT	40.5	42.7
145003	4	FRACTURE	11	11.3
145003	1	TOPSOIL	0	0.3
145003	2	SCHIST, DECO	0.3	3
145003	3	SCHIST, DECO	3	11
145003	5	SCHIST	11.3	20
145003	6	FRATURE	20	20.3
145003	7	SHALE	20.3	27
145003	8	FRACTURE	27	27.3
145003	9	SHALE	27.3	33
145003	10	FRACTURE	33	33.3
145003	11	SHALE	33.3	39.3
145003	12	FRACTURE	39.3	39.6
145003	13	SHALE	39.6	41
145013	1	TOPSOIL	0	0.3
145013	2	FILL	0.3	1
145013	3	CLAY, BROWN	1	2.5
145013	4	LOAM, SANDY	2.5	6
145013	5	LOAM, SANDY, MOIST	6	8
145013	6	CLAY, SANDY, MOIST	8	12.8
145013	7	SAND, ALLUVIAL	12.8	14
145016	1	TOPSOI	0	0.3
145016	2	CLAY, BROWN	0.3	4.3
145016	3	CLAY, BROWN, MOIST	4.3	4.6
145016	4	CLAY, GREY	4.6	23
145016	5	CLAY, SANDY, LIGHT	23	24.4
145069	4	CLAY, SANDY, LIGHT BROWN	6	11
145069	1	CEMENT AND LANDFILL	0	0.5
145069	2	CLAY, LIGHT BROWN	0.5	5
145069	3	SAND, LIGHT BROWN, FINE	5	6
145069	5	SAND, MEDIUM	11	17
145069	6	SANDS AND GRAVEL	17	19
145069	7	GRAVEL	19	21
145069	8	HARD BAND	21	21.5
145022	4	SCHIST	12.3	16.5
145022	1	CONCRETE	0	0.3
145022	2	CLAY, BROWN	0.3	1
145022	3	SCHIST, DECO	1	12.3
145022	5	FRACTURE	16.5	16.8
145022	6	SCHIST	16.8	35

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
145022	7	FRACTURE	35	35.3
145022	8	SCHIST	35.3	36
145022	9	FRACTURE	36	36.3
145022	10	SCHIST	36.3	38.1
145032	4	SHALE, GREY	8	30
145032	1	CLAY	0	1
145032	2	BOULDERS	1	2
145032	3	CLAY, SANDY	2	8
145032	5	SHALE, GREEN, DRY	30	98
145068	1	TOPSOIL	0	0.4
145068	2	CLAY, YELLOW	0.4	1
145068	3	CLAY, LIGHT BROWN	1	2
145068	4	CLAY, BROWN	2	6
145068	5	CLAY, WHITE	6	13
145068	6	CLAY, LIGHT BROWN	13	18
145068	7	SAND, CLAY BANDING	18	21
145068	8	CLAY, SAND BANDING	21	24
145068	9	SAND, GRAVEL BANDING	24	27
145068	10	HARD BANDING	27	27.01
145070	1	SAND	0	2
145070	2	CLAY, BROWN	2	10
145070	3	CLAY, SANDY, LIGHT BROWN	10	11
145070	4	SAND, BLACK	11	14.5
145070	5	CLAY, BLACK	14.5	16
145070	6	CLAY, SANDY, BLACK	16	19
145070	7	CLAY, SANDY, BROWN	19	20
145070	8	SAND	20	21
145070	9	SAND AND GRAVEL	21	23
145070	10	HARD BAND	23	23.5
145071	1	TOPSOIL	0	1
145071	2	CLAY, WHITE	1	2
145071	3	CLAY, SANDY, BROWN	2	3
145071	4	CLAY, BROWN	3	6
145071	5	CLAY, SANDY, BROWN	6	14
145071	6	SAND, MEDIUM	14	17
145071	7	SAND AND GRAVEL (MEDIUM)	17	24
145071	8	SAND AND GRAVEL (FINE)	24	30
145165	4	CLAY, LIGHT BROWN	6	15
145165	1	TOPSOIL	0	1
145165	2	CLAY, LIGHT BROWN	1	2
145165	3	WHITE CLAY	2	6
145165	5	CLAY, SANDY	15	24
145165	6	SAND, WITH BANDS OF CLAY	24	30
145096	4	SHALE, BLUE, HARD	7	29
145096	1	SOIL, SANDY	0	1
145096	2	CLAY, YELLOW, HEAVY	1	3
145096	3	CLAY; SHALE, YELLOW	3	7
145096	5	QUARTZ, BLUE; SHALE	29	41
145096	6	SHALE, BLACK, HARD	41	50
145098	1	TOPSOIL; GRAVEL	0	0.5
145098	2	CLAY, DARK GREY	0.5	4
145098	3	CLAY, LIGHT BROWN	4	9
145098	4	CLAY, DARK RED	9	14
145098	5	SAND WITH CLAY BANDS	14	23
145098	6	CLAY, DARK BROWN	23	24
145099	1	TOPSOIL	0	1
145099	2	CLAY, YELLOW	1	2
145099	3	CLAY, RED	2	3

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
145099	4	CLAY, BROWN	3	7
145099	5	CLAY, WHITE	7	10
145099	6	CLAY, ORANGE	10	14
145099	7	SAND AND CLAY BANDS	14	15
145099	8	SAND, FINE TO MEDIUM GRAINED	15	24
145099	9	HARD BAND	24	24.01
145158	1	TOPSOIL	0	0.5
145158	2	FILL	0.5	2.5
145158	3	SAND, CLAY-BOUND	2.5	8.5
145158	4	LOAM, SANDY	8.5	14
145158	5	ALLUVIUM	14	15.5
145164	1	TOPSOIL	0	1
145164	2	CLAY, BROWN	1	3
145164	3	CLAY, LIGHT BROWN	3	4
145164	4	CLAY, BROWN	4	8
145164	5	CLAY, SANDY, BROWN	8	17
145164	6	CLAY, SANDY, LIGHT BROWN	17	24
145164	7	SAND AND GRAVEL	24	25
145164	8	HARD BAND	25	25.01
145166	1	TOPSOIL	0	1
145166	2	CLAY, BROWN	1	8
145166	3	CLAY, SANDY, BROWN	8	14
145166	4	CLAY, SNADY, LIGHT BROWN	14	18
145166	5	HARD BAND	18	19.5
145303	4	CLAY, SANDY	5	6
145303	1	TOPSOIL	0	1
145303	2	CLAY, BROWN	1	3
145303	3	CLAY, BLUE	3	5
145303	5	CLAY, BLUE	6	8
145303	6	CLAY, BROWN	8	12
145303	7	CLAY, GREY	12	19
145303	8	CLAY, BLUE	19	21
145218	4	BASALT, WEATHERED	6	13
145218	1	TOPSOIL	0	1
145218	2	CLAY	1	2
145218	3	GRAVEL	2	6
145218	5	BASALT	13	37
145218	6	BASALT, DECOMPOSED	37	41
145218	7	BASALT	41	66
145218	8	SHALE	66	67
145218	9	SHALE, SANDY	67	75
145218	10	SHALE, SANDY, WITH SANDSTONE SEAMS	75	82
145218	11	SHALE, SANDY	82	99
145218	12	SHALE, SANDY, WITH SEAMS OF SANDSTONE	99	102
145218	13	SHALE, SANDY	102	115
145218	14	SANDSTONE SEAMS	115	119
145218	15	SHALE, SANDY	119	121
145239	4	SAND	5.5	17.5
145239	1	TOPSOIL	0	0.5
145239	2	FILL	0.5	2
145239	3	CLAY	2	5.5
145240	1	TOPSOIL	0	0.5
145240	2	SAND	0.5	1
145240	3	CLAY, BROWN	1	4
145240	4	SAND AND CLAY BANDS	4	8
145240	5	SAND	8	16
145301	1	TOPSOIL	0	1
145301	2	CLAY, BROWN	1	4

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
145301	3	CLAY, BROWN	4	18
145301	4	CLAY, SANDY, BROWN	18	23.5
145302	1	TOPSOIL	0	1
145302	2	CLAY, BROWN	1	16
145302	3	CLAY, SANDY, BROWN	16	24
145302	4	SAND	24	26.5
145327	2	CLAY, GREY, HEAVY	4	11
145326	1	CLAY, WHITE-YELLOW	0	17
145326	2	CLAY, SANDY, YELLOW	17	45
145327	1	LOAM, BROWN	0	4
145327	3	SHALE	11	46.5
145328	1	LOAM, BROWN	0	4
145328	2	CLAY, GREY, HEAVY	4	19
145328	3	SHALE	19	28.5
145465	4	SHALE, BLACK	12	23
145392	1	TOPSOIL	0	1
145392	2	CLAY, YELLOW	1	3
145392	3	SHALE, GREY	3	85
145465	1	CONCRETE	0	0.6
145465	2	CLAY, BROWN	0.6	6
145465	3	CLAY, GREY	6	12
145465	5	FRACTURE	23	23.5
145465	6	SHALE	23.5	30
145465	7	SHALE, CARBONACEOUS	30	30.5
145465	8	SHALE	30.5	41
145465	9	SHALE, CARBONACEOUS	41	41.5
145465	10	SHALE	41.5	49
145627	4	DECO, SCHIST	9	10
145627	1	FILL	0	0.5
145627	2	CLAY, BROWN	0.5	8
145627	3	CLAY, SANDY, BROWN	8	9
145627	5	SCHIST, GREY	10	20
145627	6	FRACTURE	20	21
145627	7	SCHIST, GREY	21	36
145469	4	CLAY, BROWN	1.9	2.4
145469	1	TOPSOIL	0	0.3
145469	2	SAND	0.3	1.3
145469	3	SHALE AND GRAVEL	1.3	1.9
145469	5	BROWN, DECOMPOSED	2.4	10
145469	6	SCHIST, BROWN	10	12.2
145469	7	SCHIST, GREY	12.2	47
145469	8	COAL SHALE	47	47.3
145469	9	SCHIST, GREY	47.3	59.4
145469	10	COAL SHALE	59.4	59.9
145469	11	SCHIST, GREY	59.9	68.6
145469	12	SCHIST, WHITE	68.6	94.5
145469	13	SCHIST, WHITE; CALCITE	94.5	95
145469	14	SCHIST, GREY	95	100.6
145469	15	SCHIST, WHITE	100.6	110
145581	4	CLAY, RED; GRAVEL	4	16
145581	1	TOPSOIL	0	1
145581	2	CLAY, BROWN	1	3
145581	3	CLAY, BROWN; GRAVEL, SMALL	3	4
145581	5	SHALE, BLUE	16	31
145614	1	TOPSOIL	0	1
145613	1	TOPSOIL	0	1
145613	2	CLAY, RED	1	4
145613	3	SHALE, GREY	4	80

"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
145614	2	DECO, GREY	1	12
145614	3	SCHIST, GREY	12	15
145614	4	SHALE, CARBONIFEROUS	15	23
145614	5	SHALE, CARBONIFEROUS	23	26
145614	6	SHALE, GREY	26	29
145614	7	SHALE, GREY	29	33
145716	4	SHALE, WEATHERED, LIGHT BROWN; CLAY, SILTY, CLAY	4	7
145716	1	CLAY, GREY, ORANGE, BROWN	0	1
145716	2	SHALE, WEATHERED; CLAY, BLUE, GREY	1	2
145716	3	SHALE, WEATHERED, LIGHT BROWN	2	4
145716	5	CLAY, SILTY, LIGHT BROWN, MINOR SMALL GRAVEL	7	9
145691	4	DECO SCHIST, FRACTURE	12.2	13.7
145691	1	TOPSOIL	0	1.2
145691	2	CLAY, BROWN	1.2	9.1
145691	3	CLAY, GREY	9.1	12.2
145691	5	SCHIST, GREY	13.7	15.2
145714	1	CLAY, GRAVELLY, RED-BROWN	0	1
145714	2	SHALE, WEATHERED, BLUE-GREY TO LIGHT GREEN	1	5
145714	3	CLAY, SUILTY, LIGHT YELLOW	5	9
145715	1	CLAY, GRAVELLY, RED-BROWN	0	1
145715	2	BASALT, WEATHERED, WITH YELLOW BROWN CLAYS	1	9
145717	1	CLAY, ORANGE, BROWN	0	1
145717	2	SHALE, WEATHERED, WITH SILTY CLAY AT TOP	1	8
145718	1	CLAY, ORANGE, BLUE, GREY AND BROWN	0	2
145721	1	CLAY, ORANGE, BROWN	0	0.3
145721	2	SHALE, WEATHERED, LIGHT YELLOW AND BROWN	0.3	6
145718	2	SHALE, WEATHERED; CLAY, SILTY, BROWN AND YELLOW	2	9
145719	1	CLAY, SILTY, LIGHT BROWN	0	1
145719	2	SHALE, WEATHERED, ;IGHT YELLOW AND BROWN; CLAY, SILTY, SAND	1	8
145720	1	CLAY, ORANGE, GREY	0	1
145720	2	SHALE, WEATHERED, YELLOW AND BROWN	1	4
145745	4	SCHIST	3	21
145745	1	CONCRETE	0	0.3
145745	2	FILL	0.3	1
145745	3	SCHIST, DECO	1	3
145745	5	COAL	21	21.5
145745	6	SHALE, BLACK	21.5	42
145745	7	FRACTURE, MOIST	42	42.5
145745	8	SHALE, BLACK	42.5	54
145745	9	FRACTURE	54	54.5
145745	10	SHALE, BLACK	54.5	60
145870	3	GRAVEL	6	13
145988	1	CLAY LOAM TOPSOIL	0	0.5
145988	2	GREY GREENISH GREY SHALE	0.5	6
145988	6	BLUE METAL	6	60
145870	1	TOPSOIL	0	0.5
145870	2	CLAY, GREY	0.5	6
145870	4	GRAVEL, HARD BAND	13	
145981	4	YELLOWISH ROCK	3	7.6
145981	1	TOPSOIL	0	0.2
145981	2	CLAY	0.2	1.1
145981	3	CLAYEY DECOMPOSED ROCK	1.1	3
145981	5	SLIGHTLY FRACTURED ROCK WET	7.6	10.7
145981	6	HARD BLUE GREY ROCK	10.7	16.2
145981	7	BLACK AND GREY ROCK AND QUARTZ	16.2	16.8
145981	8	BLACK AND GREY ROCK AND QUARTZ SOFTER	16.8	21.3
145981	9	HARD ROCK GREY AND QUARTZ	21.3	27.4
145981	10	HARD GREY ROCK	27.4	34.1

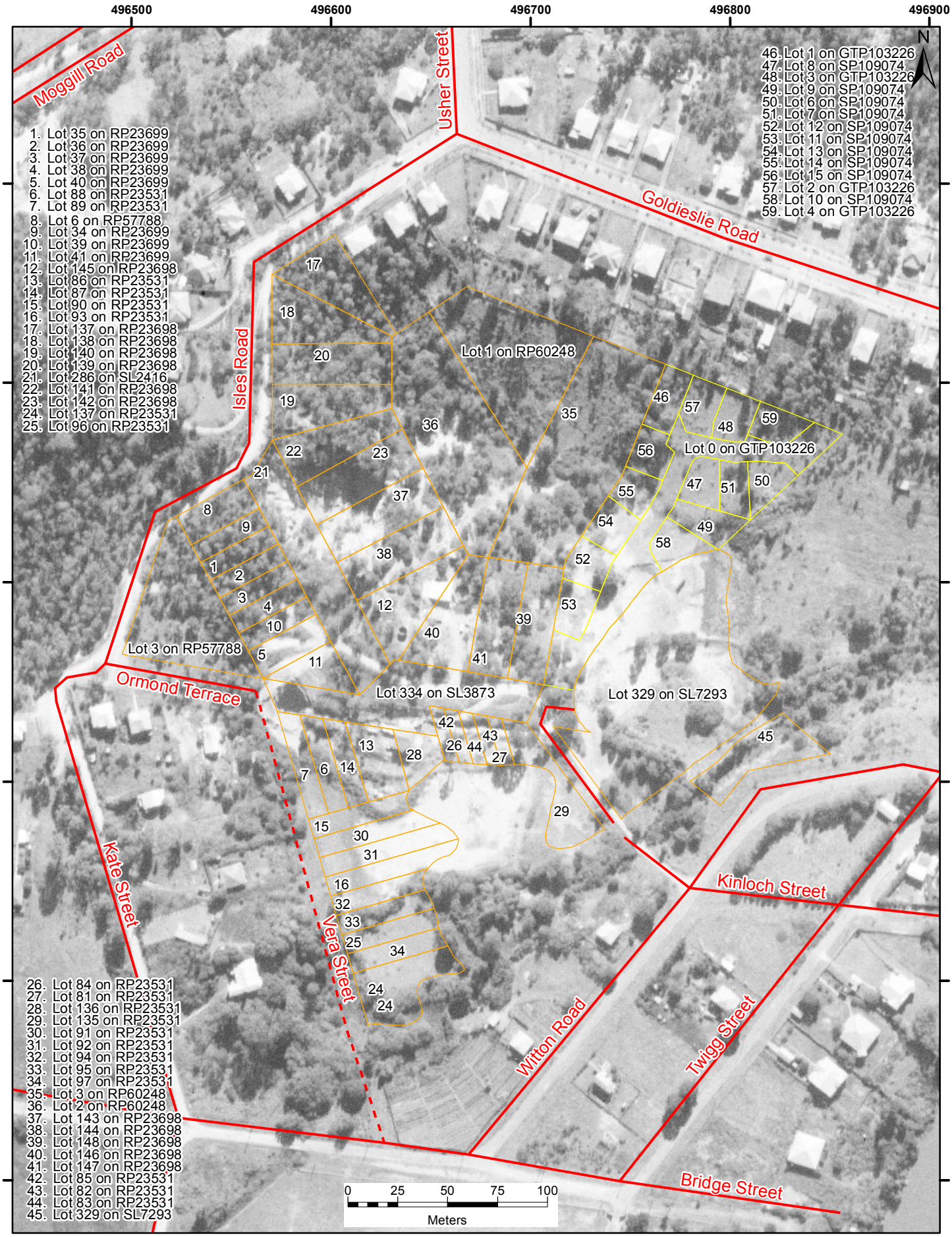
"RN"	"REC"	"DESCR"	"TOP"	"BOTTOM"
145981	11	HARD GREY AND BLACK ROCK	34.1	34.7
145981	12	BROWN WEATHERED ROCK WITH QUARTZ VIENS WET	34.7	36
145981	13	BLACK AND GREY HARD ROCK	36	39.4
145982	4	GRAVEL/SAND	23	24.4
145982	1	CLAY TOP SOIL	0	1
145982	2	BROWN CLAY	1	22
145982	3	SANDY CLAY WET	22	23
145982	5	SANDSTONE	24.4	34.4

"RN"	"REC"	"DATA_OWNER"	"FORM_DESC"	"TOP"	"BOTTOM"
142905	1	DNR	BUNYA PHYLLITE	0	27.4
142906	1	DNR	BUNYA PHYLLITE	0	39.6
142907	1	DNR	BUNYA PHYLLITE	0	57.9
142914	1	DNR	BUNYA PHYLLITE	0	42.7

"RN"	"PIPE"	"RDATE"	"REC"	"ANALYST"	"ANALYSIS_NO"	"SOURCE"	"DEPTH"	"CONDUCT"	"PH"	"SIO2"	"HARD"	"ALK"	"NA_ADS_RATIO"	"TOTAL_IONS"	"TOTAL_SOLIDS"	"NA"	"K"	"CA"	"MG"	"FE"	"MN"	"HCO3"	"CO3"	"CL"	"F"	"NO3"	"SO4"
79381	A	30/10/1990	1	GCL	136411	GB	30	2400	7.8	46	284	187	10.5	1412.13	1343.76	405	1.6	66	29	0.02	0.21	225	1.2	620	1.1	1	62

"RN"	"PIPE"	"RDATE"	"MEAS_POINT"	"MEASUREMENT"	"REMARK"	"LOGGER"
133120	A	8/04/2010	R	-4		
133121	A	8/04/2010	R	-6		
133122	A	9/04/2010	R	-4		
133153	A	26/05/2010	R	-11		
133198	A	28/05/2008	R	-6		
133405	A	22/10/2007	R	-11		
133826	A	27/08/2007	R	-6		
133827	A	28/08/2007	R	-6		
133828	A	29/08/2007	R	-6		
133803	A	26/04/2007	R	-25		
138804	A	28/11/2006	R	-12		
138879	A	21/01/2009	R	-24		
138982	A	24/05/2010	R	-6.6		
142906	A	7/12/1999	R	-10.7		
142905	A	5/12/1999	R	-8.8		

Appendix C Historical Aerial Photographs and Mine Plans



Legend

- Roads
- UQ Site Parcels
- Relevant Ad acent Properties

Note: Airphoto Captured in 1946 © DNRM

Cadastral Parcels of Interest Overlaid on a 1946 Air Photo

C-1	UQ	
Date: 27/02/2014	**Author:** Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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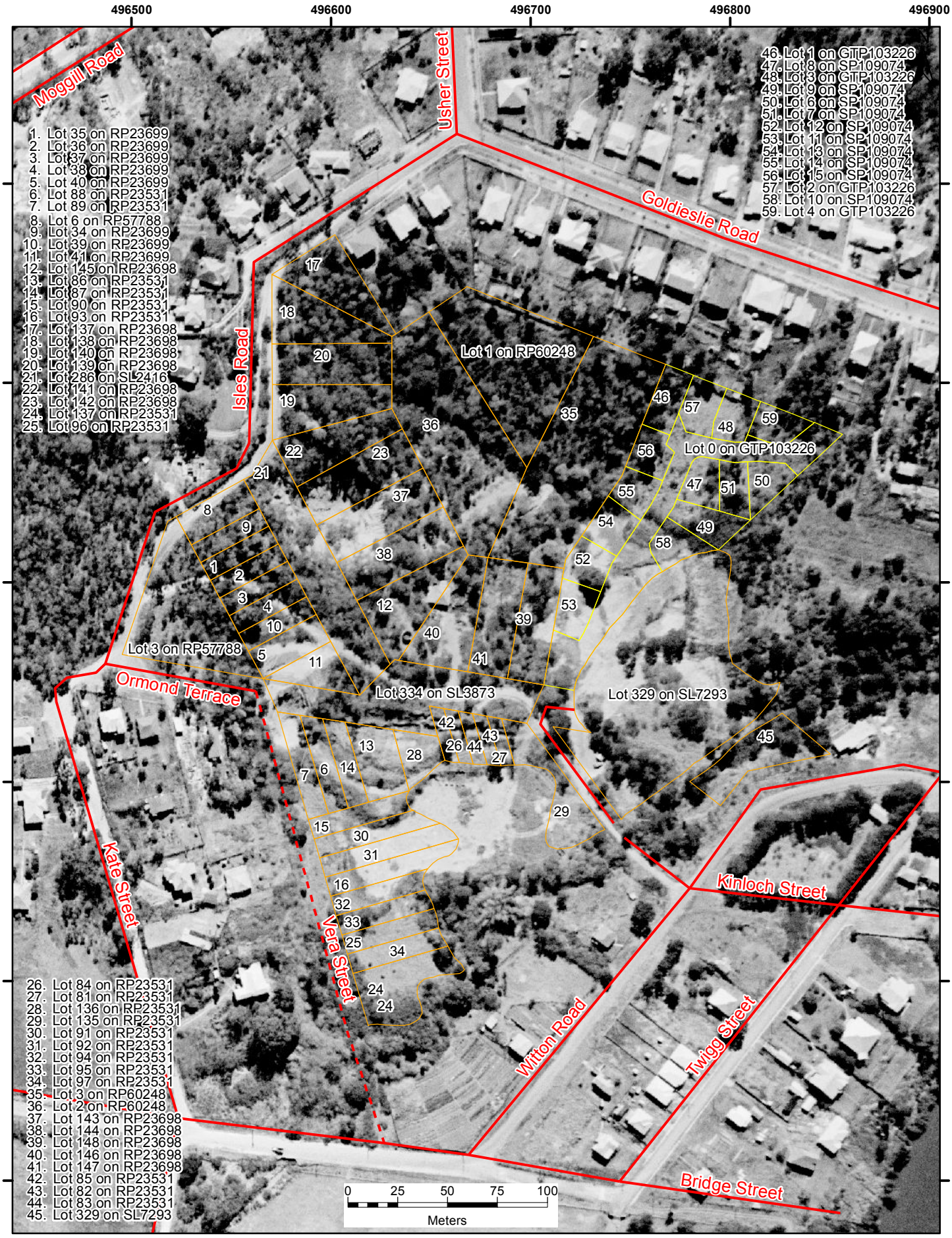

Legend

- Roads
- UQ Site Parcels
- Relevant Ad acent Properties

Note: Airphoto Captured in 1951 © UQ

Cadastral Parcels of Interest Overlaid on a 1951 Air Photo

C-2	UQ	
Date: 27/02/2014	**Author:** Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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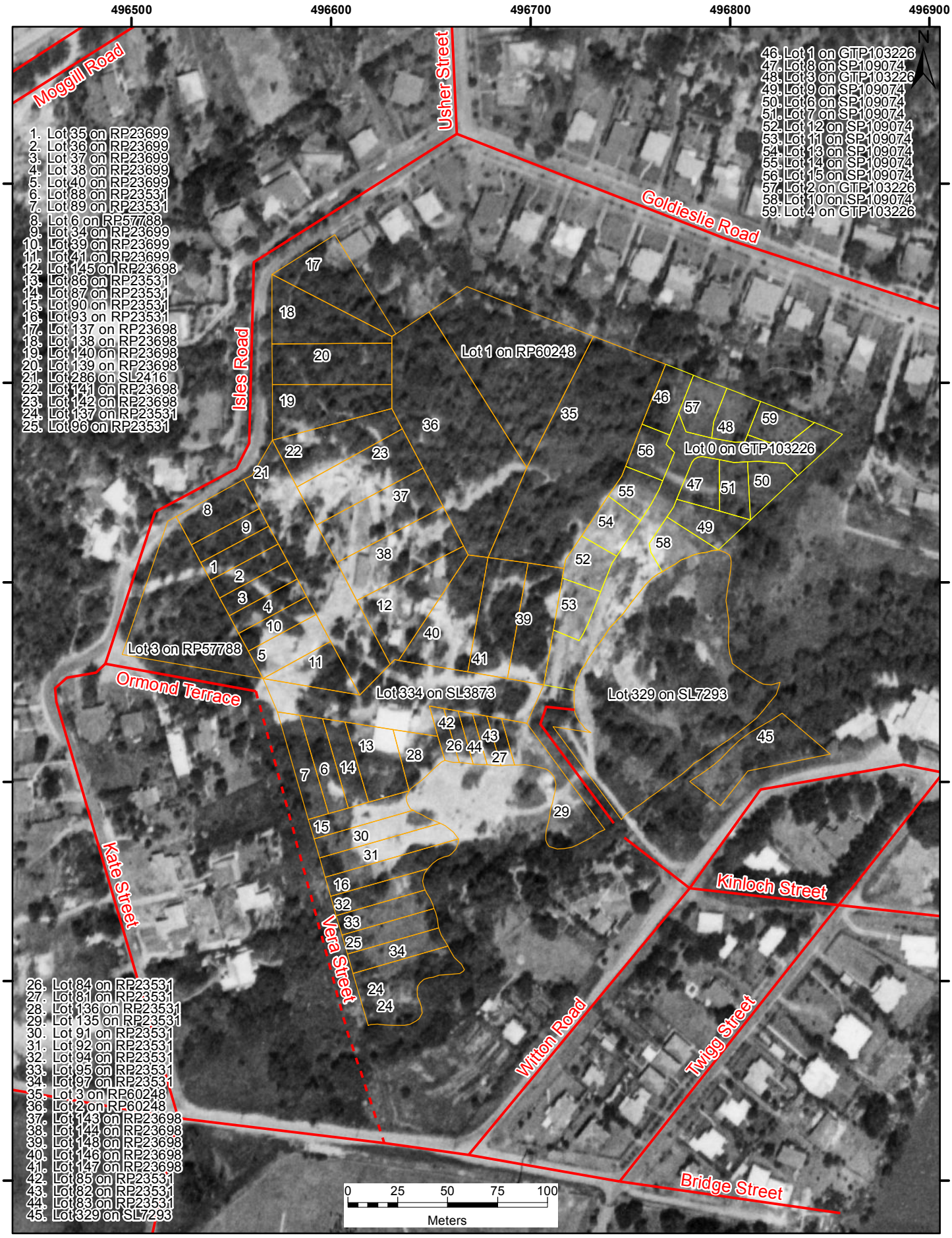

Legend

- Roads
- UQ Site Parcels
- Relevant Ad acent Properties

Note: Airphoto Captured in 1960 © DNRM

Cadastral Parcels of Interest Overlaid on a 1960 Air Photo

C-3	UQ	elp environmental and licensing professionals pty ltd
Date: 27/02/2014	**Author:** Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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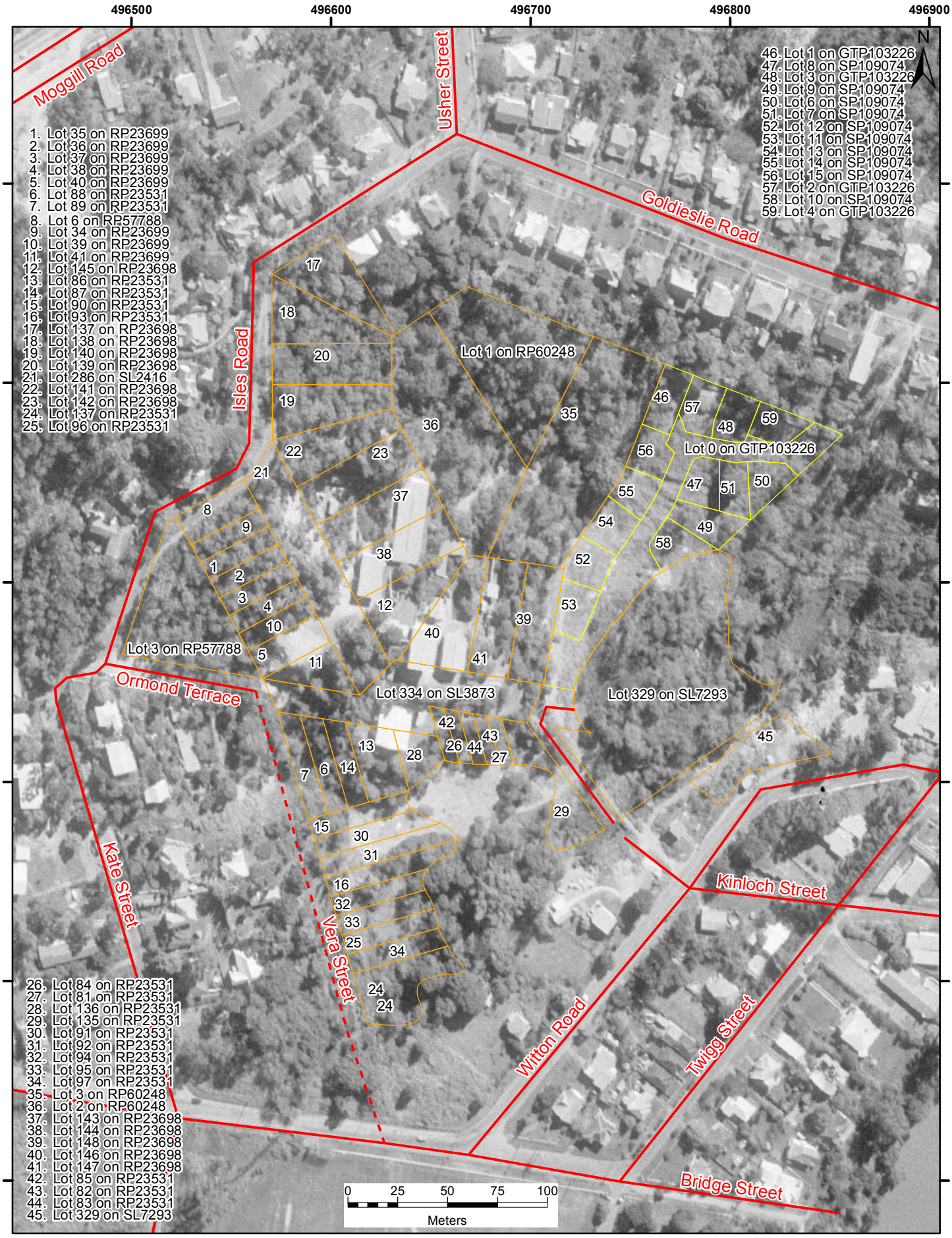

Legend

- Roads
- UQ Site Parcels
- Relevant Ad acent Properties

Note: Airphoto Captured in 1972 © DNRM

Cadastral Parcels of Interest Overlaid on a 1972 Air Photo

C-4	UQ	
Date: 27/02/2014	Author: Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	Coordinate System: GDA 1994 MGA Zone 56	

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Legend

- Roads
- UQ Site Parcels
- Relevant Ad acent Properties

Note: Airphoto Captured in 1983 © DNRM

Cadastral Parcels of Interest Overlaid on a 1983 Air Photo

C-5	UQ	
Date: 27/02/2014	**Author:** Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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Legend

- Roads
- UQ Site Parcels
- Relevant Ad acent Properties

Note: Airphoto Captured in 1994 © DNRM

Cadastral Parcels of Interest Overlaid on a 1994 Air Photo

C-6	UQ	
Date: 27/02/2014	**Author:** Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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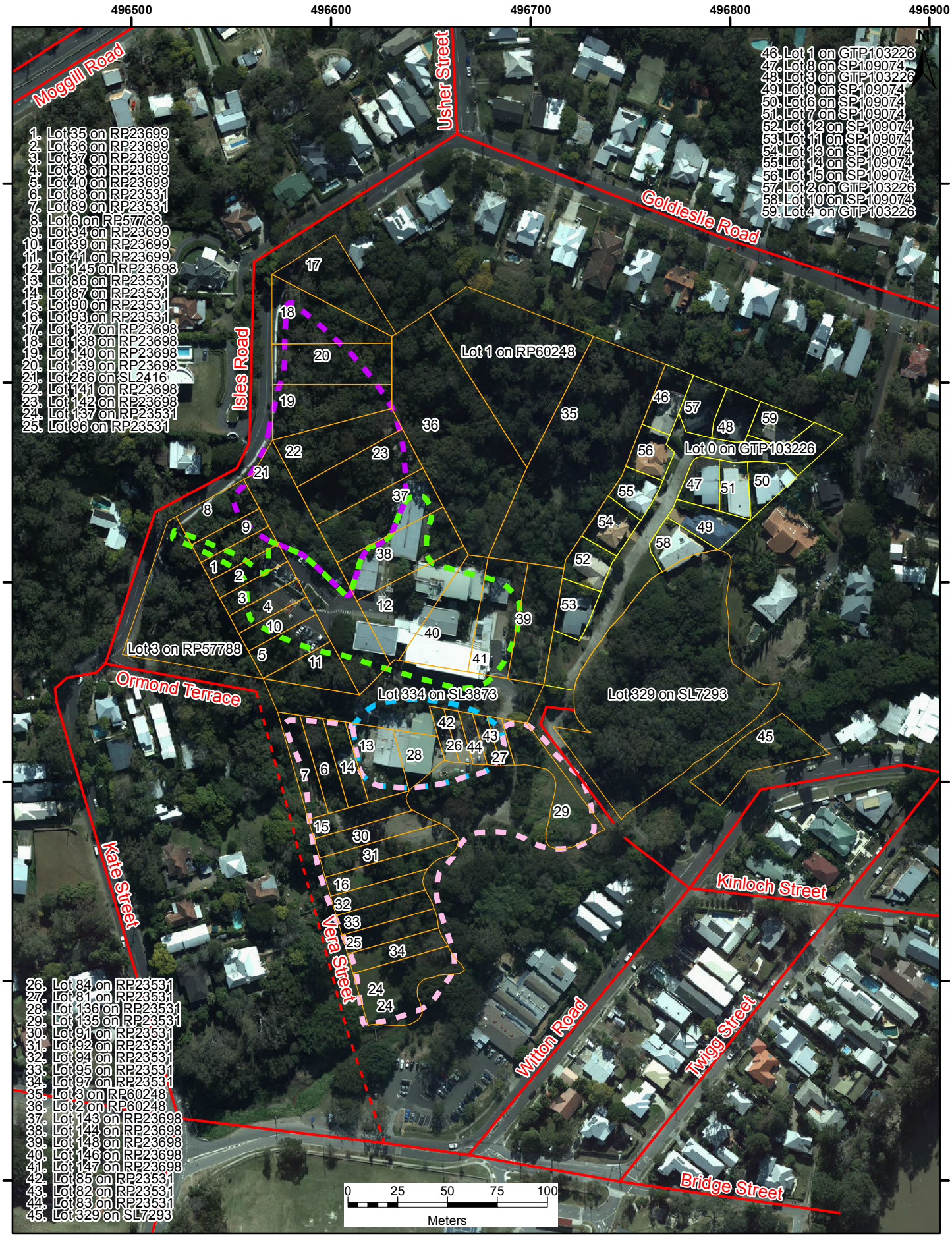

Legend

- Roads
- UQ Site Parcels
- Relevant Ad acent Properties
- Area 1 - Entrance Level
- Area 2 - Open Cut Area
- Area 3 - Pilot Plant Area
- Area 4 - Lower Car Par and Surrounds

Note: Aerial Imagery Captured in 2011 © UQ

Cadastral Parcels of Interest Overlaid on 2011 Aerial Imagery		
C-7	UQ	elp environmental and licensing professionals pty ltd
Date: 27/02/2014	Author: Christopher.Maddox	
	Map Scale: 1:2,500	
Revision: R1	Coordinate System: GDA 1994 MGA Zone 56	
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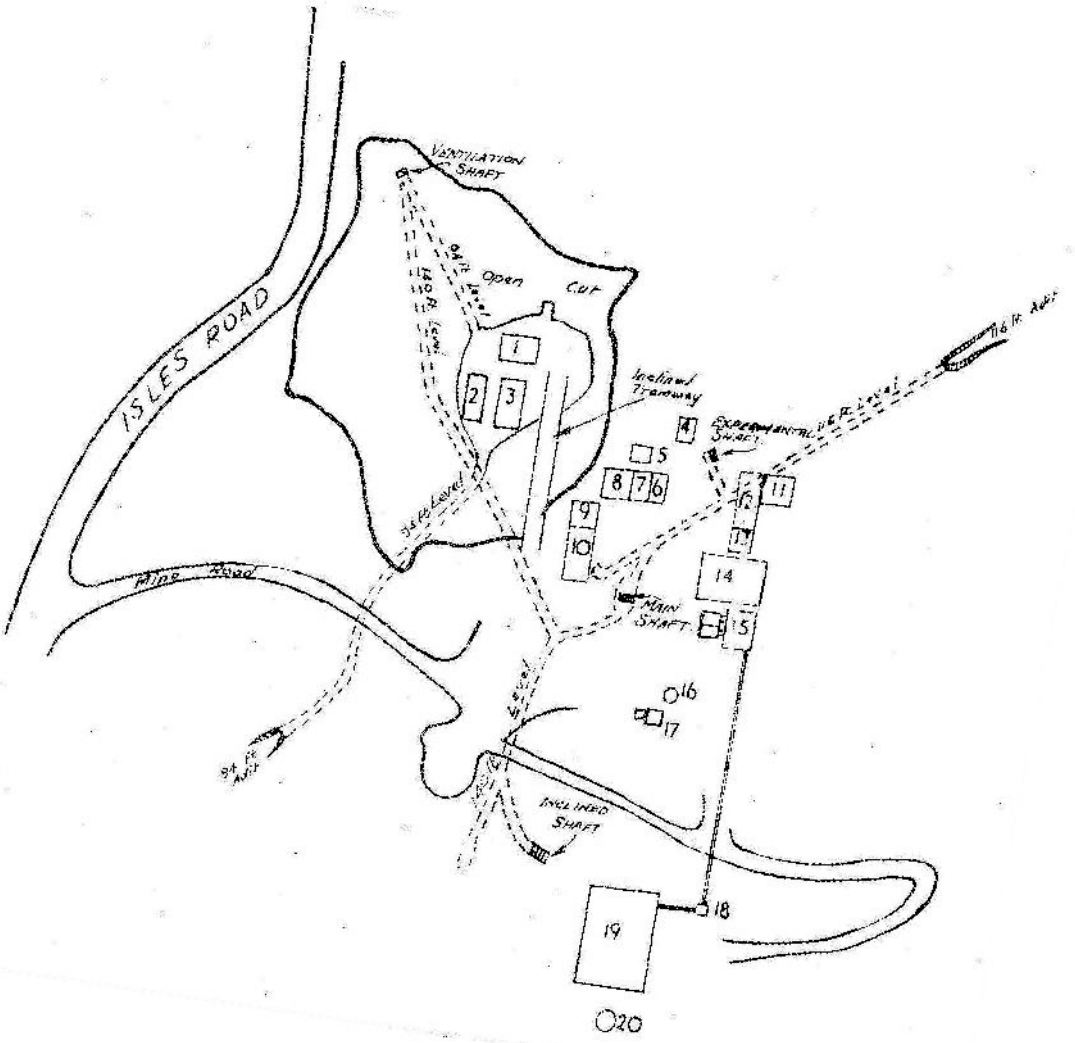

1. Jet Piercing Laboratory
2. Ballistic Mortar
3. Flameproof Testing Laboratory
4. Noise Abatement Anechoic Chamber
5. Electrical Switchgear Room
6. Winder House
7. Compressor House
8. General Store
9. Workshop
10. Store (Workshop & Timber)
11. Research and Project Rooms
12. Mine Survey Office
13. Cap Lamp Room
14. Mine Office, Change Room & Residence
15. Coarse Ore Bins and Crusher Station
16. Water Head Tank
17. Electrical Sub-Station and Transformer (200 kVA)
18. Fine Ore Bins
19. Experimental Pilot Plant
20. Residue Thickener

0 20 40 60 80
Meters

Experimental Mine Items and Features (1963) Source: University of Queensland Dept. of Mining and Metallurgical Engineering 1963 - Approximately Referenced

C-8	UQ
Date: 27/02/2014	Author: Christopher.Maddox
	Map Scale: 1:1,500
Revision: R1	Coordinate System: GDA 1994 MGA Zone 56

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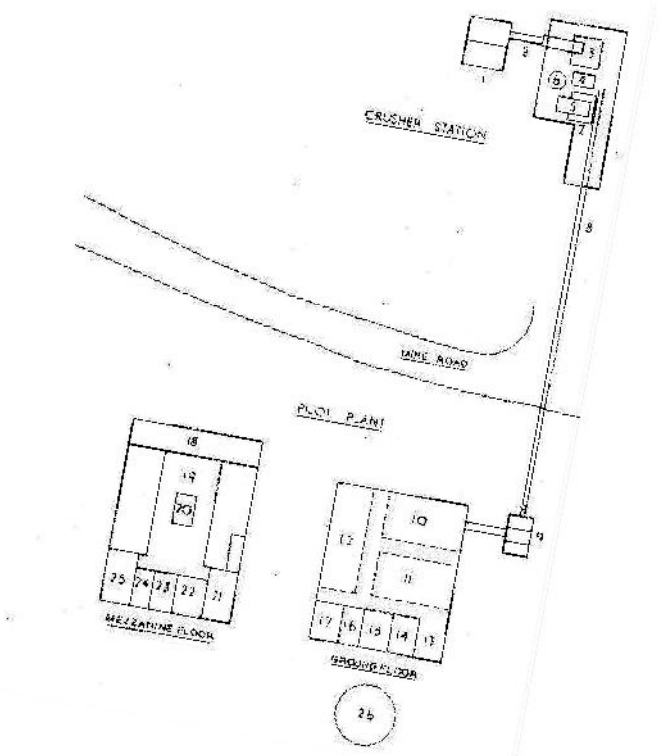

1. Crude Ore Bins
2. Conveyor System
3. Jaw (Primary) Crusher
4. Bucket Elevator
5. Vibrating Screens
6. Gyratory (Secondary) Crusher
7. Intermediate Fine Ore Bins
8. Handtrucking System
9. Fine Ore Bins (Mill)
10. Grinding, Classification & Flotation Section
11. Hydro-Metallurgical Section
12. Ancillary Treatment Section
13. Receiving Bay and Workshop
14. Engineering Store
15. Mill Office & Research Laboratory
16. Testing Laboratory
17. General and Sample Store
18. Solar Heating Bay
19. Solar Heating Instrumentation Section
20. Control Laboratory
21. Reagent Store
22. Research Laboratory
23. Research Laboratory
24. Balance and Microscope Room
25. Instrument Store & Repair Shop
26. Thickener

0 10 20 30 40
Meters

Experimental Mine Items and Features (1963) Source: University of Queensland Dept. of Mining and Metallurgical Engineering 1963 - Approximately Referenced

C-9	UQ
Date: 27/02/2014	**Author:** Christopher.Maddox
	Map Scale: 1:1,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56

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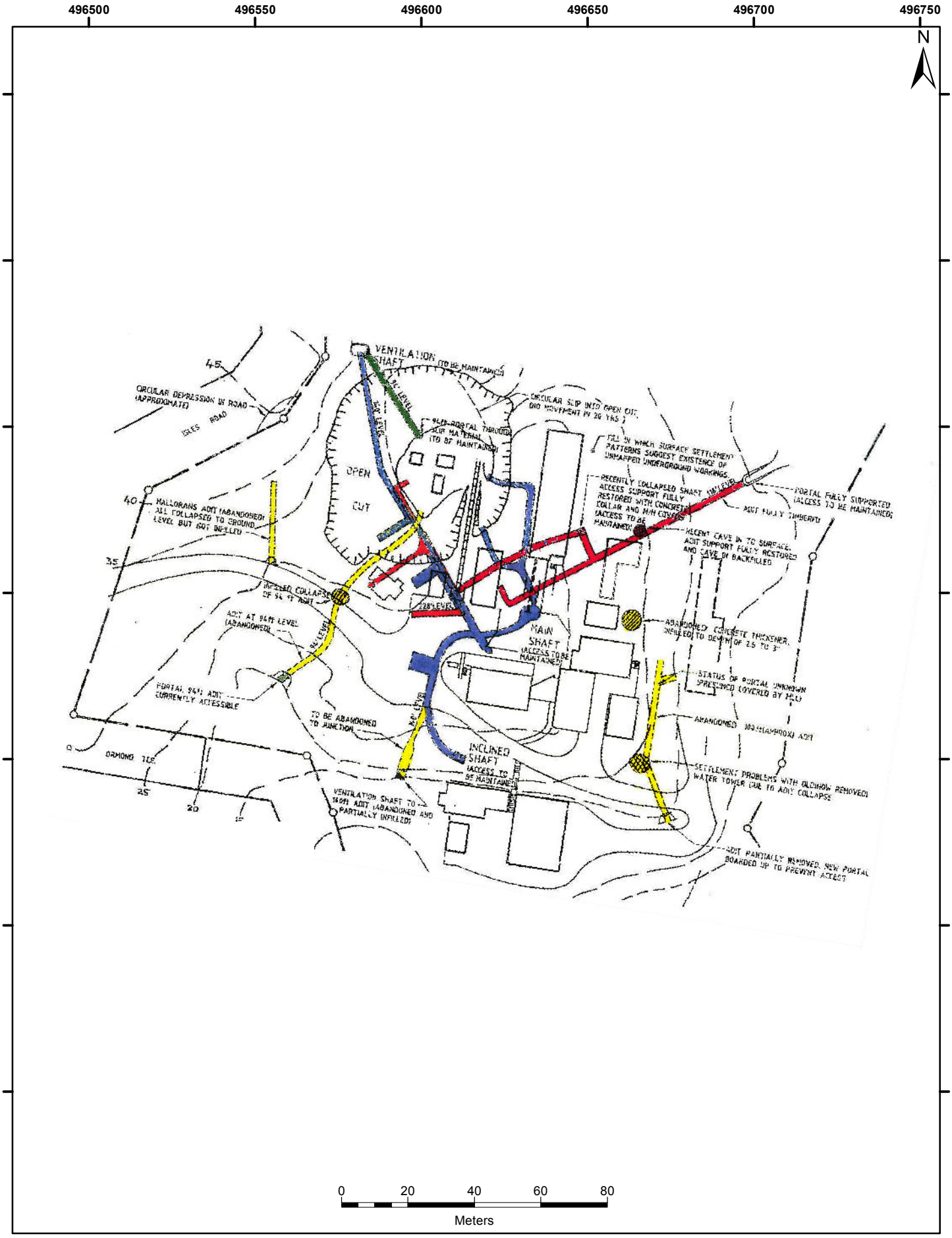

Mine Layout per AMC 2013 (from Mine Development Plan Compiled by GHD: (1990)) Approximately Referenced

C-10	UQ	
Date: *27/02/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:1,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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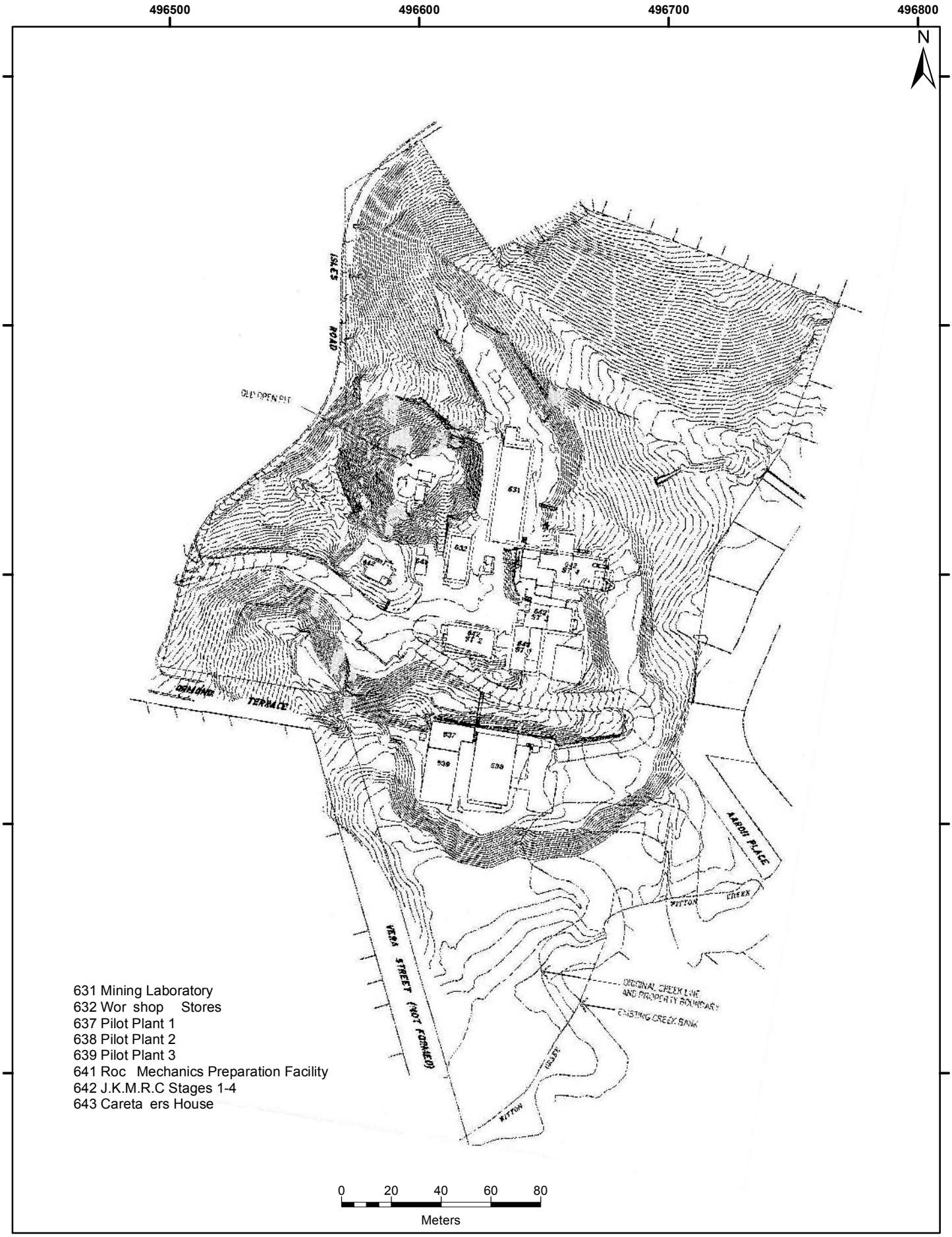

Mine Layout per Site Planning Report (2000) - Approximately Referenced

C-11	UQ	
Date: *27/02/2014*	**Author:** Christopher.Maddox	
	Map Scale: 1:2,000	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	

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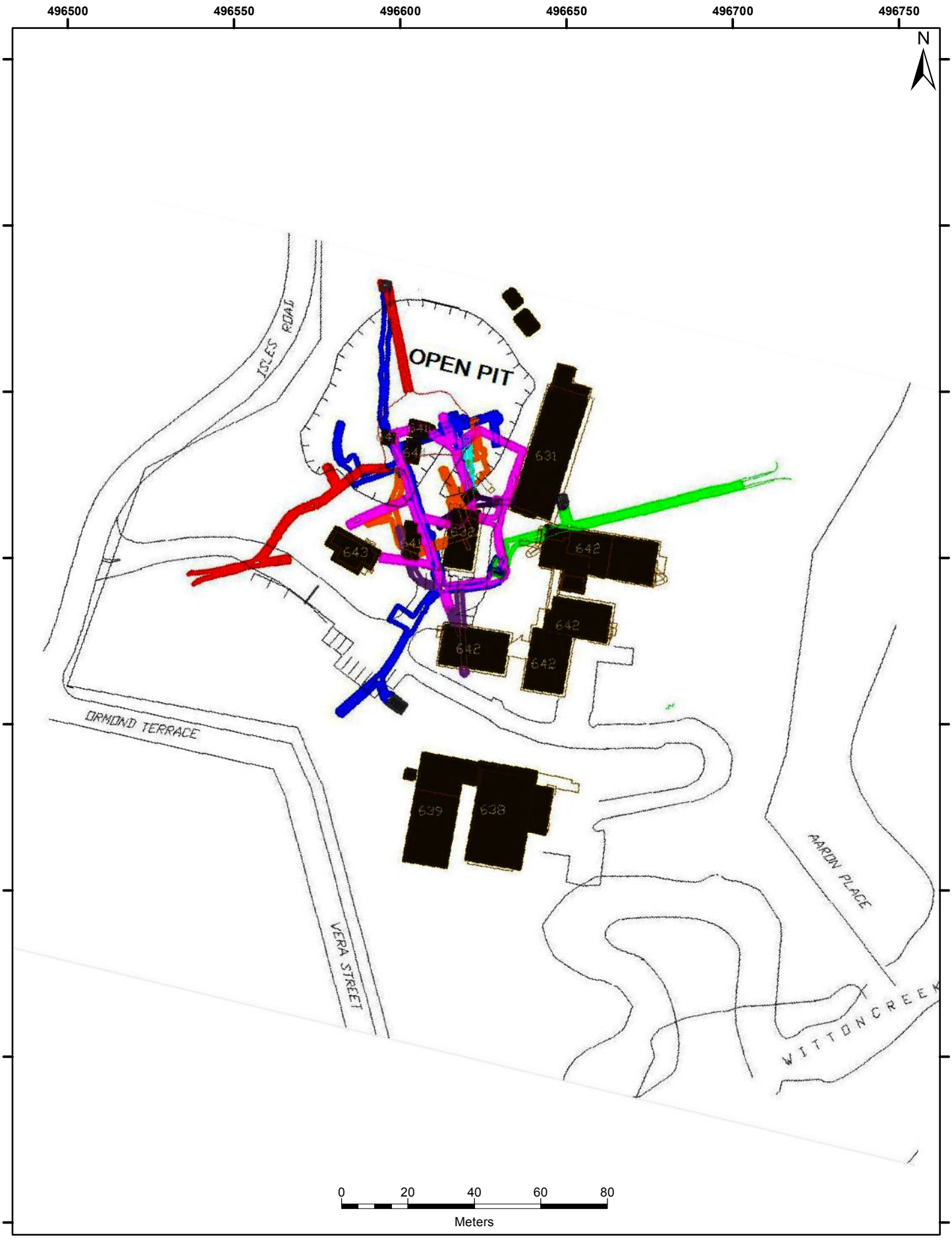
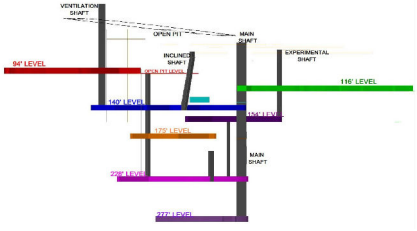


Legend



Mine Layout per Responsibilities Report (2009) - Approximately Referenced		
C-12	UQ	elp environmental and licensing professionals pty ltd
Date: 27/02/2014	**Author:** Christopher.Maddox	
	Map Scale: 1:1,500	
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56	
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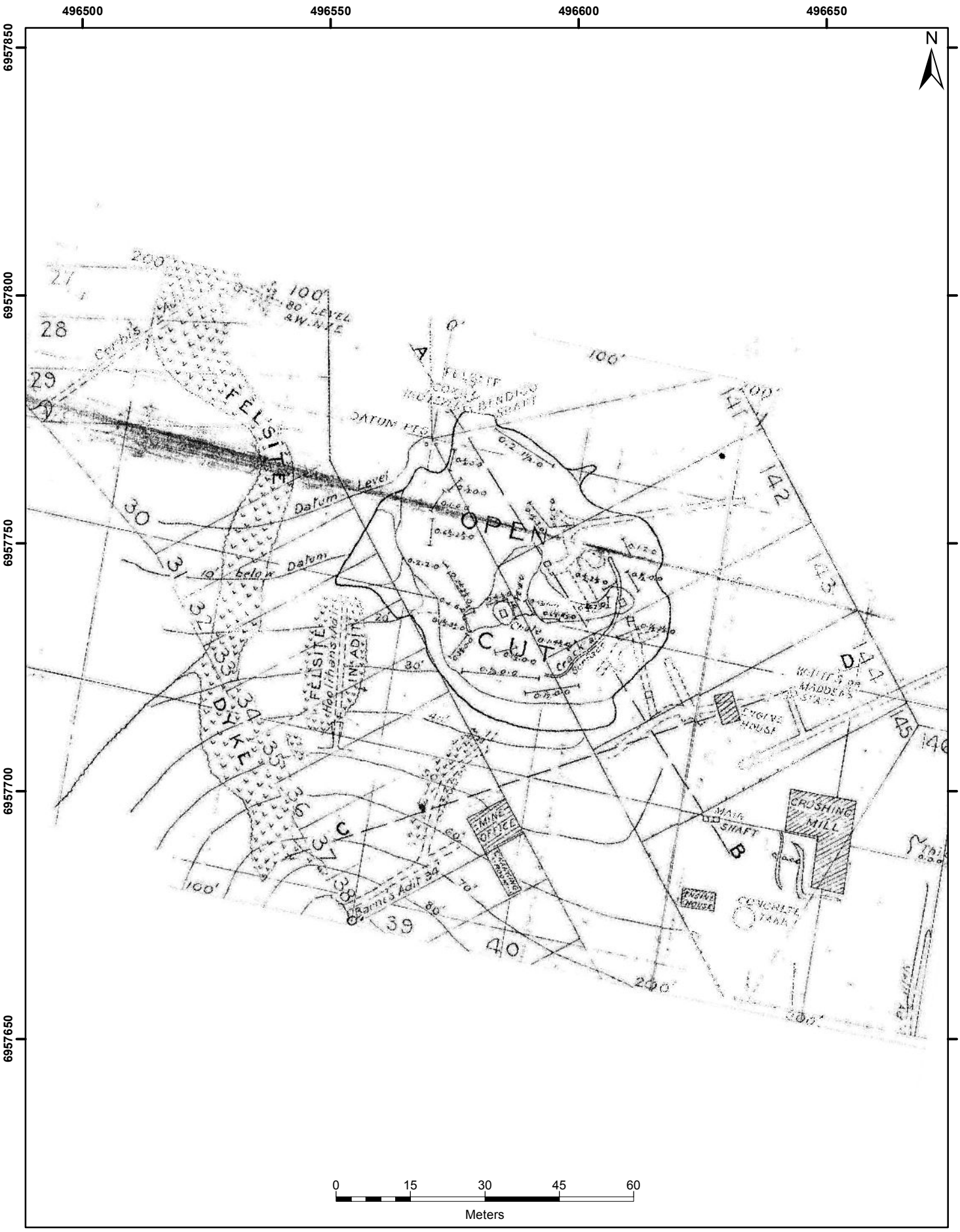

Site Plan from Ball L C (1925) Approximately Referenced

C-13	UQ
Date: 27/02/2014	**Author:** Christopher.Maddox
	Map Scale: 1:1,000
Revision: R1	**Coordinate System:** GDA 1994 MGA Zone 56

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