DRAFT
Mt Lofty Rifle Range Disposal Study
Rifle Range Road, Toowoomba Queensland

30 November 2005

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ATTACHMENTS

1 INTRODUCTION

1.1 Background

HLA-Envirosciences Pty Limited (HLA) was engaged by the Department of Defence (Defence) to undertake a Property Disposal Study for the Mt Lofty Rifle Range located at Toowoomba, Queensland.

The site is a 379ha Defence owned property located on the north eastern fringes of the City of Toowoomba in south-eastern Queensland. Encompassing a plateau, steep escarpment and lower lying undulating ranges overlooking the Lockyer Valley, the property includes a diverse range of environmental and surrounding land use conditions.

The site's European history dates back to 1879 when the Queensland Colonial Government established the Toowoomba Volunteer Rifles, which with other militia units and the police force were entrusted with the defence of the Colony. Twenty acres were set aside as a Rifle Range for the Toowoomba Volunteer Rifles. Since this time, the range has been expanded to accommodate Defence training needs and developments in rifle design and ammunition. While ostensibly a target range for the training of militia, police and subsequently Defence personnel in rifle use and marksmanship, the Range has also been used for other military training and testing purposes.

In 1949 the Range was declassified as a Rifle Club. When not in use as a Rifle Range, the Range at various times has been leased for private animal grazing and in more recent times, horse agistment.

1.2 Approach and Methodology

HLA conducted environmental and heritage assessments of the Site to equip Defence with the necessary understanding of the issues of concern and potential associated financial impacts in the context of relevant requirements to enable a suitable property disposal strategy to be developed.

The strategy adopted has been to assess the levels of contamination, heritage significance and presence of hazardous materials, ecological status and planning constraints of the site, which may impact on the property disposal. A multidisciplinary team of HLA specialists was organised to conduct separate investigations on the Site. These investigations were individual in scope; the interrelationships between their respective reports have been integrated within this report to enable the development of recommendations for future management.

1.3 Objectives

The overall objective of this document is to provide sufficient information to assist Defence in assessing each of the potential issues of concern in the context of relevant regulatory requirements to facilitate the development of a suitable property disposal strategy.

1.4 Scope of Works

The scope of works conducted by HLA in order to achieve the objectives of this study, incorporate investigation of the following aspects:

- **Site History**: This information forms the basis of the various aspects of this study, particularly with regard to assessment of unexploded ordnance, contaminated land, heritage and landownership/boundary conflict issues.
- **Unexploded Ordnance**: Based on known information of past site usage, a 5% Analogue Assessment Survey over the site was undertaken in order to confirm or add to information obtained from the Site History.
- **Contaminated Land**: Based on information obtained through the UXO assessment, and a limited site inspection, a sampling and analysis program was conducted focusing on the primary areas of historical use for Defence training use and as a rifle club.
- **Flora and Fauna**: Flora and fauna assessments were conducted to identify the existing environment within the Mount Lofty site and to assess the likely presence or absence of Commonwealth and/or State listed threatened communities, and species, or their potential habitat.
- **Heritage**: Indigenous and European heritage assessments were conducted to identify any issues and values within the study area and outline the relevant management options
- **Land Use Planning**: Land uses surrounding the area were investigated and the various planning requirements which apply to any development proposal for part or all of the site are discussed
- **Building Condition Assessment**: A building condition assessment was conducted to determine the condition and potential for future use of structures on site
- **Infrastructure Capacity**: The availability of water, sewerage, electric power, roads and stormwater infrastructure to the site was assessed
- **Surveying**: A complete resurvey was conducted of legal title and actual property boundaries to resolve suspected boundary conflict issues. The study also defined the outlines of all on-site structures and services within the surrounding area.

1.5 Structure of this Report

The purpose of this report is to provide an overview of the environmental, heritage, infrastructure and land use issues that may pose constraints in the potential disposal of the property. Individual reports for each of the elements within HLA's Scope of Works are included as an appendix to this document as follows:

Attachment A: Unexploded Ordnance Assessment
Attachment B: Non Ordnance Contamination
Attachment C: Flora Assessment
Attachment D: Fauna Assessment
Attachment E: European Heritage Assessment
Attachment F: Indigenous Heritage Assessment
Attachment G: Land Use Planning
Attachment H: Infrastructure
Attachment I: Survey Drawings

2 SITE DESCRIPTION

2.1 Property Location and Description

The Mt Lofty Rifle Range is located to the north-east of Toowoomba, Queensland, approximately 3km from the Central Business Centre. The site comprises seven lots namely, Lots 1-2, 112, 114 and 191 on RP46221, Lot 2 on RP17738 and Lot 86 on CC350 and is located within Toowoomba City Council. The study areas south and western boundaries are constrained by Rifle Range Road and Martini Road respectively, while the north and eastern boundaries are located in the vicinity of the Withcott outskirts at the base of the escarpment.

There are three shooting ranges on the site; a 12 lane, 600m classification range, a small bore range and a small bore silhouette range. The range is currently used by the Australian Defence Force units based at Oakey and Cabarlah, 25/49 Royal Queensland Regiment and Darling Downs cadet units.

There are currently two licences over the Rifle Range; an agistment license and one issued to the Mt Lofty Shooting Complex. The agistment license is for a 12 month period, from February 2004, with two 12 month options, with a six month termination clause. The shooting club licence commenced in April 2004 for a 12 month period, with two 12 month options and a six month termination clause (Defence, 2004).

2.2 Physical Description

2.2.1 Geology

The geology of the region is represented schematically in **Figure 2** of the Indigenous Heritage Assessment (**Attachment F**). The region consists of a concealed basement of late Palaeozoic rocks, which are overlain by a sequence of mid-Mesozoic shales and sandstones. This in turn is overlain by mid-Tertiary basalts and associated volcanics and palaeosols known as the Toowoomba volcanics. These volcanics are a member of the Main Range Volcanics (MRV), which are the most extensive surface unit in the region. Quaternary denudation (the combined process of weathering and erosion) has resulted in more recent soils, colluvial and alluvial deposits.

The study area appears to be largely situated over a number of MRV Lava Pools with its western and southern edges overlaying the Upper Laterite deposits (**Figure 3** of **Attachment F**). The MRV unit comprises materials derived from several small local eruptive centres; mostly basalt flows and various inter-beds of tuffs (the evolution of an MRV lava pool is represented in **Figure 4** of **Attachment F**). Lava pools of the MRV unit display two distinctive stages; an explosive phreatic eruption, which forms a cratered tuff cone, and an effusive lava-forming magmatic eruption, filling and overflowing the crater. Post-eruptive erosion of these eruptive centres results in rapid removal of the tuff crater, undercutting the fresh basalt in the crater resulting in screes (Willey, 2003). The MRV unit is bounded by two geological land surfaces. The lower surface is bounded by thin, immature soils (Lower Palaeosol) that were formed on Mesozoic strata, while the upper surface is marked by the lateritic Upper Palaeosol. At Mt Lofty at least two laterite horizons appear to be separated by a possible tuffaceaous material (Willey, 2003). It should also be noted that further east at the base of the escarpment is evidence of sandstone deposits within the Walloon Coal Measures. Other sandstone layers are also present in the lower Woogaroo and Marburg subgroups beneath these coal measures.

2.2.2 Landforms

Toowoomba can be split into two types of landform units – the Toowoomba plateau and the Basaltic uplands. The former is only located in the City of Toowoomba generally above 650m AHD (Australian Height Datum) and consists of flat parallel low ridges covered by red lateritic soils. The latter consists of parallel layers of basaltic rock on which denudation has proceeded. This basaltic landform consists of low flat-crested ridges with numerous narrow flattish spurs projecting from the slopes below the crests (Thompson & Beckmann, 1957). The study area largely falls within the Basaltic uplands with some evidence of the Toowoomba plateau landforms to the south and west side of the rifle range.

2.2.3 Soils

The soils of the Toowoomba region have been classed into four general groups:

1. The red soils of the Toowoomba plateau;
2. The generally dark and brown soil types of the basaltic uplands of the Eastern Darling Downs;
3. Soils developed on alluvial materials; and
4. Immature soil types found on escarpment slopes.

The study area contains a number of these soil types, but most predominantly the thin dark brown weathered basaltic soils of the Eastern Darling Downs (referred to as *Shallow black earths* by Beckmann *et al*., 1974). Beckmann *et al*. (1974) describes these soils as shallow to moderately deep (<90cm) to weathered basalt, dark coloured heavy clay soils, self mulching surface and medium to blocky subsoils. Although Willey (2003) points out that these soils are not always mature, often thinly overlying weathered basalt without any form of subsoil.

Towards the south and western edges of the site the red soils of the Toowoomba region are present. The red colouration of these soils is caused by laterization or strong weathering which produces high concentrations of secondary formed ferric (red form of iron) minerals like hematite. This red soil is thought to be weathered soil profile, or regolith profile. Regolith is classified as the material that lies between bedrock and the surface and generally refers to deep *in situ* profiles and is described through a series of weathering stages moving down through the profile.

Towards the north and east end of the study area overlying the sandstone bedrock, soils typically consist of eroding red lateritic soils possibly defined as the Lower Palaeosol by Willey (2003).

2.3 Climate

Toowoomba experiences dry winters and wet summers, with monthly rainfall averages ranging between 39.8 mm and 56.8 mm during the winter months, rising to between 122.4 mm and 133.0mm during the summer. Average maximum temperatures vary from 27.6°C in January to 16.3°C in July. Average minimum temperatures range from 16.6°C in January and 5.3°C in July. An overview of the mean monthly maximum and minimum temperatures and mean monthly rainfall is provided in **Figure 1**.

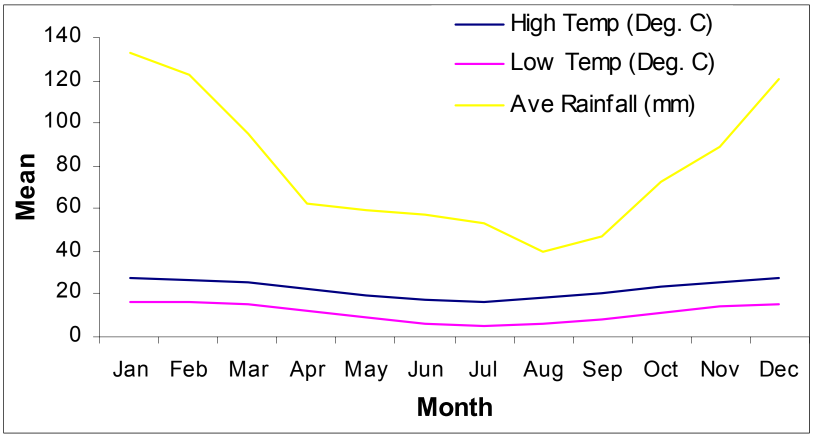

Figure 1: Climate details (mean max. and min. temperatures, and mean rainfall) for the Toowoomba area (source: Bureau of Meteorology, 2005)

2.4 Surrounding Land Uses

The subject site is zoned Special Use (G- Other government precinct) in the planning scheme. The area to the south is zoned Open Space (Environment Precinct) with a small area of Park Residential (Bushland Residential Precinct) and Neighbourhood Residential (Escarpment Residential Precinct). The area to the west is also zoned Neighbourhood Residential (Escarpment Residential Precinct).

2.5 Easements and Access

Road access to the plateau part of the site is from Martini Street and Rifle Range Road in Toowoomba City while Jones road in Shire provides access to the eastern and lower part of the site. There is no easement on the property however, there appear to be services which utilise the site and which would need consideration in the planning and future development of the site.

3 ENVIRONMENT AND HERITAGE ISSUES

3.1 Site Contamination

3.1.1 Ordnance Contamination

A site inspection was undertaken by G-tek to determine whether the site is affected by UXO and if so, the nature and type of UXO (see **Attachment A**). Defence have no record of UXO being recorded for this range and no UXO or EO was located.

Components from functioned grenades were found in two locations. Four mortar impact points were found, two of these were created by 3 inch high explosive (HE) projectiles, one was from a 2 inch HE projectile and one was a 2 inch smoke projectile.

A small impact area with two identified impact points for 40 mm HE grenades was found immediately in front of the rifle range target area. No other remnants of functioned projected grenades was found, however an empty fired projected infantry anti-tank (PIAT) round was found on the current rifle range. This would indicate that PIAT projectiles have been fired on this range, however, the incidence was low.

An empty fired hand held signal was found during the assessment, and a component from a No. 94 anti-tank practice projectile. A variety of small arms ammunition components, fired from pistols and rifles dated from the early 1900's to the present day were located on the site, indicating that the range has been used as an infantry close training area.

See **Attachment A** for a detailed report of the UXO study which provides a map showing the location of significant finds (**Appendix 5** of **Attachment A**).

3.1.2 Non Ordnance Contamination

An assessment of the Mt Lofty Rifle Range was conducted by HLA. Findings of this assessment are presented in **Attachment B**.

The following summary of potential areas of environmental concern (AEC) (**Table 1**) was identified from information detailed in the UXO report compiled by G-tek (**Attachment A**) noting areas with the potential for environmental impacts. Review of existing defence information and undertaking of a limited site inspection did not identify any other potential contaminant sources such as bulk fuel or other petroleum storage or vehicle maintenance.

Table 1: Summary of potential AEC at Mt Lofty Rifle Range

Reference Location	Potential AEC
Caretaker's Cottage (built approx 1906 used by rifle club, until 1968 subsequently then used by Defence	Potential for arsenic, As, or pesticide use for White ant and borer infestations treated in 1952. May contain asbestos from building materials. Lead based paints may also be present.
Office	Potential for arsenic or pesticide use for White ant and borer infestations treated in 1952. May contain asbestos from building materials. Lead based paints may also be present.
Sheds	Potential for arsenic or pesticide use for White ant and borer infestations treated in 1952. Also potential for contaminated soil to have been spread from soils removed from beneath store shed in 1941. May contain asbestos from building materials. Lead based paints may also be present.
Ladies amenities erected in 1956	Contains asbestos building materials and is on the Asbestos Register. Lead based paints may also be present.
Danger Area - Prickly pear infestation only 1929	Potential for pesticides or herbicides (OCP/OPP) to have been used and present in affected areas.
Stop butt- toe	Potential for heavy metals from bullet and shell casing of ammunition, hydrocarbons and explosive residues from accelerants and detonation sources. Pesticides and herbicides may be present from vegetation control. TPH/BTEX and explosives.
Range Firing mounds	Potential for heavy metals from bullet and shell casing of ammunition, hydrocarbons and explosive residues from accelerants and detonation sources. Pesticides and herbicides may be present from vegetation control. TPH/BTEX and explosives.

Review of results from the site investigation works (soil) conducted in October 2005 across the site has reported concentrations of potential contaminants of concern (including arsenic, cadmium, chromium, cobalt, copper, lead, nickel, zinc, mercury, nitrite, nitrate, TPH and in one sample, explosives) above laboratory limits of reporting. Of these, cobalt, copper, lead and TPH were found in concentrations exceeding current regulatory guidelines.

The primary drainage gully in the centre of the site presents the potential primary pathway for surface migration of contaminants away from source areas when water is flowing. However, the sampling at the down gradient end of the gully indicates that no significant migration has occurred. Additionally, given the clayey nature of the underlying soils and the lack of a significant shallow groundwater aquifer, and the relative immobility of the heavy metals present at the site, it is unlikely that there has been any significant migration of contamination either off-site or vertically into the underlying natural soils other than that identified as part of this investigation. Personnel utilising the facilities should avoid direct contact with contaminant impacted soils and buildings.

Horses grazing on the site should be restricted from areas of contaminated soils and asbestos and lead containing buildings.

There is no visible evidence of deleterious impact to native fauna and flora from the identified areas of contamination.

3.2 Flora and Fauna

3.2.1 Flora

A flora assessment was undertaken by HLA botanist Wayne Harris (see **Attachment C** for a full report).

The property has a number of cleared areas but also areas containing intact woodlands and vine thickets. Some of the woodlands have canopy and shrub layers in close to natural condition, while others are degraded or partly cleared. The vine thickets are also close to natural condition but they too have been modified by grazing and the invasion of weed species, particularly *Asparagus* spp. (Asparagus fern), *Lantana camara* (Lantana) and *Ligustrum lucidum* (Privet). The ground layer is modified by grazing. The declared weed species *Opuntia* sp. (Prickly Pear) is very common throughout the areas as are *Asparagus* spp.

Regional Ecosystems

The REs identified on the property, as mapped in Version 4 of the DNRM Regional Ecosystem mapping, are shown in **Appendix A** of **Attachment C**.

Table 2 below describes mapped and identified REs on the property. Some differences between the previously mapped areas and the vegetation communities identified during the field survey exist in the north-western corner of the property (see RE map) and a map modification should be proposed. This is a reflection of the different scales of mapping undertaken (the RE mapping at a scale of 1:100,000 as opposed to the detailed and therefore more accurate ground truthing for the present assessment).

In this same area there is a distinct community of riparian microphyll / notophyll rainforest species fringing a small stream. This unit is too small to be mapped at 1:100 000 scale but is, nevertheless, an important habitat. For these reasons it has been included as part of RE 12.9-10.15. Prominent species include *Grevillea robusta* and *Ficus* spp.

Table 2: Mapped and identified RE's on the property

Version 4 DNRM RE map	Field survey results	Existing level of disturbance	VMA Status	Commonwealth Endangered Communities present*
12.8.21	12.8.21	Minor (grazing)	EN	Yes
12.9-10.15	12.9-10.15	Major (grazing)	EN	Yes
12.9-10.7/12.9-10.2	12.9-10.7/12.9-10.2. (60/40)	Minor (grazing)	OC	No
12.8.14	12.8.14	Some cleared, Regrowth, grazing	NOC	No
12.8.17	12.8.17	Some cleared, regrowth (grazing)	NOC	No
12.3.7	12.3.7	grazing	NOC	No

** As per the Commonwealth* Environment Protection and Biodiversity Conservation Act 1999.

VMA status based on the Vegetation Management Regulation 2000.
EN = Endangered under the Queensland Vegetation Management Act 1999.
OC = Of Concern under the Queensland Vegetation Management Act 1999
NOC = Not Of Concern under the Queensland Vegetation Management Act 1999

3.2.2 Scheduled flora species

The review of the Queensland Herbarium and Commonwealth Department of Environment and Heritage flora databases established that 5 scheduled plant species are known to have ranges that overlap the wider study area (see **Appendix B** of **Attachment C** for database search results). These species, as listed in **Table 3**, were targeted during the plant survey.

Table 3: Protected flora species potentially occurring within site*

Family	Scientific name (Common name)	Conservation status	Preferred habitat	Preferred habitat present at site	Located during field survey
Asteraceae	*Stemmacantha australis*	Vulnerable *Aust, Qld*	Widespread on heavy soils	**Yes**	**No**
Proteaceaa	*Grevillea singuliflora*	Rare *Qld*	Sandy or sandstone areas	**Yes**	**No**
Lauraceae	*Cryptocarya floydii*	Rare *Qld*	Dry rainforests	**Yes**	**No**
Cupressaceae	*Callitris baileyii*	Rare *Qld*	Hilly or mountainous areas	**Yes**	**No**
Myrtaceae	*Callistemon formosus*	Rare *Qld*	In or near depauperate rainforest	**Yes**	**No**

Aust = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
Qld = Queensland *Nature Conservation (Wildlife) Regulation 1994.*
* *as recorded by Queensland Herbarium and Department of Environment and*

3.2.3 Fauna

A fauna assessment was undertaken by HLA to identify the existing faunal environment within the Mt Lofty site, and to assess the likely presence or absence of Commonwealth and/or State listed threatened species, or their potential habitat. The technical report for this assessment is provided as **Attachment D** to this document.

The review of fauna databases for the wider area around the Mount Lofty site identified the potential presence of 29 fauna species listed as threatened species under Commonwealth and/or State legislation (2 butterflies, 2 amphibians, 4 reptiles, 14 birds and 7 mammals). Six of these species are listed as threatened species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), 9 species are listed under the Queensland *Nature Conservation Act 1992* (NCA Act), and 14 species are listed under both Commonwealth and State legislation.

During this fauna assessment, a total of 9 amphibians, 9 reptiles, 39 birds and 4 mammals (not including bats) were recorded on the Mount Lofty site. A list of these species is included in **Appendix A** of **Attachment D**. Two of the species recorded have been listed as threatened species under Commonwealth and/or State legislation: Grey Goshawk (*Accipiter novaehollandiae*) and Collared Delma (*Delma torquata*). The ecology and status of these species are discussed further in Section 3.3 of **Attachment D**.

Other significant species have been recently recorded on or near the Mount Lofty site during other fauna surveys. These included Powerful Owl (*Ninox strenua*), Glossy-black Cockatoo (Calyptorynchus lathami), and Grey-headed Flying-fox (*Pteropus poliocephalus)* (Boobook 2005). These species are discussed further in Section 3.3 of **Attachment D**.

A number of the fauna species recorded on the Mount Lofty site during the fauna habitat assessment were feral or introduced animal species. A total of 4 species (Dog, Hare, Black Rat and Cane Toad) were identified, either directly or from scat or pellet analysis, not including Horses agisted on the site. These species are denoted in **Appendix B** of **Attachment C** as introduced animals by an asterisk.

Habitat Types

Of the 29 listed threatened species potentially present in the wider area, a total of 18 could potentially utilise the Mount Lofty site based solely on habitat preference. Six different broad habitat types are represented on the Mt Lofty Site. Each of these provides potential habitat for a wide range of fauna types. The habitat types include Open Eucalypt Forest, Open Ironbark Woodland, Semi-evergreen Vine Thicket, Riparian Vine Forest, Lantana Thickets and Cleared Land. Detailed descriptions of each of the habitat types are given in **Attachment D**.

Connectivity

Almost all the remnant vegetation on the Mount Lofty site has been mapped as State Wildlife Corridor, except for small sections near the eastern boundary. Many species of wildlife need to move through large areas of vegetation, whether to disperse, hunt, or search for mates. Wildlife corridors link patches of habitat, as well as providing valuable habitat in themselves. They also provide corridors for gene flow, reducing the risk of population fragmentation and genetic isolation, and consequent higher extinction risk.

Remnant vegetation on the Mount Lofty site forms an important part of a much larger wildlife corridor that links two very large habitat patches: Main Range to the south and the area around Mount Cross including Deongwar State Forest to the northeast. Although somewhat fragmented by roads and clearing, this wildlife corridor provides a vital link along the Great Divide between these important faunal refuges, allowing mobile species such as Powerful Owl, Red Goshawk and Spotted-tail Quoll to move between habitat patches. The Mount Lofty site is located at one of the narrowest points along this corridor, and so loss of the remnant vegetation would result in a significant discontinuity in this important path for the movement of wildlife.

3.3 Heritage

3.3.1 European Heritage Aspects

A study of the European heritage aspects of the Mt Lofty Rifle Range is reported in **Attachment E**. It was found that the buildings and structures at the Mt Lofty Range site have minimal heritage significance.

The Mt Lofty Rifle Range site has been associated with the training of militia groups, police cadets and defence personnel since the earliest days of settlement in Queensland. The history of one of Australia's most decorated Battalions, the 25th Royal Queensland Regiment dates from January 20th 1875, when volunteers enrolled at Toowoomba in the No. 8 Company of the Queensland Volunteer Rifles. The Mt Lofty range has increased in size and developed over time with the Battalion as weapons changed from muskets to rifles to fully automatic weapons.

All remnants of the first two firing ranges have been completely removed so there is nothing of heritage significance relating to militia use of the site pre-Commonwealth ownership in 1913.

The current buildings and structures (apart from the Rifle Club buildings) dating from the 1913 upgrade of the site (or replacements thereof) are also of little heritage significance. The target trenches and target shutters are of potential minor historic interest.

The Darling Downs Rifle Club building has possibly some heritage significance but only at the local community level.

The Toowoomba Rifle Club building has no heritage significance.

3.3.2 Indigenous Heritage

An assessment of the Indigenous heritage at Mt Lofty Rifle Range was conducted by HLA to identify any indigenous cultural heritage issues and values within the site. This assessment is attached as **Attachment F**.

A search of the Native Title Tribunal on 5 October 2005 identified two registered 'active' applications on the Register of Native Title Claims:

- QC99/4 – Western Wakka Wakka people; and
- QC03/15 – Jaggera people #2.

It would appear that two other groups, the *Jarowair* people and the *Giabal* people are also considered potential traditional owners. See **Attachment F** for more information.

From a historic perspective, the tribal maps and information on the Aboriginal communities of the area suggest that the study area is on the periphery of a number of tribal group's boundaries, namely the *Giabal*, *Jagera* and potentially *Jarowair* tribes. Typically, large scale settlement and occupation by Aboriginal groups would not focus on their tribal boundaries due to the conflict this could lead to between tribes, limiting the potential archaeological resource of this area. In addition, the natural relief of the area is likely to limit the use of the study area – the slopes are too steep for settlement and in many cases prohibitive to movement across them, the creeks appear to be ephemeral (although admittedly this may not have always been the case) and of limited use for Aboriginal people. Sections of the plateau would have been of some use for lookouts, although better locations would arguably have been nearby Prince Henry Heights and Blue Mountain Heights. The site visit did identify a potential grinding groove that suggests Aboriginal people passed through the area (at least at the base of the escarpment) although the existence of only one groove rather than many suggests this site was not regularly visited.

Archaeological research identifies the most likely sites to occur in the Lockyer Valley region to be artefact scatters and scarred trees. The site visit revealed the visibility was too poor to identify the former, while the latter seemed unlikely given the historic and recent destruction of the study area. However, both have the potential to occur in this area. Grinding grooves have previously been identified within the Lockyer Valley, which increases the credibility of the find within this project. With regards to the periods of occupation, research is limited. Typically Holocene (10,000 years ago to present) dates are commonly found within the region, such as the Rocky Scrub Rockshelter in the Lockyer Valley, dated 4,000-3,820 before present.

The DNRM search revealed that there were a number of sites (33) located within 5km of the study area, largely in the low lying areas to the north following Oaky Creek. While none of these sites are located within the study area, a number of them (specifically springs, artefacts and a rock concavity) were situated near the northern border. Only a very small portion of the northern part of the study area falls over the low lying and cleared areas surrounding Oaky Creek, which runs parallel to the northern boundary. However, these areas were inaccessible during the site visit.

While the most likely locations for archaeological deposits within the study area are likely to be on the plateau or in the zones of accumulation at the base of the escarpment, the former has been heavily disturbed by Defence activities (such as the two rifle ranges, grenade practise range, structures and multiple roads) and the latter seems unlikely to yield any *in situ* archaeological deposits due to the unstable nature of this environment.

4 PLANNING

4.1 Planning

There are several planning documents which are of relevance to the subject site. These are the:

- South East Queensland Regional Plan;
- State Planning Policies;
- Planning Scheme for the City of Toowoomba; and
- Planning Scheme for the Shire of Gatton.

4.1.1 South East Queensland Regional Plan

The South East Queensland (SEQ) Regional Plan is a statutory instrument prepared in accordance with the provisions of Section 2.5A of the Integrated Planning Act 1997 (IPA). The primary purpose of the Regional Plan is to provide a sustainable growth management strategy for SEQ to the year 2026.

The Regional Plan is the pre-eminent plan for the SEQ region and takes precedence over all other planning instruments. Under the *Integrated Planning Act* (IPA), the Regional Plan prevails where there is any inconsistency with any other plan, policy or code, including any other planning instrument made under State legislation, that have effect within the SEQ region.

The SEQ Regional Plan includes the subject site in the Rural Landscape and Rural Production Area, the intent of which is to *identify lands that have regional landscape, rural production or other non urban values and protects these areas from encroachment by inappropriate development, particularly urban or rural residential development.*

The Regulatory Provisions of the Plan do not allow further fragmentation of land holdings below 100 hectares and makes material change of use applications for urban activities and rural residential purposes impact assessable. Urban development is generally permitted only in the Urban Footprint designation and rural residential is generally permitted only in the Rural Living designation. The Rural Landscape and Rural Production Area designation is exclusive of the Urban Footprint and Rural Living Designations.

There are no criteria for acceptance of environmental offsets in exchange for permitting urban development of areas outside the urban footprint.

Given the SEQ Regional Plan Provisions, it would potentially be difficult to obtain approval to develop any part of the subject site for urban or rural residential purposes without modification of the Regional Plan. Modification of the Regional Plan is reasonably onerous and requires extensive consultation prior to the Regional Planning Minister being able to finalise the amendment. Should the amendment involve the Regulatory Provisions, then the amendment requires ratification by Parliament.

4.1.2 State Planning Policies

The following State Planning Policies are of relevance to the subject site:

- *SPP1/92 – Development and Conservation of Agricultural Land*: This site is not regarded as being good agricultural land and is therefore not subject to this SPP.
- *State Coastal Management Plan*: This site is not within the boundaries of concern of the SCMP.
- *SPP 1/02 – Development in the Vicinity of Certain Airports*: This site is not beneath Toowoomba Airport's operational airspace; is not within or beneath any sensitive areas of Toowoomba Airport; is not within Toowoomba Airport's 20 ANEF contour and is not within the public safety areas at the end of the Toowoomba Airport runway, therefore this SPP does not apply.
- *SPP 2/02 – Planning and Managing Development Involving Acid Sulfate Soils*: The site does not contain nor have the potential to contain acid sulfate soils as it is well above 5.0m AHD, therefore this SPP does not apply.

- *Mitigating the Adverse Impacts of Flood, Bushfire and Landslide*: Parts of the site are subject to bushfire and landslide hazard, therefore this SPP does apply.
- *Draft SPP – Protection of Extractive Industries*: A Key Resource Area is identified adjacent to the north west boundary of the site. This SPP is not yet adopted. The presence of a key resource area adjacent to the subject site suggests that there may be extractive resource on the site.

4.1.3 Toowoomba City Council Planning Scheme

The subject site is zoned Special Use (G-Other Government precinct) in the planning scheme. The area to the south is zoned Open Space (Environment Precinct) with a small area of Park Residential (Bushland Residential Precinct) and Neighbourhood Residential (Escarpment Residential Precinct) (see figure 1, **Attachment H**).

In the Special Use (G-Other Government precinct) zone, Telecommunications facility (Low Impact) is exempt from assessment under the planning scheme and Telecommunications facility (Medium Impact) is self assessable. All other material change of use will require impact assessment other than Office (general or service), industrial premises if used for scientific, biomedical or technological research, bus/rail passenger terminal or major utility.

The zone and precinct is intended for State and Commonwealth purposes including joint ventures with the state or Commonwealth government.

The subject site is identified in the Scheme's Regulatory Maps as having various categories of steep and potentially unstable land and as being prone to bushfire or being a bushfire hazard area. The site also has obstacle limitation surfaces applied to it; however these are in excess of 700 metres above sea level.(See Figure 2, **Attachment H**)

4.1.4 Gatton Shire Planning Scheme

The area along Jones Road in Gatton Shire that is in the vicinity of the subject site is shown in the draft Planning Scheme as Rural Uplands and is characterised by lands which are steep, have significant topographical features or significant vegetation. This zone is intended to retain the land in its natural state.

4.2 Surveying

Results of the surveying have been included as **Attachment I**. It was found that Lot 1 RP46221 is encroached by Jones Road and that the fence lines are well inside the subject land along the north east boundary of the rifle range. Additionally, a Telstra cable lies within the property parallel to the north eastern boundary, but the exact location is currently unknown.

5 BUILDING CONDITION AND INFRASTRUCTURE CAPACITY

5.1 Building Conditions

A visual building condition assessment was undertaken in Novermber 2005. A full account of the findings is provided in **Appendix B of Attachment H**. Notices on buildings and discussions with Defence personnel indicate that an asbestos audit of the property has been completed and therefore has not been included in this assessment.

The site contained ten independent structures which were assessed by visual observation. All of these structures are concentrated around the Mt Lofty Rifle Range complex. A plan of the buildings is shown in **Figure 8** of **Attachment H**.

The condition of each of the buildings is as follows:

- Building No. 1 - currently serves as a local gun club, meeting hall and office. This building is in good condition and does not require any rectifications. This building does have the potential to be relocated if the future development plans require so. Any such relocation plans should be discussed with a suitable qualified structural engineer to determine if any additional stiffening or strengthening of the buildings structural elements is required to support such as operation.
- Building No. 2 - serves as the club house for the Toowoomba Rifle Club. The building has an electrical, water and sewer connection. This building is in good condition.
- Building No. 3 – a single person external toilet in satisfactory condition, however requires some maintenance to external timber and door.
- Building No. 4 – clubhouse, storeroom building on the north-west of the site. This building is in average condition with some minor maintenance works required.
- Building No. 5 – firing point shelter. Immediate work is required on the bracing rods to ensure the structural integrity of the shelter.
- Building No. 6 – firing point shelter. It is recommended that this shelter either be removed or adequate structural bracing provided to this structure.
- Building No. 7 – External toilet structure in good condition. Building ahs some asbestos sheeting
- Building No. 8 – Storage shed. Structure is in good condition and requires no maintenance.
- Building No. 9 – Storage shed. Structure is in good condition and requires no maintenance.
- Rifle Range Butts – This concrete structure appears to be quite old and some concrete is deteriorating.

5.2 Infrastructure Capacity

5.2.1 Water

The site has immediate access to water reticulation provided by Toowoomba City Council. Water reticulation mains are located in Martini Street, Henry Street as well as Rifle Range Road. Council has advised that the local water reticulation system can service the site in excess of 300 lots without loss of flow and pressure. However this preliminary advice would need to be assessed by conducting a detailed water network analysis at master planning stage. Any development on site would attract a headworks charge of $1580/lot payable by the developer.

Toowoomba City Council also has a rain tank policy which requires up to 65% of the roof area to be captured and routed through rain tanks. Currently in south-east Queensland the general optimised size of rain tanks is in the order of 11KL which equates to approximately $7,000 per lot. However it is possible to reduce this size to a 3KL tank (which is the minimum requirement of Toowoomba City Council).

5.2.2 Sewerage

Gravity sewerage reticulation is provided in the adjacent Henry Street, Martini Street and Rifle Range Road, however due to the topography of the site in relation to the existing residential infrastructure, this infrastructure cannot support most of the site. As a result, a sewerage pump station (at least one pump station) would be required to support any proposed development on the site. This pump station would be required to be built on the lowest section of developable area in order to capture all new development sites. At this stage the most likely location would be adjacent to the creekline at the end of Rifle Range Road (approximately RL 605m AHD). This pump station would require high head pumps (>60m) to adequately pump sewage to the existing gravity system. Should this pump station be proposed, Council will most likely decommission the Martini Street Pump Station and insist that the pump station rising main discharge to the existing gravity system in Ross Street. Council is likely to insist that any new pump station also cater for adjacent development such as a 15 lot subdivision proposed for Enfield Court (between the site, Martini Street and Henry Street). It is expected that this developer (Eixie Developments Pty Ltd) would proportionally contribute to the cost of the new pump station.

Toowoomba City Council advised that the receiving 225mm diameter receiving gravity main system in Ross Street has spare capacity for up to 350–400 ET based on preliminary checks. However this preliminary advice would need to be assessed by conducting a detailed sewerage network analysis at master planning stage. Any development on site would attract a headworks charge of $1440/lot payable by the developer.

5.2.3 Electrical Power

There is electrical power available along Martini Street, Henry Street and Rifle Range Road. The Local Power Authority has not provided an indication of what upgrade requirements are available, however based on experience, developments in excess of 70 to 100 lots located off existing residential areas generally attract 5 KVA transformer upgrades. However this requirement would need to be confirmed by a suitably qualified electrical engineer during the master planning phase.

5.2.4 Stormwater

The site does not contain any significant stormwater drainage structures which may impact or support any proposed development on the site. Any proposed residential development would involve an increase in impervious area on the site and as a result, suitable detention facilities would be required. An indication of the stormwater detention basin sizes for proposed development options are provided in the options given in **Attachment H**. One of the key issues surrounding the design of stormwater detention is the area of the land which is required. Due to the steep nature of the site, it is very difficult to provide stormwater detention basins in a cost effective manner. One solution however, is the provision of additional rain water tanks that have been fitted with orifice valve outlets that discharge water at or below predeveloped flows. This requirement would be over and above any minimum rain tank requirement on site (as Toowoomba City Council would not accept a minimum rain tank solution to cater for stormwater drainage due to the fact that rain tanks would probably be full during major storm events.)

Finally, there are a number of stormwater surface drainage outlets located along Martini Street and Rifle Range Road which require to be picked up by any future development, routed through the site and discharged in an appropriate manner in order to ensure a 'no worsening' situation downstream. Part of meeting this requirement is ensuring that any stormwater discharge outlets do not cause erosion or scouring of water courses immediately downstream. Council have also indicated that a 40m drainage reserve be provided from the flow path emanating from the Martini Street Sewer Pump Station, through the site to the escarpment. The loss of land yield associated with this has been taken into account with the options analysis.

Toowoomba City Council has indicated that a stormwater headworks charge of $17,000 /hectare would be required to be paid by the developer. This payment can be offset by performing stormwater headworks within the site. A work item that would attract a headworks offset is works associated with the 40m wide drainage reserve

5.2.5 Traffic

Toowoomba City Council has indicated there is no traffic issues associated with this site. Further to this, there are no gazetted roads administered by Queensland Department of Main Roads immediately abutting the site. Any future development option should consider the location of the site entry and exits in order to meet the local road hierarchy requirements. The preferred site entry and exit is Rifle Range Road which is currently designated as a local collector road.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Site Contamination

6.1.1 Ordnance Contamination

While no UXO or EO were located during the site assessment, it is recommended that intrusive investigations conducted with UXO technical support within the identified HE ranges would be beneficial.

6.1.2 Non Ordnance Contamination

The preliminary environmental site contamination assessment reports that there has been some impact as a result of historical and current usage of the site as a rifle and grenade range. However, areas of impact are isolated to specific areas (ranges). This site is therefore considered suitable for existing use and no further contamination assessment is required at the stage if there is no immediate plan to redevelop the site.

However, the site in total is not suitable in its current state to meet the requirements for residential HIL "A" (EPA Health-based soil investigation level – Residential with Soil Access) and is likely to require further investigation and potential remediation due to recorded levels of contaminants present on site in the areas described in the report, should the site be redeveloped for residential use in the future. On closure of the facility and redevelopment the following activities will likely be required:

1. Removal of the stop butts, hydrocarbon and explosives impacted areas;
2. Other isolated areas of contaminated soils not suitable for residential development either quarantined as reserve e.g. existing gully area and in areas of high concentrations of spent cartridges, bullets, the soils should be sieved for removal of metal fragments, and/or buried at depths greater than >1.0 meters below finished ground level;
3. Decommission of above ground infrastructure including cottage, storage sheds, targets and ablutions with appropriate handling of asbestos materials; and
4. UXO management.

6.2 Flora and Fauna

6.2.1 Flora

Regional Ecosystems

The property contains three REs listed as 'Endangered' or 'Of Concern' under the Queensland *Vegetation Management Act 1999* and/or as an 'Endangered Ecological Community' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC).
The short descriptions for each of these RE's are as follows:

- RE 12.8.21 – Semi-evergreen vine thicket with *Brachychiton rupestris* on Cainozoic igneous rocks.
- RE 12.9-10.15 – Semi-evergreen vine thicket with *Brachychiton rupestris* on sedimentary rocks.
- RE 12.9-10.7 – *Eucalyptus crebra* woodland on sedimentary rocks.

The 'Endangered' and 'Of Concern' REs occurring within the site are generally restricted to relatively steeper slopes (ie. >15^{o}).

Scheduled Flora Species
No flora species scheduled under the Commonwealth EPBC Act or the Queensland *Nature Conservation Act* (NCA) were recorded on the property. The survey also established that there is a very low probability that any such scheduled flora species occur on the property.

Weeds
Several declared weed species were observed within the property boundaries. *Opuntia* sp. (Class 2 Pest Plant) is present in all of the communities but is more common in disturbed areas. Asparagus fern (*Asparagus* spp.), Lantana (*Lantana camara*) and Privet (*Ligustrum* l*ucidum*), Class 3 Pest Plants, are present throughout the area. A small population of Mother of Millions (*Bryophyllum* sp., Class 3 Pest Plant) is present in a small disturbed area immediately north of the rifle range where dumping has previously occurred.

An illustration and description of Prickly Pear is provided in **Appendix C** of **Attachment C**.

6.2.2 Fauna

Sixteen threatened species potentially utilise the habitat within the Mt Lofty Site. These species comprise one frog, two reptiles, seven birds and six mammals. Two of these species (Grey Goshawk and Collared Delma) were identified by targeted searches as present on the site, while three (Powerful Owl, Glossy-black Cockatoo and Grey-headed Flying-fox) others were recently recorded on the site by other fauna surveys. The site is also identified as an integral part of an important wildlife corridor linking Main Range to the south with other larger patches of habitat to the northeast.

6.3 Building Conditions

Building No.1 (currently serving as the local gun club, meeting hall and office) has the potential to be relocated if required or could remain on site and serve as a suitable site/sale office for a developer.

Buildings No. 2 (clubhouse for Toowoomba Rifle Club) and 4 (clubhouse/store room building on north-western part of site) would require special development assessment to remain as well as determining a suitable end user considering any future development would likely result in the current rifle club leaving the buildings. Otherwise the buildings are likely to be demolished.

Buildings No. 3, 5, 6, 7, 8 and 9 (an assortment of toilet blocks, shelters and storage sheds) are light frame structures that will become redundant after the closing of the rifle range and will more than likely be earmarked for demolition.

The Riffle Butts Gallery contains large amounts of mass concrete and would require significant demolition effort unless future plans could result in burying the butts gallery and ensuring that future use of this area does not rely on Class 1 earthworks compaction outcome.

6.4 Surveying

Jones Road encroaches in two places, firstly in the northeast corner of Lot 1 on RP 46221 and then again to the west where the Jones Road corridor deviates to the north west. There are two options to consider regarding these encroachments.

Firstly, a new road corridor could be surveyed to follow the existing construction of Jones Road. This would involve subdividing Lot 1 on RP 46221 into two lots, or potentially simply dedicating part of Lot 1 on RP 46221 as new road resulting in the reduction of the size of the subject land.

The second option would be to negotiate with Gatton Shire Council to reconstruct the road inside the existing road reserve. This would not adversely affect the subject site nor result in any expenditure on Defence’s behalf whereas this would be the case with the first option.

6.5 Heritage

6.5.1 European Heritage Aspects

Should the rifle range site be disposed of and/or no longer retained as a rifle range the following strategies for the buildings and structures are proposed:

- **Target Trench and Target Machine Shutters**: While the target trench and target machine shutters are not considered to be significant under the EPBC Act criteria, it is possible that they would meet the criteria for inclusion on Toowoomba’s City Council Places of Potential Cultural Heritage Significance. Council could be consulted prior to any decision being taken by Defence to demolish or remove them. Interpretive signage that informs visitors of the history of the range could be considered;
- **Darling Downs Rifle Club**: That Toowoomba Council be approached first as to whether there might be an alternative location for the building within Toowoomba amongst other buildings of the same style; and

- **Other Buildings and Structures**: That on disposal all buildings and structures except where noted above, can be removed completely.

6.5.2 Indigenous Heritage Aspects

While the evidence found during this assessment suggests no nationally significant cultural heritage issues which may subsequently trigger the EPBC Act, consultation with the Aboriginal groups could be consulted to discuss the project and identify specific cultural issues within the study area. Since the proposed use of the land is yet to be determined, identifying the specific requirements, categories and actions under the Queensland *Aboriginal Cultural Heritage Act 2003* is not possible at this time.
Based on the assessment within this report, it seems likely that further investigation (with Aboriginal input) is needed for the lower foot slopes and alluvial flats to the north, northeast and east of the study area. The local aboriginal communities may also wish to undertake physical inspections of these and other areas within the study site.

6.6 Land Use Planning

The range of land uses permitted by zoning are limited to office, industrial premises for scientific, biomedical or technical research, passenger terminal or major utility. All other uses are impact assessable. Given that the site is outside the Urban Footprint, its range of uses is limited to rural land uses and these will require impact assessment.

The site may have potential as an extractive industry site for hard rock as there is an existing quarry on nearby land with similar site conditions as the subject site. However, the Department of Natural Resources and Mines indicated that this quarry has approximately 50 years supply of hard rock. The demand for the material may change as more coastal quarries, particularly in the Sunshine Coast become constrained or are worked out. It would be necessary to assess the quality of hard rock that the site may be able to yield and to understand the extractive industry market. Impact assessment would be required of any application for an extractive industry in this area.

The site has significant conservation values and forms part of the Toowoomba escarpment which is partly developed with walking and bridle trails. This site could make a valuable contribution to the region's open space network.

s47(1)(b) - commercially valuable information

[redacted]

s47(1)(b) - commercially valuable information

7 SUMMARY

A number of development issues have been identified for the Mt Lofty Rifle Range:

Site development opportunities are heavily constrained by the SEQ Regional Plan, a statutory plan governing the extent of the Urban Footprint in SEQ. The site is not in the Urban Footprint designation but is included in the Rural Living and Landscapes designation which prevents subdivision below 100.0 ha. According to the Regional Plan and Toowoomba Planning Scheme the land use options for the site involve maintaining the rural character of the property and dispose of it as is subject to site contamination management. The planning scheme would allow the land to be used for a variety of purposes provided that it does not involve lot reconfiguration below 100.0 ha or any form of urban development. Many of the non-urban land uses are impact assessable and given that the site is overlooked by an existing residential area, any change of land use to non-urban purposes would need to be compatible with the character and amenity of the existing residential area. This severely limits the land use options for the site.

Part of the site does have physical development capacity for residential development. It would be necessary to have the Regional Plan amended to allow residential development to occur. The opportunity to amend the plan when it was in draft form has expired and the plan is not a fully implemented statutory document. Amendment to the plan are actively discouraged and can only be made by the Minister administering the Plan , currently the Premier, the Honorable Mr. Peter Beattie.

Should Department of Defence choose to broaden the land use options for the site, it is essential to discuss this with the Office of Urban Management and the minister administering the Regional plan in order to gain support to amend the Plan. s47(1)(b) - commercially valuable information [redacted]

- The site has significant conservation values and forms part of the Toowoomba escarpment and forms part of an important wildlife corridor linking Main Range to the south with other large patches of habitat to the northeast. Areas in its vicinity have low key recreation uses of pathways and bridle trails which are compatible uses with the conservation values of the area.
- Physical constraints exist including the steepness of the escarpment, and issues relating to slope stability.
- According to the Toowoomba Planning Scheme Regulatory Map (**Figure 2** of **Attachment H**) parts of the site have been identified to contain both bushfire prone areas as well as bushfire hazard areas. Council generally discourages any form of development in bushfire hazard areas. In bushfire prone areas however, Council may approve development subject to certain agreed bushfire mitigation measures to ensure the safety and well being of both life and property.
- Site remediation would be required should part of the site be developed for residential purposes.
- Structures on site are not regarded as having major cultural heritage significance. However, some of the structures may be of interest locally and could form part of the walking trail with interpretative work to describe the site’s previous history and to contribute to the development of a sense of place for the area.

- Consultation with the relevant indigenous groups is recommended as part of the disposal strategy.
- s47(1)(b) - commercially valuable information

8 REFERENCES

Defence (2004) Defence Property Disposal Study and Consultancy – Request for Quote. Australian Government Department of Defence.

Willey, E.C. (2003) Urban Geology of the Toowoomba conurbation, SE Queensland, Australia. Quaternary International. 103:57-74

Attachment A: Unexploded Ordnance Assessment

Attachment B: Non Ordnance Contamination

Attachment C: Flora Assessment

Attachment D: Fauna Assessment

Attachment E: European Heritage Assessment

Attachment F: Indigenous Heritage Assessment

Attachment G: Land Use Planning

Attachment H: Infrastructure

Attachment I: Survey Drawings

BETTER BY DEFINITION

REPORT

POST ACTIVITY REPORT

UNEXPLODED ORDNANCE ASSESSMENT
MT LOFTY RIFLE RANGE
MARTINI ROAD
TOOWOOMBA QLD

G-tek Australia Pty Limited
[ABN 47 099 519 034]

Project Ref: HLAE04159

Prepared For: HLA-Envirosciences Pty Ltd

Date of Issue: 23 September 2005

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Prepared by:

Max Verrier
Senior Project Manager

Date: 23 September 2005

DOCUMENTATION CONTROL	
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2	G-tek Australia Pty Limited

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The following Definitions apply within this report:

Ammunition: A device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in connection with defence or offence including demolitions. Certain ammunition can be used for training, ceremonial or other non-operational purposes.

Ammunition Produce: Non-explosive stores and components used in the assembly or the initiation of ammunition.

Explosive Ordnance (EO): All munitions containing explosives, nuclear fission and fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges; demolition charges; pyrotechnics; clusters and dispensers; cartridges and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature.

Explosive Ordnance Waste (EOW): Inert material remnant from the initiation or functioning of explosive ordnance.

Fragmentation: Metallic fragments of the fractured casing of EO resultant from the initiation of high explosive filling and often projected at high velocities over considerable distances from the point of initiation.

Hazard Reduction Operation (HRO): An operation designed to reduce the EO hazard within the boundaries of an affected area.

Military Produce: Any item identified as military in origin that is not ammunition-related.

Small Arms: All arms, including automatic weapons of less than 20 mm in calibre and all gauges of shotguns.

Small Arms Ammunition (SAA): Ammunition for small arms, ie all ammunition of less than 20 mm in calibre, and all gauges of shotgun cartridges.

Small Arms Ammunition Waste (SAAW): Inert material remnant from the transport, packaging, preparation, and use of SAA.

Unexploded Ordnance (UXO): Explosive ordnance that has been primed, fused, armed or otherwise prepared for action and which has been fired, dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel or material but remains unexploded either by malfunction or design or for any cause. UXO includes items of military ammunition or explosives removed from their original resting-place for any reason, including souveniring by members of the public.

UXO Assessment: An activity designed to determine whether an area is affected by UXO, the boundaries of any affected area, the location of impact points within any affected area and the nature and concentration of UXO within any affected area.

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Appendices

1.0 INTRODUCTION

1.1 General

The Mt Lofty Rifle Range is a Department of Defence (Defence) owned facility located on Martini Road, Toowoomba. HLA-Envirosciences Pty Ltd (HLA) was contracted by Defence to conduct an environmental study of the facility.

G-tek Australia Pty Limited (G-tek) was contracted by HLA to conduct an unexploded ordnance (UXO) assessment of the Mt Lofty Rifle Range (the Site).

1.2 Authority to Undertake Task

Authority provided by James Begg.

1.3 Objectives

The objectives of this UXO assessment were to determine:

- Whether the Site is affected by UXO.
- The nature and type of UXO within any affected area of the Site.

1.4 Nature of Report

This report details the activities conducted as part of this assessment, and the results obtained. All relevant documentation, maps, diagrams and photographs are included as parts of this report.

1.5 Dates of Conduct

Fieldwork was conducted during the period 18 August and 25 August 2005.

1.6 Previous Investigations

G-tek Australia Pty Limited has not conducted any previous UXO operations on this Site.

2.0 UXO CONTRACTOR DETAILS

The contracting firm is G-tek Australia Pty Limited (G-tek) ABN 47 099 519 034.

2.1 G-tek Staff

The following G-tek staff were directly involved in this operation:

Project Manager/UXO Technician –	Max Verrier
Field Operators –	Terry Foot
	Rob Moellers
	Jenny Verrier

The Project Manager is a Member of the Institute of Explosive Engineers (MIExpE) and is deemed a competent professional on UXO related matters.

3.0 OWNERSHIP / CLIENT DETAILS

The Department of Defence is the owner of the property and HLA-Envirosciences Pty Ltd was the client for the assessment; their contact details are:

Mark Imber
HLA-Envirosciences Pty Ltd
Suite 3, 11 Camford St
Milton QLD 4064
Telephone: 07 3367 2166
Facsimile: 07 3367 2279

4.0 SITE DETAILS

The Site details are as follows:

- The street address is Martini Road, Toowoomba, QLD 4350.
- The real property description is Lots 1-2,112,114 and 191 RP 46221, and Lot 86,.
- County of Aubigny, Parish of Drayton.
- The Site is located within the Toowoomba Local Government Area.
- The property is currently used for defence purposes.

A map showing the Site location is at Appendix 1.

Photo 1. View of the Current Firing Range.

5.0 REVIEW OF HISTORICAL DATA

G-tek conducted a review of historical information held by Archives and found that the Army purchased land in 1906 in order to establish the Toowoomba Rifle Range. Subsequent to this original purchase additional portions of land were acquired to enable expansion of the site and to gain amended access routes. The original rifle range generally followed a direction of southwest to northeast and was shared by the Army and the local rifle club. The original range was re-aligned to its present configuration due to safety concerns of the surrounding land owners. It is not known when this re-alignment occurred however, in August 1930 the range was subjected bouts of heavy continuous rain which caused subsidence and necessitated repairs to the target area.

In June 1935 a listing of range facilities included a half pit range and a half bank gallery range.

It is not known when the small bore ranges were constructed however it is interesting to note that separate ladies conveniences were erected in 1956. It is believed that these are still in use at the small bore range complex.

The Toowoomba Rifle Range was predominantly used for the firing of small arms weapons. Records show a reference to a demonstration of high explosive (HE) grenades and pyrotechnics which was held on the range in 1942. Defence have no record of UXO being recorded for this range.

The report on the review of historical data is at Appendix 2.

Photo 2. View of Target Area of Current Range.

6.0 ASSESSMENT METHODOLOGY

6.1 Preparation

During the preparation stage, a base map derived from cadastral data of the area requiring assessment and information supplied by the client was prepared using MapInfo Graphical Information System (GIS). Search lanes at the specified spacing and appropriate control points were developed in the GIS and the survey programme was fully planned. The base map was transferred into a Differential Global Positioning System (DGPS).

Staff was deployed to Toowoomba by road, and local accommodation arranged.

All staff were inducted for the task and communication and liaison protocols established.

The DGPS base map was confirmed on the ground and equipment was tested.

6.2 Site Assessment

Assessment was conducted in a linear grid pattern by having trained Field Operators applying Minelab metal detectors over the individual lanes covering a swathe a minimum of 1 metre wide. Two lanes, spaced 20 metres apart, were searched simultaneously, controlled from the western lane. Minelab metal detectors were selected for this assessment as the most appropriate tool for this soil type.

A field operator, using the DGPS for guidance, was positioned on the western lane and continuously recorded the position of this control lane. A map showing the position of recorded lanes is included at Appendix 3.

Two Field Operators, one 20 metres on the eastern side of the DGPS operator and one immediately behind the DGPS operator, simultaneously searched the two lanes in a generally north-south, south-north alignment.

Photo 3. Assessment Methodology.

6.3 Data Recording

Search lane and finds data was stored in Trimble Data Logger utilising Asset Surveyor 5.22 software and later transferred into GPS Pathfinder Office 2.80 where it was converted into Trimble Standard Survey Format (.ssf) files. These files were then exported utilising MapInfo Interchange Format (.mif) and imported into MapInfo Professional 6.5 where they were saved as MapInfo (.tab) files using MGA (GDA 94) Zone 56.

The Defence UXO Project Custom Symbol set was used to plot all ammunition related finds.

6.4 Search Quality Control

Quality control checks performed during the assessment included:

- Supervision and spot-checking of operators.
- Testing detection equipment prior to work each day in accordance with the manufacturer's procedures.
- Use of DGPS to maintain spatial integrity.

6.5 Limits and Exclusions

In some areas the vegetation hindered search and adjustment to lane locations was required. The assessment was confined to accessible portions of the property as the majority of the property contains steep terrain which at times restricts effective assessment.

Detection equipment was regularly rebalanced to compensate for the varying magnetic qualities of the soil.

7.0 EQUIPMENT

7.1 Detection Equipment

The detection equipment used during the operation was the Minelab F1A4 electromagnetic detector. Technical specifications are included at Appendix 4.

Photo 4. Minelab F1A4.

7.2 Differential Global Positioning System (DGPS)

Spatial control and spatial accuracy was achieved through utilising a Trimble Pathfinder Pro XR (S) DGPS. This is a twelve channel integrated GPS which utilises differential corrections from RTCM beacon radio transmissions. Root mean square (RMS) accuracy with this system is better than 1 metre.

8.0 ASSESSMENT OF CONFIDENCE LEVELS

When an item of explosive ordnance (EO) such as an artillery projectile or mortar bomb functions components such as fuze and body fragments are scattered over a large area. These fragments can be either composed of ferrous or non-ferrous material. Some of these fragments will be buried and the remainder will be remnant on the surface. Usually more than one item of EO is fired into an area, and, with each additional fired item there is a proportional increase in the number of remnant fragments. Consequently the presence and number of fragments on or near the surface confirms that EO has functioned in the area and the quantity found indicates the usage rate. The higher the usage rate, the more likely it is that one or more items will have failed to function and that there will be remnant UXO.

To achieve the objectives of the assessment, UXO, EO or EO related material needed to be detected on or near the surface. Factors used to determine the confidence level included:

- Use of state of the art EM detectors that have the ability to detect ferrous and non-ferrous material.
- The detection equipment used during this task detected small ferrous and non-ferrous items to a depth of approximately 200 mm across the Site.
- The detection equipment performed within manufacturer specification during all daily tests.
- Ongoing supervision and QC checking revealed no faults in operator performance.
- DGPS position testing showed no degradation of positional accuracy within the task.

In view of the competence of the operators, the capabilities of the equipment, the results of regular equipment testing and the outcomes of QC checks, it is considered that search methodology applied to conduct assessment within this Site was appropriate and that a high confidence level was achieved.

9.0 RESULTS

9.1 Finds

No UXO or EO were located during this task.

Components from functioned grenades were found in two locations during the assessment.

Photo 5. Finds - Grenade Components.

Four mortar impact points were found, two of these were created by 3 inch HE projectiles, one was from a 2 inch HE projectile and one was a 2 inch smoke projectile. The resulting fragments, pictured below, were all located on the knoll to the rear of the rifle range target area.

Photo 6. Finds – Mortar Components.

A small impact area with two identified impact points for 40 mm HE grenades was found immediately in front of the target area. No other remnants of functioned projected grenades were found however, an empty fired projected infantry anti-tank (PIAT) was found on the current rifle range. This would indicate that PIAT projectiles have been fired on this range however, the incidence was low.

Photo 7. Finds – Components from functioned 40 mm HE grenades.

Hand held signals are regularly used during training exercises and night firings. An empty fired signal was found during this assessment. A component from a No 94 anti-tank practice projectile was found. No other components of this projectile were found.

Photo 8. Finds – An empty fired signal and a component from an anti tank practice projectile.

A variety of small arms ammunition components were found during the operation. These small arms were fired from pistols and rifles and are dated from the early 1900's to present day. The presence of practice small arms ammunition components throughout the assessed area indicates that the range has been used as an infantry close training area.

Photo 9. Finds – A selection of small arms ammunition found during the operation. An empty fired PIAT cartridge can be seen at the top left of the photo.

A map showing the location of significant finds is at Appendix 5.

9.2 Ranges Located During the Assessment

The following ranges were found during the UXO assessment:

- The former rifle range located on the original rifle range reserve.
- The current rifle range.
- Two 25 metre ranges which appear to have been used for testing, zeroing and the conduct of gunnery shoots.
- Two small bore rifle ranges.
- Two HE grenade ranges. One of these ranges was well constructed with a single throwing bay and a waiting bay which had overhead protection. The other range appears to be of the assault type without formal throwing bays.
- One mortar impact area.
- One 40 mm grenade range which was also possibly used as a PIAT range.
- The area assessed has been used as a close training area.

A map showing the locations of these ranges is at Appendix 6.

10.0 CONCLUSIONS

The site has been used as a rifle range since 1906. It has also been used as a close training area for infantry and for the firing of HE grenades and projectiles. The presence of a formal well constructed grenade range would indicate that the level of activity on that range was likely to be high. The activity level for the other HE ranges appears to have been low and they were possibly used for demonstration purposes only.

11.0 RECOMMENDATIONS

s47(1)(b) - commercially valuable information [redacted]

APPENDIX 1

SITE MAP


Mt Lofty Rifle Range
UXO Assessment
Site Map
DIVIDING
RANGE
AMG (AGD 84) Zone 56
1000 m Grid
Property Boundary
G-tek
Better by Definition

APPENDIX 2

REVIEW OF HISTORICAL DATA

HLAE 04195
Historical Research

Land Acquisitions

On the 28th April 1906 the Army purchased the Toowoomba Rifle Range Reserve, consisting of more of less 134 acres, 3 roods and 20 perches, from the Queensland State Governments for defence purposes for the sum of £157.7.8. Upon purchase of the range a Caretaker's Cottage was constructed on site at a cost of £1240. The cottage was primarily used by Rifle Clubs until the 11th October 1968 when it was handed back to the Army.

Additional land, subdivision 2 of portion 528 in the Parish of Drayton, County of Aubigny, was compulsorily acquired from Mrs Ethel May Berry on the 8th March 1913 to allow for expansion of the range, see Figure 1 below. The federal government acquired 4 acres, 3 roods and 21 perches of land from Mrs Berry at a cost of £339.15.9 – an inflated price to compensate Mrs Berry for the loss of the windmill which was located on this parcel of land. This portion of land contained a road which was relocated to the south western boundary as the initial road crossed the line of fire of the proposed extensions to the range.

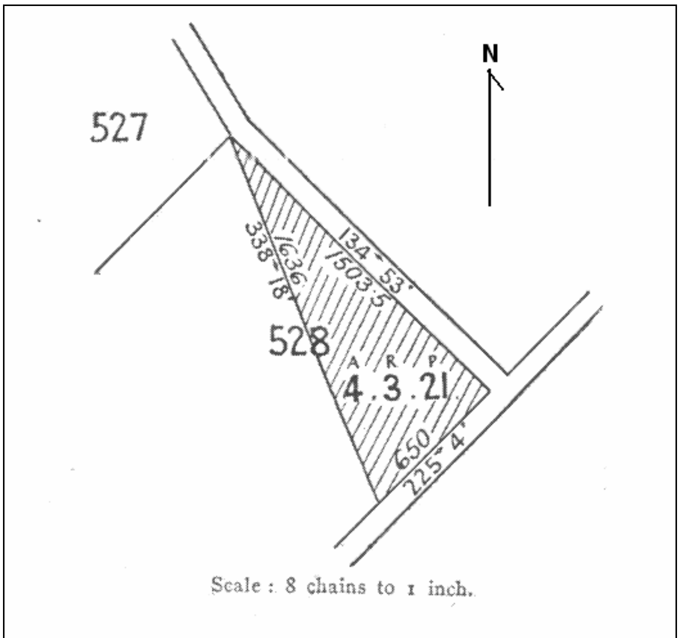


Figure 1: Subdivision 2 of portion 528, Parish of Drayton acquired 8th March 1913 from Mrs Berry[1]

The Toowoomba Rifle Range was further extended in October 1913 by the purchase, under the Lands Acquisition Act 1906, of Police Paddock in the parish of Taylor and surrounding Crown Land – portion 103 in the parish of Taylor, County of Churchill, and portion 191 in the parish of Drayton, County of Aubigny. The purchase of Police Paddock from the Queensland State Government and Crown Land from the Federal Government for the sum of £2447.1.11 increased the area of Toowoomba Rifle Range by 776 acres and 16 perches.

In total the Toowoomba Rifle Range was extended by 914 acres, 1 rood and 17 perches during the period April 1906 to October 1913, whilst an area of 1 acre and 2 roods of roads were transferred to the Queensland State Government in August 1914 as advertised in the Government Gazette dated 15th August 1914.

[1] Map taken from Commonwealth of Australia Gazette, No. 17, dated 8th March 1913

During the initial land purchases in 1906 and 1913, an open chain road was excluded from sale. In order to purchase the chain road the road had to be permanently closed. In order to close the road permanently, the pending closure had to be advertised for a period of six (6) months prior to closure to provide time for objections to be raised. The intent to permanently close the chain road was advertised in the Government Gazette dated 18th June 1927 with a latest date for objections of the 2nd September 1927. No objections were received and the road was officially closed on the 22nd September 1927 as advertised in the Government Gazette dated 24th September 1927. On the 1st March 1928 the Governor-General in Council consented his approval for the purchase of land for defence purposes consisting of an area of 2 acres and 39 perches, more or less, being a closed road through the southern part of portion 103, Parish of Taylor, County of Churchill, in the Commonwealth of Australia Gazette No. 22. The purchased proceeded at a rate of £3 per acre, totally £6.14.8. The chain road is shown in Figure 2 below.

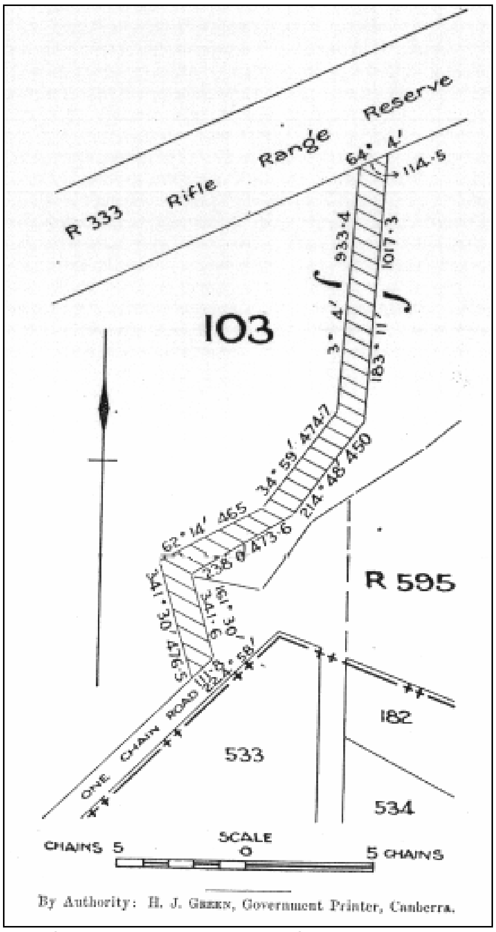


Figure 2: Chain road, southern part of portion 103 parish of Taylor, purchased 1st March 1928[2]

The total area of the Toowoomba Rifle Range Reserve following the extensions was 934 acres, 8 roods and 15 perches, consisting of Police Paddock, the Rifle Range Reserve, portions 56 and 103 in the parish of Taylor, County of Churchill, and portion 191 and subdivision 2 of portion 528 in the parish of Drayton, County of Aubigny. Figure 3 illustrates the history of the land acquisitions over the time period described above.

[2] Map taken from Commonwealth of Australia Gazette, No. 22, dated 1st March 1928

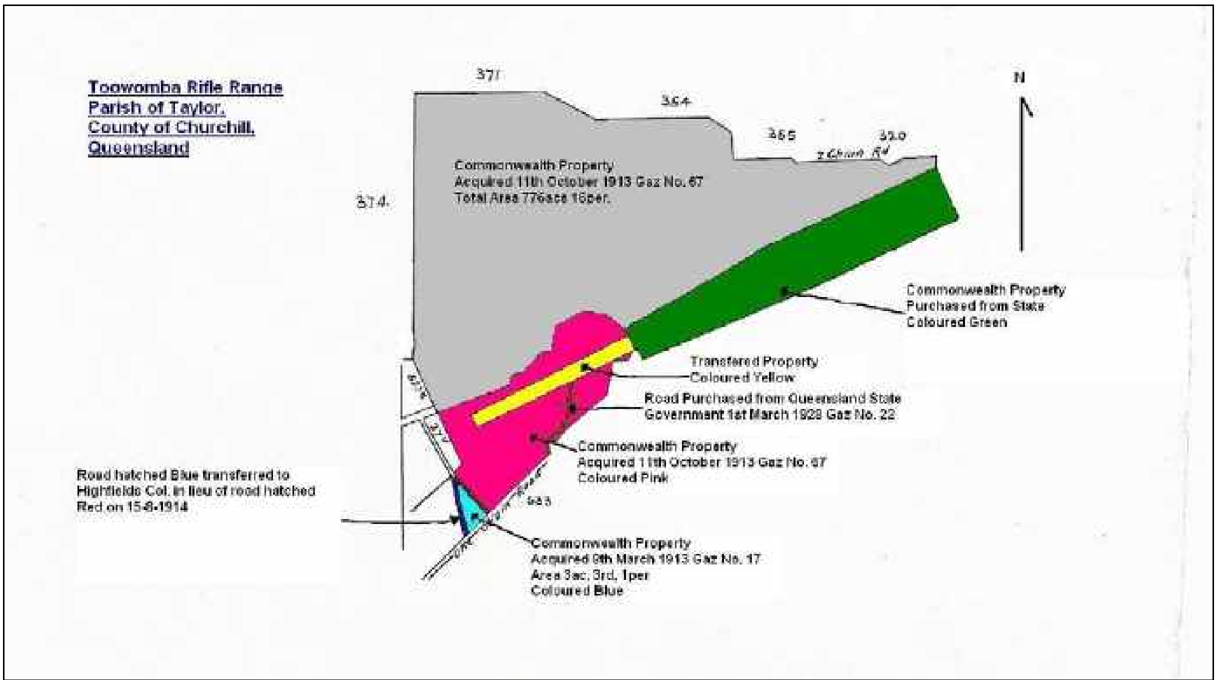


Figure 3: Summary of Land Acquisitions, Toowoomba Rifle Range [3]

Operational Activities

The Range was shared by the Army and a local rifle club. The Range was utilised by the Darling Downs District Rifle Club Union (DDDRCU) for club meetings and functions on days allocated to them by the Army. The military units who routinely used the Range for practice included the 11th Light Horse Regiment Regimental Headquarters and Headquarters Squadrons; and the 25th Battalion Headquarters Wing, "D" Coy and Regimental Senior Cadets.

In 1914, Assistant Brigade-Major, 3rd Brigade Area, Toowoomba, was appointed the Officer in Charge of Toowoomba Rifle Range, vice Major J.C. Black, 3rd Light Horse. The appointment was advertised in the District Orders No. 57, 1914.

A three target range was planned to be constructed, during July 1915, to the right and clear of the present range to increase the capacity of the Range. This development did not proceed due to safety concerns of the surrounding land owners. The second range was planned at an angle to the existing range, which would send bullets on a path away from the existing natural barriers of the cliff and mountains which lie directly in the path of fire behind the existing Range.

At June 1935, the Toowoomba Rifle Range contained:

- Ranges at 25, 100, 200, 300, 500 and 600 yards
- Eight (8) angle iron shutter target machines
- Half pit and half bank gallery

The Toowoomba Rifle Range was predominantly used for small arms ammunition. Records show a reference to a demonstration of HE grenades and Pyrotechnics which was held on the Range in 1942. There is no reference to EOIR activities at the Range.

---

3 Map modified from illustration taken from NAA:J56/QL1111Part1A

Range Closures and Significant Incidents

The range was plagued with bush fires during the early years of operations, with a number of repairs required to fences and structures as a result of fire damage. The most extensive fire at the site spanned from the 2nd November 1940 to the 9th November 1940. In July 1912 bushfire burnt out the range causing considerable damage to the targets and head covers. After the July 1912 bushfires only three of the shutter targets were fit for use, after earthworks and repairs rendered them safe. On the 19th July 1912 the Toowoomba Rifle Range was closed due to it being reported as unsafe, as recorded in the District Orders No. 34, 1912. The Range was reported as unsafe due to a number of factors including complaints from the owner of land within the Range's Danger Area reporting that bullets were interfering with the working of his land, and the state of disrepair of the mantlet and targets. The Range remained closed until the 23rd October 1914 when sufficient repairs and modifications had been completed and relevant inspection declared the Range to be open for Musketry practice.

On the 5th April 1915 a stray bullet alleged to have come from the 600yard range penetrated the dwelling of Mr French. The Range was closed during investigation into the incident, reopening on the 27th April 1915 after extensive investigation indicated that the bullet was unlikely to have been shot from the Range and that a repeat of the incident was extremely unlikely. No modifications to the Range were required.

A portion of the mound collapsed at the mantlet again on the 27th November 1917.

In August 1930 the Range was subjected to bouts of heavy, continuous rain. The rain caused subsidence of the mantle destroying four (4) of the ten (10) target machines, reducing the available target machines to six (6). Work commenced to dismantle the present mantlet and construct a new concrete mantlet which would house six (6) targets. The construction work was completed on the 30th March 1933. The mantlet was extended in concrete to enable to installation of two additional target machines in June 1935. This increased the number of target machines from six (6) to eight (8). Further repairs and extension to the mantlet in the 1950's provided twelve (12) operational targets by October 1954.

Repairs and Maintenance

Repairs at the Toowoomba Rifle Range were conducted by the Department of Works and Housing and external contractors engaged by the Darling Downs District Rifle Club Union (DDDRCU). These episodes of maintenance relate to both the Range and support buildings.

Minor repairs were made to the Stop Butt in September 1912 by placing sods at the toe of the butt. During May 1951 extensions were made to the firing mounds on the Range, increasing the length of the mounds to approximately 120 feet. These extensions were conducted to accommodate future meetings of the DDDRCU to be held at the Range. Repairs were conducted on the flag pole and targets in March 1947. The installation of concrete target pits was completed by the 3rd May 1939.

The buildings at Toowoomba Rifle Range, in particular the Caretaker's Cottage, were subject to white ant and borer infestation during the 1930's, 1940's and 1950's. Soil was removed from under the store shed on the 27th June 1941 in at attempt to reduce white ant and borer damage. Repairs to timbers of the cottage, office and sheds were conducted on the 25th September 1939, 6th March 1940 and 5th September 1946, with an attempt at eradication of these pests on the 18th July 1952.

Broken screens on the tanks were repaired during June 1941. Repairs and painting of store sheds and the Caretaker's Cottage were conducted in March 1947. Minor repairs to the guttering of the target and ammunition sheds were conducted in March and April 1953. Repairs were also carried out on the overflow tank and CGI sheeting on the target sheds at the same time as the guttering repairs. During August 1954 minor repairs were made to the office and store by the Department of Works and Housing.

The DDDRCU erected separate ladies conveniences on the Range during April 1956. The ladies convenience was deemed necessary as the number of women attending the Range during DDDRCU meetings had increased and it was deemed inappropriate for the women to have to use the same facilities as the male members of the Club. The Army deemed this improvement as non-essential and required the DDDRCU meet the costs of the development.

Agricultural and Grazing Rights

The Army provided 15 year leases for the agricultural and grazing rights on the land surrounding the Toowoomba Rifle Range Reserve. The agricultural and grazing rights for Police Paddock, approximately 130 acres, was awarded to the Caretaker as a benefit of his tenure. The additional land, inclusive of the Danger Area, was offered for lease as two leases or one large lease, total area of 804 acres.

The agricultural and grazing rights for the 804 acres of land surrounding the reserve was held by Mr Fredrick Wilson 1st October 1926 to February 1957. Some controversy arose during Mr Wilson's lease relating to alligations that Mr Wilson was illegally removing timber from the site for processing in his timber mill. The lease clearly prohibited the removal of timber from the site without prior written approval.

The Range was infected by an infestation of Prickly Pear in the Danger Area during 1929. The infestation was satisfactorily controlled.
Other Issues
Investigations were conducted in 1972 to assess the possibility of relocating the Toowoomba Rifle Range to a 1200 acre site at Withcott. The investigation found that it was not practical or cost effective to relocate the Range.

The vegetation on site consists of gum and stringy-barks. The stop butt end of the Range is thickly timbered with gums.

References

Commonwealth of Australia Gazette, No. 17, dated 8th March 1913

Commonwealth of Australia Gazette, No. 67, dated 11th October 1913

Commonwealth of Australia Gazette, No. 22, dated 1st March 1928

Government Gazette dated 18th June 1927

Government Gazette dated 24th September 1927

District Orders 1912, No. 34

District Orders 1914, No. 57

National Archives of Australia: J56, Toowoomba - Rifle Range, alternative site, 1969-1972;QL5943

National Archives of Australia: J2774, Toowoomba Rifle Range – Additions, 1928-1928; W3792

National Archives of Australia: J56, Toowoomba Rifle Range – Caretakers Cottage, 1972-1987; 1111/1

National Archives of Australia: BP374/1, Toowoomba Rifle Range Road – Survey of Portion No. 191, Parish of Drayton, County of Aubigny, District of Toowoomba, 1913-1913; Q38

National Archives of Australia: J56, Toowoomba Rifle Range – Acquisition, 1905-1929; QL1111 Part 1A

National Archives of Australia: J2774, Toowoomba Rifle Range, 1913-1913; W1912

National Archives of Australia: J2774, Toowoomba Rifle Range – New Mantle, 1913-1913; W1597

National Archives of Australia: J56, Toowoomba Rifle Range, 1923-1956; QL1111

National Archives of Australia: BP190/1, Toowoomba Rifle Range, 1912-1957; RR400

National Archives of Australia: J2774, Toowoomba Rifle Range – Practice range, drainage etc., 1913-1913; W1594

National Archives of Australia: BP129/1, Toowoomba Rifle Range – acquisitions, grazing rights, gazette notices, appointment of caretaker, 1893-1948; NCCR210/46/54

National Archives of Australia: J2774, Toowoomba Rifle Range Frenchville – Mantle, 1931-1931; W4832

National Archives of Australia: J2774, Toowoomba Rifle Range – Firing Mounds, 1913-1913; W1595

National Archives of Australia: BP374/1, Drayton Rifle Range – Plan of portion no. 103 Rifle Range, Parish of Taylor, 1912-1912; Q28

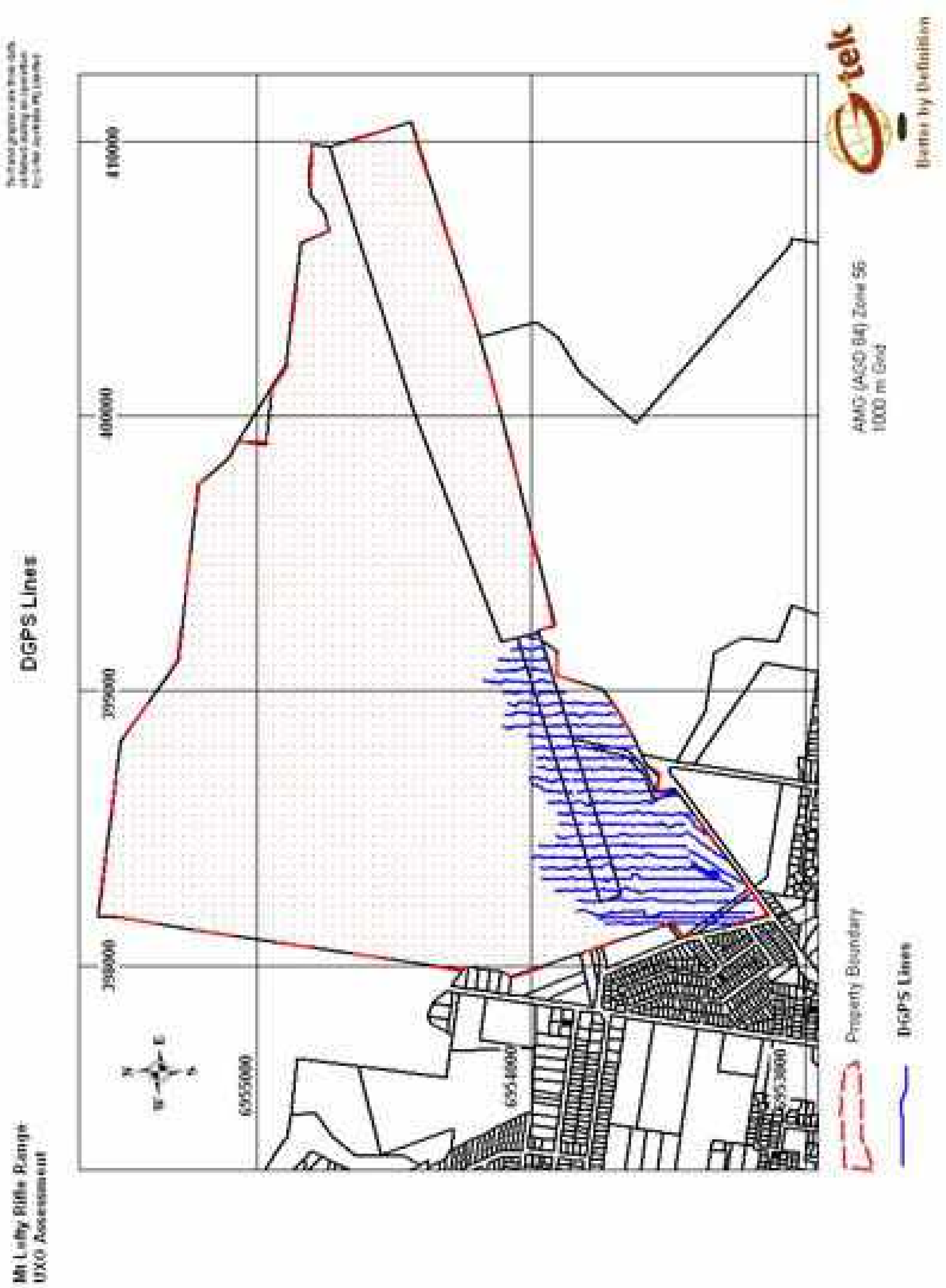
National Archives of Australia: J2774, Toowoomba Rifle Range – store and shelter (2 sheets), 1913-1913; W1596

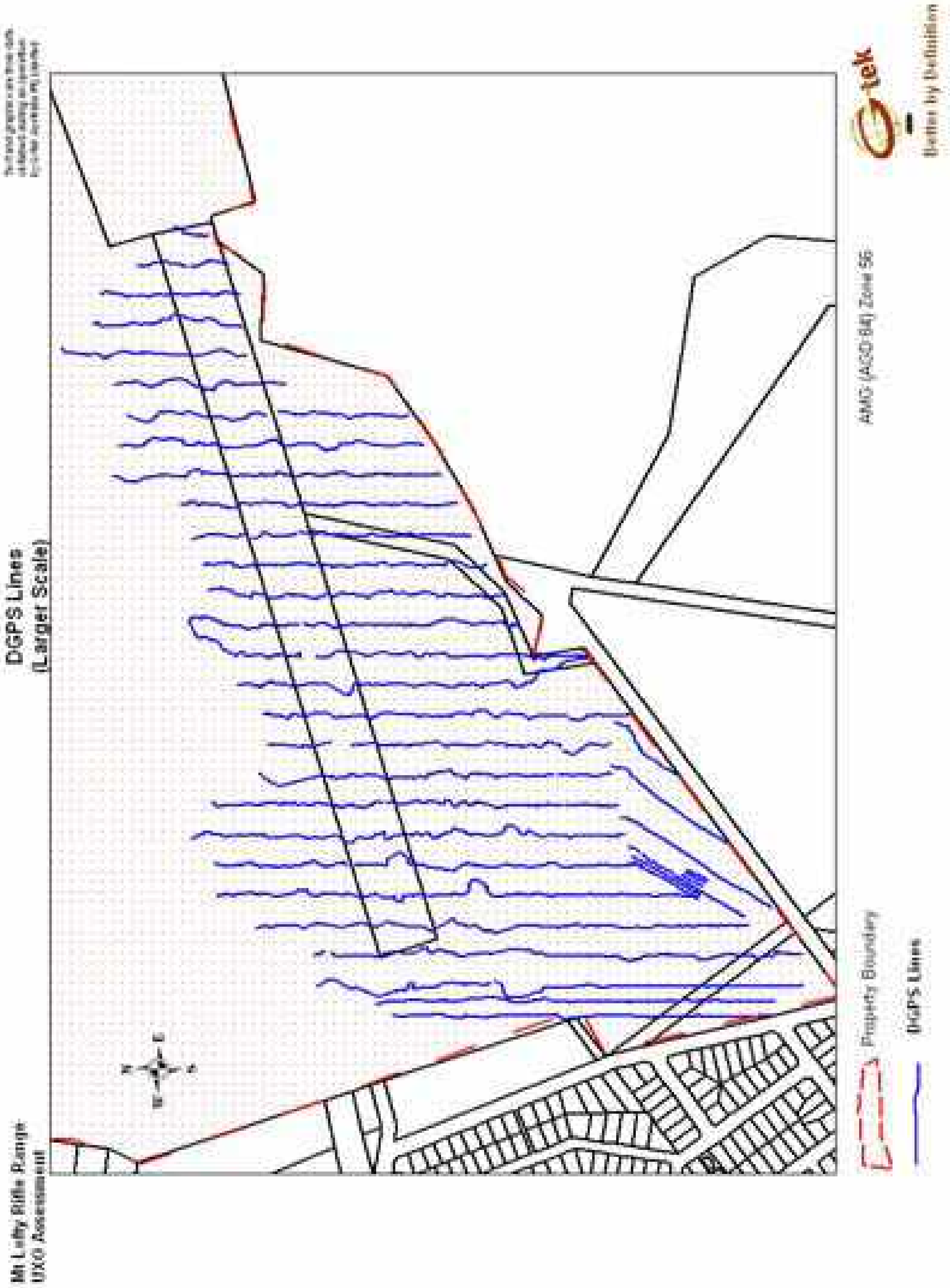
National Archives of Australia: BP374/1, Toowoomba Rifle Range – Survey of Rifle Range, Parish of Taylor, County of Churchill, District of Toowoomba, 1913-1913; Q37

National Archives of Australia: J2774, Toowoomba Rifle Range – Caretaker's Cottage, 1900-1900; W1595B

APPENDIX 3

DGPS LINES


DGPS Lines
Mt Lofty Rifle Range
UXO Assessment
Property Boundary
DGPS Lines
AMG (AGD 84) Zone 56
1000 m Grid
G-tek
Better by Definition


Mt Lofty Rifle Range
UXO Assessment
DGPS Lines
(Larger Scale)
AMG (AGD 84) Zone 56
Property Boundary
DGPS Lines
Better by Definition

APPENDIX 4

DETECTION EQUIPMENT SPECIFICATIONS

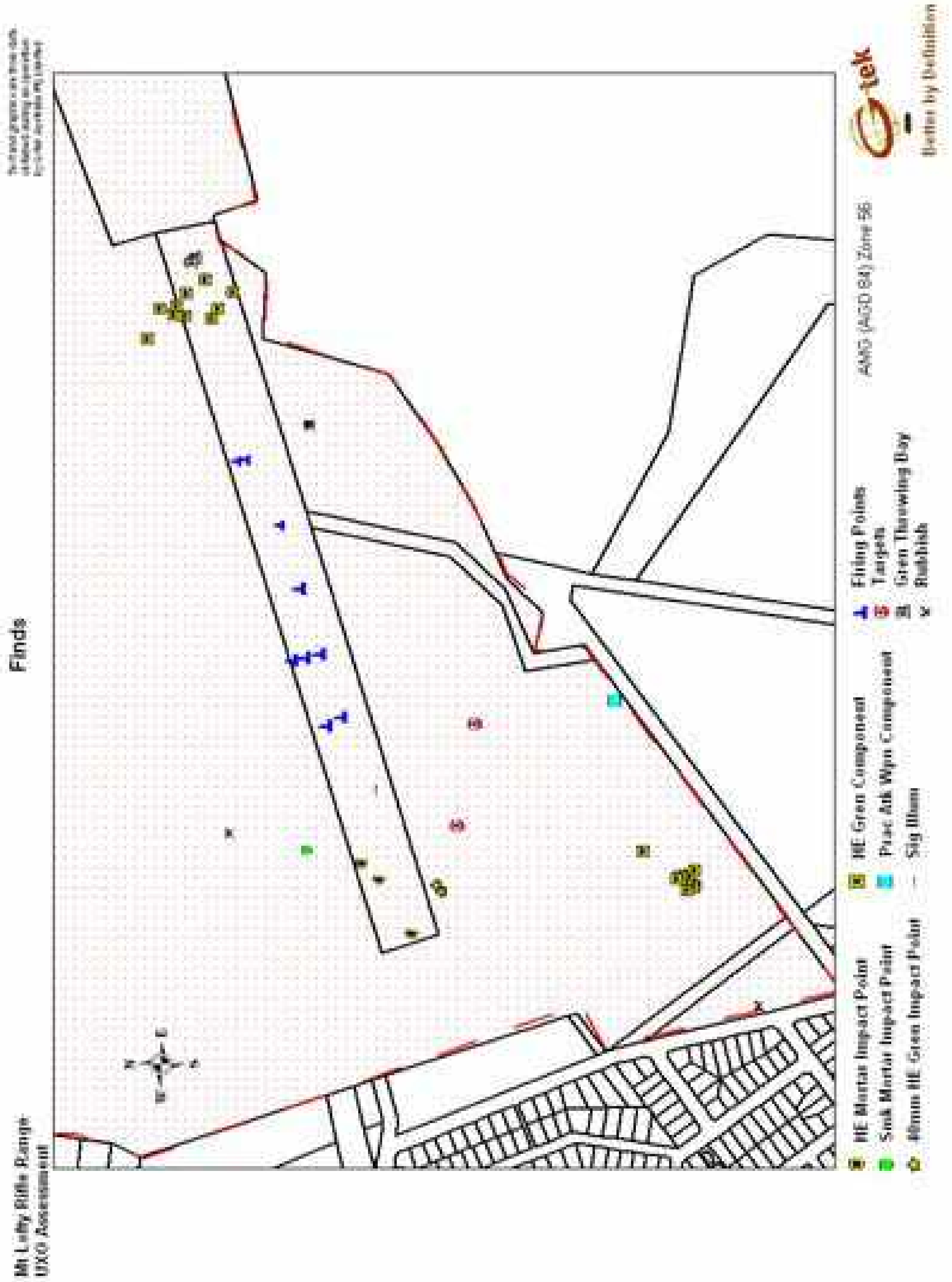
MINELAB F1A4 METAL DETECTOR TECHNICAL SPECIFICATIONS

TECHNICAL DATA

Frequency - Sinewave Transmission	Multi-period sensing
Search Modes	Motion
Controls	Ground Balance Noise Cancel Audio Reset On/Off
Search coils	Size – 200 mm Windings - Double D Weight - 475 gm Interchangeable - Yes Cable length - 1.2m
Audio output	Speaker - 51 mm Headphone jack
Power source	4 x D Cells
Battery low alert	Automatic
Weight Complete (excluding batteries) Control Box (excluding batteries) Shaft and search coil	 3094 g 1073 g 890 g
Length - extended - un- assembled	1200 mm (min) 1450 mm (max) 710 mm
NATO Stock Number	Awaiting Information

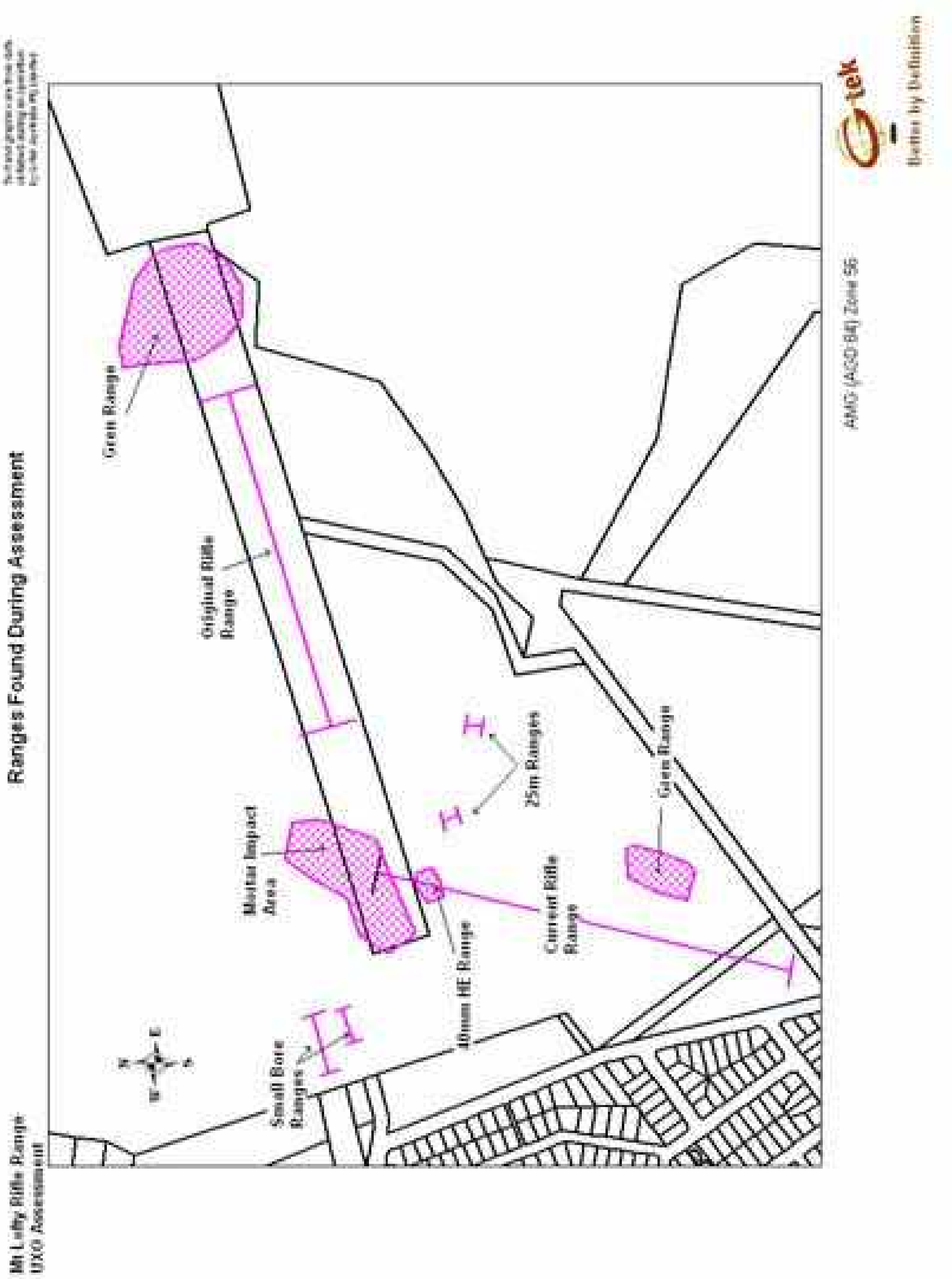
APPENDIX 5

SIGNIFICANT FINDS


Finds
Mt Lofty Rifle Range
UXO Assessment
HE Mortar Impact Point
Sink Mortar Impact Point
40mm HE Gren Impact Point
HE Gren Component
Prac Atk Wpn Component
Sig Illum
Firing Points
Targets
Gren Throwing Bay
Rubbish
AMG (AGD 84) Zone 56
G-tek
Better by Definition

APPENDIX 6

RANGES FOUND DURING ASSESSMENT


Ranges Found During Assessment
Gren Range
Original Rifle Range
Mortar Impact Area
25m Ranges
Gren Range
Current Rifle Range
40mm HE Range
Small Bore Ranges
Mt Lofty Rifle Range
UXO Assessment
AMG (AGD 84) Zone 56
G-tek
Better by Definition

DRAFT
Preliminary Environmental Site Contamination Report
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland

30 November 2005

Prepared for:

Property Disposal Taskforce

BP-2-A013

Department of Defence

CANBERRA ACT 2600

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HLA Ref: D1024101_RPTDraft_30Nov05.doc

DISTRIBUTION

DRAFT
Preliminary Environmental Site Contamination Report
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland
8 November 2005

Copies	Recipient	Copies	Recipient

This document was prepared for Department of Defence. This Preliminary Environmental Site Contamination Assessment was prepared as part of an HLA project to undertake an investigation into the potential environmental, heritage, infrastructure and land use issues affiliated with the potential disposal of the Mt Lofty Rifle Range. This specific document addresses the potential contamination issues associated with the facility.

The Preliminary Environmental Site Contamination Assessment is based on a review of the condition of the site at the time of investigation, as described in the assessment reports described herein. This Preliminary Environmental Site Contamination Assessment has been prepared in consideration of the relevant guidelines used for site contamination assessment in Queensland at the time that HLA was appointed. HLA notes that subsurface conditions can vary over short distances and it is possible that areas of contaminated soil may not have been detected between the sampling points.

However, in the opinion of HLA, the investigation is deemed representative of overall conditions.

By

HLA-Envirosciences Pty Limited
ABN: 34 060 204 702
57 Berwick Street, Fortitude Valley QLD 4006
PO Box 720, Fortitude Valley QLD 4006 Australia

Sheri Fitton
Environmental Scientist

Maria Woodgate
Project Hydrogeologist

Peer Review: **Date:**

Paul Myers-Allen **Principal Hydrogeologist** **Workgroup Manager - QLD & NT**	

CONTENTS

TABLES

FIGURES

PLATES

APPENDICES

GLOSSARY OF TERMS

AEC	Area of Environmental Concern
PIAT	Projector, Infantry, Anti Tank
UXO	Unexploded ordinance
ESA	Environmental Site Assessment
Pb	Lead, a heavy metal
Hg	Mercury, a metal
Zn	Zinc, a heavy metal
Ni	Nickel, a metal
Cd	Cadmium, a heavy metal
Cu	Copper, a heavy metal
Cr	Chromium, a heavy metal
As	Arsenic
HLA	HLA-Envirosciences Pty Ltd
G-tek	G-tek Australia Pty Ltd
Defence	Department of Defence, Corporate Services and Infrastructure Group
NEPM	National Environmental Protection Measures (1998)
Qld EPA	Queensland Environmental Protection Authority (formerly Department of Environment DoE)
MLSS	Mount Lofty Surface Soil sample
MLTP	Mount Lofty Test Pit
DUP	Duplicate sample
m	metres, metric unit
mg/k	milligrams per kilogram, unit measure
mg/L	milligrams per litre, unit measure

1 INTRODUCTION

HLA-Envirosciences Pty Limited (HLA) was engaged by the Department of Defence, Property Disposal Taskforce to undertake a *Preliminary Environmental Site Contamination Assessment* relating to the Mt Lofty Rifle Range Disposal. The proposed development site is registered as Lots 1-2,112,114 and 191 on RP46221, Lot 2 on RP17738, and Lot 86 CC350 and bordered on the south by Jubilee Park and on the south-west corner by Rifle Range Road and Martin Street, Toowoomba.

G-tek completed an *Unexploded Ordinance Assessment- Mt Lofty Rifle Range, Martini Road, Toowoomba, Qld* (2005). The investigation identified that the former rifle range area contained a number of unexploded ordinance (UXO's) from its prior operation. A more detailed contamination assessment was conducted to identify the location, nature and extent of potential contaminants associated with the historical and current land use of the site in order that the environmental and health risk associated with the current and any proposed change to a more sensitive land use can be evaluated.

This report has been prepared based on the requirements of environmental site contamination assessments and consistent with the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland* (DoE, 1998).

1.1 Background Overview

HLA-Envirosciences were commissioned by the Department of Defence Corporate Services and Infrastructure Group (Defence) to undertake a Preliminary Environmental Site Contamination Assessment at the Mt Lofty Rifle Range, Rifle Range Road, Toowoomba (herein referred to as the 'Site'). These works were conducted in the period between 3rd to 6th October 2005.

The Site comprises Lots 1-2,112,114 and 191 RP46221, Lot 2 on RP17738, and Lot 86 CC350 and covers an area of 379 ha (**Figure 1**). The property is currently used for Defence Purposes, and as a local Rifle Club Range.

HLA indicated in their proposal to Defence that under Queensland Legislation the property should be placed on the Environmental Management Register (EMR) for the notifiable activity of Rifle Ranges (HLA, 2004).

The purpose of this investigation is to assess the environmental impacts from former site activities in the context of the potential disposal of the Mt Lofty Rifle Range site.

A list of references and source publications is contained at the end of the report (**Section 10**). The site plans are included in **Appendix A** (**Figure 1**).

1.2 Previous Studies

As part of the preliminary investigations in 2005, HLA engaged G-tek Australia Pty Ltd (G-tek) to perform an unexploded ordinance assessment of the former Mt Lofty Rifle Range, a summary of which is as follows. It was indicated that a number of small arms ammunition components were found; however no unexploded ordinance (UXO) or exploded ordinance (EO) were noted (G-tek, 2005).

G-tek reported that the site had been used as a rifle range since 1906, and as a close training area for infantry. Firing on the site reportedly included High Explosive (HE) grenades and projectiles, with grenade ranges likely to have experienced higher usage than other HE ranges (G-tek, 2005).

The report referred to below, should be read in conjunction with this report:

- G-tek Australia, 2005. Post Activity Report- Unexploded Ordnance Assessment, Mt Lofty Rifle Range, Martini Road, Toowoomba Qld (September 2005)

There have been no previously known environmental assessments conducted at the site.

1.3 Areas of Potential Environmental Concern

The following summary of potential Areas of Environmental Concern (AEC) was identified from information detailed in the UXO report compiled by G-tek (2005), noting areas with the potential for environmental impacts (refer **Table 1**).

Refer to **Appendix A**, **Figure 1** for illustration of AEC locations.

Ranges located during the G-tek investigation are listed as follows:

- Former rifle range- original rifle range reserve;
- Current rifle range;
- 2 x 25 metre ranges;
- 2 x small bore rifle ranges;
- 2 x HE grenade ranges;
- Mortar impact area; and
- 40 mm grenade range, also possible PIAT range.

The area had also been used as a close training area. Refer to G-tek (2005).

Table 1: Summary from UXO Report (G-tek, 2004)

Reference Location	Potential AEC
Caretaker's Cottage (built approx 1906 used by rifle club, until 1968 subsequently then used by Defence	Potential for arsenic, As, or pesticide use for White ant and borer infestations treated in 1952. May contain asbestos from building materials. Lead based paints may also be present.
Office	Potential for arsenic or pesticide use for White ant and borer infestations treated in 1952. May contain asbestos from building materials. Lead based paints may also be present.
Sheds	Potential for arsenic or pesticide use for White ant and borer infestations treated in 1952. Also potential for contaminated soil to have been spread from soils removed from beneath store shed in 1941. May contain asbestos from building materials. Lead based paints may also be present.
Ladies amenities erected in 1956	Contains asbestos building materials and is on the Asbestos Register. Lead based paints may also be present.
Danger Area - Prickly pear infestation only 1929	Potential for pesticides or herbicides (OCP/OPP) to have been used and present in affected areas.
Stop butt- toe	Potential for heavy metals from bullet and shell casing of ammunition, hydrocarbons and explosive residues from accelerants and detonation sources. Pesticides and herbicides may be present from vegetation control. TPH/BTEX and explosives.
Range Firing mounds	Potential for heavy metals from bullet and shell casing of ammunition, hydrocarbons and explosive residues from accelerants and detonation sources. Pesticides and herbicides may be present from vegetation control. TPH/BTEX and explosives.

Review of existing defence information and undertaking of a limited site inspection did not identify any other potential contaminant sources such as bulk fuel or other petroleum storage or vehicle maintenance.

Based on the information above the sampling and analysis program focused on the area identified as primary areas of historical use for defence training use and as a rifle club range.

2 SITE INFORMATION

2.1 Site and Legal Description

The Mt Lofty Rifle Range is located to the north-east of Toowoomba, Queensland, approximately 3 km from the Central Business Centre of Toowoomba. The site occupies Lots 1-2, 112, 114 and 191 RP 46221, and Lot 86 CC350, and is located within the Toowoomba Local Government Area.

2.2 Site EMR Status

A summary of the site's EMR status is presented in **Table 2.** The site is not currently listed on the Qld Environmental Protection Authority (Qld EPA) Environmental Management Register. However the current land use as a rifle range is a notifiable activity.

Table 2: Summary of the Site's EMR Status

Physical Address	Property Description	EMR	Notifiable Activity
Rifle Range Road, Toowoomba	Lots 1-2, 112, 114 and 191 RP 46221, Lot 2 on RP17738, and Lot 86 CC350	✕	Rifle Ranges

Notes:
✓ = Site included on EMR
✕ = Site not included on EMR
N/A = Not applicable due to site not being included on EMR

2.3 Topography

The Mt Lofty Rifle Range is located on a plateau at the top of a steep escarpment. The study area is undulating, gently sloping predominantly towards the southeast. The vegetation cover is mostly disturbed with large cleared areas and regrowth dry schlerophyll forest covering the abandoned original range area.

2.4 Geology

Geologically the plateau consists of a basalt capping, overlying sedimentary strata. Soils are developed to at least two metres in places and consist primarily of structureless, dark red, brown silty clays, and clay, overlying highly weathered basalt.

2.5 Surface Water

There is no permanent water on the site. There is one dominant drainage line, (a dry gully at the time of survey), that drains the Mt Lofty area of the plateau. This gully drains to the southeast off the escarpment and into Oaky Creek, which in turn flows eastward into the Lockyer Creek and ultimately the Brisbane River. Due to the elevated nature of the site, it is presumed that the site would drain rapidly following rainfall.

2.6 Hydrogeology

At the time of site investigations the soil zone (highly weathered basalt) was found to be moist in a few places at depths of around one metre. Groundwater is expected to be encountered at depths exceeding 20m and groundwater resources are likely to be restricted to more permeable areas such as in fracture zones in the basalt or highly weathered zones. The aquifer is likely to be discontinuous with various yields and expected to occur at significant depth.

2.7 Potential Environmental Receptors

The following potential environmental receptors have been identified:

- The main gully which runs south east from the main range stop butt area;
- Native fauna and flora inhabiting the site;
- The users of the rifle range including members of the Toowoomba Rifle Club;
- Defence personnel;
- Horses and their handlers currently using the site.

3 SAMPLING AND ANALYSIS PLAN

3.1 Objectives

The primary objectives of the detailed investigation sampling were to:

- Targeted subsurface investigations and sample collection at the location of the specific issues of concern identified by the site history and/ or UXO survey, including stop butt areas and any identified UXO hot spots; and
- Assessment of potential contaminants from undocumented site activities and migration pathways, such as drains and streambeds. To be investigated on broad-scale grid-based subsurface investigation and sampling program across the remainder of the property to identify unknown areas of concern.

Assessment of the impact (extent and concentration) of current and historical activities on the site includes evaluation of:

- Impact to underlying soils in the areas identified as being used for historical and or current defence or rifle range activities;
- Identification of potential receptors and migration pathways for any potential contaminants of concern;
- Assessment of the impacts of historical and current site activities in regard to suitability for future more sensitive land use;

The investigation focussed on the assessment of soil contamination from historical or current land use of the site.

No groundwater or surface water sampling was undertaken as part of this study.

All works were undertaken consistent with the National Environmental Protection Measure (NEPM) for assessment of site contamination (NEPM, 1999).

3.1.1 Sampling Location and Frequency

The locations of the test pitting investigations were based on historical records, site observations and UXO survey results. Consideration was also given to the sampling methodology design as described in the following guideline documents for sampling methodologies and QA reporting:

- Department of Environment, 1998, Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland, Brisbane.

A total of 24 targeted test pits were completed across the Mt Lofty Rifle range area. Test pit locations targeted areas of potential contamination to determine the presence and type of contaminants (refer **Figure 2**). Two HLA field staff, Alana Eggleton and Maria Woodgate collected the following test pit samples over a three-day period, 3rd to 5th October 2005.

Table 3: Location of Test Pit Investigations

Location of Test Pits	Test Pit Numbers	No. of Soil Samples Collected
Grenade Range (south-west)	MLTP01	1
Grenade Range (north-east)	MLTP02 MLTP03	2
Road reserve adjoining 25 mm ranges	MLTP04	1
Original Rifle Range	MLTP05 MLTP06 MLTP07	3
Mortar Impact Area	MLTP08 MLTP09	2
Old house	MLTP10	1
Small bore ranges	MLTP11 MLTP12	2
Mortar Impact Area/ Current Rifle range	MLTP13	1
40mm HE Range	MLTP14	1
Possible testing range	MLTP15 MLTP16	2
Stop butt (25 mm ranges)	MLTP17	1
Firing point (25 mm ranges)	MLTP18	1
Background pit	MLTP19 & DUP	1
200 yard mark	MLTP20	1
300 yard mark	MLTP21 & DUP	1
500 yard mark	MLTP22	1
600 yard mark	MLTP23	1
Old Cottage	MLTP24	1

In addition to the excavation of test pits a number of surface soil samples were collected from drainage channels and other areas of interest as follows:

- MLSS01 – Stop butt behind top small bore rifle range
- MLSS02 – Stop butt behind bottom small bore rifle range
- MLSS03 – Next to old trough below old house site near entrance gate
- MLSS04 – Western end of stop butt gully 600 m rifle range
- MLSS05 – Eastern end of stop butt gully 600 m rifle range
- MLSS06 – Gully below the 40 mm HE range
- MLSS07 – Gully between the two 25m ranges

In addition to the collection of surface soil samples, a portable x-ray fluorescence (XRF) instrument was used to screen test pit locations and additional surface areas for metal contaminants of potential concern.

3.1.2 Quality Control

ANZECC (2000b) suggests a minimum of 5% of samples should be analysed in duplicate. Duplicate samples reveal the magnitudes of errors (contamination, random and systematic) occurring between sampling and sample analysis. They are obtained by dividing a sample into two or more sub-samples.

The proposed sampling strategy involves two duplicate soil samples (i.e. 13% of soil samples). For further discussion of duplicate results and investigation Quality Control refer to **Section 4** and, **Appendix D**.

3.2 Field Sampling Methods

The fieldwork was undertaken between the 3rd to the 6th October 2005. HLA-Envirosciences representatives undertook geotechnical soil excavation and sample collection using a backhoe for test pit excavations. A G-tek representative supervised all excavation works due to the potential for unexploded ordinance (UXO).

HLA-Envirosciences engaged the services of a backhoe operator to obtain test pit soil samples from freshly exposed soil in the excavations. Soil samples were generally collected directly from the backhoe bucket. To obtain surface samples (SS), a shallow hole was excavated using a clean stainless steel shovel prior to obtaining a sample of soil from that depth. Soil samples were collected in laboratory supplied sampling jars. No surface or groundwater sampling was intersected in the investigation.

Sampling procedures employed were in compliance HLA-Envirosciences' internal quality control management system.

Physical sediment, soil characteristics such as colour, texture, particle size and grading were recorded in the field based on observations during test pitting. Test pit logs were used to record the soil profile and characteristics and are summarised in **Appendix A.** Sample identifications were labelled directly onto soil jars with a water proof marker pen, and chain of custody forms were completed to document the transit of samples and provide traceability from the collection of samples to delivery to the analytical laboratory for testing.

Soil samples were collected just below surface top 10 cm and to a depth of 0.4 m below surface, with further observations recorded on test pit logs to a maximum depth of 1.3 metres. The soil sampling equipment (e.g. trowel) was cleaned in Decontamination Liquid (Extran) between the collection of each sample. Samples were placed in laboratory prepared glass jars, stored on ice and delivered to the laboratory at the end of the field program. Sampling locations were recorded using a handheld GPS (accuracy approximately +/- 5 m).

Additional assessment was conducted utilising a Niton portable X-Ray fluorescence (XRF) instrument, to optimise test pit location and soil sample collection as well as to enable, delineation of contamination patterns on a broad scale, provide rapid assessment of surface and subsurface soil for inorganic contaminants (i.e. metals). The XRF instrument was used to confirm 'hot spots' in the UXO and targeted surface soil sampling locations. The vertical extent of contaminants in the test pit areas was assessed. Additional transects and other hot spot areas were investigated by soil sampling.

The XRF was also used to analyse paints on buildings and other above ground infrastructure for the presence of lead.

Based upon the completed program a total of 30 soil samples were selected for full scale laboratory analysis for relevant contaminants of concern, including:

- Metals (As, Cd, Cu, Cr, Hg, Ni, Pb, Zn);
- Petroleum Hydrocarbons;
- Organo-chloride/organo-phosphate (OC/OP) pesticides and herbicides; and
- Ammonia, nitrates and other explosive residues.

3.2.1 Analytical Testing

Samples were analysed by ALS-Environmental laboratory, a NATA accredited laboratory who conduct an internal QA system on analyses.

The suite of analytes selected was based on known uses and potential contaminants of areas such as the firing and grenade ranges, housing and storage buildings and mortar impact area. Potential contaminants included explosives, heavy metals, ammonia, nitrate, VOC, TPH, OCP and OPP's.

At the location of a total of 24 test pit samples and two duplicates collected the following were analysed for the elements specified:

- 24 samples and two duplicates were analysed for Heavy Metals (As, Cd, Cr, Cu, Zn, Hg, Ni, Pb). Also, seven samples and one duplicate were selected for heavy metal TCLP leachate testing;
- Six samples and one duplicate were analysed for organochlorine and organophosphate pesticides (OCP/ OPP);
- 10 samples and one duplicate were analysed for volatile organic carbon (VOC);
- 10 samples and one duplicate were analysed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylene & total xylenes (BTEX);
- 24 samples and two duplicates were analysed for explosives;
- 11 samples and one duplicate were analysed for nitrates and ammonia; and
- 11 samples and two duplicates were analysed for arsenic.

A further seven surface samples were collected and tested for the following analytes:

- Six samples were analysed for Heavy Metals (As, Cd, Cr, Cu, Zn, Hg, Ni, Pb)
- Three samples were analysed for volatile organic carbon (VOC);
- Two samples were analysed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylene & total xylenes (BTEX);
- Four samples were analysed for explosives; and
- One sample was analysed for nitrates.

All samples were submitted under HLA internal Chain of Custody within applicable holding times.

4 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Data Quality Objectives

Data quality objectives (DQOs) employed for the investigation work conducted at the Mt Lofty Rifle Range, included:

- Adequate sampling density and appropriate contaminants for the purpose of the investigation;
- Sampling data assessed against the adopted criteria (NEPM, 1995);
- Laboratory limit of reporting (LOR) less than the assessment criteria;
- Laboratory blanks, duplicates and spikes analysed at a frequency of > 5% of total;
- Relative percentage differences (RPDs) for field duplicates of:
  - Less than or equal to 50% for standard samples (lab standards);
  - Less than or equal to 50% for inorganic analytes; and
  - Less than or equal to 50% for organic analytes.
- Matrix spikes within 70-130% recovery for inorganic organic compounds.

4.2 Laboratory Methods

All soil (surface and ground) samples were analysed by ALS Environmental. The laboratory is NATA (National Association of Testing Authorities) accredited for the analyses undertaken and operates under a third party accredited quality assurance system. A summary of the methods used for samples analysis are detailed in the following table (**Table 4**).

Table 4: Laboratory Analysis Methods

ALS Method	Description	Number Samples Analysed
EA055-103	Moisture Content	32
EG005C	Leachable Metals by ICPAES	8
EG005T	Total Metals by ICP-AES	32
EG035C	Leachable Mercury by FIMS	8
EG035T	Total Mercury by FIMS	32
EK055	Buchi Ammonia	12
EK057	Nitrite as N - Soluble	13
EK058	Nitrate as N - Soluble	13
EK059	Nitrite and Nitrate as N (NOx) - Soluble	13
EN33	TCLP for Non and Semivolatile Analytes	8
EP068	Pesticides by GCMS	7
EP071	TPH - Semivolatile Fraction	13
EP074	Volatile Organic Compounds	14
EP080	TPH Volatiles/BTEX	13
EP203	Explosives	30

4.3 Field

The field QA/QC consisted of standard sampling methods, procedures for handling samples under chain of custody and standard decontamination procedures.

As part of the investigation program, two duplicate soil samples (MLTP19-DUP & MLTP21-DUP) were collected and analysed for a suite of analytes.

For analytes within the detection limits the relative percentage difference was calculated using the formula presented below (**Formula 1**).

Formula 1 – Relative Percentage Difference (RPD%)

$$RPD = \frac{(a - b)}{\frac{(a + b)}{2}} \times 100$$

Where: a- primary sample
b- duplicate sample

The RPD calculation was used to normalise each pair of results to allow for better QA/QC data interpretation. For those RPD values which exceed a generally acceptable 30% - 50%

The sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds”), data correlation is considered poor.

However, consideration needs to be given to sample homogeneity and the concentrations detected. In accordance with the ANZECC guidelines for the Laboratory Analysis of Contaminated Soils (August 1996) and the USEPA SW-846 guidelines, the RPD between “split” samples should in general be within 50% for low level duplicates (i.e., 4-10xPQL/MDL) and 30% for high level laboratory duplicates (>PQL/MDL) for all analytes.

A total of 12 tests were carried out on the two duplicate samples:

- One duplicate pair had calculated RPD’s of greater than 50%, however the results for these analytes were below ten times (x10) the LOR and as such were not considered significant
- No RPD’s were recorded for OCP, OPP, BTEX, TPH, and explosives.
- Exceedences below the adopted HIL-A NEPM guidelines and less than ten times the LOR were reported for sample MLTP19 and duplicate, zinc heavy metal leachate analysis and Nitrite as N and tare not considered significant.

4.4 Laboratory

HLA-Envirosciences have presented a brief commentary on the results of the laboratory quality control reports below, which concluded that the statistical validation of laboratory results was adequately reliable. The report did not address the reliability of the analytical results in terms of data quality indicators (DQIs) such as precision, accuracy, comparability and completeness.

The laboratories included the following quality control samples in most of the testing conducted for this project.

- Method blanks
- Laboratory duplicates
- Matrix spike recoveries
- Method limits of reporting

Refer to **Appendix B** for copies of laboratory QA reporting.

The results of the analyses reported by ALS for quality control purposes are summarised below:

SOIL

- Samples were received within appropriate holding times.
- Four samples, which were re-tested for leachability failed the analysis holding time by 1 day, samples: MLTP 1 (0.1-0.2), MLTP 2 (0.1-0.3), MLTP 3 (0.1-0.3), MLTP 4 (0.0-0.4) 10 Oct 2005. No other samples failed holding times for analysis.
- Laboratory duplicates were conducted at ten percent (10 %) or greater.
- Laboratory control samples (LCS), method blanks (MB) and matrix spikes (MS) were performed at a rate of 5 % to 14.3%.

- Laboratory Duplicates (DUP) for total metals in soil exceeded LOR based limits.
- Sample MLTP 15 (0.1-0.2) Matrix spikes (MS) had a recovery less than the lower data quality objective for arsenic (As). The levels for the other metals analysed, copper, lead, nickel had background levels of 4 or more times more then the spike level.
- Sample MLTP 6 (0.0-0.2) Matrix spikes (MS) had recovery less than the lower data quality objective for arsenic (As). Chromium had a background level of 4 or more times greater than the spike level.
- Sample MLTP 4 (0.0-0.4) ammonia (as N) spike recovery was unable to be recovered due to sample matrix interference.
- An unspecified laboratory sample TPH C6 - C9 Fraction had a background level of 4 or more times greater than the spike level.

WATER

- Water quality control was also conducted for heavy metal leachate testing with no outliers or recovery breaches recorded.

5 SITE CHARACTERISATION

5.1 Assessment Guidelines

To assess the significance of results obtained during environmental investigations, laboratory results for soil and/or water testing are commonly compared to criteria developed or applied by regulatory authorities. These criteria are developed through research and represent concentrations of contaminants within the environment that may lead to adverse health or environmental effects.

In the case of soil investigations, EPA environmental investigation threshold levels (EITL) have been adopted as the assessment guideline in the first instance, with the EPA health-based soil investigation levels (HIL) guidelines used where contaminant levels exceed EITL. For the purposes of this investigation, HLA-Envirosciences has adopted the HIL ‘A’ (‘standard’ residential with soil access) based upon the proposed land use of the site. In addition, the EPA Draft Guidelines dated January 1999 have been adopted as the initial guideline values for TPH (C_6-C_9, C_{10}-C_{14}, C_{15}-C_{28} and C_{29}-C_{36}).

For analytes that may be tested in groundwater and surface water, Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines for Fresh and Marine Waters 2000 are used. In the absence of ANZECC 2000 guidelines, Dutch Intervention Level (DIL) guidelines are used for comparison. The EPA accepts these values as indicators of potential contamination in the absence of ANZECC 2000 or other Australian developed water quality criteria. Note, no water assessment has been undertaken during this investigation.

The criteria specified within this assessment have been developed with consideration to Queensland EPA guidelines and the NEPM for Assessment of Site Contamination. These guidelines are subject to change with the development of further NEPMs and through the updating of scientific knowledge with respect to potential health and environmental risks.

The relevant assessment guidelines are summarised below:

Table 5: Summary of the Site Assessment Guidelines for Soils (mg/kg)

Contaminant of Concern	Limit of Reporting mg/kg	HIL 'A' Adopted Guideline	EITL	Qld EPA
Metals				
Arsenic	1	100	20	-
Lead	1	300	300	-
Zinc	1	7000	200	
Cadmium	1	20	3	
Chromium III	1	12 %	400	
Chromium VI	1	100	1	
Cobalt	1	100	-	
Copper	1	1000	100	
Mercury (inorganic)	1	15	1	
TPH				
C_6-C_9	25	-	-	100
C_{10}-C_{14}	50	-	-	100
C_{15}-C_{28}	100	-	-	1,000
C_{29}-C_{36}	100	-	-	1,000
Total TPH	-	-	-	1,000
BTEX				
Benzene	0.2	1	-	1
Toluene	0.2	-	-	-
Ethylbenzene	0.2	-	-	-
Total Xylenes	0.2	-	-	-
Total BTEX	-	-	-	7
PAHs				
Benzo(a)pyrene	1	1	-	1
Total PAHs	-	20	-	20
PCBs	0.1	10	1	-

Notes:
EITLs: Urban Ecological Investigation Threshold Levels (DEH, 1998)
HIL 'A': Health-based Investigation Level – Residential with Soil Access (DEH, 1998)
EPA: QLD EPA Draft 'Investigation Thresholds' Guidelines (EPA, 1999)

The soil assessment HIL-A guidelines are appropriate for this investigation based on the intention to assess whether the site would be suitable for future residential development.

6 RESULTS

Refer to Tables 1 - 8, **Appendix B** for laboratory results which are discussed in **Section 7**.

6.1 HEAVY METALS

Arsenic

- A total of 32 samples were analysed for arsenic, a positive result was recorded for eight samples with concentrations of 6 mg/kg to 11 mg/kg;
- The eight samples tested for arsenic leachate, were below the laboratory limit of reporting; and
- All results were below adopted guidelines.

Cadmium

- A total of 32 samples were analysed for cadmium, a positive result was recorded for 5 samples with concentrations of 1mg/kg to 3 mg/kg;
- The eight samples tested for cadmium leachate, were below the laboratory limit of reporting; and
- All results fell below adopted guidelines.

Chromium (Cr) III

- All 32 samples analysed reported positive results for Cr of 84 mg/kg to 322 mg/kg; and
- Two samples were rebatched for chromium speciation *(EB0508900)*- MLTP6 (0-0.2), and MLTP8 (0-0.2).
- The results for speciation determined that chromium occurred in the form of chromium **III**, and did not exceed the guideline of (12%). These are within the range of naturally occurring soils in Queensland (9- 607 mg/kg) and are not regarded as a direct reflection of impact from site land use.

Cobalt (Co)

- All 32 samples analysed reported positive results for Cr of 11 mg/kg to 128 mg/kg; and
- One result (MLTP11) had Co concentration of 128 mg/kg exceeding the HIL 'A' guidelines of 100 mg/kg.

Copper (Cu)

- All 32 samples analysed reported results for copper of between 6 mg/kg and 3200 mg/kg;
- Three samples were rebatched for copper leachability testing (*EB0508879)* (MLSS 5, MLTP 13 (0.0-0.2) & MLTP 15 (0.1-0.2)), which returned leachability results of 0.4, 0.9 and 26.8 mg/L respectively; and

- The following samples exceeded the HIL-A guidelines of 1000 mg/kg:

Sample ID	Exceeding HIL-A Copper mg/kg	Leachate Testing Copper mg/L
MLSS 5	1830	0.4
MLTP 15 (0.1-0.2)	3200	26.8

Lead

- 28 samples analysed reported results for lead of 6 mg/kg to 27,700 mg/kg.
- The following samples exceeded the HIL-A guidelines of 300 mg/kg:

Sample ID	Exceeding HIL-A Lead mg/kg	Leachate Testing Lead mg/L
MLTP 24 (0.0-0.2)	602	0.3
MLTP 17 (0.0-0.2)	854	-
MLTP 2 (0.1-0.3)	861	0.2
MLTP 8 (0.0-0.2)	1120	-
MLSS 3	2090	-
MLSS 4	4660	-
MLSS 5	4660	9.7
MLTP 13 (0.0-0.2)	10900	128
MLSS 1	27400	-
MLTP 15 (0.1-0.2)	27700	133

Nickel

- There were 27 nickel samples exceeding the EIL- interim urban guidelines, no samples exceeded the HIL-A adopted guidelines of 600 mg/kg.
- The eight samples tested for nickel leachate, were below the laboratory limit of reporting.

Zinc

- There were seven zinc samples exceeding the EIL- interim urban guidelines with concentrations of 33 mg/kg to 1330 mg/kg out of a total of 32 samples which were analysed. No samples exceeded the HIL-A adopted guideline of 7000 mg/kg.
- Zinc leachability testing was conducted on eight samples with two samples (MLTP 4 (0.0-0.4) & MLTP 24 (0.0-0.2)) exceeding the limit of 1 mg/L. These samples are summarised below.
- The following samples met with HIL-A guidelines, and leachability test results are included for reference:

Sample ID	Exceeding EIL-interim urban Zinc mg/kg	Leachate testing Zinc mg/L
MLTP 4 (0.0-0.4)	164	1.5
MLTP 24 (0.0-0.2)	971	3.2
MLSS4		9.2

Mercury

A total of 32 samples were analysed for mercury, a positive result was recorded for eight samples with concentrations of 0.1 mg/kg to 0.5 mg/kg. Of the eight leachate tests performed, all had values below the laboratory limit of reporting.

6.2 Nitrogen Compounds

Ammonia NH_3

All of the 12 samples analysed for ammonia reported levels below the laboratory limit of reporting.

Nitrite NO^{2-} (soluble)

A total of 13 samples were analysed for nitrite, a positive result was recorded for 11 samples with concentrations of 0.1 mg/kg to 2.6 mg/kg.

Nitrate NO^{3-} (soluble)

A total of 13 samples were analysed for nitrate, a positive result was recorded for 10 samples with concentrations of 0.1 mg/kg to 7.2 mg/kg.

Total Nitrite & Nitrate (soluble)

Combined a total of 13 samples were analysed for nitrate and nitrite, a positive result was recorded for 10 samples with concentrations of 0.2 mg/kg to 9.4 mg/kg.

6.3 Organochlorine and Organophosphate Pesticides

Of the seven samples analysed for OCP and OPPs, all reported levels below the laboratory limit of reporting.

6.4 TPH

Total Petroleum hydrocarbons (TPH)

- Petroleum hydrocarbons were detected in sample MLTP 24 (0.0-0.2) below the adopted guidelines with C15 - C28 Fraction concentration of 110 mg/kg and C29 - C36 Fraction concentration of 100mg/kg.
- Surface samples MLSS4 and MLSS5 reported C15 - C28 Fraction concentration of 1860mg/kg and 200mg/kg respectively. C29 - C36 Fraction results were 3170mg/kg and 270mg/kg respectively. MLSS5 sample exceeded Qld EPA Draft 'Investigation Thresholds' Guidelines of 1000 mg/kg for C15- C36. These two samples were taken from soils in proximity to shed and an adjacent drain that connects to target infrastructure that is covered in lubricating oils.

6.5 BTEX

Benzene, toluene, ethylene & total xylenes
Of the eight samples analysed for BTEX, all reported levels below the laboratory limit of reporting.

Refer to Table G, **Appendix B**.

6.6 Volatile Organic Hydrocarbons

Of the 14 samples analysed for VOCs, all reported levels below the laboratory limit of reporting.

6.7 Explosives

- One sample (MLTP 4 (0.0-0.4)) reported a concentration of explosive above the laboratory limit of reporting for 2-Nitrotoluene with a concentration of 0.3 mg/kg.
- All the 29 other samples analysed reported levels below the laboratory limit of reporting.

6.8 XRF Results

Elevated metals were detected on the surface and at the base of the test pits using the portable XRF. Approximately 165 reading points were taken. The elevated metals detected include lead, copper, nickel, zinc, mercury, cobalt, and a range of other minor elements. Many of these metals occur naturally in the local geology basalt. However, there are also concentrations of some metals that are deemed exceed what would occur naturally. The XRF results of major metals are plotted in **Figures 6** to **9**. These figures show that elevated metals are concentrated in known impacted areas, and that no previously unknown hotspots occur outside these areas. Of note is the elevated zinc, and lead in the area of the old house site in the southern corner of the site. Note also that the XRF readings did not identify any elevated metals at the suspected old house site north of the main mortar impact area.

XRF readings were collected at the approximate base of each test pit, (around 1 metre below natural surface). The results indicate that elevated lead concentrations do not generally occur at depth (with the exception of MLTP02), but that copper, zinc, and nickel do occur at elevated concentrations at depth.

6.9 Building Conditions

There are a number of small buildings on the site including two sheds at either end of the stop butt range, a toilet half way down the main range, and a shed and two toilets at the small arms fire range. The two toilets contain asbestos and have asbestos register signage on them. The sheds were tested for lead paint using the XRF. The shed at the small arms range had metal walls and the XRF recorded elevated levels of many metals including lead, cadmium and zinc. A reading was taken on the wooden door that had peeling paint similar to the walls. Elevated lead was recorded for the door indicating that the paint on the rest of the shed is potentially likely to contain lead.

The two sheds at the stop butt end of the main range were also tested and found to be free of lead.

7 DISCUSSION

7.1 EVALUATION OF SITE

7.1.1 Assessment of Risk

Review of results from the site investigation works (soil) conducted in October 2005 across the Site has reported concentrations of potential contaminants of concern (including arsenic, cadmium, chromium, cobalt, copper, lead, nickel, zinc, mercury, nitrite, nitrate, TPH, and in one sample, explosives) above laboratory limits of reporting. Of these, cobalt, copper, lead and TPH were found in concentrations exceeding current regulatory guidelines.

Leachate testing was performed on soils at pH 4.9. The results showed that if the pH of soils is lowered to 4.9, high concentrations of lead are mobilised in all samples, and in the case of MLTP15, high concentrations of zinc, and for surface sample MLSS4, high concentrations of copper. However, given that the natural condition of the soil was found to be near neutral pH with results of 6-7.5 pH and the geology is basic, it is unlikely that the metals would be naturally mobilised to generate any leachate with high concentrations of metals.

Based upon field and laboratory results, and the understanding that the site is to be potentially redeveloped for future residential purposes (with soil access), a number of ongoing sources of contamination that may present a risk to human health and the environment were identified.

7.1.2 Potential Receptors

The primary drainage gully in the centre of the site presents the potential primary pathway for surface migration of contaminants away from source areas when water is flowing. However, the sampling at the down gradient end of the gully (MLTP04) indicates that no significant migration has occurred. Additionally, given the clayey nature of the underlying soils and the lack of a significant shallow groundwater aquifer, and the relative immobility of the heavy metals present at the site, it is unlikely that there has been any significant migration of contamination either off-site or vertically into the underlying natural soils other than that identified as part of this investigation. Personnel utilising the facilities, should avoid direct contact with contaminant impacted soils and buildings.

Horses grazing on the site should be restricted from areas of contaminated soils and asbestos and lead containing buildings.

There is no visible evidence of deleterious impact to native fauna and flora from the identified areas of contamination.

7.1.3 Risk Assessment

Based on the observed extend of contamination a qualitative risk based approach has been utilised in order to determine a risk level for the site. The risk assessment has been undertaken in accordance with the Department of Defence *Estate Risk Assessment Guidance, Facilities Operations* (2005). Refer to **Table 6** below.

Table 6: Risk Assessment

Risk Dimension	Measure Consequence	Measure of Likelihood of Occurrence	Overall Risk Level
Capability	Negligible	Rare	30
Occupational Health and Safety	Negligible	Rare	30
Legislative Compliance	Negligible	Rare	30
Environment Heritage	Negligible	Likely	24
Financial Efficiency	Negligible	Likely	24
Personnel	Negligible	Rare	30
Reputation	Negligible	Unlikely	30
	RISK PRIORITY	TOTAL	**198**

Based on the preliminary risk assessment conducted the risk band is **LOW** and the risk priority is **198**.

7.1.4 Land Use Suitability

HLA-Envirosciences conclude based on the contaminated site assessment herein, that the Site is considered suitable for ongoing use as a Defence and Rifle Range facility.

Further investigations and potential remediation of impacted areas are considered necessary if the zoning of the site were to be changed for future residential development in accordance with EPA guidelines.

7.1.5 Compliance with Regulatory Guidelines

In general, the investigation was conducted in accordance with recognised Sampling Design Guidelines (Australian Standards 1997/ 1999 for the COPCs) and the analytical work was conducted by NATA certified laboratories.

8 CONCLUSIONS AND RECOMMENDATIONS

The Preliminary Environmental Site Contamination reports that there has been some impact as a result of historical and current usage of the site as a rifle and grenade range. However, areas of impact are isolated to specific areas (ranges) and the risk band is **LOW** and the risk priority is **198**. The site is considered suitable for existing use.

The site is not suitable in its current state to meet the requirements for residential HIL ‘A” and is likely to require further investigation and potential remediation due to recorded levels of contaminants present on site in the areas described in the report should the site be redeveloped for residential use in the future.

No further contamination assessment is required at this stage if there is no immediate plan to redevelop the site.

s47(1)(b) [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

8.2 Limitations

This document was prepared for Department of Defence. This Preliminary Environmental Site Contamination Assessment is prepared as part of HLA to undertake an investigation into the potential environmental, heritage, infrastructure and land use issues affiliated with the potential disposal of the Mt Lofty Rifle Range. This specific document addresses the potential contamination issues associated with the facility.

The Preliminary Environmental Site Contamination Assessment is based on a review of the condition of the site at the time of investigation, as described in the assessment reports described herein. This Preliminary Environmental Site Contamination Assessment has been prepared in consideration of the relevant guidelines used for site contamination assessment in Queensland at the time the TPR was appointed. The TPR notes that subsurface conditions can vary over short distances and it is possible that areas of contaminated soil may not have been detected between the sampling points.

However, in the opinion of HLA, the investigation is deemed representative of overall conditions

The investigation was limited to the scope of original works and did not involve any surface water or groundwater assessment and no claims are made to the status of such sources.

9 REFERENCES

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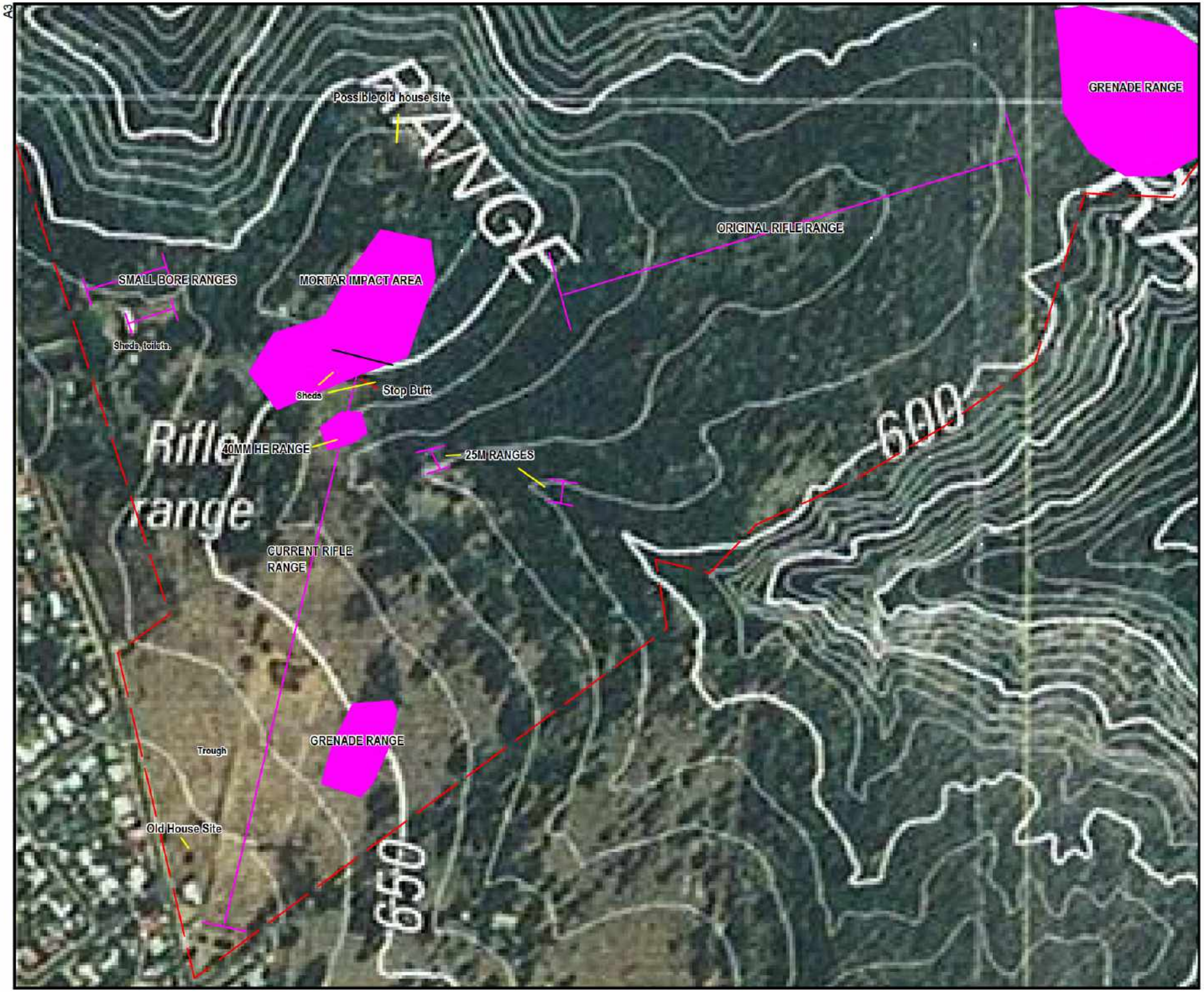
G-tek Australia, *Post Activity Report- Unexploded Ordnance Assessment*, Mount Lofty Rifle Range, Martini Road, Toowoomba Qld, September 2005

Ministry of Housing and Sectional Planning, '*Environmental Quality Objectives in the Netherlands*', 1994.

National Environmental Protection Council, '*National Environmental Protection Measures (Assessment of Site Contamination)*', December 1999.

Standards Australia, AS4482.1 & 2 '*Guide to the Sampling and Investigation of Potentially contaminated Soil, Part 1: Non-volatile and Semi-volatile Compounds & Part 2: Volatile Substances*', 1997/1999.

Figures



DATE: October 2005
PROJECT- FILE NAME: D1024101
DRAWN: MFW
APPROVED: PMA

Property Boundary

Identified impacted areas (G-Tek, 2005)

0 0.1 0.2 kilometres

N

SITE LOCATION SHOWING AREAS OF ENVIRONMENTAL CONCERN

Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

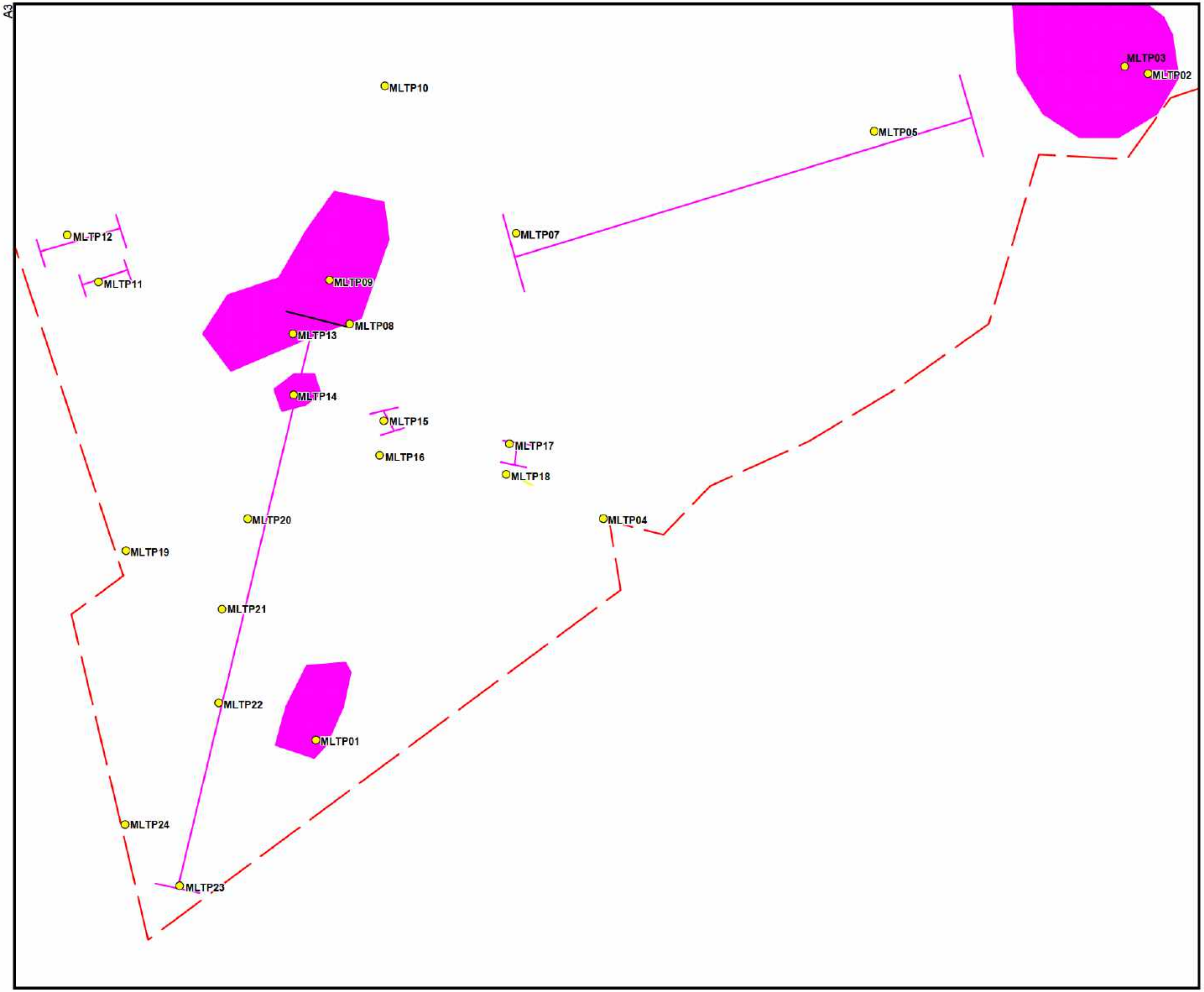
Mt Lofty Rifle Range

Source: G-Tek, 2005

HLA

FIGURE 1

A3



DATE:	October 2005
PROJECT- FILE NAME:	D1024101
DRAWN:	ESH
APPROVED:	PMA

TEST PIT LOCATIONS

Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

Mt Lofty Rifle Range

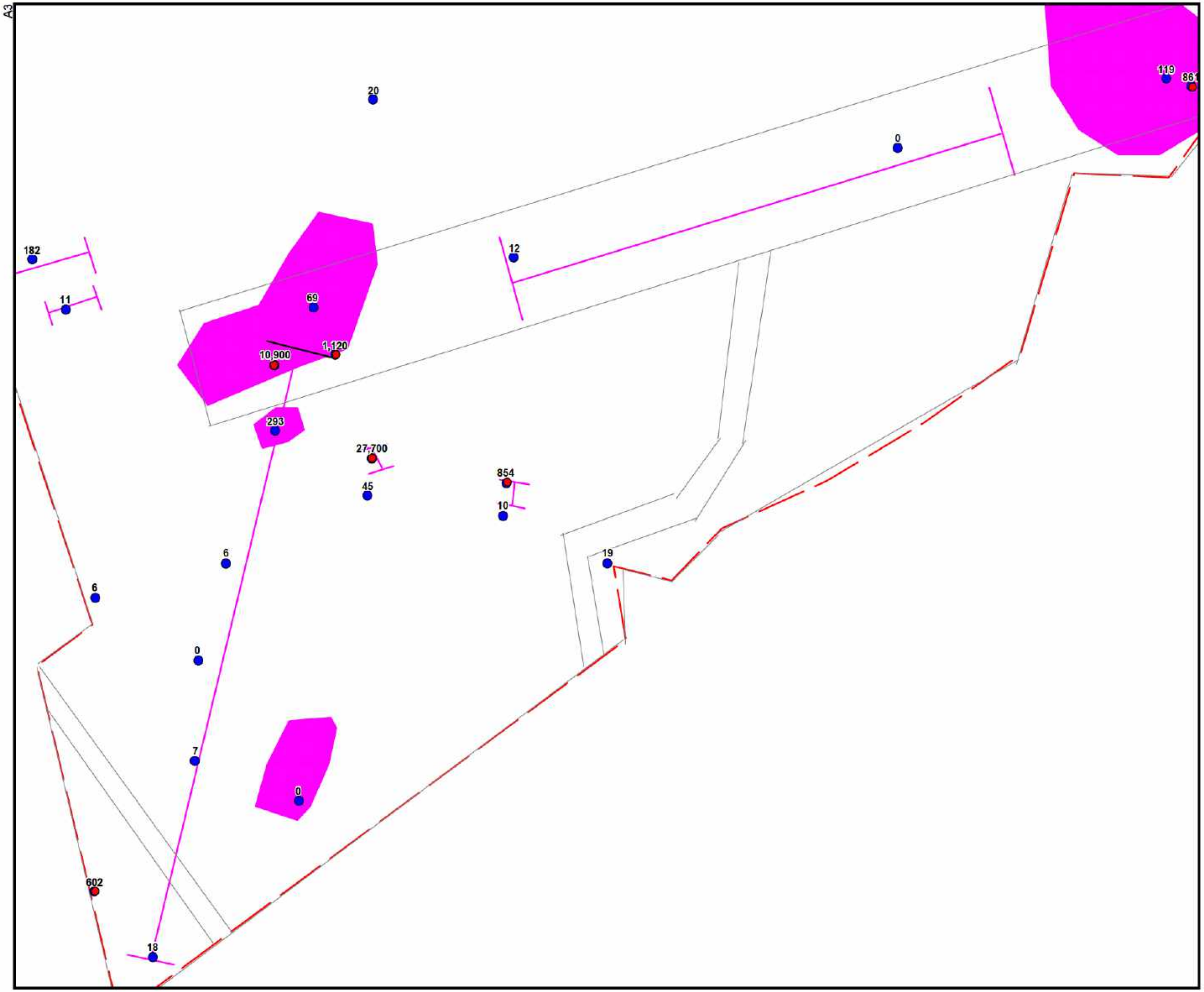
Source: G-Tek, 2005

HLA

FIGURE

2

A3



DATE: October 2005
PROJECT- FILE NAME: D1024101
DRAWN: MFW
APPROVED: PMA

Lead concentration at test pit (mg/kg) <NEPM HIL 'A' guidelines

Lead concentration at test pit (mg/kg) exceeding NEPM HIL 'A' guidelines of 300mg/kg

Lot Plan Boundaries

0 0.1 0.2
kilometres

N

TEST PIT SOIL LEAD CONCENTRATIONS FROM LABORATORY ANALYSIS mg/kg

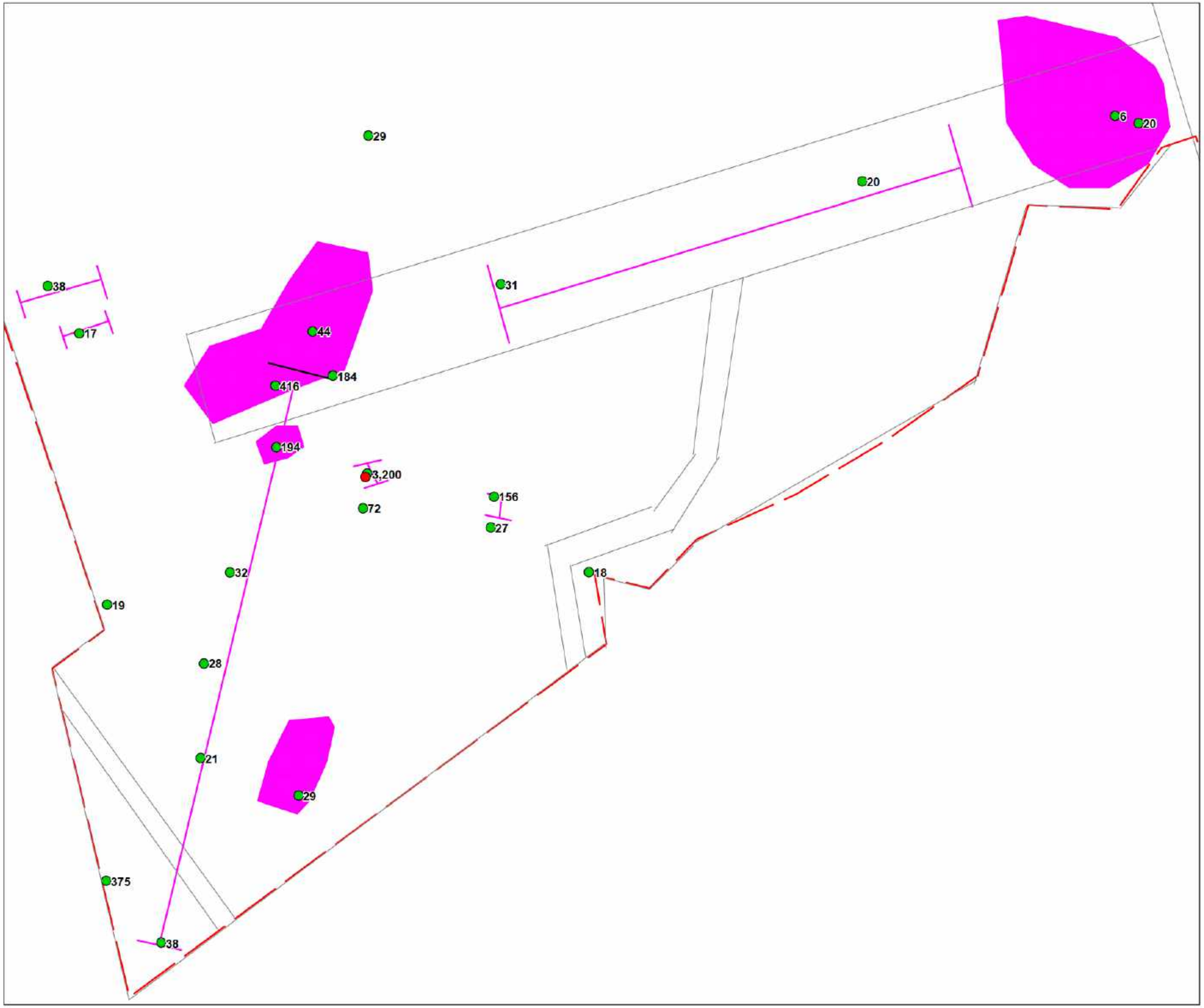
Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

Mt Lofty Rifle Range

Source: HLA,2005

FIGURE
3



DATE: October 2005

PROJECT- FILE NAME: D1024101

DRAWN: MFW

APPROVED: PMA

Copper concentration at test pit (mg/kg) < NEPM HIL 'A' guidelines

Copper concentration at test pit (mg/kg) exceeds NEPM HIL 'A" guideline 1000 mg/kg

Lot Plan Boundaries

0 0.1 0.2
kilometres

N

TEST PIT SOIL COPPER CONCENTRATIONS FROM LABORATORY ANALYSIS mg/kg

Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

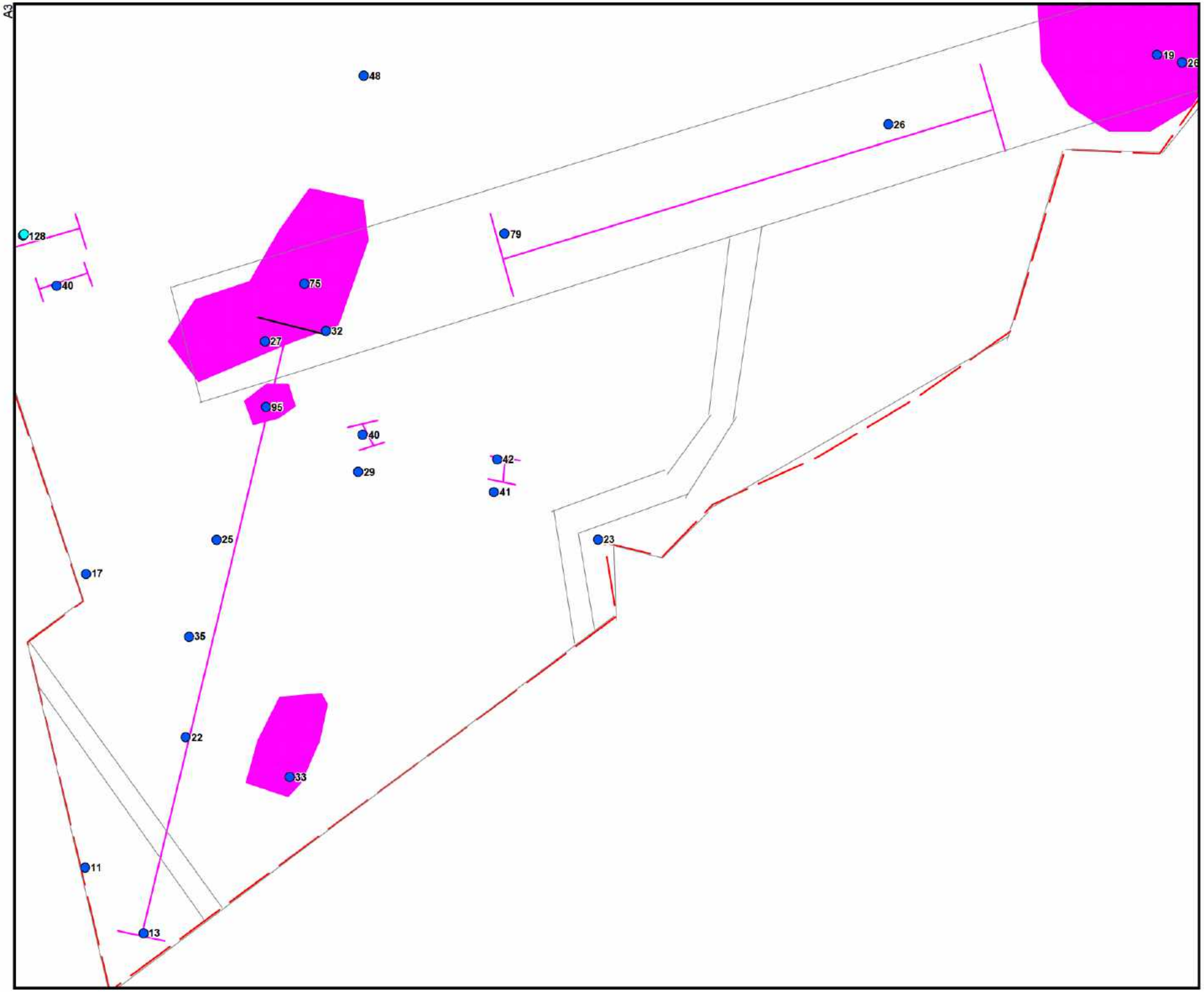
Mt Lofty Rifle Range

Source: HLA,2005

HLA

FIGURE **4**

A3



DATE: October 2005

PROJECT- FILE NAME: D1024101

DRAWN: MFW

APPROVED: PMA

Cobalt concentration per test pit (mg/kg) <NEPM HIL 'A' guidelines

Cobalt concentration per test pit (mg/kg) exceeds HIL 'A' guideline of 100 mg/kg

Lot Plan boundaries

0 0.1 0.2

kilometres

N

TEST PIT SOIL COBALT CONCENTRATIONS FROM LABORATORY ANALYSIS mg/kg

Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

Mt Lofty Rifle Range

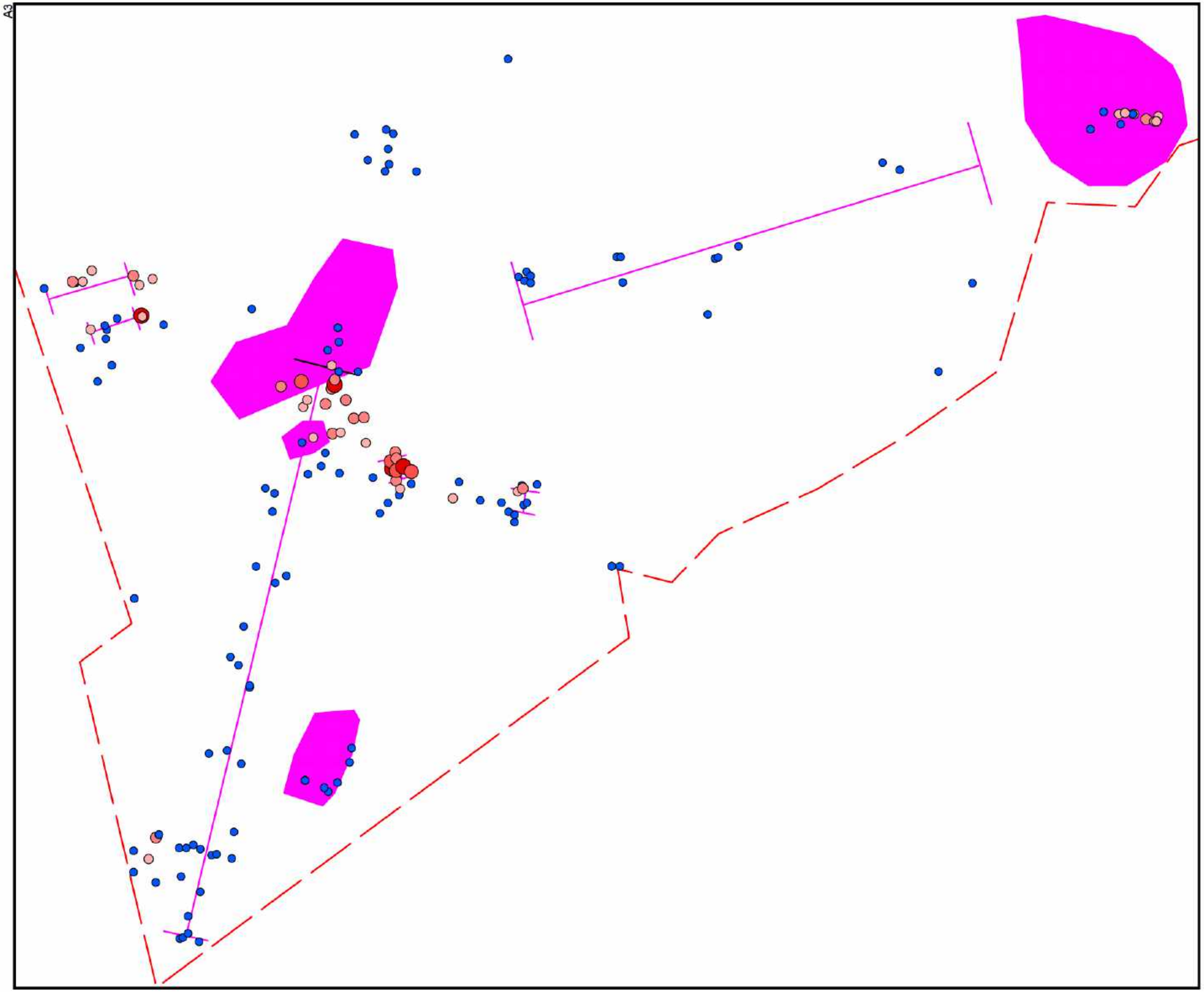
Source: HLA, 2005

HLA

FIGURE

5

A3



DATE:	October 2005
PROJECT- FILE NAME:	D1024101
DRAWN:	MFW
APPROVED:	PMA

XRF Lead Conc ppm
(* >300 ppm exceeds HIL 'A' guidelin

10,000 to 41,300*	(4)
5,000 to 10,000*	(4)
1,000 to 5,000*	(16)
300 to 1,000*	(26)
0 to 300	(115)

0 0.25 0.5
kilometres

N

XRF MEASURED LEAD CONCENTRATIONS IN SOILS PPM

Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

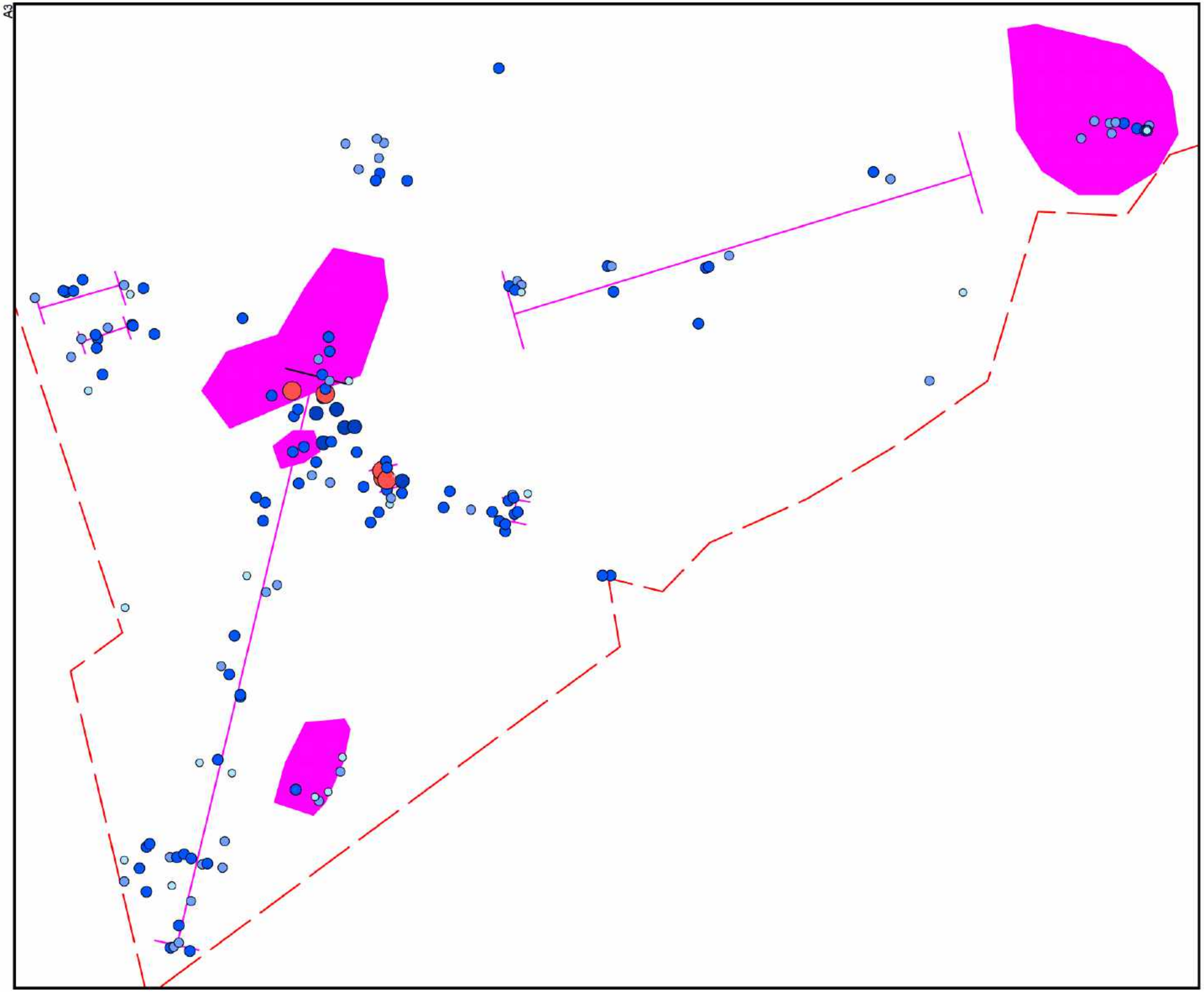
Mt Lofty Rifle Range

Source: HLA, 2005

HLA

FIGURE
6

A3



DATE:	October 2005
PROJECT- FILE NAME:	D1024101
DRAWN:	MFW
APPROVED:	PMA

XRF Copper concentrations ppm
* >1000 exceeds HIL'A' guideline

1,000 to 4,000*
500 to 1,000
200 to 500
100 to 200
0 to 100

0 0.25 0.5
kilometres

N

XRF MEASURED COPPER CONCENTRATION IN SOIL (ppm)

Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

Mt Lofty Rifle Range

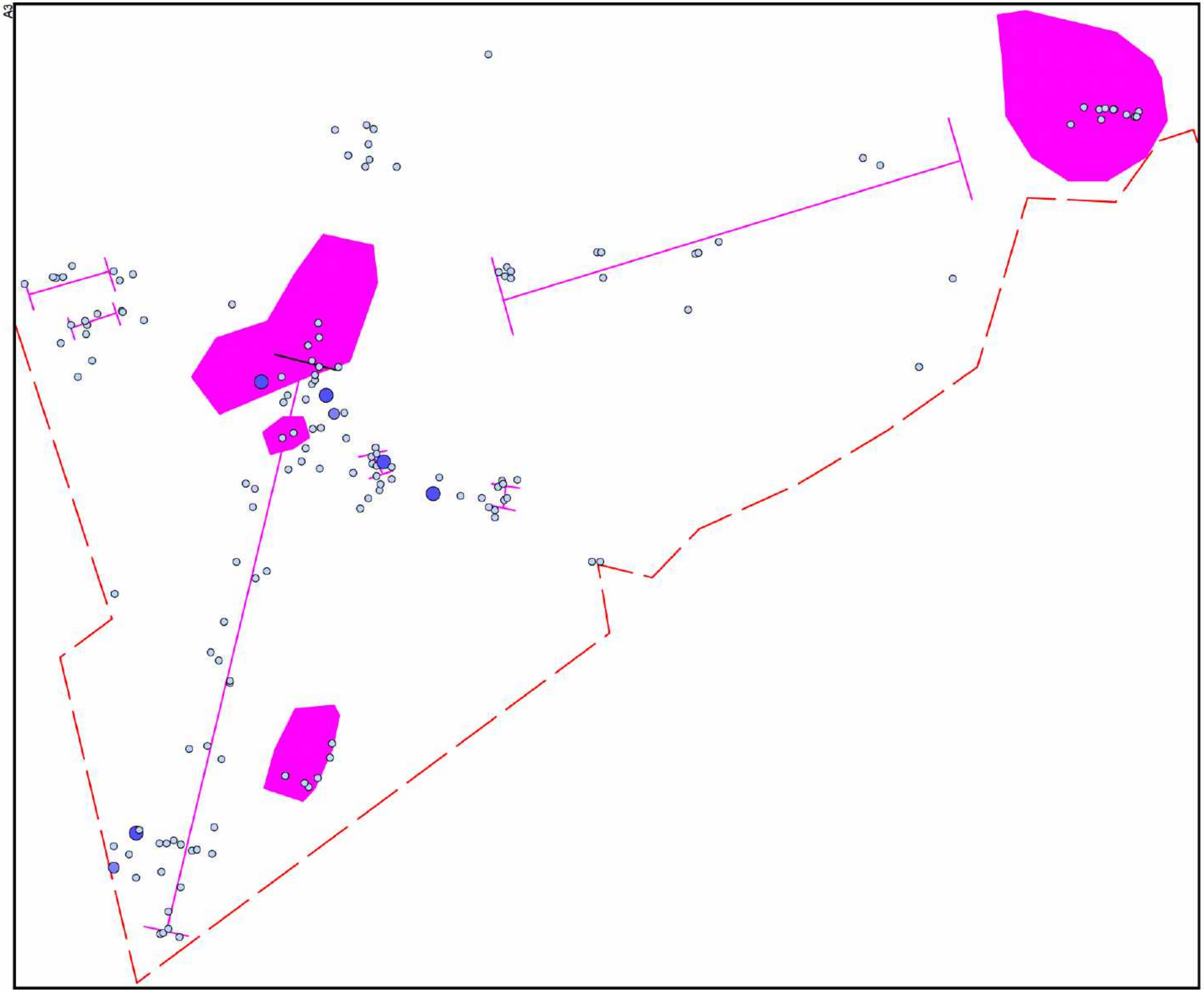
Source: HLA, 2005

HLA

FIGURE

7

A3



DATE: October 2005
PROJECT- FILE NAME: D1024101
DRAWN: MFW
APPROVED: PMA

Zinc concentrations ppm
(NEPM HIL 'A' guideline Zn-7000 mg/k

1,000 to 5,000 (5)
500 to 1,000 (3)
0 to 500 (157)

0 0.1 0.2
kilometres

N

XRF MEASURED ZINC CONCENTRATION IN SOIL (ppm)

Department of Defence, Corporate Services and Infrastructure

Preliminary Environmental Site Contamination Assessment

Mt Lofty Rifle Range

Source: HLA, 2005

HLA

FIGURE
8

Plates

Plate 1: Typical Soil Profile from Test Pit

Plate 2: View Toward Target Area and Stopbutt at Small Arms Range

Plate 3: Stopbutt of Main Range Showing Physical Impact

Plate 4: Main Range Looking Toward Target Area and Head of the Gully

Appendices

Appendix A: Test Pit Logs

APPENDIX A : TEST PIT LOGS

D1024101- MT LOFTY CSA 3-5th October 2005

EXCAVATION- GILES EARTHMOVING BACKHOE

LOGS RECORDED BY: MARIA WOODGATE

UXO SUPERVISION- G-TEK

ON SITE SURVEYOR: MAX MULLER

****LAB SAMPLES**

PointID	Depth	Number	Analysed	Description	Feature
MLTP1(0.1-0.2)	0.1	0.2		Red highly weathered BASALT (minor grenade fragments)	
MLTP02 (0.1-0.3)	0.1	0.3		Brown CLAYEY SILT / Light yellow/brown GRAVEL	
MLTP03 (0.1-0.2)	0.1	0.2		Brown CLAYEY SILT- mottled cream brown (highly impacted grenade fligh off levers)	
MLTP04 (0-0.4)	0	0.4		Dark brown CLAY/ CLAYEY SILT- moist, large boulders, humic	
MLTP05 (0-0.2)	0	0.4		Brown CLAYEY SILT with large BASALT boulders (may be cut/fill for mound, oxidised patches noted of possible rusted metals fragments)	
MLTP06 (0-0.2)	0	0.2		Dark brown CLAYEY SILT with weathered BASALT rocks. (Circa 1900's casing noted on soil surface and SAA fragments found on top of mound)	Old Range Firing mound
MLTP07 (0-0.2)	0	0.2		Homogenous dark brown CLAYEY SILT with weathered BASALT rocks. (Circa 1930's cartridge casings noted on soil surface of cut/fill mound)	Old Range Firing mound- westerley
MLTP08 (0-0.1)	0	0.1		Dark red brown CLAYEY SILT, in channel. Presence of mixed earth, bottles and other fragment possible indication of cut/fill.	Mortar Range gulley, behind big stop butt mound at the top.
MLTP09 (0-0.2)	0	0.2		Dark red brown SILTY CLAY with BASALT boulders (Usds as high explosives, smoke mortar and HCE/ horse shoe, small ammo project, surrounded by regrowth, grass cover)	Located behind highest stop butt- hill slope behind in unexcavated area.
PointID	Depth	Number	Analysed	Description	Feature

PointID	Depth	Number	Analysed	Description	Feature
MLTP10 (0.1-0.2)	0.1	0.2		Red brown gravelly CLAYEY SILT with stiff-hard BASALT and gravel from 0.25 m.	Downgradient from the old house site, former dump site.
MLTP11 (0.1-0.2)	0.1	0.2		Dark red brown SILTY CLAY.	Small arms and small bore range. Sample collected from Stop butt. Middle of the range in front of flat grass firing covered point.
MLSS1 (MLTP11)	0	0.1		Dark red brown SILTY CLAY. Small arms and small bore range. Stop but top SA range.	Small arms and small bore range. Sample collected from Stop butt. Middle of the range in front of flat grass firing covered point.
MLTP12 (0-0.1)	0	0.1		Dark brown SILTY CLAY becoming red. (Small arms and ammo projectile range, lead cartridges predominantly 0.22 and air-rifle from stop butt MLSS2.)	
MLSS2 (MLTP12)	0	0.1		Dark brown SILTY CLAY becoming red. (Small arms and ammo projectile range, lead cartridges predominantly 0.22 and air-rifle from stop butt MLSS2.)	
MLTP13 (0.0)	0	0.05		Red brown CLAYEY SILT with stiff-hard BASALT from 0.25 m. Excavation terminated at 0.3 m due to refusal at basalt. (lead cartridges on surface.)	Stop butt- Main mortar range
MLTP14 (0-0.2)	0	0.2		Dark red brown SILTY CLAY. (components of 40mm grenades found)	
MLTP15 (0-0.2)	0	0.2		Dark brown SILTY SAND and CLAY to 1m. (concentration of SAA and small projectiles, metal target material, wood)	
MLTP16 (0.1-0.2)	0.1	0.2		Dark red brown SILTY CLAY (small arms cartridge cases on the surface)	Firing mound

MLTP17 (0.1-0.2)	0.1	0.2		Dark brown SILTY CLAY- moist at 0.5m (old ammo box and metal post for targets)	Stop butt- 25 mm Eastern Range
MLTP18 (0-0.2)	0	0.5		Brown red SILTY CLAY (cartridge cased and small arms ammo on surface)	Firing mound- 25 mm Eastern Range
MLTP19 (0-0.2)	0	0.2		Red brown SILTY CLAY- grading to red clays	Background sample near western fenceline, Martini Street
MLTP20 (0-0.2)	0	0.2		Red SILTY CLAY	200 yard firing mound
MLTP21 (0-0.2), DUP MLTP21	0	0.2		Red brown SILTY CLAY- grading to red clays	300 yard firing mound
MLTP22 (0-0.2)	0	0.2		Red SILTY CLAY (small arms cartridge cases on surface)	400 yard firing mound
MLTP23 (0-0.2)	0	0.2		Brown SILTY CLAY- grading to red brown silty clays	
MLTP24 (0-0.2)	0	0.2		Red brown SILTY CLAY	Old house site near gate

Appendix B: Laboratory Results

Table 1: Laboratory Analytical Results for Heavy Metals

ALS	EB0509055	Analyte	Arsenic	Cadmium	Chromium III	Cobalt	Copper	Lead	Nickel	Zinc	Mercury
20/10/2005	Results	Method	EG005T	EG005T	EG005T	EG005T	EG005T	EG005T	EG005T	EG005T	EG035T
Sample		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*ID 2*	*LOR*	*5*	*1*	*2*		*5*	*5*	*2*	*5*	*0.1*
Guideline	HIL-A		100	20	12%/ 100	100	1000	300	600	7000	15
	EIL-Interim Urban		20	3	400/1		100	600	60	200	1
MLSS 1		SOIL	<5	<1	195	53	26	27400	72	42	<0.1
MLSS 2		SOIL	<5	<1	205	92	31	158	93	49	<0.1
MLSS 3		SOIL	10	2	146	27	50	2090	67	1220	0.3
MLSS 4		SOIL	6	<1	123	54	76	625	222	1330	<0.1
MLSS 5		SOIL	<5	<1	180	34	1830	4660	165	586	<0.1
MLSS 7		SOIL	<5	<1	184	33	42	123	134	116	<0.1
MLTP 1 (0.1-0.2)		SOIL	<5	<1	152	26	29	<5	72	41	<0.1
MLTP 2 (0.1-0.3)		SOIL	<5	<1	84	19	20	861	93	94	<0.1
MLTP 3 (0.1-0.3)		SOIL	<5	<1	129	23	6	119	68	62	<0.1
MLTP 4 (0.0-0.4)		SOIL	<5	<1	146	26	18	19	88	164	<0.1
MLTP 5 (0.0-0.2)		SOIL	<5	<1	118	81	20	<5	90	90	<0.1
MLTP 6 (0.0-0.2)		SOIL	<5	<1	305	79	68	39	197	171	0.5
MLTP 6 (0.0-0.2) Cr SPECIATION					378						
MLTP 7 (0.0-0.1)		SOIL	<5	<1	230	32	31	12	178	79	<0.1
MLTP 8 (0.0-0.2)		SOIL	<5	<1	205	75	184	1120	185	72	<0.1
Cr SPECIATION					265						
MLTP 9 (0.0-0.2)		SOIL	<5	<1	292	48	44	69	218	72	<0.1
MLTP 10 (0.0-0.2)		SOIL	<5	<1	322	40	29	20	187	52	<0.1
MLTP 11 (0.0-0.2)		SOIL	<5	<1	176	128	17	11	70	33	<0.1
MLTP 12 (0.0-0.2)		SOIL	<5	<1	201	33	38	182	90	51	<0.1

Table 1: Laboratory Analytical Results for Heavy Metals cont'd

ALS	EB0509055	Analyte	Arsenic	Cadmium	Chromium III	Cobalt	Copper	Lead	Nickel	Zinc	Mercury
20/10/2005	Results	Method	EG005T	EG005T	EG005T	EG005T	EG005T	EG005T	EG005T	EG005T	EG035T
Sample		Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*ID 2*	*LOR*	*5*	*1*	*2*		*5*	*5*	*2*	*5*	*0.1*
Guideline	HIL-A		100	20	12%/ 100	100	1000	300	600	7000	15
	EIL-Interim Urban		20	3	400/1		100	600	60	200	1
MLTP 13 (0.0-0.2)		SOIL	6	<1	166	27	**416**	**10900**	**86**	92	<0.1
MLTP 14 (0.1-0.2)		SOIL	<5	<1	180	95	**194**	293	**166**	**420**	0.1
MLTP 15 (0.1-0.2)		SOIL	11	3	116	40	**3200**	**27700**	**413**	**481**	0.1
MLTP 16 (0-0.1)		SOIL	<5	<1	114	29	72	45	**75**	**376**	0.2
MLTP 17 (0.0-0.2)		SOIL	<5	<1	145	42	**156**	**854**	**90**	148	<0.1
MLTP 18 (0.0-0.2)		SOIL	<5	<1	136	41	27	10	**91**	115	<0.1
MLTP 19 (0-0.2)		SOIL	<5	<1	94	17	19	6	47	52	<0.1
MLTP 19_DUP		SOIL	<5	<1	93	16	19	9	44	59	<0.1
MLTP 20 (0.0-0.2		SOIL	<5	1	130	25	32	6	55	65	0.2
MLTP 21 (0.0-0.2)		SOIL	<5	1	169	35	28	<5	**87**	67	<0.1
MLTP21_DUP		SOIL	<5	<1	145	36	35	<5	**79**	64	<0.1
MLTP 22 (0.0-0.2)		SOIL	<5	<1	111	22	21	7	58	86	<0.1
MLTP 23 (0.0-0.2)		SOIL	<5	<1	100	13	38	18	**68**	139	0.3
MLTP 24 (0.0-0.2)		SOIL	<5	2	147	11	**375**	**602**	56	**971**	0.1
MIN			6	1	84	11	6	6	44	33	0.1
MAX			11	3	322	128	3200	27700	413	1330	0.5
AVERAGE			2.0	1.3	152	43.9	224	1576	111.6	231.3	1.1

NEPM Table 5-A - HIL-A	
EIL- Interim Urban	

Table 2: Laboratory Analytical Results for Heavy Metal Acid Leachate Testing

ALS	EB0509055	Analyte	Arsenic	Cadmium	Chromium III	Copper	Lead	Nickel	Zinc	Mercury	Initial pH	After HCl pH	Extraction Fluid Number	Final pH
10/20/2005	Results	Method	EG005C	EG005C	EG005C	EG005C	EG005C	EG005C	EG005C	EG035C	EN33	EN33	EN33	EN33
Sample		Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH Unit	pH Unit		pH Unit
ID 1	*ID 2*	*LOR*	*0.1*	*0.05*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.001*	*0.1*	*0.1*	*1*	*0.1*
Guideline	HIL-A		1	1	1	1	1	1	1	1				
MLTP 1 (0.1-0.2)		SOIL	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.2	<0.001	6.7	1.7	1	4.9
MLTP 2 (0.1-0.3)		SOIL	<0.1	<0.05	<0.1	<0.1	0.2	<0.1	0.3	<0.001	6.8	1.7	1	4.9
MLTP 3 (0.1-0.3)		SOIL	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.5	<0.001	6.8	1.7	1	4.8
MLTP 4 (0.0-0.4)		SOIL	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	1.5	<0.001	6.7	1.7	1	4.9
MLTP 5 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 6 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 7 (0.0-0.1)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 8 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 9 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 10 (0.0-0.2)		SOIL	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.1	<0.001	6.6	1.7	1	4.9
MLTP 11 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 12 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 13 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 14 (0.1-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 15 (0.1-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 16 (0-0.1)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 17 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 18 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 19 (0-0.2)		SOIL	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.4	<0.001	7.3	1.8	1	4.9
MLTP 19_DUP		SOIL	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	0.8	<0.001	6.9	1.8	1	4.9
MLTP 20 (0.0-0.2		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 21 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-

Table 2: Laboratory Analytical Results for Heavy Metal Acid Leachate Testing cont'd

ALS	EB0509055	Analyte	Arsenic	Cadmium	Chromium III	Copper	Lead	Nickel	Zinc	Mercury	Initial pH	After HCl pH	Extraction Fluid Number	Final pH
20/10/2005	Results	Method	EG005C	EG005C	EG005C	EG005C	EG005C	EG005C	EG005C	EG035C	EN33	EN33	EN33	EN33
Sample		Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	pH Unit	pH Unit		pH Unit
ID 1	*ID 2*	*LOR*	*0.1*	*0.05*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.001*	*0.1*	*0.1*	*1*	*0.1*
Guideline	HIL-A		1	1	1	1	1	1	1	1				
MLTP21_DUP		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 22 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 23 (0.0-0.2)		SOIL	-	-	-	-	-			-	-	-	-	-
MLTP 24 (0.0-0.2)		SOIL	<0.1	<0.05	<0.1	<0.1	0.3	<0.1	3.2	<0.001	7.5	1.8	1	4.9

	Arsenic	Cadmium	Chromium III	Copper	Lead	Nickel	Zinc	Mercury
MIN	0	0	0	0	0.2	0	0.1	0
MAX	0	0	0	0	0.3	0	3.2	0
AVERAGE	1.0	1.0	1.0	1.0	1.0	1.0	1.5	1.0

NEPM Table 5-A - HIL-A

Table 3: Laboratory Analytical Results for Nitrates and OCP's

		NITRATES				ORGANOCHLORINE PESTICIDES											
ALS	Analyte	Ammonia as N	Nitrite as N (Sol.)	Nitrate as N (Sol.)	Nitrite + Nitrate as N (Sol.)	alpha-BHC	Hexachloro benzene (HCB)	beta-BHC	gamma-BHC	delta-BHC	Hepta chlor	Aldrin	Heptachlor epoxide	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin
20/10/2005	Method	EK055	EK057	EK058	EK059	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*20*	*0.1*	*0.1*	*0.1*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
MLSS 1	SOIL	-				-	-	-	-	-	-	-	-	-	-	-	-
MLSS 2	SOIL	-				-	-	-	-	-	-	-	-	-	-	-	-
MLSS 3	SOIL	-	<0.1	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 4	SOIL	-				-	-	-	-	-	-	-	-	-	-	-	-
MLSS 5	SOIL	-				-	-	-	-	-	-	-	-	-	-	-	-
MLSS 7	SOIL	-				-	-	-	-	-	-	-	-	-	-	-	-
MLTP 1 (0.1-0.2)	SOIL	<20	0.3	0.2	0.5	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 2 (0.1-0.3)	SOIL	<20	0.1	0.1	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 3 (0.1-0.3)	SOIL	<20	0.6	<0.1	0.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 4 (0.0-0.4)	SOIL	<20	0.8	4.9	5.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 5 (0.0-0.2)	SOIL	<20	0.4	2.4	2.8	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 6 (0.0-0.2)	SOIL	<20	1.5	7.2	8.7	-	-	-	-	-	-	-	-	-	-	-	-

Table 3: Laboratory Analytical Results for Nitrates and OCP's cont'd

		NITRATES				ORGANOCHLORINE PESTICIDES											
ALS	Analyte	Ammonia as N	Nitrite as N (Sol.)	Nitrate as N (Sol.)	Nitrite + Nitrate as N (Sol.)	alpha-BHC	Hexachloro benzene (HCB)	beta-BHC	gamma-BHC	delta-BHC	Hepta chlor	Aldrin	Heptachlor epoxide	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin
20/10/2005	Method	EK055	EK057	EK058	EK059	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*20*	*0.1*	*0.1*	*0.1*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
MLTP 7 (0.0-0.1)	SOIL	<20	0.3	<0.1	0.4	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 8 (0.0-0.2)	SOIL	<20	0.6	1.2	1.8	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 9 (0.0-0.2)	SOIL	<20	0.5	2.1	2.6	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 10 (0.0-0.2)	SOIL					<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 11 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 12 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 13 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 14 (0.1-0.2)	SOIL	<20	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 15 (0.1-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 16 (0-0.1)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 17 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-

Table 3: Laboratory Analytical Results for Nitrates and OCP's cont'd

		NITRATES				ORGANOCHLORINE PESTICIDES											
ALS	Analyte	Ammonia as N	Nitrite as N (Sol.)	Nitrate as N (Sol.)	Nitrite + Nitrate as N (Sol.)	alpha-BHC	Hexachloro benzene (HCB)	beta-BHC	gamma-BHC	delta-BHC	Hepta chlor	Aldrin	Heptachlor epoxide	trans-Chlordane	alpha-Endosulfan	cis-Chlordane	Dieldrin
20/10/2005	Method	EK055	EK057	EK058	EK059	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*20*	*0.1*	*0.1*	*0.1*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
MLTP 18 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 19 (0-0.2)	SOIL	<20	2.6	6.8	9.4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 19_DUP	SOIL	<20	1.5	5.5	7	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 20 (0.0-0.2	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 21 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP21_DUP	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 22 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 23 (0.0-0.2)	SOIL					-	-	-	-	-	-	-	-	-	-	-	-
MLTP 24 (0.0-0.2)	SOIL					<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MIN		0	0.1	0.1	0.2	0	0	0	0	0	0	0	0	0	0	0	0
MAX		0	2.6	7.2	9.4	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		1.0	1.7	3.4	4.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Table 4: Laboratory Analytical Results for OCP's cont'd and OPP's

		ORGANOCHLORINE PESTICIDES									ORGANOPHOSPHATE PESTICIDES						
ALS	Analyte	4.4?-DDE	Endrin	beta-Endosulfan	4.4?-DDD	Endrin aldehyde	Endosulfan sulfate	4.4?-DDT	Endrin ketone	Methoxy chlor	Dichlorvos	Demeton-S-methyl	Monocro tophos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Parathion-methyl
20/10/2005	Method	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.2*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	*0.2*
MLSS 1	SOIL																
MLSS 2	SOIL																
MLSS 3	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 4	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 5	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 7	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 1 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 2 (0.1-0.3)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 3 (0.1-0.3)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 4 (0.0-0.4)	SOIL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2
MLTP 5 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2
MLTP 6 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2
MLTP 7 (0.0-0.1)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 8 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 9 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4: Laboratory Analytical Results for OCP's cont'd and OPP's cont'd

		ORGANOCHLORINE PESTICIDE									ORGANOPHOSPHATE PESTICIDE						
ALS	Analyte	4.4?-DDE	Endrin	beta-Endosulfan	4.4?-DDD	Endrin aldehyde	Endosulfan sulfate	4.4?-DDT	Endrin ketone	Methoxy chlor	Dichlorvos	Demeton-S-methyl	Monocro tophos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Parathion-methyl
20/10/2005	Method	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.2*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	*0.2*
MLTP 10 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 11 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 12 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2
MLTP 13 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 14 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 15 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 16 (0-0.1)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 17 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 18 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 19 (0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 19_DUP	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 20 (0.0-0.2	SOIL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2
MLTP 21 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2

Table 4: Laboratory Analytical Results for OCP's cont'd and OPP's cont'd

		ORGANOCHLORINE PESTICIDES									ORGANOPHOSPHATE PESTICIDES						
ALS	Analyte	4.4?-DDE	Endrin	beta-Endosulfan	4.4?-DDD	Endrin aldehyde	Endosulfan sulfate	4.4?-DDT	Endrin ketone	Methoxy chlor	Dichlorvos	Demeton-S-methyl	Monocro tophos	Dimethoate	Diazinon	Chlorpyrifos-methyl	Parathion-methyl
20/10/2005	Method	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.2*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	*0.2*
MLTP21_DUP	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 22 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 23 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 24 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MIN		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2
MAX																	
AVERAGE		32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32

Table 5: Laboratory Analytical Results for OPP's cont'd

		ORGANOPHOSPHATE PESTICIDES											
ALS	Analyte	Malathion	Fenthion	Chlorpyrifos	Parathion	Pirimphos-ethyl	Chlorfenvinphos	Bromophos-ethyl	Fenamiphos	Prothiofos	Ethion	Carbophenothion	Azinphos Methyl
20/10/2005	Method	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
MLSS 1	SOIL												
MLSS 2	SOIL												
MLSS 3	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 4	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 5	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 7	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 1 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 2 (0.1-0.3)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 3 (0.1-0.3)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 4 (0.0-0.4)	SOIL	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 5 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 6 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 7 (0.0-0.1)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 8 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 9 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-

Table 5: Laboratory Analytical Results for OPP's cont'd

		ORGANOPHOSPHATE PESTICIDES											
ALS	Analyte	Malathion	Fenthion	Chlorpyrifos	Parathion	Pirimphos-ethyl	Chlorfenvinphos	Bromophos-ethyl	Fenamiphos	Prothiofos	Ethion	Carbophenothion	Azinphos Methyl
20/10/2005	Method	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
MLTP 10 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 11 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 12 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 13 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 14 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 15 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 16 (0-0.1)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 17 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 18 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 19 (0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 19_DUP	SOIL	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MLTP 20 (0.0-0.2	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 21 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-

Table 5: Laboratory Analytical Results for OPP's cont'd

	ORGANOPHOSPHATE PESTICIDES												
ALS	Analyte	Malathion	Fenthion	Chlorpyrifos	Parathion	Pirimphos-ethyl	Chlorfenvinphos	Bromophos-ethyl	Fenamiphos	Prothiofos	Ethion	Carbophenothion	Azinphos Methyl
20/10/2005	Method	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068	EP068
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
MLTP21_DUP	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 22 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 23 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 24 (0.0-0.2)	SOIL	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table 6: Laboratory Analytical Results for Monocyclic Aromatic Hydrocarbons

		MONOCYCLIC AROMATIC HYDROCARBONS													
ALS	Analyte	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	Styrene	ortho-Xylene	Isopropyl benzene	n-Propyl benzene	1.3.5-Trimethyl benzene	sec-Butyl benzene	1.2.4-Trimethyl benzene	tert-Butyl benzene	p-Isopropyl toluene	n-Butyl benzene
20/10/2005	Method	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
MLSS 1	SOIL														
MLSS 2	SOIL														
MLSS 3	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 4	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 5	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLSS 7	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 1 (0.1-0.2)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5
MLTP 2 (0.1-0.3)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 3 (0.1-0.3)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 4 (0.0-0.4)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 5 (0.0-0.2)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 6 (0.0-0.2)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 7 (0.0-0.1)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 8 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 9 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6: Laboratory Analytical Results for Monocyclic Aromatic Hydrocarbons cont'd

		MONOCYCLIC AROMATIC HYDROCARBONS													
ALS	**Analyte**	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	Styrene	ortho-Xylene	Isopropyl benzene	n-Propyl benzene	1.3.5-Trimethyl benzene	sec-Butyl benzene	1.2.4-Trimethyl benzene	tert-Butyl benzene	p-Isopropyl toluene	n-Butyl benzene
20/10/2005	**Method**	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074
Sample	**Units**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	***LOR***	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
MLTP 10 (0.0-0.2)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 11 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 12 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 13 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 14 (0.1-0.2)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 15 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 16 (0-0.1)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 17 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 18 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 19 (0-0.2)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 19_DUP	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MLTP 20 (0.0-0.2	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6: Laboratory Analytical Results for Monocyclic Aromatic Hydrocarbons cont'd

		MONOCYCLIC AROMATIC HYDROCARBONS													
ALS	Analyte	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	Styrene	ortho-Xylene	Isopropyl benzene	n-Propyl benzene	1.3.5-Trimethyl benzene	sec-Butyl benzene	1.2.4-Trimethyl benzene	tert-Butyl benzene	p-Isopropyl toluene	n-Butyl benzene
20/10/2005	Method	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074	EP074
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*	*0.5*
MLTP 21 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP21_DUP	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 22 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 23 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MLTP 24 (0.0-0.2)	SOIL	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Table 7: Laboratory Analytical Results for TPH, BTEX, and Explosives

		TPH				BTEX				EXPLOSIVES					
ALS	Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	Benzene	Toluene	Ethylbenzene	meta- & para- Xylene	HMX	RDX	1.3.5-Trinitrobenzene	1.3-Dinitrobenzene	Tetryl	2.4.6-TNT
10/20/2005	Method	EP080	EP071	EP071	EP071	EP080	EP080	EP080	EP080	EP203	EP203	EP203	EP203	EP203	EP203
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*2*	*50*	*100*	*100*	*0.2*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
	Guideline	100 EPA	100 EPA	1000 EPA	1000 EPA										
MLSS 1	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLSS 2	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLSS 3	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLSS 4	SOIL	<2	<50	**1860**	**3170**	<0.2	<0.2	<0.2	<0.2	-	-	-	-	-	-
MLSS 5	SOIL	<2	<50	200	270	<0.2	<0.2	<0.2	<0.2	-	-	-	-	-	-
MLSS 7	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 1 (0.1-0.2)	SOIL	<2	<50	<100	100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 2 (0.1-0.3)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 3 (0.1-0.3)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 4 (0.0-0.4)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 5 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 6 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 7 (0.0-0.1)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 8 (0.0-0.2)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 7: Laboratory Analytical Results for TPH, BTEX, and Explosives cont'd

		TPH				BTEX				EXPLOSIVES					
ALS	Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	Benzene	Toluene	Ethylbenzene	meta- & para- Xylene	HMX	RDX	1.3.5-Trinitrobenzene	1.3-Dinitrobenzene	Tetryl	2.4.6-TNT
20/10/2005	Method	EP080	EP071	EP071	EP071	EP080	EP080	EP080	EP080	EP203	EP203	EP203	EP203	EP203	EP203
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*2*	*50*	*100*	*100*	*0.2*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
MLTP 9 (0.0-0.2)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 10 (0.0-0.2)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 11 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 12 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 13 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 14 (0.1-0.2)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 15 (0.1-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 16 (0-0.1)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 17 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 18 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 19 (0-0.2)	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 19_DUP	SOIL	<2	<50	<100	<100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 7: Laboratory Analytical Results for TPH, BTEX, and Explosives cont'd

		TPH				BTEX				EXPLOSIVES					
ALS	Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	Benzene	Toluene	Ethylbenzene	meta- & para- Xylene	HMX	RDX	1.3.5-Trinitrobenzene	1.3-Dinitrobenzene	Tetryl	2.4.6-TNT
20/10/2005	Method	EP080	EP071	EP071	EP071	EP080	EP080	EP080	EP080	EP203	EP203	EP203	EP203	EP203	EP203
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*2*	*50*	*100*	*100*	*0.2*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
MLTP 20 (0.0-0.2	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 21 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP21_DUP	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 22 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 23 (0.0-0.2)	SOIL	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MLTP 24 (0.0-0.2)	SOIL	<2	<50	110	100	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 7: Laboratory Analytical Results for Explosives Cont'd

		EXPLOSIVES											
ALS	Analyte	4-Amino.2.6-DNT	2-Amino-4.6-DNT	4-& 2-AM-DNT(Isomeric Mixture)	2.4-Dinitrotoluene	2.6-Dinitrotoluene	2.4-& 2.6-DNT(Isomeric Mixture)	Nitrobenzene	2-Nitrotoluene	3-Nitrotoluene	4-Nitrotoluene	Nitroglycerine	PETN
20/10/2005	Method	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*1*	*1*
MLSS 1	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLSS 2	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLSS 3	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLSS 4	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 5	SOIL	-	-	-	-	-	-	-	-	-	-	-	-
MLSS 7	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 1 (0.1-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 2 (0.1-0.3)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 3 (0.1-0.3)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 4 (0.0-0.4)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<1.0	<1.0
MLTP 5 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 6 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 7 (0.0-0.1)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 8 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 9 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0

Table 7: Laboratory Analytical Results for Explosives Cont'd

		EXPLOSIVES											
ALS	Analyte	4-Amino.2.6-DNT	2-Amino-4.6-DNT	4-& 2-AM-DNT(Isomeric Mixture)	2.4-Dinitrotoluene	2.6-Dinitrotoluene	2.4-& 2.6-DNT(Isomeric Mixture)	Nitrobenzene	2-Nitrotoluene	3-Nitrotoluene	4-Nitrotoluene	Nitroglycerine	PETN
20/10/2005	Method	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*1*	*1*
MLTP 10 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 11 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 12 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<1.0	<1.0
MLTP 13 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 14 (0.1-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 15 (0.1-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 16 (0-0.1)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 17 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 18 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 19 (0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 19_DUP	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<1.0	<1.0

Table 7: Laboratory Analytical Results for Explosives Cont'd

		EXPLOSIVES											
ALS	Analyte	4-Amino.2.6-DNT	2-Amino-4.6-DNT	4-& 2-AM-DNT(Isomeric Mixture)	2.4-Dinitrotoluene	2.6-Dinitrotoluene	2.4-& 2.6-DNT(Isomeric Mixture)	Nitrobenzene	2-Nitrotoluene	3-Nitrotoluene	4-Nitrotoluene	Nitroglycerine	PETN
20/10/2005	Method	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203	EP203
Sample	Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
ID 1	*LOR*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*1*	*1*
MLTP 20 (0.0-0.2	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 21 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP21_DUP	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<1.0	<1.0
MLTP 22 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 23 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0
MLTP 24 (0.0-0.2)	SOIL	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.0	<1.0

Appendix C: Chain-of-Custodies

HLA

CHAIN OF CUSTODY

HLA - Envirosciences Pty Limited - Brisbane
57 Berwick St
Fortitude Valley QLD 4006
ph: 07 3606 8900
fax: 07 3606 8999
E-mail: mail@bris.hla-enviro.com.au

Laboratory Details

Lab. Name: ALS
Lab. Address: 32 Shand Std St, Stafford
Contact Name:
Lab. Ref:
Tel:
Fax:
Preliminary Report by:
Final Report by:
Lab Quote No:

Sampled By: AE & MW
HLA Project No: D1024101
Project Name: MT LOFTY CSA
PO No.

Specifications: Yes (tick)

1. Urgent TAT required? (please circle: 24hr 48hr ______ days)
2. Fast TAT Guarantee Required?
3. Is any sediment layer present in waters to be excluded from extractions?
4. % extraneous material removed from samples to be reported as per NEPM 5.1.1?
5. Special storage requirements? (details: ________________)
6. Shell Quality Partnership:
7. Report Format: Fax Hardcopy Email: mwoodgate@hla-enviro.com.au

Analysis Request

Lab. ID	Sample ID	Sampling Date	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	BTEX + TPH	Metals*	PAH's	OCP	OPP	PCB	SVOC	VOC	TPH + BTEX	Lead	TCLP Heavy Metals	TCLP PAH's	Phenols	VHC	Speciated TPH	Other: Explosives	Other: Nitrate	Other: Ammonia	Other: Hexachloroethane	Other: Arsenate
1	MLTP 14 (0.1-0.2)	4/10/05	|							Orang Jar		✓						✓	✓							✓	✓	✓		✓
2	MLTP 15 (0.1-0.2)	4/10/05										✓														✓				✓
3	MLTP 16 (0-0.1)	4/10/05										✓														✓				✓
4	MLTP 17 (0.0-0.2)	4/10/05										✓														✓				✓
5	MLTP 18 (0.0-0.2)	4/10/05										✓														✓				✓
6	MLTP 19 (0-0.2)	4/10/05										✓		✓	✓			✓	✓		✓					✓	✓	✓	✓	✓
7	MLTP 20 (0.0-0.2)	4/10/05										✓														✓				✓
8	MLTP 21 (0.0-0.2)	4/10/05										✓														✓				✓
9	MLTP 22 (0.0-0.2)	5/10/05										✓														✓				✓
10	MLTP 23 (0.0-0.2)	5/10/05	↓									✓														✓				✓
11	MLTP 24 (0.0-0.2)	5/10/05	↓									✓		✓	✓			✓	✓		✓					✓				✓
12	MLTP 19_DUP	4/10/05										✓		✓	✓			✓	✓		✓					✓	✓	✓	✓	✓
13	MLTP 21_DUP	4/10/05	↓							↓		✓														✓				✓

ALS Environmental
Brisbane
Work Order
EB0509055
Report Version: WOLabel 1.00
Telephone : 61-7-32437222
AJ

* Metals Required (Delete elements not required): As Cd Cr Cu Ni Pb Zn Hg

Comments:

Lab Report No.
Esky ID

Relinquished by: MWoodgate Signed: MWoodgate Date: 6/10/05
Recieved by: ALS AJ Signed: AJ Date: 06/10/05
Relinquished by: Signed: Date:
Recieved by: Signed: Date:

Field_Worksheet_FORM025_Dec04

HLA

CHAIN OF CUSTODY

HLA - Envirosciences Pty Limited - Brisbane
57 Berwick St
Fortitude Valley QLD 4006
ph: 07 3606 8900
fax: 07 3606 8999
E-mail: mail@bris.hla-enviro.com.au

Laboratory Details

Lab. Name:	ALS	Tel:	
Lab. Address:	32 Shand Std St, Stafford	Fax:	
Contact Name:		Preliminary Report by:	
Lab. Ref:		Final Report by:	
		Lab Quote No:	

Sampled By: AE & MW

HLA Project No: D1024101

Project Name: Mt Lofty CSA

PO No.

Specifications:

	Yes (tick)
1. Urgent TAT required? (please circle: 24hr 48hr ______ days)	
2. Fast TAT Guarantee Required?	
3. Is any sediment layer present in waters to be excluded from extractions?	
4. % extraneous material removed from samples to be reported as per NEPM 5.1.1?	
5. Special storage requirements? (details: ______________________)	
6. Shell Quality Partnership:	
7. Report Format: Fax Hardcopy Email: mwoodgate@hla-enviro.com.au	

Lab. ID	Sample ID	Sampling Date	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	~~BTEX + TPH~~	Metals*	PAH's	OCP	OPP	PCB	SVOC	VOC	TPH + btex	Lead	TCLP Heavy Metals	TCLP PAH's	Phenols	VHC	Speciated TPH	Other: Explosives	Other: Nitrates	Other	Other
14	MLSS 1	4/10/05	↓							Orange jar		✓														✓			
15	MLSS 2	4/10/05										✓														✓			
16	MLSS 3	5/10/05										✓						✓								✓	✓		
17	MLSS 4	5/10/05										✓						✓	✓										
18	MLSS 5	5/10/05										✓						✓	✓										
19	MLSS 7	5/10/05	↓							↓		✓														✓			

* Metals Required (Delete elements not required): As Cd Cr Cu Ni Pb Zn Hg

Comments:

Lab Report No.

Esky ID

Relinquished by:	M WOODGATE	Signed:	MWoodgate	Date:	Relinquished by:	Signed:	Date:
Recieved by:		Signed:		Date:	Recieved by:	Signed:	Date:

HLA

CHAIN OF CUSTODY

HLA - Envirosciences Pty Limited - Brisbane
57 Berwick St
Fortitude Valley QLD 4006
ph: 07 3606 8900
fax: 07 3606 8999
E-mail: mail@bris.hla-enviro.com.au

Laboratory Details
Lab. Name: ALS
Lab. Address: 32 Shand Std St, Stafford
Contact Name:
Lab. Ref:
Tel:
Fax:
Preliminary Report by:
Final Report by:
Lab Quote No:

Sampled By: AE & MW
HLA Project No: D1024101
Project Name: Mt Lofty CSA
PO No.

Specifications: Yes (tick)

1. Urgent TAT required? (please circle: 24hr 48hr ______ days)
2. Fast TAT Guarantee Required?
3. Is any sediment layer present in waters to be excluded from extractions?
4. % extraneous material removed from samples to be reported as per NEPM 5.1.1?
5. Special storage requirements? (details: ______)
6. Shell Quality Partnership:
7. Report Format: Fax Hardcopy Email: mwoodgate@hla-enviro.com.au

Analysis Request

Lab. ID	Sample ID	Sampling Date	Matrix: soil	Matrix: water	Matrix: other	Preservation: filt'ed	Preservation: acid	Preservation: ice	Preservation: other	Container (No. & type)	BTEX + TPH	Metals*	PAH's	OCP	OPP	PCB	SVOC	VOC	TPH + Btex	Lead	TCLP Heavy Metals	TCLP PAH's	Phenols	VHC	Speciated TPH	Other: Explosives	Other: Nitrates	Other: Ammonia	Other: Hexachlorethane	Other: Arsenic
20	MLTP1 (0.1-0.2)	3/10/05										✓						✓	✓		✓					✓	✓	✓	✓	✓
21	MLTP2 (0.1-0.3)	3/10/05										✓		✓	✓			✓	✓		✓					✓	✓	✓	✓	✓
22	MLTP3 (0.1-0.3)	3/10/05										✓		✓	✓			✓	✓		✓					✓	✓	✓	✓	✓
23	MLTP4 (0.0-0.4)	3/10/05										✓		✓	✓			✓	✓		✓					✓	✓	✓	✓	✓
24	MLTP5 (0.0-0.2)	4/10/05										✓														✓	✓	✓		✓
25	MLTP6 (0.0-0.2)	4/10/05										✓														✓	✓	✓		✓
26	MLTP7 (0.0-0.1)	4/10/05										✓														✓	✓	✓		✓
27	MLTP8 (0.0-0.2)	4/10/05										✓						✓	✓							✓	✓	✓	✓	✓
28	MLTP9 (0.0-0.2)	4/10/05										✓						✓	✓							✓	✓	✓	✓	✓
29	MLTP10 (0.0-0.2)	4/10/05										✓		✓	✓			✓	✓		✓					✓				✓
30	MLTP11 (0.0-0.2)	4/10/05										✓														✓				✓
31	MLTP12 (0.0-0.2)	4/10/05										✓														✓				✓
32	MLTP13 (0.0-0.2)	4/10/05										✓														✓				✓

* Metals Required (Delete elements not required): As Cd Cr Cu Ni Pb Zn Hg

Comments:

Lab Report No.
Esky ID

Relinquished by: MWoodgate	Signed: MWoodgate	Date: 6/10/05		Relinquished by:	Signed:	Date:
Recieved by:	Signed: AH	Date:		Recieved by:	Signed:	Date:

Field_Worksheet_FORM025_Dec04

267 - 265

HLA OF CUSTODY

HLA - Envirosciences Pty Limited - Brisbane
57 Berwick St
Fortitude Valley QLD 4006
ph: 07 3606 8900
fax: 07 3606 8999

Sampled By: Maria Woodgate
HLA Project No: D1024101

Laboratory Details
Lab. Name: ALS
Lab. Address: 32 Shand St Stafford
Contact Name: M Heery
Lab. Ref: EB0509055
Tel: 61.7.3243.7222
Fax: 61.7.3243.7218
Preliminary Report by:
Final Report by: 27/10/05
Lab Quote No:
Project Name: Mt Lofty CSA
PO No.

Specifications: REBATCH # EB0509056 *refaxed on 21/10/05*

Chromium Speciation- Cr III or Cr VI?

Report Format: Fax Hardcopy
Email :

Yes (tick) | Analysis Request

Lab. ID		Sample ID	Sampling Date	Matrix: soil	water	other	Preservation: filled	acid	ice	other	Container (No. & type)	Cr Speciation
28	25	MLTP 6 (0.0-0.2) 1		x							jar	x
30	27	MLTP 8 (0.0-0.2) 2		x							jar	x
32	29	MLTP 10 (0.0-0.2) 3		x							jar	x

*Metals Required (Delete elements not required): As Cd Cr Cu Ni Pb Zn Hg

Comments:

Lab Report No. EB0509056

Requested by: S FITTON Signed: SNF Date: 20/10/2005
Relinquished by: Signed: Date:
Recieved by: Signed: Date:
Recieved by: FADI Signed: Date: 24/10/5

9:30am

Field Worksheet FORM026 Dec04

ALS Environmental
Sydney
Work Order
ES0508900

Report Version WOLabel 1.00
Telephone : 61-2-87848555

3263 - 3265

HLA CHAIN OF CUSTODY

HLA - Envirosciences Pty Limited - Brisbane
57 Berwick St
Fortitude Valley QLD 4006
ph: 07 3606 8900
fax: 07 3606 8999

Laboratory Details
Lab. Name: ALS
Lab. Address: 32 Shand St Stafford
Contact Name: M Heery
Lab. Ref: EB0509055
Tel: 61.7.3243.7222
Fax: 61.7.3243.7218
Preliminary Report by:
Final Report by: 27/10/05
Lab Quote No:

Sampled By: Maria Woodgate
HLA Project No: D1024101
Project Name: Mt Lofty CSA
PO No.

Specifications: REBATCH # EB0509055

TCLP

7. Report Format: Fax Hardcopy
Email:

Yes (tick) Analysis Request

Lab. ID	Sample ID	Sampling Date	Matrix: soil	water	other	Preservation: filtered	acid	ice	other	Container (No. & type)	Cu TCLP	Pb TCLP	Zn TCLP
21 15	MLSS 5	①	x							jar	x	x	
35 32	MLTP 13 (0.0-0.2)	②	x							jar	x	x	
5 2	MLTP 15 (0.1-0.2)	③	x							jar	x	x	
20 17	MLSS 4	④	x							jar			x

ALS Environmental
Sydney
Work Order
ES0508879
Report Version: WOLabel 1.00
Telephone : 61-2-87848555

Lab Report No. EB0509055
Esky ID

* Metals Required (Delete elements not required):

Comments:

Requested by:	S FITTON	Signed: SNF	Date: 21/10/2005	Relinquished by:	Signed:	Date:
Recieved by:		Signed:	Date:	Recieved by: FAD	Signed: [signature]	Date: 24/10/5 9.30

Appendix D: Laboratory QA/QC Results

ALS Environmental

QUALITY CONTROL REPORT

Client	: **HLA-ENVIROSCIENCES PTY LTD**	**Laboratory**	: ALS Environmental Brisbane	**Page**	: **1 of 34**
Contact	: MS MARIA WOODGATE	**Contact**	: Michael Heery		
Address	: P O BOX 720 FORTITUDE VALLEY QLD AUSTRALIA 4006	**Address**	: 32 Shand Street Stafford QLD Australia 4053	**Work order**	: **EB0509055**
				Amendment No.	:
Project	: D1024101 MT LOFTY CSA	**Quote number**	: EN/004/05	**Date received**	: 6 Oct 2005
Order number	: - Not provided -			**Date issued**	: 19 Oct 2005
C-O-C number	: - Not provided -				
Site	: - Not provided -				
E-mail	: mwoodgate@hla-enviro.com.au	**E-mail**	: Michael.Heery@alsenviro.com	**No. of samples**	
Telephone	: 07 3606 8900	**Telephone**	: 61-7-32437222	**Received**	: 32
Facsimile	: 07 3606 3999	**Facsimile**	: 61-7-32437259	**Analysed**	: 32

This final report for the ALSE work order reference EB0509055 supersedes any previous reports with this reference.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

Work order specific comments

Low spike recovery for Arsenic for sample EB0509055-25 due to matrix interference. Repeat analysis, 59 %.
Low spike recovery for Total Ammonia for sample "MTLP 4 (0.0-0.4)" due to matrix interference. Repeat Analysis, 14%
All analysis conducted by ALS Sydney, NATA accreditation no. 825, site no 10911

ALSE - Excellence in Analytical Testing

NATA Accredited Laboratory - 825

WORLD RECOGNISED ACCREDITATION

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IED 17025

This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Greg Vogel	Inorganics - NATA 10911 (Sydney)
Marc Centner	Organics - NATA 10911 (Sydney)
Peter Dickenson	Inorganics - NATA 10911 (Sydney)
Rassem Ayoubi	Organics - NATA 10911 (Sydney)

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting - Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

Matrix Type: SOIL ***Laboratory Duplicates (DUP) Report***

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EA055: Moisture Content						
EA055: Moisture Content - (QC Lot: 123756)				%	%	%
EB0508960-005	Anonymous	Moisture Content (dried @ 103°C)	1.0 %	5.6	5.6	0.0
EB0509053-008	Anonymous	Moisture Content (dried @ 103°C)	1.0 %	1.4	1.1	24.7
EA055: Moisture Content - (QC Lot: 123757)				%	%	%
EB0509055-005	MLTP 18 (0.0-0.2)	Moisture Content (dried @ 103°C)	1.0 %	9.2	9.3	0.0
EB0509055-014	MLSS 1	Moisture Content (dried @ 103°C)	1.0 %	3.5	3.4	4.3
EA055: Moisture Content - (QC Lot: 123758)				%	%	%
EB0509055-025	MLTP 6 (0.0-0.2)	Moisture Content (dried @ 103°C)	1.0 %	9.1	8.0	11.9
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 124181)				mg/kg	mg/kg	%
EB0509055-002	MLTP 15 (0.1-0.2)	Arsenic	5 mg/kg	11	<5	74.2
		Cadmium	1 mg/kg	3	<1	90.3
		Chromium	2 mg/kg	116	111	4.3
		Copper	5 mg/kg	3200	3090	3.6
		Lead	5 mg/kg	27700	26900	3.0
		Nickel	2 mg/kg	413	353	15.6
		Zinc	5 mg/kg	481	479	0.3
EB0509055-011	MLTP 24 (0.0-0.2)	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	2	2	0.0
		Chromium	2 mg/kg	147	142	3.2
		Copper	5 mg/kg	375	195	63.0
		Lead	5 mg/kg	602	615	2.0
		Nickel	2 mg/kg	56	55	2.1
		Zinc	5 mg/kg	971	985	1.4
EG005T: Total Metals by ICP-AES - (QC Lot: 124183)				mg/kg	mg/kg	%
EB0509055-021	MLTP 2 (0.1-0.3)	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	84	81	3.4
		Copper	5 mg/kg	20	20	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EG005T: Total Metals by ICP-AES - continued						
EG005T: Total Metals by ICP-AES - (QC Lot: 124183) - continued				mg/kg	mg/kg	%
EB0509055-021	MLTP 2 (0.1-0.3)	Lead	5 mg/kg	861	882	2.5
		Nickel	2 mg/kg	93	84	10.3
		Zinc	5 mg/kg	94	96	1.8
EB0509055-031	MLTP 12 (0.0-0.2)	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	190	187	2.1
		Copper	5 mg/kg	36	36	0.0
		Lead	5 mg/kg	172	170	1.4
		Nickel	2 mg/kg	86	89	4.0
		Zinc	5 mg/kg	48	50	2.5
EG005T: Total Metals by ICP-AES - (QC Lot: 124243)				mg/kg	mg/kg	%
ES0508449-023	Anonymous	Arsenic	5 mg/kg	8	6	23.2
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	15	14	0.0
		Copper	5 mg/kg	24	24	0.0
		Lead	5 mg/kg	51	42	19.3
		Nickel	2 mg/kg	11	12	0.0
		Zinc	5 mg/kg	100	100	0.0
ES0508518-006	Anonymous	Arsenic	5 mg/kg	<5	6	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	12	14	18.2
		Copper	5 mg/kg	26	26	0.0
		Lead	5 mg/kg	89	90	1.5
		Nickel	2 mg/kg	16	20	22.6
		Zinc	5 mg/kg	176	235	28.8
EG005T: Total Metals by ICP-AES - (QC Lot: 124627)				mg/kg	mg/kg	%
EB0509055-025	MLTP 6 (0.0-0.2)	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	305	294	3.8
		Copper	5 mg/kg	68	68	0.0
		Lead	5 mg/kg	39	37	4.1
		Nickel	2 mg/kg	197	204	3.4

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EG005T: Total Metals by ICP-AES - continued						
EG005T: Total Metals by ICP-AES - (QC Lot: 124627) - continued				mg/kg	mg/kg	%
EB0509055-025	MLTP 6 (0.0-0.2)	Zinc	5 mg/kg	171	168	2.3
ES0508420-012	Anonymous	Arsenic	5 mg/kg	<5	<5	0.0
		Cadmium	1 mg/kg	<1	<1	0.0
		Chromium	2 mg/kg	<2	<2	0.0
		Copper	5 mg/kg	<5	<5	0.0
		Lead	5 mg/kg	<5	<5	0.0
		Nickel	2 mg/kg	<2	<2	0.0
		Zinc	5 mg/kg	<5	<5	0.0
EG035T: Total Mercury by FIMS						
EG035T: Total Mercury by FIMS - (QC Lot: 124182)				mg/kg	mg/kg	%
EB0509055-002	MLTP 15 (0.1-0.2)	Mercury	0.1 mg/kg	0.1	0.1	0.0
EB0509055-011	MLTP 24 (0.0-0.2)	Mercury	0.1 mg/kg	0.1	0.1	0.0
EG035T: Total Mercury by FIMS - (QC Lot: 124184)				mg/kg	mg/kg	%
EB0509055-021	MLTP 2 (0.1-0.3)	Mercury	0.1 mg/kg	<0.1	<0.1	0.0
EB0509055-031	MLTP 12 (0.0-0.2)	Mercury	0.1 mg/kg	<0.1	<0.1	0.0
EG035T: Total Mercury by FIMS - (QC Lot: 124626)				mg/kg	mg/kg	%
EB0509053-001	Anonymous	Mercury	0.1 mg/kg	<0.1	<0.1	0.0
EB0509053-011	Anonymous	Mercury	0.1 mg/kg	<0.1	<0.1	0.0
EK055: Ammonia as N						
EK055: Ammonia as N - (QC Lot: 124021)				mg/kg	mg/kg	%
EB0509055-012	MLTP 19_DUP	Ammonia as N	20 mg/kg	<20	<20	0.0
EB0509055-028	MLTP 9 (0.0-0.2)	Ammonia as N	20 mg/kg	<20	<20	0.0
EK057: Nitrite as N						
EK057: Nitrite as N - (QC Lot: 124236)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Nitrite as N (Sol.)	0.1 mg/kg	<0.1	<0.1	0.0
EB0509055-025	MLTP 6 (0.0-0.2)	Nitrite as N (Sol.)	0.1 mg/kg	1.5	1.3	11.0
EK059: Nitrite plus Nitrate as N (NOx)						
EK059: Nitrite plus Nitrate as N (NOx) - (QC Lot: 124237)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Nitrite + Nitrate as N (Sol.)	0.1 mg/kg	<0.1	0.1	0.0
EB0509055-025	MLTP 6 (0.0-0.2)	Nitrite + Nitrate as N (Sol.)	0.1 mg/kg	8.7	8.1	7.2
EP068A: Organochlorine Pesticides (OC)						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 123697)				mg/kg	mg/kg	%

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP068A: Organochlorine Pesticides (OC) - continued						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 123697) - continued				mg/kg	mg/kg	%
EB0509055-006	MLTP 19 (0-0.2)	alpha-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		Hexachlorobenzene (HCB)	0.05 mg/kg	<0.05	<0.05	0.0
		beta-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		gamma-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		delta-BHC	0.05 mg/kg	<0.05	<0.05	0.0
		Heptachlor	0.05 mg/kg	<0.05	<0.05	0.0
		Aldrin	0.05 mg/kg	<0.05	<0.05	0.0
		Heptachlor epoxide	0.05 mg/kg	<0.05	<0.05	0.0
		trans-Chlordane	0.05 mg/kg	<0.05	<0.05	0.0
		alpha-Endosulfan	0.05 mg/kg	<0.05	<0.05	0.0
		cis-Chlordane	0.05 mg/kg	<0.05	<0.05	0.0
		Dieldrin	0.05 mg/kg	<0.05	<0.05	0.0
		4,4'-DDE	0.05 mg/kg	<0.05	<0.05	0.0
		Endrin	0.05 mg/kg	<0.05	<0.05	0.0
		beta-Endosulfan	0.05 mg/kg	<0.05	<0.05	0.0
		4,4'-DDD	0.05 mg/kg	<0.05	<0.05	0.0
		Endrin aldehyde	0.05 mg/kg	<0.05	<0.05	0.0
		Endosulfan sulfate	0.05 mg/kg	<0.05	<0.05	0.0
		4,4'-DDT	0.2 mg/kg	<0.2	<0.2	0.0
		Endrin ketone	0.05 mg/kg	<0.05	<0.05	0.0
		Methoxychlor	0.2 mg/kg	<0.2	<0.2	0.0
EP068B: Organophosphorus Pesticides (OP)						
EP068B: Organophosphorus Pesticides (OP) - (QC Lot: 123697)				mg/kg	mg/kg	%
EB0509055-006	MLTP 19 (0-0.2)	Dichlorvos	0.05 mg/kg	<0.05	<0.05	0.0
		Demeton-S-methyl	0.05 mg/kg	<0.05	<0.05	0.0
		Monocrotophos	0.2 mg/kg	<0.2	<0.2	0.0
		Dimethoate	0.05 mg/kg	<0.05	<0.05	0.0
		Diazinon	0.05 mg/kg	<0.05	<0.05	0.0
		Chlorpyrifos-methyl	0.05 mg/kg	<0.05	<0.05	0.0
		Parathion-methyl	0.2 mg/kg	<0.2	<0.2	0.0
		Malathion	0.05 mg/kg	<0.05	<0.05	0.0
		Fenthion	0.05 mg/kg	<0.05	<0.05	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP068B: Organophosphorus Pesticides (OP) - continued						
EP068B: Organophosphorus Pesticides (OP) - (QC Lot: 123697) - continued				mg/kg	mg/kg	%
EB0509055-006	MLTP 19 (0-0.2)	Chlorpyrifos	0.05 mg/kg	<0.05	<0.05	0.0
		Parathion	0.2 mg/kg	<0.2	<0.2	0.0
		Pirimphos-ethyl	0.05 mg/kg	<0.05	<0.05	0.0
		Chlorfenvinphos	0.05 mg/kg	<0.05	<0.05	0.0
		Bromophos-ethyl	0.05 mg/kg	<0.05	<0.05	0.0
		Fenamiphos	0.05 mg/kg	<0.05	<0.05	0.0
		Prothiofos	0.05 mg/kg	<0.05	<0.05	0.0
		Ethion	0.05 mg/kg	<0.05	<0.05	0.0
		Carbophenothion	0.05 mg/kg	<0.05	<0.05	0.0
		Methyl Azinphos	0.05 mg/kg	<0.05	<0.05	0.0
EP074A: Monocyclic Aromatic Hydrocarbons						
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 123728)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Benzene	0.5 mg/kg	<0.5	<0.5	0.0
		Toluene	0.5 mg/kg	<0.5	<0.5	0.0
		Ethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		meta- & para-Xylene	0.5 mg/kg	<0.5	<0.5	0.0
		Styrene	0.5 mg/kg	<0.5	<0.5	0.0
		ortho-Xylene	0.5 mg/kg	<0.5	<0.5	0.0
		Isopropylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Propylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,3,5-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		sec-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,4-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		tert-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		p-Isopropyltoluene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Benzene	0.5 mg/kg	<0.5	<0.5	0.0
		Toluene	0.5 mg/kg	<0.5	<0.5	0.0
		Ethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		meta- & para-Xylene	0.5 mg/kg	<0.5	<0.5	0.0
		Styrene	0.5 mg/kg	<0.5	<0.5	0.0
		ortho-Xylene	0.5 mg/kg	<0.5	<0.5	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP074A: Monocyclic Aromatic Hydrocarbons - continued						
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 123728) - continued				mg/kg	mg/kg	%
EB0509055-022	MLTP 3 (0.1-0.3)	Isopropylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Propylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,3,5-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		sec-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,4-Trimethylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		tert-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
		p-Isopropyltoluene	0.5 mg/kg	<0.5	<0.5	0.0
		n-Butylbenzene	0.5 mg/kg	<0.5	<0.5	0.0
EP074B: Oxygenated Compounds						
EP074B: Oxygenated Compounds - (QC Lot: 123728)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Vinyl Acetate	5 mg/kg	<5	<5	0.0
		2-Butanone (MEK)	5 mg/kg	<5	<5	0.0
		4-Methyl-2-pentanone (MIBK)	5 mg/kg	<5	<5	0.0
		2-Hexanone (MBK)	5 mg/kg	<5	<5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Vinyl Acetate	5 mg/kg	<5	<5	0.0
		2-Butanone (MEK)	5 mg/kg	<5	<5	0.0
		4-Methyl-2-pentanone (MIBK)	5 mg/kg	<5	<5	0.0
		2-Hexanone (MBK)	5 mg/kg	<5	<5	0.0
EP074C: Sulfonated Compounds						
EP074C: Sulfonated Compounds - (QC Lot: 123728)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Carbon disulfide	0.5 mg/kg	<0.5	<0.5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Carbon disulfide	0.5 mg/kg	<0.5	<0.5	0.0
EP074D: Fumigants						
EP074D: Fumigants - (QC Lot: 123728)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	2,2-Dichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		cis-1,3-Dichloropropylene	0.5 mg/kg	<0.5	<0.5	0.0
		trans-1,3-Dichloropropylene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dibromoethane (EDB)	0.5 mg/kg	<0.5	<0.5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	2,2-Dichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		cis-1,3-Dichloropropylene	0.5 mg/kg	<0.5	<0.5	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP074D: Fumigants - continued						
EP074D: Fumigants - (QC Lot: 123728) - continued				mg/kg	mg/kg	%
EB0509055-022	MLTP 3 (0.1-0.3)	trans-1,3-Dichloropropylene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dibromoethane (EDB)	0.5 mg/kg	<0.5	<0.5	0.0
EP074E: Halogenated Aliphatic Compounds						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 123728)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Dichlorodifluoromethane	5 mg/kg	<5	<5	0.0
		Chloromethane	5 mg/kg	<5	<5	0.0
		Vinyl chloride	5 mg/kg	<5	<5	0.0
		Bromomethane	5 mg/kg	<5	<5	0.0
		Chloroethane	5 mg/kg	<5	<5	0.0
		Trichlorofluoromethane	5 mg/kg	<5	<5	0.0
		1,1-Dichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		Iodomethane	0.5 mg/kg	<0.5	<0.5	0.0
		trans-1,2-Dichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1-Dichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		cis-1,2-Dichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,1-Trichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,1-Dichloropropylene	0.5 mg/kg	<0.5	<0.5	0.0
		Carbon Tetrachloride	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		Trichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		Dibromomethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,2-Trichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,3-Dichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		Tetrachloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,1,2-Tetrachloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		trans-1,4-Dichloro-2-butene	0.5 mg/kg	<0.5	<0.5	0.0
		cis-1,4-Dichloro-2-butene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,2,2-Tetrachloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,3-Trichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		Pentachloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dibromo-3-chloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		Hexachlorobutadiene	0.5 mg/kg	<0.5	<0.5	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP074E: Halogenated Aliphatic Compounds - continued						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 123728) - continued				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Bromochloromethane	0.5 mg/kg	<0.5	<0.5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Dichlorodifluoromethane	5 mg/kg	<5	<5	0.0
		Chloromethane	5 mg/kg	<5	<5	0.0
		Vinyl chloride	5 mg/kg	<5	<5	0.0
		Bromomethane	5 mg/kg	<5	<5	0.0
		Chloroethane	5 mg/kg	<5	<5	0.0
		Trichlorofluoromethane	5 mg/kg	<5	<5	0.0
		1,1-Dichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		Iodomethane	0.5 mg/kg	<0.5	<0.5	0.0
		trans-1,2-Dichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1-Dichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		cis-1,2-Dichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,1-Trichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,1-Dichloropropylene	0.5 mg/kg	<0.5	<0.5	0.0
		Carbon Tetrachloride	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		Trichloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		Dibromomethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,2-Trichloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,3-Dichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		Tetrachloroethene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,1,2-Tetrachloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		trans-1,4-Dichloro-2-butene	0.5 mg/kg	<0.5	<0.5	0.0
		cis-1,4-Dichloro-2-butene	0.5 mg/kg	<0.5	<0.5	0.0
		1,1,2,2-Tetrachloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,3-Trichloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		Pentachloroethane	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dibromo-3-chloropropane	0.5 mg/kg	<0.5	<0.5	0.0
		Hexachlorobutadiene	0.5 mg/kg	<0.5	<0.5	0.0
		Bromochloromethane	0.5 mg/kg	<0.5	<0.5	0.0
EP074F: Halogenated Aromatic Compounds						
EP074F: Halogenated Aromatic Compounds - (QC Lot: 123728)				mg/kg	mg/kg	%

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP074F: Halogenated Aromatic Compounds - continued						
EP074F: Halogenated Aromatic Compounds - (QC Lot: 123728) - continued				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Chlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		Bromobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		2-Chlorotoluene	0.5 mg/kg	<0.5	<0.5	0.0
		4-Chlorotoluene	0.5 mg/kg	<0.5	<0.5	0.0
		1,3-Dichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,4-Dichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,4-Trichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,3-Trichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Chlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		Bromobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		2-Chlorotoluene	0.5 mg/kg	<0.5	<0.5	0.0
		4-Chlorotoluene	0.5 mg/kg	<0.5	<0.5	0.0
		1,3-Dichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,4-Dichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2-Dichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,4-Trichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
		1,2,3-Trichlorobenzene	0.5 mg/kg	<0.5	<0.5	0.0
EP074G: Trihalomethanes						
EP074G: Trihalomethanes - (QC Lot: 123728)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Chloroform	0.5 mg/kg	<0.5	<0.5	0.0
		Bromodichloromethane	0.5 mg/kg	<0.5	<0.5	0.0
		Dibromochloromethane	0.5 mg/kg	<0.5	<0.5	0.0
		Bromoform	0.5 mg/kg	<0.5	<0.5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Chloroform	0.5 mg/kg	<0.5	<0.5	0.0
		Bromodichloromethane	0.5 mg/kg	<0.5	<0.5	0.0
		Dibromochloromethane	0.5 mg/kg	<0.5	<0.5	0.0
		Bromoform	0.5 mg/kg	<0.5	<0.5	0.0
EP074H: Naphthalene						
EP074H: Naphthalene - (QC Lot: 123728)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	Naphthalene	5 mg/kg	<5	<5	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Naphthalene	5 mg/kg	<5	<5	0.0

Matrix Type: SOIL ***Laboratory Duplicates (DUP) Report***

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EP080/071: Total Petroleum Hydrocarbons						
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 123698)				mg/kg	mg/kg	%
EB0509055-017	MLSS 4	C10 - C14 Fraction	50 mg/kg	<50	60	19.8
		C15 - C28 Fraction	100 mg/kg	1860	2130	13.3
		C29 - C36 Fraction	100 mg/kg	3170	3800	18.1
EB0509055-020	MLTP 1 (0.1-0.2)	C10 - C14 Fraction	50 mg/kg	<50	<50	0.0
		C15 - C28 Fraction	100 mg/kg	<100	<100	0.0
		C29 - C36 Fraction	100 mg/kg	100	<100	0.0
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 123727)				mg/kg	mg/kg	%
EB0508960-005	Anonymous	C6 - C9 Fraction	2 mg/kg	130	140	7.5
EB0509055-022	MLTP 3 (0.1-0.3)	C6 - C9 Fraction	2 mg/kg	<2	<2	0.0
EP080: BTEX						
EP080: BTEX - (QC Lot: 123727)				mg/kg	mg/kg	%
EB0508960-005	Anonymous	Benzene	0.2 mg/kg	<0.2	<0.2	0.0
		Toluene	0.2 mg/kg	<0.2	<0.2	0.0
		Ethylbenzene	0.2 mg/kg	<0.2	<0.2	0.0
		meta- & para-Xylene	0.2 mg/kg	<0.2	<0.2	0.0
		ortho-Xylene	0.2 mg/kg	0.9	0.9	0.0
EB0509055-022	MLTP 3 (0.1-0.3)	Benzene	0.2 mg/kg	<0.2	<0.2	0.0
		Toluene	0.2 mg/kg	<0.2	<0.2	0.0
		Ethylbenzene	0.2 mg/kg	<0.2	<0.2	0.0
		meta- & para-Xylene	0.2 mg/kg	<0.2	<0.2	0.0
		ortho-Xylene	0.2 mg/kg	<0.2	<0.2	0.0
EP203A: Explosives						
EP203A: Explosives - (QC Lot: 123711)				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	HMX	0.1 mg/kg	<0.1	<0.1	0.0
		RDX	0.1 mg/kg	<0.1	<0.1	0.0
		1,3,5-Trinitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		1,3-Dinitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		Tetryl	0.1 mg/kg	<0.1	<0.1	0.0
		2,4,6-TNT	0.1 mg/kg	<0.1	<0.1	0.0
		4-Amino,2,6-DNT	0.1 mg/kg	<0.1	<0.1	0.0
		2-Amino-4,6-DNT	0.1 mg/kg	<0.1	<0.1	0.0
		4-& 2-AM-DNT(Isomeric Mixture)	0.1 mg/kg	<0.1	<0.1	0.0

Matrix Type: SOIL

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP203A: Explosives - continued						
EP203A: Explosives - (QC Lot: 123711) - continued				mg/kg	mg/kg	%
EB0509055-001	MLTP 14 (0.1-0.2)	2,4-Dinitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		2,6-Dinitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		2,4-& 2,6-DNT(Isomeric Mixture)	0.1 mg/kg	<0.1	<0.1	0.0
		Nitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		2-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		3-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		4-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		Nitroglycerine	1.0 mg/kg	<1.0	<1.0	0.0
		PETN	1.0 mg/kg	<1.0	<1.0	0.0
EB0509055-011	MLTP 24 (0.0-0.2)	HMX	0.1 mg/kg	<0.1	<0.1	0.0
		RDX	0.1 mg/kg	<0.1	<0.1	0.0
		1,3,5-Trinitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		1,3-Dinitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		Tetryl	0.1 mg/kg	<0.1	<0.1	0.0
		2,4,6-TNT	0.1 mg/kg	<0.1	<0.1	0.0
		4-Amino,2,6-DNT	0.1 mg/kg	<0.1	<0.1	0.0
		2-Amino-4,6-DNT	0.1 mg/kg	<0.1	<0.1	0.0
		4-& 2-AM-DNT(Isomeric Mixture)	0.1 mg/kg	<0.1	<0.1	0.0
		2,4-Dinitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		2,6-Dinitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		2,4-& 2,6-DNT(Isomeric Mixture)	0.1 mg/kg	<0.1	<0.1	0.0
		Nitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		2-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		3-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		4-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		Nitroglycerine	1.0 mg/kg	<1.0	<1.0	0.0
		PETN	1.0 mg/kg	<1.0	<1.0	0.0
EP203A: Explosives - (QC Lot: 123712)				mg/kg	mg/kg	%
EB0509055-023	MLTP 4 (0.0-0.4)	HMX	0.1 mg/kg	<0.1	<0.1	0.0
		RDX	0.1 mg/kg	<0.1	<0.1	0.0
		1,3,5-Trinitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		1,3-Dinitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0

Matrix Type: SOIL — *Laboratory Duplicates (DUP) Report*

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP203A: Explosives - continued						
EP203A: Explosives - (QC Lot: 123712) - continued				mg/kg	mg/kg	%
EB0509055-023	MLTP 4 (0.0-0.4)	Tetryl	0.1 mg/kg	<0.1	<0.1	0.0
		2,4,6-TNT	0.1 mg/kg	<0.1	<0.1	0.0
		4-Amino,2,6-DNT	0.1 mg/kg	<0.1	<0.1	0.0
		2-Amino-4,6-DNT	0.1 mg/kg	<0.1	<0.1	0.0
		4-& 2-AM-DNT(Isomeric Mixture)	0.1 mg/kg	<0.1	<0.1	0.0
		2,4-Dinitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		2,6-Dinitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		2,4-& 2,6-DNT(Isomeric Mixture)	0.1 mg/kg	<0.1	<0.1	0.0
		Nitrobenzene	0.1 mg/kg	<0.1	<0.1	0.0
		2-Nitrotoluene	0.1 mg/kg	0.3	0.3	0.0
		3-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		4-Nitrotoluene	0.1 mg/kg	<0.1	<0.1	0.0
		Nitroglycerine	1.0 mg/kg	<1.0	<1.0	0.0
		PETN	1.0 mg/kg	<1.0	<1.0	0.0

Matrix Type: WATER — *Laboratory Duplicates (DUP) Report*

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EG005C: Leachable Metals by ICPAES						
EG005C: Leachable Metals by ICPAES - (QC Lot: 124467)				mg/L	mg/L	%
EB0509055-006	MLTP 19 (0-0.2)	Arsenic	0.1 mg/L	<0.1	<0.1	0.0
		Cadmium	0.05 mg/L	<0.05	<0.05	0.0
		Chromium	0.1 mg/L	<0.1	<0.1	0.0
		Copper	0.1 mg/L	<0.1	<0.1	0.0
		Lead	0.1 mg/L	<0.1	<0.1	0.0
		Nickel	0.1 mg/L	<0.1	<0.1	0.0
		Zinc	0.1 mg/L	0.4	0.4	0.0
ES0508420-029	Anonymous	Arsenic	0.1 mg/L	<0.1	<0.1	0.0
		Cadmium	0.05 mg/L	<0.05	<0.05	0.0
		Chromium	0.1 mg/L	<0.1	<0.1	0.0
		Copper	0.1 mg/L	<0.1	<0.1	0.0
		Lead	0.1 mg/L	<0.1	<0.1	0.0
		Nickel	0.1 mg/L	<0.1	<0.1	0.0
		Zinc	0.1 mg/L	1.0	1.0	0.0

Matrix Type: WATER

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EG035C: Leachable Mercury by FIMS						
EG035C: Leachable Mercury by FIMS - (QC Lot: 124469)				mg/L	mg/L	%
EB0509055-006	MLTP 19 (0-0.2)	Mercury	0.001 mg/L	<0.001	<0.001	0.0
ES0508420-030	Anonymous	Mercury	0.001 mg/L	<0.001	<0.001	0.0

Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

The quality control term **Method / Laboratory Blank** refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term **Laboratory Control Sample (LCS)** refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

		Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
Analyte name	*LOR*			*LCS*	*Low*	*High*
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 124181)		mg/kg	mg/kg	%	%	%
Arsenic	5 mg/kg	----	13.1	93.0	70	130
	5 mg/kg	<5	----	----	----	----
Cadmium	1 mg/kg	----	2.76	110	70	130
	1 mg/kg	<1	----	----	----	----
Chromium	2 mg/kg	----	60.9	102	70	130
	2 mg/kg	<2	----	----	----	----
Copper	5 mg/kg	----	54.7	98.1	70	130
	5 mg/kg	<5	----	----	----	----
Lead	5 mg/kg	----	55.2	98.6	70	130
	5 mg/kg	<5	----	----	----	----
Nickel	2 mg/kg	----	54.8	104	70	130
	2 mg/kg	<2	----	----	----	----
Zinc	5 mg/kg	----	104	105	70	130
	5 mg/kg	<5	----	----	----	----
EG005T: Total Metals by ICP-AES - (QC Lot: 124183)		mg/kg	mg/kg	%	%	%
Arsenic	5 mg/kg	----	13.1	83.7	70	130
	5 mg/kg	<5	----	----	----	----
Cadmium	1 mg/kg	----	2.76	94.8	70	130
	1 mg/kg	<1	----	----	----	----
Chromium	2 mg/kg	----	60.9	94.6	70	130
	2 mg/kg	<2	----	----	----	----
Copper	5 mg/kg	----	54.7	94.7	70	130
	5 mg/kg	<5	----	----	----	----
Lead	5 mg/kg	----	55.2	91.0	70	130
	5 mg/kg	<5	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EG005T: Total Metals by ICP-AES - continued						
EG005T: Total Metals by ICP-AES - (QC Lot: 124183) - continued		mg/kg	mg/kg	%	%	%
Nickel	2 mg/kg	----	54.8	95.2	70	130
	2 mg/kg	<2	----	----	----	----
Zinc	5 mg/kg	----	104	97.1	70	130
	5 mg/kg	<5	----	----	----	----
EG005T: Total Metals by ICP-AES - (QC Lot: 124243)		mg/kg	mg/kg	%	%	%
Arsenic	5 mg/kg	----	13.1	94.1	70	130
	5 mg/kg	<5	----	----	----	----
Cadmium	1 mg/kg	----	2.76	97.3	70	130
	1 mg/kg	<1	----	----	----	----
Chromium	2 mg/kg	----	60.9	94.5	70	130
	2 mg/kg	<2	----	----	----	----
Copper	5 mg/kg	----	54.7	94.3	70	130
	5 mg/kg	<5	----	----	----	----
Lead	5 mg/kg	----	55.2	88.2	70	130
	5 mg/kg	<5	----	----	----	----
Nickel	2 mg/kg	----	54.8	95.9	70	130
	2 mg/kg	<2	----	----	----	----
Zinc	5 mg/kg	----	104	98.2	70	130
	5 mg/kg	<5	----	----	----	----
EG005T: Total Metals by ICP-AES - (QC Lot: 124627)		mg/kg	mg/kg	%	%	%
Arsenic	5 mg/kg	----	13.1	98.9	70	130
	5 mg/kg	<5	----	----	----	----
Cadmium	1 mg/kg	----	2.76	94.8	70	130
	1 mg/kg	<1	----	----	----	----
Chromium	2 mg/kg	----	60.9	94.4	70	130
	2 mg/kg	<2	----	----	----	----
Copper	5 mg/kg	----	54.7	94.6	70	130
	5 mg/kg	<5	----	----	----	----
Lead	5 mg/kg	----	55.2	89.8	70	130
	5 mg/kg	<5	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results* Spike concentration	Spike Recovery LCS	*Recovery Limits* Dynamic Recovery Limits Low	High
EG005T: Total Metals by ICP-AES - continued						
EG005T: Total Metals by ICP-AES - (QC Lot: 124627) - continued		mg/kg	mg/kg	%	%	%
Nickel	2 mg/kg	----	54.8	95.5	70	130
	2 mg/kg	<2	----	----	----	----
Zinc	5 mg/kg	----	104	96.6	70	130
	5 mg/kg	<5	----	----	----	----
EG035T: Total Mercury by FIMS						
EG035T: Total Mercury by FIMS - (QC Lot: 124182)		mg/kg	mg/kg	%	%	%
Mercury	0.1 mg/kg	----	1.4	95.8	70	130
	0.1 mg/kg	<0.1	----	----	----	----
EG035T: Total Mercury by FIMS - (QC Lot: 124184)		mg/kg	mg/kg	%	%	%
Mercury	0.1 mg/kg	----	1.4	96.4	70	130
	0.1 mg/kg	<0.1	----	----	----	----
EG035T: Total Mercury by FIMS - (QC Lot: 124626)		mg/kg	mg/kg	%	%	%
Mercury	0.1 mg/kg	----	1.4	98.3	70	130
	0.1 mg/kg	<0.1	----	----	----	----
EK055: Ammonia as N						
EK055: Ammonia as N - (QC Lot: 124021)		mg/kg	mg/kg	%	%	%
Ammonia as N	20 mg/kg	----	125	91.2	70	130
	20 mg/kg	<20	----	----	----	----
EK057: Nitrite as N						
EK057: Nitrite as N - (QC Lot: 124236)		mg/kg	mg/kg	%	%	%
Nitrite as N (Sol.)	0.1 mg/kg	----	5.0	99.7	70	130
	0.1 mg/kg	<0.1	----	----	----	----
EK059: Nitrite plus Nitrate as N (NOx)						
EK059: Nitrite plus Nitrate as N (NOx) - (QC Lot: 124237)		mg/kg	mg/kg	%	%	%
Nitrite + Nitrate as N (Sol.)	0.1 mg/kg	----	5.0	97.7	70	130
	0.1 mg/kg	<0.1	----	----	----	----
EP068A: Organochlorine Pesticides (OC)						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 123697)		mg/kg	mg/kg	%	%	%

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

		Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
Analyte name	*LOR*			*LCS*	*Low*	*High*
EP068A: Organochlorine Pesticides (OC) - continued						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 123697) - continued		mg/kg	mg/kg	%	%	%
4,4'-DDD	0.05 mg/kg	----	0.25	82.8	72.4	109
	0.05 mg/kg	<0.05	----	----	----	----
4,4'-DDE	0.05 mg/kg	----	0.25	83.3	73.6	107
	0.05 mg/kg	<0.05	----	----	----	----
4,4'-DDT	0.2 mg/kg	----	0.25	76.9	62.1	125
	0.2 mg/kg	<0.2	----	----	----	----
Aldrin	0.05 mg/kg	----	0.25	82.5	73.3	108
	0.05 mg/kg	<0.05	----	----	----	----
alpha-BHC	0.05 mg/kg	----	0.25	93.9	77.5	109
	0.05 mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	0.05 mg/kg	----	0.25	82.9	71.5	112
	0.05 mg/kg	<0.05	----	----	----	----
beta-BHC	0.05 mg/kg	----	0.25	95.4	73.1	110
	0.05 mg/kg	<0.05	----	----	----	----
beta-Endosulfan	0.05 mg/kg	----	0.25	85.1	73.8	112
	0.05 mg/kg	<0.05	----	----	----	----
cis-Chlordane	0.05 mg/kg	----	0.25	82.0	70.8	111
	0.05 mg/kg	<0.05	----	----	----	----
delta-BHC	0.05 mg/kg	----	0.25	84.4	67.1	113
	0.05 mg/kg	<0.05	----	----	----	----
Dieldrin	0.05 mg/kg	----	0.25	83.1	72.7	109
	0.05 mg/kg	<0.05	----	----	----	----
Endosulfan sulfate	0.05 mg/kg	----	0.25	85.8	68.5	115
	0.05 mg/kg	<0.05	----	----	----	----
Endrin	0.05 mg/kg	----	0.25	84.4	65.8	107
	0.05 mg/kg	<0.05	----	----	----	----
Endrin aldehyde	0.05 mg/kg	----	0.25	80.9	72.2	114
	0.05 mg/kg	<0.05	----	----	----	----
Endrin ketone	0.05 mg/kg	----	0.25	80.7	71.1	114
	0.05 mg/kg	<0.05	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EP068A: Organochlorine Pesticides (OC) - continued						
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 123697) - continued		mg/kg	mg/kg	%	%	%
gamma-BHC	0.05 mg/kg	----	0.25	93.5	73.1	110
	0.05 mg/kg	<0.05	----	----	----	----
Heptachlor	0.05 mg/kg	----	0.25	88.1	74.8	107
	0.05 mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	0.05 mg/kg	----	0.25	80.5	74	108
	0.05 mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	0.05 mg/kg	----	0.25	93.3	69.6	108
	0.05 mg/kg	<0.05	----	----	----	----
Methoxychlor	0.2 mg/kg	----	0.25	69.0	56.8	137
	0.2 mg/kg	<0.2	----	----	----	----
trans-Chlordane	0.05 mg/kg	----	0.25	82.0	74.6	108
	0.05 mg/kg	<0.05	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)						
EP068B: Organophosphorus Pesticides (OP) - (QC Lot: 123697)		mg/kg	mg/kg	%	%	%
Methyl Azinphos	0.05 mg/kg	----	0.25	83.1	33.1	144
	0.05 mg/kg	<0.05	----	----	----	----
Bromophos-ethyl	0.05 mg/kg	----	0.25	81.4	66.5	112
	0.05 mg/kg	<0.05	----	----	----	----
Carbophenothion	0.05 mg/kg	----	0.25	80.2	67.8	108
	0.05 mg/kg	<0.05	----	----	----	----
Chlorfenvinphos	0.05 mg/kg	----	0.25	96.8	54.5	132
	0.05 mg/kg	<0.05	----	----	----	----
Chlorpyrifos	0.05 mg/kg	----	0.25	81.8	75	109
	0.05 mg/kg	<0.05	----	----	----	----
Chlorpyrifos-methyl	0.05 mg/kg	----	0.25	82.4	72.2	107
	0.05 mg/kg	<0.05	----	----	----	----
Demeton-S-methyl	0.05 mg/kg	----	0.25	83.2	57.7	123
	0.05 mg/kg	<0.05	----	----	----	----
Diazinon	0.05 mg/kg	----	0.25	81.2	72.9	108
	0.05 mg/kg	<0.05	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results* Spike concentration	Spike Recovery LCS	*Recovery Limits* Dynamic Recovery Limits Low	High
EP068B: Organophosphorus Pesticides (OP) - continued						
EP068B: Organophosphorus Pesticides (OP) - (QC Lot: 123697) - continued		mg/kg	mg/kg	%	%	%
Dichlorvos	0.05 mg/kg	----	0.25	64.2	64	117
	0.05 mg/kg	<0.05	----	----	----	----
Dimethoate	0.05 mg/kg	----	0.25	95.9	60.7	117
	0.05 mg/kg	<0.05	----	----	----	----
Ethion	0.05 mg/kg	----	0.25	81.8	58.9	116
	0.05 mg/kg	<0.05	----	----	----	----
Fenamiphos	0.05 mg/kg	----	0.25	83.4	48.8	118
	0.05 mg/kg	<0.05	----	----	----	----
Fenthion	0.05 mg/kg	----	0.25	83.2	72.5	107
	0.05 mg/kg	<0.05	----	----	----	----
Malathion	0.05 mg/kg	----	0.25	88.2	61.6	121
	0.05 mg/kg	<0.05	----	----	----	----
Monocrotophos	0.2 mg/kg	----	0.25	116	46.9	125
	0.2 mg/kg	<0.2	----	----	----	----
Parathion	0.2 mg/kg	----	0.25	101	65.2	116
	0.2 mg/kg	<0.2	----	----	----	----
Parathion-methyl	0.2 mg/kg	----	0.25	87.3	68	109
	0.2 mg/kg	<0.2	----	----	----	----
Pirimphos-ethyl	0.05 mg/kg	----	0.25	81.3	66.3	118
	0.05 mg/kg	<0.05	----	----	----	----
Prothiofos	0.05 mg/kg	----	0.25	82.4	73	111
	0.05 mg/kg	<0.05	----	----	----	----
EP074A: Monocyclic Aromatic Hydrocarbons						
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
1,2,4-Trimethylbenzene	0.5 mg/kg	----	1	95.5	76	123
	0.5 mg/kg	<0.5	----	----	----	----
1,3,5-Trimethylbenzene	0.5 mg/kg	----	1	92.3	76	126
	0.5 mg/kg	<0.5	----	----	----	----
Benzene	0.5 mg/kg	----	1	98.4	79	126
	0.5 mg/kg	<0.5	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EP074A: Monocyclic Aromatic Hydrocarbons - continued						
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 123728) - continued		mg/kg	mg/kg	%	%	%
Ethylbenzene	0.5 mg/kg	----	1	96.8	75	127
	0.5 mg/kg	<0.5	----	----	----	----
Isopropylbenzene	0.5 mg/kg	----	1	96.7	73	129
	0.5 mg/kg	<0.5	----	----	----	----
meta- & para-Xylene	0.5 mg/kg	----	2	96.5	76	128
	0.5 mg/kg	<0.5	----	----	----	----
n-Butylbenzene	0.5 mg/kg	----	1	102	72	126
	0.5 mg/kg	<0.5	----	----	----	----
n-Propylbenzene	0.5 mg/kg	----	1	88.9	75	125
	0.5 mg/kg	<0.5	----	----	----	----
ortho-Xylene	0.5 mg/kg	----	1	94.2	75	128
	0.5 mg/kg	<0.5	----	----	----	----
p-Isopropyltoluene	0.5 mg/kg	----	1	94.9	76	125
	0.5 mg/kg	<0.5	----	----	----	----
sec-Butylbenzene	0.5 mg/kg	----	1	89.3	75	124
	0.5 mg/kg	<0.5	----	----	----	----
Styrene	0.5 mg/kg	----	1	96.8	77	129
	0.5 mg/kg	<0.5	----	----	----	----
tert-Butylbenzene	0.5 mg/kg	----	1	92.1	78	124
	0.5 mg/kg	<0.5	----	----	----	----
Toluene	0.5 mg/kg	----	1	89.4	72	128
	0.5 mg/kg	<0.5	----	----	----	----
EP074B: Oxygenated Compounds						
EP074B: Oxygenated Compounds - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
2-Butanone (MEK)	1 mg/kg	----	10	107	72	129
	5 mg/kg	<5	----	----	----	----
2-Hexanone (MBK)	1 mg/kg	----	10	112	72	125
	5 mg/kg	<5	----	----	----	----
4-Methyl-2-pentanone (MIBK)	1 mg/kg	----	10	107	71	128
	5 mg/kg	<5	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EP074B: Oxygenated Compounds - continued						
EP074B: Oxygenated Compounds - (QC Lot: 123728) - continued		mg/kg	mg/kg	%	%	%
Vinyl Acetate	1 mg/kg	----	10	88.3	71	128
	5 mg/kg	<5	----	----	----	----
EP074C: Sulfonated Compounds						
EP074C: Sulfonated Compounds - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
Carbon disulfide	0.5 mg/kg	----	1	93.5	73	127
	0.5 mg/kg	<0.5	----	----	----	----
EP074D: Fumigants						
EP074D: Fumigants - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
1,2-Dibromoethane (EDB)	0.5 mg/kg	----	1	96.4	74	125
	0.5 mg/kg	<0.5	----	----	----	----
1,2-Dichloropropane	0.5 mg/kg	----	1	102	73	125
	0.5 mg/kg	<0.5	----	----	----	----
2,2-Dichloropropane	0.5 mg/kg	----	1	87.4	74	128
	0.5 mg/kg	<0.5	----	----	----	----
cis-1,3-Dichloropropylene	0.5 mg/kg	----	2	92.0	73	124
	0.5 mg/kg	<0.5	----	----	----	----
trans-1,3-Dichloropropylene	0.5 mg/kg	----	2	92.1	76	124
	0.5 mg/kg	<0.5	----	----	----	----
EP074E: Halogenated Aliphatic Compounds						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
1,1,1,2-Tetrachloroethane	0.5 mg/kg	----	1	92.0	70	126
	0.5 mg/kg	<0.5	----	----	----	----
1,1,1-Trichloroethane	0.5 mg/kg	----	1	92.7	74	128
	0.5 mg/kg	<0.5	----	----	----	----
1,1,2,2-Tetrachloroethane	0.5 mg/kg	----	1	108	71	125
	0.5 mg/kg	<0.5	----	----	----	----
1,1,2-Trichloroethane	0.5 mg/kg	----	1	111	73	126
	0.5 mg/kg	<0.5	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EP074E: Halogenated Aliphatic Compounds - continued						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 123728) - continued		mg/kg	mg/kg	%	%	%
1,1-Dichloroethane	0.5 mg/kg	----	1	97.4	72	126
	0.5 mg/kg	<0.5	----	----	----	----
1,1-Dichloroethene	0.5 mg/kg	----	1	96.7	73	128
	0.5 mg/kg	<0.5	----	----	----	----
1,1-Dichloropropylene	0.5 mg/kg	----	1	94.8	75	129
	0.5 mg/kg	<0.5	----	----	----	----
1,2,3-Trichloropropane	0.5 mg/kg	----	1	116	72	126
	0.5 mg/kg	<0.5	----	----	----	----
1,2-Dibromo-3-chloropropane	0.5 mg/kg	----	1	96.4	70	128
	0.5 mg/kg	<0.5	----	----	----	----
1,2-Dichloroethane	0.5 mg/kg	----	1	102	76	128
	0.5 mg/kg	<0.5	----	----	----	----
1,3-Dichloropropane	0.5 mg/kg	----	1	104	73	126
	0.5 mg/kg	<0.5	----	----	----	----
Bromochloromethane	0.5 mg/kg	<0.5	----	----	----	----
Bromomethane	1 mg/kg	----	10	106	71	125
	5 mg/kg	<5	----	----	----	----
Carbon Tetrachloride	0.5 mg/kg	----	1	88.9	76	126
	0.5 mg/kg	<0.5	----	----	----	----
Chloroethane	1 mg/kg	----	10	100	71	126
	5 mg/kg	<5	----	----	----	----
Chloromethane	1 mg/kg	----	10	116	73	127
	5 mg/kg	<5	----	----	----	----
cis-1,2-Dichloroethene	0.5 mg/kg	----	1	98.7	73	127
	0.5 mg/kg	<0.5	----	----	----	----
cis-1,4-Dichloro-2-butene	0.5 mg/kg	----	1	106	71	126
	0.5 mg/kg	<0.5	----	----	----	----
Dibromomethane	0.5 mg/kg	----	1	101	72	126
	0.5 mg/kg	<0.5	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits (Dynamic Recovery Limits): Low	Recovery Limits (Dynamic Recovery Limits): High
EP074E: Halogenated Aliphatic Compounds - continued						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 123728) - continued		mg/kg	mg/kg	%	%	%
Dichlorodifluoromethane	1 mg/kg	----	10	117	74	126
	5 mg/kg	<5	----	----	----	----
Hexachlorobutadiene	0.5 mg/kg	----	1	91.6	70	128
	0.5 mg/kg	<0.5	----	----	----	----
Iodomethane	0.5 mg/kg	----	1	99.5	74	129
	0.5 mg/kg	<0.5	----	----	----	----
Pentachloroethane	0.5 mg/kg	----	1	90.2	71	126
	0.5 mg/kg	<0.5	----	----	----	----
Tetrachloroethene	0.5 mg/kg	----	1	92.8	76	128
	0.5 mg/kg	<0.5	----	----	----	----
trans-1,2-Dichloroethene	0.5 mg/kg	----	1	95.1	72	128
	0.5 mg/kg	<0.5	----	----	----	----
trans-1,4-Dichloro-2-butene	0.5 mg/kg	----	1	93.7	71	125
	0.5 mg/kg	<0.5	----	----	----	----
Trichloroethene	0.5 mg/kg	----	1	92.0	73	124
	0.5 mg/kg	<0.5	----	----	----	----
Trichlorofluoromethane	1 mg/kg	----	10	83.2	72	127
	5 mg/kg	<5	----	----	----	----
Vinyl chloride	1 mg/kg	----	10	112	71	124
	5 mg/kg	<5	----	----	----	----
EP074F: Halogenated Aromatic Compounds						
EP074F: Halogenated Aromatic Compounds - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
1,2,3-Trichlorobenzene	0.5 mg/kg	----	1	95.1	73	123
	0.5 mg/kg	<0.5	----	----	----	----
1,2,4-Trichlorobenzene	0.5 mg/kg	----	1	89.7	72	128
	0.5 mg/kg	<0.5	----	----	----	----
1,2-Dichlorobenzene	0.5 mg/kg	----	1	93.1	75	128
	0.5 mg/kg	<0.5	----	----	----	----
1,3-Dichlorobenzene	0.5 mg/kg	----	1	91.0	72	127
	0.5 mg/kg	<0.5	----	----	----	----

Matrix Type: SOIL — **Method Blank (MB) and Laboratory Control Samples (LCS) Report**

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits (Dynamic Recovery Limits): Low	Recovery Limits (Dynamic Recovery Limits): High
EP074F: Halogenated Aromatic Compounds - continued						
EP074F: Halogenated Aromatic Compounds - (QC Lot: 123728) - continued		mg/kg	mg/kg	%	%	%
1,4-Dichlorobenzene	0.5 mg/kg	----	1	89.9	73	126
	0.5 mg/kg	<0.5	----	----	----	----
2-Chlorotoluene	0.5 mg/kg	----	1	90.0	71	126
	0.5 mg/kg	<0.5	----	----	----	----
4-Chlorotoluene	0.5 mg/kg	----	1	84.8	71	126
	0.5 mg/kg	<0.5	----	----	----	----
Bromobenzene	0.5 mg/kg	----	1	95.8	73	126
	0.5 mg/kg	<0.5	----	----	----	----
Chlorobenzene	0.5 mg/kg	----	1	94.8	72	126
	0.5 mg/kg	<0.5	----	----	----	----
EP074G: Trihalomethanes						
EP074G: Trihalomethanes - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
Bromodichloromethane	0.5 mg/kg	----	1	90.8	72	122
	0.5 mg/kg	<0.5	----	----	----	----
Bromoform	0.5 mg/kg	----	1	95.7	70	128
	0.5 mg/kg	<0.5	----	----	----	----
Chloroform	0.5 mg/kg	----	1	98.4	72	122
	0.5 mg/kg	<0.5	----	----	----	----
Dibromochloromethane	0.5 mg/kg	----	1	94.7	73	126
	0.5 mg/kg	<0.5	----	----	----	----
EP074H: Naphthalene						
EP074H: Naphthalene - (QC Lot: 123728)		mg/kg	mg/kg	%	%	%
Naphthalene	0.5 mg/kg	----	1	98.2	72	128
	5 mg/kg	<5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons						
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 123698)		mg/kg	mg/kg	%	%	%
C10 - C14 Fraction	50 mg/kg	----	200	93.9	79	112
	50 mg/kg	<50	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EP080/071: Total Petroleum Hydrocarbons - continued						
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 123698) - continued		mg/kg	mg/kg	%	%	%
C15 - C28 Fraction	100 mg/kg	----	200	97.7	84	108
	100 mg/kg	<100	----	----	----	----
C29 - C36 Fraction	100 mg/kg	----	200	98.3	76	117
	100 mg/kg	<100	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 123727)		mg/kg	mg/kg	%	%	%
C6 - C9 Fraction	2 mg/kg	----	26	103	80	119
	2 mg/kg	<2	----	----	----	----
EP080: BTEX						
EP080: BTEX - (QC Lot: 123727)		mg/kg	mg/kg	%	%	%
Benzene	0.2 mg/kg	----	1	111	80	118
	0.2 mg/kg	<0.2	----	----	----	----
Ethylbenzene	0.2 mg/kg	----	1	106	80	120
	0.2 mg/kg	<0.2	----	----	----	----
meta- & para-Xylene	0.2 mg/kg	----	1	104	79	119
	0.2 mg/kg	<0.2	----	----	----	----
ortho-Xylene	0.2 mg/kg	----	1	103	80	119
	0.2 mg/kg	<0.2	----	----	----	----
Toluene	0.2 mg/kg	----	1	106	81	119
	0.2 mg/kg	<0.2	----	----	----	----
EP203A: Explosives						
EP203A: Explosives - (QC Lot: 123711)		mg/kg	mg/kg	%	%	%
1,3,5-Trinitrobenzene	0.1 mg/kg	<0.1	----	----	----	----
1,3-Dinitrobenzene	0.1 mg/kg	<0.1	----	----	----	----
2,4,6-TNT	0.1 mg/kg	----	1	91.8	53	149
	0.1 mg/kg	<0.1	----	----	----	----
2,4-Dinitrotoluene	0.1 mg/kg	----	1	94.1	69	124
	0.1 mg/kg	<0.1	----	----	----	----
2,6-Dinitrotoluene	0.1 mg/kg	<0.1	----	----	----	----
2-Amino-4,6-DNT	0.1 mg/kg	<0.1	----	----	----	----
2-Nitrotoluene	0.1 mg/kg	<0.1	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	*LOR*	*Method blank result*	*Actual Results* Spike concentration	*Spike Recovery* LCS	*Recovery Limits* Dynamic Recovery Limits Low	High
EP203A: Explosives - continued						
EP203A: Explosives - (QC Lot: 123711) - continued		mg/kg	mg/kg	%	%	%
3-Nitrotoluene	0.1 mg/kg	<0.1	----	----	----	----
4-Amino,2,6-DNT	0.1 mg/kg	----	1	86.4	70	126
	0.1 mg/kg	<0.1	----	----	----	----
4-Nitrotoluene	0.1 mg/kg	<0.1	----	----	----	----
HMX	0.1 mg/kg	----	1	81.6	71	132
	0.1 mg/kg	<0.1	----	----	----	----
Nitrobenzene	0.1 mg/kg	----	1	96.6	76	123
	0.1 mg/kg	<0.1	----	----	----	----
Nitroglycerine	1.0 mg/kg	<1.0	----	----	----	----
PETN	1.0 mg/kg	----	1	108	59	132
	1.0 mg/kg	<1.0	----	----	----	----
RDX	0.1 mg/kg	<0.1	----	----	----	----
Tetryl	0.1 mg/kg	<0.1	----	----	----	----
EP203A: Explosives - (QC Lot: 123712)		mg/kg	mg/kg	%	%	%
1,3,5-Trinitrobenzene	0.1 mg/kg	<0.1	----	----	----	----
1,3-Dinitrobenzene	0.1 mg/kg	<0.1	----	----	----	----
2,4,6-TNT	0.1 mg/kg	----	1	95.8	53	149
	0.1 mg/kg	<0.1	----	----	----	----
2,4-Dinitrotoluene	0.1 mg/kg	----	1	97.0	69	124
	0.1 mg/kg	<0.1	----	----	----	----
2,6-Dinitrotoluene	0.1 mg/kg	<0.1	----	----	----	----
2-Amino-4,6-DNT	0.1 mg/kg	<0.1	----	----	----	----
2-Nitrotoluene	0.1 mg/kg	<0.1	----	----	----	----
3-Nitrotoluene	0.1 mg/kg	<0.1	----	----	----	----
4-Amino,2,6-DNT	0.1 mg/kg	----	1	80.2	70	126
	0.1 mg/kg	<0.1	----	----	----	----
4-Nitrotoluene	0.1 mg/kg	<0.1	----	----	----	----
HMX	0.1 mg/kg	----	1	83.9	71	132
	0.1 mg/kg	<0.1	----	----	----	----

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EP203A: Explosives - continued						
EP203A: Explosives - (QC Lot: 123712) - continued		mg/kg	mg/kg	%	%	%
Nitrobenzene	0.1 mg/kg	----	1	94.1	76	123
	0.1 mg/kg	<0.1	----	----	----	----
Nitroglycerine	1.0 mg/kg	<1.0	----	----	----	----
PETN	1.0 mg/kg	----	1	101	59	132
	1.0 mg/kg	<1.0	----	----	----	----
RDX	0.1 mg/kg	<0.1	----	----	----	----
Tetryl	0.1 mg/kg	<0.1	----	----	----	----

Matrix Type: WATER

Method Blank (MB) and Laboratory Control Samples (LCS) Report

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EG005C: Leachable Metals by ICPAES						
EG005C: Leachable Metals by ICPAES - (QC Lot: 124467)		mg/L	mg/L	%	%	%
Arsenic	0.1 mg/L	----	1	102	70	130
	0.1 mg/L	<0.1	----	----	----	----
Cadmium	0.05 mg/L	----	1	106	70	130
	0.05 mg/L	<0.05	----	----	----	----
Chromium	0.1 mg/L	----	1	102	70	130
	0.1 mg/L	<0.1	----	----	----	----
Copper	0.1 mg/L	----	1	106	70	130
	0.1 mg/L	<0.1	----	----	----	----
Lead	0.1 mg/L	----	1	100	70	130
	0.1 mg/L	<0.1	----	----	----	----
Nickel	0.1 mg/L	----	1	103	70	130
	0.1 mg/L	<0.1	----	----	----	----
Zinc	0.1 mg/L	----	1	103	70	130
	0.1 mg/L	<0.1	----	----	----	----
EG035C: Leachable Mercury by FIMS						
EG035C: Leachable Mercury by FIMS - (QC Lot: 124469)		mg/L	mg/L	%	%	%

Matrix Type: WATER

Method Blank (MB) and Laboratory Control Samples (LCS) Report

		Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
Analyte name	*LOR*			*LCS*	*Low*	*High*
EG035C: Leachable Mercury by FIMS - continued						
EG035C: Leachable Mercury by FIMS - (QC Lot: 124469) - continued		mg/L	mg/L	%	%	%
Mercury	0.0001 mg/L	----	0.010	98.4	70	130
	0.001 mg/L	<0.001	----	----	----	----

Quality Control Report - Matrix Spikes (MS)

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.*
* Indicates failed QC

Matrix Type: SOIL

Matrix Spike (MS) Report

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*		*MS*	*Low*	*High*
EG005T: Total Metals by ICP-AES								
EG005T: Total Metals by ICP-AES - (QC Lot: 124181)				mg/kg	mg/kg	%	%	%
Arsenic	EB0509055-002	MLTP 15 (0.1-0.2)	5 mg/kg	50	11	61.2	70	130
Cadmium			1 mg/kg	50	3	88.1	70	130
Chromium			2 mg/kg	50	116	90.6	70	130
Copper			5 mg/kg	250	3200	* Not Determined	70	130
Lead			5 mg/kg	250	27700	* Not Determined	70	130
Nickel			2 mg/kg	50	413	* Not Determined	70	130
Zinc			5 mg/kg	250	481	81.2	70	130
EG005T: Total Metals by ICP-AES - (QC Lot: 124183)				mg/kg	mg/kg	%	%	%
Arsenic	EB0509055-021	MLTP 2 (0.1-0.3)	5 mg/kg	50	<5	82.8	70	130
Cadmium			1 mg/kg	50	<1	94.6	70	130
Chromium			2 mg/kg	50	84	83.7	70	130
Copper			5 mg/kg	250	20	93.2	70	130
Lead			5 mg/kg	250	861	103	70	130
Nickel			2 mg/kg	50	93	72.6	70	130
Zinc			5 mg/kg	250	94	79.1	70	130
EG005T: Total Metals by ICP-AES - (QC Lot: 124243)				mg/kg	mg/kg	%	%	%
Arsenic	ES0508449-023	Anonymous	5 mg/kg	50	8	90.5	70	130
Cadmium			1 mg/kg	50	<1	97.1	70	130
Chromium			2 mg/kg	50	15	93.3	70	130
Copper			5 mg/kg	250	24	94.2	70	130
Lead			5 mg/kg	250	51	94.5	70	130
Nickel			2 mg/kg	50	11	95.3	70	130
Zinc			5 mg/kg	250	100	91.4	70	130
EG005T: Total Metals by ICP-AES - (QC Lot: 124627)				mg/kg	mg/kg	%	%	%
Arsenic	EB0509055-025	MLTP 6 (0.0-0.2)	5 mg/kg	50	<5	56.0	70	130

Matrix Type: SOIL

Matrix Spike (MS) Report

Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration	Actual Results: Sample Result	Actual Results: Spike Recovery MS	Recovery Limits (Static Limits): Low	Recovery Limits (Static Limits): High
EG005T: Total Metals by ICP-AES - continued								
EG005T: Total Metals by ICP-AES - (QC Lot: 124627) - continued				mg/kg	mg/kg	%	%	%
Cadmium	EB0509055-025	MLTP 6 (0.0-0.2)	1 mg/kg	50	<1	87.7	70	130
Chromium			2 mg/kg	50	305	* Not Determined	70	130
Copper			5 mg/kg	250	68	94.8	70	130
Lead			5 mg/kg	250	39	82.3	70	130
Nickel			2 mg/kg	50	197	111	70	130
Zinc			5 mg/kg	250	171	89.1	70	130
EG035T: Total Mercury by FIMS								
EG035T: Total Mercury by FIMS - (QC Lot: 124182)				mg/kg	mg/kg	%	%	%
Mercury	EB0509055-002	MLTP 15 (0.1-0.2)	0.1 mg/kg	5	0.1	104	70	130
EG035T: Total Mercury by FIMS - (QC Lot: 124184)				mg/kg	mg/kg	%	%	%
Mercury	EB0509055-021	MLTP 2 (0.1-0.3)	0.1 mg/kg	5	<0.1	113	70	130
EG035T: Total Mercury by FIMS - (QC Lot: 124626)				mg/kg	mg/kg	%	%	%
Mercury	EB0509053-001	Anonymous	0.1 mg/kg	5	<0.1	114	70	130
EK055: Ammonia as N								
EK055: Ammonia as N - (QC Lot: 124021)				mg/kg	mg/kg	%	%	%
Ammonia as N	EB0509055-023	MLTP 4 (0.0-0.4)	20 mg/kg	25	<20	* Not Determined	70	130
EK057: Nitrite as N								
EK057: Nitrite as N - (QC Lot: 124236)				mg/kg	mg/kg	%	%	%
Nitrite as N (Sol.)	EB0509055-001	MLTP 14 (0.1-0.2)	0.1 mg/kg	3	<0.1	101	70	130
EK059: Nitrite plus Nitrate as N (NOx)								
EK059: Nitrite plus Nitrate as N (NOx) - (QC Lot: 124237)				mg/kg	mg/kg	%	%	%
Nitrite + Nitrate as N (Sol.)	EB0509055-001	MLTP 14 (0.1-0.2)	0.1 mg/kg	3	<0.1	103	70	130
EP068A: Organochlorine Pesticides (OC)								
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 123697)				mg/kg	mg/kg	%	%	%
gamma-BHC	EB0509055-029	MLTP 10 (0.0-0.2)	0.05 mg/kg	0.25	<0.05	85.2	75.65	110.44
Heptachlor			0.05 mg/kg	0.25	<0.05	89.8	72.2	106.71
Aldrin			0.05 mg/kg	0.25	<0.05	105	77.54	107.0
Dieldrin			0.05 mg/kg	0.25	<0.05	82.1	76.37	109.7

Matrix Type: SOIL

Matrix Spike (MS) Report

Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*	*Actual Results* Sample Result	*Actual Results* Spike Recovery MS	*Recovery Limits* Static Limits Low	*Recovery Limits* Static Limits High
EP068A: Organochlorine Pesticides (OC) - continued								
EP068A: Organochlorine Pesticides (OC) - (QC Lot: 123697) - continued				mg/kg	mg/kg	%	%	%
Endrin	EB0509055-029	MLTP 10 (0.0-0.2)	0.05 mg/kg	1	<0.05	94.1	68.51	119.47
4,4'-DDT			0.2 mg/kg	1	<0.2	69.5	67.12	118.10
EP068B: Organophosphorus Pesticides (OP)								
EP068B: Organophosphorus Pesticides (OP) - (QC Lot: 123697)				mg/kg	mg/kg	%	%	%
Diazinon	EB0509055-029	MLTP 10 (0.0-0.2)	0.05 mg/kg	0.25	<0.05	89.0	75.85	107.06
Chlorpyrifos-methyl			0.05 mg/kg	0.25	<0.05	89.1	74.84	107.91
Pirimphos-ethyl			0.05 mg/kg	0.25	<0.05	87.4	67.98	109.42
Bromophos-ethyl			0.05 mg/kg	0.25	<0.05	81.3	74.94	107.37
Prothiofos			0.05 mg/kg	0.25	<0.05	82.4	75.45	106.05
EP074A: Monocyclic Aromatic Hydrocarbons								
EP074A: Monocyclic Aromatic Hydrocarbons - (QC Lot: 123728)				mg/kg	mg/kg	%	%	%
Benzene	EB0509055-001	MLTP 14 (0.1-0.2)	0.5 mg/kg	2.5	<0.5	81.5	70	130
Toluene			0.5 mg/kg	2.5	<0.5	81.1	70	130
EP074E: Halogenated Aliphatic Compounds								
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 123728)				mg/kg	mg/kg	%	%	%
1,1-Dichloroethene	EB0509055-001	MLTP 14 (0.1-0.2)	0.5 mg/kg	2.5	<0.5	105	70	130
Trichloroethene			0.5 mg/kg	2.5	<0.5	86.2	70	130
EP074F: Halogenated Aromatic Compounds								
EP074F: Halogenated Aromatic Compounds - (QC Lot: 123728)				mg/kg	mg/kg	%	%	%
Chlorobenzene	EB0509055-001	MLTP 14 (0.1-0.2)	0.5 mg/kg	2.5	<0.5	81.5	70	130
EP080/071: Total Petroleum Hydrocarbons								
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 123698)				mg/kg	mg/kg	%	%	%
C10 - C14 Fraction	EB0509055-017	MLSS 4	50 mg/kg	700	<50	81.9	70	130
C15 - C28 Fraction			100 mg/kg	3400	1860	118	70	130
C29 - C36 Fraction			100 mg/kg	3600	3170	118	70	130
EP080/071: Total Petroleum Hydrocarbons - (QC Lot: 123727)				mg/kg	mg/kg	%	%	%
C6 - C9 Fraction	EB0508960-005	Anonymous	2 mg/kg	26	130	* Not Determined	70	130
EP080: BTEX								

Matrix Type: SOIL

Matrix Spike (MS) Report

Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration	Actual Results: Sample Result	Actual Results: Spike Recovery MS	Recovery Limits (Static Limits): Low	Recovery Limits (Static Limits): High
EP080: BTEX - continued								
EP080: BTEX - (QC Lot: 123727)				mg/kg	mg/kg	%	%	%
Benzene	EB0508960-005	Anonymous	0.2 mg/kg	2.5	<0.2	121	70	130
Toluene			0.2 mg/kg	2.5	<0.2	112	70	130
Ethylbenzene			0.2 mg/kg	2.5	<0.2	123	70	130
meta- & para-Xylene			0.2 mg/kg	2.5	<0.2	124	70	130
ortho-Xylene			0.2 mg/kg	2.5	0.9	114	70	130
EP203A: Explosives								
EP203A: Explosives - (QC Lot: 123711)				mg/kg	mg/kg	%	%	%
HMX	EB0509055-001	MLTP 14 (0.1-0.2)	0.1 mg/kg	1	<0.1	71.8	70	130
2,4,6-TNT			0.1 mg/kg	1	<0.1	87.2	70	130
4-Amino,2,6-DNT			0.1 mg/kg	1	<0.1	70.1	70	130
2,4-Dinitrotoluene			0.1 mg/kg	1	<0.1	84.7	70	130
Nitrobenzene			0.1 mg/kg	1	<0.1	87.2	70	130
PETN			1.0 mg/kg	1	<1.0	100	70	130
EP203A: Explosives - (QC Lot: 123712)				mg/kg	mg/kg	%	%	%
HMX	EB0509055-023	MLTP 4 (0.0-0.4)	0.1 mg/kg	1	<0.1	86.8	70	130
2,4,6-TNT			0.1 mg/kg	1	<0.1	96.7	70	130
4-Amino,2,6-DNT			0.1 mg/kg	1	<0.1	84.5	70	130
2,4-Dinitrotoluene			0.1 mg/kg	1	<0.1	99.3	70	130
Nitrobenzene			0.1 mg/kg	1	<0.1	95.3	70	130
PETN			1.0 mg/kg	1	<1.0	111	70	130

Matrix Type: WATER

Matrix Spike (MS) Report

Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration	Actual Results: Sample Result	Actual Results: Spike Recovery MS	Recovery Limits (Static Limits): Low	Recovery Limits (Static Limits): High
EG005C: Leachable Metals by ICPAES								
EG005C: Leachable Metals by ICPAES - (QC Lot: 124467)				mg/L	mg/L	%	%	%
Arsenic	EB0509055-011	MLTP 24 (0.0-0.2)	0.1 mg/L	1	<0.1	105	70	130
Cadmium			0.05 mg/L	0.250	<0.05	104	70	130
Chromium			0.1 mg/L	1	<0.1	103	70	130

Matrix Type: WATER

Matrix Spike (MS) Report

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*		*MS*	*Low*	*High*
EG005C: Leachable Metals by ICPAES - continued								
EG005C: Leachable Metals by ICPAES - (QC Lot: 124467) - continued				mg/L	mg/L	%	%	%
Copper	EB0509055-011	MLTP 24 (0.0-0.2)	0.1 mg/L	1	<0.1	109	70	130
Lead			0.1 mg/L	1	0.3	102	70	130
Nickel			0.1 mg/L	1	<0.1	100	70	130
Zinc			0.1 mg/L	1	3.2	91.6	70	130
EG035C: Leachable Mercury by FIMS								
EG035C: Leachable Mercury by FIMS - (QC Lot: 124469)				mg/L	mg/L	%	%	%
Mercury	EB0509055-006	MLTP 19 (0-0.2)	0.0001 mg/L	0.0100	<0.001	95.4	70	130

ALS Environmental

QUALITY CONTROL REPORT

Client	: **HLA-ENVIROSCIENCES PTY LTD**	**Laboratory**	: ALS Environmental Brisbane	**Page**	: **1 of 4**
Contact	: MS MARIA WOODGATE	**Contact**	: Michael Heery		
Address	: P O BOX 720 FORTITUDE VALLEY QLD AUSTRALIA 4006	**Address**	: 32 Shand Street Stafford QLD Australia 4053	**Work order**	: **EB0509724**
				Amendment No.	:
Project	: D1024101 Mt Lofty CSA	**Quote number**	: ----	**Date received**	: 25 Oct 2005
Order number	: - Not provided -			**Date issued**	: 26 Oct 2005
C-O-C number	: - Not provided -				
Site	: - Not provided -				
E-mail	: mwoodgate@hla-enviro.com.au	**E-mail**	: Michael.Heery@alsenviro.com	**No. of samples**	
Telephone	: 07 3606 8900	**Telephone**	: 61-7-32437222	**Received**	: 32
Facsimile	: 07 3606 3999	**Facsimile**	: 61-7-32437259	**Analysed**	: 32

This final report for the ALSE work order reference EB0509724 supersedes any previous reports with this reference.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

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NATA
WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory - 825

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Accredited for compliance with ISO/IED 17025

This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Kim McCabe	Inorganics - NATA 818 (Brisbane)
Stephen Hislop	Inorganics - NATA 818 (Brisbane)

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting - Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

Matrix Type: SOIL ***Laboratory Duplicates (DUP) Report***

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EA055: Moisture Content						
EA055: Moisture Content - (QC Lot: 130143)				%	%	%
EB0509724-004	MLTP 17 (0.0-0.2)	Moisture Content (dried @ 103°C)	1.0 %	6.2	6.2	0.0
EB0509724-011	MLTP 24 (0.0-0.2)	Moisture Content (dried @ 103°C)	1.0 %	3.1	3.1	0.0
EA055: Moisture Content - (QC Lot: 130144)				%	%	%
EB0509724-024	MLTP 5 (0.0-0.2)	Moisture Content (dried @ 103°C)	1.0 %	4.1	4.1	0.0
EB0509724-031	MLTP 12 (0.0-0.2)	Moisture Content (dried @ 103°C)	1.0 %	5.4	5.4	0.0
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 130189)				mg/kg	mg/kg	%
EB0509724-001	MLTP 14 (0.1-0.2)	Cobalt	2 mg/kg	95	96	0.0
EB0509724-011	MLTP 24 (0.0-0.2)	Cobalt	2 mg/kg	11	11	0.0
EG005T: Total Metals by ICP-AES - (QC Lot: 130190)				mg/kg	mg/kg	%
EB0509724-021	MLTP 2 (0.1-0.3)	Cobalt	2 mg/kg	26	24	10.1
EB0509724-031	MLTP 12 (0.0-0.2)	Cobalt	2 mg/kg	128	128	0.0

Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

The quality control term **Method / Laboratory Blank** refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term **Laboratory Control Sample (LCS)** refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

		Method blank result	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
Analyte name	*LOR*			*LCS*	*Low*	*High*
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 130189)		mg/kg	mg/kg	%	%	%
Cobalt	2 mg/kg	<2	----	----	----	----
EG005T: Total Metals by ICP-AES - (QC Lot: 130190)		mg/kg	mg/kg	%	%	%
Cobalt	2 mg/kg	<2	----	----	----	----

Quality Control Report - Matrix Spikes (MS)

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.*

* Indicates failed QC

Matrix Type: SOIL ***Matrix Spike (MS) Report***

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*		*MS*	*Low*	*High*
EG005T: Total Metals by ICP-AES								
EG005T: Total Metals by ICP-AES - (QC Lot: 130189)				mg/kg	mg/kg	%	%	%
Cobalt	EB0509724-002	MLTP 15 (0.1-0.2)	2 mg/kg	50.0	40	97.5	70	130
EG005T: Total Metals by ICP-AES - (QC Lot: 130190)				mg/kg	mg/kg	%	%	%
Cobalt	EB0509724-022	MLTP 3 (0.1-0.3)	2 mg/kg	50.0	19	101	70	130

ALS Environmental

QUALITY CONTROL REPORT

Client	: **HLA-ENVIROSCIENCES PTY LTD**	**Laboratory**	: ALS Environmental Sydney	**Page**	:	**1 of 4**
Contact	: MS MARIA WOODGATE	**Contact**	: Greg Vogel			
Address	: P O BOX 720 FORTITUDE VALLEY QLD AUSTRALIA 4006	**Address**	: 277-289 Woodpark Road Smithfield NSW Australia 2164	**Work order**	:	**ES0508900**
				Amendment No.	:	
Project	: D1024101 Mt Lofty CSA	**Quote number**	: EN/004/05	**Date received**	:	25 Oct 2005
Order number	: rebatch EB0509055			**Date issued**	:	27 Oct 2005
C-O-C number	: - Not provided -					
Site	: MT LOFTLY CSA					
E-mail	: mwoodgate@hla-enviro.com.au	**E-mail**	: Greg.Vogel@alsenviro.com	**No. of samples**		
Telephone	: 07 3606 8900	**Telephone**	: 61-2-87848555	**Received**	:	3
Facsimile	: 07 3606 3999	**Facsimile**	: 61-2-87848500	**Analysed**	:	2

This final report for the ALSE work order reference ES0508900 supersedes any previous reports with this reference.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

Work order specific comments

****Manual Comment****

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Accredited for compliance with ISO/IED 17025

WORLD RECOGNISED ACCREDITATION

This document has been digitally signed by those names that appear on this report and are the authorised signatories. Digital signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Nanthini Coilparampil	Inorganics - NATA 10911 (Sydney)
Peter Dickenson	Inorganics - NATA 10911 (Sydney)

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting - Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

Matrix Type: SOIL ***Laboratory Duplicates (DUP) Report***

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EA055: Moisture Content						
EA055: Moisture Content - (QC Lot: 130225)				%	%	%
ES0508850-011	Anonymous	Moisture Content (dried @ 103°C)	1.0 %	10.5	11.1	5.6
ES0508900-002	MLTP 8 (0.0-0.2)	Moisture Content (dried @ 103°C)	1.0 %	14.4	13.3	8.0
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 130030)				mg/kg	mg/kg	%
ES0508889-021	Anonymous	Chromium	2 mg/kg	6	7	0.0
ES0508889-031	Anonymous	Chromium	2 mg/kg	28	24	15.3
EG050S: Soluble Hexavalent Chromium						
EG050S: Soluble Hexavalent Chromium - (QC Lot: 129859)				mg/kg	mg/kg	%
ES0508900-001	MLTP 6 (0.0-0.2)	Hexavalent Chromium - Soluble	1 mg/kg	<1	<1	0.0

Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

The quality control term **Method / Laboratory Blank** refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term **Laboratory Control Sample (LCS)** refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

		Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
Analyte name	*LOR*			*LCS*	*Low*	*High*
EG005T: Total Metals by ICP-AES						
EG005T: Total Metals by ICP-AES - (QC Lot: 130030)		mg/kg	mg/kg	%	%	%
Chromium	2 mg/kg	----	60.9	106	70	130
	2 mg/kg	<2	----	----	----	----
EG050S: Soluble Hexavalent Chromium						
EG050S: Soluble Hexavalent Chromium - (QC Lot: 129859)		mg/kg	mg/kg	%	%	%
Hexavalent Chromium - Soluble	1 mg/kg	----	2.5	102	70	130
	1 mg/kg	<1	----	----	----	----

Quality Control Report - Matrix Spikes (MS)

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.*
* Indicates failed QC

Matrix Type: SOIL

Matrix Spike (MS) Report

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*		*MS*	*Low*	*High*
EG005T: Total Metals by ICP-AES								
EG005T: Total Metals by ICP-AES - (QC Lot: 130030)				mg/kg	mg/kg	%	%	%
Chromium	ES0508889-021	Anonymous	2 mg/kg	50	6	106	70	130
EG050S: Soluble Hexavalent Chromium								
EG050S: Soluble Hexavalent Chromium - (QC Lot: 129859)				mg/kg	mg/kg	%	%	%
Hexavalent Chromium - Soluble	ES0508900-001	MLTP 6 (0.0-0.2)	1 mg/kg	2.5	<1	112	70	130

DRAFT
Flora Assessment Disposal Study Report
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland

30 November 2005

Prepared for:
Property Disposal Taskforce
BP-2-A013
Department of Defence
CANBERRA ACT 2600

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DRAFT
Flora Assessment Disposal Study Report
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland
30 November 2005

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Botanist

Peer Review:	Date:
Steve Fox **Senior Environmental Scientist**	

CONTENTS

APPENDICES

1 INTRODUCTION

The assessed property includes intact woodlands with canopy and shrub layers close to natural condition. The ground layer is modified, often to a large degree by grazing. Several Regional Ecosystems (REs) that are listed as 'Endangered' or 'Of Concern' as per the Environmental Protection Agency's classification occur on the property. No protected plant species were recorded.

2 FLORA

2.1 Methodology

The flora assessment employed the following methodology:

- Review of aerial photographs and Version 4 of the Department of Natural Resources and Mines (DNRM) RE mapping (release date September 2003) to establish areas of remnant vegetation as per the EPA's Regional Ecosystem classifications.
- The conservation status of each RE was determined based on the status given in the *Vegetation Management Regulation 2000* (10 September 2004 reprint) and the biodiversity status as per the Environmental Protection Agency's RE Description Database (REDD) as at 10 October 2005.
- The Department of Environment and Heritage flora database was searched to identify the potential presence of Endangered ecological communities and Commonwealth threatened flora species. The search area centred on the property.
- The Queensland Herbarium (Environmental Protection Agency) 'HERBRECS' database was reviewed to establish which Queensland scheduled flora species are known to occur within the wider area.
- A three-day ground truthing field survey was completed over the property by HLA-Envirosciences' in-house botanist, Wayne Harris. The survey was undertaken from 12-14 October 2005 and focussed on identifying those REs occurring within the property, that were identified from the Herbarium mapping as either 'Endangered ' or 'Of Concern'. The dominant flora within each strata of these ecosystems, and whether any scheduled flora species are present or likely to be present based on preferred habitats was also established. Although somewhat dry, the vegetation was in reasonable condition at the time of the survey.
- Vegetation communities identified on the property (as presented in Table 2.1) were estimated based on individual survey sites and the existing DNRM RE mapping. As it was not possible to ground truth the entire property, the DNRM RE polygons were assumed to be correct except where the survey site data identified inaccuracies in the DNRM RE mapping. Where possible the boundaries of "Endangered' and "Of Concern' REs were walked.

2.2 Existing Environment

The property has a number of cleared areas but also areas containing intact woodlands and vine thickets. Some of the woodlands have canopy and shrub layers in close to natural condition, while others are degraded or partly cleared. The vine thickets are also close to natural condition but they too have been modified by grazing and the invasion of weed species particularly *Asparagus* spp. (Asparagus fern), *Lantana camara* (*Lantana*) and *Ligustrum lucidum* (Privet). The ground layer is modified by grazing. The declared weed species, (Prickly Pear) *Opuntia* sp., is very common throughout the area as are *Asparagus* spp.

2.2.1 Regional Ecosystems

The REs identified on the property, as mapped in Version 4 of the DNRM Regional Ecosystem mapping, are shown in **Appendix A**.

Table 2.1 describes mapped and identified REs on the property. Some differences between the previously mapped areas and the vegetation communities identified during the field survey exist in the north-western corner of the property (see RE map) and a map modification should be proposed. This is a reflection of the different scales of mapping undertaken (the RE mapping at a scale of 1:100,000 as opposed to the detailed and therefore more accurate ground truthing for the present assessment).

In this same area there is a distinct community of riparian microphyll / notophyll rainforest species fringing a small stream. This unit is too small to be mapped at 1:100 000 scale but is, nevertheless, an important habitat. For these reasons it has been included as part of RE 12.9-10.15. Prominent species include *Grevillea robusta* and *Ficus* spp.

Table 2.1 Mapped and identified RE's on the property.

Version 4 DNRM RE map	Field survey results	Existing level of disturbance	VMA Status	Commonwealth Endangered Communities Present*
12.8.21	12.8.21	Minor (grazing)	EN	Yes
12.9-10.15	12.9-10.15	Major (grazing)	EN	Yes
12.9-10.7/12.9-10.2	12.9-10.7/12.9-10.2. (60/40)	Minor (grazing)	OC	No
12.8.14	12.8.14	Some cleared, Regrowth, grazing	NOC	No
12.8.17	12.8.17	Some cleared, regrowth (grazing)	NOC	No
12.3.7	12.3.7	grazing	NOC	No

** As per the Commonwealth* Environment Protection and Biodiversity Conservation Act 1999.

VMA status based on the Vegetation Management Regulation 2000.
EN = Endangered under the Queensland Vegetation Management Act 1999.
OC = Of Concern under the Queensland Vegetation Management Act 1999
NOC = Not Of Concern under the Queensland Vegetation Management Act 1999

The property contains three REs listed as 'Endangered' or 'Of Concern' under the Queensland *Vegetation Management Act 1999* and/or as an 'Endangered Ecological Community' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC).

The short descriptions for each of these RE's are as follows:

- RE 12.8.21 – Semi-evergreen vine thicket with *Brachychiton rupestris* on Cainozoic igneous rocks.
- RE 12.9-10.15 – Semi-evergreen vine thicket with *Brachychiton rupestris* on sedimentary rocks.
- RE 12.9-10.7 – *Eucalyptus crebra* woodland on sedimentary rocks.

The 'Endangered' and 'Of Concern' REs occurring within the site are generally restricted to relatively steeper slopes (i.e. >15^{o}).

2.2.2 Scheduled flora species

The review of the Queensland Herbarium and Commonwealth Department of Environment and Heritage flora databases established that 5 scheduled plant species are known to have ranges that overlap the wider study area (see **Appendix B** for database search results). These species, as listed in **Table 2.2**, were targeted during the plant survey.

Table 2.2 Protected flora species potentially occurring within site*

Family	Scientific name (Common name)	Conservation status	Preferred habitat	Preferred habitat present at site	Located during field survey
Asteraceae	*Stemmacantha australis*	Vulnerable *Aust, Qld*	Widespread on heavy soils	**Yes**	**No**
Proteaceaa	*Grevillea singuliflora*	Rare QLD	Sandy or sandstone areas	**Yes**	**No**
Lauraceae	*Cryptocarya floydii*	Rare *Qld*	Dry rainforests	**Yes**	**No**
Cupressaceae	*Callitris baileyii*	Rare *Qld*	Hilly or mountainous areas	**Yes**	**No**
Myrtaceae	*Callistemon formosus*	Rare *Qld*	In or near depauperate rainforest	**Yes**	**No**

Aust = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
Qld = Queensland *Nature Conservation (Wildlife) Regulation 1994.*
* *as recorded by Queensland Herbarium and Department of Environment and Heritage as having ranges that overlap with the site.*

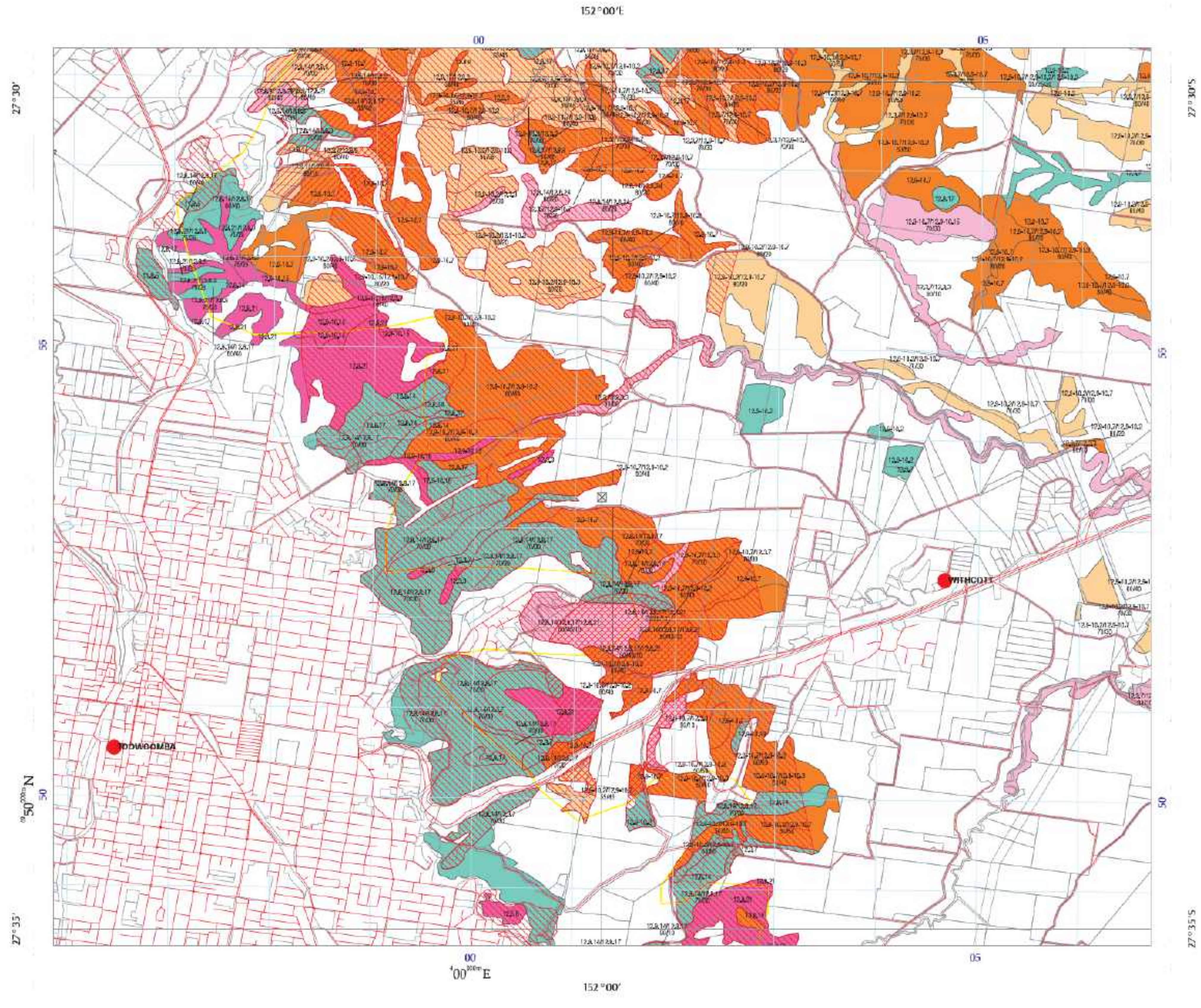
No flora species scheduled under the Commonwealth EPBC or the Queensland *Nature Conservation Act* (NCA) were recorded on the property. The survey also established that there is a very low probability that any such scheduled flora species occur on the property.

2.2.3 Declared weed species

Several declared weed species were observed within the property boundaries. *Opuntia* sp. (Class 2 Pest Plant) is present in all of the communities but is more common in disturbed areas. Asparagus fern (*Asparagus* spp.), Lantana (*Lantana camara*) and Privet (*Ligustrum* l*ucidum*), Class 3 Pest Plants, are present throughout the area. A small population of Mother of Millions (*Bryophyllum* sp., Class 3 Pest Plant) is present in a small disturbed area immediately north of the rifle range where dumping has previously occurred.

An illustration and description of Prickly Pear is provided in **Appendix C**.

Appendix A: RE Map



2001 REGIONAL ECOSYSTEM MAP

Based on 2001 Landsat TM imagery

Requested By: SHUDSON@HLA-ENVIRO.COM.AU
Date: 27 Sep 05 Time: 11.59.13

Centered on point position:
Latitude: -27.5400 Longitude: 152.0000 (decimal degrees)

This is a copy of the certified regional ecosystem map defined by the map extent for the purpose of the *Vegetation Management Act 1999*. Areas of property maps of assessable vegetation (PMAVs) are not shown on this map.

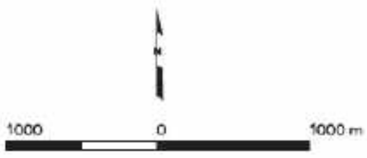
2001 Remnant endangered regional ecosystem
- Dominant
- Sub-dominant

2001 Remnant of concern regional ecosystem
- Dominant
- Sub-dominant

- 2001 Remnant not of concern regional ecosystem
- Non-remnant
- Plantation Forest
- Dam or Reservoir
- 2001 Remnant Vegetation Cover (RVC)
- Essential Habitat
  Area identified as essential habitat by the EPA for a species of wildlife listed as endangered, vulnerable, near threatened or rare under the *Nature Conservation Act 1992*.
- State Wildlife Corridor
  Areas identified as links between large remnant tracts of vegetation including riparian areas.
- Certified Map Amendment area
- Roads
  © MapInfo Australia Pty Ltd 2003
- Bioregion boundary
- National Park, Conservation Area State Forest and other reserves
- Cadastre line
  The maximum spatial error of parcels extracted for this map from the Digital Cadastral Data Base(DCDB) range from: 14m to 251m at a 95% confidence level. Property boundaries shown are provided as a locational aid only.
- Towns
- Coordinate entered

Queensland Government

LOCALITY DIAGRAM



Horizontal Datum: Geocentric Datum of Australia 1994 (GDA94)

Defined map areas are labelled with the regional ecosystem (RE) code along with the percentage breakdown if more than one RE occurs within the area. Detailed definitions of regional ecosystems are available from www.epa.qld.gov.au/REDD. Defined map areas smaller than 5ha may not be labelled.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/-100 metres. The extent of remnant regional ecosystems as of 2001, depicted on this map is based on rectified 2001 Landsat TM imagery (supplied by SLATS, Department of Natural Reources and Mines).

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines, the Environmental Protection Agency and MapInfo Australia Pty Ltd, makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

All datasets are updated as they become available to provide the most current information as of the date shown on this map.

Additional information is required for the purposes of land clearing or assessment of a regional ecosystem map. For further information go to the web site: www.nrm.qld.gov.au/vegetation or contact the Department of Natural Resources and Mines.

Digital regional ecosystem data is available in shapefile format, please contact the Queensland Herbarium.
Email: regional.ecosystem@epa.qld.gov.au

Appendix B: Schedule Flora and Fauna Database Search Results and Fauna Species List

Species	12.8.21	12.9-10.15	12.9-10.7 / 12.9-10.2	12.8.14 / 12.9-17	12.3.7
Acacia disparrima			X	X	
Acacia fasciculifera			X		
Acacia fimbriata			X		
Acacia sp.			X	X	
Acacia maidenii				X	
Agave sp.				X	
Alectryon diversifolius	X				
Alchornia ilicifolia		X			
Alectryon subcinerius		X			
Alectryon subdentatus	X	X			
Allocasuarina torulosa			X		
Alphitonia excelsa		X	X	X	
Alyxia ruscifolia					
Angophora sp.		X	X		
Aphananthe philippinensis		X			
Asparagus spp.	X	X	X	X	X
Atalaya salicifolia	X	X	X		
Brachychiton rupestris	X				
Breynia oblongifolia	X			X	
Bridelia exaltata		X			
Bryophyllum sp.				X	
Bursaria incana	X				
Callistemon viminalis					X
Canthium buxifolium	X	X			
Canthium odoratum	X	X	X		
Carex sp.			X		
Carissa ovata			X		
Cassia floribunda				X	
Cassinia sp.			X		
Casuarina cunninghamii					X
Ceratopetalum apetalum			X		
Cheilanthes tenuifolium				X	
Cissus opaca			X		
Clerodendron floribundum	X		X		
Corymbia citriodora			X	X	
Corymbia tessellaris			X	X	
Cupaniopsis parvifolia		X			
Denhamia oleaster	X	X			
Dianella sp,		X	X		
Digitaria sp.			X	X	

Species	12.8.21	12.9-10.15	12.9-10.7 / 12.9-10.2	12.8.14 / 12.9-17	12.3.7
Diospyros geminata	X	X			
Dodonaea viscosa	X	X			
Drypetes deplanchei	X	X			
Ellatostachys xylocarpa	X	X			
Erythrina vespertilio	X	X			
Erythroxylon sp.	X	X			
Eucalyptus crebra			X	X	
Eucalyptus eugenioides			X		
Eucalyptus mollucana				X	
Eucalyptus tereticornis					X
Exocarpos aphyllus			X		
Exocarpos cupressiformis			X		
Exocarpos latifolius			X		
Ficus rubiginosa		X			
Flindersia australis	X	X			
Flindersia collina	X	X			
Geitonoplesium cymosum	X		X		
Grevillea robusta		X			
Harpullia pendula		X			
Hibiscus heterophyllus					X
Jasminum didymium ssp. lineare	X				
Jasminum simplicifolium			X		
Lantana camara	X	X	X	X	X
Ligustrum lucidum	X	X	X	X	X
Lomandra sp.				X	X
Lophostemon confertus				X	
Mallotus philippinensis		X			X
Marsdenia sp.		X			
Melaleuca bracteata					X
Melia azedarach	X	X	X		
Notelaea microcarpa	X				
Olea paniculate				X	
Opuntia sp.	X	X	X	X	
Owenia acidula		X	X		
Pandorea pandorana	X		X		
Parsonsia lanceolata	X				
Pilidiostigma tomentosa	X	X			
Pittosporum rhombifolium				X	
Pouteria cotinifolia	X	X			
Sida sp.			X	X	

Species	12.8.21	12.9-10.15	12.9-10.7 / 12.9-10.2	12.8.14 / 12.9-17	12.3.7
Smilax australis		X	X		
Themeda triandra			X	X	
Trema tomentosa		X			
Wikstroemia indica		X			X

Appendix C: Prickly Pear

pest series

Prickly pear identification and their control

DECLARED CLASS 2

The introduction and spread of prickly pears into Queensland and New South Wales is one of the greatest environment invasions of modern times. Prickly pears were introduced into pastoral districts in the 1840's. By 1900, over 4 million hectares in Queensland and New South Wales was infested by prickly pear and by 1925, the pest had invaded over 24 million hectares. Control costs were prohibitive and the only effective herbicide at the time was hazardous. This resulted in the abandonment of a great deal of land by landholders.

Research for biological control agents commenced in 1912 and in 1914 cochineal insects were released to control one of the minor prickly pear species. Control of this minor prickly pear species by these introduced insects occurred within a few years. The success of the cochineal insects led to renewed efforts against other types of prickly pear in the 1920's. These efforts resulted in the control of the major pest prickly pear by the moth, *Cactoblastis cactorum* and by the mid-1930's, prickly pear was no longer a major problem. Several prickly pear species have since remained as minor weeds.

PP29 September 2005 Produced by: Land Protection Author: Land Protection QNRM01246

Description

Prickly pear is a general term used to describe some plants of the Cactaceae family. The term includes species of *Opuntia, Nopalea,* and *Acanthocereus*. All of these plants originate in the Americas. The term "prickly pear" relates to the fruit that is often spiny and pear-shaped. Plants are normally leafless succulent shrubs. Stems are divided into segments (pads or joints) that are flat and often incorrectly called leaves.

Young shoots have true leaves resembling small fleshy scales that fall off as the shoot matures.

Flowers are large, normally seen during spring and can be yellow, orange, red, pink, purple or white depending on the species. Prickly pear fruits vary between species and are either red, purple, orange, yellow or green.

Areoles (spots with clusters of spines) are found on both the pads (joints, segments) and fruit. In addition to spines, areoles often have clusters of sharp bristles called glochids and tufts of fibre called "wool". Each areole contains a growing point that can produce roots or shoots.

Pest attributes

Prickly pears have several features that enable them to compete and become pests.

Prickly pears are drought resistant because of their succulent nature, their lack of leaves and their thick tough skins. These features result in plants that use the majority of their internal tissues for water storage and their outer parts to reduce water loss and damage by grazing and browsing animals. They can remain vigorous in hot dry conditions that cause most other plants to lose vigour or even die. Some species develop underground bulbs that enable the plant to resist fire and mechanical damage.

Prickly pears reproduce both sexually and asexually. Birds and other animals readily eat the many seeded fruits and deposit seeds in their droppings. Seeds have hard seed coats that allow them to survive heat and lack of water. Asexual reproduction (cloning) of prickly pears occurs when pads (joints, segments) or fruits located on the ground take root and produce shoots. Animals and floods move broken pads long distances. These pads can survive long periods of drought before weather conditions allow them to set roots.

Prickly pears considered pests in Queensland are:

- Common pest pear — *Opuntia stricta* var. *stricta* (= *Opuntia inermis*)
- Spiny pest pear — *Opuntia stricta* var. *dillenii* (= *Opuntia stricta*)
- Tiger pear — *Opuntia aurantiaca*
- Drooping tree pear — *Opuntia vulgaris* (= *O. monacantha*)
- Velvety tree pear — *Opuntia tomentosa*
- Westwood pear — *Opuntia streptacantha*
- Devil's rope pear — *Opuntia imbricata*
- Coral cactus — *Opuntia cylindrica*
- Snake cactus — *Opuntia fulgida* X *O. imbricate*
- Sword pear — *Acanthocereus pentagonus*

Common pest pear (*Opuntia stricta var. stricta*)
A bushy spreading plant up to 1.5 m in height that forms large clumps. The stems are divided into oval, blue-green spineless pads 20 cm long and 10 cm wide. Areoles are in diagonal lines along the pads 2.5 cm to 5 cm apart and have a cushion of brown wool containing bristles but usually no spines. When spines occur they are stout, yellow and up to 4 cm long.

Common pest pear produces flowers that are 7.5 cm wide, bright lemon yellow and green at the base. The fruit is oval shaped, has a deep cavity on one end and tapers at the other. It is purple in colour 6 cm long and 3 cm wide with carmine coloured seeds and a fleshy pulp.

Common pest pear is found as small to large clumps of varying density. The clumps are usually broken up by the action of *Cactoblastis cactorum.* Common pest pear occurs throughout most of central and southern Queensland and is still spreading westwards. It is often found along beaches and on offshore islands.

Spiny pest pear (*Opuntia stricta var. dillenii*)
A succulent shrub that grows between 1 and 2 metres in height. The stems are hairless and bluish-green or dull green in colour. The stems are divided into pads up to 30 cm long, 15 cm wide and 1 cm to 2 cm thick. The areoles have tufts of short and finely barbed bristles accompanied by one or two yellow spines between 2 cm and 4 cm in length. Small scale-like leaves are found on areoles of immature pads.

Spiny pest pear produces 6 cm to 8 cm wide flowers that are lemon yellow in colour with green or pink markings on the back. The fruit is pear shaped and about 4 cm to 6 cm long with a red-purple skin. The areoles located on fruits have fine barbed bristles. The red flesh of fruits contains rounded seeds that are yellow or pale brown in colour.

While this prickly pear once formed large-scale dense infestations, it is now found as small clumps or as scattered plants. These clumps are usually broken by the action of *Cactoblastis cactorum.* It is found in eastern central Queensland, the Burnett district, the Darling Downs and south east Queensland.

Tiger pear (*Opuntia aurantiaca*)
A succulent low shrub with underground tubers that usually grows between 30 cm and 60 cm high. The stems are divided into very spiny, slightly flattened pads that are 1 to 30 cm long and 1 to 5 cm wide. The stems are dark green to purple and red in colour. The areoles have between three to seven brown barbed spines up to 4 cm long surrounded by tufts of short fine bristles. The pads detach easily and are transported on the skins of animals. Small and scale-like leaves are found on areoles of immature pads.

Tiger pear produces 6 cm wide yellow flowers. The rarely formed fruits are pear shaped and about 2.5 cm long, mainly red colour with purple markings when ripe.

Dense tiger pear forms an impenetrable spiny ground-cover and is prevalent in southern Queensland but extends into central Queensland.

Drooping tree pear (*Opuntia vulgaris*)
An erect succulent shrub with fibrous roots that grows up to 5 m high but is usually 2 m to 3 m high. The branches are divided into glossy light green pads up to 45 cm long, 15 cm wide and 1.5 cm thick. The dark grey trunk is up to 25 cm in diameter. Drooping tree pear gets its name because the upper segments tend to droop. The areoles on the older pads have 1 to 5 sharp spines about 5 cm long.

Small scale-like leaves are found on areoles of very young pads that are quickly shed as the pad grows. Drooping tree pear produces yellow flowers that are 6 cm wide and have red markings on the back. The fruit is pear shaped and 4 cm to 7 cm long with a green skin. The flesh of the fruit is red, pulpy and contains round seeds that are yellow or pale brown in colour. The fruits have areoles with tufts of fine barbed bristles.

Dense thickets result when drooping tree pear is allowed to grow freely. Small scattered infestations occur in the south east corner of Queensland and in coastal north Queensland.

Velvety tree pear (*Opuntia tomentosa*)
A tree like plant that forms a central woody trunk over 40 cm wide and grows to 5 m in height. The stems are divided into oblong pads that are dull green and velvety to touch due to the dense covering of short fine hairs. The pads are 15 cm to 35 cm long, 8 cm to 12 cm wide and 1.5 cm to 2 cm thick. Young plants have two to four white or pale yellow spines located in the areoles with one spine reaching a length of 2.5 cm. The areoles usually become spineless as the plant matures. A more spiny variety does exist and has more than 50 spines in each areole on the trunk.

The flowers are a deep orange. The fruit is egg shaped, about 5 cm long and 3 cm wide, and dull red in colour. The top of the fruit is saucer shaped with circular lines that meet in the centre and give the fruit a shrivelled appearance. The fruit produces many seeds within a reddish pulp.

Velvety tree pear is found predominantly throughout the brigalow belt of Queensland and is still extending its range. It is occasionally found as dense shrubs, but more usually as small clumps of trees or as trees scattered over the landscape.

Westwood pear, Cardona (*Opuntia streptacantha*)
Westwood pears are shrub or tree-like plants that form clumps by branching from the base. They are usually 2 m to 4 m high. The stems are divided into almost circular dull green pads 25 cm to 30 cm long and 15 cm to 20 cm wide. The areoles have white spines that vary in number and size when the plant matures. Young pads have 2−5 white spines 1−2 cm long accompanied by 2 hair like spines 0.5 cm long in the lower part of the areole. Spines increase in number (up to 20) and size (5 cm long) in areoles along the trunk of the plant.

The flowers are yellow and fruits are barrel shaped, 6 cm long and 5 cm wide with a flat top. The fruit has a purple skin and a rind that is 1 cm thick. Fruits contain red seeds buried in a dark red (carmine) pulp.

Westwood pear is found in eastern central Queensland as small clumps or as plants scattered over the landscape.

Devil's rope pear (*Opuntia imbricata*)
An open branching shrub that grows from 1.5 to 3 m high. The stems are divided into hairless, dull green cylindrical pads that vary up to 37 cm in length and from 3.5 cm to 5 cm in thickness. The pads have a series of short raised ridges that give them a twined rope-like appearance. The areoles are found on these ridges and produce 3 to 11 pale yellow or white spines with the longest being 2.5 cm long. Papery sheaths cover these spines.

The flowers are a dull red-purple colour and found at the ends of pads. The yellow fruit resembles a small 5 cm wide custard apple and has a spineless areole at the top.

Devil's rope pear occurs in Queensland as a small infestation at Gladfield.

Coral cactus (*Opuntia cylindrica)*
Coral cactus grows as branching shrub from 1 to 1.5 metres in height. The stems of Coral cactus are divided into green cylinder like pads that are fist like and obtuse at their apex. Mature coral cactus pads widen, become distorted and wavy and resemble a piece of coral. Areoles along the pads have a number of short white spines.

Coral cactus produces small (1−2 mm wide) scarlet flowers. The fruit is yellow-green in colour and 2−5 cm wide.

Coral cactus has been located near Mt Isa, Longreach, Wyandra, Eulo and Hungerford but its potential spread includes all of far western Queensland.

Snake cactus (*Opuntia fulgida* X *Opuntia imbricata*)
An open branching shrub that grows from 1 to 2 m high. The stems are divided into hairless, dull green cylindrical pads that vary up to 20 cm in length and from 3.5 cm to 5 cm in thickness. The pads have a series of short raised ridges that give them a twined rope-like appearance. The areoles are found on the bottom of these ridges and produce 5 to 10 pale yellow to brown spines with the longest being 3 cm long.

The flowers are light red to dark rose commonly 5−7 cm wide. Snake cactus produces fruit that is yellow in colour and 2 to 5 cm wide.

Snake cactus has been located near Longreach but its potential spread includes all of north west Queensland.

Sword pear (*Acanthocereus pentagonus*)
An elongated branching shrub that grows in clumps up to 4 m high. The stems are erect, up to 1.5 m long, 3 to 8 cm wide and divided into many joints. Sword pear stems are three, four or five angled and resemble star picket posts. The areoles are found on the edges of the joints and produce many white spines 1 to 4 cm in length.

The flowers are white, funnel shaped and 14 to 20 cm long. The flowers open at night between spring and summer. Sword Pear produces bright red sphere shaped fruits that are 5 cm in diameter. The fruit has a red pulp and black seeds.

Sword pear occurs in the Gogango area west of Rockhampton.

Biological control

Investigations into biological control agents against prickly pears began in 1912. Over 150 insect species were studied throughout the world, with fifty-two species selected for transport to Queensland. Following intensive host specificity testing, eighteen insects and one mite were released in Queensland. Nine insects and the mite remain established in Queensland. These species are:

- *Cactoblastis cactorum,* a stem-boring moth
- *Dactylopius ceylonicus,* a cochineal mealybug
- *Dactylopius opuntiae,* a cochineal mealybug
- *Dactylopius confusus,* a cochineal mealybug
- *Dactylopius tomentosus,* a cochineal mealybug
- *Dactylopius austrinus,* a cochineal mealybug
- *Chelinidea tabulata,* a cell-sucking bug
- *Tucumania tapiacola,* a stem-boring moth
- *Archlagocheirus funestus,* a stem-boring beetle
- *Tetranychus opuntiae,* prickly pear red spider mite

These biological control agents continue to keep several prickly pears under control. It is important to remember not all the agents attack all prickly pears.

The most successful of these species were the moth *Cactoblastis cactorum* and five cochineal mealybugs, *Dactylopius ceylonicus, D. opuntiae, D. confusus, D. tomentosus* and *D. austrinus*. The other agents are still around but not in sufficient numbers to provide control.

***Cactoblastis cactorum* (cactoblastis moth)**
Larvae of this moth were introduced from Argentina in 1925. Cactoblastis proved to be the most effective agent against the common and spiny pest pears, destroying massive infestations of these prickly pears in Australia. It keeps these two pest pears controlled to an acceptable level most of the time although it is less effective in some coastal and far western areas.

The larvae collectively eat out the contents of the pads leaving empty pad skins and piles of mushy droppings. The orange and black larvae are occasionally observed on the outsides of pads. Cactoblastis also attacks most types of prickly pear but is not effective against them.

***Dactylopius* spp. (cochineal insects)**
All female cochineal insects are small sessile mealy bugs that spend their adult lives permanently attached to their host plants sucking plant juices. They are covered by a fine white waxy secretion and when crushed yield a carmine colouring. The adult males are small free-flying insects that do not feed.

***Dactylopius ceylonicus* (monacantha cochineal, Argentine cochineal)**
This South American mealy bug was released in 1914 and 1915 to control drooping tree pear. It destroyed the dense infestations existing at that time. It is specific to drooping tree pear and today remains the only effective biological control agent for drooping tree pear. This insect needs to be distributed manually.

***Dactylopius opuntiae* (prickly pear cochineal)**
This mealy bug was introduced from Mexico and southern USA between 1920 and 1922. It is effective against common pest pear, spiny pest pear, velvety tree pear and Westwood pear and remains the main biological control agent against velvety tree pear and Westwood pear. This insect spreads slowly in nature and can be assisted manually.

***Dactylopius confusus* (prickly pear cochineal)**
This mealy bug was introduced from Florida and released in 1933 against spiny pest pear. It remains effective against spiny pest pear in central Queensland but spreads slowly. This insect can be spread manually.

***Dactylopius tomentosus* (devil's rope pear cochineal)**
This mealy bug was introduced from southern USA in 1925 and 1926. It is effective against devil's rope pear but works slowly.

Dactylopius austrinus (tiger pear cochineal)

This mealy bug was introduced from Argentina in 1932. It is specific to and effective against tiger pear. It rapidly reduces tiger pear populations but dies out in a paddock after the destruction of tiger pear. It needs to be reintroduced after tiger pear regrows.

***Chelinidea tabulata* (prickly pear bug)**
This plant sucking bug was introduced from Texas in 1921. It was effective against dense common pest pear before *Cactoblastis cactorum* was but is now relatively ineffective. This insect also attacks most other prickly pears. The adult is a pale brown bug up to 20 mm long that leaves characteristic round bleached spots on the surface of the cactus.

***Tucumania tapiacola* (prickly pear moth-borer)**
This moth was introduced from Argentina in 1934 against tiger pear. Its solitary larvae feed internally and eat out tiger pear pads with limited effect. It has been observed attacking common pest pear and Harrisia cactus.

***Archlagocheirus funestus* (tree pear beetle)**
This stem boring beetle was introduced from Mexico in 1935. It was effective against velvety tree pear and Westwood pear but has become rare since the dense stands of these prickly pears have gone.

***Tetranychus opuntiae* (prickly pear spider mite)**
This mite was introduced from southern USA and Mexico in 1922. It was effective against common pest pear but is now rare and difficult to find. It causes distinctive scar tissue formation around areoles.

Distributing prickly pear biological control agents

Cactoblastis
Cactoblastis can be spread manually by distributing eggs or larvae. Cactoblastis moths lay chains of eggs called eggsticks on prickly pear pads between the periods of January-February and September-November. The eggsticks are distinguished from spines by their curved appearance.

1. Collect the fragile eggsticks carefully.
2. Glue single eggsticks to small pieces of paper using a starch based adhesive.
3. Pin the egg papers to prickly pear pads. (Eggs take up to 1 month to hatch.)
4. Collect pads or plants in which it is obvious that larvae are still active.
5. At a release site place all the collected plant material in a small part of the infestation.
6. Subsequent generations of moths will disperse through the infestation.
7. Follow up the biological control with either herbicide or mechanical treatment.

Cochineals
Seeing there are several cochineal insects that affect some prickly pears and not others, it is essential to know what prickly pear you wish to control.

1. Identify your prickly pear type.
2. Find the same prickly pear type which is being attacked by a cochineal.
3. Collect pads of the prickly pear with the insects.
4. Place affected pads against unaffected prickly pears at the release site.
5. Follow up the biological control with either herbicide or mechanical treatment.

Tiger pear cochineal
Tiger pear cochineal is easy to multiply quickly after collection.

1. Carefully collect a reasonable quantity of unaffected tiger pear in a container (box or bucket).
2. Place a few pieces of cochineal affected tiger pear into the same container.
3. Cover the container with a cloth and store under cover for a few weeks.
4. Check the cactus occasionally.
5. When most of the tiger pear in the container has cochineal, it is ready to distribute.
6. At the release site place affected pads against unaffected prickly pears.
7. Follow up the biological control with either herbicide or mechanical treatment.

(N.B. It is best to multiply tiger pear cochineal before release).

Mechanical control

Mechanical control using machinery is difficult because prickly pear pads can easily re-establish. A hot fire is an effective control method for dense prickly pear infestations. Before burning consult your Queensland Department of Primary Industries, Extension Agronomist if this practice is suitable for your pasture and land management practices.

Herbicide control

Herbicide options available for the control of prickly pears in Queensland are shown in Table 1.

Landholders and contractors should check if the property is in a hazardous area as defined in the Agricultural Chemicals Distribution Act 1966 prior to spraying.

Further information

Further information is available from the vegetation management/weed control/environmental staff at your local government.

TABLE 1 – HERBICIDES REGISTERED FOR THE CONTROL OF PRICKLY PEARS

Herbicide	Situation	Rate	Method	Comments
Triclopyr	Forest-timber production; land – commercial/industrial, non-agricultural, pastures, rights of way	.8L/60L diesel	Overall spray	For use against Common Prickly Pear, Drooping Prickly Pear, Tiger Pear
Triclopyr	Forest-timber production, land – commercial/industrial, non-agriculture, pastures, rights of way	3L/100L water	Overall spray	For use against Common Prickly Pear, Drooping Prickly Pear and Tiger Pear
Picloram + Triclopyr	Agricultural land – non-crop; forest – timber production; land – commercial and industrial, pastures, rights of way.	1L/60L diesel	Basal bark/cut stump	For use against Velvet Tree Pear, Tree Pears, Tiger Pear, Common Prickly Pear, Snake Cactus
Amitrole	Land – around buildings, commercial/industrial, non-agricultural, rights of way	1mL/3cm	Inject	
		1L/25L	Overall spray	Small plants or regrowth

Fact sheets are available from NR&M Service Centres and the NR&M Information Centre phone (07 3237 1435). Check our website <www.nrm.qld.gov.au> to ensure you have the latest version of this fact sheet. The control methods referred to in this Pest Fact should be used in accordance with the restrictions (federal and state legislation and local government laws) directly or indirectly related to each control method. These restrictions may prevent the utilisation of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, the Department of Natural Resources and Mines does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

DRAFT
Fauna Assessment Disposal Study Report
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland

30 November 2005

Prepared for:
Property Disposal Taskforce
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CANBERRA ACT 2600

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DISTRIBUTION

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This document was prepared for the sole use of Department of Defence and the regulatory agencies that are directly involved in this project, the only intended beneficiaries of our work. No other party should rely on the information contained herein without the prior written consent of HLA-Envirosciences Pty Limited and Department of Defence.

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TABLES

APPENDICES

EXECUTIVE SUMMARY

This report identifies the existing faunal environment on the Mount Lofty Rifle Range Defence site, and assesses the likely presence or absence of Commonwealth and/or State listed threatened species or their potential habitat within the proposed railway corridor.

The methodology employed for the assessment was to undertake detailed reviews of State and Commonwealth fauna databases for the wider area of the Mount Lofty site and to supplement this review with field surveys of the site. These surveys included targeted searches for threatened fauna species listed under Commonwealth and/or State legislation, and also assessed habitat types on the Mount Lofty site to determine whether they constituted preferred habitats or otherwise of threatened fauna species. The assessment of suitable habitat adopted a precautionary approach so as to ensure that any protected species potentially present on the site were identified and addressed.

The collation and review of fauna databases established that a total of 29 fauna species listed as threatened under either Commonwealth and/or State legislation, along with a further 47 species listed as migratory and/or marine protected species, have been previously recorded or have geographic ranges that overlap the wider area of the Mount Lofty site. Following targeted searches for these species, assessment of their preferred habitats within the Mount Lofty site, and surveys of habitat types, it was found that a total of 16 threatened species potentially utilise habitat within the Mount Lofty site. These species comprise 1 frog, 2 reptiles, 7 birds and 6 mammals. Two of these species (Grey Goshawk and Collared Delma) were identified by targeted searches as present on the site, while three (Powerful Owl, Glossy-black Cockatoo and Grey-headed Flying-fox) others were recently recorded on the site by other fauna surveys. The site is also identified as an integral part of an important wildlife corridor linking Main Range to the south with other larger patches of habitat to the northeast.

1 INTRODUCTION

1.1 Scope of this Report

This report presents the results of a fauna assessment of the Mount Lofty Rifle Range Defence land situated immediately to the east of Toowoomba.

This report has been developed to identify the existing faunal environment within the Mount Lofty site, and to assess the likely presence or absence of Commonwealth and/or State listed threatened species, or their potential habitat.

1.2 Fauna Assessment Limitations

The scope of the present assessment was not to undertake a detailed and complete fauna inventory of the Mount Lofty site, but rather to focus on identifying those fauna species listed under Commonwealth and/or State legislation, conducting targeted searches for those fauna, and establishing whether preferred habitats for these species occur within the Mount Lofty site. As such, the time spent was limited, with a total of 5 days spent on fauna survey and targeted searches. The timing and of the fauna assessment along with weather conditions may have hampered detection of some frogs, reptiles, nocturnal mammals and migratory bird species.

In recognition of these limitations, a precautionary approach has been adopted throughout this assessment. In other words, any species that could potentially occur within the study area as identified through ecological databases and the habitat knowledge of the fauna by the consultant fauna ecologist have been assumed to occur in the study area. .

2 METHODOLOGY

2.1 Desktop Assessment

The desktop and field survey components of this fauna assessment were undertaken by HLA's fauna ecologist, Dr Simon Hudson, assisted by Amber Wood (Environmental Scientist) and James Powell (Environmental Technician).

The desktop study involved a review of published material and searches of relevant databases and archives. This assessment was used to document known records for the study area and identify the potential presence of protected fauna species. Listed fauna were defined primarily as those species listed in the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 and Queensland *Nature Conservation (Wildlife) Regulation 1994*. The results of the desktop study were also used to focus targeted searches for listed significant species.

Searches were performed on the following databases:

- Queensland Environmental Protection Agency WildNet database for the area 27.4500S to 27.6000S and 151.8333E to 151.9667E
- Department of Environment and Heritage On-line database for the area 27.4833S to 27.56666S and 151.9166E to 152.0333E (buffer 1 km), and
- Queensland Museum database and Birds Australia database for the area 27° 27'S to 27° 36'S and 151° 53'E to 151° 58'E

The following texts were also reviewed: Cogger (2000), Churchill (1998), Ehmann (1992), Garnett and Crowley (2002), Johnson (2003), Menkhorst and Knight (2004), Morcombe (2003), Robinson (1998), Strahan (1995), Wilson (2005), Wilson and Swan (2003), Wilson and Knowles (1988).

2.2 Field Surveys

Field investigations of the study area were conducted over a total of 5 days from 12-14 October and 1-2 November 2005.

Fauna trapping methods such as Elliott trapping, pit fall trapping, hair tube sampling or harp trapping were not employed during this assessment. Rather, dedicated searches for fauna and fauna signs were carried out across the Mount Lofty site. Survey techniques employed involved:

- Spotlighting;
- Recording of bat calls using the Anabat II echolocation recorder;
- Audio identification (e.g. bird and frog calls);
- Dedicated searches under rocks, logs, bark and leaf litter for reptiles;
- Dedicated searches of likely faunal hotspots such as rocky sandstone outcrops, semi-evergreen vine thicket and riparian vine forest;
- Dedicated searches for animal signs (e.g. scats and tracks); and
- Opportunistic observations.

3 FINDINGS

3.1 Commonwealth and / or State Listed Species

The review of fauna databases for the wider area around the Mount Lofty site identified the potential presence of 29 fauna species listed as threatened species under Commonwealth and/or State legislation (two butterflies, two amphibians, four reptiles, 14 birds and seven mammals). Six of these species are listed as threatened species under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), nine species are listed under the Queensland *Nature Conservation Act 1992* (NCA Act), and 14 species are listed under both Commonwealth and State legislation. A list of the Commonwealth and/or State listed threatened fauna species, together with their preferred habitat and an indication as to whether this habitat is present within the Mount Lofty site, is given in **Table 3-1**.

An additional 47 species identified as potentially present in the wider area are listed under the EPBC Act as migratory protected species (two species), marine protected species (33 species), or both migratory and marine species (12 species). These fauna species are listed in **Table 3-2**. The majority of the species listed as marine are not particularly relevant to this assessment, as there are no marine habitats in the area. Of the 47 species potentially present in the wider area, 30 species were identified with the potential to use the Mount Lofty site based solely on their habitat preference.

3.2 Fauna Species Recorded on the Mount Lofty Site

During this fauna assessment, a total of nine amphibians, nine reptiles, 39 birds and four mammals (not including bats) were recorded on the Mount Lofty site. A list of these species is included in **Appendix A**. Two of the species recorded have been listed as threatened species under Commonwealth and/or State legislation: Grey Goshawk (*Accipiter novaehollandiae*) and Collared Delma (*Delma torquata*). The ecology and status of these species are discussed further in **Section 3.3**.

Other significant species have been recently recorded on or near the Mount Lofty site during other fauna surveys. These included Powerful Owl (*Ninox strenua*), Glossy-black Cockatoo (Calyptorynchus lathami), and Grey-headed Flying-fox (*Pteropus poliocephalus)* (Boobook 2005). These species are discussed further in **Section 3.3**.

A number of the fauna species recorded on the Mount Lofty site during the fauna habitat assessment were feral or introduced animal species. A total of four species (Dog, Hare, Black Rat and Cane Toad) were identified, either directly or from scat or pellet analysis, not including Horses agisted on the site. These species are denoted in **Appendix A** as introduced animals by an asterisk.

Table 3-1: Vertebrate and Invertebrate Fauna Species Listed by Commonwealth and / or State Legislation Potentially Occurring Within the Mount Lofty Site

Common Name	Scientific Name	Status*	Preferred habitats	Preferred habitats within site	Known Records**
AMPHIBIANS					
Tusked Frog	*Adelotus brevis*	V [2]	Rainforest, wet sclerophyll forest or flooded grassland, close to water. Usually found under logs or rocks beside streams, puddles and ditches	**Yes**	2
Giant Barred Frog	*Mixophyes iteratus*	E [1]	Wet sclerophyll forest and rainforest, often hiding in leaf litter near permanent fast-flowing streams	**Yes**	None
REPTILES					
Long-legged Worm-skink	*Anomalopus mackayi*	V [1] / E [2]	Under surface cover such as logs, on deep cracking clay soils in grasslands and open woodlands in the Darling Downs.	**No**	2
Orange-tailed Shadeskink	*Saproscincus rosei*	R [2]	Rainforests and adjacent wet sclerophyll forests in SE Qld and NE NSW. Often occurs on the edges of small clearings in rainforests.	**Yes**	2
Collared Delma	*Delma torquata*	V [1 and 2]	Open rocky hillsides, supporting open woodland with a sparse understorey. Usually found sheltering under surface cover such as rocks.	**Yes**	1
Dunmall's Snake	*Furina dunmalli*	V [1 and 2]	Dry sclerophyll forest and woodland and brigalow scrub on floodplains of cracking soils	**No**	3
BIRDS					
Grey Goshawk	*Accipiter novaehollandiae*	R [2]	Rainforest and margins, heavily wooded forests.	**Yes**	1, 2, 3
Red Goshawk	*Erythrotriorchis radiatus*	V [1] / E [2]	Tropical and subtropical open woodland, edges of rainforest and dense riverine vegetation. Nests in trees taller than 20 m and within 1 km of a permanent watercourse or wetland. Foraging usually occurs in open forests and gallery forests.	**Yes**	None
Swift Parrot	*Lathamus discolour*	E [1 and 2] / Ma [1]	Forests and woodlands with flowering trees. Breeds in Tasmania and over winters on the Australian mainland. Congregates in areas where eucalypts are flowering profusely.	**Yes**	3, 4
Squatter Pigeon (Southern subspp)	*Geophaps scripta scripta*	V [1 and 2]	Open grasslands often in eucalypt woodland. Preference for areas on sandy soil with low gravel ridges and nearby water.	**No**	None
Black-Breasted Button-Quail	*Turnix melanogaster*	V [1 and 2]	Semi-evergreen vine-thickets or lantana thickets adjacent to semi-evergreen vine thickets	**Yes**	2, 3, 4

Common Name	Scientific Name	Status*	Preferred habitats	Preferred habitats within site	Known Records**
Australian Painted Snipe	*Rostratula australis (benghalensis)*	V 1 and 2 / Mi 1 /Ma 1	Shallow muddy freshwater swamps and marshes.	**No**	None
Square-Tailed Kite	*Lophoictinia isura*	R 2	Sparsely distributed in open eucalypt forests, woodlands and sand plains.	**Yes**	2
Coxen's Fig-Parrot	*Cyclopsitta diophthalma coxeni*	E 1	Lower altitude rainforests rich in figs. Extremely rare in SE Qld with few records in the last 15 years, from only the McPherson, Main and Conondale Ranges.	**No**	None
Regent Honeyeater	*Xanthomyza phrygia*	E 1	Eucalypt woodland and open forest on the slopes of the Great Dividing Range	**Yes**	None
Major Mitchell's Cockatoo	*Cacatua leadbeateri*	V 2	Open sparsely timbered grasslands and shrublands; mulga, mallee, *Callitris*, and *Casuarina* country, watercourse trees. Never far from water.	**No**	3
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V 2	Coastal forest and open inland woodland. Feeds primarily on *Allocasuarina*.	**Yes**	3
Paradise Parrot	*Psephotus pulcherrimus*	PE 1	Believed to be extinct, but former habitat was open grassy woodlands and scrubby grasslands, particularly with termite mounds.	**No**	2
Powerful Owl	*Ninox strenua*	V 2	Eucalypt forests along the Great Dividing Range, preferring tall wet sclerophyll forests, where 800-1000 ha territories centre on densely vegetated gullies.	**Yes**	3
Black-throated finch	*Poephila cincta*	E 1 / V 2	Open grasslands with sparse, tall overtopping eucalypts and paperbarks	**No**	2
MAMMALS					
Tiger Quoll	*Dasyurus maculatus maculatus*	E 1 / V 2	Wide range of habitats, including: rainforest, wet and dry sclerophyll forest, woodland, coastal heathlands, inland riparian forests. Dens in caves, crevices and hollow logs.	**Yes**	None
Brush-tailed Rock-wallaby	*Petrogale penicillata*	V 1 and 2	Rock piles and cliffs with ledges, caves and crevices in wet and dry sclerophyll forests	**Yes**	None
Long-nosed Potoroo	*Potorous tridactylus tridactylus*	V 1 and 2	Coastal wet heath, dry and wet forests with thick ground cover	**Yes**	None
Grey-Headed Flying-Fox	*Pteropus poliocephalus*	V 1	Rainforest, eucalypt forest and fruit trees. Roosting sites usually in dense forest adjacent to waterbodies.	**Yes**	3
Large-eared Pied Bat	*Chalinolobus dwyeri*	V 1 / R 2	Dry forests and woodlands, moist eucalypt forests, caves and mines.	**Yes**	None
Eastern Long-Eared Bat	*Nyctophilus timoriensis*	V 1 and 2	River Red Gum forest, semi-arid woodlands and savannas (in SE Qld). Appears to prefer semi-arid areas but can be found in high rainfall areas. Roosts in tree hollows, fissures in branches and under sheets of bark.	**Yes**	None
Eastern Bent-Wing Bat	*Miniopterus schreibersii*	Conservation Dependent[1]	Typically found in well-timbered valleys, these bats rest by day in old mines, caves, stormwater channels and other similar structures.	**No**	3

Common Name	Scientific Name	Status*	Preferred habitats	Preferred habitats within site	Known Records**
INVERTEBRATES					
Illidge's Ant-blue	*Acrodipsas illidgei*	V [2]	Eggs are laid on trunks and branches of Grey Mangrove trees that have colonies of *Crematogaster* ants. All breeding colonies have been in or next to stands of old growth mangroves, except for one female found near Toowoomba.	**No**	3
Imperial Hairstreak (Northern Subspecies)	*Jalmenus evagoras eubulus*	V [2]	Brigalow forest is the principal vegetation community associated with this butterfly, and the preferred food plant of the larvae is brigalow.	**No**	3

* Status: [1]: Commonwealth listed: PE = Presumed Extinct; CE = Critically Endangered; E = Endangered; V = Vulnerable; Mi = Migratory Protected Species; Ma = Marine Protected Species.
[2]: State listed: E = Endangered; V = Vulnerable; R = Rare.
** Known records: 1 = Observations made as part of this survey; 2 = Queensland Museum (QM) record; 3 = QEPA WildNet record; 4 = Birds Australia record; none = species has not previously been recorded from the area but at least part of the geographic range of the species, as per the Department of Environment and Heritage database, falls within the railway corridor.

Table 3-2: Migratory Protected Fauna Previously Recorded / or with geographic Range of Study Area

(Note: those migratory and/or marine species listed in Table 3-1 as threatened species have been omitted from this table).

Common Name	Scientific Name	Status*	Preferred habitats	Preferred habitats within corridor	Known Records**
BIRDS					
Stubble Quail	*Coturnix pectoralis*	Ma	Grassland, spinifex, saltbush, stubble, pasture, crops	**No**	2, 3
Magpie Goose	*Anseranas semipalmata*	Ma	Open wetlands, swamps, farmlands and major watercourses.	**No**	None
Cotton Pygmy-Goose	*Nettapus coromandelianus*	Mi	Freshwater lakes, swamps and impoundments.	**No**	None
Gould's Petrel	*Pterodroma leucoptera*	Ma	Offshore waters, oceans. Australian population breeds only on Cabbage Tree Is, NSW	**No**	2
Australian Pelican	*Pelecanus conspicillatus*	Ma	Large shallow waters both coastal and inland, islands, mudflats, and temporary lakes	**No**	3
Great Egret	*Ardea alba*	Ma	Floodwater, rivers, shallows of wetlands, intertidal mudflats.	**No**	3
Cattle Egret	*Ardea ibis*	Mi / Ma	Pasture, shallows of freshwater wetlands.	**No**	3
Intermediate Egret	*Ardea intermedia*	Ma	Floodwater, rivers, shallows of wetlands, intertidal mudflats.	**No**	3
Nankeen Night Heron	*Nycticorax caledonicus*	Ma	Shallow margins of swamps, lakes, mangroves and rivers. Roosts in dense vegetation	**No**	3
Glossy Ibis	*Plegadis falcinellus*	Mi	Shallows of swamps, floodwaters, irrigated pastures	**No**	3
White-Bellied Sea-Eagle	*Haliaeetus leucogaster*	Mi / Ma	Coastal seas, islands, estuaries and inlets. Follows major rivers and wetlands far inland. Huge nests of sticks, usually in tall trees.	**No**	None
Whistling Kite	*Haliastur sphenurus*	Ma	Open woodlands, scrublands, farmlands, wetlands, estuaries, mudflats	**Yes**	3
Brown Goshawk	*Accipiter fasciatus*	Ma	Forests and woodlands, dry scrublands, farmland	**Yes**	3, 4
Nankeen Kestrel	*Falco cenchroides*	Ma	Open woodlands, grasslands, farmland, heathlands	**Yes**	1, 3, 4
Purple Swamphen	*Porphyrio porphyrio*	Ma	Margins of swamps, lakes and shallow rivers will cover of rushes or reeds	**No**	3
Latham's Snipe	*Gallinago hardwickii*	Mi / Ma	Breeds in Japan. Wet treeless tussocky grasslands and grassed marshes.	**No**	3
Sharp-Tailed Sandpiper	*Calidris acuminata*	Mi / Ma	Fresh or salt wetlands, muddy edges of swamps, lagoons, lakes, dams, temporary floodwaters	**No**	3
Black-Winged Stilt	*Himantopus himantopus*	Ma	Shallow freshwater wetlands, swamps, dams, lakes, estuaries, mudflats	**No**	3
Sooty Tern	*Sterna fuscata*	Ma	Tropical and subtropical seas, returns to islands only to breed	**No**	2
Superb Fruit-Dove	*Ptilinopus superbus*	Ma	Tropical and subtropical rainforest and scrub, riparian forest, lantana thickets	**Yes**	3

Common Name	Scientific Name	Status*	Preferred habitats	Preferred habitats within corridor	Known Records**
Oriental Cuckoo	*Cuculus saturatus*	Mi / Ma	Rainforest margins, vine thicket, wet sclerophyll forest, paperbark swamp, mangroves	Yes	3
Pallid Cuckoo	*Cuculus pallidus*	Ma	Open forests, woodlands, scrublands, roadsides, paddocks and farmlands	Yes	2, 3
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*	Ma	Rainforest, open forests, woodlands, roadside trees, mallee, mulga, farmland, mangroves, gardens	Yes	3
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	Ma	Dense wet rainforests, eucalypt forests and woodlands, gardens	Yes	1, 2, 3, 4
Common Koel	*Eudynamys scolopacea*	Ma	Rainforests, wet sclerophyll forests, woodlands, farmlands and gardens	Yes	1, 2, 3
Channel-Billed Cuckoo	*Scythrops novaehollandiae*	Ma	Rainforest, open forest, woodland, swamp woodland	Yes	1, 3, 4
Southern Boobook	*Ninox novaeseelandiae*	Ma	Almost anywhere with trees - forests, open forests and woodlands, farmland with scattered trees, parks and gardens	Yes	3
White-Throated Nightjar	*Eurostopodus mystacalis*	Ma	Forests, woodlands and heathlands, often on open drier ridges among rocks, leaves and fallen timber	Yes	3
Fork-Tailed Swift	*Apus pacificus*	Mi / Ma	Varied; airspace over habitat ranging from rainforest to semi-desert.	Yes	3, 4
White-Throated Needletail	*Hirundapus caudacutus*	Mi / Ma	Variety of habitats. Aerial forager. Breeds in northern hemisphere where it nests in tree hollows.	Yes	3
Forest Kingfisher	*Todiramphus macleayii*	Ma	Open forests, woodlands, margins of rivers, swamps and billabongs, mangroves, farmlands	Yes	2, 3
Sacred Kingfisher	*Todiramphus sanctus*	Ma	Open forests, woodlands, semi-and scrublands, mangroves	Yes	2, 3, 4
Rainbow Bee-Eater	*Meropus ornatus*	Mi / Ma	Open country, most vegetation types, sand dunes, banks.	Yes	1, 3, 4
Dollarbird	*Eurystomus orientalis*	Ma	Woodlands, forest edges, inland watercourse trees, farmlands	Yes	1, 2, 3, 4
Black-Faced Monarch	*Monarcha melanopsis*	Mi / Ma	Rainforests, mangroves and their fringes, eucalypt forests	Yes	1, 2, 3, 4
Spectacled Monarch	*Monarcha trivirgatus*	Mi / Ma	Rainforests, mangroves, dense gullies in wet forests	Yes	2, 3
Satin Flycatcher	*Myiagra cyanoleuca*	Mi / Ma	Tall wet eucalypt forests in gullies, plains and tablelands of coastal eastern Australia and nearby ranges.	Yes	1, 3
Rufous Fantail	*Rhipidura rufifrons*	Mi / Ma	Rainforest, dense wet eucalypt forest, paperbark and mangrove swamps, riparian vegetation	Yes	1, 2, 3, 4

Common Name	Scientific Name	Status*	Preferred habitats	Preferred habitats within corridor	Known Records**
Spangled Drongo	*Dicrurus bracteatus*	Ma	Woodlands, rainforest margins, mangroves and paperbark swamps, riverside thickets, gardens	Yes	3
Magpie-Lark	*Grallina cyanoleuca*	Ma	Varies, almost anywhere with trees and water, coastal to semi-arid.	Yes	2, 3, 4
Black-Faced Cuckoo-Shrike	*Coracina novaehollandiae*	Ma	Rainforests, eucalypt forests and woodlands, tree-lined watercourses of the interior, farmland, gardens.	Yes	1, 3, 4
White-Bellied Cuckoo-Shrike	*Coracina papuensis*	Ma	Eucalypt forests and woodlands, mangroves, riparian forests, gallery forests	Yes	3
Cicadabird	*Coracina tenuirostris*	Ma	Foliage of rainforests, eucalypt forests, woodlands, paperbark swamps and mangroves	Yes	3, 4
Welcome Swallow	*Hirundo neoxena*	Ma	Diverse, most habitats except densest forests and most arid deserts	Yes	3, 4
Tree Martin	*Hirundo nigricans*	Ma	Open woodlands and farmlands near lakes and rivers.	Yes	3, 4
Clamorous Reed-Warbler	*Acrocephalus stentoreus*	Ma	Wetlands, lakes and rivers with stands of reeds; lantana, bamboo and tall crops beside water	No	3
Silvereye	*Zosterops lateralis*	Ma	Diverse: woodlands and forests, heath, mallee, mangroves, farmland, gardens	Yes	1, 2, 3, 4

* Status under the Environment Protection and Biodiversity Conservation Act 1999. Mi = Migratory Protected Species; Ma = Marine Protected Species.

** Known records: 1 = Observations made as part of this survey; 2 = Queensland Museum (QM) record; 3 = QEPA WildNet record; 4 = Birds Australia record; none = species has not previously been recorded from the area but at least part of the geographic range of the species, as per the Department of Environment and Heritage database, falls within the railway corridor.

3.3 Significant Species

The assessment of fauna species found that of the 29 listed threatened species potentially present in the wider area, a total of 18 could potentially utilise the Mount Lofty site based solely on habitat preference (**Table 3-1**). The ecology and status of these species are discussed further below.

3.3.1 Tusked Frog, *Adelotus brevis*

The Tusked Frog is a medium sized pond or stream dwelling frog. It is usually found associated with water in wet forests or grasslands that sometimes flood, where it is usually found under logs or rocks beside streams, puddles and ditches (Cogger 2000, Morcombe 2003). In southeastern Queensland it has been recorded from a range of habitats including coastal forests, open eucalypt woodland, vine forest, high altitude wet forests and rainforests (DOE 1997). Although it can be common in some areas of southeast Queensland, possible extinction in parts of its range has been causing concern (DOE 1997). Major habitat threats to the Tusked Frog include altered stream flows and increased nutrient or sediment loads (Hazell 2003).

The Tusked Frog may be present on the Mount Lofty site, particularly in riparian vine forest along Rocky Creek, although it was not recorded during this assessment. This species has been recorded less than 20km to the southeast of the site (DOE 1997). Clearing of vegetation, especially the denser vegetation along the creeks, would impact upon the Tusked Frog if present, as would any upstream development that altered stream flow or increased nutrient or sediment loads in the creeks.

3.3.2 Giant Barred Frog, *Mixophyes iteratus*

The Giant Barred Frog is the largest of the barred frogs, and is restricted to rainforests or wet forests in southeast Queensland and northern NSW, usually close to permanent running water. Its preferred habitat is deep, slow-flowing creeks with overhanging banks in riverine rainforest, typically in lowland and mid-altitude areas (DOE 1997). Threats to this species are believed to include upstream clearing and logging, changes in water flow regimes, degradation of water quality and water pollution, disturbance to riparian vegetation and infection with chytrid fungus Hines 2002, Hazel 2003).

In SE Queensland, the Giant Barred Frog was historically known from areas including the Bunya Mountains, Main Range and Border Ranges, but has declined in range and is currently known from only a few locations north of Brisbane, despite intensive survey effort and monitoring (DOE 1997, Hines *et al.* 2002). Consequently, the Giant Barred Frog would not be likely to utilise habitat on the Mount Lofty site.

3.3.3 Orange-tailed Shadeskink, *Saproscincus rosei*

This small diurnal skink is restricted to rainforest and adjacent wet eucalypt forest in near coastal areas between southeastern Queensland and the Hunter Valley in New South Wales (Moussalli *et al.* 2005, Greer 2005). It is not found in dry rainforest habitats such as vine thicket (Moussalli *et al.* 2005). The Orange-tailed Shadeskink typically occurs in clearings and light-gaps in rainforest, and along rainforest edges, where it is able to bask in small patches of sun.

In southeastern Queensland, the Orange-tailed Shadeskink is mostly found in the Main and Border Ranges and the D'Aguilar and Conondale Ranges, in large areas of rainforest. It may be present in riparian vine forest along Rocky Creek, although it was not recorded during this assessment. Clearing of preferred habitat along the creeks would impact on this species if present.

3.3.4 Collared Delma, *Delma torquata*

The Collared Delma is a small legless lizard, largely restricted to southeastern Queensland between the Bunya Mountains, Gympie and the western suburbs of Brisbane (DOE 1997). It generally occurs in open eucalypt forest with a sparse understorey of shrubs and tussock grasses, on rocky hillsides with flattish rocks or on deep-cracking soils (Ehmann 1992, Wilson 2005). This species has also been recorded from eucalypt woodland over semi-evergreen vine thicket (Wilson and Knowles 1988). This small (60 mm snout to vent) cryptic legless lizard is very difficult to locate in the field, and is most often found under surface cover such as rocks, although logs and mats of leaf litter may also be used (Greer 2005). The restricted and scattered distribution of the Collared Delma in an area undergoing rapid development and expansion (Brisbane and environs) indicates that this species is likely to continue to decline (Greer 2005).

Four individuals of the Collared Delma were recorded during this assessment. Two individuals were found under small loose basalt rocks at the top of the escarpment in open Eucalypt forest. Another two individuals were found near the northern boundary of the Mount Lofty site, under loose flat sandstone rocks on low cliffs and outcroppings of sandstone bedrock, in open Ironbark woodland. The only detailed study of this species, at Mt Crosby west of Brisbane, captured only 39 individuals over nearly 2 years, with one Delma captured for every 150-200 rocks turned (Porter 1998, in DEH 2005). Given the brief fauna survey conducted as part of this assessment, the recording of four individuals strongly indicates that rocky areas of the site are very good habitat for the Collared Delma, and that the site supports a substantial population of this species. Interference with or removal of rocks used for shelter would be likely to heavily impact this species, whether basalt rocks on the escarpment or sandstone outcroppings below the escarpment.

3.3.5 Grey Goshawk, *Accipiter novaehollandiae*

The Grey Goshawk generally inhabits humid forests and rainforests, but may also be found in dense eucalypt and paperbark forests where they form tall gallery forest along watercourses (Schodde & Tideman 1990). They occur around coastal and subcoastal northern and eastern Australia, from the Kimberleys to southeastern South Australia. Individuals of this species are generally sedentary, occupying the same home range year after year, and pairings seem to be permanent. Grey Goshawks prey mainly upon mammals up to the size of a rabbit and small birds, along with reptiles and invertebrates. They skulk in dense foliage and burst out with speed to take prey. The main threat to the Grey Goshawk is loss of its preferred dense habitat through clearing.

One Grey Goshawk was recorded during this assessment, in riparian vine forest along Rocky Creek, in the northwest of the site. A pair of Grey Goshawks was also recently recorded along Rocky Creek in another fauna survey (Boobook 2005). Any clearing or removal of the Goshawk's preferred dense forest habitat along the creek would impact upon this species.

3.3.6 Red Goshawk, *Erythrotriorchis radiatus*

The Red Goshawk lives in coastal and subcoastal areas from northeastern New South Wales north to Cape York and west to the Kimberleys. Its preferred habitats are forest and woodland with permanent water and large populations of birds (Schodde & Tideman 1990, DOE 1997). In partly cleared areas of eastern Queensland, this species tends to occur in gorge and escarpment country (Garnett and Crowley 2002). Red Goshawks usually hunt in open forests and gallery forests within a home range of up to 200 square km, taking mostly medium to large birds. Red Goshawks hunt by stealth through and beneath the canopy of taller woodlands and open forests, working from tree to tree and snatching prey from a perch, on the ground or in midair. Individuals tend to form permanent pairs and occupy the same large territory in which they nest year after year. This species nests in trees taller than 20 m within 1 km of a permanent watercourse or wetland. As a consequence of the secretive and solitary nature of this species, it is commonly regarded as Australia's rarest and least-known raptor. The major threat to the Red Goshawk is clearing of its preferred habitat (Garnett and Crowley 2002).

The Red Goshawk was not recorded during this assessment, but this species has been previously recorded immediately to the northeast of the site (DOE 1997), as well as in the wider area. Given its secretive behaviour and large home range, this species may utilise some or all of the Mount Lofty site as part of a larger hunting range. Clearing of vegetation, particularly open forest and woodland on the escarpment, would be likely to impact upon the Red Goshawk if present.

3.3.7 Square-Tailed Kite, *Lophoictinia isura*

The Square-Tailed Kite is a widespread but sparsely distributed bird of prey, occurring through much of coastal and subcoastal mainland Australia (DOE 1997, Garnett and Crowley 2002). It hunts in open eucalypt forests and woodlands, along with adjacent heathlands, flying slowly through or adjacent to the canopy of trees or shrubs and seizing small birds and their nestlings. The Square-Tailed Kite is generally nomadic, and may be solitary or in well dispersed pairs. This species typically nests in mature living trees, in areas of forest or woodland at least several hundred hectares in size (DOE 1997). Land clearing is thought to be the major threat to this species, which is believed to have declined due to extensive clearing of its preferred habitat (DOE 1997, Garnett and Crowley 2002).

No Square-Tailed Kites were recorded on the Mount Lofty site during this fauna assessment. However, this species has been recorded approximately 20 km east, and may utilise habitat within the site. Clearing of vegetation, particularly open forest and woodland, would be likely to impact upon the Square-Tailed Kite if present.

3.3.8 Black-Breasted Button-Quail, *Turnix melanogaster*

The Black-Breasted Button-Quail is a small cryptic bird that is restricted to dry rainforest, vine thicket and shrubby scrub with deep leaf litter in southeastern Queensland (Garnett and Crowley 2002). It forages by scratching in the leaf litter for insects. Adults appear to be sedentary, and form small groups typically composed of a female and several males (DOE 1997). The major threat to the Black-Breasted Button-Quail is land clearing, with over 90% of its habitat having been cleared, leading to local extinction and population fragmentation (Garnett and Crowley 2002). As a result, the species is comprised of small, localised sub-populations in suitable habitat (DOE 1997). Other threats include habitat degradation by grazing and, as a ground-dwelling bird that reacts to danger by becoming immobile, feral predators. This species is listed in the IUCN Red List because its total world population is thought to contain fewer than 2,500 mature individuals and this continues to decline in response to severe fragmentation of its habitat such that no single population is thought to exceed 250 mature individuals (Smyth and Young 1996).

No individuals of the Black-breasted Button-quail were recorded during this assessment. However, this is a small and cryptic bird, which has been previously recorded immediately adjacent to the Mount Lofty site (DOE 1997). Given the large extent of its preferred habitat (vine thicket) on the site and the previous records, it is likely that this species is present on the site. Any clearing or burning of vine thicket is likely to impact upon the Black-breasted Button-quail if present, as is any increase in feral predators such as cats, dogs and foxes.

3.3.9 Glossy Black-cockatoo, *Calyptorhynchus lathami*

The Glossy Black-cockatoo occurs from central Queensland in the north as far south as the Dandenong ranges in Victoria. This species is a wide-ranging seedeater that feeds almost exclusively on the seed of She-oaks (*Allocasuarina* spp.) (Garnett and Crowley 2002). Glossy Black-cockatoos are nomadic and migratory; travelling widely to where fruiting She-oaks are located (DOE 1997, Morcombe 2003). They require tree-hollows for nesting, generally in eucalypts. Major threats to this species are clearing of their habitat, burning of fire-sensitive She-oak species, habitat fragmentation leading to increased competition for hollows from other native species, and coastal development (Garnett and Crowley 2002).

Glossy-black Cockatoo was not recorded on the Mount Lofty site during this assessment, but has been recorded in the immediate area by other recent fauna surveys (DOE 1997, Boobook 2005). Stands of She-oak were recorded in the lower reaches of Rocky Creek, near the northwestern boundary of the site, and Glossy-black Cockatoos may periodically feed on the seeds of these trees when they are fruiting. Any clearing of She-oaks or of other vegetation resulting in the loss of hollow-bearing trees may potentially impact upon this species.

3.3.10 Swift Parrot, *Lathamus discolour*

The Swift Parrot inhabits eucalypt forests and woodlands, especially box-ironbark woodlands, breeding in hollows in mature and senescent trees. Though it will feed on lerps and seeds, this species shows a preference for eucalypt nectar and follows the blossoming of various eucalypt species (Schodde & Tideman 1990). The Swift Parrot breeds only in Tasmania and over-winters on the Australian mainland, from March to November, as far north as southeast Queensland. On the mainland, the Swift Parrot congregates in areas where eucalypts are flowering profusely, often returning regularly to the same locations, although sites visited may vary from year to year as nectar availability does. The major threat to the Swift Parrot on mainland Australia is clearing of its preferred habitat for agriculture and residential development (Garnett and Crowley 2002). The Swift Parrot population appears to be small and declining, with an estimated total of approximately 1,000 breeding pairs in 1995/96 (Garnett and Crowley 2002).

Swift Parrots were not recorded during this assessment, although the field survey was carried towards the end of the period spent on the mainland, and so any individuals present may have already flown south. This species may feed on flowering eucalypts on the Mount Lofty site from time to time, depending on blossoming and nectar availability. Swift Parrots may potentially be impacted by clearing of winter-flowering eucalypts such as the Narrow-leaved Ironbark *Eucalyptus crebra*, which flowers from May to August (Brooker and Kleinig 1994).

3.3.11 Powerful Owl, *Ninox strenua*

The Powerful Owl is the largest species of owl in Australia, inhabiting eucalypt forests along the Great Dividing Range from western Victoria north to Rockhampton. This species' preferred habitat is tall open forest, although they often roost in denser vegetation. The general diet of this species consists mainly of small to medium-sized tree-dwelling mammals such as possums and gliders, but it will also take flying-foxes and rats. Powerful Owls need to eat the equivalent of a large possum every two – three days to survive (Schodde & Tideman 1990), and a sedentary pair hunts over an area of up to 1,000 ha to achieve this. Nests are in large tree hollows in large living eucalypts 150-500 years old (Garnett and Crowley 2002).

A large owl pellet was found in Ironbark woodland during this assessment, and is likely to be from a Powerful Owl, but cannot be definitively attributed to this species. Powerful Owls have been recently recorded on the site during another fauna survey, with 2 adults and one juvenile observed roosting in riparian vine forest along Rocky Creek (Boobook 2005). A Powerful Owl feather was also found in open Ironbark woodland. Powerful Owls are likely to hunt across much or all of the site as part of a larger territory, up to 10 square km. Clearing of vegetation, especially the dense vegetation along the creeks, would impact upon this species, as would the removal of eucalypts with hollows.

3.3.12 Regent Honeyeater, *Xanthomyza phrygia*

The Regent Honeyeater lives in woodland and open forest on the eastern and western flanks of the Great Dividing Range. They are most often recorded from box-ironbark forest, where they prefer the wetter locations such as creek flats and river valleys (Garnett and Crowley 2000). This species has declined throughout its range, and also suffered a contraction of its range. Although in Queensland it formerly occurred as far north the Dawson River, it is now limited to southern Queensland. Most recent records are from the New England tablelands, and there are few recent records from within southeast Queensland, with no known breeding records (DOE 1997). For this reason, the Regent Honeyeater is not considered likely to utilise habitat within the Mount Lofty site.

3.3.13 Spotted-tailed Quoll, *Dasyurus maculatus maculatus*

The southern subspecies of the Spotted-tailed Quoll formerly ranged from southeastern South Australia, across Tasmania, through coastal and sub-coastal Victoria and NSW, and into southeastern Queensland as far north as Fraser Island (Strahan 1995). Another subspecies, *D. m. gracilis*, is found in northern Queensland. The southern subspecies no longer occurs in South Australia, and has declined in Victoria, southeastern NSW and southeastern Queensland (DOE 1997). The Spotted-tailed Quoll inhabits rainforest and dense forests, and is an opportunistic predator eating small to medium sized mammals, birds, reptiles, insects and carrion (Strahan 1995, DOE 1997). It is partly arboreal, and dens in tree hollows, hollow logs and rock crevices (Menkhorst and Knight 2004). Within southeastern Queensland, the main remaining populations are in the Blackall/Conondale Ranges, Main Range, Lamington Plateau and the McPherson and Border Ranges (DOE 1997). Threats to the species include loss of habitat through clearing and logging, competition with introduced predators such foxes and cats, persecution, and poisoning from fox and dog baiting programs (Strahan 1995).

Spotted-tailed Quolls were not recorded during this assessment and have not been previously recorded from the immediate area. They are difficult to observe, however, because of their behaviour and their dense preferred habitat, and so may utilise habitat on the Mount Lofty site. Clearing of habitat and baiting programs to control feral animals such as dogs and foxes would impact upon this species if present.

3.3.14 Brush-tailed Rock-wallaby, *Petrogale penicillata*

The Brush-tailed Rock-wallaby occurs in rocky areas either on scree slopes or cliff lines, in rainforest gullies, wet and dry sclerophyll forest, and open woodland (Strahan 1995, Johnson 2003). The most preferred habitat includes sites with numerous ledges, caves and crevices, offering multiple escape routes. Generally, favoured sites have a northerly aspect allowing the rock-wallabies to bask in the sun in cool weather (Strahan 1995). This species was originally widespread and abundant in New South Wales and northern Victoria, but has since declined significantly due to competition from introduced herbivores such as rabbits and goats and predation from foxes. In southeastern Queensland, significant populations remain at Main Range and Moogerah Peaks, and the species has been recently recorded in Deongwar State Forest near Esk, northeast of Toowoomba (DOE 1997).

Although the Brush-tailed Rock-wallaby was not recorded at the Mount Lofty site during this assessment, some habitat is present on the site as scree slopes in semi-evergreen vine thicket along the escarpment, and as low sandstone cliffs near the northeastern boundary in open ironbark woodland. These areas are not as rocky as the most preferred habitat for this species, but it is possible that it may be utilising rocky habitat on the site, as it has been recorded less than 20 km to the northeast (DOE 1997). Disturbance to rocky habitats would impact on this species if present.

3.3.15 Long-nosed Potoroo, *Potorous tridactylus tridactylus*

The Long-nosed Potoroo occurs in wet and dry sclerophyll forests from southwest Victoria to southeastern Queensland, where its distribution is bounded by the McPherson Range to the south, the Great Divide to the west and Dawes range to the north (DOE 1997, Johnson 2003). It requires a dense ground layer of shrubs and grass for shelter, and prefers areas with light sandy soil, where it digs for fungi, roots and invertebrates (Strahan 1995, DOE 1997). The Long-nosed Potoroo is cryptic and rarely seen as it seldom leaves the shelter of thick ground cover, where it rests during the day in depressions under tussock grasses and grass trees (Johnson 2003). Threats to this species include clearing, fire, grazing and competition with introduced herbivores (DOE 1997).

Long-nosed Potoroos were not recorded during this assessment, and have not been previously recorded in the immediate area. However, as a cryptic and difficult to detect animal, it is possible (although unlikely) that this species is present in preferred habitat on the Mount Lofty site. If present, destruction of thick ground cover by clearing or fire would impact upon this species.

3.3.16 Grey-Headed Flying-Fox, *Pteropus poliocephalus*

The Grey-headed Flying-fox is the largest of the fruit bats, and occurs from the Gladstone area south along the east coast into southern Victoria (Menkhorst and Knight 2004). It forms communal roosts or camps, often in the hundreds of thousands, in gullies with a dense vegetation canopy. It feeds on rainforest fruits, and flowers of eucalypts, and other trees. Individuals travel up to 50 kilometres from their camp to forage on flowering eucalypts, paperbarks and turpentines. The Grey-headed Flying fox is threatened by the destruction of camp areas, and by clearing and development of its feeding habitat (DOE 1997).

A camp of five to ten thousand Grey-headed Flying-foxes is present in riparian vine forest along a tributary of Rocky Creek near the northern boundary of the site (Boobook 2005). Interference with or destruction of the vegetation in the vicinity of the camp would impact upon this species.

3.3.17 Large-eared Pied Bat, *Chalinolobus dwyeri*

The Large-eared Pied Bat occurs in eucalypt forest and rainforest from Blackdown Tableland in central Queensland, to southeastern NSW (Menkhorst and Knight 2004). Habitat requirements are poorly understood for this species, but most records are from drier sclerophyll forests and woodlands (DOE 1997), although in southeastern Queensland it has mainly been recorded from higher altitude moist tall open forest adjacent to rainforest (Duncan *et al.* 1999). The only recent records in southeast Queensland have been from the Border Ranges, Main Range, Gambubal State Forest, Wivenhoe Dam and Moogerah Dam (DOE 1997, Duncan *et al.* 1999). The Large-eared Pied Bat roosts in small groups in mine shafts, caves and the abandoned conical mud nests of Fairy Martins (Strahan 1995), and it has been suggested that natural roosts of this species may depend heavily on sandstone outcrops (Duncan *et al.* 1999). This species appears to be sparsely distributed within its range, with localised distributions. Destruction of roost sites is a known threat to the Large-eared Pied Bat, and other possible threats include clearing of habitat for agriculture and urban development, and predation by feral animals (Duncan *et al.* 1999).

The Large-eared Pied Bat was not recorded on the Mount Lofty site during this assessment, but may utilise habitat within the site. Damage to potential roost sites, including sandstone outcrops, may impact upon this species.

3.3.18 Eastern Long-Eared Bat, *Nyctophilus timoriensis*

In eastern Australia the Eastern Long-eared Bat inhabits a range of dry woodlands and shrublands in arid and semi-arid country, including River Red Gum forest, semi-arid savannah woodland and mallee. They can also be found in high rainfall areas such as southwest WA and Tasmania, where they live in wet sclerophyll forest (Strahan 1995, Menkhorst and Knight 2004). Individuals of this species roost singly or in pairs in tree hollows, fissures in branches and under dried sheets of bark. Threats to this species include clearing for agriculture, timber harvesting, loss of hollow-bearing trees and grazing (Duncan *et al.* 1999).

The Large-eared Pied Bat was not recorded on the Mount Lofty site during this assessment, but may utilise habitat within the site. Damage to potential roost sites, including hollow-bearing trees, may impact upon this species.

4 FAUNA HABITAT VALUES

Six different broad habitat types are represented on the Mount Lofty site. Each of these provides potential habitat for a wide range of fauna species. Detailed descriptions of each of the habitat types are given below.

4.1.1 Open Eucalypt Forest

This habitat type consists of eucalypt forest with a relatively open shrub layer over a grassy understorey, and is present on the plateau on the top of the escarpment (mapped as Regional Ecosystems 12.8.14 and 12.8.17). The condition of this habitat is moderate to good for a range of fauna. Many of the trees are relatively young, but there are also scattered large older trees with hollows, providing habitat for hollow-dependent fauna. Fallen timber on the ground provides refuge for ground-dwelling reptiles and small mammals. Towards the edge of the escarpment there are many loose basalt rocks on the ground, providing good habitat for reptiles. Two individuals of the Collared Delma, listed as Vulnerable under both State and Commonwealth legislation, were found under basalt rocks in this habitat type. Open Eucalypt Forest also provides habitat for a number of common species including Bearded Dragon, Tussock Rainbow-skink, Fence Skink, Sulphur-crested Cockatoo, Laughing Kookaburra, Silvereye and Australian Magpie. It also provides potential habitat for the threatened Powerful Owl and Red Goshawk.

A smaller patch of Open Eucalypt Forest is present on hillsides in the northwest corner of the Mount Lofty site, in similar condition to that on the plateau but with a generally more open shrub layer. This was the only location on the site where Scute-snouted Calyptotis, Eastern Yellow Robin, Jacky Winter, Satin Flycatcher and Black-faced Monarch were recorded.

4.1.2 Open Ironbark Woodland

This habitat type occupies most of the eastern half of the Mount Lofty site, including the escarpment and lower hillsides (mapped as Regional Ecosystem 12.9-10.7). It comprises open woodland dominated by ironbarks over a thin shrub layer and a sparse grassy understorey. This habitat type is in good condition for fauna, with little disturbance. Scattered large trees provide habitat for hollow-dependent fauna, while significant amounts of fallen timber provide refuge for ground-dwelling reptiles and mammals. Open Ironbark Woodland provides habitat for a range of common fauna such as Lace Monitor, Pale-headed Rosella, Galah, Little Friarbird, Blue-faced Honeyeater and Rainbow Bee-eater. It is also potential habitat for the threatened Swift Parrot, Red Goshawk and Square-tailed Kite. A large owl pellet found in this habitat is likely to be from the threatened Powerful Owl, although it is not possible to be certain.

Sandstone outcrops occur near the base of the hillsides close to the northeastern boundary. Numerous loose flat rocks are present on or close to these outcrops, and these provide excellent habitat for a range of reptile fauna. Two individuals of the threatened Collared Delma were recorded under loose sandstone rocks on these outcrops. This sandstone is also habitat for common reptile fauna including the Three-clawed Worm-skink, Red-throated Skink and Brown Tree Snake.

4.1.3 Semi-evergreen Vine Thicket

Much of the western part of the Mount Lofty site is taken up with this habitat type, which comprises low dense closed dry microphyll forest (mapped as Regional Ecosystems 12.8.21 and 12.9-10.15). It occurs on the escarpment, in the gullies and on the hillsides towards the vicinity of Rocky Creek in the northwest of the site. This habitat type is generally in good condition for fauna, and provides habitat for common fauna including Rufous Fantail, Common Koel and Eastern Whipbird. It also provides potential habitat for the threatened Black-breasted Button-quail.

4.1.4 Riparian Vine Forest

A thin strip of Riparian Vine Forest is present along the margins of Rocky Creek, in the northwest of the site. This habitat type is in good condition, and comprises closed dense multilayered forest including large figs. The threatened Grey Goshawk was observed in Riparian Vine Forest during this assessment, while another recent fauna survey along Rocky Creek also recorded Grey Goshawk, along with Powerful Owl and a large camp of Grey-headed Flying-fox in this habitat (Boobook 2005). This habitat type also supports a range of common fauna including Giant Barred Frog, Emerald Dove, Shining Bronze-Cuckoo, Lewin's Honeyeater and Rufous Fantail. Riparian Vine Forest is also potential habitat for threatened species including Tusked Frog, Orange-tailed Shadeskink and Spotted-tailed Quoll.

4.1.5 Lantana Thickets

Much of the formerly cleared land on the lower hillsides in the middle north of the Mount Lofty site has become overgrown with Lantana, forming dense thickets. Although fauna values are generally low in these Lantana thickets, it still provides habitat for common fauna such as Double-barred Finch, Pale-headed Rosella, Lewin's Honeyeater, and Variegated Fairy-wren. In addition, Lantana thickets adjacent to Semi-evergreen Vine Thicket may also provide potential habitat for the Black-breasted Button-quail.

4.1.6 Cleared Land

In the southeastern corner of the site, above the escarpment, is a large area of cleared land around the rifle range, currently used for agisting horses. This area is generally poor in fauna habitat values, although it does provide habitat for a few common fauna species including Noisy Miner, Masked Lapwing, Pied Currawong, Torresian Crow, Australian Magpie and Willie Wagtail, along with the scattered trees adjacent. This cleared land is not potential habitat for any threatened species, and has the lowest general fauna habitat values of the entire site.

4.1.7 Connectivity

Almost all the remnant vegetation on the Mount Lofty site has been mapped as State Wildlife Corridor, except for small sections near the eastern boundary. Many species of wildlife need to move through large areas of vegetation, whether to disperse, hunt, or search for mates. Wildlife corridors link patches of habitat, as well as providing valuable habitat in themselves. They also provide corridors for gene flow, reducing the risk of population fragmentation and genetic isolation, and consequent higher extinction risk.

Remnant vegetation on the Mount Lofty site forms an important part of a much larger wildlife corridor that links two very large habitat patches: Main Range to the south and the area around Mount Cross including Deongwar State Forest to the northeast. Although somewhat fragmented by roads and clearing, this wildlife corridor provides a vital link along the Great Divide between these important faunal refuges, allowing mobile species such as Powerful Owl, Red Goshawk and Spotted-tail Quoll to move between habitat patches. The Mount Lofty site is located at one of the most narrow points along this corridor, and so loss of the remnant vegetation would result in a significant discontinuity in this important path for the movement of wildlife.

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Appendix A: Fauna Species Recorded During the Assessment

Species recorded during habitat assessments and fauna searches.
* - Introduced species.

Common name	Scientific name
AMPHIBIANS	
Eastern Pobblebonk	*Limnodynastes dumerilli*
Striped Marsh frog	*Limnoynastes peronii*
Spotted Marsh Frog	*Limnodynastes tasmaniensis*
Great Barred Frog	*Mixophyes fasciolatus*
Green Tree Frog	*Litoria caerulea*
Eastern Sedge Frog	*Litoria fallax*
Peron's Tree Frog	*Litoria peronii*
Little Red Tree Frog	*Litoria rubella*
Cane Toad	*Bufo marinus**
REPTILES	
Eastern Bearded Dragon	*Pogona barbata*
Collared Delma	*Delma torquata*
Red-throated Skink	*Acritoscincus platynotum*
Three-clawed Worm-skink	*Anomalopus verreauxii*
Scute-snouted Calyptotis	*Calyptotis scutirostrum*
Tussock Rainbow-skink	*Carlia vivax*
Fence Skink	*Cryptoblepharus virgatus*
Lace Monitor	*Varanus varius*
Brown Tree Snake	*Bioga irregularis*
BIRDS	
Australian Wood Duck	*Chenonetta jubata*
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Black-faced Monarch	*Monarcha melanopsis*
Blue-faced Honeyeater	*Entomyzon cyanotis*
Brown-headed Honeyeater	*Melithreptus brevirostris*
Channel-billed Cuckoo	*Scythrops novaehollandiae*
Dollarbird	*Eurystomus orientalis*
Double-barred Finch	*Taeniopygia bichenovii*
Eastern Whipbird	*Psophodes olivaceus*
Eastern Yellow Robin	*Eopsaltria australis*
Emerald Dove	*Chalcophaps indica*
Galah	*Cacatua roseicapilla*
Grey Butcherbird	*Cracticus torquatus*
Grey Fantail	*Rhipidura fuliginosa*
Grey Goshawk	*Accipiter novaehollandiae*
Jacky Winter	*Microeca fascinans*
Common Koel	*Eudynamys scolopacea*
Laughing Kookaburra	*Dacelo novaeguineae*
Lewin's Honeyeater	*Melipha galewinii*
Little Friarbird	*Philemon citreogularis*
Magpie	*Gymnorhina tibicen*
Masked Lapwing	*Vanellus miles*
Nankeen Kestrel	*Falco cenchroides*
Noisy Friarbird	*Philemon corniculatus*

Common name	Scientific name
Noisy Miner	*Manorina melanocephala*
Pale-headed Rosella	*Platycercus adscitus*
Peaceful Dove	*Geopelia striata*
Pied Currawong	*Strepera graculina*
Rainbow Bee-eater	*Merops ornatus*
Red-browed Finch	*Neochmia temporalis*
Rufous Fantail	*Rhipidura rufifrons*
Satin Flycatcher	*Myiagra cyanoleuca*
Shining Bronze-Cuckoo	*Chrysococcyx lucidus*
Silvereye	*Zosterops lateralis*
Sulphur-crested Cockatoo	*Cacatua galerita*
Torresian Crow	*Corvus orru*
Variegated Fairy-wren	*Malurus lamberti*
Willie Wagtail	*Rhipidura leucophrys*
Yellow-tufted Honeyeater	*Lichenostomus melanops*
MAMMALS	
European Hare	*Lepus europeaus**
Common Brushtail Possum	*Trichosurus vulpecula*
Dog	*Canis familiaris* *
Black Rat	*Rattus rattus**

DRAFT
Aboriginal Heritage Desktop Study
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland

30 November 2005

Prepared for:
Property Disposals Task Force
BP-2-A013
Department of Defence
Canberra ACT 2600

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Aboriginal Heritage Desktop Study
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland
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1 INTRODUCTION

The Department of Defence Corporate Services & Infrastructure Group (Defence) is seeking to undertake a Property Disposal Study for the Mt Lofty Rifle Range located at Toowoomba, Queensland. Defence is assessing options for the potential disposal of the Mt Lofty Rifle Range and is seeking to gain a clear understanding of potential constraints and associated financial implications associated with environmental, heritage, infrastructure and land use issues.

HLA-Envirosciences Pty Ltd (HLA) was commissioned by Defence in October 2005 to conduct a Property Disposal Study for the Mt Lofty Rifle Range. A component of the disposal study is a consideration of Aboriginal heritage issues. This desktop study has therefore been commissioned to identify the nature and extent of any Indigenous archaeological resources within the Mt Lofty study area.

This report will identify any indigenous cultural heritage issues and values within the study area and outline the relevant management options. As outlined in the brief, this report will;

- Conduct background research of relevant published documentation regarding the archaeology and early history of the study area. Provide an overview of these aspects. Create a series of predictions regarding potential for areas to contain cultural materials;
- Undertake a search of the DNRM Cultural Heritage Register for information about any recorded areas in the study area and surrounding region;
- Identify relevant Commonwealth and State legislation and policies affecting cultural heritage issues for the site;
- Establish the current Native Title situation for the study area and identify the current Native Title Claimant group(s);
- Collate existing information on historical and indigenous values from other sources such as local historical societies and local museums; and
- Undertake a site visit to determine previous land use and impacts, current visibility conditions and terrain constraints.

The desktop report will also provide information and guidance in relation to:

- Assessment of cultural heritage issues likely to affect the study area;
- Cultural heritage values and recommendation of relevant management options;
- Identification of cultural heritage constraints; and
- Determination of Disturbance category.

1.1 Study Area

The study area encompasses a plateau, steep escarpment and lower-lying undulating ranges overlooking the Lockyer Valley (**Plates 1, 2** and **3**). The Mount Lofty Rifle Range constitutes 379 hectares of generally undeveloped land located on the north-eastern fringes of the city of Toowoomba, Queensland (**Figure 1**). The study areas south and western boundaries are constrained by Rifle Range Road and Martini road respectively, while the north and eastern edges are located in the vicinity of the Withcott outskirts at the base of the escarpment.

1.2 Project Team

The indigenous component of this report has been authored by Cornelia de Rochefort and Alan Williams with Jakub Czastka providing technical review. On site assessment was undertaken by Alan Williams. Bret McLennan was responsible for QA/review, and support services were provided by Kim Wilkinson and Tim Osbourne.

1.3 Report Structure

The report structure relates the sections of the report and their contribution to the study.

Section 2 of this report outlines the identified Native Title situation and Traditional Owners of the region. **Section 3** summarises the regional archaeological and environmental context for the assessment of the study area. This review specifically targets known sites within the area based on the DNRM search, past reports and landscape evolution. **Section 3** also includes information obtained during the site visit to the area by HLA personnel. **Section 4** provides information on the relevant Commonwealth and State legislation. **Section 5** outlines the likely cultural heritage issues and provides suggestions on constraints and opportunities. This section also includes an identification of cultural values where appropriate, management options and a Determination of Disturbance Category.

A summary of the statutory requirements regarding Aboriginal heritage is provided in **Section 4**. This is based on experience with the heritage system in Qld and does not purport to be legal advice. It should be noted that legislation, regulations and guidelines change over time and users of the report should satisfy themselves that the statutory requirements have not changed since the report was written.

1.4 Limitations

This assessment is based on the existing environmental and archaeological knowledge of the study area, within the larger context of the Darling Downs region. This discussion has been based on the reports prepared by others (as cited in this report) and HLA has relied on these reports and has not sought to independently verify the results and interpretations in these reports.

Predictions have been made about the probability of subsurface archaeological materials occurring within the study area. It is possible that materials may occur in any landscape context, and the assessment of subsurface materials refers to the likelihood of occurrence based on surface indications and environmental context.

HLA has undertaken a search of the DNRM register. The search results are provided in **Appendix B**. The register searches are constrained by the amount of data in the register and the quality of that data (for example grid references can be inaccurate). Large areas of Qld may not have been systematically searched and may contain Aboriginal objects and other heritage values not recorded on the DNRM register.

Additionally, the DNRM reports database can only be searched by the title of the report, which may not indicate the geographical location of the area covered. This means that it is possible that some known sites and some reports may have been omitted from this study. Sites and reports are added and removed from the DNRM register and therefore the accuracy of information provided is only valid on the day the register is searched and to the nature of the search.

2 ABORIGINAL COMMUNITIES

As requested in the brief, HLA sought to identify the relevant Aboriginal communities for the Mount Lofty region. At this stage, HLA has only identified these groups as being relevant and has yet to make any form of contact with them.

HLA undertook a search of the Native Title Tribunal on 5 October 2005. The search identified two registered "active" applications on the Register of Native Title Claims:

- QC99/4 – Western Wakka Wakka people; and
- QC03/15 – Jagera people #2[1].

It is HLA's understanding that both applications are currently being processed for Native Title Claim – both being identified as "active" rather than "finalised". Additional research by HLA and discussions[2] with nearby Universities and other organisations revealed two other potential traditional owners, specifically Lillian Colonel of the Jarowair tribe and Paddy Gerome of the Giabal tribe. These two tribes, specifically the latter, have their tribal boundaries within the Toowoomba region (French 1989: 12). It seems likely from Tindale's (cit. French 1989:12) map that the study area is completely within Giabal country, however the Jarowair and Jagera are nearby, while the Western Wakka Wakka encompasses all three of these tribal areas.

It should also be noted that during consultation with the Qld Department of Natural Resource Management (DNRM) in relation to the archaeological site search for Mount Lofty, HLA was informed of two Aboriginal communities that required consultation for any information to be released on the area. The first group was identified as the Jagera #2 people outlined below, the second group was the Mandingalbay Yidinji People #1. HLA believes this latter group to be an error by DNRM, since the Mandingalbay Yidnji people are currently placing a native title claim in Cairns and seem to have little relevance to Toowoomba. However, Mandingalbay Yidinji People #1 can be contacted through Mr. Peter Poynton (Terry Fisher & Co. PO Box 5169, Cairns, QLD. Ph: 07 4031 3495, Fax: 07 4031 9085)

The Western Wakka Wakka people application is being undertaken by Mr Adrian Beattie, Mr Bill Hall, Mr Neville Turbane, Ms Jean Smith (nee Turbane), Ms Margaret McLeod, Ms Patricia Hall, Ms Sandra Bauwens (nee Turbane) and Mr Brian Tobane. The basis of their claim is from Jack Darlow, who was known to be a Western Wakka Wakka person. Their claim is seeking to cover an area of some 32,941km^2 extending from Nobby to Gulguba and including the Toowoomba LGA.

The Western Wakka Wakka application includes 18 rights and interests, a number of which refer to their status as Traditional Owners and their interests in the cultural heritage of their people. A complete copy of their application and rights and interests is presented in **Appendix A**.

Contact with the Western Wakka Wakka people can be sought through Eddy Neumann of *Craddock Murray Neumann Solicitors* (Level 2, 255 Castlereagh St, Sydney, NSW 2000. Ph: 02 9283 4755, Fax: 02 9283 4180).

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[1] It appears from an on-line search of the register that the Jagera people have already placed a claim, which was discontinued in 2002. This accounts for this application having #2 in the title.
[2] These discussions were generic regarding the Toowoomba region and at no time was Mount Lofty or Defence mentioned.

The Jagera people #2, specifically the Bonner family, have placed a claim for an area covering some 6100km^2 from (and including) Brisbane to the base of the Dividing Range at Toowoomba. While the map attached to the claim does not appear to include the study area, it should be noted that the map is of a poor resolution and the boundaries are within the general vicinity of Mount Lofty. Furthermore, the traditional boundaries (Tindale cit. French, 1989:12) of the Jagera people appear to abut the base of the Dividing Range in the Toowoomba area.

The Jagera people #2 application also has a number of rights and interests. Most relevant to this study is their wish to participate in maintaining and protecting Aboriginal cultural sites.

The Jagera people #2 can be contacted through the *Jagera People Association* (78 Park Road, Wooloowin, QLD 4030. Ph: 07 3315 6463).

In summary, it seems likely that four groups have laid claim to the study area – Jagera people #2, Jarowair, Giabal and Western Wakka Wakka. While another group, the Mandingalbay Yidinji People #1, were identified they seem unlikely to be relevant to the study area, placing a claim in Cairns.

The complete Native Title search is provided in **Appendix A**.

3 BACKGROUND RESEARCH

The background research section has been split into the following areas: environmental context, historical overview, regional and site specific archaeological context, previously recorded sites and physical inspection information.

3.1 Environmental Context

This section is based purely on documentary research and may in some areas contrast with the physical inspection of the study area presented in **Section 3.4**.

Mount Lofty is located in the township of Toowoomba, which is the principal centre for communities in the Darling Downs region. The Darling Downs are situated west of the Great Dividing Range in the south-eastern corner of Queensland (**Figure 1**). The region has been divided into three zones. The eastern zone, some 20-30km wide, along the western slopes of the Range is characterised by rounded flat topped basalt hills marking off broad, shallow black clay valleys and basins, while the narrow western zone is marked by a scrubby and dry sandstone belt. The central zone is the Condamine River, its anabranches and tributaries forming part of the headwaters of the Murray-Darling system (French 1989). Toowoomba is located within the eastern zone of the region situated on a plateau immediately west of the Range, which generally lies over 600m a.s.l. Westward, the land surface falls gently (slopes about 3 °) to the plains of the Darling Downs (at about 450-500m a.s.l.) and the streams of the Murray-Darling River catchment (Willey 2003).

The geology of the region is represented schematically in **Figure 2.** The region consists of a concealed basement of late Palaeozoic rocks, which are overlain by a sequence of mid-Mesozoic shales and sandstones. This in turn is overlain by mid-Tertiary basalts and associated volcanics and palaeosols known as the Toowoomba volcanics. These volcanics are a member of the Main Range Volcanics (MRV), which are the most extensive surface unit in the region. Quaternary denudation (the combined process of weathering and erosion) has resulted in more recent soils, colluvial and alluvial deposits.

From Willey's (2003) geology map, it appears that the study area is largely situated over a number of MRV Lava Pools with its western and southern edges overlaying the Upper Laterite deposits (**Figure 3**). The MRV unit comprises materials derived from several small local eruptive centres; mostly basalt flows and various inter-beds of tuffs. The evolution of an MRV lava pool is represented in **Figure 4.** Lava pools of the MRV unit display two distinctive stages; an explosive phreatic eruption[3], which forms a cratered tuff cone, and an effusive lava-forming magmatic eruption, filling and overflowing the crater. Post-eruptive erosion of these eruptive centres results in rapid removal of the tuff crater, undercutting the fresh basalt in the crater resulting in screes (Willey 2003). The MRV unit is bounded by two geological land surfaces. The lower surface is bounded by thin immature soils (Lower Palaeosol) that were formed on Mesozoic strata, while the upper surface is marked by the lateritic[4] Upper Palaeosol (**Figure 2**). At Mount Lofty at least two laterite horizons appear to be separated by a possible tuffaceous material (Willey 2003). It should also be noted that further east at the base of the escarpment is evidence of sandstone deposits within the Walloon Coal Measures. Other sandstone layers are also present in the lower Woogaroo and Marburg subgroups beneath these coal measures.

[3] Phreatic eruptions occur when rising hot lava or magma makes contact with either ground water or surface water

[4] A red residual soil in humid tropical and subtropical regions that is leached of soluble minerals, aluminium hydroxides, and silica but still contains concentrations of iron oxides and iron hydroxides.

Toowoomba can be split into two types of landform units – the Toowoomba plateau and the Basaltic uplands. The former is only located in the city of Toowoomba generally above 650m AHD (Australian Height Datum) and consisting of flat parallel low ridges largely covered by red lateritic soils (see below). The latter consists of parallel layers of basaltic rock on which denudation has proceeded. This basaltic landform consists of low flat-crested ridges with numerous narrow flattish spurs projecting from the slopes below the crests (Thompson and Beckmann1957). The study area largely falls within the Basaltic uplands with some evidence of the Toowoomba plateau landforms to the south and west side of the rifle range.

Generally speaking, the soils of the Toowoomba region have been classed into four groups;

1. The red soils of the Toowoomba plateau.
2. The generally dark and brown soil types of the basaltic uplands of the Eastern Darling Downs.
3. Soils developed on alluvial materials.
4. Immature soil types found on escarpment slopes.

The study area contains a number of these soil types, but most predominantly the thin dark brown weathered basaltic soils of the Eastern Darling Downs (referred to as *Shallow black earths* by Beckmann *et al* 1974). Beckmann *et al.* (1974) describes these soils as shallow to moderately deep (<90cm) to weathered basalt, dark coloured heavy clay soils, self mulching surface and medium to blocky subsoils. Although Willey (2003) points out that these soils are not always mature, often thinly overlying weathered basalt without any form of subsoil.

Towards the south and western edges of the site the red soils of the Toowoomba region are present (identified as *Euchrozems* in Beckmann *et al.* 1974). The red colouration of these soils is caused by laterization or strong weathering which, produces high concentrations of secondary formed ferric (red form of iron) minerals like hematite. This red soil is thought to be the lateritic Upper Palaeosol described by Willey (2003) and is in fact a description of a deeply weathered soil profile, or regolith profile. Regolith is classified as the material that lies between bedrock and the surface and generally refers to deep *in situ* soil profiles and is described through a series of weathering stages moving down through the profile.

Towards the north and east end of the study area overlying the sandstone bedrock, soils typically consist of eroding red lateritic soils possibly defined as the Lower Palaeosol by Willey (2003).

The indigenous vegetation of the general area ranges from grassy woodland and open forest communities to tall closed forest communities. The mountain ranges of the eastern zone support stands of silver ash, silky elm, camphor wood, white bark and hoop pine characteristic of rainforest, while the foothills feature eucalyptus stands of blue gum, yellow box, and ironbark. Open forest was the dominant vegetation on the deep soils on top of the range at Toowoomba, supporting forest eucalypts such as tallow-wood, stringybarks and blackbutt, while iron barks predominate on the thinner soils of escarpments.

3.2 Historical Overview

This section outlines the indigenous historical context of the study area. Literature concerning the Indigenous history of Toowoomba and Mount Lofty is sparse, as most researchers have dealt with Aboriginal history on a regional basis. As such, a more general Indigenous history, dealing with the Darling Downs region is provided.

3.2.1 Indigenous History

Little is known about the history of the Aboriginal people on the Darling Downs before the arrival of Europeans. According to Tindale (1964) the Darling Downs region was home to four Aboriginal tribes; the *Barrunggam* to the west of Dalby, the *Jarowair* around the Bunya mountains to the north, the *Keinjan* around Warwick and the *Giabal* around Toowoomba. Coastal Aboriginies allegedly knew these tribes as the Gomaingguru- 'men of the Condamine' or Gooneburra –'fire blacks' (from their habit of frequently firing grasslands) (French 1989). French (1989) goes on to outline that the Jagara (or Turubul) were known to dominate the Lockyer valley to the east of the Great Dividing Range. Although Meston (1895) suggests that the "Turubal" language was actually spoken on the Toowoomba plateau suggesting some confusion or integration of the tribes within this peripheral zone. Other groups such as the Bandajalang and Wakka Wakka were also known to occur in the general region (Tindale 1974).

Much of what is known about Aboriginal society at the time of contact is encapsulated in the observations of Thomas Hall. Arriving on the Downs in 1853, he established a close relationship with the surviving Aborigines and in the 1920's recorded his observations in *A Short History of the Downs Blacks Known as the Blucher Tribe.* The extensive grasslands of the Darling Downs and the Condamine river and its tributaries provided the Aboriginal people with a viable and sustainable environment. As such, the first Europeans to the Downs area described the Aborigines as robust, healthy muscular men. French (1989) estimates their population to have numbered around 2000, however during the tribal gatherings for the harvesting of the Bunya nuts, some estimates have reached as high as 20,000.

One specific event that is mentioned by a number of the historical texts (specifically Oakes 1972 and Martin 1988, who both reference Bundock) regarding the Downs region was the triennial visit to the Bunya Pines (*Araucaria bidwillii*) in the Bunya Mountains. Bundock elaborates:

> *…every third year or so the pines bear a profusion of cones as large as a man's head. The seeds are about 1 ½ inches long and as thick as a woman's fingers; they are sweet and very nourishing, and when roasted, are like Spanish chestnuts.*
>
> *On the years when the trees bore, word was passed from tribe to tribe, and there was a sort of "Truce of God" understood, for the blacks then went through each other's territories unharmed, and all met together in peace and feasted on the plentiful provisions.*
>
> (Bundock cit. Dawson 1940: 7)

These accounts are corroborated by those of Oakes (1978: 2-4), who states that "for bunya [nut] festivals groups would come from around a 300 mile radius" to take advantage of this nutritious resource (see also Bowdler 1981: 104-5). The festival was also a good opportunity for cultural exchange. Each night individual groups would take turns in performing a corroboree for the entertainment of the other groups. During the days trading, fighting tournaments, marriage arrangements, the learning of neighbouring languages, stitch swapping and demonstrating, etc, would continue. Evidence of this triennial movement may still be observed in the growth of the Bunya Pine away from its native mountains, growth that has taken place from the dropped and discarded seeds deposited by the Aboriginal peoples on their way home from the gathering. Upon return to their tribal lands after the festival, local tribes would find their local bush food stocks regenerated after the three months of their absence (Oakes 1978: 4).

Allan Cunningham discovered the Darling Downs region in June 1827. Although the area was not settled by Europeans until 1840 when squatters Patrick Leslie and Arthur Hodgson formed the first squatter advance on the region. Within a few years the squatters had established more than 20 stations on the eastern Darling Downs. By encroaching eastwards across the Range, the squatters forced the closure of the penal colony at Moreton Bay and the opening of the northern districts of New South Wales to free settlement. Twenty years later there were 33 stations on the eastern Darling Downs bounded by Warwick, Toowoomba and Dalby, with more than 100 pastoral leases on the Western Downs. The Downs region then comprised 7000 settlers, 1.5 million sheep and 140,000 cattle scattered over 1.32 million hectares. There were very few Aboriginal occupants left (French 1989).

As the European colonisation intensified so did the violence. From 1841 to 1843 a 'great fear' came over the Downs frontier as Aborigines and Europeans engaged in open conflict. French (1989) estimates that destruction of Aboriginal tribes was in the order of 60-80% and what was not accomplished through violence, was accomplished through outbreaks of influenza, smallpox, and the spread of venereal diseases. From the early 1850's Aboriginal society on the Downs disintegrated. Although some Aboriginal people took on the European way of life finding work as servants or station stockman, most were reduced to fringe dwellers. With the break down of their society (the last Bora ceremony on the Downs was held in 1858) the remaining tribes fell to pieces. In 1911 only 50 Aborigines remained on the Downs. In that year they were transferred to Taroom to the north of the Downs (French 1989). In the meantime, Toowoomba had fast grown into a thriving township, eventually developing into the regional centre of the Darling Downs, functioning as the gateway and commercial hub for the production and export of the region's agricultural produce.

3.3 Archaeological Context

This section outlines the archaeological context of the study area based on regional information and the DNRM site database. It should be noted that research reveals the Toowoomba region to be relatively understudied with regard to archaeology, few documents being discovered for the Darling Downs region.

3.3.1 Regional Archaeological Context

Archaeological studies of the southeast Queensland region have centred predominantly on coastal sites. In Ulm and Hall's (1996) synthesis of radiocarbon dates of sites in southeast Queensland, only 14% of sites analysed were sub coastal in origin. The earliest date for the region comes from Kings creek near Cliffton where charcoal found in association with human habitation has been dated to 40,000 B.P (French1989). The Darling Downs region is relatively understudied in terms of Aboriginal archaeology. The most famous discovery of the region was that of the Talgai Skull. In 1886 near the township of Allora, south of Toowoomba, a fossilized skull was found eroding from the banks of Dalrymple creek by a fencing contractor on the Talgai estate. The Talgai fossil was eventually found to be the fractured skull of a 14-16 year old boy radiocarbon dated to 12,000 to 15,4000 B.P (Gill 1978). Despite these dates, the archaeological record remains quite sparse until about 6,000 years ago, with the majority of sites dating to the Holocene period (Ulm and Hall 1996).

Two regional studies predicting site types in the Murray–Darling Basin, and the Lockyer Valley, located east of the Darling Downs, present a view of the types of sites that are found throughout inland southeast Queensland. A series of archaeological surveys undertaken in the Lockyer Valley have recorded scarred trees, artefact scatters, burial caves, quarry sites and axe grinding grooves (Alfredson 2000). According to Alfredson's (2000) review of the Lockyer Valley regional archaeological record, the most likely type of sites to be found within the region would be stone artefact scatters and scarred trees. Individual stone artefacts or stone artefact scatters are frequently located on flats adjacent to fresh water sources or along ridgelines.

One of the first sites to be recorded in Queensland was Rocky Scrub Rockshelter, located in the Lockyer Valley. Radiocarbon dates gave a range of use of the site from 4000-3820 B.P. Excavation of the site revealed that a wide range of faunal resources were exploited and changes in stone tool technology were recorded through time. Immediately north of the Lockyer valley a stone axe manufacturing area with thousands of fragments lying around has been reported at Flagstone Creek, while numerous citings of burial caves occur in the regions historic brochures (Alfredson 2000). Burials have been reported from 14 locations on the Darling Downs. Six individuals were found at the Bunya Mountains, and two ground burials were found at Brigalow and at Mt. Tyson. One individual came from Toowoomba, and three individuals were found in a cave at Crows Nest. Skeletal remains were also recovered at Clifton, Darling Downs and Jandowae and a burial was found at Millmerran (Bonhomme 1998).

Bonhomme (1998:127) provides a comprehensive review of the archaeology of the Murray-Darling Basin. Of specific relevance is her research concerning the Condamine river catchment encompassing the western region of the Darling Downs. Fifteen site types occur throughout this region including paintings, burials, stone circles, stone arrangements, earth circles, earth arrangements, scared trees, fish traps, wells, axe grinding grooves, hearth/ovens, quarry's, shell middens, artefact scatters and 'other'. These site types occur in varying proportions across the Condamine river catchment region, with the most dominant site type generally being artefact scatters and stone arrangements. Bonhomme (1998) found that the alluvial plains with watercourses tended to contain a high proportion of sites. Sand plains have significant numbers of artefact scatters, hearths and knapping floors associated with watercourses. Clay plains were associated with campsites, knapping floors, seed grinding implements, wherever water is present. Hill slopes and ridges were strongly associated with stone arrangements.

3.3.2 DNRM Search

A DNRM search was conducted for all archaeological sites in a 5km radius around the study area by HLA on the 11 October 2005. The search identified 33 archaeological sites within 5km of the study area. These are listed in **Table 1**.

Table 1: DNRM search results for 5km around the study area.

File No.	Longitude*	Latitude*	Attribute
KB:C30	151.98305	-27.50617	Isolated Finds
KB:C31	151.98259	-27.50121	Isolated Finds
KB:C41	151.98448	-27.51611	Artefact
KB:C42	151.98245	-27.5161	Artefact
KB:C43	151.98248	-27.51339	Artefact
KB:C44	151.9825	-27.51068	Artefact
KB:C45	151.98557	-27.5071	Artefact
KB:C46	151.97952	-27.50525	Artefact
KB:C47	151.9846	-27.50348	Artefact
KB:C48	151.98865	-27.5026	Artefact
KB:C49	151.9826	-27.50076	Artefact
KB:C50	151.97348	-27.50159	Artefact
KB:C51	151.97046	-27.49976	Artefact
KB:C52	151.98041	-27.51789	Artefact
KB:C53	151.97842	-27.51427	Isolated Finds
KB:C54	151.98248	-27.51339	Rock Concavities
KB:C55	151.98659	-27.5062	Rock Concavities
KB:C56	151.98144	-27.51609	Spring
KB:C57	151.98446	-27.51792	Spring
KB:C58	151.98557	-27.5071	Artefact, Spring
KB:C59	151.98864	-27.50441	Spring
KB:C60	151.97743	-27.51245	Artefact, Spring
KB:F01	151.97292	-27.51301	Earthen
KB:G80	152.02247	-27.51947	Artefact
KB:G81	152.01028	-27.51699	Cultural, Isolate
KB:G82	151.98465	-27.50839	Artefact
KB:G83	151.98454	-2750304	Artefact
KB:G84	151.97413	-2750414	Artefact
KB:G85	151.97305	-27.50361	Artefact
KB:G86	152.01533	-27.51457	Artefact
KB:G87	152.01212	-27.50861	Artefact
KB:G88	152.01086	-27.50758	Artefact
KB:G89	152.01069	-27.50792	Artefact

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The search reveals that the majority of sites in the area are artefacts (23 or 70%), with other sites including springs (5 or 15%), rock concavities (2 or 6%), isolated finds (3 or 9%), an isolated cultural site and an earthern mound. **Figure 5** shows the location of these sites, which are generally located in the valley bottom surrounding Oaky Creek, a tributary of Lockyer creek. This is unsurprising, since water in this area is likely to be the key determinant of human settlement and movement. The sites appear to be typically located between 300 to 400 metres AHD and follow the valleys that run north from the study area. None of the sites fall within the study area, although a number of them are nearby consisting of artefact scatters, springs and a rock concavity.

No further information on these sites could be obtained from DNRM without the written consent of the Aboriginal communities identified in **Section 2**.

3.4 Site Visit

As part of the brief, HLA undertook a site visit to the study area to obtain additional information about a number of environmental factors, specifically landform units, vegetation coverage, soil types, geology, archaeological sites, disturbance, geomorphological information and effectiveness.

The site visit undertook three broad transects across the areas of the study area that were most accessible (**Figure 6**). These transects are described below and summarised in **Table 2.**

Table 2: Site Visit Summary

Transect	1	2	3
Start AMG Co-ordinate	400412E, 6954075N	398249E, 6953975N	398284E, 6953376N
Intermediate AMG Co-ordinates	399603E, 6954275N	398447E, 6954572N	399111E, 6953870N
Intermediate AMG Co-ordinates	39994E, 6954483N	398444E, 6954333N	399091E, 6954364N
End AMG Co-ordinate	400404E, 6954254N	398432E, 6953946N	398410E, 6953736N
Approximate Transect Area	44,000m^2	30,000m^2	68,000m^2
Geological Unit	Walloon Coal Measures, MRV Lava Pool	MRV Lava Pool	Upper Laterite, MRV Lava Pool
Soil Landscape	Brown weathered Basaltic soils; red lateritic soils	Brown weathered Basaltic soils	Brown weathered Basaltic soils; red lateritic soils
Terrain Unit	Spurline, simple slope	Hillcrest, simple slope	Ridgecrest, plateau, simple slope
Slope	Moderate to steeply inclined	Steeply inclined	Very gently to gently inclined; flat
Geo. Agent	Soil creep, mass movement, human	Soil creep, debris flow mass movement, human	Soil creep, mass movement, human
Human Action	Roads	Roads, structures, rifle range	Roads, rifle range, grenade range
Erosion Action	Colluvial, human	Colluvial, human	Colluvial, human
Level of Disturbance	Moderate	High	High
Exposure Area	4,400m^2	3,000m^2	6,800m^2
% of Transect Exposed	10	10	10
Visibility (%)	10	10	10
Soil Profile	A, B, C	A, C	A, C
Vertical Profile	Yes	Yes	Yes
Vegetation	Low, mid, tall	Low, mid	Low, mid, tall
Groundcover	Dense	Dense	Dense
Artefacts/\Sites	Potential grinding groove	Absent	Absent

Table 3 has been presented to show the available exposure and detection of the survey.

Table 3: Survey Coverage of the Study Area

Transect no.	Landform unit.	Total Area of LF unit (m^2)	Exposure (%)	Area of Exposure (m^2)	Visibility %	Area available for detection (m^2)	% of landform available for site detection
1	**Spurline, Slope**	40,000	10	4,400	10	440	1
2	**Hillcrest, Slope**	30,000	10	3,000	10	300	1
3	**Ridgecrest, Plateau, Slope**	68,000	10	6,800	10	680	1
AVERAGE		*46,000*	*10*	*4,733*	*10*	*473*	*1*
TOTAL		**138,000**		**14,200**		**1,420**	

While **Table 4** shows that the effective coverage of the site was low, many of these figures represent heavily disturbed and modified areas of the site such as transect 3 (**Plate 3**), which has been manipulated for Defence activities and has virtually no potential for surface archaeological material. The desktop study investigated some 14 hectares (equivalent to 138,000m^2) of the study area, some 4% of the overall 379 hectares of the Mount Lofty rifle range. The site visit revealed that the terrain was severely rugged and was covered in substantial vegetation allowing only 1% (or some 0.14 hectares of the 14 hectares studied to be effectively observed).

Transect 1 was undertaken from the southeast corner of the study area and progressed up a spurline (**Plates 4, 5** and **6**) to the base of the steep escarpment due east of the grenade practise range (**Plate 7**). The transect then turned north down the slope into the two first order creeks running southwest-northeast in this location (**Plate 8**). This transect consisted of moderate to steep slopes, between 4 to 11°, generally getting steeper further west (and closer to the escarpment), with the slopes immediately beneath the escapement being the most inclined. The bedrock consists of sandstone in the lower areas (**Plates 4** and **18**), mainly under 350metres AHD, and basaltic bedrock for the remainder of the study area over 350metres AHD (**Plates 5, 20** and **21**).

Soils above the sandstone consisted of truncated duplex soils - the topsoil having eroded away leaving only the red irregularly pedded clay subsoil evident (**Plate 18**). Above the basaltic bedrock was the occurrence of dark brown weathered basaltic soils, referred to as *Shallow black earths* in **Section 3.1**. This dark brown weathered soil was formed relatively recently and lacks any form of subsoil – the soil profile consisting of shallow organic clay topsoil over weathered bedrock - and dominating the study area. The nature of this basaltic soil, particularly the loose organic topsoil and Tor like erosion (see below) of the bedrock, promotes massive natural colluvium movement downslope (**Plates 20** and **21**). Evidence of large scree slopes and the instability of the soil profile, especially on the steeper slopes, suggest that much of the Toowoomba plateau (in this area) and escarpment slopes have eroded downslope into the lower lying areas (**Plate 21**). This hypothesis is confirmed by the truncation of these accumulation zones of sediment by the first order creeks, which have subsequently eroded to bedrock and reveal sections and exposures of an irregular mixture of topsoil and basalt stones and boulders.

Tors are defined as rock hills produced by differential weathering and erosion. The following discussion on tor formation largely based on a website on tor formation (http://www.fettes.com/Cairngorms/tors.htm). The Mount Lofty study area has tor formation along ridgelines, crests, and slopes. There is general agreement that the tors reflect long-term differential weathering and erosion. The zones of widely-spaced joints weather more slowly than their surroundings and the removal of the weathered material leads to the emergence of the tor.

What is less certain is the nature of the processes of weathering and removal. In the classic models of tor evolution for southwest England, weathering is considered a result of deep chemical weathering in the Tertiary, prior to the Ice Age (Linton, 1955) or intense frost action during the Ice Age (Palmer and Nielsen, 1963), whilst removal of weathered material is attributed to solifluction under periglacial conditions during the Ice Age. Neither model appears to fit closely the evidence for the origins of Australian tors, although climatic changes over the course of the Quaternary have certainly provided different weathering regimes based on variations in temperature and precipitation. The emergence of small tors is more likely; therefore, to reflect the cyclic development and stripping of relatively thin regolith from slopes during the Quaternary. The availability of water and organic acids in the regolith promotes granular disintegration due to chemical attack. The protruding rock surface remains relatively dry and weathers more slowly. Repeated development of regolith and stripping by sheet wash, as well as mass movement, may then allow the tors to become isolated features in the landscape.

Within transect 1, not far from the confluence of the two first order streams, a potential grinding groove was uncovered (**Plate 9**). This piece of sandstone was the only exposed sandstone in several hundred metres and was not far from a large water source. The groove was some 25cm long by 2.5cm wide. While it cannot be categorically confirmed that this is a grinding groove, certainly the material, location and shape suggest it is. However, other marks and grooves were located upon the stone in other locations but these were considered to be natural, and it may be postulated that all of them are.

Transect 2 was undertaken from the northern side of the plateau down onto the lower fore-slopes of the escarpment (**Plate 10**). The transect was generally orientated in a north south direction and incorporated parts of the plateau, a section of the steepest parts of the escarpment and the hilltops and slopes of the escarpment's surrounding fore-slopes. While attempts were made to enter and investigate the gullies and low lying areas in this location, the steepness of the fore-slopes and the thickness of the vegetation prohibited it. This transect was undertaken largely on slopes in excess of 37° covered in a low to mid dense vegetation cover (**Plate 12**). Observations in this area confirmed the unstable nature of the soil profile, clear evidence being found of debris flows, landslips and general soil creep downslope (**Plates 20** and **21**). From this transect, it was clear that the quarry to the west of the study area has had substantial impacts both with regard to erosion and dumping in this general area (**Plate 11**).

It should also be noted in transects 1 and 2 that the vegetation was typically regrowth – few old or large trees being evident. There was also evidence of substantial bushfires having occurred in the past. It therefore seems unlikely that scarred trees or other carved trees are likely to be preserved within the site based on the observations of this study.

Transect 3 was undertaken upon the southwest corner of the study area, particularly the ridgecrest considered part of the Toowoomba plateau (**Plates 13** to **17** inclusive). This area has been heavily disturbed by human activities, specifically the 1905 and WW2 rifle range, the grenade practice range, the current rifle range (**Plate 13**), the horse farm, roads (**Plate 14**), and previous structures (such as the caretaker's house at the start of transect 2). The southwest corner of the study area revealed evidence of red lateritic soils that were considered to be characteristic of the Toowoomba plateau as outlined in **Section 3.1**. However, the remainder of this transect, was considered to retain a natural soil profile composed of basaltic weathered soils as described elsewhere (see **Plate 15** for example). A particular focus of the investigations in this area was the very edges of the plateau overlooking Lockyer Valley, since it was known to be a tribal boundary and would likely have lookout spots. However, it was noted during the visit that only the southern part of the plateau would have been suitable for use as a lookout, due to its steep escarpment (generally in excess of 70 to 80°) providing good views of the Withcott and Prince Henry Heights areas (**Plate 16**). The eastern and northern edges of the plateau are all gentle slopes, which progressively get steeper and provide no good locations (particularly with the thickness of vegetation, although admittedly this could have changed over time) to observe the Lockyer Valley (**Plate 17**). It therefore seems likely that if this area was used for observation purposes by Aboriginal people, only the southern side of the study area is likely to have been used. Furthermore, while the coverage of transect 3 was poor, the entire plateau has clearly been impacted by Defence activities over the last 100 or so years.

In summary, three transects were undertaken across the study area. All reveal a similar pattern of geology and soil landscapes that was postulated in **Section 3.1** based on literature relating to the area. Of more interest during the site visit was the natural and human modifications that were evident across the study area. The natural modifications, specifically the unstable slopes of weathered soils, clearly demonstrate mass movement (through soil creep, debris flow and landslips) of material from the plateau and slopes into the gullies below. However, it should also be noted that the gullies below (where accessible) reveal only a metre or so of material before additional basaltic (or sandstone) bedrock is reached. It therefore seems likely that the material from the slopes has been washed and eroded into the creeklines and moved some substantial distance from the escarpment. Imprinted over this natural erosion, specifically on the plateau, is the heavy disturbance by Defence activities, including earthworks, roads and structures.

While survey coverage was limited, due to the dense vegetation cover, it seems likely based on the geomorphology that any archaeological deposit present has been severely compromised through natural and human modifications within the study area. Any Aboriginal archaeological material within the study area is likely to have been moved into areas of accumulation, namely the base of the escarpment or further downslope in the lower lying valley areas.

The nature of the landscape and vegetation coverage and access to the site suggest that the options relating to further investigation are likely to be limited. However, as has been demonstrated above, it seems unlikely that *in situ* archaeology will be present due to the eroding nature of the environment in this area.

3.5 Summary

From the environmental context within which the study area has been discussed above, a number of conclusions can be made regarding its archaeological potential.

The geology and soil landscape of the region suggest that there is clear evidence of substantial sediment movement downslope through a variety of colluvial activities, namely soil creep, mass movement, debris flow and landslips (**Plates 18** to **21** inclusive). The latter is evidenced by massive scree slopes of basaltic stones and boulders at the base of the escarpment. While there is evidence of red lateritic deposits on the plateau, which are considered undisturbed geological landscapes (and hence a likely place for *in situ* surface finds), these are literally situated in the southwest corner of the study area and directly underneath the modern day rifle range – an area of intense human disturbance through earthworks, roads and structures (**Plate 13**).

The majority of the study area consists of brown basaltic weathered soils overlying weathering basalt or regolith, both types of deposit are inherently unstable and severely prone to erosion. Indeed, it is clear from the site visit that the plateau and slopes are highly unstable and in consequence the looser material (i.e. the topsoil and regolith) is being eroded into the gullies and valleys below. In places there is evidence of the escarpment being purely bedrock, the upper deposits having eroded completely (**Plate 22**). Observations of these gullies suggest that the material is subsequently being moved even further downslope and into the larger water bodies, since first order creek erosion sections only reveal about a metre of deposits, which is unlikely to account for all of the material lost from the escarpment. From an archaeological perspective, it seems unlikely that material will exist *in situ* on the plateau or slopes, due to the high instability of this natural system. Furthermore, it seems unlikely for *in situ* archaeology to be present in the gullies due to the high volumes of erodeable material that must be passing through them and in addition, no *in situ* soil profiles in the creek exposures (the most likely place for them) were evident.

The vegetation cover of the study area is very dense, consisting largely of grasses and regrowth shrubs, both of which indicate historical and more recent disturbance (**Plates 6** and **8**). The lack of significant sized (older) trees and evidence of bushfires suggest that the vegetation has been substantially altered in the recent past. Furthermore, discussions with the site personnel identified that the area was partially timbered historically, which would also account for the lack of older trees and surge in the shrub-like ecosystem now present. Therefore, the likelihood of scarred or carved trees surviving these historical activities seems low.

From a historic perspective, the tribal maps and information on the Aboriginal communities of the area suggest that the study area is on the periphery of a number of tribal group's boundaries, namely the Giabal, Jagera and potentially Jarowair tribes. Typically, large scale settlement and occupation by Aboriginal groups would not focus on their tribal boundaries due to the conflict it can lead to between the tribes. Therefore, it seems likely that the study area, being on the periphery of two or three groups would only exhibit ephemeral use by the tribes limiting the potential archaeological resource in this area. In addition, the natural relief of the area is likely to limit the use of the study area – the slopes are too steep for settlement and in many cases prohibitive to movement across them (**Plates 10** and **16**), the creeks appear to be ephemeral (although admittedly this may not have always been the case) and of limited use for Aboriginal people. Sections of the plateau would have been of some use for lookouts, although better locations would arguably have been nearby Prince Henry Heights and Blue Mountain Heights. The site visit did identify a potential grinding groove that suggests Aboriginal people passed through this area (at least the base of the escarpment), although the existence of only one groove rather than many suggests this site was not revisited regularly.

Archaeological research identifies the most likely sites to occur in the Lockyer Valley region to be artefact scatters and scarred trees. The site visit revealed the visibility was too poor to identify the former, while the latter seem unlikely given the historic and recent destruction of the study area. However, both have the potential to occur in this area. Alfredson (2000) also found grinding grooves within the Lockyer Valley, which increases the credibility of the find within this project. With regards to the periods of occupation, research is limited. Typically Holocene (10,000 years ago to present) dates are commonly found within the region, such as the Rocky Scrub Rockshelter in the Lockyer Valley, dated 4,000 – 3,820 BP.

The DNRM search revealed that there were a number of sites (33) located within 5km of the study area, largely in the low lying valley areas to the north following Oaky[5] Creek (**Figure 5**). While none of the sites were located within the study area, a number of them (specifically springs, artefacts and a rock concavity) were situated near the northern border. Only a very small portion of the northern part of the study area falls over the low lying and cleared areas surrounding Oaky Creek, which runs parallel to the northern boundary. However, these areas were inaccessible during the site visit.

While the most likely locations for archaeological deposits within the study area are likely to be on the plateau or in the zones of accumulation at the base of the escarpment, the former has been heavily disturbed by Defence activities (such as the two rifle ranges, grenade practise range, structures and multiple roads) and the latter seems unlikely to yield any *in situ* archaeological deposits due to the unstable nature of this environment.

[5] Please note that this is Oaky creek not Oakey creek, the latter being situated further north.

4 STATUTORY CONTROLS

Sites of cultural heritage significance are protected or controlled by a number of varying levels of statutory control that vary according to Authority and site type. The nature and levels of controls on the project area are set out below.

Defence generally seeks to comply with the intent of State legislative standards. Qld State legislation, specifically the *Aboriginal Cultural Heritage Act* (2003) does not have a permit or licensing system. Instead, those undertaking activities in an area must ensure that they meet the Aboriginal cultural heritage duty of care by complying with the guidelines, or by entering into an agreement with the Aboriginal party for the area.

4.1 Commonwealth

4.1.1 Environment Protection and Biodiversity Conservation Act, 1999

The Commonwealth *Environment Protection and Biodiversity Conservation (EPBC) Act, 1999* requires the approval of the Commonwealth Minister for the Environment and Heritage for actions that may have a significant impact on matters of National Environmental Significance.

As of 1 January 2004 the *EPBC Act* also provides for the identification, conservation and protection of places of national heritage significance as a matter of National Environmental Significance. In addition the *EPBC Act* provides for the management of Commonwealth heritage places and establishes the Australian Heritage Council.

Under the *EPBC Act* assessment and approval is required for actions that are likely to have a significant impact on:

- A matter of National Environmental Significance;
- The environment of Commonwealth land (even if taken outside Commonwealth land); and
- The environment anywhere in the world (if the action is undertaken by the Commonwealth).

An action includes a project, development, undertaking, activity, or series of activities. When a person proposes to take an action that they believe may need approval under the *EPBC Act*, they must refer the proposal to the Commonwealth Environment Minister.

It should also be noted that under **Section 158** of the Act the Commonwealth Environment Minister may exempt a person proposing to take an action from the requirement to conduct an environmental assessment and/or obtain approval in relation to the action to which the exemption relates. Under **Section 158** the Minister may exempt a person from any or all steps in the assessment and approvals process. However, the Minister may only grant an exemption under **Section 158** if he is satisfied that it is in the national interest to do so.

4.1.2 Aboriginal and Torres Strait Islander Heritage Protection Act, 1984

The *Aboriginal and Torres Strait Islander Heritage Protection Act, 1984* (Heritage Protection Act) is the principal Commonwealth legislation protecting Indigenous heritage. The Act complements state/territory legislation and is intended to support state/territory laws and processes.

Under the Heritage Protection Act the responsible Minister can make temporary or long-term declarations to protect areas and objects of significance under threat of injury or desecration. The Heritage Protection Act also encourages heritage protection through mediated negotiation and agreement between land users, developers and Indigenous people.

Since the passage of this legislation:

- Around 200 applications have been lodged under the Act
- Eight declarations have been made protecting objects of significance to Indigenous people
- Emergency (i.e. temporary) declarations have protected five significant places, and
- Two long-term declarations remain in place, one protecting women's sites under threat from a dam near Alice Springs and the other (with effect from July 2000) protecting Boobera Lagoon in northern New South Wales.

On 17 December 1998 responsibility for administration of the Heritage Protection Act was transferred by Administrative Arrangement Orders from ATSIC to the Environment and Heritage portfolio and the Heritage Protection Act is now administered by the Department of Environment and Heritage (DEH).

4.2 Queensland

The Queensland government began a new regime to protect indigenous cultural heritage on 16 April 2004, with the commencement of the *Aboriginal Cultural Heritage Act 2003* and the *Torres Strait Islander Cultural Heritage Act 2003*. These acts repeal the *Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987* (previously administered by the Environmental Protection Authority). The provisions of both pieces of legislation are identical apart from a number of minor cultural differences, and are both administered by the Department of Natural Resources, Mines and Energy.

4.2.1 Aboriginal Cultural Heritage Act, 2003

The *Aboriginal Cultural Heritage Act, 2003* has superseded other relevant cultural heritage legislation, specifically the *Native Title (Queensland) Act, 1993* and the *Aboriginal Land Act, 1991*. The *Aboriginal Cultural Heritage Act, 2003* defines Aboriginal cultural heritage as anything that is:

a) A significant Aboriginal area in Queensland;
b) A significant Aboriginal object; or,
c) Evidence, of archaeological or historic significance, of Aboriginal occupation of an area of Queensland.

A significant Aboriginal area or object must be particularly significant to Aboriginal people because of either or both of the following:

a) Aboriginal tradition;
b) The history, including contemporary history, of any Aboriginal party for the area.

The most relevant section of the legislation is **Section 23,** which outlines **Aboriginal Cultural Heritage Duty of Care Guidelines.** The legislation does not have a permit or licensing system. Instead, those undertaking activities in an area must ensure that they meet the Aboriginal cultural heritage duty of care by complying with the guidelines, or by entering into an agreement with the Aboriginal party for the area.

The guidelines focus on six matters specified in the Act that are to be considered in determining whether the duty of care has been discharged:

- The nature of the activity [proposed impact], and its likelihood of causing harm to Aboriginal cultural heritage;
- The nature and extent of past uses in the area affected by the activity;
- The nature of the Aboriginal cultural heritage likely to be harmed by the activity;
- The extent to which consultation was conducted with the Aboriginal parties;
- Whether a study or survey of the area affected by the activity was carried out to find out the location and extent of the Aboriginal cultural heritage; and,
- Whether the Aboriginal Cultural Heritage Database and Aboriginal Cultural Heritage Register was searched for information about the area affected by the activity.

It is not compulsory to comply with the guidelines. However, compliance is deemed to satisfy a person's duty of care obligation under the Act.

The type of activities [proposed impact] that may affect Aboriginal cultural heritage are divided into five categories under the guidelines:

- Category 1- Activities involving no surface disturbance (surface disturbance is disturbance that causes a lasting impact to the land or waters).
- Category 2- Activities causing no additional surface disturbance (disturbance not inconsistent with previous surface disturbance).
- Category 3- Activities in developed areas (areas developed or maintained for a particular purpose, such as a park, garden, railway, orad or infrastructure facility).
- Category 4- activities in areas previously subject to significant ground disturbance (an area previously affected by disturbance by machinery of the topsoil or surface rock layer of the ground or the removal of native vegetation).
- Category 5 – Activities causing additional surface disturbance (an activity that does not fall within the above four categories).

Under Category 1, the guidelines allow the activity to proceed without any further cultural heritage assessments or conditions attached. Under Categories 2-4 the guidelines allow these activities to proceed without any further cultural heritage assessments, provided that any excavation, relocation or removal of a cultural heritage find, needs to be carried out upon agreement from the Aboriginal party concerned on how to best minimise the harm to the Aboriginal cultural heritage. The activity cannot proceed without the agreement of the Aboriginal party of the area, or a Cultural Heritage management Plan approved by the relevant government agency. Under category 5, the guidelines provide that the activity should not proceed without a cultural heritage assessment.

4.2.2 Torres Strait Islander Cultural Heritage Act, 2003

The *Torres Strait Islander Cultural Heritage Act, 2003* has exactly the same legislative content and requirements as the *Aboriginal Cultural Heritage Act, 2003* but for the Torres Strait Islands and is therefore irrelevant to this study.

5 CONCLUSIONS

This section outlines the potential cultural heritage issues, the current levels of disturbance and suggested management options for the disposal of the study area.

5.1 Determination of Disturbance

This section outlines the disturbance of the site based on visual observations and known activities that have occurred in the study area.

Naturally, the soil profile across much of the study area is eroding downslope through colluvial processes. The weathered basaltic soils and regolith combined with the sloped plateau and steep escarpment encourages the movement of the soil profile into the gullies and valleys at the base of the escarpment. Furthermore, much of the study area below the escarpment still consists of slopes and gullies with angles up to 11° and it therefore seems likely that this soil profile is continuing to erode beyond the boundaries of the study area into the lower lying areas of Withcott. Based on this geomorphological model, it seems unlikely that any *in situ* buried archaeological deposits are likely to be found within the study area, particularly the escarpment slopes and lower areas due to the ongoing movement of the landscape in these areas. While the plateau has a far higher likelihood of containing archaeological deposits, both for cultural and geomorphological reasons, it has been heavily impacted as outlined below.

Historically, there is limited evidence that the study area has been logged, particularly the lower slopes to the north and east of the study area. Observations by HLA personnel would tend to confirm this through evidence of cleared and exposed locations across the study area. Furthermore, the site visit revealed that much of the vegetation growth on the lower slopes and escarpment consisted of young trees and low dense shrubs, both of which are indicative of relatively recent clearing either naturally or humanly induced. The former most likely occurring in the form of massive land slips and debris flows (evident at a number of locations at the base of the escarpment) and bushfires.

More recent disturbance involves the heavy impact and erosion promoted on the west side by a working quarry, which has led to large scree deposits and bedrock dumps on the slopes and within the gullies surrounding the area. On the plateau, aside from the obvious encroachment of the Toowoomba suburbs, a number of Defence activities have caused impact to the study area. Originally a rifle range (dated to 1905), which consisted of substantial clearing and land manipulation (specifically numerous earthern mounds and hillocks), was developed on an east west orientation along the northern side of the plateau. Later there is evidence of a grenade practise range on the eastern edge of the plateau, which is thought to date to WW2. Currently, there is an additional modern rifle range orientated northeast to southwest from the corner of Martini Road and Rifle Range Road, which also consists of large scale land manipulation. Surrounding these ranges are numerous roads and ancillary structures. Cumulatively, the ranges and support structure cover the majority of the Toowoomba plateau within the study area, leaving no evident natural vegetation or remains evident upon the plateau. In many cases the plateau reveals bedrock or truncated subsoil (mainly in the southwest) suggesting a limited soil profile either through natural or human processes.

Activities upon this plateau were thought to have been mainly small arms fire, however recent ordnance investigation have revealed mortar, grenade and RPG ammunition, all of which would also have caused substantial impact on the surrounding landscape.

5.2 Cultural Values

Since this project did not seek to contact or consult with the Aboriginal communities as outlined in the brief, it is difficult to provide cultural values of the study area. Generally, the archaeologist outlines the scientific values and the Aboriginal communities provide a cultural perspective, which are combined to give an overall assessment. Due to the lack of Aboriginal input into this study, an attempt will be made here regarding the scientific value of the study area.

Scientifically, there is limited archaeological interest within large parts of the study area, due to the heavy human and ongoing natural disturbance. The natural erosion of the soil profiles into the low lying areas around the base of the escarpment (and outside of the study area boundaries) indicate that there is limited *in situ* soil profiles or archaeological deposits. However, the presence of a potential grinding groove in the eastern section of the study area, as well as a number of sites in the low lying areas immediately north of the study area suggest Aboriginal activities did occur in this region. Sites are typically indicative of everyday activities and uses, such as artefacts, grinding grooves, and springs (i.e. water sources) and in the case of the grinding groove suggest repetitive use. These site types are typically associated with camping activities around a water resource and suggest short term activities in the region (Bonhomme, 1998). There is also the presence of an earthen arrangement, which are typically referred to as Bora rings/grounds. These sites were used for ceremonial activities and are usually highly significant to Aboriginal people. **Figure 5** suggests that the earthen arrangement is part way up the escarpment, some 400 to 500 metres from the northern boundary. Further access to the specific information on each of the identified sites was restricted due to the lack of Aboriginal involvement in this study.

In summary, there is clear evidence of Aboriginal use and occupation in the valley's surrounding Oaky Creek not far to the north of the study area. The sites indicate a diverse series of activities and settlement within the Oaky Creek area and this is likely to be of some scientific and cultural significance to the local Aboriginal people. While the study area is not situated within the Oaky Creek valley, it's northern, northeast and eastern edge borders and incorporates some of the landform (i.e. alluvial flats, lower foot-slopes), and there is clear evidence of sites further up the escarpment in other areas to a height of 400 metres AHD.

With regard to the Toowoomba plateau, despite the heavy development nearby, no sites were identified on this type of landform (within 5km of the study area) and as such suggests little cultural value would be associated with it. From a scientific perspective, the heavy impact of Defence activities has limited the potential for *in situ* archaeological sites to remain intact in this area.

In summary, it seems likely that cultural and scientific values for the study area will be focussed upon the lower foot-slopes and alluvial flat areas towards the north, northeast and eastern edges of the study area (**Figure 7**).

5.3 Cultural Heritage Issues

The site visit and environmental context revealed that many areas of the study area for both geomorphological and cultural reasons are unlikely to have any cultural heritage issues. The geomorphology reveals the whole area is substantially eroding into the low lying areas around Oaky Creek, while the escarpment acted as a traditional boundary for the Aboriginal tribes of the area and as such was only peripheral to settlement.

The Toowoomba plateau in the southwest of that area has been heavily modified by Defence activities over the last hundred years and it seems unlikely that any *in situ* archaeological deposits would remain in these areas. In addition, much of the escarpment is very steep and is also severely eroding into the valleys and therefore limiting the *in situ* soil profiles and/or any archaeological resources that may be present.

The lower foot-slopes and low lying alluvial areas (relating to Oaky Creek) that run along the north, northeast and eastern side of the study area are likely to have cultural heritage issues. The DNRM search reveals a substantial number of diverse archaeological sites to the north of the study area following Oaky Creek. Typically, these sites are situated on the lower foot-slopes overlooking the alluvial flats and the flats themselves. However, sites are found up the escarpment to heights of 400 metres AHD. Since these sites are only some 400 metres north of the study area, it is feasible that other sites exist up to these heights within the study area. The existence of a potential grinding groove at heights of about 350m AHD would tend to confirm this model. Although it should be noted that the majority of sites (32 of 33) are within 50 metres or so of the water source (i.e. Oaky Creek) at heights of 350 metres AHD or less, and therefore implies higher potential for sites to occur in these lower locations (**Figure 7**).

In summary, while the site visit and geomorphology suggest much of the higher and steeper areas are likely to have no cultural issues due to erosion and disturbance, the lower areas particularly close to Oaky Creek warrant further investigation, and given the archaeology of the surrounding areas are likely to reveal cultural and archaeological sites.

5.4 Constraints and Opportunities

While beyond the scope of this report, it seems likely that future development of the study area will be constrained to the Toowoomba plateau area in the southwest of the study area. The development of these upper plateau areas overlooking the escarpment and Lockyer Valley are already common in Toowoomba as can be demonstrated by the suburbs of Blue Mountain Heights, Prince Henry Heights, Rangeville and Picnic Point. The potential development of the escarpment and the lower lying areas (near Withcott) are relatively limited from HLA observations, most likely due to flood, fire and erosion issues, in addition to the lack of access from the Warrego Highway. It therefore seems likely that the upper plateau is the only area that requires detailed consideration with regard to archaeological issues.

Typically, a heritage assessment will discuss the constraints and opportunities for the site in question. However, this is more appropriate for structures that are still standing, since their re-use and educative potential is normally possible and a good opportunity at promoting heritage and local history. However, for archaeological sites, the opportunities are relatively limited, since the site is currently buried and has little reuse potential.

The main opportunities for this study area would largely revolve around educative and interpretive tools. It has been shown in Sydney and Brisbane, amongst other areas, that site visits made by the public to archaeological sites during their investigation are often very popular. Depending on the findings of this investigation, a public open day to the site, especially if remains are located is likely to be very popular and would promote both the client involved in the project and the heritage of Toowoomba.

Interpretive signs of the development following the investigation are also often recommended by the State Government agencies. These signs can be located within or surrounding the new development on the site and can again be used to promote the local heritage. Retention of any finds within the new structure (preferably on display) is also a potential positive outcome from the destruction of the archaeological resource.

5.5 Management Options

The desktop investigation and site visit at Mount Lofty rifle range revealed a number of constraints and opportunities in relation to cultural heritage.

The investigation reveals that there are likely to be archaeological sites within the lower foot slopes and alluvial flats located along the north, northeast and eastern boundaries of the study area. While there is limited potential for archaeological sites to exist above 400 metres AHD, it seems likely that they will generally be found below 350 metres AHD based on existing site information in the area (**Figure 7**).

The specific DNRM site information is unobtainable without permission of the relevant Aboriginal communities (which was beyond the scope of this study). However, it seems likely given their broad descriptions that the sites relate to ephemeral short term activities across the area surrounding Oaky Creek, largely being composed of artefact scatters and springs. While HLA's knowledge of the communities in this area is relatively limited, these forms of sites (specifically artefact scatters) in other areas of QLD and Australia are not generally considered highly cultural significant, and as such their assessment, recording, removal or destruction are normally viable options if required (although retention is always preferable). However, the most significant site identified was the earthern mound (thought to be a Bora ground) some 400 metres north of the study area – these sites are considered highly significant to Aboriginal people.

The lack of sites (based on the DNRM search) and the heavy development upon the Toowoomba plateau within this region suggests that archaeological sites on this landform are limited. No evidence from the recent development of Prince Henry Heights or Blue Mountains Heights has revealed any (literary) data upon archaeological sites on the edge of the plateau. From a cultural perspective, the edge of the plateau was the edge of a number of tribal boundaries and as such is likely to have been ephemeral to any major form of settlements – the vast majority of the settlement occurring closer to nearby Gowrie Creek, Oakey Creek, Westbrook Creek and the Condamine River.

Four Aboriginal groups have shown association with the area, specifically the Giabal, Jagera, Jarowair and Western Wakka Wakka. Based on historical maps and information, it seems likely that the Giabal and Jagera are direct descendants of this area – the Giabal occupying the plateau and the Jagera situated in the low lying valley below – and these should be approached first to discuss the project. Advice should be sought from these groups in relation to the other two groups, which seem to lack any direct relevance to the area and have only been identified through HLA's consultation with a number of State Government and Academic institutions, rather than historical data.

While the evidence within this report does not suggest any nationally significant cultural heritage issues, which may subsequently activate the *EPBC Act 1999*, consultation with the Aboriginal groups should be attempted to discuss the project and identify specific cultural issues within the study area. Since it is unclear of the proposed activities to be undertaken within the study area at this time, identifying the specific requirements, categories and actions under the QLD *Aboriginal Cultural Heritage Act 2003* is unfeasible (see **Section 4.2.1**). However, typically most activities will require some form of agreement with the relevant Aboriginal communities and this should be sought prior to any proposed development.

Based on the assessment within this report, it seems likely that further investigation (with Aboriginal input) is needed for the lower foot slopes and alluvial flats to the north, northeast and east of the study area. The Aboriginal communities may also wish to undertake physical inspections of these and other areas within the study area.

5.6 Management Summary

- Contact the Giabal and Jagera people (see **Section 2**) to discuss the cultural values and proposed disposal study for the Mount Lofty Rifle Range;
- Dependent on the views of the Giabal and Jagera, contact the Western Wakka Wakka and Jarowair groups (see **Section 2**) to discuss the cultural values and proposed disposal study for Mount Lofty Rifle Range;
- Based on existing evidence, there is high potential for archaeological material to be present on the lower foot-slopes and alluvial flats near Oaky Creek running along the north and eastern boundaries of the study area. Any future activities on the site should avoid impacting these areas (see **Figure 7**);
- Additional investigation (preferably with the Aboriginal groups) should be undertaken of the lower foot-slopes and alluvial flat areas under 350 metres AHD in the north, northeast and eastern areas of the study area (**Figure 7**). Should any sites be located, discussions with the Aboriginal communities should identify options and mitigation measures (such as Plans of Management) if they are likely to be impacted upon;
- Due to the long use of the study area as a Defence facility and evidence provided within this report, it seems unlikely that there will be any further cultural heritage issues on the Toowoomba plateau within the study area. However, agreement to this assessment should be sought from the Aboriginal communities;
- Due to the steep relief and eroding weathered basaltic soils within the study area, there is low to nil potential for any *in situ* archaeological remains to be present upon the escarpment between 450 to 600 metres AHD.

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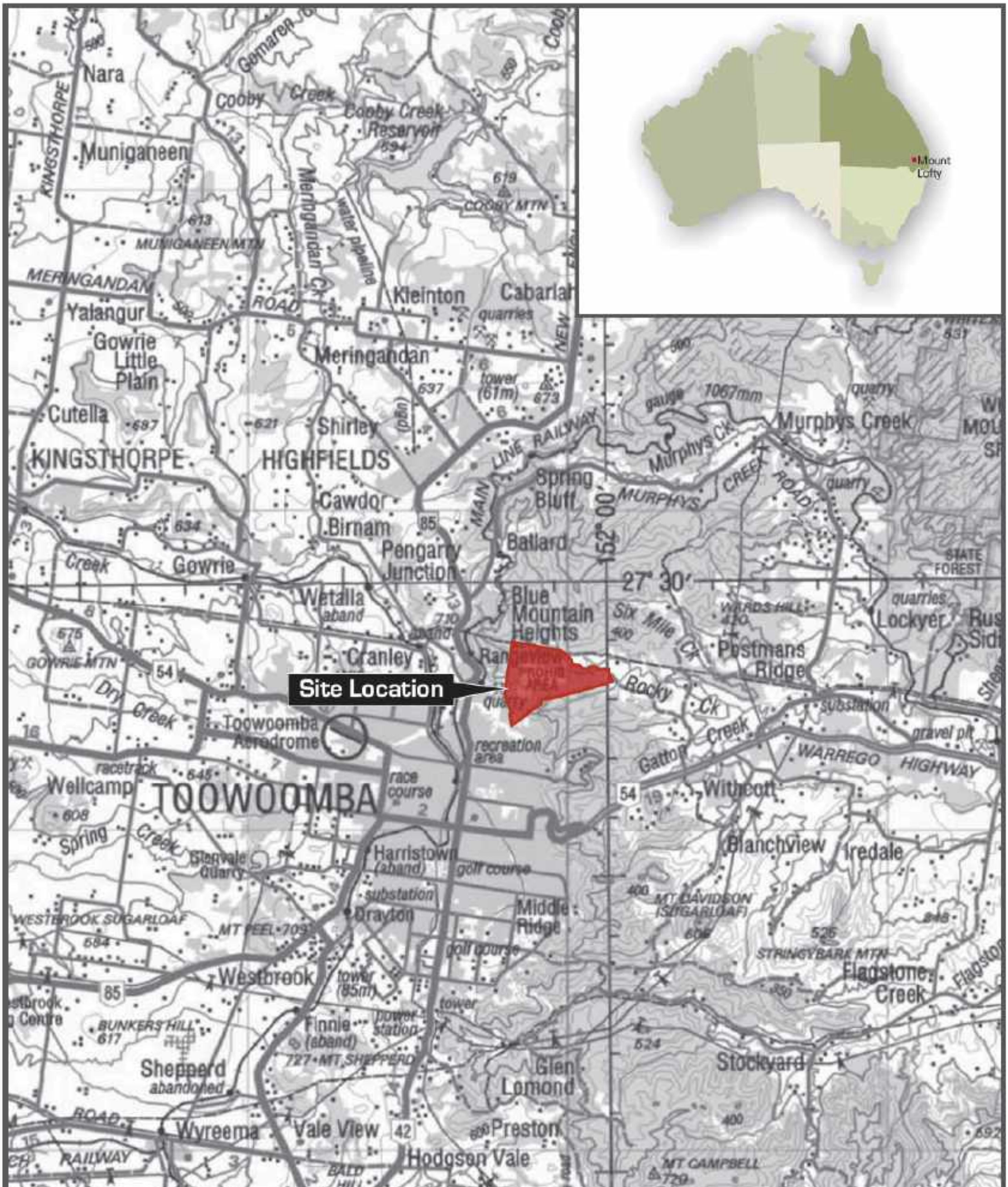
Figures

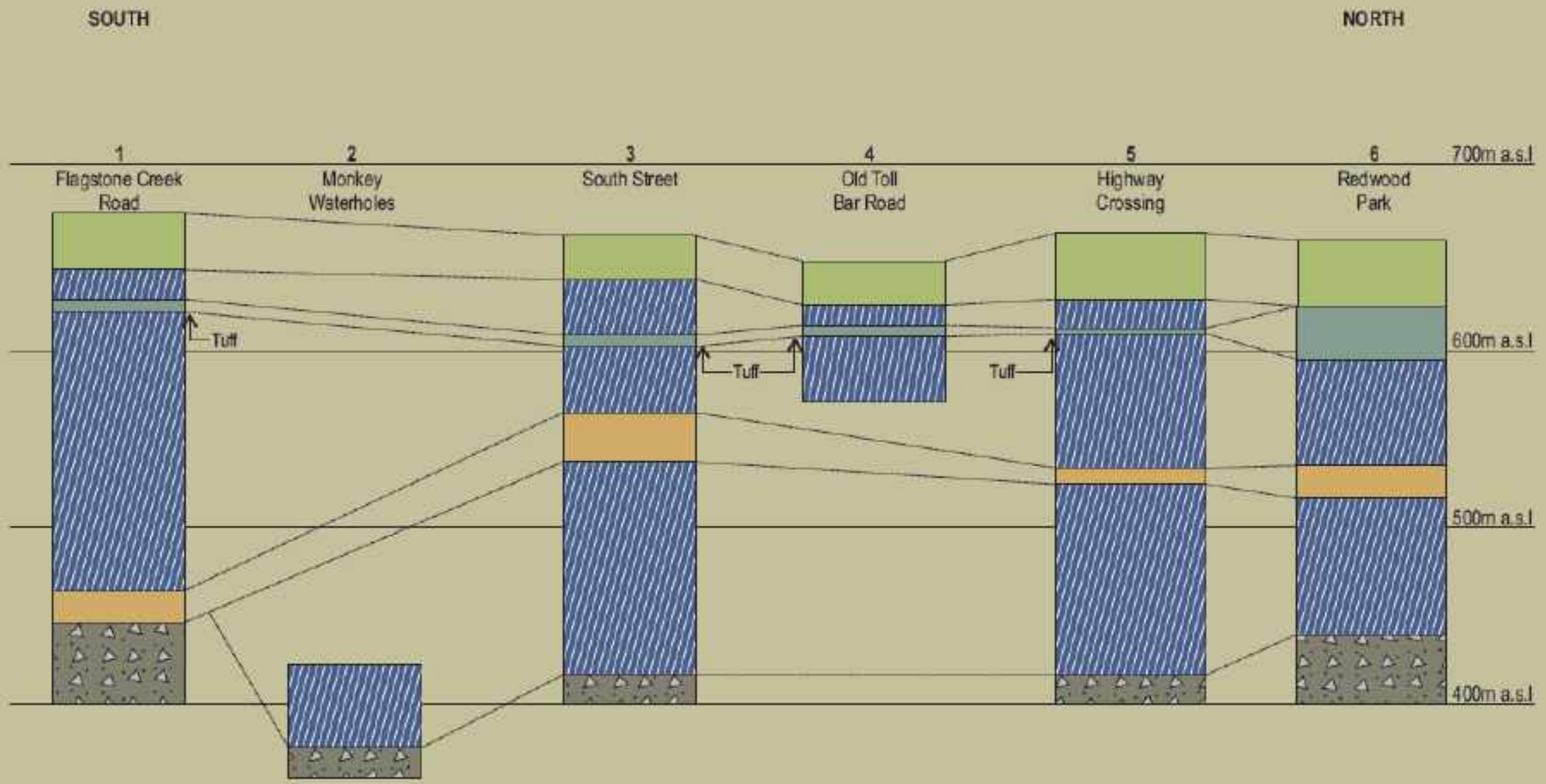
Plates



Site Location
Department of Defence
Aboriginal Heritage Desktop Assessment
Mount Lofty, QLD 4350

FIGURE 1

PROJECT-FILE NAME D1024101 DATE 25 October 2005 DRAWN TO APPROVED

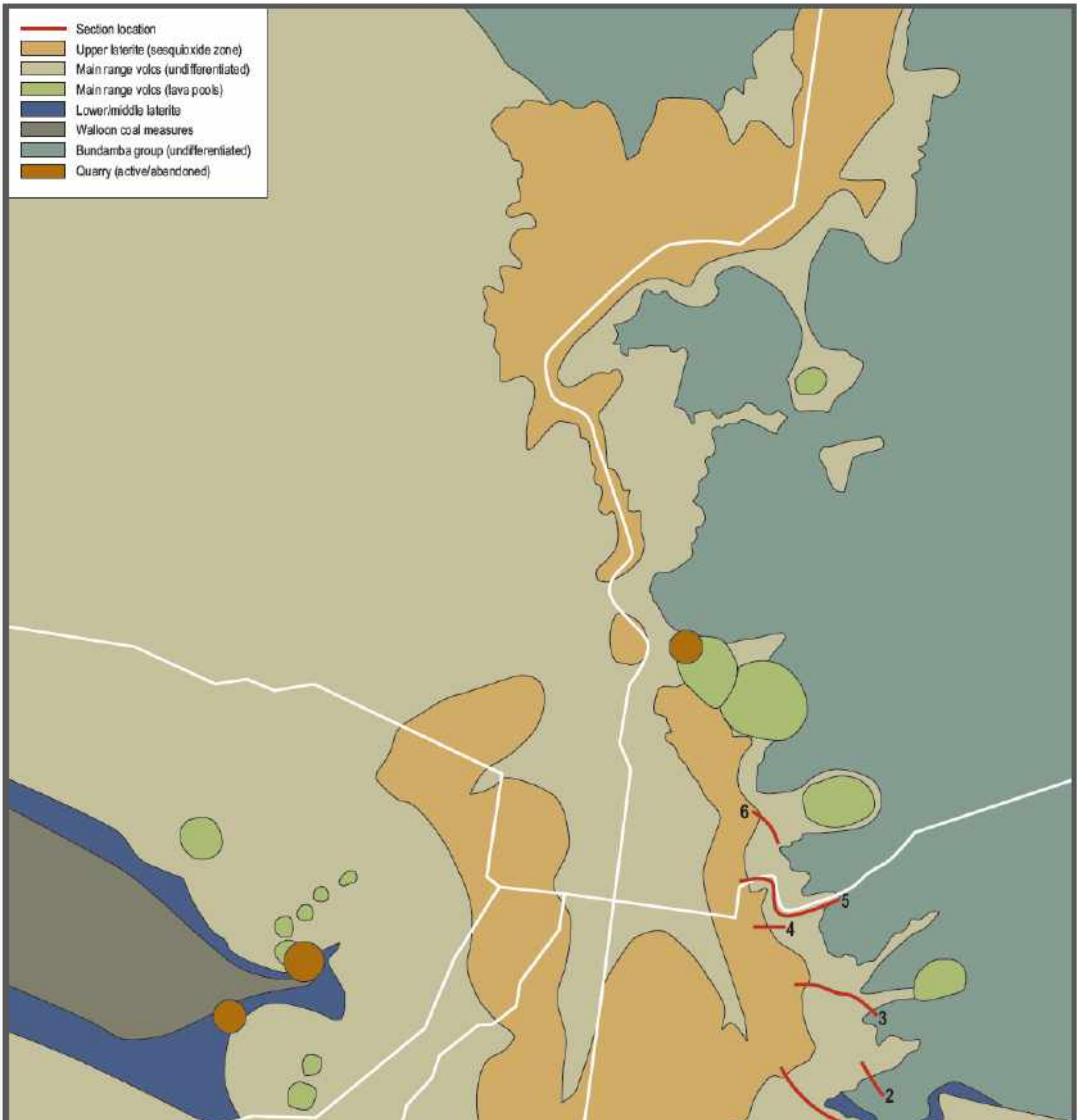


PROJECT-FILE NAME D1024101
DATE 25 October 2005
DRAWN TO
APPROVED

Correlation of Sections of the MRV and Associated Palaeosols Exposed along the Escarpment East of Toowoomba (Willey 2003)
Department of Defence
Aboriginal Heritage Desktop Assessment
Mount Lofty, QLD 4350

HLA

FIGURE
2



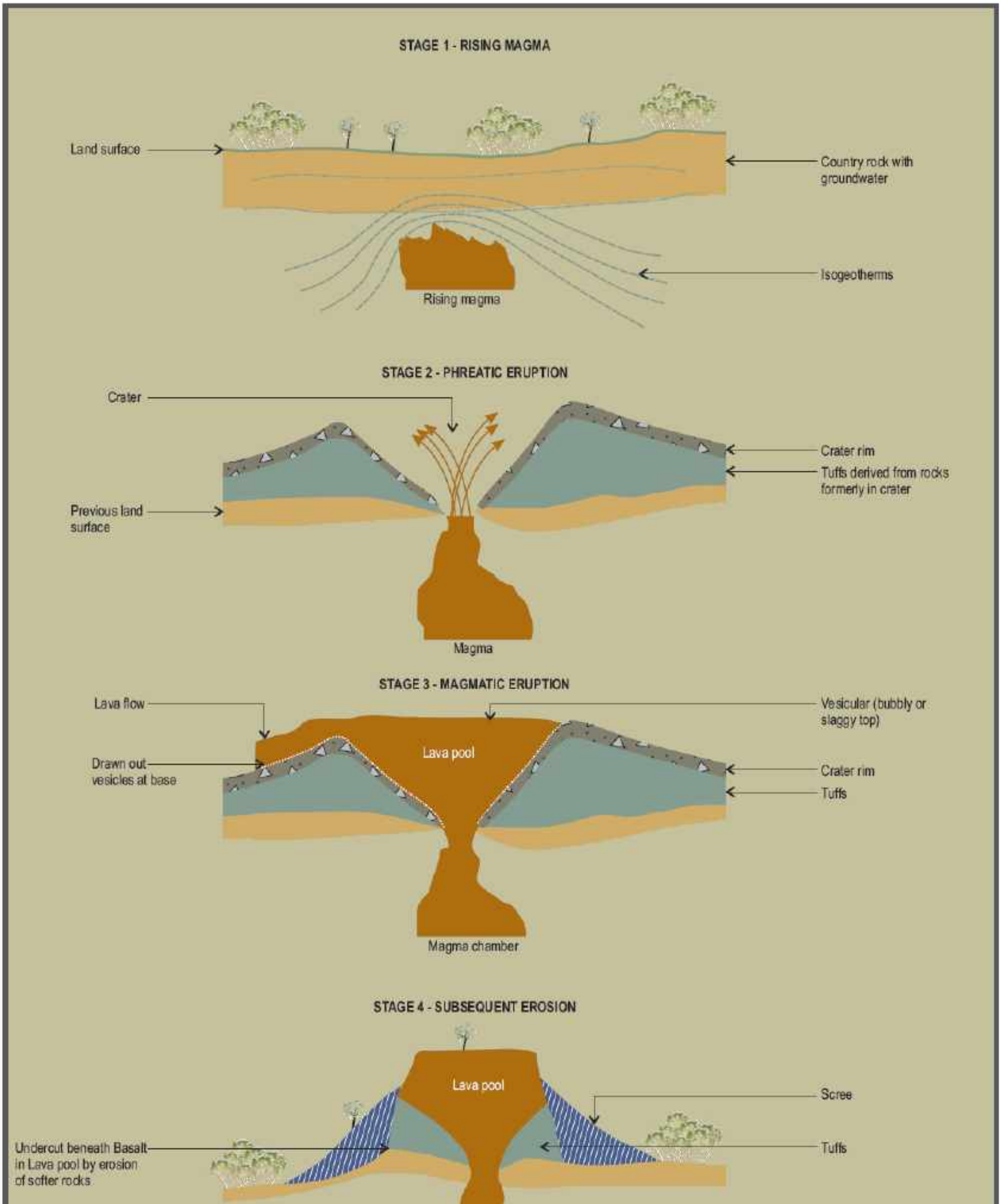
HLA

Solid Geology of the Toowoomba Conurbation
(Numbers 1 - 6 refer to sections in figure 2)
Department of Defence
Aboriginal Heritage Desktop Assessment
Mount Lofty, QLD 4350

0 2km
Approximate

FIGURE
3

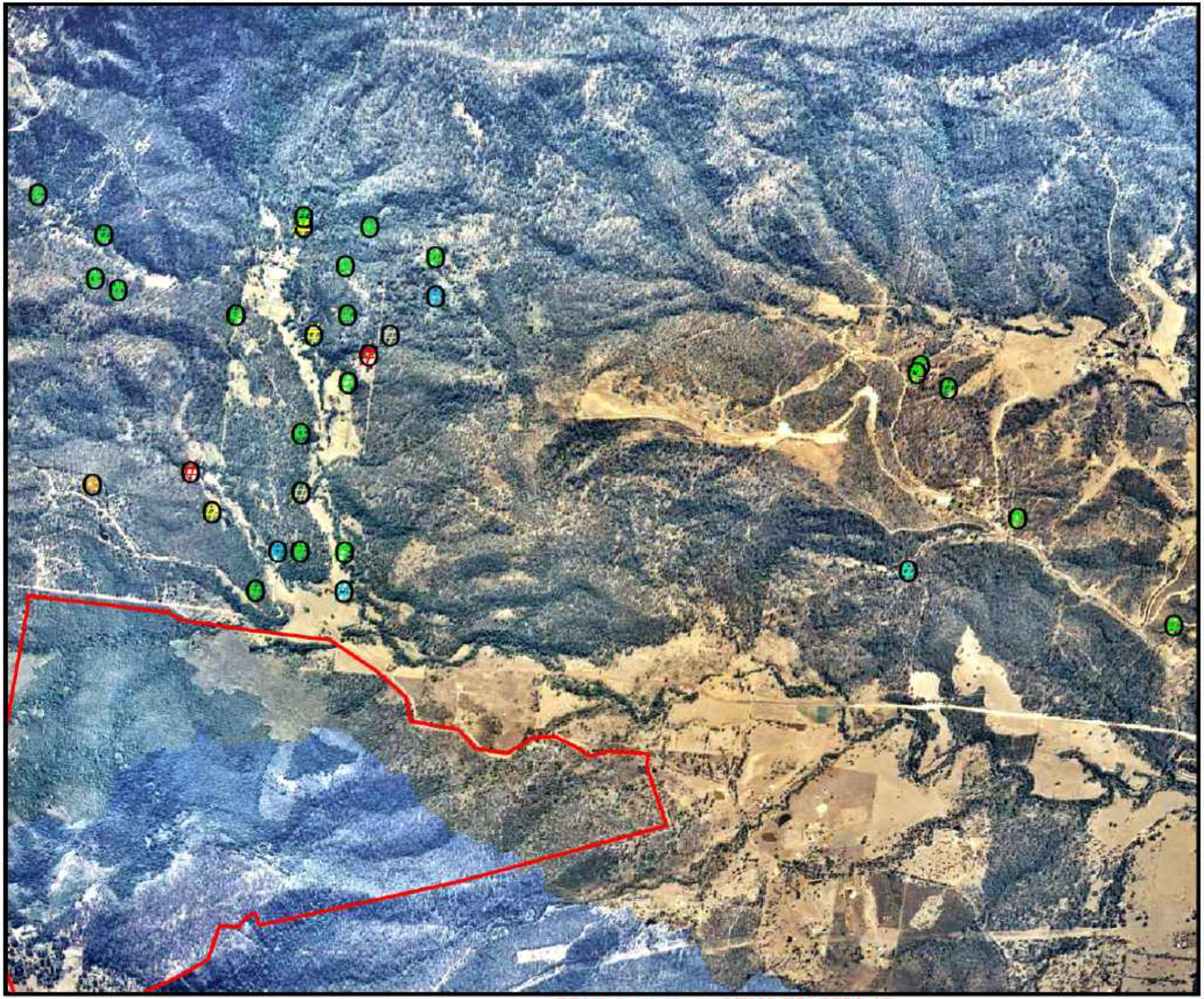
PROJECT-FILE NAME D1024101 DATE 25 October 2005 DRAWN TO APPROVED



Stages in the Evolution of a Lava Pool
Department of Defence
Aboriginal Heritage Desktop Assessment
Mount Lofty, QLD 4350

FIGURE **4**

PROJECT-FILE NAME	D1024101	DATE	25 October 2005	DRAWN	TO	APPROVED



PROJECT NUMBER	D10241
DATE	October 2005
DRAWN	ESH
REVISION	

Legend

- Artefact
- Artefact, Sprin
- Cultural, Isola
- Earthen
- Rock Concavitie
- Spring
- Isolated Finds
- Military Boundary

MAP OF ACHAEOLOGICAL SITES BASED ON THE DNRM SEARCH
Department of Defence
Mt Lofty Rifle Range

HLA

Figure
5

PROJECT-FILE NAME D1024101
DATE 25 October 2005
DRAWN TO
APPROVED

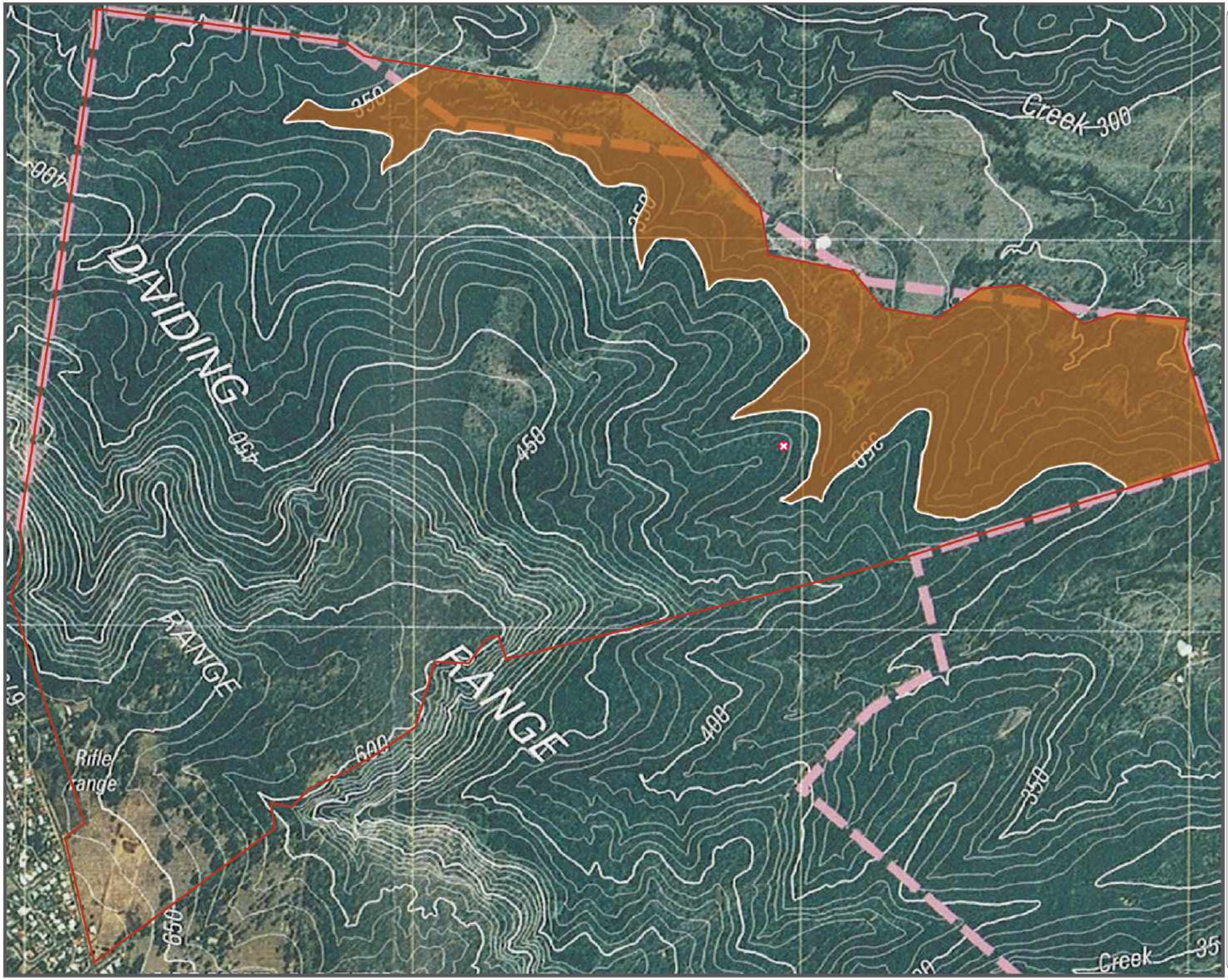
Site boundary
Transect

Transects Walked as Part of Site Visit
Department of Defence
Aboriginal Heritage Desktop Assessment
Mount Lofty, QLD

HLA

0 200m

FIGURE
6



PROJECT-FILE NAME	D1024101
DATE	25 October 2005
DRAWN	TO
APPROVED	

Site boundary
Area of constraint
Potential grinding groove

Areas of Constraint Based on the Desktop Study
Department of Defence
Aboriginal Heritage Desktop Assessment
Mount Lofty, QLD 4350

HLA

0 200m

FIGURE
7

Appendices

Appendix A: Native Title Search and Information

NATIONAL NATIVE TITLE TRIBUNAL

Application Information and Extract from the Register of Native Title Claims

Application Information

Application numbers:	Federal Court number:	QUD6004/99
	NNTT number:	QC99/4
Application name:	Western Wakka Wakka People	
Registration history:	Registered from 26/02/1999.	

Register Extract (pursuant to s.186 of the *Native Title Act 1993*)

Application filed with: Federal Court of Australia

Date application filed: 27/01/1999

Date claim entered on Register: 26/02/1999

Applicants: Mr Adrian Beattie, Mr Bill Hall, Mr Neville Turbane, Ms Jean Smith (nee Turbane), Ms Margaret McLeod, Ms Patricia Hall, Ms Sandra Bauwens (nee Turbane), Brian Tobane

Address for service:
Eddy Neumann
Craddock Murray Neumann Solicitors
Level 2
255 Castlereagh Street
SYDNEY NSW 2000
Phone: 02 9283 4755
Fax: 02 9283 4180

Area covered by the claim:

The boundary of the application commences at a point 149.883 degree E longitude, 27.3167 degrees S latitude, near the locality of Meandarra, then traverses in a north westerly direction to 149.71349 degrees E longitude, 27.074521 degrees S longitude, then further north westerly to 149.383 degrees E longitude, 26.6 degrees S latitude, northerly to 149.474786 degrees E longitude, 26.264654 degrees S latitude, easterly to

150.017 degrees E longitude 26.2167 degrees S latitude, north easterly to 150.384419 degrees E longitude, 26.005398 degrees S latitude, south easterly to 151.17954 degrees E longitude, 26.468876 degrees S latitude, further south easterly to 151.65 degrees E longitude, 26.6833 degrees S latitude near the location of Kumbia, then southerly to 152.05 degrees E longitude, 27.25 degrees S latitude, then further to 152.117 degrees E longitude, 27.55 degrees S latitude then south westerly to 151.9 degrees E longitude, 27.93333 degrees S latitude then south westerly to 27.93333 degrees S latitude and then back to the commencement point.

Longitude and latitudes are in decimal degrees and reference to the Australian Geodetic Datum (1984).

In regard to the internal boundaries, the Western Wakka Wakka native title claim excludes any areas over which native title has been lawfully extinguished (save for those areas where prior extinguishment may be disregarded under s 47, 47A and 47B, of the Native Title Act, and in it excludes:

Areas which are subject to previous exclusive possession acts done by the commonwealth or the state of Queensland as set out in division 2B of the Native Title Act (as amended).

The Western Wakka Wakka native title claimants do not claim exclusive possession over areas which are subject to previous non-exclusive possession acts done by the Commonwealth or the state of Queensland as set out in division 2B of the Native Title Act.

The native title rights and interests expressed and claimed in this application are in accordance with Australian laws, and in particular;

The Western Wakka Wakka native title claims and assertions in this application are subject to any other extinguishment of native title which is recognised to have occurred under the general common law of Australia.

Persons claiming to hold native title:

The native title rights and interests claimed in relation to the area covered by this application, is and on behalf of the descendants of Jack Darlow, daughter Jane Darlow and her descendants and that these families recognise that they are direct descendants of the Western Wakka Wakka people.

Registered native title rights and interests:

The following Native Title Rights & Interests were entered on the Register on 26/02/1999:
1. To be identified as traditional owners;
2. To speak as traditional owners;
3. To occupy the claimed lands as traditional owners;
4. To protect and manage sites of cultural and environmental significance;
5. To protect and manage sites of educational value;
6. To host and perform customary and cultural practices;
7. To gather, meet and stay on the claimed lands;
8. To hunt and fish on the claimed lands and waters;
9. To grow, harvest and gather native resources for either cultural or commercial practices and purposes;
10. To be consulted in matters relating to the environmental protection of the claimed lands and waters;
11. To be consulted, negotiate and participate in matters relating to Western Wakka Wakka cultural and heritage matters;
12. To Western Wakka Wakka cultural knowledge and information; and
13. To be consulted on the use of Western Wakka Wakka cultural information.

Register attachments:

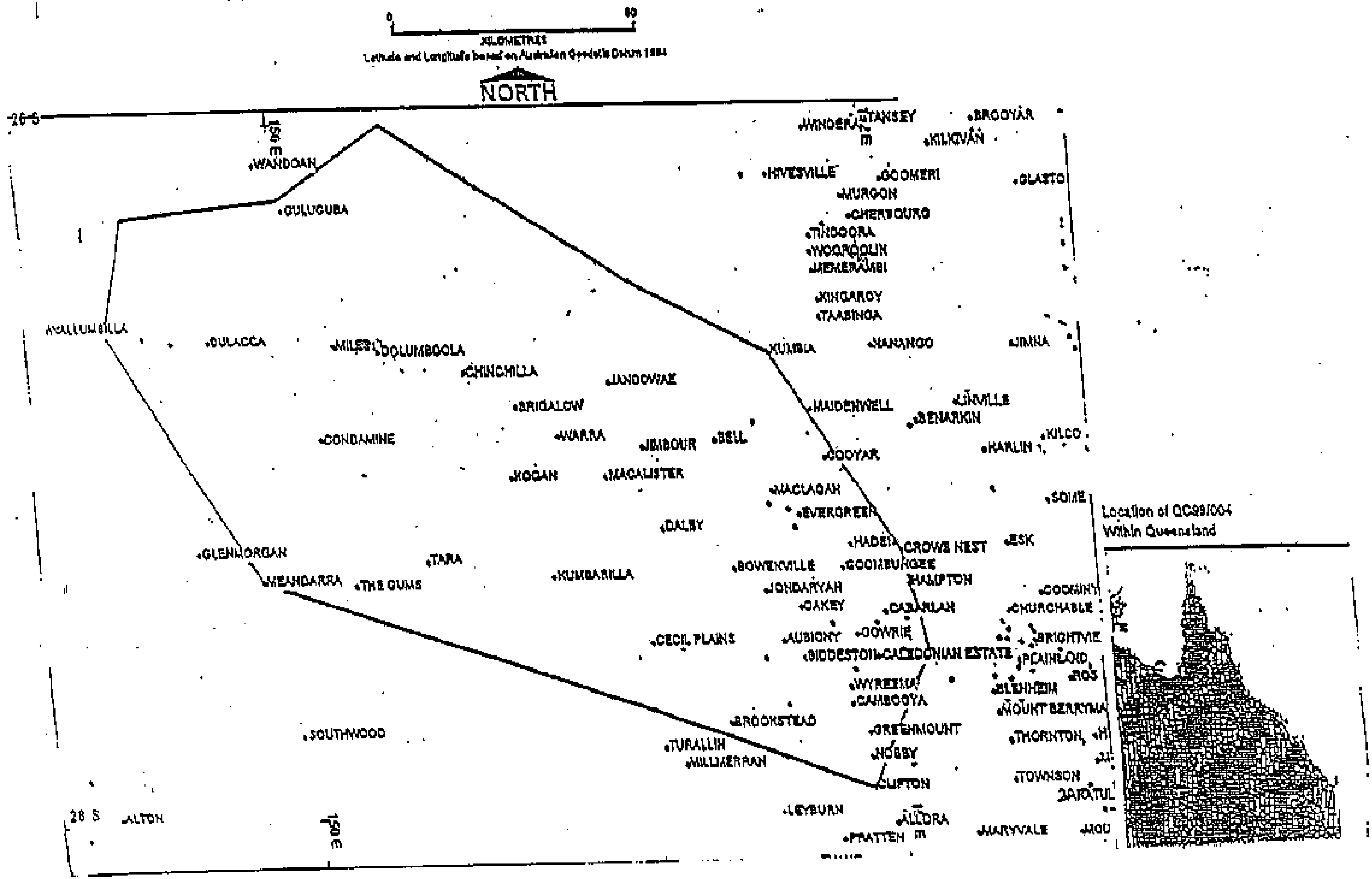
1. Detailed Map of Claim Area (revised), Attachment C of the Application, 1 page - A4, Attached 26/02/1999.

Note: The Register may, in accordance with s.188 of the Native Title Act 1993, contain confidential information that will not appear on the Extract.

QUD6004/99 (QC99/4)
Detailed Map of Claim Area (revised)
Attachment C of the Application
Page 1 of 1, A4, 26/02/1999

as at 18/02/1999

Map produced by the Geospatial Information Unit, National Native Title Tribunal



NATIONAL NATIVE TITLE TRIBUNAL

Claimant Application Summary

Application numbers	Federal Court number: QUD6004/99 NNTT number: QC99/4
Application name	Western Wakka Wakka People
Name of body where application filed	Federal Court of Australia
Date application filed	27/01/1999
Current stage(s)	Notification Complete, In Mediation
Applicants	Mr Adrian Beattie, Mr Bill Hall, Mr Neville Turbane, Ms Jean Smith (nee Turbane), Ms Margaret McLeod, Ms Patricia Hall, Ms Sandra Bauwens (nee Turbane), Brian Tobane
Address for service	Eddy Neumann Craddock Murray Neumann Solicitors Level 2 255 Castlereagh Street SYDNEY NSW 2000 Phone: 02 9283 4755 Fax: 02 9283 4180
Persons claiming to hold native title	The native title rights and interests claimed in relation to the area covered by this application, is and on behalf of the descendants of Jack Darlow, daughter Jane Darlow and her descendants and that these families recognise that they are direct descendants of the Western Wakka Wakka people.
Native title rights and interests claimed	1.The native title rights and interests claimed in relation to the area covered by this application, is by the descendants Jack Darlow who are of the Western Wakka Wakka / Barunggam dialects. 2. The native title rights and interests asserted in this application are true and correct as far as is known to the Western Wakka Wakka native title claimants. 3. The native title rights and interests expressed and claimed in this application are in accordance with Australian laws and in particular abides by the Native Title Act 1993 and the Native Title Amendment Act 1998 and in particular freehold title areas and other exclusive possession type acts. 4. The native title rights and interests in this application is subject to and in accordance with traditional Western Wakka Wakka laws and customs. 5. The native title rights and interests expressed and claimed in the said area have been a continuing practise and is still being enjoyed and exercised by the native title claimants. 6. A Western Wakka Wakka native title right to be identified as traditional owners of the claimed lands. 7. A Western Wakka Wakka native title right to speak as traditional owners. 8. The Western Wakka Wakka native title claim is to vacant crown lands, creeks, rivers, banks/beds, water holes, lagoon, lakes, billabongs, waters and air space. 9. A Western Wakka Wakka native title right as a traditional owner to occupy the said Western Wakka Wakka lands. 10. A Western Wakka Wakka native title right on the said Western Wakka Wakka lands and waters to protect and manage sites including, religious places, birthing places, burial places, places of death, homes of spirits, traditional camping places, town and station camping sites, native fauna and flora areas, ceremonial places, mens and women sites, sacred waters, haunted places, other cultural sites and places, of Western Wakka Wakka. 11. Native title right on the said Western Wakka Wakka lands and waters to protect and manage sites, places and areas of an educational value to the well being of the claimants.

12. A Western Wakka Wakka native title right on the said Western Wakka Wakka lands and waters to those fields where employment value must be inclusive of areas traditional owners. In particular culture and heritage studies, research, and monitoring.
13. A Western Wakka Wakka native title right to the said Western Wakka Wakka lands to host and perform Western Wakka Wakka customary and cultural practices.
14. A Western Wakka Wakka native title right on these said lands to gather, meet and stay.
15. A Western Wakka Wakka native title right on these said lands and waters to hunt and fish.
A Western Wakka Wakka native title right on these said lands to grow, harvest and gather native resources for either cultural or commercial practices and purposes.
16. A Western Wakka Wakka native title right on these lands and waters to monitor, manage and distribute waters both surface and subsurface.
17. A Western Wakka Wakka native titles right on these said lands to all matters pertaining to the environmental protection of these lands. In particular to be consulted and included in Indigenous land and water agreements, national park management, advisory and planning, regional forest agreements, section 29's, mining studies and agreements, cultural and heritage studies and plans, water allocation management plans, national heritage trust studies and projects, new or altered roads studies and plans, new or altered railways studies and plans, new or altered pipelines studies and plan, new or altered powerlines studies and plans, new or altered telecommunications studies and plans, new or altered air routes studies and plans, toxic or dangerous dumps studies and plans.
18. A Western Wakka Wakka native title right on the said lands to be consulted, negotiate, and participate in any and all matters affecting Western Wakka Wakka native title and or cultural and heritage matters.
A Western Wakka Wakka native title right to Wester Wakka Wakka cultural knowledge and information. To be consulted on the use of a Western Wakka Wakka cultural knowledge and information. Provide permission to use Western Wakka Wakka cultural knowledge and information.

Area:

Jurisdiction: Queensland
Location: In the vicinity of Toowoomba, Southern Queensland (32,940 sq km).
Local government region(s): Bendemere Shire Council, Cambooya Shire Council, Chinchilla Shire Council, Clifton Shire Council, Crows Nest Shire Council, Dalby Town Council, Gatton Shire Council, Jondaryan Shire Council, Kingaroy Shire Council, Millmerran Shire Council, Murilla Shire Council, Nanango Shire Council, Pittsworth Shire Council, Rosalie Shire Council, Tara Shire Council, Taroom Shire Council, Toowoomba City Council, Wambo Shire Council, Warroo Shire Council, Wondai Shire Council
ATSIC region(s): Central Queensland Regional Council, Goolburri Regional Council, South-East Queensland Indigenous Regional Council
Representative A/TSI body(s): Gurang Land Council Aboriginal Corporation, Queensland South Representative Body Aboriginal Corporation
Approximate size: 32 941.29398 sq km
(Note: There may be areas within the external boundary of the application that are not claimed.)
Land/water and/or sea: Land/Water

Area covered by the claim (as detailed in the application):
The boundary of the application commences at a point 149.883 degree E longitude, 27.3167 degrees S latitude, near the locality of Meandarra, then traverses in a north westerly direction to 149.71349 degrees E longitude, 27.074521 degrees S longitude, then further north westerly to 149.383 degrees E longitude, 26.6 degrees S latitude, northerly to 149.474786 degrees E longitude, 26.264654 degrees S latitude, easterly to 150.017 degrees E longitude 26.2167 degrees S latitude, north easterly to 150.384419 degrees E longitude, 26.005398 degrees S latitude, south easterly to 151.17954 degrees E longitude, 26.468876 degrees S latitude, further south easterly to 151.65 degrees E longitude, 26.6833 degrees S latitude near the location of Kumbia, then southerly to 152.05 degrees E longitude, 27.25 degrees S latitude, then further to 152.117 degrees E longitude, 27.55 degrees S latitude then south westerly to 151.9 degrees E longitude, 27.93333 degrees S latitude then south westerly to 27.93333 degrees S latitude and then back to the commencement point.

Longitude and latitudes are in decimal degrees and reference to the Australian Geodetic Datum (1984).

In regard to the internal boundaries, the Western Wakka Wakka native title claim excludes any areas over which native title has been lawfully extinguished (save for those areas where prior extinguishment may be disregarded under s 47, 47A and 47B, of the Native Title Act, and in it excludes:

	Areas which are subject to previous exclusive possession acts done by the commonwealth or the state of Queensland as set out in division 2B of the Native Title Act (as amended). The Western Wakka Wakka native title claimants do not claim exclusive possession over areas which are subject to previous non-exclusive possession acts done by the Commonwealth or the state of Queensland as set out in division 2B of the Native Title Act. The native title rights and interests expressed and claimed in this application are in accordance with Australian laws, and in particular; The Western Wakka Wakka native title claims and assertions in this application are subject to any other extinguishment of native title which is recognised to have occurred under the general common law of Australia.

Registration information	*Please refer to the Register of Native Title Claims/National Native Title Register (as appropriate) for registered details of this application.* **Date claim entered on Register of Native Title Claims:** 26/02/1999 **Registration test status:** Accepted for registration **Registration history:** Registered from 26/02/1999.

Attachments	1. Detailed Map of Claim Area (revised), Attachment C of the Application, 1 page - A4, Attached 26/02/1999.

NNTT contact details	**Case manager:**	Ann Stokes
	Address:	National Native Title Tribunal Level 30 239 George Street BRISBANE QLD 4000 GPO Box 9973 BRISBANE QLD 4001
	Phone:	(07) 3226 8200 Freecall 1800 640 501
	Fax:	(07) 3226 8235
	Web page:	www.nntt.gov.au

NATIONAL NATIVE TITLE TRIBUNAL

Application Information and Extract from the Register of Native Title Claims

Application Information

Application numbers:	Federal Court number:	QUD6014/03
	NNTT number:	QC03/15
Application name:	Jagera People #2	
Registration history:	Registered from 11/03/2004.	

Register Extract (pursuant to s.186 of the *Native Title Act 1993*)

Application filed with:	Federal Court of Australia
Date application filed:	12/11/2003
Date claim entered on Register:	11/03/2004
Applicants:	Mr Kenneth Henry Bonner, Mr Clarence William Bonner, Ms Caroline Joyce Bonner-Bray, Mr James Bonner, Ms Madonna Williams
Address for service:	C/- Jagera Peoples Association 78 Park Road, WOOLOOWIN QLD 4030 PO Box 48 BANYO QLD 4014 Phone: (07) 3315 6463

Area covered by the claim:

1. The area covered by this application is described in Annexure "C2"
2. Subject to paragraphs 4 and 5, the area covered by the application excludes any land or waters which presently or was previously covered by -

(a) a Scheduled interest as defined in section 249C of the Native Title Act 1993 (Cth);

(b) a freehold estate (including any right in land or waters taken to be the vesting of a freehold estate by virtue of subsection 23B(3));
(c) a commercial lease that is neither an agricultural lease nor a pastoral lease;
(d) an exclusive agricultural lease or an exclusive pastoral lease;
(e) a residential lease;
(f) a community purposes lease;
(g) a lease dissected from a mining lease referred to in subparagraph 23B(2)(c)(vii) of the Native Title Act 1993 (Cth); or
(h) any lease (other than a mining lease) that confers a right to exclusive possession over particular land or waters,
which was validly granted or vested on or before 23 December 1996.

3. subject to paragraphs 4 and 5, the land and waters the subject of the application excludes any area covered by the valid construction or establishment of any public work (as defined by the Native Title Act 1993 (Cth)), where the construction or establishment of the public work commenced on or before 23 December 1996.

4. Where the act specified in paragraph 2 or 3 falls within the provisions of -
(a) section 23B(9) - Exclusion of acts benefiting Aboriginal peoples or Torres Strait Islanders
(b) section 23B(9A) - Exclusion of national parks etc;
(c) section 23B(9B) - Exclusion of acts where legislation provides for non-extinguishment;
(d) section 23B(9C) - Exclusion of Crown to Crown grants etc; or
(e) section 23B(10) - Exclusion by regulation,
the land and waters affected by the act is not excluded from the application.

5. Where the act referred to in paragraph 2 or 3 affects or affected land or waters referred to in -

(a) section 47 - pastoral leases held by or on behalf of native title claimants or any of the members of the native title claim group;
(b) section 47A – reserves etc. covered by claimant applications; or
(c) section 47B - vacant Crown land covered by claimant applications,
the land and waters affected by the act is not excluded from the application,

The application excludes areas over which native title has otherwise been extinguished exceptthan where it is saved by a s.47(a)(b) provision or by any other provision of this schedule.

Persons claiming to hold native title:

The Jagera People are descended from:
King Moppy
King Billy Turner
Topsy from Ipswich
These are the known apical ancestors of the Jagera People at this time. This description includes all Jagera People whether or not known at this time and includes all persons who hold the native title claimed.

Registered native title rights and interests:

The following Native Title Rights & Interests were entered on the Register on 11/03/2004:

A. The following right and interest can be established prima facie pursuant to s.190B(6) only over areas where exclusive possession can be sustained
The right to possess, occupy , use and enjoy the lands and waters in accordance with and subject to their traditional laws and customs and the force and operation of laws of the Commonwealth and the State, in relation to land where there may be exclusive possession by the Jagera People.

B The following rights and interests can be established prima facie pursuant to s.190B(6) over the whole of the claim area
(a) Live and dwell on the area.
(b) Conserve the natural resources of the area for the benefit of the common law holders;
(c) Maintain, use and enjoy the area for the benefit of the common law holders to the extent permissible by law, that is to:
(i) maintain and protect sites of significance to the common law holders and other Aboriginal People within the meaning of that term in the Native Title Act 1993;
(ii) inherit, dispose of or give native title rights and interests to others provided that such persons are Aboriginal People within the meaning of that term in the Native Title Act 1993;
(iii) decide who are the Jagera People, provided that such persons must be Aboriginal people within the meaning of that term in the Native Title Act 1993
(iv) regulate among and resolve disputes between the common law holders in relation to the rights claimed in the area;
(v) conduct social, religious, cultural and economic activities on the area;
(vi) exercise and carry out economic life on the area, including harvesting, fishing, cultivating, management and exchange of economic resources.
(d) Conserve, use and enjoy the natural resources of the area for social, cultural, economic religious, spiritual, customary and traditional purposes; and make decisions about the use and enjoyment of the area and its natural resources by the common law holders
(e) Make decisions in co-operation with and subject to the co-existing statutory title holders rights and interests, regarding access to, and the use and enjoyment of, the determination area and its natural resources by the Jagera People according to their traditional laws and customs..

These rights may co-exist with other statutory or common law rights in relation to some lands and waters , but in relation to USL land where there are no co-existing rights, exclusive possession is claimed.

In relation to the rights and interests asserted:
- they do not operate exclusive of the Crown's valid ownership of minerals, petroleum or gas;
- they are not exclusive rights or interests if they relate to waters in an offshore place; and
- they will not apply if they have been extinguished in accordance with valid State and Commonwealth laws.

Register attachments:

1. Map of Claim Area, Attachment "C1" of the Application, 1 page - A3, Attached 12/11/2003.
2. External Boundary Description, Attachment "C2" of the Application, 78 pages - A4, Attached 12/11/2003.

Note: The Register may, in accordance with s.188 of the Native Title Act 1993, contain confidential information that will not appear on the Extract.

NATIONAL NATIVE TITLE TRIBUNAL

Claimant Application Summary

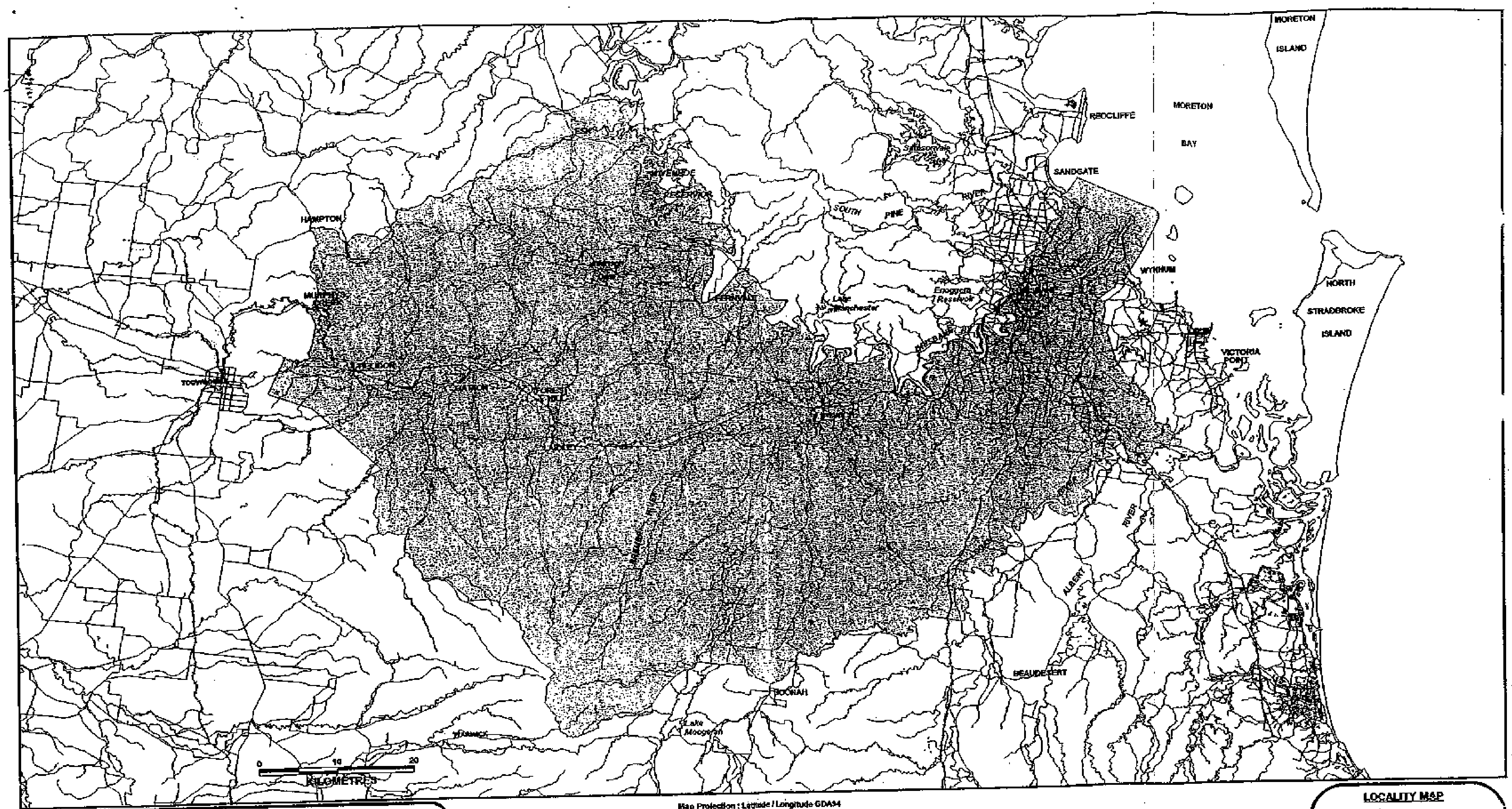
Application numbers	Federal Court number: QUD6014/03 NNTT number: QC03/15
Application name	Jagera People #2
Name of body where application filed	Federal Court of Australia
Date application filed	12/11/2003
Current stage(s)	Notification Complete, In Mediation
Applicants	Mr Kenneth Henry Bonner, Mr Clarence William Bonner, Ms Caroline Joyce Bonner-Bray, Mr James Bonner, Ms Madonna Williams
Address for service	C/- Jagera Peoples Association 78 Park Road WOOLOOWIN QLD 4030 Phone: 07 3315 6463
Persons claiming to hold native title	The Jagera People are descended from: King Moppy King Billy Turner Topsy from Ipswich
Native title rights and interests claimed	The nature and extent of the native title rights and interests claimed are the rights and interests of the common law holders to possess, occupy, use and enjoy lands and waters in accordance with and subject to their traditional laws and customs and the force and operation of laws of the Commonwealth and the State, in relation to land where there may be exclusive possession by the Jagera People. In land where there is not exclusive possession the Jagera people claim the following rights: (a) Live and dwell on the area; (b) conserve the natural resources of the area for the benefit of the common law holders; (c) maintain, use, and enjoy the area for the benefit of the common law holders to the extent permissible by law, that is to: (i) maintain and protect sites of significance to the common law holders and other Aboriginal people within the meaning of that term in the Native Title Act 1993; (ii) inherit, dispose of or give native title rights and interests to others provided that such persons are Aboriginal people within the meaning of that term in the Native Title Act 1993. (iii) decide who are the Jagera people, provided that such persons must be Aboriginal people within the meaning of that term in the Native Title Act 1993; (iv) regulate among, and resolve disputes between, the common law holders in relation to the rights claimed in the area; (v) conduct social, religious, cultural and economic activities on the area;

	5. Where the act referred to in paragraph 2 or 3 affects or affected land or waters referred to in - (a) section 47 - pastoral leases held by or on behalf of native title claimants or any of the members of the native title claim group; (b) section 47A - reserves etc. covered by claimant applications; or (c) section 47B - vacant Crown land covered by claimant applications, the land and waters affected by the act is not excluded from the application, The application excludes areas over which native title has otherwise been extinguished exceptthan where it is saved by a s.47-s.47A-s.47B provision orby any other provision of this schedule.

Registration information	*Please refer to the Register of Native Title Claims/National Native Title Register (as appropriate) for registered details of this application.* **Date claim entered on Register of Native Title Claims:** 11/03/2004 **Registration test status:** Accepted for registration **Registration history:** Registered from 11/03/2004.

Attachments	1. Map of Claim Area, Attachment "C1" of the Application, 1 page - A3, Attached 12/11/2003. 2. External Boundary Description, Attachment "C2" of the Application, 78 pages - A4, Attached 12/11/2003.

NNTT contact details	**Case manager:**	Ann Stokes
	Address:	National Native Title Tribunal Level 30 239 George Street BRISBANE QLD 4000 GPO Box 9973 BRISBANE QLD 4001
	Phone:	(07) 3226 8200 Freecall 1800 640 501
	Fax:	(07) 3226 8235
	Web page:	www.nntt.gov.au



MAP SHOWING EXTENT OF LAND UNDER NATIVE TITLE CLAIMANT APPLICATION BY THE YUGGERA / JAGERA PEOPLES

QUD6014/03 (QC03/15)
Map of Claim Area
Attachment "C1" of the Application
Page 1 of 1, A3, 12/11/2003

N
W E
S

Map Projection : Latitude / Longitude GDA94

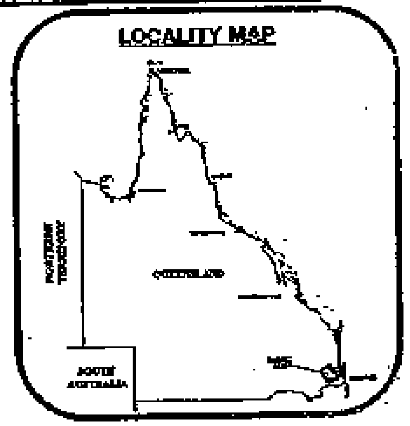
Compilation : Land Tenure Information obtained from the Digital Cadastre Data Base Department of Natural Resources and Mines Brisbane. The Land Registry in the Department of Natural Resources and Mines should be consulted for verification of tenures.

Feature names shown on this map have been obtained from available information. It is possible that errors and omissions may exist. The Department of Natural Resources and Mines disclaims any liability for any errors or omissions that appear in this document.

Inquiries should be addressed to the Director-General, Locked Bag 40, Coorparoo Delivery Centre, 4151 QUEENSLAND, AUSTRALIA.

MAP PRODUCED BY NATIVE TITLE SERVICES, SOUTH EAST REGION, DEPARTMENT OF NATURAL RESOURCES AND MINES BRISBANE.

Queensland Government
Natural Resources and Mines



NATIONAL NATIVE TITLE TRIBUNAL

D10241

MLC Building
Level 30 239 George Street
BRISBANE QLD 4000
AUSTRALIA

GPO Box 9973, BRISBANE QLD 4001
Telephone: (07) 3226 8200
Facsimile: (07) 3226 8235
Website: www.nntt.gov.au

0? OCT 2005

5 October 2005

Our reference: bris.search . 6270
Your reference: D10241

Attn: Cornelia de Rochefort

HLA – Envirosciences Pty Ltd
PO Box 726
Pymble NSW 2073

Dear Sir/Madam

RE: NATIVE TITLE SEARCH – TOOWOOMBA LOCAL GOVERNMENT AREA

Thank you for your search request received 3 October 05 in relation to the above area.

SEARCH RESULT
A search of the Register of Native Title Claims, Register of Indigenous Land Use Agreements, the National Native Title Register and the Applications Summary, based on the information you supplied, has been conducted. The results at the time of the search are listed below.

REGISTER TYPE	**SEARCH RESULT**
National Native Title Register	Nil
Register of Native Title Claims	QC99/4 Western Wakka Wakka People QC03/15 Jagera People 2
Summary of Applications received	QC99/4 Western Wakka Wakka People QC03/15 Jagera People 2
Register of Indigenous Land Use Agreements	Nil

Copies of the relevant register extract/application summary, maps and attachments are enclosed as is the overlap analysis.

Please note that there may be a delay of up to 48 hours between a native title determination application being lodged in the Federal Court and its transfer to the Tribunal. The Applications Summary may therefore not show applications recently lodged with the Court.

SEARCH CHARGES
The charge for a search of the registers/applications summary is $21.45 per 15 minutes and $7.15 per five minutes thereafter. All charges are inclusive of GST.

An invoice for the amount of $27.45 will be forwarded to you shortly.

TRIBUNAL ACCEPTS NO LIABILITY FOR RELIANCE PLACED ON ENCLOSED INFORMATION
The enclosed information has been provided in good faith. Use of this information is at your sole risk. The National Native Title Tribunal makes no representation, either express or implied, as to the accuracy or suitability of the information enclosed for any particular purpose and accepts no liability for use of the information or reliance placed on it.

Should you have any further inquiries, please do not hesitate to contact me on the number below or on the free call number 1800 640 501.

Yours sincerely

GWerner

GAYLE WERNER
SEARCH OFFICER
Tel: (07) 3226 8208
Fax: (07) 3226 8235
Encl.

Overlap Analysis	
Local Govt Authority	Toowoomba City Council
Area extent	116.79548km^2

Export To Excel

This information product has been created to assist in understanding the spatial characteristics and relationships of this native title matter and is intended as a guide only. Spatial data used has been sourced from the relevant custodians in each jurisdiction and is referenced to the AGD84 datum. The Registrar, the National Native Title Tribunal and its staff and officers and the Commonwealth, accept no liability and give no undertakings, guarantees or warranties concerning the accuracy, completeness or fitness for purpose of the information provided.

Applications (Schedule)

Tribunal_No	FC_No	Name	RT_Status	Date_CurrentReg	Area km^2	Overlapped Area km^2
QC99/4	QUD6004/99	Western Wakka Wakka People	Accepted	19990226	32,941.29398	116.79490
QC03/15	QUD6014/03	Jagera People 2	Accepted	20040311	6,102.80994	0.14946

Applications (RNTC)

Tribunal_No	FC_No	Name	Date_CurrentReg	Area km^2	Overlapped Area km^2
QC99/4	QUD6004/99	Western Wakka Wakka People	19990226	32,941.29398	116.79490
QC03/15	QUD6014/03	Jagera People 2	20040311	6,102.80994	0.14946

Determinations (NNTR)

Tribunal_No	FC_No	Name	Area km^2	Overlapped Area km^2
No overlaps	N/A	N/A	N/A	N/A

ILUAs

Tribunal_No	Name	Agreement_Status	Area km^2	Overlapped Area km^2
No overlaps	N/A	N/A	N/A	N/A

Proposed ILUAs

Tribunal_No	Name	Agreement_Status	Area km^2	Overlapped Area km^2
No overlaps	N/A	N/A	N/A	N/A

Appendix B: DNRM Site Search

D 10241

18 OCT 2005

Queensland Government

Natural Resources and Mines

Author Nicole Harman
File CLH/000054/Reference No CHCU111005R3
Your ref:
Cultural Heritage Coordination Unit
Phone 07 3238 3838

11 October 2005

Ms Cornelia De Rochefort
HLA Envirosciences Pty Ltd
PO Box 726
PYMBLE NSW 2072

Dear Ms De Rochefort

Cultural Heritage Search - within a 5 klm radius of Mt Lofty

I refer to your application, dated 4 October 2005, in which you requested advice on Aboriginal cultural heritage places recorded on the above location.

I wish to advise that the search has been performed on the inventory of recorded Aboriginal sites as per your description. Attached is a list which highlights the identified Aboriginal cultural heritage sites, as recorded for the search area. However, it is not possible to conclusively guarantee the accuracy of these recordings (in particular, the longitude and latitude location description for each site) and extra diligence is required when operating in these locations.

All significant Aboriginal cultural heritage in Queensland is protected under the *Aboriginal Cultural Heritage Act 2003*, and penalty provisions apply for any unauthorized harm. Under the legislation a person carrying out an activity must take all reasonable and practical measures to ensure the activity does not harm Aboriginal Cultural Heritage. This applies whether or not such places are recorded in an official register and whether or not they are located in, on or under private land.

Aboriginal cultural heritage, which may occur on the subject property, is protected under the terms of the *Aboriginal Cultural Heritage Act 2003* even if Natural Resources & Mines has no records relating to it.

Locked Bag 40
WOOLLOONGABBA
Queensland 4102 Australia
Telephone (07) 3238 3838
Facsimile (07) 3238 3842
Website www.nrm.qld.gov.au
ABN 83 705 537 586

Please refer to our website *www.nrm.qld.gov.au/cultural_heritage/index.html* for a copy of the gazetted Cultural Heritage duty of care guidelines, which set out reasonable and practical measures for meeting the duty of care.

In order to meet your duty of care, prior to undertaking the proposed land use activity within the vicinity of the recorded cultural heritage, you must consult with the Aboriginal Party for the area.

For further queries including advice regarding the contact details for the Aboriginal party for the area, please contact Nicole Harman on (07) 3238 3839.

Yours sincerely

for Paul Travers
Director
Cultural Heritage Coordination Unit

Fileno	Longitude	Latitude	Attribute
KB:C30	151.98305	-27.50617	Isolated finds
KB:C31	151.98259	-27.50121	Isolated find
KB:C41	151.98448	-27.51611	ARTEFACT
KB:C42	151.98245	-27.51610	ARTEFACT
KB:C43	151.98248	-27.51339	ARTEFACT
KB:C44	151.98250	-27.51068	ARTEFACT
KB:C45	151.98557	-27.50710	ARTEFACT
KB:C46	151.97952	-27.50525	ARTEFACT
KB:C47	151.98460	-27.50348	ARTEFACT
KB:C48	151.98865	-27.50260	ARTEFACT
KB:C49	151.98260	-27.50076	ARTEFACT
KB:C50	151.97348	-27.50159.	ARTEFACT
KB:C51	151.97046	-27.49976	ARTEFACT
KB:C52	151.98041	-27.51789	ARTEFACT
KB:C53	151.97842	-27.51427	Isolated finds
KB:C54	151.98248	-27.51339	Rock Concavities
KB:C55	151.98659	-27.50620	Rock concavities
KB:C56	151.98144	-27.51609	Spring
KB:C57	151.98446	-27.51792	Spring
KB:C58	151.98557	-27.50710	ARTEFACT, Spring
KB:C59	151.98864	-27.50441	Spring
KB:C60	151.97743	-27.51245	ARTEFACT, Spring
KB:F01	151.97292	-27.51301	EARTHEN
KB:G80	152.02247	-27.51947	ARTEFACT
KB:G81	152.01028	-27.51699	CULTURAL, Isolate
KB:G82	151.98465	-27.50839	ARTEFACT
KB:G83	151.98454	-27.50304	ARTEFACT
KB:G84	151.97413	-27.50414	ARTEFACT
KB:G85	151.97305	-27.50361	ARTEFACT
KB:G86	152.01533	-27.51457	ARTEFACT
KB:G87	152.01212	-27.50861	ARTEFACT
KB:G88	152.01086	-27.50758	ARTEFACT
KB:G89	152.01069	-27.50792	ARTEFACT

* written authorisation from Aboriginal party.

PROJECTION: GDA 94

DRAFT
Disposal Study Report
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland

30 November 2005

Prepared for:
Property Disposals Taskforce
BP-2-AO13
Department of Defence
CANBERRA ACT 2600

Report by:
HLA-Envirosciences Pty Limited
ABN: 34 060 204 702
57 Berwick Street Fortitude Valley QLD 4006
PO Box 720 Fortitude Valley QLD 4006 Australia
Ph: +61 7 3606 8900
Fax: +61 2 3606 8999

HLA Ref: D10241001_RPTDraft_30Nov05.doc

DISTRIBUTION

DRAFT
Disposal Study Report
Mount Lofty Rifle Range
Rifle Range Road, Toowoomba Queensland
30 November 2005

Copies	Recipient	Copies	Recipient

This document was prepared for the sole use of Department of Defence and the regulatory agencies that are directly involved in this project, the only intended beneficiaries of our work. No other party should rely on the information contained herein without the prior written consent of HLA-Envirosciences Pty Limited and Department of Defence.

By

HLA-Envirosciences Pty Limited
ABN: 34 060 204 702
57 Berwick Street Fortitude Valley QLD 4006
PO Box 720 Fortitude Valley QLD 4006 Australia

Janet Marshall
Principal Planner

Peer Review:	**Date:**
Mark Imber **Manager, Environmental Services**	

CONTENTS

1 LAND USE PLANNING

1.1 Introduction

The Mt Lofty Rifle Range is located to the north-east of Toowoomba, Queensland, approximately 3km from the Central Business Centre. The site comprises seven lots namely, Lots 1-2, 112, 114 & 191 on RP46221, Lot 2 on RP17738 and Lot 86 on CC350 and is located within Toowoomba City Council. The study areas south and western boundaries are constrained by Rifle Range Road and Martini Road respectively, while the north and eastern boundaries are located in the vicinity of the Withcott outskirts at the base of the escarpment.

There are three shooting ranges on the site; a 12 lane, 600m classification range, a small bore range and a small bore silhouette range. The range is currently used by the Australian Defence Force units based at Oakey and Cabarlah, 25/49 Royal Queensland Regiment and Darling Downs cadet units.

There are currently two licences over the Rifle Range; and agistment license and one issued to the Mt Lofty Shooting Complex. The agistment license is for a 12 month period, from February 2004, with two 12 month options, with a six month termination clause. The shooting club licence commenced in April 2004 for a 12 month period, with two 12 month options and a six month termination clause (Defence, 2004).

The site is fully situated within the Toowoomba City Council local government area and is comprised of a plateau, steep escarpment and low lying undulating ranges overlooking the Lockyer Valley. Consequently the site has a diverse range of environmental and surrounding land use conditions.

This section of the report will describe the land uses of the surrounding area and will discuss the various planning requirements which apply to any development proposal for the part or all of the site.

1.2 Planning Framework

There are several planning documents which are of relevance to the subject site. These are:

- South East Queensland Regional Plan;
- State Planning Policies;
- Planning scheme for the City of Toowoomba;
- Planning scheme for the Shire of Gatton.

1.2.1 South East Queensland Regional Plan (SEQ Regional Plan)

The SEQ Regional Plan is a statutory instrument prepared in accordance with the provisions of section 2.5A of the Integrated Planning Act 1997. The primary purpose of the Regional Plan is to provide a sustainable growth management strategy for SEQ to the year 2026.

The Regional Plan is the pre- eminent plan for the SEQ region and takes precedence over all other planning instruments. Under the IPA, the Regional Plan prevails where there is any inconsistency with any other plan, policy or code, including any other planning instrument made under State legislation, that have effect within the SEQ region.

The South East Queensland Regional Plan includes the subject site is the Rural Landscape and Rural Production Area, the intent of which is to *identify lands that have regional landscape, rural production or other non urban values and protects these areas from encroachment by inappropriate development*, *particularly urban or rural residential development.*

The Regulatory Provisions of the Plan do not allow further fragmentation of land holdings below 100 hectares and makes material change of use applications for urban activities and rural residential purposes impact assessable. Urban development is generally permitted only in the Urban Footprint designation and rural residential development is generally permitted only in the Rural Living designation. The Rural Landscape and Rural Production Area designation is exclusive of the Urban Footprint and Rural Living Designations.

There are no criteria for acceptance of environmental offsets in exchange for permitting urban development of areas outside the urban footprint.

Given the SEQ Regional Plan Provisions, it would be difficult to obtain approval to develop any part of the subject site for urban or rural residential purposes without modification of the Regional Plan. Modification of the Regional Plan is reasonably onerous and requires extensive consultation prior to the Regional Planning Minister being able to finalise the amendment. Should the amendment involve the Regulatory Provisions, then the amendment requires ratification by Parliament.

1.2.2 State Planning Policies

The following State Planning Policies are of relevance to the subject site:

SPP1/92- Development and Conservation of Agricultural Land—The site is not regarded a being good agricultural land and is therefore not subject to this SPP.

State Coastal Management Plan- The site is not within the boundaries of concern of the SCMP.
SPP 1/02 Development in the Vicinity of Certain Airports- The site is not beneath Toowoomba Airport's operational airspace; is not within or beneath any sensitive areas of Toowoomba Airport; is not within Toowoomba airport's 20 ANEF contour and is not within the public safety areas at the end of Toowoomba airport runway, therefore this SPP does not apply.

SPP 2/02 Planning and Managing Development Involving Acid Sulfate Soils- The site does not contain nor have potential to contain acid sulfate soils as it is well above 5.0 m AHD, therefore this SPP does not apply.

SPP1/03 Mitigating the Adverse Impacts of Flood, Bushfire and Landslide- Parts of the site are subject to bushfire and landslide hazard, therefore, this SPP does apply.

Draft SPP Protection of Extractive Industries- A Key Resource Area is identified adjacent to the north west boundary of the site. This SPP is not yet adopted. The existence of a key resource area adjacent to the subject site suggests that there maybe extractive resources on the subject site.

1.2.3 Toowoomba City Council Planning Scheme

The subject site is zoned Special Use (G- Other government precinct) in the planning scheme. The area to the south is zoned Open Space (Environment Precinct) with a small area of Park Residential (Bushland Residential Precinct) and Neighbourhood Residential (Escarpment Residential Precinct). The area to the west is also zoned Neighbourhood Residential (Escarpment Residential Precinct).

In the Special Use (G- Other government precinct) zone, Telecommunications facility(Low Impact) is exempt from assessment under the planning scheme and Telecommunications facility (Medium Impact) is self assessable. All other material change of use will require impact assessment other than Office (general or service), industrial premises if used for scientific, biomedical or technological research, bus/rail passenger terminal or major utility.

The zone and precinct is intended for State and Commonwealth purposes including joint ventures with the state or commonwealth government.

The subject site is identified in the Scheme's Regulatory Maps as having various categories of steep and potentially unstable land and as being prone to bushfire or being a bushfire hazard area. The site also has obstacle limitation surfaces applied to it, however these are in excess of 700 metres above sea level.

1.2.4 Gatton Shire Planning Scheme

The area along Jones Road in Gatton Shire that is in the vicinity of the subject site is shown in the draft. Planning scheme as Rural Uplands and is characterised by lands which are steep, have significant topographical features or significant vegetation. This zone is intended to retain the land in its natural state.

2 DISCUSSION

s47(1)(b) - commercially valuable information

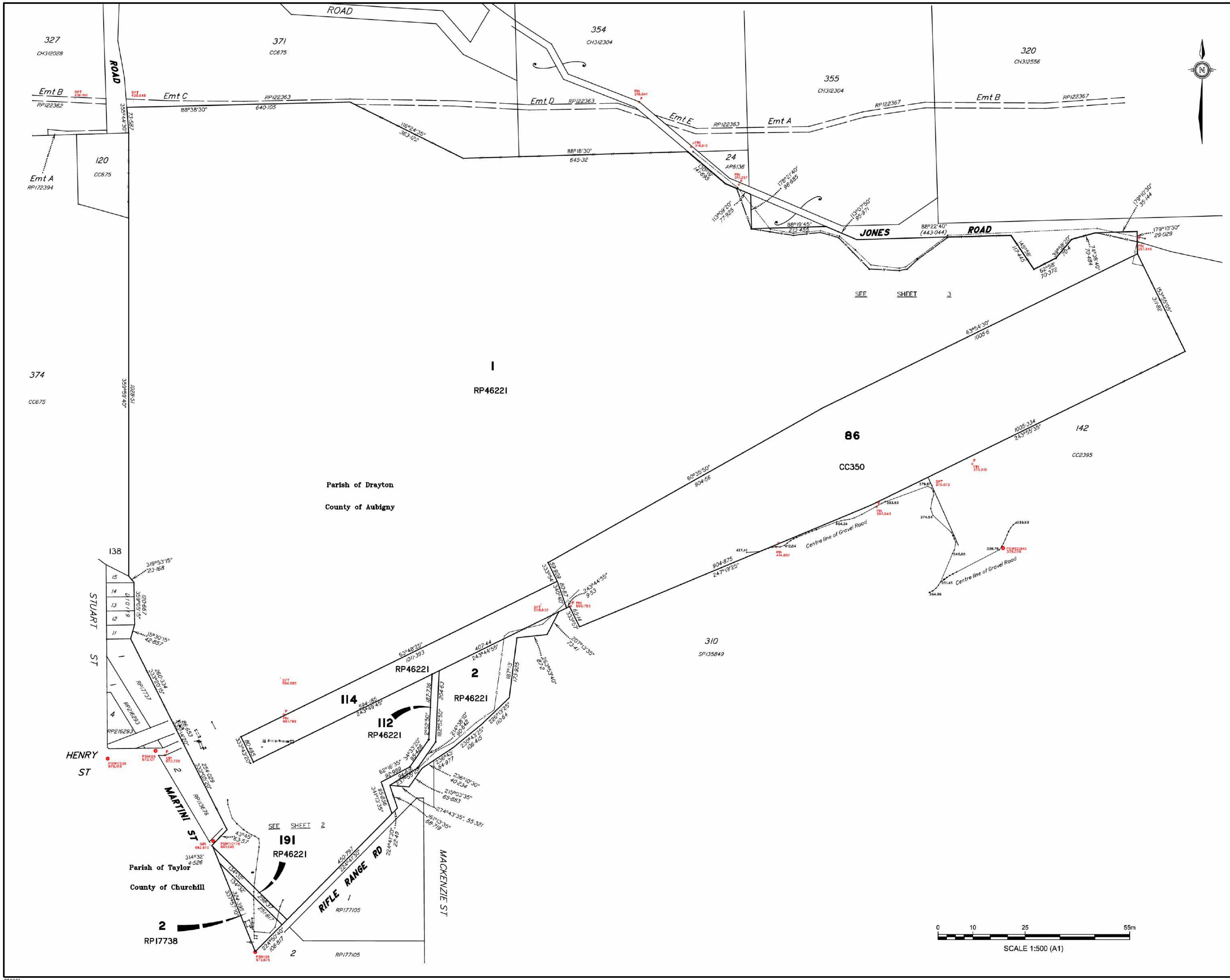
s47(1)(b) - commercially valuable information

[redacted]

s47(1)(b) - commercially valuable information

3 CONCLUSION

s47(1)(b) - commercially valuable information



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PROJECT

PART DETAIL SURVEY OF LOTS 1, 2, 112, 114 & 191 ON RP46221 LOT 2 ON RP17738 AND LOT 86 ON CC350 (RIFLE RANGE RD, MT. LOFTY)

NOTES

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002a/B1	KMcD	8/11/05	INITIAL ISSUE

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BM	BENCH MARK	SM	SEWERAGE MANHOLE
EBX	ELECTRIC BOX	SNSGN	STREET NAME SIGN
ECM	ELECT.CABLE MARKER	SPR	SPRINKLER
ELP	ELECT/LIGHT POLE		SPRED TREE
EM	ELECT.PIT	SSV	STOP/SLUICE VALVE
EP	ELECT.POLE	STN	SURVEY STATION
ESP	ELECT.STAY POLE	SW	STORMWATER M/HOLE
FH	FIRE HYDRANT	TAP	TAP
FHP	FIRE HYDRANT PILLAR	TE	TELECOM PIT
FLAGP	FLAG POLE	TM	TELECOM MANHOLE
GMH	GAS MANHOLE	TOH	TRANSFORMER O/HEAD
GMK	GAS MARKER	TP	TELEPHONE POLE
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GV	GAS VALVE	WCU	WATER END CAP
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HM	HYDRANT MARKER	WMH	WATER MANHOLE
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PKM	PARKING METER	WSV	WATER SCOUR VALVE
PSM	PERM.SURVEY MARK	WTE	WATER TEE JUNCTION
SEV	SEWERAGE VENT	WV	WATER VALVE
SHB	SHRUB	WVM	WATER VALVE MARKER

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ELECT. CABLE A/G
ELEC. CABLE U/G
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FENCE LINE
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WATER PIPE

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HEIGHT DATUM: AHD D	LOCAL COUNCIL AUTHORITY: TOOWOOMBA CITY
HEIGHT ORIGIN: PSM126 RL 672.121	SCALE: 1:5000 (A1)
MERIDIAN: IS194585	CONTOUR INTERVAL: N/A
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PLAN NUMBER

JD 3923-00-002a Sheet 1 of 3

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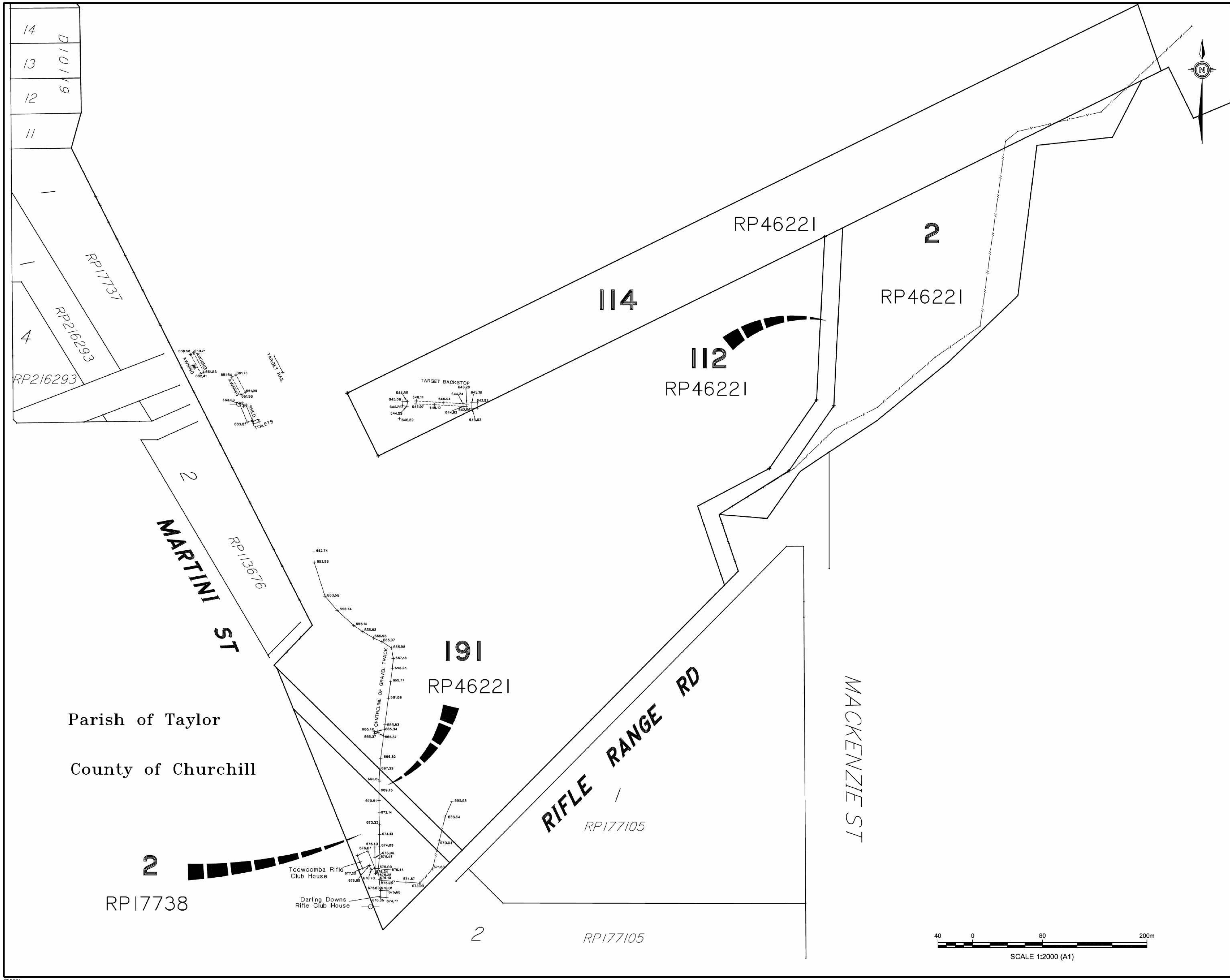

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JD 3923-00-002a Sheet 2 of 3

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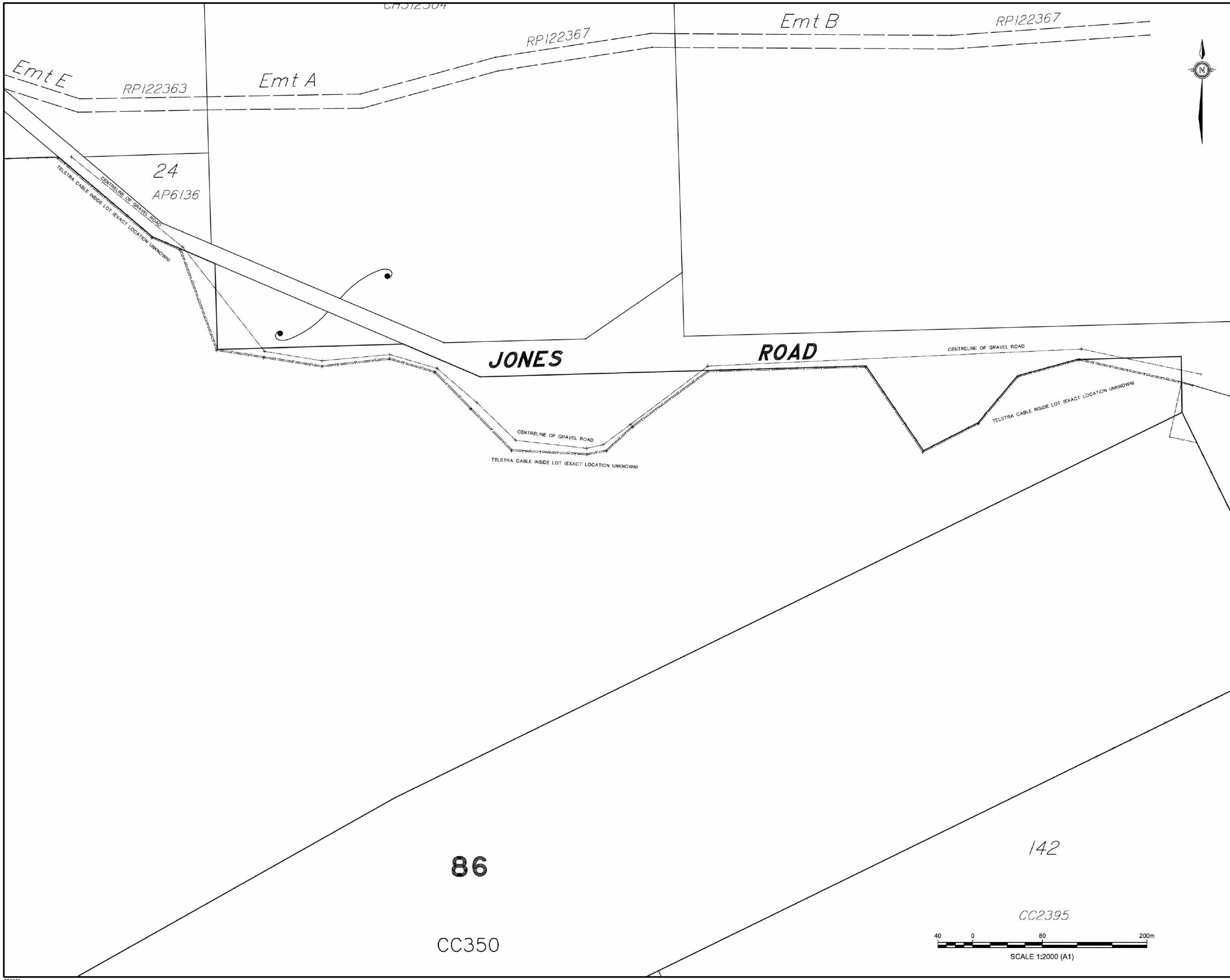

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