ENVIRONMENTAL CONSULTING Pty Ltd

PRELIMINARY SITE INVESTIGATION

PROPOSED SUBDIVISION

March 2024

Prepared for: John Tilton

Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859,
Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886
133-193 Dulguigan Road
Dulguigan NSW

HMC2023.616.02

RE: Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886, 133-193 Dulguigan Road, Dulguigan NSW.

HMC Environmental Consulting Pty Ltd is pleased to present our report for a Preliminary Site Investigation for the abovementioned site.

We trust this report meets with your requirements. If you require further information, please contact HMC Environmental Consulting directly on the numbers provided.

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EXECUTIVE SUMMARY

BACKGROUND

A six lot rural residential subdivision is proposed for a large rural property located at 133-193 Dulguigan Road, Dulguigan NSW. The landholding includes Low Density Residential R2 zoned land on the elevated western portion of the site, while the flats to the east are currently zoned as RU1 Primary Production, and currently used for sugar cane cropping. The proposed future dwelling sites are wholly withing the R2 zoned area.

To address potential site contamination associated with current and former land use, HMC Environmental Consulting (HMC) was commissioned by B & P surveys on behalf of the proponent John Tilton to undertake the required investigation in accordance with *State Environmental Policy (Resilience and Hazards) 2021 (SEPP 2021)*.

A Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection was completed. The investigation areas were confined to the proposed dwelling sites and immediate surrounds with general comments relating to current and former land use across the landholding.

Several historic structures, which have since been demolished, and stockpiled material were located in close proximity to the proposed dwelling sites for proposed Lots 1 and 6, and required further investigation.

OBJECTIVES

The objectives of the Preliminary Site Investigation are to:

- Assess the current and former land use on the investigation area for potentially contaminating activities.
- Based on potentially contaminating activities associated with the current and former land use, assess the suitability of the investigation area for the proposed land use.

SCOPE OF WORKS

The scope of work undertaken during the investigation included the following:

- A desktop assessment of current and former land use on the site including search of available records.
- Review of previous investigations.
- Interview with current and former owners' as available
- A detailed site inspection.
- Preparation of a Preliminary Site Investigation report including:
  - review of available land use history information, and results of the site inspection.
  - assessment of potentially contaminating activities, potential contaminants of concern (PCoC) and areas of concern (AoC).
  - preparation of a soil and analysis quality plan (SAQP).
  - Two soil sampling rounds

    Round 1 –
    - collection of 16 primary soil samples + 2 x QA/QC samples and laboratory analysis for potential contaminants of concern (PCoC) associated with historic structures, across the two proposed dwelling sites.
    - collection of 4 strategic (targeted) hotspot primary samples around the location of a historic structure and laboratory analysis for potential contaminants of concern with the use of this historic structure.

- collection of 3 stockpile samples + 2 x QA/QC samples and laboratory analysis for potential contaminants of concern associated with the stockpile material from an unknown source.

Round 2 –

- Collection of an additional 10 primary soil samples + 2 x QA/QC samples and laboratory analysis in order to delineate the elevated lead contamination detected in the initial sampling round.

- evaluation of laboratory results for compliance with investigation criteria.
- conclusions and recommendations including suitability of the investigation area for the proposed development and need for further investigation and remediation.
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CONCLUSIONS/RECOMMENDATIONS

The Preliminary Site Investigation conclusions are based on the information described in this report and Appendices and should be read in conjunction with the complete report, including Section 14 Limitations.

A subdivision is proposed for the sites located at Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886, 133-193 Dulguigan Road, Dulguigan NSW. A review of available information and a detailed site inspection indicated historic structures existed on the site within close proximity to the proposed dwelling sites on proposed Lots 1 & 6 from prior to 1961 until prior to 2022. These structures may have including hazardous building materials in their construction and may have had historic agricultural uses including the bulk storage of agricultural chemicals and fuel. An investigation of stockpiled material was also completed.

A Sampling and Analysis Quality Plan was prepared and both a systematic and targeted soil investigation was implemented to assess total soil concentrations of contaminants of potential concern including pesticides, fuel and metals, across the identified areas of concern. Laboratory results recorded all organochlorine/organophosphorus chemicals and petroleum hydrocarbons below the investigation criteria for residential land use. Metal results were generally typical of background levels, and, below the investigation criteria. A number of results exceeded the copper and zinc Ecological Investigation Criteria. An ecological risk characterisation indicated that there was unlikely to be an adverse impact on site ecological values. However, laboratory results recorded elevated soil lead results exceeding the investigation criteria. Further investigation was completed to delineate the location of the lead-impacted soil. Asbestos containing material was also recorded on the soil surface within the investigation area.

Based on the information presented, in relation to potential site contamination, the existing dwelling and proposed subdivision site located at Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886, 133-193 Dulguigan Road, Dulguigan NSW as shown in Appendix 1 & 2 of this report, is considered suitable for the proposed development, subject to:

1. Preparation, approval, and implementation of a Remedial Action Plan prepared by a suitably qualified environmental consultant to remediate the identified lead impacted soil; and
2. An assessment by a Safework NSW licensed contractor to identify any asbestos containing material to inform its removal from on and around the proposed future dwelling sites.

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ABBREVIATIONS/ ACRONYMS

ACM	Asbestos containing material
ANZECC	Australian and New Zealand Environment and Conservation Council
AoPC	Area of potential concern
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
AS	Australian Standard
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 (amended 2013)
Client	John Tilton
CLM Act	*Contaminated Land Management Act 1997*
CSM	Conceptual site model
DQO	Data quality objective
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
HIL	Health Investigation Level
HMC	HMC Environmental Consulting
Investigation Area	Proposed development areas (dwelling sites)
mBGL	Metres below ground level
OEH	[NSW] Office of Environment and Heritage
CoPC	Contaminants of Potential Concern
PSI	Preliminary Site Investigation
Site	Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886, 133-193 Dulguigan Road, Dulguigan NSW

1 INTRODUCTION

1.1 BACKGROUND

A six lot rural residential subdivision is proposed for a large rural property located at 133-193 Dulguigan Road, Dulguigan NSW. The landholding includes Low Density Residential R2 zoned land on the elevated western portion of the site, while the flats to the east are currently zoned as RU1 Primary Production, and currently used for sugar cane cropping. The proposed future dwelling sites are wholly withing the R2 zoned area.

To address potential site contamination associated with current and former land use, HMC Environmental Consulting (HMC) was commissioned by B & P surveys on behalf of the proponent John Tilton to undertake the required investigation in accordance with *State Environmental Policy (Resilience and Hazards) 2021 (SEPP 2021)*.

A Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection was completed. The investigation areas were confined to the proposed dwelling sites and immediate surrounds with general comments relating to current and former land use across the landholding.

Several historic structures, which have since been demolished, and stockpiled material were located in close proximity to the proposed dwelling sites for proposed Lots 1 and 6, and required further investigation.

1.2 PROJECT DESCRIPTION

A six lot subdivision is proposed for the large rural landholding located at Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886, 133-193 Dulguigan Road, Dulguigan NSW. The development proposal would rationalise and reorganise the lot layout to provide flood free dwelling sites on the elevated parts of the site. The proposed Lots would comprise:

Lot 1 53.5Ha
Lot 2 19.19 Ha
Lot 3 2.0 Ha
Lot 4 1.65 Ha
Lot 5 1.72 Ha
Lot 6 22.86 Ha:

For the purposes of this report the *investigation area* is the proposed dwelling sites on Lots1, 3-6. An existing approved dwelling is located on proposed Lot 2.

1.3 OBJECTIVE OF THE INVESTIGATION

The objectives of the Preliminary Site Investigation are to:

- Assess the current and former land use on the investigation area for potentially contaminating activities.
- Based on potentially contaminating activities associated with the current and former land use, assess the suitability of the investigation area for the proposed land use.

1.4 SCOPE OF WORKS

The scope of work undertaken during the investigation included the following:

- A desktop assessment of current and former land use on the site including search of available records.
- Review of previous investigations.
- A detailed site inspection.
- Interview with current and former owners' as available
- Preparation of a Preliminary Site Investigation report including:

- review of available land use history information, and results of the site inspection.
- assessment of potentially contaminating activities, Contaminants of Potential Concern (CoPC) and areas of concern (AoC).
- preparation of a soil and analysis quality plan (SAQP).
- Two soil sampling rounds

  Round 1 –
  - collection of 16 primary soil samples + 2 x QA/QC samples and laboratory analysis for potential contaminants of concern (PCoC) associated with historic structures, across the two proposed dwelling sites.
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  Round 2 –
  - Collection of an additional 10 primary soil samples + 2 x QA/QC samples and laboratory analysis in order to delineate the elevated lead contamination detected in the initial sampling round.
- evaluation of laboratory results for compliance with investigation criteria.
- conclusions and recommendations including suitability of the investigation area for the proposed development and need for further investigation and remediation.

2 SITE INFORMATION

2.1 SITE IDENTIFICATION

Table 1 - Site Identification Summary

Street Address		133-193 Dulguigan Road, Dulguigan NSW
Allotment Description		Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886
Allotment size		105 Hectares
Property Number		5184
Local Government		Tweed Shire
Parish		Berwick
County		Rous
Geographical Coordinates (MGA Zone 56)		Easting: -28.287296m E Northing: 153.400974 m S (Approximate centre of site).
Zoning		RU1 - Primary Production, RU2 - Rural Landscape
Land use - Existing		Agriculture, Farming
Land use - Proposed		Rural residential
Site Services		Mains Power, Tank, OSSM
Surround Land Uses	North	Rural, Uncleared bushland
	East	Rural Agriculture, Rural farming
	South	Rural Residential, Rural , Rural farming
	West	Rural Residential

Closest Sensitive Environment	The Rous River is located adjacent south to the subject site. Surface runoff would flow into the various farm drains and intermittent water courses before discharging into the Rous River.

Table 2 – Site Characteristics

Topography	Generally undulating cattle grazing land with elevated areas to the north and central parts of the site grading towards the lower floodplain eastern and southern parts of the site. The Rous River forms the southern boundary, and the site is bisected by Dulguigan Road. All proposed dwelling sites located north of Dulguigan Road. Landform: Ridge, Slope Upper, Slope Middle Aspect: East Slope: Divergent, Waxing Gradient: <3% Elevation: Approximately 1m - 39m AHD across the property. Proposed dwelling sites 21-26m AHD
Regional Geology	Quaternary Alluvial Deposits Current and recent mud, silt, sand, and gravel deposited by river (alluvial) systems.
Soil Landscape	Elevated undulating area (proposed dwelling sites) Billinudgel (bi) landscape: Rolling hills on metamorphics of the Neranleigh-Fernvale Group. Soils: Deep, moderately well-drained Red Podzolic Soils on crests; moderately deep, moderately well-drained Yellow Podzolic Soils on slopes. Geology: Palaeozoic Neranleigh-Fernvale Group. Thinly bedded fissile shales, siltstones and sandstones with occasional more massive greywackes, volcanic tuffs, agglomerates, sandstones, and massive cobble conglomerates. Lower floodplain Tweed (tw) landscape: Extensive marine plain of lower Tweed catchment consisting of deep Quaternary alluvium and estuarine sediments. Soils: Deep, poorly drained Brown Alluvial Clays on levees; deep, poorly drained Humic Gleys, on backplain. Geology: Deep Quaternary alluvium and estuarine sediments. Marine clays are predominant
Australian Soil Classification	Hydrosols (HY) Soils that are saturated in the major part of the soil profile for at least 2-3 months in most years (ie. includes tidal waters). Kurosols (KU) Soils with strong texture contrast between A horizons and strongly acidic B horizons. Many of these soils have some unusual subsoil chemical features (high magnesium, sodium, and aluminium).
Regional Hydrogeology	Groundwater vulnerability is mapped as moderate – moderately high over the elevated portion of the property and proposed dwelling locations. The flats are mapped as high groundwater vulnerability.

	Shallow groundwater (<5m depth) is not expected to be encountered on the elevated areas where future residential development is proposed.
Groundwater Database Search	The online NSW Office of Water groundwater mapping (http://allwaterdata.water.nsw.gov.au/water.stm) shows the nearest mapped registered groundwater bores is GW049343 & GW300324 located within 100m of the site. GW049343 bore use is unknown and GW300324 is registered for domestic use.

3 SITE HISTORY

3.1 OWNERSHIP

As of the search date, the property is currently owned by John Tilton. A review of the title information via the online Land and Property Information portal on 6 December 2023 provides the following information:

Table 3 – Property Ownership

Folio Description	Date of Folio	Search Date	Ownership Details
1/364474 A/174886	15/10/2021	06/12/2023	*John Tilton Pty Ltd*

3.2 AERIAL PHOTOGRAPH INTERPRETATION

A summary of the reviewed historic aerial photography is shown in Table 4.

Table 4 – Historic Aerial Photography Summary

Year	Source	Comments	Areas of Potential Concern Yes/No
1961	NSW Government (Historical Imagery) [1]	The property has generally been cleared of native vegetation, with scattered trees visible across the site. The flats on the north-eastern portion of the property are covered by cropping activities. There appears to be a plantation on the higher slopes to the north-west of the proposed Lot 6 dwelling site. The existing structures on the western boundary of the site are visible (proposed lot 2). There are also two structures visible on proposed Lots 1 and 6, the northern one appearing to be a stable and yards, while the southern appearing to be a dwelling. Another structure is visible on proposed Lot 2 to the south of Dulguigan Rd. What appears to be the Knights TD cattle dip is visible adjacent to the south-eastern access from Dulguigan Road onto proposed Lot 6	YES Historic structures were existing onsite since prior to 1961, in close proximity to the proposed dwelling sites for proposed lots 1 and 6. These structures were both removed prior to 2022. Given the age of the structures, they may be involved in
1970		Similar to 1961. The structure on proposed Lot 2 has been removed, with the majority of the area covered by cropping. No other significant changes noted to the subject site.	
1986		The two existing farm structures on the south-western portion of proposed Lot 1 are now visible. No other significant changes noted to the subject site. The apparent cattle dip and associated yards still appear to be present on the landholding.	
1990		Similar to 1986. It is difficult to distinguish, but it appears that the cattle dip yards have now been removed, along with the shelter over the dip bath.	

1996		Similar to1991. The flats remain covered in cropping activities while the elevated areas are clear of any intensive land uses. No changes to the existing structures are noted.	potentially contaminating activities, or had including hazardous building materials in their construction.
2004 - 2019	Google Earth	Realigned access from Dulguigan Road was installed prior to 2006. Earthworks appear to have occurred on the property prior to 2010 to the north-west of the dwelling site on proposed Lot 6, adjacent to the cropping. No other changes were noted to the property during this period.	
2022 - 2024		Stockpiles of waste are visible around the farm structures adjacent to Duguigan Road to the south-east, as well as to the north–west of the dwelling site on proposed lot 6. This material was removed prior to 2022. The two historic structures on proposed Lots 1 and 6 were also removed prior to 2022, with scattered material remaining around the site of the former structure on proposed lot 6. Some vegetation clearing and earthworks occurred around the existing dwelling and shed on the western boundary of the property, including an upgrade to the driveway access from Dulguigan Road.	

(1) https://portal.spatial.nsw.gov.au/portal/apps/webappviewer/index.html?id=f7c215b873864d44bccddda8075238cb

Table 5 – Statutory Searches

Search	Comment
NSW EPA Contaminated Land Public Record http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx	No records (orders, notices) for the site were discovered.
Australian Department of Defence Unexploded Ordinance Contaminated Sites http://www.defence.gov.au/uxo/where_is_uxo/UXOSearch.asp?State=NSW	No UXO sites are located near the investigation area.
Cattle dip site locator http://www.dpi.nsw.gov.au/agriculture/livestock/health/specific/cattle/ticks/cattle-dip-site-locator	The nearest mapped cattle dip is Knights TD (Decommissioned) located on the southern boundary of the site and Braemar Dip (Demolished) approximately 900m north-west of the site.

3.3 HISTORIC PARISH MAPS & TOPOGRAPHIC MAPS

A summary of the available historic parish and topographic mapping information is shown in Table 6.

Table 6 – Historic Parish and Topographic Map Summary

Search	Comment
Historic Berwick Parish Maps 1910, 1921, 1929, 1937, 1965 https://hlrv.nswlrs.com.au/	Maps do not record land use. Berwick parish maps 1910 to 1965 show the subject site as part of the larger historic lots 8 (46 acres), 9 (100 acres) and 10 (216 acres). No changes were noted during the 1910-1965 period.
Topographic Maps ● Australian Section of the Imperial General Staff (1942), N°223 Zone 8 Murwillumbah, Topographic Map	There are two structures mapped on the property with vehicle tracks extending from Dulguigan Road to the structures. One on the southeastern portion of the site and one of the northwestern portion. Agricultural drains are mapped across the

	eastern portion of the property. No other land uses are shown for the site.
• Department of Lands NSW (Reprinted 1979), 1:25000 9541-II-N Murwillumbah, Topographic Map	The historic lots are mapped for the property. There are scatted structures across the property, including two on the western boundary, and four along the driveway access from Dulguigan Road. 'T.D. Knights Dip' is mapped adjacent south to the property. The eastern portion of the site is mapped as sugarcane.
• NSW Land & Property Information (2002), 1:25000 9641-2N Murwillumbah, Topographic Map	The existing lot boundaries are now mapped. There are four structures mapped along the vehicle access on the southeastern portion of the site, as well as two on the western boundary. There are scattered dams across the property, and patches of open forest. No land uses are mapped for the site.
• NSW Land & Property Information (2016), 1:25000 9641-2N Murwillumbah, GeoPDF Topographic Map	Similar to 2002. An additional structure is mapped towards the north of the property.

3.4 INFORMAL INFORMATION REQUEST – TWEED SHIRE

An informal request for information was submitted by HMC on 6th of December 2023. A response was received on 8 December 2023. The only information on file was a 2020 HMC Environmental Consulting Validation Report for the cleanup of the waste material on the south-eastern portion of the site. The report was undertaken following a Notice of Clean-up Action released by Tweed Shire Council on the 22 October 2020 under the Protection of the Environmental Operations Act 1997. TSC discovered the dumping and burial of waste material around the existing farm sheds adjacent to Dulguigan Road, and stockpiles further north.

As part of the cleanup action, HMC was commissioned by the owners of the property to undertake a Detailed Site Investigation, in order to identify the extent of the waste contamination onsite, in which it was concluded that the waste could be classified as General Solid Waste. HMC then developed a Remedial Action Plan which was approved by TSC in order to remove all waste material from the site. Following which Validation testing was completed and it was concluded that all work was completed in accordance with the TSC Clean Up Notice under the Protection of the Environmental Operations Act 1997.

3.5 OWNER INTERVIEW

An interview was conducted by HMC with the current owner John Tilton on 8th of December 2023. The information gathered is as follows:

- They purchased the property in 2021 from the Eilola Family. They had owned the property for over 100 years.
- At the time of purchase there was a derelict house located on the elevated land to the northwest of the existing farm sheds, which has since been demolished from the site. Since purchase there has not been any further developments.
- They currently use the property for grazing and cane.
- To the best of their knowledge there has never been any orchards, plantations or cropping on the site.
- There is storage of chemicals (Round Up) on the property located at the shed as well as the storage of fuel for the machinery.

- There are no groundwater bores on the property.
- There has been no fill or earthworks ever carried out on the property, nor any farm dumps.

3.6 KNIGHTS TD CATTLE DIP SITE

A review of online NSW DPI Dip Site Locator, available Tweed Shire Council mapping, and historic aerial photography shows the on-site capped Knights TD cattle dip site (Dip) was located on the southeastern portion of the property, adjacent to the driveway access from Dulguigan Road. The Dip was decommissioned and capped, with the lease expiring on 30 June 2002. The Dip was charged with Arsenic 1950-1960 and DDT 1960-1962. The yards and other structures have also been removed and the site now vacant with adjoining rural land uses including cropping and machinery storage.

The TSC GIS and the aerial photography show the dip bath approximately 250m distance from the closest proposed dwelling location, and the yards appeared to be located on the eastern side of the bath extending away from the subject site. Although this is a significant physical buffer, with the gradient away from the subject site, as the dip is located on site nearby to the driveway access, a risk assessment was completed in accordance with NSW DIPMAC (1995) guidelines.

In 1995, the former Cattle Tick Dip Site Management Committee (DIPMAC) produced a guideline for local government recommending a 200-metre radius assessment zone around all cattle tick dip sites. In accordance with the DIPMAC Guidelines, the recommended heads of consideration were addressed within this report using the results of the site inspection and search of DPI records to assess the risk of impact of the former dip site on the proposed dwelling site. The risk assessment process is summarised in Table 7 below.

Table 7 – Risk Assessment – Knights TD Dip

Heads of Consideration	Comments
Whether the dip site is in active use, and if so, whether current dip practices are likely to result in exposure of tickicides to the proposed development by any means.	The Dip is not in use, the dip was decommissioned and capped. The former dip bath is separated from the closest proposed dwelling site by a distance of approximately 250m.
Whether contaminants are likely to move off the site through spray drift, erosion of contaminated soil, stormwater run-off or windblown dust.	The Dip is not active. The soil surface of the former dip bath surrounds is generally sloping south-east towards an agricultural drain away from the subject site. There is an elevation difference of ~10-15m with the development areas located upslope of the former dip site. With the land gradient there is minimal potential for contamination to move towards the site during flooding events, stormwater run-on or via windblown dust.
Whether the proposed development site is located "upstream" or "downstream" of the dip site.	The proposed development would be located upslope of the former dip site with a physical buffer between the sites including sheds, fences and vegetation. The land gradient around the former dip site and yards is southeast away from the proposed development site, with all surface runoff flowing away from the property.
Whether the dip site is securely fenced, particularly with respect to preventing children from entering the dip area. Most fencing around dip sites is designed for stock control and would not normally be of a standard that would exclude humans.	The former dip site area would be securely fenced from the shared driveway access to minimise any access to the area. Given the physical separation between the site and any proposed dwelling locations, access to the area would be limited.

Whether warning signs have been erected around the perimeter of the contaminated area.	The Dip is demolished and has not been active for approximately 20 years. Due to the physical separation, occupants and visitors, would not generally come in contact with the Dip soil. This situation is similar to many current decommissioned dip sites located on large rural landholdings with no warning signs in place.
The lateral extent of chemical contamination in the soil around the dip site, as determined by soil sampling techniques undertaken in accordance with EPA/DIPMAC guidelines.	Given the topography of the site sloping away from any future residential developments, as well as a physical buffer greater than 200m radius, no soil sampling was required for the site.
Whether the proposed development could result in the use of contaminated land for purposes such as the growing of vegetables, fruit trees or raising of poultry, livestock etc.	As discussed, the physical buffer, vegetation and land gradient together, show contaminated land would not be used for purposes such as the growing of vegetables, fruit trees or raising of poultry, livestock etc.
Whether any rehabilitation measures are proposed for the dip site (such as the relocation of contaminated soils off the site to a secure storage area).	The site is to remain grassed with no residential or recreational use proposed for the area. No remediation is required.

In regard to estimating the potential lateral extent of the contamination, the location of the yards control the cattle movement after dipping.

The DIPMAC Guidelines (NSW DPI, 1995) state that:
"The extent of contamination around a dip site is likely to be not more than 20 metres uphill or on the flat and 50 metres downhill of the dip bath. The potential for spread of the contamination is limited by the presence of gullies, rises in slope, road, drains and creeks…"

The NSW Agriculture Guidelines (1996) also state that:

'…the bulk of contamination is within 5 metres of the edges of the bath and draining pen, although concentration of concern may extend further. At sites where the slope away from the dip bath exceeds about 5° the contamination can extend down the hill for about 30m from the dip bath."

In the information fact sheet, "*Arsenic and DDT residues at cattle dip yards*" (Prime Fact, NSW DPI, 2017), the expected location, process and extent of contamination from the bath fluid is described as follows:

'The highest residues are found:
- *close to the dip bath*
- *around the concrete drain pen*

During dipping, cattle splashed dip fluid from the bath leaving residues in the surrounding soil. At some yards, fluid surged down the race. Fluid also dripped into the area around the drain pen and the yard where cattle were held after dipping. Scooping of sediment from the bath into the fenced area outside the dip yard has deposited residues in this area. In 1955, when the arsenic dips were changed to DDT, the arsenic was first separated from the dip bath fluid by adding lime. An insoluble arsenic compound settled to the bottom of the bath, the liquid was pumped out and the solid arsenic compound buried beside the dip bath. At some yards, the arsenic dipping fluid was pumped into the yard. In 1962, similar procedures were used for DDT disposal.

4 SITE INSPECTION

A site inspection was undertaken by H Tunks, M Tunks, and T Richards of HMC on 6 December 2023. There are two separate informal access tracks from Dulguigan Road to the proposed dwelling sites Dulguigan Road bisects the property and unformed vehicle tracks access the proposed house sites for proposed lots 3, 4 and 5. There are no proposed dwelling sites on the southern side of Dulguigan Road and the Rous River bounds the property to the south.

The low-lying level floodplain on the eastern portion of the property is cropped with sugarcane, along with the adjoining properties further south. The elevated western portion of the property is generally cleared pasture land with cattle grazing and patches of mature vegetation.

Two large farm structures are located on the southern part of Proposed Lot 1 north of Dulguigan Road. An existing dwelling and shed are located on the northern part of Proposed Lot 2, near the western boundary of the property. The remainder of the property is clear of any structures.

The proposed dwelling sites for Proposed Lots 1 and 6 are located on the elevated lower hills adjacent to Dulguigan Road to the southeast. The sites are undulating cattle grazing land with both pasture groundcover and also some bare soil/gravel groundcover near the existing cattle yards. There are no mature trees located on the proposed dwelling sites.

Proposed lot 1 dwelling site would be located on a pasture grass area, immediately adjacent to a bare soil/gravel area immediately north-west, towards the proposed lot 2 dwelling site. There were small fragments of what appeared to be asbestos containing material in this area, and there was evidence (debris) of a previous structure (shown in historic aerial photography) in this location.

There are temporary metal cattle yards on Proposed lot 6 dwelling site with some loose debris/disused material, and a small stockpile of soil and assorted debris. Small fragments of what appeared to be asbestos containing material were recorded on and near the cattle yards.

There was no evidence of intensive cropping, vegetative die-off, soil staining, or chemical or other use/storage.

The proposed dwelling sites for Proposed Lots 3, 4 and 5 are located on undulating cattle grazing land on the central, western part of the property. The sloping sites are clear of mature vegetation, with predominantly pasture grass cover. There was no evidence of historic cropping or plantations, nor any historic structures.

4.1 SUMMARY OF SITE CONDITIONS

Table 8 provides a summary of observations during the site inspection.

4.2 SITE PHOTOGRAPHS

See Appendix 10

4.3 SITE LAYOUT

The details of the site inspections are shown in Table 8.

4.4 SITE FEATURES

Table 8 - Site Features Indicating Potential Contamination

Features of Contamination	Comments
Disturbed, discoloured, or stained soil	No visible soil staining, Disturbed soil
Disturbed or distressed vegetation	No Vegetative die-off

Surface water quality	On site dams and drains appeared to be of typical farm water quality
Agrichemical Storage/Use	None recorded during site inspection
Other chemical/fuel storage	None recorded during site inspection
Waste storage	Stockpile on site, Building waste
Asbestos Waste or Use in Structures	Confirmed bonded asbestos fragments noted on soil surface
Fill from unapproved source	Presence of stockpiled debris
Other	Nil

5 IDENTIFIED AREAS OF CONCERN AND CONTAMINANTS OF POTENTIAL CONCERN

A review of available historic aerial photography and topographical mapping, shows intensive agricultural activities on the property since prior to 1961; however, no intensive agricultural activities occurred on or in the immediate vicinity of any of the proposed dwelling sites, and given the topography of the site, there is minimal risk of these activities impacting on these dwelling sites

There were historic structures located on site since prior to 1942. The 1942 historic topographic map shows two structures mapped on site, while the 1961 historic aerial photography showed a number of former structures across the property. Two structures were visible on the Proposed Lots 1 (possibly dwelling) and 6 (possibly farm shed), in close proximity to the proposed dwelling sites. Given their age, the construction of these former buildings may have included hazardous building materials. In addition, they may have been associated with the agricultural activities occurring on the property, including the storage of farm equipment, as well as bulk fuels and agrichemicals. All other proposed dwelling sites have remained clear of any structures or other intensive land uses.

During the site inspection a small stockpiled of debris material was located south-west of the proposed dwelling site 6, of an unknown nature, which may have been associated with the demolition of the structures. Scattered potential ACM material was also noted across the investigation areas.

Table 9 - List of Contaminants of Potential Concern (CoPC) and Areas of Potential Concern (AoPC)

AoPC	PCoC	Description and common relationship
Historic dwelling and associated structures	Organochlorine and organophosphorus pesticides (OCP/OPP) Heavy metals - arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg) Petroleum Hydrocarbons - benzene, toluene, ethyl benzene, xylene (BTEX), volatile and semi-volatile Total Recoverable Hydrocarbons (C6-C40), Polyaromatic hydrocarbons (PAH).	Unknown use historic structures including bulk storage of agricultural chemicals and fuel. Potential historic use of hazardous building materials

	Hazardous Building Materials – lead paint (Pb), asbestos containing material (ACM)	
Stockpile debris from an unknown origin	Organochlorine and organophosphorus pesticides (OCP/OPP) Heavy metals - arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg) Petroleum Hydrocarbons - benzene, toluene, ethyl benzene, xylene (BTEX), volatile and semi-volatile Total Recoverable Hydrocarbons (C6-C40), Polyaromatic hydrocarbons (PAH).	Unknown land use of the site in which the material was sourced. Potential demolition debris.

6 APPLICABLE INVESTIGATION LEVELS AND INVESTIGATION CRITERIA

6.1 SOIL CRITERIA

The proposed residential subdivision would increase the number of persons occupying/visiting the site. There is currently an existing dwelling near the western boundary.

The proposal would allow for future residential development which would include increased occupancy, and therefore, the potential increased exposure to CoPC, if present. Final exposure would depend on the presence and concentrations of soil CoPC, earthworks, and the approved use of the land. The applicable exposure settings for potential exposure of persons to soil, and soil disturbance associated with the potential land use on and around the proposed residential subdivision (investigation area) would be:

- Health investigation level (HIL A) residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children's day care centres, preschools, and primary schools.
- Ecological investigation level (EIL) Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios.
- Health Screening Levels (HSL A) Low - high density residential (assessing fuel/oil contaminants only).
- Ecological Screening Level (ESL) Urban residential areas and public open space (assessing fuel/oil contaminants only).
- Management Limits (ML) Residential, parkland and public open space (assessing fuel/oil contaminants only).

The following guidance notes were considered in the preparation of this report:

- *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (April 2013), EPHC 2013, Canberra.

  (Schedule B)
  - *(1) Guidelines on the Investigation Levels for Soil and Groundwater, and*
  - *(2) Guidelines on Site Characterisation*

In NSW the Measure is now being implemented by way of endorsement under section 105 of the Contaminated Land Management Act 1997. This will provide expanded technical guidance to site auditors, contaminated land consultants, planning authorities and the public when assessing a contaminated site.

- NSW EPA (2022) *Sampling design part 1 - application–Contaminated Land guidelines* were followed during design of the sampling and analysis plan and predetermination of data quality objectives (DQOs).
- SEPP (2021) *State Environmental Planning Policy (Resilience and Hazards)*– provided guidance on project objectives.'
- NSW EPA (2020) *Consultants reporting on contaminated land - Contaminated land guidelines* were followed throughout the investigations and during preparation of this report.
- NSW DEC (2005*) Contaminated Sites - Guidelines for Assessing Former Orchards and Market Gardens* – were used to assist in sampling and analysis plan and preliminary screening criteria.

Table 10 - Investigation Criteria (Soil & Sediment)

Analyte	HIL A [1]	EIL (Bi) [2]	HSL [3]	ESL [4]	ML [5]
Metals/Metalloids (mg/kg)					
Arsenic	100	100			
Chromium	100 (VI)	400 (III)			
Copper	6000	55			
Nickel	400	130			
Zinc	7400	160			
Cadmium	20				
Lead	300	1100			
Mercury (inorganic)	40	100			
Organochlorine/Organophosphorus Chemicals (mg/kg)					
Chlordane	50				
Dieldrin + Aldrin	6				
DDT+DDD+ DDE	240	180			
Heptachlor	6				
Chlorpyrifos	160				
Endosulfan	270				
Endrin	10				
BTEX (mg/kg)					
Benzene			0.7	65	
Toluene			480	105	
Ethyl Benzene			NL	125	
Total Xylenes			110	45	
Total Petroleum Hydrocarbons					
F1 C_6-C_{10}			50	180	800
F2 >C_{10}-C_{16}			280	120	1000

F3 >C_{16}-C_{34}				1300	3500
F4 >C_{34}-C_{40}				5600	10000
Polyaromatic Hydrocarbons					
Napthalene			4	170	
Benzo-pyrene				0.7	
Carcinogenic PAHs (as BaP TEQ)	3				
Total PAH	300				

(1) Health Investigation Levels for residential "A" land use (HIL A) as stated in Table 1A (1) of Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater within the National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended and in force from 16 May 2013

(2) Ecological Investigation Levels (EILs) for Residential (Billinudgel Soil Landscape ca1 pH 4.0, CEC 8.9) as stated in Tables 1B(1)-1B(5) of Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater within the National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended and in force from 16 May 2013

(3) Health Screening Levels for fine soil in Table 1A(3) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013

(4) Ecological Screening Levels for fine soil, in Tables 1B(6) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013.

(5) Management Limits for fine soil Table 1B(7) of *Schedule B (1) Guideline of Investigation Levels for Soil and Groundwater* within the *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended and in force from 16 May 2013

6.2 RELEVANT ENVIRONMENTAL MEDIA

Based on the site history, topography and soils, the relevant environmental media would generally be the surface soil, on and around the proposed residential subdivision location, where soil might be disturbed during earthworks associated with the construction of the development, or subject to movement due to erosion (rain) or wind (dust). In this circumstance, the upper part of the soil profile would be most likely to be disturbed.

6.3 INVESTIGATION CRITERIA

The investigation criteria are based on the Health Investigation Level deemed relevant for the proposed land use in clayey soil. The Ecological Investigation Level applies to ecological receptors and are relevant within 2m of the ground surface.

Groundwater was expected to be at less than 5m depth near the investigation area with sandy clay soil. No groundwater investigation was completed during this preliminary investigation. If surface soil investigation recorded elevated CoPC exceeding investigation criteria then the groundwater regime would be further assessed and, if warranted, groundwater investigation, including collection of representative samples, would be implemented. No groundwater use for domestic purposes is proposed.

ASC NEPM (2013) recommends that "*at the very least, the maximum and the 95% UCL of the arithmetic mean contaminant concentration should be compared to the relevant Tier 1 screening criteria*" and also that "*the results should also meet the following criteria:*

- *the standard deviation of the results should be less than 50% of the relevant investigation or screening level, and*
- *no single value should exceed 250% of the relevant investigation or screening level*".

The 95% UCL of the arithmetic mean provides a 95% confidence level that the true population mean will be less than, or equal to, this value. The 95% UCL is a useful mechanism to account for uncertainty in whether the data set is large enough for the mean to provide a reliable measure of central tendency.

ASC NEPM (2013) recommends that "*at the very least, the maximum and the 95% UCL of the arithmetic mean contaminant concentration should be compared to the relevant Tier 1 screening criteria*" and also that "*the results should also meet the following criteria:*

- *the standard deviation of the results should be less than 50% of the relevant investigation or screening level, and*
- *no single value should exceed 250% of the relevant investigation or screening level*".

The 95% UCL of the arithmetic mean provides a 95% confidence level that the true population mean will be less than, or equal to, this value. The 95% UCL is a useful mechanism to account for uncertainty in whether the data set is large enough for the mean to provide a reliable measure of central tendency

6.4 Data quality objectives

- State the Problem
  - Historic structures were shown to have existed on the property since prior to 1935. The nature of these structures is unknown, but may have been related to a number of potentially contaminating activities including the bulk storage of fuels and chemicals relating to the agricultural activities. CoPC may be present in the soil at concentrations exceeding the investigation criteria for the proposed land use.
  - The detailed site inspection found a small debris stockpile located within the investigation area. The material is of unknown origin and, therefore, CoPC may be present in the soil at concentrations exceeding the investigation criteria for the proposed land use.
- Identify the Decisions/Goals
  - Soil concentrations of CoPC to meet adopted investigation criteria based on future residential land use.
- Identify Information Inputs
  - Soil organochlorine, organophosphate, and metal concentrations, petroleum hydrocarbons
  - Sampling depth and location 0-150mm based on NSW EPA (2022) – *Sampling design part 1 – application* (section 5.3.1)
  - Soil texture
  - Field measurements - visual and olfactory
  - Investigation criteria generally based on residential land use for clay (fine) soil (<2m depth) as shown in Table 10
- Define the Study Boundaries
  - The investigation area is confined to the proposed dwelling locations on proposed Lots 1 and 6. Historic structures were found to have existed on or near both locations. A systematic sampling approach was undertaken over the two areas (2000m^2 each). NSW EPA (2022) requires a minimum of 8 sampling locations for a 2000m^2 area. 8 sampling locations were used at each site for this investigation.
  - A strategic (targeted) sampling investigation of the immediate surrounds of the former historic structure located on proposed Lot 1 was also conducted, with 4 sampling locations around the perimeter of the structure used.

- A stockpile (<75m^3) investigation was conducted adjacent to the investigation area on proposed Lot 6, with three sampling locations across the footprint of the stockpile used.

- Develop the Analytical Approach
  - If the results exceeded the investigation criteria, then the soil would require further investigation/remediation.
  - If the results were below the investigation criteria, then the soil can remain in-situ, and the investigation area would be suitable for the proposed residential land use.
- Specify the Acceptance Criteria
  - Investigation criteria – 95% UCL < HIL A, EIL, HSL A & ESL, Standard Deviation <50% HIL A, EIL, HSL A & ESL, maximum sample concentration <250% HIL A, EIL, HSL A & ESL. – see Table 10.
- Investigation Criteria
  - See Table 10.
- Optimise the Design
  - Vary design based on site conditions and results.

7 SAMPLING AND ANALYSIS PLAN AND SAMPLING METHODOLOGY

7.1 SAMPLING, ANALYSIS AND DATA QUALITY OBJECTIVES

The following sampling, analysis and data quality objectives have been adopted for this site investigation:

- To collect the minimum number of soil samples across the investigation area to assess whether concentrations of CoPC are present and meet the soil investigation criteria for the proposed land use.
- To employ quality assurance when sampling, assessing, and during evaluation of the subject soils.
- To ensure that decontamination techniques are applied during the sampling procedure and that no cross contamination of samples occurs.

7.2 SOIL SAMPLING AND ANALYSIS PROGRAM

A sampling and analysis quality plan (SAQP), and a sampling and analysis program, were developed to assess the site for CoPC associated with storage use of fuel, agrichemicals, and fertilisers.

A systematic sampling approach was adopted for the two investigation areas. 8 primary soil sample locations were generally assessed for each of the 2000m^2 investigation areas subject to the future residential development.

A strategic (targeted) sampling approach was adopted for the hotspot investigation with 4 primary sampling locations in the immediate surrounds of the historic structure on Proposed Lot 1.

A stockpile soil investigation was adopted for the existing material located on Proposed Lot 6, including 3 primary surface soil samples across the footprint of the stockpile (<75m^3).

Additional sampling was undertaken within the investigation area on Proposed Lot 1 following the return of lead results exceeding investigation criteria in order to delineate the extent of the contamination.

Surface soil sampling was adopted as any soil exposure would be to the surface soil within the investigation area. The NSW EPA (2005) recommends 0-150mm sampling interval for disturbed areas.

The following basic measures were undertaken by HMC Environmental Consulting to conform to the minimum standards for field quality assurance and quality control procedures for the samples collected:

- Soil sampling (Round 1) was undertaken by Mark Tunks, Helen Tunks and Taylah Richards of HMC Environmental Consulting, with experience in site contamination investigations on 6 December 2023. The additional sampling (Round 2) was undertaken by Mark Tunks of HMC on 22 January 2024.
- Dedicated, clean stainless-steel trowels were used to collect samples from immediately below the root zone and detritus layer, where present, (0-150mm) using disposable nitrile gloves.
- The trowels were decontaminated before sampling by pressure cleaning (12V) thoroughly with clean water, scrubbing with Decon 90 cleanser, and finally re-rinsing with clean water.
- Field quality assurance and quality control (QA/QC) protocols implemented included details of collection and analysis of field duplicate and triplicate samples.
- Chain of custody documentation was completed.
- The laboratory results and quality assurance and quality control reports including a description of the analytical methods used and reporting for surrogates was also completed.

8 QUALITY ASSURANCE AND QUALITY CONTROL

Sampling was undertaken in accordance with the SAQP (see section 7).

Table 11 – Soil Quality Control Samples

Primary Sample ID	Type	Quality Control Sample ID	Laboratory	Analytes
L1DP6A	Duplicate	DRDUP	ALS, Brisbane	OCPs, OPPs, Metals, TRH, BTEX, and PAH
	Triplicate	DRTRIP	ALS, Sydney	
L2DRSP2A	Duplicate	L2DRSPDUP	ALS, Brisbane	
	Triplicate	L2DRSPTRIP	ALS, Sydney	
L1DR13A	Duplicate	DRDUP2	ALS, Brisbane	Metals (lead)
	Triplicate	DRTRIP2	ALS, Sydney	

The laboratory results and quality control reports include a description of the analytical methods used and reporting for surrogates used by ALS Environmental.

Table 12 - Data Quality Indicators

Data Quality Indicator	Criteria	Comment
Precision		
Laboratory matrix duplicate relative percentage differences (RPDs) within criteria	Limits set by the laboratory: Soil results <10 times the LOR: No limit Soil results between 10-20 times the LOR: RPD must lie between 0-50% Soil results >20 times the LOR: RPD must lie between 0-30%	All soil results recorded an RPD within the prescribed limits.
Field duplicate RPDs within criteria	In accordance with AS4482.1 (2005), RPD results ≥50% will be considered to exceed the data quality objectives (DQO) of the assessment. However, based on	Generally all field duplicate and triplicate <50% RPD or the results was less than 10 times the LOR.

	industry best practice, RPD results will be discounted if both sample results used to calculate the RPD are below the laboratory's limit of reporting (LOR) or less than 10 times the LOR.	
Accuracy		
Matrix spike sample results reported with prescribed limits	Limits set by the laboratory: Results to be between 70-130%.	All results were all between 70-130%.
Surrogate spike sample results reported with prescribed limits	Limits set by the laboratory: Recoveries must lie between 50-150%.	Surrogate spike sample results reported within the prescribed limits.
Laboratory method blanks reported with prescribed limits	Concentrations of targeted parameters should be below the laboratory's limit of reporting (LOR).	Laboratory method blanks reported with prescribed limits.
All analysis NATA accredited	Analysis to be completed by a NATA accredited laboratory.	All analysis NATA accredited
Representativeness		
Samples delivered to laboratory within sample holding times, chilled and with correct preservative	Target temp <4°C. Samples to be submitted to the laboratory within the designated holding times. Different holding times exist for different parameters. Samples to meet the preservation requirements set by the laboratory.	Samples delivered to laboratory within sample holding times, chilled and with correct preservative
Required number of field duplicates and sample blanks taken	Intra and inter laboratory duplicates are to be collected at a ratio of one duplicate pair per 20 samples. One rinse blank and field blank to be collected per day as required. One trip blank to be collected per cooler where analysis of volatile compounds is proposed.	Required number of field duplicates and sample blanks taken Dedicated stainless steel trowels but rinsate collected prior to sampling to check HMC implement cleaning.
Sample blanks reported results below detection limits	Concentrations of targeted parameters to be below the laboratory's limit of reporting (LOR).	The sample blank results were below the LOR
Samples collected in accordance with regulatory and HMC procedures	Samples to be collected in general accordance with standard operating procedures (SOPs) which are based on applicable regulatory guidance and industry best practice.	Samples collected in accordance with regulatory and HMC procedures

Comparability		
Same standard operation procedures (SOPs) applied during each sampling event	The same SOPs to be adopted for each sampling event.	Same standard operation procedures (SOPs) applied during each sampling event
LORs below the adopted assessment criteria	The laboratory's LOR is to be below the adopted assessment criteria.	LORs below the adopted assessment criteria
LORs below the adopted assessment criteria	The sampler is to be a Suitably Qualified Person (SQP)	SQP collected samples
Same type of sample preservation and analysis techniques	The same type of sample preservation and analysis techniques are to be applied to all samples. This information is to be provided within laboratory reports.	Same type of sample preservation and analysis techniques applied to all samples
Completeness		
All laboratory data reviewed and presented in the report (i.e., COCs, SRNs, COAs and QCRs)	All information provided by the laboratory is to be provided in the final report.	All laboratory data reviewed and presented in the report
All sample results reported	All sample results are to be reported and discussed.	All sample results reported
Sample blanks data reported	All sample blank data is to be reported.	Sample blanks not required
Relative percent differences (RPDs) calculated	RPDs to be calculated for all sets of field duplicates.	Relative percent differences (RPDs) calculated
Laboratory duplicates reported	All laboratory duplicate results are to be reported.	Laboratory duplicates/triplicates reported
NATA stamp on reports	NATA stamps to be shown on all laboratory reports.	NATA stamp on reports

9 FIELD AND ANALYTICAL RESULTS

9.1 FIELDWORK

Systematic and strategic field sampling was conducted by experienced environmental scientists on 6 December 2023 and 22 January 2024.

Table 13 – Sample Locations

Primary Sample	Location	Depth (mm)	ID	Soil Description	Laboratory Program
L1DR1A – L1DR8A	Systematic surface sampling across proposed dwelling site on Proposed Lot 1 (1500m^2)	0 - 150mm	Primary	Brown Clay Loam	OCPs, OPPs, Metals, TRH, BTEX, PAH
L1DR9A – L1DR14A	Strategic delineation sampling around the elevated lead sampling locations			Brown-Dark Grey Clay Loam	Metals (lead only)
L2DR1A – L2DR8A	Systematic surface sampling across proposed dwelling site on Proposed Lot 6 (~2000m^2)			Yellow Brown Gravelly Clay-Brown Clay Loam	OCPs, OPPs, Metals, TRH, BTEX, PAH
HSDR1A – HSDR4A	Strategic (targeted) sampling across the footprint of the historic structure located near Proposed Lot 1 dwelling site			Gravelly Yellow Brown Clay	
HSDR5A & HSDR6A	Strategic delineation sampling around the elevated lead sampling locations				Metals (lead only)
HSDR1B & HSDR3B	Subsoil samples for HSDR1A & HSDR3A	150 – 300mm		Brown Clay	
DRL13A-ACM,	ACM found at sampling location L2DR3A		Bulk Sample	NA	ACM
DRL15A-ACM	ACM found at sampling location L2DR5A				
DRL2-ACM1 – DRL2-ACM3	ACM found on or near Potential Lot 2 dwelling site				

A total of 33 primary soil samples (plus 6 x QA/QC) were recovered and placed in laboratory supplied glass jars. The primary samples, together with the QA/QC samples, and potential ACM samples were transported to the HMC office for refrigerated storage prior to delivery to ALS Environmental laboratory Brisbane for analysis for CoPC.

Refer to Appendix 1, 2 and 12 for the site plan and sampling locations.

9.2 ANALYTICAL TESTING

Laboratory analytical services were provided by ALS Environmental, Brisbane.

9.3 SOIL PROGRAM

Round 1 - 6 December 2023

A total of 16 primary samples were taken across the two proposed dwelling sites and submitted for analysis for the following:

- Organochlorine/organophosphorus (OCPs/OPPs) pesticides
- Metals - arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg)
- Petroleum Hydrocarbons – benzene, toluene, ethyl benzene, xylene (BTEX), volatile and semi-volatile Total Recoverable Hydrocarbons (C6-C40), Polyaromatic hydrocarbons (PAH)

A total of 4 primary samples were taken in the immediate surrounds of the historic structure location (potential hotspot) and submitted for analysis for:

- Organochlorine/organophosphorus (OCPs/OPPs) pesticides
- Metals - arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg)
- Petroleum Hydrocarbons – benzene, toluene, ethyl benzene, xylene (BTEX), volatile and semi-volatile Total Recoverable Hydrocarbons (C6-C40), Polyaromatic hydrocarbons (PAH)

A total of 3 primary surface samples were taken across the footprint of the stockpile material and submitted for analysis for:

- Organochlorine/organophosphorus (OCPs/OPPs) pesticides
- Metals - arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg)
- Petroleum Hydrocarbons – benzene, toluene, ethyl benzene, xylene (BTEX), volatile and semi-volatile Total Recoverable Hydrocarbons (C6-C40), Polyaromatic hydrocarbons (PAH)

Round 2 – 22 January 2024

A total of 10 additional samples were taken around the areas which previously returned lead exceedances and submitted for analysis for the following:

- Metals - lead (Pb)

9.4 PRIMARY AND REPLICATE RESULTS

9.4.1 Dwelling Site on Proposed Lot 1

The laboratory analysis of the selected primary samples from the initial sampling round is summarised in Table 14.

Table 14 – Laboratory Results Summary – Round 1 (6 December 2023)

Parameter	Number of primary samples	LOR (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
Metals/Metalloids					
Arsenic	8	5	0	<5 – 14	5-53
Chromium	8	2	0	4 – 10	5-56
Copper	8	5	**2**	12 – **91**	3-412
Nickel	8	2	0	5 – 8	5-38
Zinc	8	5	**3**	82 – **1380**	5-92
Cadmium	8	1	0	<1 – 3	nd
Lead	8	5	**3**	5 – **365**	5-56
Mercury (inorganic)	8	0.1	0	<0.1 – 0.5	nd
Organochlorine/Organophosphorus					
Chlordane	8	0.05	0	<0.05	
Dieldrin + Aldrin	8	0.05	0	<0.05 – 0.07	
DDT+DDD+DDE	8	0.05	0	<0.05	
Heptachlor	8	0.05	0	<0.05	
Chlorpyrifos	8	0.05	0	<0.05	
Endosulfan	8	0.05	0	<0.05	
Endrin	8	0.05	0	<0.05	
BTEX					
Benzene (mg/kg)	8	0.2	0	<0.2	
Toluene (mg/kg)	8	0.5	0	<0.5	
Ethyl Benzene (mg/kg)	8	0.5	0	<0.5	
Total Xylenes	8	0.5	0	<0.5	
Total Petroleum Hydrocarbons					
C6-C10	8	10	0	<10	
>C10-C16	8	50	0	<50	
>C16-C34	8	100	0	<100 – 120	
>C34-C40	8	100	0	<100	
Total >C10-C40	8	50	0	<50 – 120	
Polyaromatic Hydrocarbons					
Napthalene	8	0.5	0	<0.5	
Benzo-pyrene	8	0.5	0	<0.5	
Total PAH	8	0.5	0	<0.5	

* **Bold** indicates a criteria exceedance

Following the return of elevated lead results, additional sampling was undertaken. The results are summarised in Table 15.

Table 15 – Laboratory Results Summary – Round 2 (22 January 2024)

Parameter	Number of primary samples	LOR (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
Metals/Metalloids					
Lead	6	5	**2**	<5 - **335**	5-56

* **Bold** indicates a criteria exceedance

9.4.2 Dwelling Site on Proposed Lot 6

The laboratory analysis of the selected primary samples is summarised in Table 16.

Table 16 – Laboratory Results Summary (6 December 2023)

Parameter	Number of primary samples	LOR (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
Metals/Metalloids					
Arsenic	8	5	0	<5 – 8	5-53
Chromium	8	2	0	8 – 64	5-56
Copper	8	5	0	13 – 25	3-412
Nickel	8	2	0	8 – 51	5-38
Zinc	8	5	**2**	81 – **294**	5-92
Cadmium	8	1	0	<1	nd
Lead	8	5	0	5 – 175	5-56
Mercury (inorganic)	8	0.1	0	<0.1	nd
Organochlorine/Organophosphorus					
Chlordane	8	0.05	0	<0.05	
Dieldrin + Aldrin	8	0.05	0	<0.05	
DDT+DDD+DDE	8	0.05	0	<0.05	
Heptachlor	8	0.05	0	<0.05	
Chlorpyrifos	8	0.05	0	<0.05	
Endosulfan	8	0.05	0	<0.05	
Endrin	8	0.05	0	<0.05	
BTEX					
Benzene (mg/kg)	8	0.2	0	<0.2	
Toluene (mg/kg)	8	0.5	0	<0.5	
Ethyl Benzene (mg/kg)	8	0.5	0	<0.5	
Total Xylenes	8	0.5	0	<0.5	
Total Petroleum Hydrocarbons					
C6-C10	8	10	0	<10	
>C10-C16	8	50	0	<50	
>C16-C34	8	100	0	<100	
>C34-C40	8	100	0	<100	
Total >C10-C40	8	50	0	<50	
Polyaromatic Hydrocarbons					
Napthalene	8	0.5	0	<0.5	
Benzo-pyrene	8	0.5	0	<0.5	
Total PAH	8	0.5	0	<0.5	

* **Bold** indicates a criteria exceedance

9.4.3 Historic Structure Sampling

The laboratory analysis of the selected primary samples from the hotspot sampling around the historic structure location is summarised in Table 17.

Table 17 – Laboratory Results Summary (6 December 2023)

Parameter	Number of primary samples	LOR (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
Metals/Metalloids					
Arsenic	4	5	0	<5 – 9	5-53
Chromium	4	2	0	5 – 17	5-56
Copper	4	5	0	25 – 44	3-412
Nickel	4	2	0	4 – 32	5-38
Zinc	4	5	**3**	154 – **566**	5-92
Cadmium	4	1	0	<1	nd
Lead	4	5	**4**	**332 – 1330**	5-56
Mercury (inorganic)	4	0.1	0	<0.1	nd
Organochlorine/Organophosphorus					
Chlordane	4	0.05	0	<0.05	
Dieldrin + Aldrin	4	0.05	0	<0.05 – 1.86	
DDT+DDD+DDE	4	0.05	0	<0.05 – 0.75	
Heptachlor	4	0.05	0	<0.05	
Chlorpyrifos	4	0.05	0	<0.05	
Endosulfan	4	0.05	0	<0.05	
Endrin	4	0.05	0	<0.05	
BTEX					
Benzene (mg/kg)	4	0.2	0	<0.2	
Toluene (mg/kg)	4	0.5	0	<0.5	
Ethyl Benzene (mg/kg)	4	0.5	0	<0.5	
Total Xylenes	4	0.5	0	<0.5	
Total Petroleum Hydrocarbons					
C6-C10	4	10	0	<10	
>C10-C16	4	50	0	<50	
>C16-C34	4	100	0	<100	
>C34-C40	4	100	0	<100	
Total >C10-C40	4	50	0	<50	
Polyaromatic Hydrocarbons					
Napthalene	4	0.5	0	<0.5	
Benzo-pyrene	4	0.5	0	<0.5	
Total PAH	4	0.5	0	<0.5	

* **Bold** indicates a criteria exceedance

Following the return of lead exceedances, additional sampling was undertaken. The results are summarised in Table 18.

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Table 18 – Laboratory Results Summary – Round 2 (22 January 2024)

Parameter	Number of primary samples	LOR (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
Metals/Metalloids					
Lead	4	5	**1**	46 - **404**	5-56

* **Bold** indicates a criteria exceedance

9.4.4 Stockpile Sampling

The laboratory analysis of the selected primary samples from the stockpile sampling is summarised in Table 19.

Table 19 – Laboratory Results Summary (6 December 2024)

Parameter	Number of primary samples	LOR (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
Metals/Metalloids					
Arsenic	3	5	0	6 – 11	5-53
Chromium	3	2	0	11 – 16	5-56
Copper	3	5	0	20 – 25	3-412
Nickel	3	2	0	11 – 16	5-38
Zinc	3	5	**3**	**337 – 814**	5-92
Cadmium	3	1	0	<1	nd
Lead	3	5	0	51 – 121	5-56
Mercury (inorganic)	3	0.1	0	<0.1	nd
Organochlorine/Organophosphorus					
Chlordane	3	0.05	0	<0.05	
Dieldrin + Aldrin	3	0.05	0	<0.05	
DDT+DDD+DDE	3	0.05	0	<0.05	
Heptachlor	3	0.05	0	<0.05	
Chlorpyrifos	3	0.05	0	<0.05	
Endosulfan	3	0.05	0	<0.05	
Endrin	3	0.05	0	<0.05	
BTEX					
Benzene (mg/kg)	3	0.2	0	<0.2	
Toluene (mg/kg)	3	0.5	0	<0.5	
Ethyl Benzene (mg/kg)	3	0.5	0	<0.5	
Total Xylenes	3	0.5	0	<0.5	
Total Petroleum Hydrocarbons					
C6-C10	3	10	0	<10	
>C10-C16	3	50	0	<50	
>C16-C34	3	100	0	<100 – 450	
>C34-C40	3	100	0	<100	
Total >C10-C40	3	50	0	<50 – 450	
Polyaromatic Hydrocarbons					
Napthalene	3	0.5	0	<0.5	
Benzo-pyrene	3	0.5	0	<0.5	
Total PAH	3	0.5	0	<0.5	

* **Bold** indicates a criteria exceedance

10 QA/QC LABORATORY DATA REVIEW

10.1 RELATIVE PERCENT DIFFERENCE (RPD)

The results show generally good correlation between the primary samples and the field replicates with all results below 50% RPD or less than 10 times the LOR. The results also show good correlation between the primary samples and the triplicates samples.

10.1.1 Rinsate

Generally, all results were below the laboratory level of reporting (LOR) and, therefore, indicative of sampling technique and field QA/QC. Very slight detections of metals and total recoverable hydrocarbons were recorded, however, the levels are not indicative of cross contamination and did not impact on results.

10.1.2 Statistical Analysis

Generally, CoPC results (total concentrations) for the investigation areas were below the investigation criteria and therefore statistical analysis was not required.

There were 2 samples at the dwelling sit for Proposed Lot 1 which exceeded the conservative EIL criteria for copper (55mg/kg), and 3 samples that exceeded the EIL criteria for zinc (160mg/kg). There were 5 samples which exceeded the HIL A criteria for lead (300mg/kg). Given the small sample number (<10), statistical analysis could not be performed on the copper and zinc results, however the copper concentrations did not exceed the 250% criteria for a single location, while the zinc concentrations did exceed this maximum criteria. The results of the statistical analysis for the lead results are summarised in Table 20 below. As shown, the statistical analysis for the lead recorded results below the investigation criteria for HIL A.

Table 20 – Historic Structure Sampling Statistical Analysis Results Summary

Analyte	95% UCL	Standard Deviation (max 50% investigation criteria)	Maximum (250% investigation criteria)
Lead	244 mg/kg	138 mg/kg	365 mg/kg

* Bold indicates exceedances in the criteria.

Two samples at the Proposed Lot 6 dwelling site exceeded the conservative EIL criteria for zinc (160mg/kg). Given the small sample number (<10), statistical analysis could not be performed on the results, however the zinc concentrations did not exceed the 250% criteria for a single location.

Three samples from the strategic historic structure sampling investigation exceeded the conservative EIL criteria for zinc (160mg/kg), while 5 samples exceeded the HIL A criteria for lead. Given the small sample number (<10), statistical analysis could not be performed on the results, however the both the zinc and lead concentrations exceeded the 250% criteria for a single location.

All three samples for the stockpile investigation exceeded the conservative EIL criteria for zinc (160mg/kg). Given the small sample number (<10), statistical analysis could not be performed on the results, however the concentrations exceeded the 250% criteria for a single location.

10.2 SOIL INVESTIGATION CONCLUSIONS

10.2.1 Proposed Lot 1 Dwelling Site Investigation

The Soil and Analysis Quality Plan was implemented, and generally all organochlorine and organophosphorus along with BTEX and Polyaromatic Hydrocarbon results, were below the LOR and, therefore, below the investigation criteria. There were 3 samples which recorded combined Dieldrin + Aldrin concentrations, as well as Total Petroleum Hydrocarbons (>C16-C34), however, all results were below the investigation criteria.

There were 2 samples at which exceeded the conservative EIL criteria for copper (55mg/kg) and 3 samples exceeded the EIL criteria for zinc (160mg/kg). There were also 3 samples which exceeded the HIL A criteria for lead (300mg/kg). Following the return of results exceeding investigation criteria, additional sampling was undertaken in order to delineate the extent of the impacted soil. Two of the additional samples also exceeded the HIL A criteria. Statistical analysis performed on the lead results recorded results all below the investigation criteria. There were concentrations exceeding LOR in the other metal results, however they were all typical of background concentrations, and all below the investigation criteria.

10.2.2 Proposed Lot 6 Dwelling Location Investigation

The Soil and Analysis Quality Plan was implemented, and all organochlorine and organophosphorus and petroleum hydrocarbon results, along with cadmium and mercury results, were below the LOR and, therefore, below the investigation criteria. There were concentrations exceeding LOR in the other metal results, however they were generally typical of background concentrations, and generally all below the investigation criteria. Two samples recorded elevated zinc results which exceeded the conservative EIL criteria; however, they did not exceed the 250% criteria for a single location. There were concentrations exceeding LOR in the other metal results, however they were all typical of background concentrations, and all below the investigation criteria.

10.2.3 Historic Structure Hotspot Investigation

The Soil and Analysis Quality Plan was implemented, and generally all organochlorine and organophosphorus along with all petroleum hydrocarbons and cadmium, were below the LOR and, therefore, below the investigation criteria. There were three samples which detected combined Dieldrin + Aldrin concentrations, as well as one sample detected elevated concentrations of combined DDT + DDD + DDE, however all results were below the investigation criteria.

There were 3 samples at which exceeded the conservative EIL criteria for zinc (160mg/kg). There were also 4 samples which exceeded the HIL A criteria for lead (300mg/kg). Following the return of elevated results, additional sampling was undertaken in order to delineate the extent of the contamination. One of the subsoil samples from the additional sampling also exceeded the HIL A criteria. There were concentrations exceeding LOR in the other metal results, however they were all typical of background concentrations, and all below the investigation criteria.

10.2.4 Stockpile Investigation

The Soil and Analysis Quality Plan was implemented, and generally all organochlorine and organophosphorus along with BTEX and Polyaromatic Hydrocarbon results, were below the LOR and, therefore, below the investigation criteria. There was a single sample which detected elevated Total Petroleum Hydrocarbons (>C16-C34); however, it was well below the investigation criteria.

There were three samples at which exceeded the conservative EIL criteria for zinc (160mg/kg). There were

concentrations exceeding LOR in the other metal results, however they were all typical of background concentrations, and all below the investigation criteria.

10.2.5 Asbestos Investigation

Potential asbestos containing material (ACM) was identified across the proposed dwelling sites on Proposed Lots 1 and 6. Five bulk samples were taken from the surrounds of the existing cattle yards, as well as in the sampling locations L1DR3A and L1DR5A, and forwarded to the lab for analysis. All five samples returned positive identification of asbestos.

Table 21 – Laboratory Results for Suspected ACM

Sample ID	DRL15A-ACM	DRL13A-ACM	DRL2-ACM1	DRL2-ACM2	DRL2-ACM3
Asbestos Detected	YES	YES	YES	YES	YES
Asbestos Type	Chrysotile + Amosite	Chrysotile	Chrysotile + Amosite	Chrysotile + Amosite	Chrysotile + Amosite

10.2.6 EIL Risk Assessment

The results of the soil investigation across the site generally meet the investigation criteria. Generally, no Health Investigation Levels have been exceeded for the proposed sensitive residential land use. There were exceedances relating to Ecological Investigation Levels.

To assess the need to address EIL exceedances, the NEPC, 2011. National Environment Protection (Assessment of Site Contamination) Measure 2011 *Schedule B5a Guideline on Ecological Risk Assessment,* National Environment Protection Council Service Corporation, April 2011 were reviewed with the following sections providing guidance:

Section 4.5 Risk Characterisation

" If the on-site soil concentration of any contaminant of concern is greater than the most appropriate EIL, the site contamination may be having an adverse impact on ecological values. Due to the general nature of data collected and the methods used to calculate EILs, the EILs are generally conservative. Therefore, levels of contamination above an EIL should not automatically necessitate remedial or clean-up action, but rather they trigger further evaluation."

Section 4.6 Risk Management Decision and ERA (Ecological Risk Assessment) outcomes
"After risk characterisation, a risk management decision is necessary. This decision weighs up the findings of the Preliminary ERA against risk management considerations.
Factors that may influence a risk management decision (and therefore determine ERA outcomes) are generally based on economic, ecological or societal considerations as well as the scientific information and results generated within the Preliminary ERA. Examples include:

- *the size of the site, land value, and cost of remediation (economic)*
- *the type of contaminants present, current and potential site land use, surrounding land use (societal)*
- *the ecological significance of the values identified in the receptor identification component of the Preliminary ERA that are to be protected (e.g. a rare and endangered species or a species that supports a valued ecological process or a sensitive introduced species of low ecological significance, e.g. a rabbit).*

If the Preliminary ERA finds that the decisions on exposure and ecological values that were made in deriving the EILs were appropriate for the site and the risk characterisation suggests that there is unlikely to be an adverse impact on ecological values, the risk manager must decide to either:

- *adopt the 'no action' outcome or*

- *adopt the 'monitoring' outcome"*

For this site the land is currently used for residential, as well as agricultural activities including cattle grazing and cropping. The site has been previously subject to long term residential use, cleared of native vegetation since prior to 1942. No threatened species have been reported for the site. The vegetative cover appears healthy, and no vegetative die-off or soil staining indicating impacts on vegetative growth have been identified. The site is elevated with an expected >5m buffer to groundwater.

Based on the existing site conditions, and the proposed subdivision and future land use, it is considered there is unlikely to be an adverse impact on ecological values, with no further action required.

11 CONCEPTUAL SITE MODEL

Table 22 – Conceptual Site Model

POTENTIAL SOURCE	PATHWAY	EXPOSURE ROUTE	RECEPTOR	OUTCOME
Historic Structures (Potential Hazardous Building Materials, Potential agricultural activities including bulk storage of chemicals and fuels)	Surface water runoff	Chemical/sediment entering local water ways	Ecological receptors	The soil investigation of the proposed Lot 1 and Lot 6 dwelling sites generally recorded CoPC concentrations below the investigation criteria. There were exceedances in the EIL criteria for both copper and zinc, however, it is considered there is unlikely to be an adverse impact on ecological values. Lead concentrations exceeded the HIL A criteria near Proposed Lot 1 dwelling site. Bonded asbestos fragments were also recorded on the ground surface The proposed subdivision site would be suitable for the proposed subdivision subject to removal of the ACM by a
	Exposed surface soil	Dermal contact to exposed soil during earthworks, proposed infrequent use	Site worker, Occupier, Visitor	
	Atmospheric dispersion	Inhalation of soil exposed during earthworks and in exposed bare soil areas		
	Leaching to groundwater	Groundwater movement off-site to beneficial users or ecological receptors	Beneficial users/Ecological receptor	

				Safework NSW licensed contractor and remediation of the lead-impacted soil located near the Proposed Lot 1 dwelling site. Relocation of this dwelling site clear of AoPC would also be an option.

12 DISCUSSION

A review of available historic aerial photography and topographical mapping, shows the property and surrounding area appears to have been generally cleared of native vegetation prior to 1942. The 1961 showed the property subject to cropping activities on the eastern portion of the property and a small plantation on the elevated slopes near the centre of the property. No intensive agricultural activities occurred on any of the proposed dwelling sites, and given the topography of the site, there is no risk of these activities potentially contaminating the areas.

There were historic structures located on site since prior to 1942. The 1942 historic topographic map shows two structures mapped on site, while the 1961 historic aerial photography showed a number of former structures across the property. Two structures were visible on the Proposed Lots 1 and 6, in close proximity to the proposed dwelling sites. Given their age, the construction of these former buildings may have included hazardous building materials. In addition, they may have been associated with the agricultural activities that occurring on the property, including the storage of farm equipment, as well as bulk fuels and agrichemicals. All other proposed dwelling sites have remained clear of any structures or other intensive land uses.

During the site inspection stockpiled debris material was located south-west of the proposed Lot 6 dwelling site, of an unknown nature, which may have been associated with the demolition of the former structures. Scattered potential ACM fragments were also noted across the investigation area.

A SAQP was implemented and the results from the sampling program generally complied with the HIL investigation criteria for the proposed residential land use. Lead results exceeding investigation criteria were recorded in seven locations across the Proposed Lot 1 dwelling site. A further sampling round with step out distances was conducted in order to further delineate the lateral and vertical extent of the lead-impacted soil.

Lead-impacted soil is regularly encountered and management options are well-established. These include:

1. Transport excavated material off-site to an approved landfill facility. Note: the waste impacted by lead paint is able to be pre-classified as general solid waste to be accepted by local facilities.
2. Subject to suitable site conditions and future development, excavate lead-impacted soil and place in a controlled sub-surface location in a suitable location on the site capped with clean virgin excavated natural material. The capping might also be concrete on an access road.

A number of samples collected from across the site exceeded the EIL criteria. An EIL risk characterisation did not indicate any likely adverse impact on site ecological values, with no further action recommended.

Although removal of the asbestos containing material in the site is required, this is able to be completed by a Safework NSW licensed contractor. Relocation of the Proposed Lot 1 dwelling site clear of the lead-impacted

soil area, and clear of other areas of potential concern may be an option to avoid lead-impacted soil remediation, subject to further investigation.

13 CONCLUSIONS AND RECOMMENDATIONS

The Preliminary Site Investigation conclusions are based on the information described in this report and Appendices and should be read in conjunction with the complete report, including Section 14 Limitations.

A subdivision is proposed for the sites located at Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886, 133-193 Dulguigan Road, Dulguigan NSW. A review of available information and a detailed site inspection indicated historic structures existed on the site within close proximity to the proposed dwelling sites on proposed Lots 1 & 6 from prior to 1961 until prior to 2022. These structures may have included hazardous building materials in their construction and may have had historic agricultural uses including the bulk storage of agricultural chemicals and fuel. An investigation of stockpiled material was also completed.

A Sampling and Analysis Quality Plan was prepared and both a systematic and targeted soil investigation was implemented to assess total soil concentrations of contaminants of potential concern including pesticides, fuel and metals, across the identified areas of concern. Laboratory results recorded all organochlorine/organophosphorus chemicals and petroleum hydrocarbons below the investigation criteria for residential land use. Metal results were generally typical of background levels, and, below the investigation criteria. A number of results exceeded the copper and zinc Ecological Investigation Criteria. An ecological risk characterisation indicated that there was unlikely to be an adverse impact on site ecological values. However, laboratory results recorded elevated soil lead results exceeding the investigation criteria. Further investigation was completed to delineate the location of the lead-impacted soil. Asbestos containing material was also recorded on the soil surface within the investigation area.

Based on the information presented, in relation to potential site contamination, the existing dwelling and proposed subdivision site located at Lot 8 DP 755685, Lot 1 DP 364474, Lot 1 DP 410859, Lot 1 DP 376131, Lot 1 DP 328107 & Lot A DP 174886, 133-193 Dulguigan Road, Dulguigan NSW as shown in Appendix 1 & 2 of this report, is considered suitable for the proposed development, subject to:

1. Preparation, approval, and implementation of a Remedial Action Plan prepared by a suitably qualified environmental consultant to remediate the identified lead impacted soil; and
2. An assessment by a Safework NSW licensed contractor to identify any asbestos containing material to inform its removal from on and around the proposed future dwelling sites.

14 LIMITATIONS

Any conclusions presented in this report are relevant to the site condition at the time of inspection and legislation enacted as at date of this report. Actions or changes to the site after time of inspection or in the future will void this report as will changes in relevant legislation.

The findings of this report are based on the objectives and scope of work outlined in Section 1. HMC Environmental has performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees expressed or implied, are given. This report does not comment on any regulatory issues arising from the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated and does not relate to any other works undertaken for the client. The report and conclusions are based on the information obtained at the time of the assessment.

The site history and associated uses, areas of use, and potential contaminants were determined based on the activities described in the scope of work. Additional site information held by the client, regulatory authorities or in the public domain, which was not provided to HMC Environmental or was not sourced by HMC Environmental under the scope of work, may identify additional uses, areas of use and/or potential contaminants. The information sources referenced have been used to determine the site history.

Whilst HMC Environmental has used reasonable care to avoid reliance on data and information that is inaccurate and unsuitable, HMC Environmental is not able to verify the accuracy or completeness of all information and data made available. Further chemicals or categories of chemicals may exist at the sites, which were not identified in the site history, and which may not be expected at the site. The absence of any identified hazardous or toxic materials on the subject land should not be interpreted as a warranty or guarantee that such materials do not exist on the site. If additional certainty is required, additional site history or desktop studies, or environmental sampling and analysis should be commissioned.

The results of this assessment are based upon site inspections and fieldwork conducted by HMC Environmental personnel and information provided by the client. All conclusions regarding the property area are the professional opinions of the HMC Environmental personnel involved with the project, subject to the qualifications made above. HMC Environmental assume no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of HMC Environmental, or developments resulting from situations outside the scope of this project.

15 SIGNATURE

This report has been prepared by Mark Tunks of HMC Environmental Consulting, a suitably qualified environmental consultant, in accordance with the NSW EPA (2020) *Consultants reporting on contaminated land – Contaminated land guidelines*. Note that HMC Environmental Consulting holds current Professional Indemnity Insurance to 4th August 2024.

.....

5 March 2024
Completion Date

Mark Tunks
Principal

16 REFERENCES

Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC guidelines) published by the Australian and New Zealand Environment and Conservation Council/National Health and Medical Research Council, January 1992

Hashimoto T.R & Troedson A.I. 2008 *Tweed Heads 1:100 000 and 1:25 000, Coastal Quaternary Geology Map Series*. Geological Survey of New South Wales, Maitland

Morand, D.T., Soil Landscapes of the Murwillumbah-Tweed Heads 1:100 000 Sheet, 1996

NEPC, 2013. National Environment Protection (Assessment of Site Contamination) Measure 1999 Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater, National Environment Protection Council Service Corporation, as amended 16 May 2013

NSW Environment Protection Authority (2020) Consultants reporting on contaminated land - Contaminated land guidelines

State Environmental Planning Policy (Resilience and Hazards) 2021

17 GLOSSARY

Added contaminant limit (ACL) is the added concentration of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values will be required. ACL values are generated in the process of deriving ecological investigation levels (EILs).

Ambient background concentration (ABC) of a contaminant is the soil concentration in a specified locality that is the sum of the naturally occurring background and the contaminant levels that have been introduced from diffuse or non-point sources by general anthropogenic activity not attributable to industrial, commercial or agricultural activities.

An **area of ecological significance** is one where the planning provisions or land use designation is for the primary intention of conserving and protecting the natural environment. This would include national parks, state parks, and wilderness areas and designated conservation areas.

Bioavailability is a generic term defined as the fraction of a contaminant that is absorbed into the body following dermal contact, ingestion or inhalation.

Bonded asbestos-cement-material (bonded ACM) comprises bonded asbestos containing material which is in sound condition (although possibly broken or fragmented), and is restricted to material that cannot pass a 7 mm x 7 mm sieve. This sieve size is selected as it approximates the thickness of common asbestos cement sheeting and for fragments to be smaller than this would imply a high degree of damage and potential for fibre release.

Conceptual site model (CSM) is a description of a site including the environmental setting, geological, hydrogeological and soil characteristics together with the nature and distribution of contaminants. Potentially exposed populations and exposure pathways are identified. Presentation is usually graphical or tabular with accompanying explanatory text.

Contamination means the condition of land or water where any chemical substance or waste has been added as a direct or indirect result of human activity at above background level and represents, or potentially represents, an adverse health or environmental impact.

Ecological investigation levels (EILs) are the concentrations of contaminants above which further appropriate investigation and evaluation will be required. EILs depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2 m of soil. EILs may also be referred to as soil quality guidelines in Schedules B5b and B5c.

Health investigation levels (HILs) are the concentrations of a contaminant above which further appropriate investigation and evaluation will be required. HILs are generic to all soil types and generally apply to the top 3 m of soil.

Health risk assessment (HRA) is the process of estimating the potential impact of a chemical, biological or physical agent on a specified human population system under a specific set of conditions.

Investigation levels and **screening levels** are the concentrations of a contaminant above which further appropriate investigation and evaluation will be required. Investigation and screening levels provide the basis of Tier 1 risk assessment.

Multiple-lines-of-evidence approach is the process for evaluating and integrating information from different sources of data and uses best professional judgement to assess the consistency and plausibility of the conclusions which can be drawn.

Risk assessment is the process of estimating the potential impact of a chemical, physical, microbiological or psychosocial hazard on a specified human population or ecological system under a specific set of conditions and for a certain timeframe.

Risk management is a decision-making process involving consideration of political, social, economic and technical factors with relevant risk assessment information relating to a hazard to determine an appropriate course of action.

Screening is the process of comparison of site data to screening criteria to obtain a rapid assessment of contaminants of potential concern.

Tier 1 assessment is a risk-based analysis comparing site data with investigation and screening levels for various land uses to determine the need for further assessment or development of an appropriate management strategy.

18 APPENDICES

See following pages

APPENDIX 1 - LOCATION MAPS

Figure 1 - Surrounding Area (Source: Nearmap, 2023)

Figure 2 – Subject Site (Source: Nearmap, 2023)

APPENDIX 2 - SITE PLAN PROPOSED DEVELOPMENT

APPENDIX 3 - GEOLOGY AND SOIL LANDSCAPE

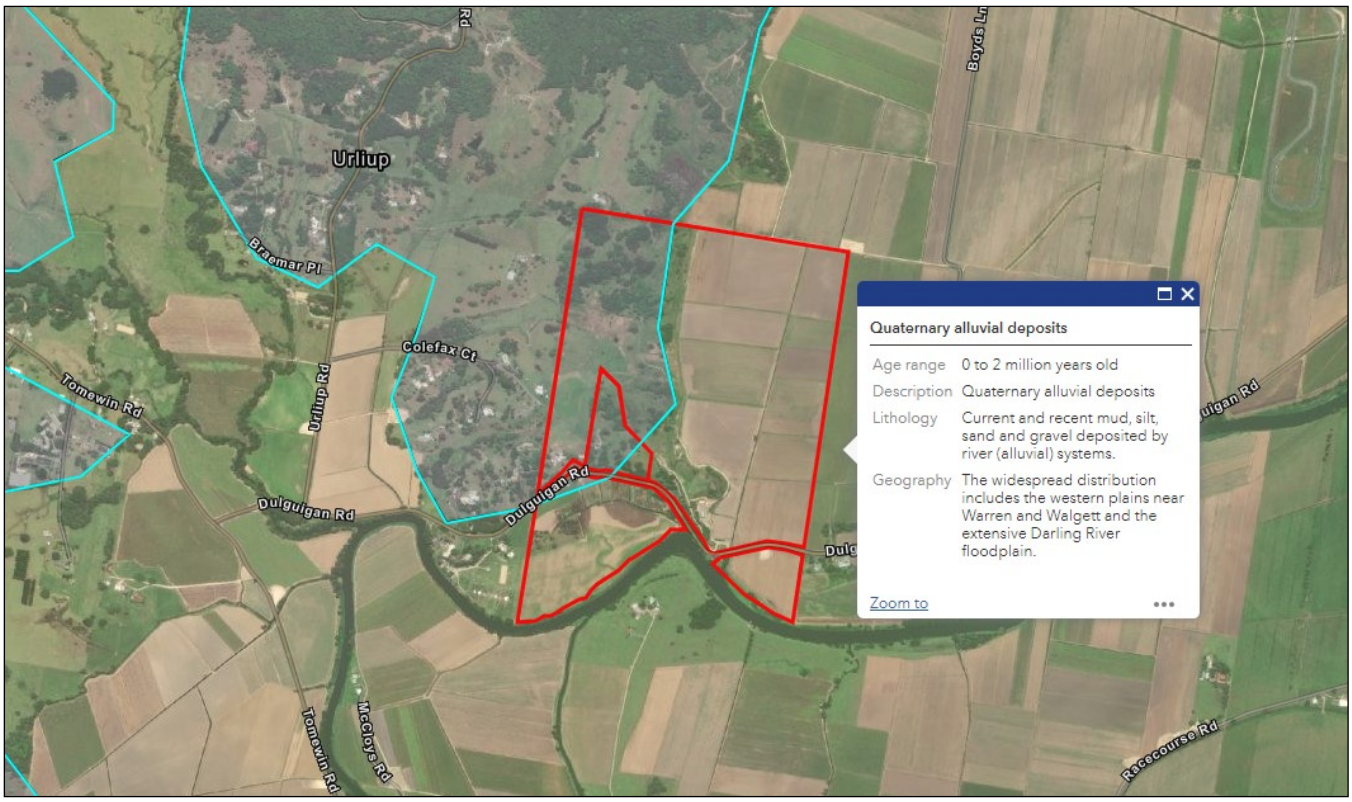

Figure 3 - Geology Map (Source: Geoscience Australia)

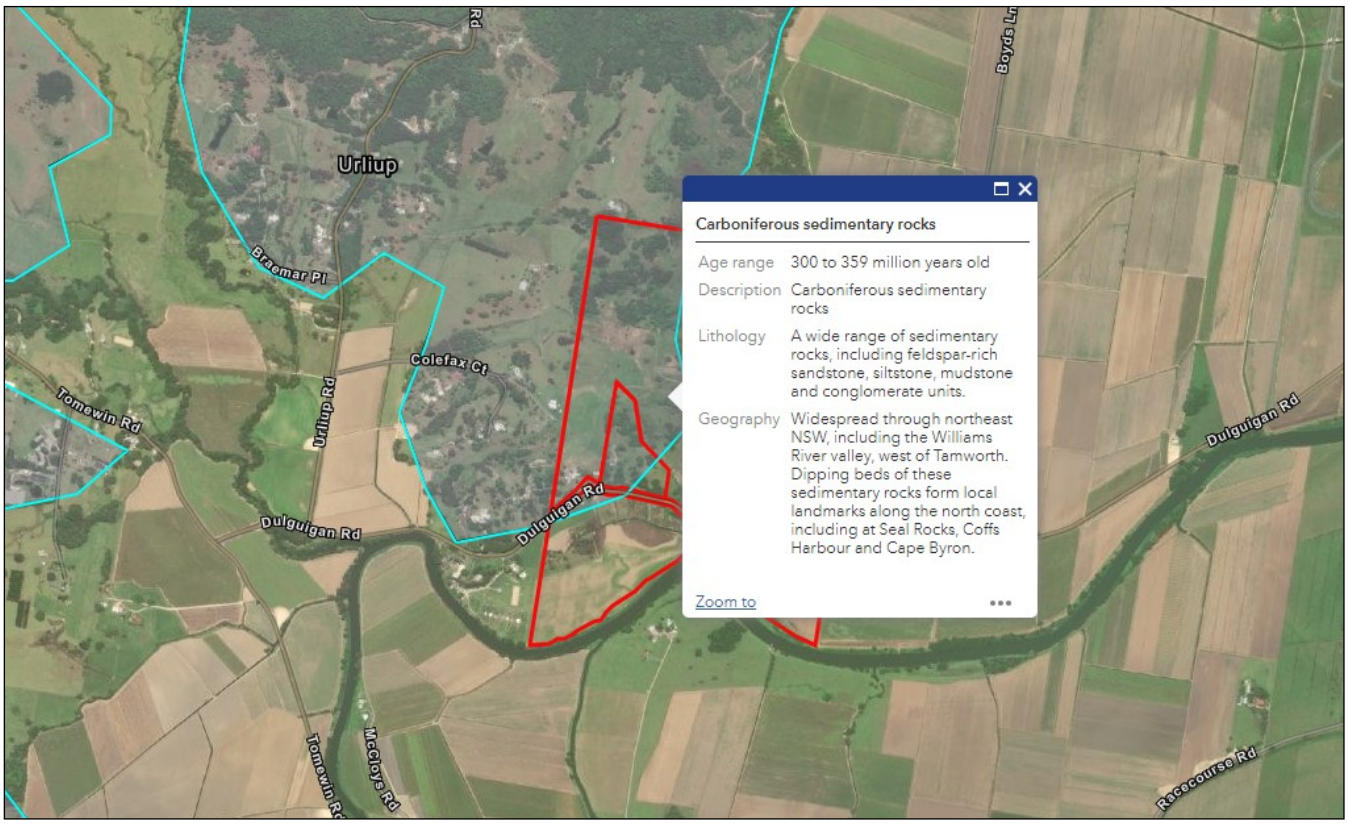

Figure 4 - Geology Map (Source: Geoscience Australia)

Figure 5 - Soil Landscape (Source: eSPADE NSW)

APPENDIX 4 - LICENSED GROUNDWATER BORES

Figure 6 – Groundwater Bore Locations (Source: http://allwaterdata.water.nsw.gov.au/water.stm)

APPENDIX 5 - CATTLE DIP SITES

Figure 7 – Cattle Dip Location (Source: DPI NSW)

APPENDIX 6 - HISTORICAL AERIAL PHOTOGRAPHY

Figure 8 - Historical Aerial 1961 (NSW Spatial Services Historical Imagery https://portal.spatial.nsw.gov.au)

Figure 9 - Historical Aerial 1970 (NSW Spatial Services Historical Imagery https://portal.spatial.nsw.gov.au)

Figure 10 - Historical Aerial 1986 (NSW Spatial Services Historical Imagery https://portal.spatial.nsw.gov.au)

Figure 11 - Historical Aerial 1990 (NSW Spatial Services Historical Imagery https://portal.spatial.nsw.gov.au)

Figure 12 - Historical Aerial 1996 (NSW Spatial Services Historical Imagery https://portal.spatial.nsw.gov.au)

Figure 13 - Historical Aerial 2004 (Google Earth)

Figure 14 - Historical Aerial 2009 (Google Earth)

Figure 15 - Current Aerial 2022 (Google Earth)

APPENDIX 7 - HISTORIC PARISH MAPS

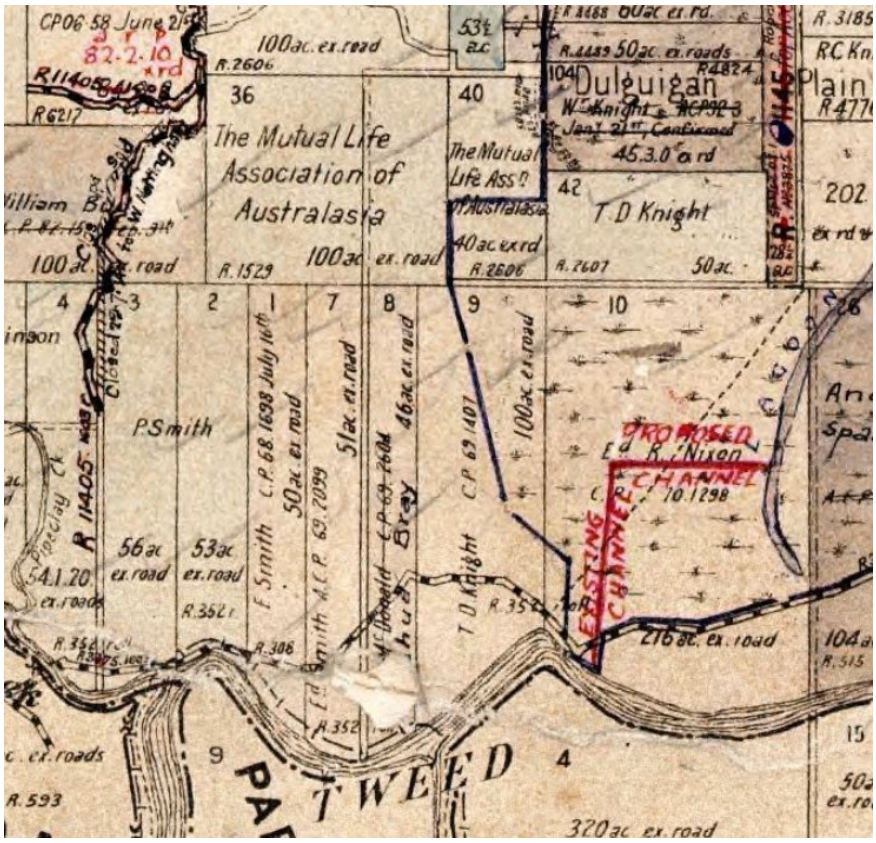

Figure 16 – 1910 Berwick Parish Map Extract (http://hlrv.nswlrs.com.au/pixel.htm)

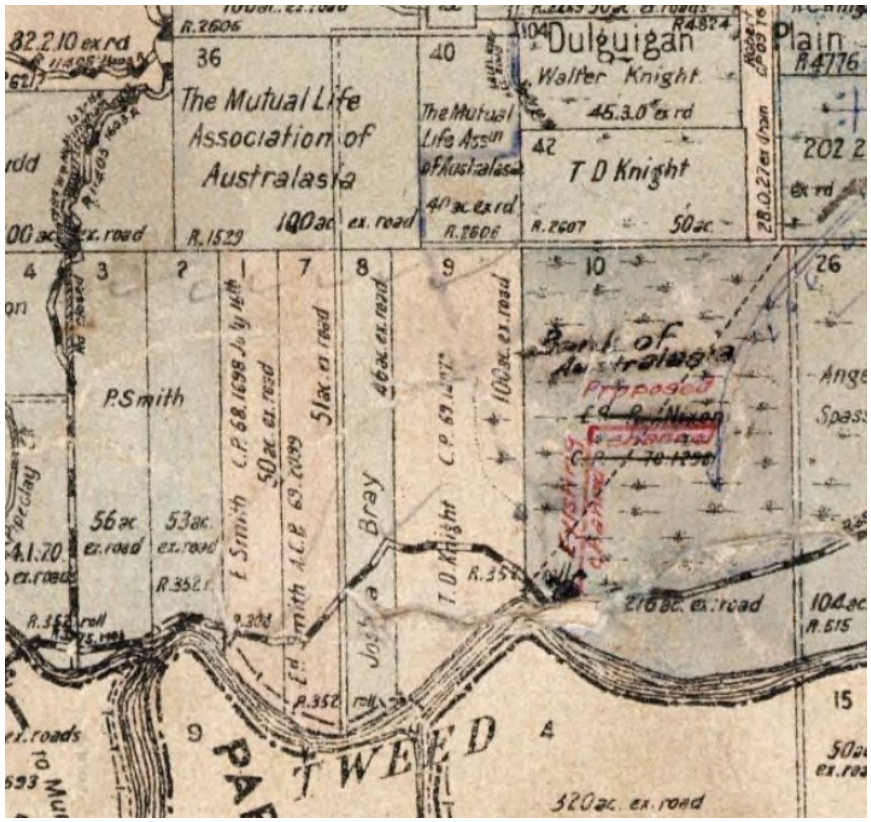

Figure 17 - 1921 Berwick Parish Map Extract (http://hlrv.nswlrs.com.au/pixel.htm)

Figure 18 – 1929 Berwick Parish Map Extract (http://hlrv.nswlrs.com.au/pixel.htm)

Figure 19 – 1937 Berwick Parish Map Extract (http://hlrv.nswlrs.com.au/pixel.htm)

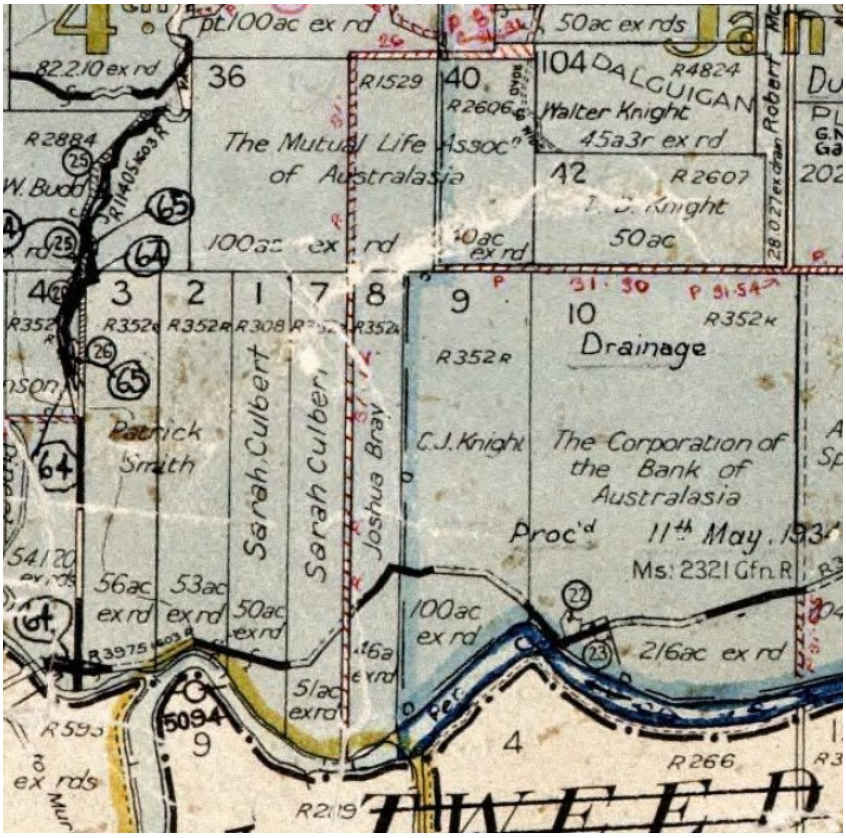

Figure 20 – 1965 Berwick Parish Map Extract (http://hlrv.nswlrs.com.au/pixel.htm)

APPENDIX 8 - HISTORIC TOPOGRAHPIC MAPS

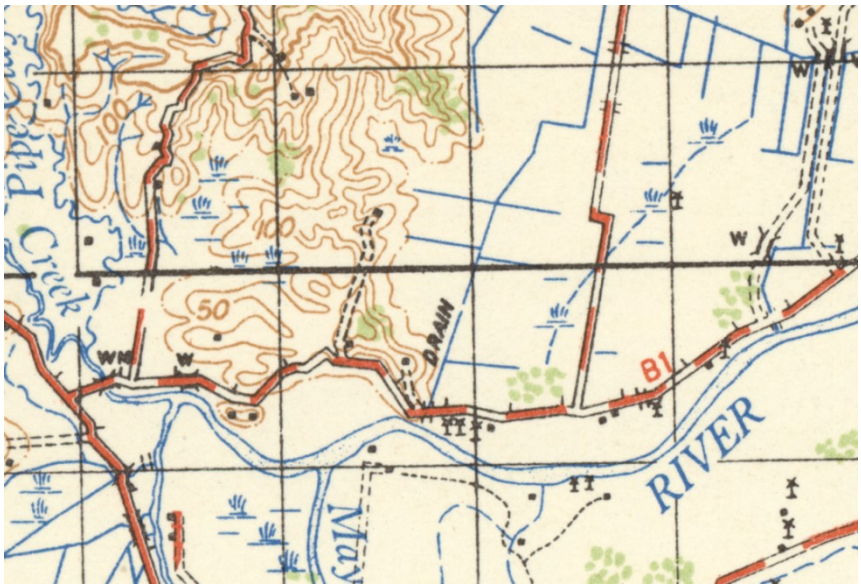

Figure 21 – 1942 *Murwillumbah* Topographical Map extract.

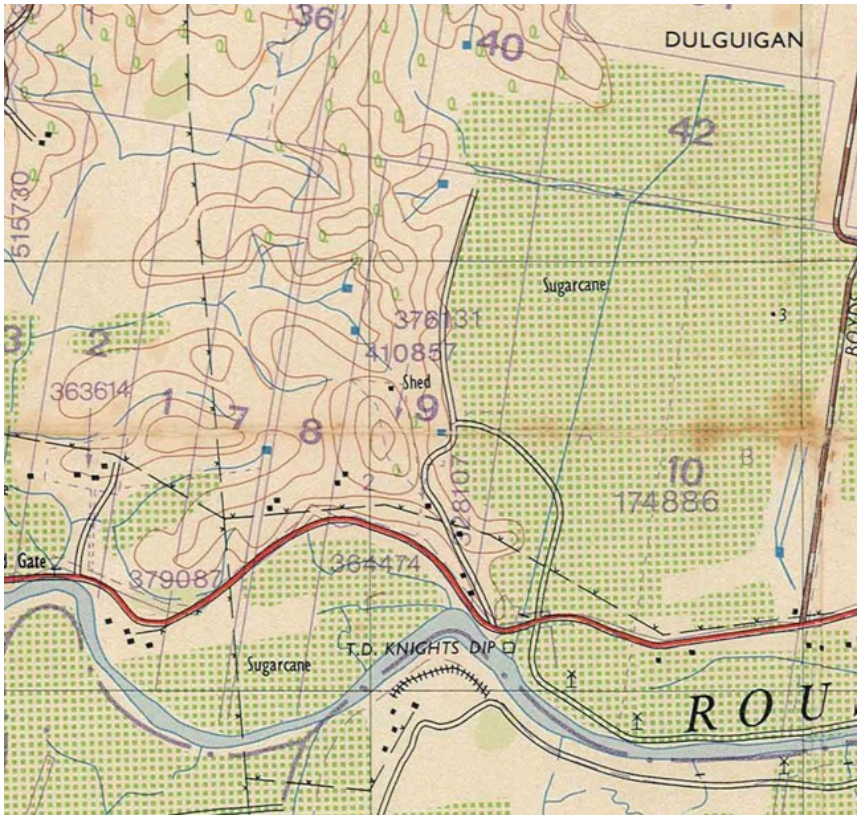

Figure 22 – 1976 *Murwillumbah* Topographical Map extract.

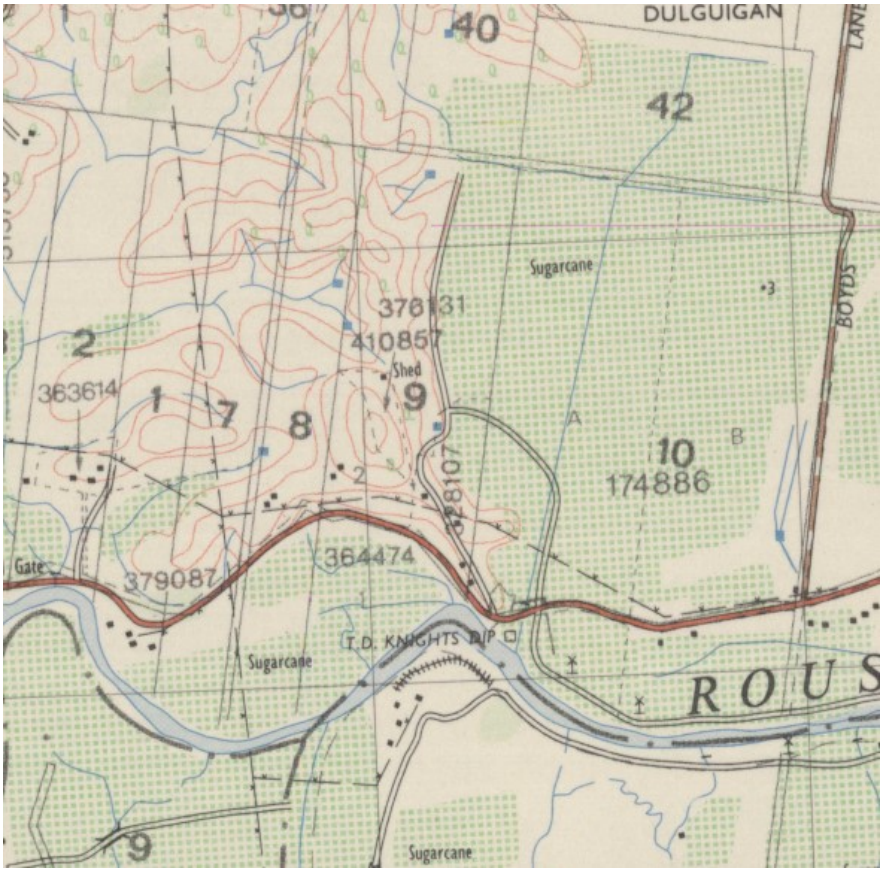

Figure 23 – 1979 *Murwillumbah* Topographical Map extract.

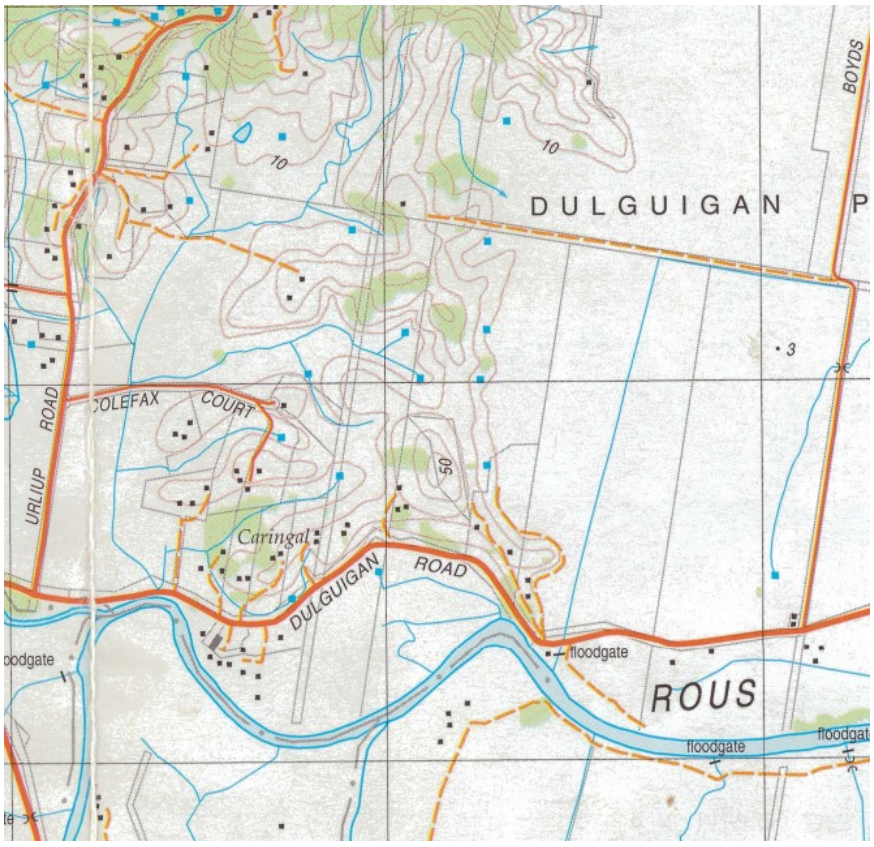

Figure 24 – 2002 *Murwillumbah* Topographical Map extract.

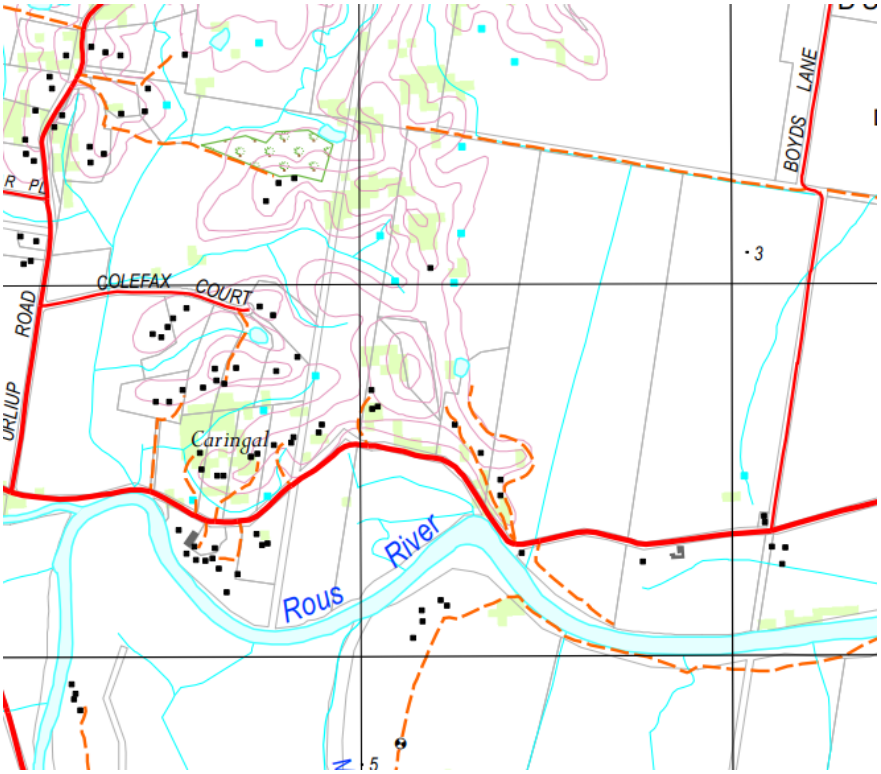

Figure 25 – 2016 *Murwillumbah* Topographical Map extract

APPENDIX 9 - ZONE MAPPING

Figure 26 – NSW Legislation Zone Plan

(Source: http://www.legislation.nsw.gov.au/maintop/view/inforce/epi+177+2014+cd+0+N)

APPENDIX 10 - PHOTOGRAPHIC LOG

Photo No.	Date
1	6.12.2023

Description:
View NW from Proposed lot dwelling site across historic structure location towards Proposed Lot 6 dwelling site near cattle yards

Photo No.	Date
2	6.12.2023

Description:
View SE from former structure location towards Proposed Lot 1 dwelling site

Photo No.	Date
3	6.12.2023

Description:
View towards sugar cane from Proposed Lot 1 dwelling site

Photo No.	Date
4	6.12.2023

Description:
Landscape near Proposed Lot ??

Photo No.	Date
5	6.12.2023

Description:
DR15A ACM (Near DRL15A)

Photo No. 6	Date
	06.12.2023

Description:
DRL2 ACM1

Photo No. 7	Date 06.12.2023
Description: DRL2 ACM2 (bank near cattle yard)	

Photo No. 8	Date 06.12.2023
Description: DRL2 ACM3	

Photo No.	Date
9	06.12.2023

Description:
HSDR1A

Photo No.	Date
10	06.12.2023

Description:
HSDR2A

Photo No.	Date
11	21.01.2024

Description:
HSDR6A

Photo No.	Date
12	22.01.2024

Description:
HSDR9A

Photo No.	Date
13	22.01.2024

Description:
HSDR13A

Photo No.	Date
14	06.12.2023

Description:
L1DR1A

Photo No.	Date
15	06.12.2023

Description:
L1DR3A

Photo No.	Date
16	06.12.2023

Description:
LRDR4A

Photo No.	Date
17	06.12.2023

Description:
LRDR5A

Photo No.	Date
18	06.12.2023

Description:
LRDR6A + DUP TRIP

Photo No. 19	Date 06.12.2023
Description: LRDR12A	

Photo No. 20	Date 06.12.2023
Description: SP1	

Photo No. 21	Date 06.12.2023
Description: Stockpile ACM	

APPENDIX 11 - LABORATORY RESULTS SUMMARY & RPD

Table 23 – Systematic Sampling Laboratory Results

Analyte (mg/kg)	L1DR1A	L1DR2A	L1DR3A	L1DR4A	L1DR5A	L1DR6A	L1DR7A	L1DR8A	L2DR1A
Metals/Metalloids									
Arsenic	7	5	14	10	7	<5	<5	5	5
Chromium (total)	6	4	10	10	10	4	4	4	10
Copper	26	24	**91**	**86**	39	15	16	12	13
Nickel	8	5	6	8	8	5	6	4	10
Zinc	153	86	**418**	**1380**	**515**	82	95	86	111
Cadmium	<1	<1	<1	3	<1	<1	<1	<1	<1
Lead	116	59	**312**	**365**	**332**	98	26	14	14
Mercury (inorganic)	<0.1	<0.1	0.2	0.4	0.5	<0.1	<0.1	<0.1	<0.1
Organochlorine/Organophosphorus									
Chlordane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin + Aldrin	<0.05	<0.05	0.06	<0.05	0.07	0.06	<0.05	<0.05	<0.05
DDT+DDD+DDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BTEX									
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethyl Benzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons									
C6-C10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10-C16	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C16-C34	<100	<100	<100	<100	100	<100	120	110	<100
>C34-C40	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total >C10-C40	<50	<50	<50	<50	100	<50	120	110	<50
Polyaromatic Hydrocarbons									
Napthalene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo-pyrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total PAH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Analyte (mg/kg)	**L2DR2A**	**L2DR3A**	**L2DR4A**	**L2DR5A**	**L2DR6A**	**L2DR7A**	**L2DR8A**	**DRDUP**	**DRTRIP**
Metals/Metalloids									
Arsenic	7	8	<5	<5	<5	7	<5	<5	<5
Chromium (total)	29	28	18	63	64	12	8	4	7
Copper	21	22	25	23	19	23	15	16	19
Nickel	29	38	17	51	46	14	8	5	7
Zinc	81	94	**222**	129	81	**294**	107	89	103
Cadmium	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	6	6	37	11	<5	175	14	160	127
Mercury (inorganic)	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organochlorine/Organophosphorus									
Chlordane	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin + Aldrin	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DDT+DDD+DDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Endosulfan	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BTEX									
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethyl Benzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons									
C6-C10	<10	<10	<10	<10	<10	<10	<10	<10	<10
>C10-C16	<50	<50	<50	<50	<50	<50	<50	<50	<50
>C16-C34	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C34-C40	<100	<100	<100	<100	<100	<100	<100	<100	<100
Total >C10-C40	<50	<50	<50	<50	<50	<50	<50	<50	<50
Polyaromatic Hydrocarbons									
Napthalene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo-pyrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total PAH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Analyte (mg/kg)	L1DR9A	L1DR10A	L1DR11A	L1DR12A	L1DR13A	L1DR14A	DRDUP2	DRTRIP2
Metals/Metalloids								
Lead	**320**	103	<5	**335**	291	118	292	252

Table 24 – Strategic Historic Structure Sampling Laboratory Results

Analyte (mg/kg)	HSDR1A	HSDR1B	HSDR2A	HSDR3A	HSDR3B	HSDR4A	HSDR5A	HSDR6A
Metals/Metalloids								
Arsenic	8		8	9		<5		
Chromium (total)	7		13	17		5		
Copper	38		44	25		32		
Nickel	7		32	8		4		
Zinc	**566**		**496**	154		**219**		
Cadmium	<1		<1	<1		<1		
Lead	**1330**	94	**534**	**629**	**404**	**332**	46	172
Mercury (inorganic)	<0.1		<0.1	0.1		<0.1		
Organochlorine/Organophosphorus								
Chlordane	<0.05		<0.05	<0.05		<0.05		
Dieldrin + Aldrin	1.86		0.08	<0.05		0.10		
DDT+DDD+DDE	<0.05		0.75	<0.05		<0.05		
Heptachlor	<0.05		<0.05	<0.05		<0.05		
Chlorpyrifos	<0.05		<0.05	<0.05		<0.05		
Endosulfan	<0.05		<0.05	<0.05		<0.05		
Endrin	<0.05		<0.05	<0.05		<0.05		
BTEX								
Benzene	<0.2		<0.2	<0.2		<0.2		
Toluene	<0.5		<0.5	<0.5		<0.5		
Ethyl Benzene	<0.5		<0.5	<0.5		<0.5		
Total Xylenes	<0.5		<0.5	<0.5		<0.5		
Total Petroleum Hydrocarbons								
C6-C10	<10		<10	<10		<10		
>C10-C16	<50		<50	<50		<50		
>C16-C34	<100		<100	<100		<100		

>C34-C40	<100		<100	<100		<100	
Total >C10-C40	<50		<50	<50		<50	
Polyaromatic Hydrocarbons							
Napthalene	<0.5		<0.5	<0.5		<0.5	
Benzo-pyrene	<0.5		<0.5	<0.5		<0.5	
Total PAH	<0.5		<0.5	<0.5		<0.5	

Table 25 – Strategic Stockpile Sampling Laboratory Results

Analyte (mg/kg)	L2DRSP1A	L2DRSP2A	L2DRSP3A	L2DRSPDUP	L2DRSPTRIP
Metals/Metalloids					
Arsenic	8	6	11	6	8
Chromium (total)	11	13	16	13	19
Copper	20	23	25	22	31
Nickel	11	13	16	12	17
Zinc	**337**	**692**	**814**	**294**	**325**
Cadmium	<1	<1	<1	<1	<1
Lead	118	51	121	42	44
Mercury (inorganic)	<0.1	<0.1	<0.1	<0.1	<0.1
Organochlorine/Organophosphorus					
Chlordane	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin + Aldrin	<0.05	<0.05	<0.05	<0.05	<0.05
DDT+DDD+DDE	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	<0.05	<0.05	<0.05	<0.05	<0.05
BTEX					
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	<0.5	<0.5	<0.5	<0.5	<0.5
Ethyl Benzene	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	<0.5	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons					
C6-C10	<10	<10	<10	<10	<10
>C10-C16	<50	<50	<50	<50	<50
>C16-C34	450	130	<100	100	<100
>C34-C40	<100	<100	<100	<100	<100
Total >C10-C40	450	130	<50	100	<50
Polyaromatic Hydrocarbons					
Napthalene	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo-pyrene	<0.5	<0.5	<0.5	<0.5	<0.5
Total PAH	<0.5	<0.5	<0.5	<0.5	<0.5

Table 26 – Relative Percentage Difference (RPD%)

Analyte	L1DP6A	DRDUP	Mean	RPD%	L1DP6A	DRTRIP	Mean	RPD%
Metals/Metalloids (mg/kg)								
Arsenic	<5	<5	<5	-	<5	<5	<5	-
Chromium	4	4	4	-	4	7	5.5	54.5
Copper	15	16	15.5	6.5	15	19	17	23.5
Nickel	5	5	5	-	5	7	6	33.3
Zinc	82	89	85.5	8.2	82	103	92.5	22.7
Cadmium	<1	<1	<1	-	<1	<1	<1	-
Lead	98	160	129	48.1	98	127	112.5	25.8
Mercury	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-
Analyte	**L2DRSP2A**	**L2DRSPDUP**	**Mean**	**RPD%**	**L2DRSP2A**	**L2DRSPTRIP**	**Mean**	**RPD%**
Metals/Metalloids (mg/kg)								
Arsenic	6	6	6	-	6	8	7	28.6
Chromium	13	13	13	-	13	19	16	37.5
Copper	23	22	22.5	4.4	23	31	27	29.6
Nickel	13	12	12.5	8	13	17	15	26.7
Zinc	692	294	493	**80.7**	692	325	508.5	**72.2**
Cadmium	<1	<1	<1	-	<1	<1	<1	-
Lead	51	42	46.5	19.4	51	44	47.5	14.7
Mercury	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-
Analyte	**L1DR13A**	**DRDUP2**	**Mean**	**RPD%**	**L1DR13A**	**DRTRIP2**	**Mean**	**RPD%**
Metals/Metalloids (mg/kg)								
Lead	291	292	291.5	0.3	291	252	271.5	14.4

APPENDIX 12 - INVESTIGATION AREA - SAMPLING LOCATIONS PLAN

APPENDIX 13 - CHAIN OF CUSTODY

APPENDIX 14 - LABORATORY CERTIFICATES