Australian Rail Track Corporation

Maitland to Minimbah Third Track Project

Submissions Report including Preferred Project Report

September 2010

H8R-REP-S2G-ENV-0019-0

Appendix F
Preliminary Contamination Study

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Australian Rail Track Corporation

Maitland to Minimbah Third Track

Submissions Report

Preliminary Site Contamination Study

September 2010

H8R-REP-S2G-ENV-0021-0

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Glossary of Terms

Acid Sulfate Soil (ASS)	Naturally occurring soils, sediments or organic substrates that contain iron sulfide minerals or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid, which can in turn release heavy metals within the soil.
Chainage	The location in kilometres of the position of a railway in relation to Sydney (NSW only) based on the 0.00 kilometres being located at the end of Central No. 1 Platform.
Consent	Approval to undertake a development received from the consent authority.
Construction Environmental Management Plan	A document setting out the management, control and monitoring measures to be implemented during construction of a development, to avoid or minimise the potential environmental impacts identified during an environmental impact assessment process.
Construction Impact Zone	The area which would be affected by construction works as part of the Project. The construction impact zone incorporates the Project's extent of works, proposed site access, construction compound locations and spoil locations.
Contaminant Threshold (CT)	Guideline defined in the Waste Classification Guidelines (DECCW, 2009) used to assess a specific concentration of a chemical for waste classification purposes.
Contaminants/Chemicals of Concern	Contaminants which could potentially be present based on the findings of a preliminary investigation (Phase 1 Contamination Assessment).
Director-General's Requirements	Requirements for an environmental assessment issued by the Director-General of the NSW Department of Planning in accordance with the Environment Planning and Assessment Act 1979.
Earthworks	Re-shaping of the natural ground level.
Ecological Investigation Level (EIL)	Ecological based assessment guideline as defined in the NEPM (NEPC, 1999) used to assess chemical concentrations in soils.
Embankment	A structure constructed from fill that raises the ground level above existing ground levels.
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle.
Groundwater	Subsurface water stored in pores of soil or rocks.
Health Investigation Level (HIL)	Health based assessment guideline as defined in the NEPM (NEPC, 1999) used to assess chemical concentration in soil for a nominated land use.
Heavy Metals	Metals with high molecular weights that are of concern because they are generally toxic to animal life and human health if naturally occurring concentrations are exceeded. Examples include arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Hunter 8 Alliance	Hunter 8 Alliance, which has been formed to deliver a new third track and ancillary infrastructure between Maitland and Minimbah.
Hydrology	The study of rainfall and surface water run-off processes.
Investigation area	The area assessed throughout the Environmental Assessment and comprises the construction impact zone and additional areas.
Mitigation	Reduction in severity.
Nutrients	Mineral or organic substances (elements or chemical compounds) that plants and animals use for growth and activity. Examples include nitrogen and phosphorus.
Organochlorine Pesticides (OCP)	A persistent man-made organic pesticide containing chlorine. Examples include DDT and Dieldrin.
Organophosphate Pesticides (OPP)	A readily degradable man-made organic pesticide containing phosphorus. Examples include Chlorpyrifos and Diazinon.
Phase 1 Contamination Assessment	A preliminary investigation to identify any past or present potentially contaminating activities and to provide a preliminary assessment of any site contamination.
Phase 2 Contamination Assessment	A detailed investigation to define the extent and degree of contamination, to assess potential risk posed by contaminants to health and the environment, and to obtain sufficient information for the development of a remedial action plan if required.
Polychlorinated Biphenyls (PCB)	A group of toxic, persistent chemicals produced by chlorination of biphenyl. PCBs were widely used in transformers, capacitors and coolants.
Polynuclear Aromatic Hydrocarbons (PAH)	A chemical compound that contains more than one fused benzene ring. They are commonly found in oil, coal and tar, and are produced as byproducts of fuel burning.
Rail corridor	The area of land dedicated to the ARTC between Maitland and Minimbah.
Rail track	The infrastructure on which a train travels. It includes two rails, sleepers, fastenings to secure the rails to the sleepers, and ballast around and under the sleepers.
Scheduled Chemicals	Chemicals defined by the Scheduled Chemical Wastes Chemical Control Order 2004.
Specific Contaminant Concentration (SCC)	Guideline defined in the Waste Classification Guidelines (DECCW, 2009) used to assess the specific concentration of a chemical for waste classification purposes.
Spoil	Excess of rock and/or earth material resulting from excavation activities.
Threshold Concentration (TC)	Guideline used to assess chemical concentrations.
Total Petroleum Hydrocarbons (TPH)	A term used to denote a large family of several hundred chemical compounds that originally come from crude oil.
Toxicity Characteristic Leaching Procedure (TCLP)	A laboratory procedure used to assess the leachable concentration of any chemical contaminant.

Executive Summary

The Hunter 8 Alliance undertook a preliminary site contamination investigation with limited soil sampling with respect to the proposed Maitland to Minimbah Third Track Project, to assess the likely potential for contamination within the additional investigation area.

The scope of works for the assessment included a desktop review of site history and environmental features such as geology and hydrology, site walkover assessments and limited soil sampling within the land surrounding the railway.

No records relating to specific contamination or remediation were identified within the Department of Environment, Climate Change and Water contaminated land register.

A review of the Department of Land and Water Conservation acid sulfate soil risk maps indicated there was only one small additional area of risk, classified as high probability of occurrence of acid sulfate soil materials within one metre of the ground surface. This area was located just within the investigation area, 40 metres south of the railway, between chainages 195.490 -195.510 kilometres.

The Hunter 8 Alliance undertook site inspections on 6 and 11 May 2010. Based on the historical review and site inspection the most likely sources of contamination within the investigation area were considered to be associated with industrial activities, imported fill and the railway. Table E-1-1 presents a summary of the potential contaminants of concern and associated sources.

Table E-1-1 Potential Sources of Contamination

Area of Concern	Rational/Details	Potential Chemicals of Concern
Rail corridor	Importation of fill and ballast material. Surface chemicals from spraying for weed and pest control. Spills of fuels, oils and greases. Illegal dumping.	Total petroleum hydrocarbons (TPH) Benzene, toluene, ethyl benzene and xylene (BTEX) Polynuclear aromatic hydrocarbons (PAH) Heavy metals Asbestos Organochlorine pesticides (OCP) Organophosphate pesticides (OPP) Polychlorinated biphenyls (PCB)
Vineyard	Surface spraying for weed and pest control. Use of fertilisers.	Arsenic OCP/OPP
Rural property	Surface spraying for weed and pest control. Use of fertilisers. Dumped building materials. Importation of fill material.	TPH/BTEX PAH Heavy metals Asbestos OCP/OPP PCB
Industrial Properties	Surface chemicals from spraying for weed and pest control. Spills of fuels, oils and greases. Dumped material.	TPH/BTEX PAH Heavy Metals OCP/OPP Asbestos
Vacant property	Importation of potential contaminated fill material. Surface chemicals from spraying for weed and pest control. Spills of fuels, oils and greases.	TPH/BTEX PAH Heavy Metals OCP/OPP Asbestos

The Hunter 8 Alliance collected soil samples from 10 test pit locations within the rail corridor and four test hole locations within surrounding vineyard land to assess potential contamination issues. Due to access restrictions the vacant property and industrial properties were unable to be inspected or sampled. The investigation program undertaken was considered sufficient to provide an indication as to the potential contamination likely to be encountered within the investigation area. However, the sampling density is not considered sufficient to delineate areas of contamination identified or to provide sufficient information to characterise material for off-site disposal. In addition, areas of unknown potential contamination may exist within the investigation area not identified during this limited investigation.

The typical soils encountered within the rail corridor during sampling were fill materials – consisting of ballast, silt, sand, and clay which were underlain by natural clay. Typical soils encountered within the vineyard consisted of natural clays.

Concentrations of heavy metals, Organochlorine Pesticides, Polynuclear Aromatic Hydrocarbons, Total Petroleum Hydrocarbons, Benzene, Toluene, Ethylbenzene, and Xylene, were reported below the Health-Investigation Level, or threshold concentration, for commercial / industrial exposure settings for all individual samples analysed.

Several samples exceeded the Ecological Investigation Level (EIL) for some heavy metals. While concentrations exceeding EILs may indicate some potential environmental impacts the "decision-making process for assessing urban redevelopment sites" from DEC 2006 does not require consideration of EILs when assessing the suitability of a site for commercial / industrial land use such as rail corridor and roads. Samples exceeding the EILs may present an ecological risk, but are not considered to restrict construction activities. These exceedances should be considered when determining potential re-use of excavated material along the route, particularly with respect to contamination of adjacent areas and waterways.

Based on the investigations undertaken, soils within the areas investigated are considered suitable for on-site use, with regards to potential contamination risk to human health and the environment.

Several samples exceeded the General Solid Waste guidelines without TCLP analysis, which would have resulted in a waste classification of Restricted Solid Waste. However, TCLP analysis of the samples (for exceeding analytes) reported concentrations below the criteria for General Solid Waste with TCLP testing. Based on the results, the indicative waste classification for the sampled soils is therefore General Solid Waste.

It should be noted that the preliminary waste classification above is indicative only and was undertaken for the purposes of off site disposal to landfill for the sampled soils only. Specific classification of soils for the purpose of re-use on projects off site, ie classification as Virgin Excavated Natural Materials (VENM) or Excavated Natural Materials (ENM) (if applicable to these soils), was not undertaken as part of this investigation.

If off site disposal of soils from site is required, it is recommended that additional sampling and analysis is undertaken to specifically characterise the material prior to off site disposal. Soils to be taken off site and that are classified as either General Solid Waste, Restricted Solid Waste or Hazardous Waste, must be taken to an appropriately licensed landfill. Soils classified as either VENM or ENM may be either used on site or taken to another site with approval to receive VENM or ENM material. Soils would be managed in accordance with a contaminated soil management measures within a Spoil and Fill Management Plan prepared for the Project. This plan would document the sampling procedures and waste classification guidelines.

An environmental risk assessment was carried out for the Project, in regard to contamination, and resulted in the recommendation of the following additional mitigation measures:

- Undertake contamination assessments within the vacant property north of the corridor (chainages 195.120 to 195.190 kilometres) and industrial properties north of the corridor (chainages 194.780 to 195.120 kilometres), which could not be accessed during this investigation prior to construction activities associated with Phase 2 of the Project impacting on these areas.

1. Introduction

This Preliminary Site Contamination Investigation has been prepared by the Hunter 8 Alliance on behalf of the Australian Rail Track Corporation (ARTC) as part of the Submissions Report for the Maitland to Minimbah Third Track Project (the Project). This report has been prepared to assess how proposed modifications to the design, construction and operation of the Project may amend or increase the potential contamination impacts identified in the Environmental Assessment, and develop any additional mitigation measures required to address such amended or increased potential impacts.

1.1 Background

The Australian Rail Track Corporation (ARTC) proposes to construct a third train track adjacent to the existing two tracks of the Main Northern Railway between Maitland and Minimbah, within the Hunter Valley, NSW (the Project).

The Project commences in Farley approximately two kilometres west of Maitland Station and continues through the local government areas of Maitland, Cessnock and Singleton for approximately 30 kilometres, concluding at Minimbah.

The Project would facilitate the more efficient movement of coal to the Port of Newcastle.

An Environmental Assessment of the Project was completed in May 2010 (Hunter 8 Alliance, 2010) in accordance with the Director General's requirements for undertaking the environmental assessment received by ARTC on 25 May 2009. The Environmental Assessment was then placed on public exhibition from 9 June 2010 to 12 July 2010 in accordance with Section 75H(3) of the *Environmental Planning and Assessment Act* 1979 (EP&A Act). During this time submissions were invited from members of the public, government agencies and stakeholders.

As a result of the community consultation process and further consideration of the project implementation, a number of modifications to the Project as described in the Environmental Assessment, are proposed.

1.2 Description of Project Modifications

Several key modifications to the Project as described in Chapter 7 of the Environmental Assessment are proposed. These modifications are summarised by the following:

- Amendments to the earthworks design required for the third track, including modification to the design of the Down side access track.
- A reduction in the required property acquisition resulting from the amendments to the earthworks design.
- Additional potential spoil disposal areas and the addition of potential sources of appropriate track construction material adjacent to the rail corridor (known as borrow pits).
- Alternative and proposed new locations for construction compounds (primary and secondary) and associated changes to traffic access and management.

- The proposed phasing of construction of the Project: deferment of the construction of the third track (and associated earthworks, infrastructure and construction support facilities) between chainages 209.840 kilometres and 216.340 kilometres (Branxton to Greta), and chainages 194.500 kilometres and 196.100 kilometres (Farley to Telarah).
- To facilitate operations until construction of the final phase is completed, installation of rail turnouts would be required at the following chainages:
  - 216.340 kilometres (Branxton).
  - 209.840 kilometres (Greta).
  - 196.100 kilometres (Farley).

Further detail on the proposed modifications to the design, construction and operation of the Project are provided in Chapter 5 of the Submissions Report.

1.3 Objectives and Purposes of this Report

Under Section 75H(6) of the *Environmental Planning and Assessment Act* 1979, the Department of Planning requires the Hunter 8 Alliance to prepare and submit a response to submissions made during the public exhibition period.

The objective of the Submissions Report (to which this report forms an appendix) is to:

- Provide information about the nature of the submissions received.
- Discuss how submissions have been considered and addressed.
- Describe aspects of the Proposal that have been modified.
- Provide specialist reports that incorporate issues raised in submissions and address the modifications to the Project.
- Describe how the Statement of Commitments has been revised to reflect the recent community consultation.

The purpose of this Preliminary Site Contamination Investigation report is to consider how the proposed modifications to the design, construction and operation of the Project may amend the impact assessment included in the Preliminary Site Contamination Investigation in the Environmental Assessment, and whether changes or additions to the mitigation measures included in the Environmental Assessment are required.

This Preliminary Site Contamination Investigation report also assists in informing the responses in the Submissions Report to issues relating to potential contamination issues raised during the Environmental Assessment exhibition period.

1.4 Revised Construction Impact Zone

The proposed Project modifications described in Section 1.2 and detailed in Chapter 5 of the Submissions Report result in revisions to the construction impact zone described in Section 7.8 and shown in Figure 7.1 of the Environmental Assessment.

Figure 1 shows the revised construction impact zone.

1.5 Additional Investigation Area

The revised construction impact zone includes areas outside of the investigation area of the Environmental Assessment. Additional desktop reviews and field investigations were undertaken to assess the potential contamination issues within these areas. These additional investigations included locations that were potentially considered for inclusion in the Project but excluded due to environmental, design, construction or other constraints.

Figure 1 shows the revised construction impact zone, and identifies the additional investigation areas assessed as part of this Preliminary Site Contamination Investigation report.

1.6 Scope of Investigation

The scope of works for the Preliminary Site Contamination Investigation included:

- Review of historical and current aerial photographs.
- Review of the Department of Environment, Climate Change and Water (DECCW) contaminated land register.
- Review of geology, hydrology, topography and the Department of Water and Energy (DWE) (now DECCW) groundwater bore database.
- Site inspection to identify any potential contamination issues or potential areas of concern.
- Limited soil sampling.
- Preparation of a report summarising the results of the investigation.

This scope is subject to the limitations as discussed below in Section 1.7.

1.7 Limitations

This Preliminary Site Contamination Investigation report for the revised construction impact zone has been prepared by the Hunter 8 Alliance for the ARTC. No warranties, expressed or implied, are offered to any third parties and no liabilities will be accepted for the use of this report by any third party.

The study was conducted by an experienced environmental engineer and was subject to internal review by a senior environmental engineer. It should be noted, however, that in gathering facts for the study, Hunter 8 Alliance relied on verbal information supplied by the client, on site records, and on visual inspection of the investigation area, which have not necessarily been independently verified.

An understanding of the investigation area conditions depends on the integration of many pieces of information, some regional, some site specific, some structure-specific and some experienced based. Hence, this report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way without prior checking and approval by the Hunter 8 Alliance. The Hunter 8 accepts no responsibility for any circumstances, which arise from the issue of the report, which has been modified in any way as outlined above.

The extent of sampling of soils and subsequent analysis has been necessarily limited, and has been targeted towards areas where contamination is considered to be most likely, based on the knowledge of the site history and visual observation. This approach maximises the probability of identifying contaminants; however, it may not identify contamination that occurs in unexpected locations or from unexpected sources.

Further, soil conditions are often variable, resulting in non-homogenous contaminant distributions across a site. Contaminant concentrations have been identified at chosen sample locations; however, conditions between sample locations can only be inferred on the basis of the estimated geological conditions and the nature and extent of identified contamination. Boundaries between zones of variable contamination are often indistinct, and have been interpreted based on available information and the application of professional judgement. The accuracy with which the sub-surface conditions have been characterised depends on the frequency and methods of sampling and the uniformity of sub-surface conditions and is therefore limited by the scope of works undertaken.

This report does not provide a complete assessment of the environmental status of the investigation area and it is limited to the scope defined herein. Should further information become available regarding conditions of the investigation area including previously unknown sources of contamination, Hunter 8 Alliance reserves the right to review the report in the context of the additional information.

2. Existing Environment

This section provides a summary of the existing environment relating to the revised construction impact zone. Information common to the investigation area of the Environmental Assessment is summarised in the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment).

2.1 Regional Context, Site Location and Surrounding land uses

The revised construction impact zone is located within the Maitland, Cessnock and Singleton local government areas within the Hunter Valley, NSW.

Land use adjacent and surrounding the revised construction impact zone is consistent with that described in Section 2.1 of the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment), including a mixture of urban and rural residential dwellings, commercial/industrial premises, viticulture and grazing land.

2.2 Zoning

The revised construction impact zone is located within the Maitland, Cessnock and Singleton Council local government areas and is covered by *Maitland Local Environmental Plan 1993,* the *Cessnock Local Environmental Plan 1989* and the *Singleton Local Environmental Plan 1996* respectively.

Maitland Location Environmental Plan 1993

The revised construction impact zone within the Maitland local government area is covered by the following land use zonings:

- 5 (b) Special Uses Railway.
- 1 (b) Secondary Rural Land.
- 4 (a) General Industrial.
- 4 (b) Light Industrial.
- 6 (b) Private Recreation.

Cessnock Local Environmental Plan 1996

The revised construction impact zone within Cessnock local government area is covered by the following land use zonings:

- 5 (b) Special Uses (Railway).
- 1 (a) (Rural “A” Zone).
- 1 (b) Secondary Rural Land.
- 1 (c) (Rural–Residential/Rural (Small Holdings) Zone).
- 2 (a), 1 (a), 7 (b), 3 (a).
- Residential 1.

Singleton Local Environmental Plan 1996

The revised construction impact zone within the Singleton Council local government area is covered by the following land use zonings:

- 1 (a) Rural Zone.
- Residential 1.

2.3 Geology and Soils

2.3.1 Geology

The geology of the revised construction impact zone includes formations of the Maitland Group, the Greta Coal Measures, and the Dalwood Group. Further information on these formations is provided in Section 2.3.1 of the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment).

2.3.2 Soils

The soil landscape of the revised construction impact zone includes the Rivermead (ri), Hunter variant a (hua), Bolwarra Heights (bh), Wallalong variant a (wga), Rothbury (ro), Branxton (bx), and Lochinvar (lv). Further information on these soil landscapes is provided in Section 2.3.2 of the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment).

2.3.3 Potential Acid Sulfate Soils

A review of the Department of Land and Water Conservation acid sulfate soil risk maps indicates a small area of risk, classified as high probability of occurrence of acid sulfate soil materials within one metre of the ground surface. This area is located within the revised construction impact zone, approximately 40 metres south of the railway, between chainages 195.490 -195.510 kilometres.

2.4 Hydrology

The hydrology of the revised construction impact zone is as described in Section 2.4 of the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment).

2.5 Hydrogeology

The hydrogeology of the revised construction impact zone is as described in Section 2.5 of the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment).

2.6 Site History

2.6.1 Historical Aerial Photographs

A review of historical aerial photographs was undertaken and is described in Section 2.6.1 of the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment). This review covered the area of the revised construction impact zone.

In addition to the potential sources of contamination previously reported, the following additional potential sources of contamination were identified:

- Industrial properties north of the rail corridor (chainages 194.780 to 195.120 kilometres).
- Disturbed area south of the rail corridor (chainages 196.020 to 196.720 kilometres).
- Vineyard present on the southern side of the rail corridor (chainages 219.230 to 219.740 kilometres).

2.6.2 Department of Environment, Climate Change and Water Contaminated Land Register

A search of the Department of Environment, Climate Change and Water (DECCW) contaminated land register was carried out for the revised construction impact zone. No records relating to specific contamination or remediation were identified.

2.7 Site Inspection

The Hunter 8 Alliance undertook specific site inspections for the revised construction impact zone on 3 and 8 February 2010. A summary of the findings is presented below. The additional investigation areas and sample locations from 2009 and 2010 are presented in Figure 2 in Appendix A.

2.7.1 Rural Property North of Rail Corridor (chainages 222.700-222.800 kilometres)

This property consisted of grazing land, bounded by the New England Highway to the north and Hermitage Road to the east. The land sloped to the west, with surface water draining into Jump Up Creek. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.2 Rural Property North of Rail Corridor (chainages 221.100-221.650 kilometres)

This property comprised largely of undeveloped bushland, with the exception of a house and large shed located in the western portion of site. Two above-ground concrete water storage tanks, a septic tank and a large shed (used as a general workshop and storage) were located in the vicinity of the house. Several dams were located to the south and east of house. The majority of the site was grassed with the exception of some significant erosion areas. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.3 Vineyard South of Rail Corridor (chainages 219.230-219.740 kilometres)

This portion of land was being used as a vineyard. The site was grassed with three rows of vines. The site sloped away from the corridor, toward a natural drainage channel and dam (outside of the revised investigation area), which drained to the east. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.4 Rural Property North of Rail Corridor (chainages 218.700-218.900 kilometres)

This property generally consisted of grazing land. The site was grassed with some mature eucalyptus trees present in the western portion of the site. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.5 Rural Property North of Rail Corridor (chainages 216.350-216.550 kilometres)

This property generally consisted of grazing land. The site was grassed with some mature eucalyptus trees scattered across the property. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.6 Rural Property North of Rail Corridor (chainages 213.470-213.630 kilometres)

This property generally consisted of grazing land. The site was grassed with some small shrubs scattered across the area. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.7 Rural Property North of Rail Corridor (chainages 205.140-205.340 kilometres)

This property generally consisted of grazing land. The site was grassed with several mature eucalyptus trees scattered across the area. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.8 Rural Property South of Rail Corridor (chainages 203.120-204.400 kilometres)

This property generally consisted of grazing land, with rock outcrops and boulders in the western portion of the site. Lochinvar Creek originated in the southeast corner of the property, running east / northeast and crossed under the corridor at approximately chainage 203.8 kilometres. Dumped building materials (cement sheeting, plywood, bricks, tiles, timber and cement) were observed in several locations. A washing machine was also dumped at the site. Towards the western end of the site, a small area had surface fill consisting of gravel and bitumen fragments. As a result of this filling, grass growth was less dense in this area. A truck was parked alongside fabricated and scrap metal (including cages and cables) as well as plastic and wooden pallets. No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.9 Rural Property North of Rail Corridor (chainages 202.430-202.470 kilometres)

This property was located adjacent to Station Lane. The site generally consisted of grazing land and had a gravel driveway in the southwest corner of the site. No evidence of plant stress or die-back and no visual or olfactory signs of contamination were observed.

2.7.10 Rural Property North of Rail Corridor (chainages 202.420-202.450 kilometres)

This area consisted of the front portion of a rural residential property. The yard was grassed and had a gravel driveway extending to a dwelling (which was outside the revised construction impact zone).

2.7.11 Rural Property North of Rail Corridor (chainages 197.500-198.800 kilometres)

This property consisted of rural grazing land, with mature eucalyptus trees and multiple wood chip piles spread across the site (presumed to be generated from land clearing on the property). No plant stress or die-back was evident and no visual or olfactory signs of contamination were observed.

2.7.12 Corridor Area South of Railway (chainages 196.100-196.750 kilometres)

This portion of the revised construction impact zone was located within the rail corridor and was used for general railway purposes, including storage and placement of fill and ballast materials. Based on discussions with the Protection Officer, it is understood that the property was previously a rock quarry. Visual evidence of the rock cutting was apparent to the south of the area. The landform on the eastern half of the site appeared to be filled (possibly ballast) and was covered with mainly weeds. An access track was located adjacent to the rail embankment. This generally consisted of natural soils with ballast in some sections. The western half of the site appeared to be unused.

2.7.13 Vacant Property North of Rail Corridor (chainages 195.120-195.190 kilometres)

The property was grassed with some small shrubs scattered across the area. A natural drainage channel ran down the eastern boundary, flowing into a low lying swamp area south of the railway, via a culvert under the railway. At the time of the inspection there was a large excavation, extending the full width of the property, adjacent to the rail corridor fence. The excavated material indicated fill was present (including concrete, timber, tyres, and metal).

2.7.14 Industrial Property North of Rail Corridor (chainages 194.970-195.120 kilometres)

The property was rectangular in shape, with access to Green Street via a narrow laneway from the north-western corner. A large shed, approximately 80 metres long was located 20 metres north of the railway corridor (outside the revised investigation area). The portion of land within the additional investigation areas was generally grassed. A dirt track was present in the middle of the property, providing access to the shed. There were scrap materials (including plastic pipe, plastic containers, car wheels and a cement truck barrel) along the fence line and in the southeast corner.

2.7.15 Industrial Property North of Rail Corridor (chainages 194.780-194.970 kilometres)

This property was an irregular shape, with access off Lismore Street. The portion of land within the additional investigation areas was grassed with a dirt access track in the southeast corner. Some trees and shrubs were present along the southern fence line, becoming dense in southwest corner. Two large sheds (approximately 500 square metres and 1000 square metres) were located in the southeast corner of the property, just outside the investigation area. Another two large sheds (approximately 500 square metres each) were located in the northwest corner of the property (outside the revised investigation area).

2.8 Sources of Potential Contamination

The following areas of concern presented in Table 2-1 were identified for the revised construction impact zone.

Table 2-1 Sources of Potential Contamination

Area of Concern	Description	Potential Contamination Sources	Potential Contaminants
Rail corridor	South of the rail corridor (chainages 196.100-196.750 kilometres).	Importation of fill and ballast material. Surface chemicals from spraying for weed and pest control. Spills of fuels, oils and greases. Illegal dumping.	Total petroleum hydrocarbons (TPH) Benzene, toluene, ethyl benzene and xylene (BTEX) Polynuclear aromatic hydrocarbons (PAH) Heavy metals Asbestos Organochlorine pesticides (OCP) Organophosphate pesticides (OPP) Polychlorinated biphenyls **(**PCB)
Vineyard	South of the rail corridor (chainages 219.230-219.740 kilometres)	Surface spraying for weed and pest control. Use of fertilisers.	Arsenic OCP/OPP
Rural property	North of rail corridor (chainages 221.100-221.650 kilometres)	Septic tank. Spills of fuels, oils and greases. Surface spraying for weed and pest control.	Nutrients Faecal coliforms TPH/BTEX PAH Heavy Metals OCP/OPP

Area of Concern	Description	Potential Contamination Sources	Potential Contaminants
Rural property	North of rail corridor (chainages 222.700-222.800, 218.700-218.900, 216.350-216.550, 213.470-213.630, 205.140-205.340, 202.430-202.470, 202.420-202.450, 197.500-198.800 kilometres)	Surface spraying for weed and pest control. Use of fertilisers.	Arsenic OCP/OPP
Rural property	South of rail corridor (chainages 203.120-204.400 kilometres)	Dumped building materials. Importation of fill material.	TPH/BTEX PAH Heavy metals Asbestos OCP/OPP PCB
Industrial properties	Properties north of the rail corridor (chainages 194.780-195.120 kilometres)	Surface chemicals from spraying for weed and pest control. Spills of fuels, oils and greases. Dumped material.	TPH/BTEX PAH Heavy Metals OCP/OPP Asbestos
Vacant property	Property north of the rail corridor (chainages 195.120-195.190 kilometres)	Importation of potential contaminated fill material. Surface chemicals from spraying for weed and pest control. Spills of fuels, oils and greases.	TPH/BTEX PAH Heavy Metals OCP/OPP Asbestos

3. Legislation and Guidelines

3.1 Relevant Guidelines

All investigations were undertaken with reference to the relevant EPA guidelines including:

- *National Environment Protection Measure (Assessment of Site Contamination)* (NEPC, 1999).
- *Contaminated Sites: Guidelines for Assessing Service Station Sites* (NSW EPA, 1994).
- *Contaminated Sites: Sampling Design Guidelines* (NSW EPA, 1995).
- *Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 1997).
- *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme* (2nd edition), (DEC 2006).

The guidelines used to assess the soil contamination status of the investigation area included:

- *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme* (2nd edition), (DEC 2006).
- *Contaminated Sites: Guidelines for Assessing Service Station Sites* (NSW EPA, 1994).
- Australian New Zealand Environmental Conservation Council (ANZECC)/*National Health and Medical Research Council* (NHMRC) (1992) "*Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*".
- National Environmental Protection Council (NEPC) (1999) "*National Environmental Protection (Assessment of Site Contamination) Measure 1999*", (NEPM).
- NSW DECCW (2009) *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW DECCW 2009).

3.2 Soil Investigation Thresholds

The National Environment Protection Measure (NEPM) includes a range of Soil Investigation Levels including Ecological Investigation Levels (EILs) largely similar to the Environmental Investigation Thresholds (EITs) listed in the Australian and New Zealand Guidelines for The Assessment and Management of Contaminated Sites (ANZECC/NHMRC 1992). Health Investigation Levels (HILs) listed in the NEPM are generally the same as the Health-based Soil Investigation Levels (HBSILs) listed in the Guidelines for the NSW Site Auditor Scheme (NSW EPA, 1998).

Essentially, both EILs and HILs are default values designed to protect the environmental and human receptors respectively. ANZECC/NHMRC recommends that generally where EITs are exceeded, an investigation should take place, but it is stressed that the values are intended as a guide only and site specific factors need to be taken into account when assessing data. It is stated that "in general terms the guideline values will protect the most sensitive receptor", and of the receptors considered, the most sensitive and hence, most stringent guidelines are for the protection of plant life.

The NEPM also uses the ANZECC/NHMRC (1992) definition of Environmental Investigation Level as the concentration above which further appropriate investigation and evaluation will be required. The EILs are based on consideration of phytotoxicity and soil survey data, and supported by the "ANZECC B" EITs (Environmental Investigation Thresholds). It is acknowledged that future ecologically based guidelines will be developed at regional level and related to land use, and that specific circumstances may warrant the use of more pertinent regional values.

The basis on which the HILs (or HBSILs) have been set should be assessed for relevance to the situation under consideration. HILs are provided for a range of different exposure settings or land uses:

- "A" Standard Residential with garden/accessible soil (includes children day-care centres, kindergartens, pre-schools and primary schools).
- "D" Residential with minimal opportunities for soil access.
- "E" Parks, recreational open space and playing fields (including secondary schools).
- "F" Commercial / industrial (includes shops, offices, factories and industrial sites).

Based on the proposed site usage as rail corridor and roadway construction, Hunter 8 considers that the most appropriate investigation level for this assessment is Commercial / Industrial (Setting "F").

It is stated in the NEPM [Schedule B(7a)] that the HILs provide "a trigger to assist in judging whether a detailed investigation of a site is necessary". It is also stated "the levels should not be interpreted rigidly" and "the proposed land use, distribution of contaminants and the frequency distribution of elevated levels will all be very important in interpreting the results for a site". Separate health and environmental investigation levels have been established to take into account the different sensitivities of humans and other components of the environment. The HILs are typically higher than, or in rare cases (eg lead) equal to or less than, the EILs. Site specific decisions need to be made to determine whether health or environmental levels (or both) should apply.

The NEPM guidelines are restricted to non-volatile and semi-volatile substances and do not include all the potential contaminants that may be at the investigation area (such a volatile substances). Therefore, for substances not included in these guidelines (such as TPH and BTEX), criteria from the NSW EPA (1994) Guidelines for Assessing Service Station Sites have been used.

The methodology used when assessing contamination levels in soils at the investigation area was to use the EILs and HILs as a cut off point to classify soils either as:

- Soils not contaminated, which pose no risk to the environment or human health and warrant no further action, such as concentrations less than or equal to the EILs.
- Soils containing elevated concentrations of contaminants, which may pose a risk to the environment (in particular plant species) but pose no risk to human health under the proposed land use scenario, such as concentrations greater than the EILs and less than the HILs. Due to the purpose of this assessment and the proposed land use these soils will generally not warrant further action but will be highlighted giving consideration to environmental risks and proposed land use.
- Soils significantly contaminated which pose a risk to both the environment and human health, such as concentrations greater than or equal to the HILs. Soils in this category would likely require remediation or management to permit the proposed land use, or would require a Site Specific, Risk Based Assessment to further determine potential risk to human health and the environment.

The methodology used to develop Ecological Investigation Levels (EILs) and Health Investigation Levels (HILs) for this Site was in accordance with EPA recommendations and comprised the following (in order of preference):

Ecological Investigation / Threshold Concentration (EIL or TC)

- NEPC (1999) NEPM Schedule B(1), Ecological Investigation Levels.
- NSW EPA (1998) *Guidelines for the NSW Site Auditor Scheme, Provisional Phytotoxicity – Based investigation Levels.*
- ANZECC (1992), *Guidelines for the Assessment and Management of Contaminated Sites, Environmental Investigation Thresholds.*
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites, Threshold Concentrations for Sensitive Land Use, protection of terrestrial organisms.*

Health Investigation Levels/Threshold Concentration (HIL or TC)

- NEPC (1999) NEPM Schedule B(1), *Health Investigation Levels, Exposure Setting F: Commercial/Industrial.*
- NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme incorporating the National Environmental Health Forum (1996), Soil Series No. 1, Health Based Soil Investigation Levels, Exposure Setting F: Commercial/Industrial.*
- NSW EPA (1994) *Guidelines for Assessing Service Station Sites, Threshold Concentrations for Sensitive Land Use, human health based protection levels.*

Table 3-1 provides a summary of the investigation levels that were used to assess soil contamination levels.

Table 3-1 Soil Assessment Criteria

Parameter	Environmental Criteria (EIL [(a)] or TC)	Commercial / Industrial Health-Based Criteria (HIL F[(f)] or TC)
Arsenic	20	500
Cadmium	3	100
Chromium	50[(b)]	500[(c)]
Copper	100	5000
Lead	600	1500
Nickel	60	3000
Zinc	200	35000
Mercury	1	75

Parameter	Environmental Criteria (EIL [a] or TC)	Commercial / Industrial Health-Based Criteria (HIL F[f] or TC)
TPH		
C_6-C_9	-	65[e]
C_{10}-C_{36}	-	1000[e]
Benzene	1[e][g]	1[e][g]
Toluene	1.4[e][h]	130[e]
Ethyl Benzene	3.1[e][h]	50[e]
Xylene	14[e][h]	25[e]
PAHs (total)	-	100
Benzo(a)pyrene	-	5
PCBs (Total)	1[d]	50
Dieldrin	0.2[d]	-
Aldrin+Dieldrin	-	50
Chlordane	-	250
DDT+DDD+DDE	-	1000
Heptachlor	-	50
Asbestos	N/A	No asbestos in surface soils [i]

Note: All units in mg/kg unless otherwise noted.

a) NEPC (1999) NEPM Schedule B(1), Ecological Investigation Levels.

b) Australian and New Zealand Environment and Conservation Council (1992), Guidelines for the Assessment and Management of Contaminated Sites, Environmental Investigation Thresholds Level where valance state is not distinguished but expected to be Cr(III). NEPM EIL for Cr(III) is 400 mg/kg.

c) NEPC (1999) HIL F, Based on Cr(VI).

d) Australian and New Zealand Environment and Conservation Council (1992), Guidelines for the Assessment and Management of Contaminated Sites, Environmental Investigation Thresholds.

e) From NSW EPA (1994) Guidelines for Assessing Service Station Sites, Threshold Concentration for Sensitive Land Use.

f) NEPC (1999) NEPM Schedule B(1), Health Investigation Levels, Exposure Setting F:Commercial/industrial.

g) From NSW EPA (1994) Guidelines for Assessing Service Station Sites, Threshold Concentration for Sensitive Land Use. A lower benzene concentration may be needed to protect groundwater.

h) From NSW EPA (1994) Guidelines for Assessing Service Station Sites, Netherlands MPC to protect terrestrial organisms in soil.

i) EPA Advice to Auditors, 31 March 2000. The DEC (2006) Guidelines for the NSW Site Auditor Scheme now states that there are no current national or DEC-endorsed guidelines relating to human health or environmental investigation of material containing asbestos on sites, and previous advice has specifically been rescinded.

3.3 Waste Classification Criteria

Material disposed of from the revised investigation area requires classification for disposal purposes, in accordance with the *Protection of the Environmental Operations Amendment (Scheduled Activities and Waste) Regulation, 2009*. Criteria from the *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW DECCW 2009) are shown in Table 3-2 for the potential contaminants most likely to be present within the revised investigation area.

Table 3-2 Waste Classification Criteria

Parameter	Maximum Total Concentration (mg/kg) for Classification Without TCLP		Maximum Values for Leachable Concentration (TCLP – mg/L) and Total Concentration (SCC – mg/kg) When Used Together			
	General Solid Waste	Restricted Solid Waste	General Solid Waste		Restricted Solid Waste	
	CT 1	CT 2	TCLP 1	SCC 1	TCLP 3	SCC 3
Benzene	10	40	0.5	18	2	72
Ethylbenzene	600	2400	30	1080	120	4320
Toluene	288	1152	14.4	518	57.6	2073
Xylenes (total)	1000	4000	50	1800	200	7200
Benzo(a)pyrene	0.8	3.2	0.04	10	0.16	23
PAHs	NA	NA	NA	200	NA	800
TPH C_6-C_9	NA	NA	NA	650	NA	2600
TPH C_{10}-C_{36}	NA	NA	NA	10000	NA	40000
PCB	NA	NA	NA	<50	NA	<50
Scheduled Chemicals[3]	NA	NA	NA	<50	NA	<50
Arsenic	100	400	5	500	20	2000
Cadmium	20	80	1	100	4	400
Chromium	100	400	5	1900	20	7600
Copper	NA	NA	NA	NA	NA	N A
Lead	100	400	5	1500	20	6000
Mercury	4	16	0.2	50	0.8	200
Nickel	40	160	2	1050	8	4200
Zinc	NA	NA	NA	NA	NA	NA

Notes: CT: Contaminant Threshold

TCLP Toxicity Characteristic Leaching Procedure (leachable concentration).

SCC Specific Contaminant Concentration.

NA: Indicates no guidelines for that particular analyte are currently applicable.

1. Scheduled chemicals, polycyclic aromatic hydrocarbons and polychlorinated biphenyls are assessed by using SCC1, SCC2 and SCC3. No TCLP analysis is required.

2. Petroleum hydrocarbons are assessed only by total concentration (SCC1, SCC2 or SCC3).

3. Scheduled Chemicals (as described in *DECC 2009*, being chlorinated hydrocarbons such as pesticides and solvents) includes Aldrin, Alpha-BHC, Beta-BHC, Gamma-BHC (Lindane), Delta-BHC, Chlordane, DDD, DDE, DDT, Dieldrin, Endrin, Endrin aldehyde, Heptachlor, Heptachlor epoxide, Hexachlorobenzene, Hexachlorophene, Isodrin, Pentachlorobenzene, Pentachloronitrobenzene, Pentachlorophenol, 1,2,4,5-Tetrachlorobenzene, 2,3,4,6 Tetrachlorophenol, 1,2,4-Trichlorobenzene, 2,4,5-Trichlorophenoxyacetic acid, salts and esters.

4. Methodology

4.1 Sampling and Analysis Plan and Methodology

4.1.1 Data Quality Objectives

The Data Quality Objectives (DQOs) for the investigation were to:

- Collect sufficient information to adequately characterise areas of environmental concern.
- Assess the nature and extent of contamination in the soils at the investigation area.
- Assess any potential contaminant risks to human health and the environment within the context of the investigation area.
- Establish an acceptable level of uncertainty in analytical results that fall within EPA guidelines for accuracy and precision (as demonstrated by field and laboratory Quality Control). The representativeness of sample locations with respect to investigation areas conditions was assessed against field observations and distribution of data, using the number of sampling locations described above.
- Produce a report describing the methodology and findings of the investigations, and addressing the above investigations.

4.1.2 Rationale for Sampling and Analysis Plan

The Hunter 8 Alliance approach to the contamination assessment of the revised construction impact zone was to conduct a preliminary site contamination investigation with limited soil sampling to establish past site usage and to identify any potential contamination issues. The limited sampling and analytical program was based on information obtained from the desktop review, site inspection and data from the previous investigations undertaken as part of the Environmental Assessment. The limited sampling program targeted only those areas which had a high potential for use of chemicals on site (such as vineyards located between chainages 219.230-219.740 kilometres) or that were used for associated railway activities (such as the corridor south of railway located between chainages 196.100-196.750 kilometres). No sampling was undertaken at the two industrial properties located between (chainages 194.780-194.970 and 194.970-195.120 kilometres) or the vacant property (located between chainages 195.120 – 195.190 kilometres) due to access restrictions.

Sampling was generally undertaken on a systematic sampling pattern, with sample locations spaced evenly apart (in a linear arrangement due to narrow investigation areas) within the AOCs identified in Table 4-1.

The sampling program undertaken was considered sufficient to provide an indication as to the potential contamination likely to be encountered. However the sampling density is not considered sufficient to delineate areas of contamination identified or provide sufficient information to characterise material for off-site disposal. In addition, areas of unknown potential contamination may exist on the investigation area, not identified during this limited investigation.

Sampling locations are presented in Figures 3 and 4 in Appendix A.

4.1.3 Field Works

Field works and environmental sampling within the additional investigation areas were undertaken by experienced Hunter 8 Alliance personnel on 6, 7 and 11 May 2010. All fieldwork was undertaken in accordance with standard field operating procedures. All sampling was conducted using carefully documented and supervised quality assurance procedures.

Field works included:

- Excavation of 10 test pits using an excavator to a maximum depth of 2.5 metres.
- Boring of four test holes using a hand auger to a maximum depth of one metre.
- Collection of 63 soil samples including quality control (QC) samples (see Section 4.1.6).

4.1.4 Soil Sampling Methodology

Samples were generally collected at surface (0.0 to 0.1 metres), subsurface (at 0.5 metre intervals or change in soil strata) and at the base of the pit or hole (at least 0.2 metres into natural soils). Samples were collected from the middle of the bucket or auger using a dedicated pair of disposable nitrile gloves for each sample.

All test pits and test holes completed during the investigations were logged detailing features such as seepage, discolouration, staining, odours and other indications of contamination being noted. Soil descriptions are presented in Table A, Appendix B.

4.1.5 Sample Handling

Samples were collected in appropriate sample containers, which had been pre-treated in a manner appropriate for the laboratory analysis. Samples were placed in the jars supplied by the laboratory, clearly labelled with sample number, sample location, sample depth and sample date. Sample containers were then transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory. A Chain-of-Custody form was forwarded with the samples to the testing laboratory and is presented with the laboratory analytical certificates in Appendix C.

4.1.6 QA/QC

Intra laboratory duplicates were collected for Quality Control purposes at a nominal rate of 1 in 10.

4.1.7 Laboratory Analytical Program

Laboratory analysis was undertaken by ALS Laboratory Group (ALS) a National Association of Testing Authorities (NATA) Accredited Laboratory. Details of the number of sample locations, parameters and analyses are summarised in Table 4-1.

Table 4-1 Analytical Program

Area of Concern Targeted	Number of Sample Locations	Analytical Parameters	Number of Analyses
Rail corridor (196.020-196.720 km)	10	TPH BTEX PAHs Heavy Metals[1] OCPs Total PCBs	17 (including 2 QC) 17 (including 2 QC) 17 (including 2 QC) 17 (including 2 QC) 17 (including 2 QC) 17 (including 2 QC)
Vineyard (219.230-219.740 km)	4	TPH BTEX PAHs Heavy Metals[1] OCPs Total PCBs	7 (including 1 QC) 7 (including 1 QC) 7 (including 1 QC) 7 (including 1 QC) 7 (including 1 QC) 7 (including 1 QC)

1. Metals included As, Cd, Cr, Cu, Hg, Pb, Ni, and Zn.

Note that OPPs have not been included in the program due to their short life-span in the environment. Asbestos in soil was not included in the program as no potential asbestos fragments were observed during the site inspections and field works.

4.2 Quality Assurance/Quality Control

4.2.1 Field Quality Assurance (QA)

All fieldwork was conducted in general accordance with the Standard Field Operating Procedures (FOP). The FOP ensures that all environmental samples were collected by a set of uniform and systematic methods.

The FOP describes many field activities including:

- Implemented decontamination procedures.
- Sample identification procedures.
- Information requirements for soil bore logs.
- Chain of custody information requirements.
- Sample duplicate frequency.
- Field equipment calibration requirements.

4.2.2 Field Quality Control (QC)

Field quality control procedures used during the project comprised:

- Intra-Laboratory Duplicates: These are prepared in the field by splitting the original sample and placing two equivalent portions of samples into two separate containers. The blind duplicate sample is sent anonymously to the project laboratory. Duplicate samples are analysed for the identical set of parameters requested for the corresponding original sample. For the intra-laboratory duplicate sample pair, relative percentage differences (RPD) are calculated. Intra-laboratory duplicates provide an indication of the analytical precision of the project laboratory, but may also be affected by factors such as sampling methodology or inherent heterogeneity of the sample medium.

Trip spikes were not used for field quality control as it was assumed that there is a low likelihood of volatile contaminants on this investigation area. The results presented in Table C, Appendix B, supported this assumption.

Field blank samples are generally collected to validate decontamination procedures for sampling equipment between sampling locations. Due to the method of sampling that was used for this investigation the use of field blank samples was not required.

Assessment of field quality control duplicate samples was undertaken by calculating the Relative Percent Difference (RPD) of duplicate samples. RPD is defined as:

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where: Co = Analyte concentration of the original sample

Cd = Analyte concentration of the duplicate sample

AS 4482.1 states that this RPD should be within 30% - 50% of the mean concentration of the analyte, noting that this variation may be higher for organics, or for cases where analyte concentrations are low. This is consistent with quality control objectives described in the NEPM. A result exceeding these guidelines does not necessarily mean the data is invalid, but rather the impact on the data may need to be assessed. AS 4482.1 notes that the significance of RPD of results should be evaluated on the basis of sampling technique, sample variability, absolute concentrations relative to criteria and laboratory performance.

4.2.3 Laboratory Quality Assurance

The analytical laboratory undertook the analyses utilising their own internal procedures and test methods (for which it is NATA accredited) and in accordance with their own quality assurance system which forms part of their NATA accreditation.

4.2.4 Laboratory Quality Control

Laboratory quality control procedures used during the project and reported comprised:

- Laboratory Duplicate Samples: Analysis of duplicate sub-samples from one sample submitted for analytical testing and analysis of the samples in the one batch. A laboratory duplicate provides data on the analytical precision (repeatability) of an analytical batch.

- Spiked Samples: A sample is spiked by adding an aliquot of known concentration of the target analyte(s) to the sample matrix prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques.
- Laboratory Blank: Usually an organic or aqueous solution that is as free of analyte as possible and contains all the reagents in the same volume as used in the processing of the samples. The reagent blank must be carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.

Other internal laboratory quality control procedures, as required for NATA registration, are performed and are not reported by the laboratories. These procedures and results can be provided on request.

5. Summary of Results

5.1 Investigation Results

5.1.1 Soil Profile

The typical soils generally encountered within rail corridor consisted of fill materials including ballast, sand, and clay, which were underlain by natural clay. Typical soils encountered within the vineyard property consisted of natural clays, which were disturbed on the surface. Detailed soil descriptions are presented in Table A, Appendix B.

5.1.2 Soil Analytical Results

Soil sample locations are presented in Figures 3 and 4, Appendix A. Summaries of the laboratory results are presented in Tables B to D, in Appendix B. Table A in Appendix B presents a summary of the samples analysed. Detailed laboratory report sheets and COC (Chain of Custody) documents are provided in Appendix C.

In documenting these results, comparison has been made to the site assessment criteria, including Ecological Investigation Levels (EILs) and Health Investigation Levels (HILs) for commercial / industrial land use as discussed in Section 3.2.

Heavy metals

Concentrations of heavy metals in all samples analysed were below the relevant HILs. Concentrations of heavy metals exceeding the EILs were:

- Arsenic – TP196.15-0.0, TP196.20-0.4, TP196.30-0.9, TP196.35-2.4, TP196.40-1.4, and TP196.45-0.4 (ranged from 23 to 112 mg/kg).
- Copper – TP196.50-0.0 (137 mg/kg).
- Zinc – TP196.30-0.9, TP196.35-2.4, TP196.40-1.4, and TP196.50-0.0 (ranged from 210 to 487 mg/kg).

Plant stress was evident at these locations.

Volatile Hydrocarbons (TPH C_6 - C_9 and BTEX)

Concentrations of TPH C_6 - C_9 and BTEX in all samples analysed were reported below the laboratory limit of reporting (LOR).

Total Petroleum Hydrocarbons (TPH C_{10} - C_{36})

All samples reported concentrations below the threshold criteria guidelines. Detectable levels of TPH C_{10} - C_{36} were reported for samples TP196.15-0.0, TP196.20-0.4, TP196.25-1.4, TP196.30-0.9, TP196.35-2.4, TP196.40-1.4, TP196.45-0.4, TP196.50-0.0 and TP196.55-0.9. All remaining samples reported concentrations of TPH C_{10}-C_{36} below the laboratory LOR.

Polyaromatic Hydrocarbons (PAH's)

All samples reported concentrations below HIL F. Detectable levels of Benzo[a]Pyrene were reported for samples TP196.15-0.0, TP196.15-0.4, TP196.30-0.9, TP196.35-2.4, TP196.45-0.4, TP196.50-0.0 and TP196.55-0.9. Detectable levels of Total PAHs were reported for samples TP196.15-0.0, TP196.15-0.4, TP196.20-0.4, TP196.30-0.9, TP196.35-2.4, TP196.40-1.4, TP196.45-0.4, TP196.50-0.0, and TP196.55-0.9.

Organochlorine Pesticides (OCPs) and Total Polychlorinated Biphenyls (PCBs)

Concentrations of OCPs and PCBs for all samples analysed were below the laboratory LOR.

5.2 Preliminary Waste Classification

The preliminary waste classification results are presented in Table E in Appendix B. Several samples exceeded the General Solid Waste guidelines without TCLP analysis, including:

- Arsenic – TP196.40-1.4 (112 mg/kg).
- Lead – TP196.30-0.9, TP196.35-2.4, TP196.40-1.4, TP196.45-0.4 and TP196.50-0.0 (ranged from 101 to 153 mg/kg).
- Benzo(a)pyrene – TP196.15-0.0, TP196.15-0.4, TP196.30-0.9 and TP196.45-0.4 (ranged from 1.0 to 2.1 mg/kg).

However, TCLP analysis of the samples above reported concentrations below the criteria for General Solid Waste with TCLP testing (SCC1/TCLP1). Based on the results, the indicative waste classification for these samples is General Solid Waste.

5.3 Quality Assurance / Quality Control

5.3.1 Field Duplicates

Relative Percent Differences (RPDs) were calculated for duplicated samples as part of the QA/QC program, and are presented in Tables B to D in Appendix B. The RPDs for soil sample pairs were generally within 30 percent, with the exception of those highlighted in Table 5-1.

Table 5-1 Relative Percent Differences Exceedances Summary

Primary/Duplicate	Parameters > 30%	Comment
TP196.30-0.9 / Q02	Lead (47%)	Elevated RPD due to soil heterogeneity
	Zinc (40%)	Elevated RPD due to soil heterogeneity
	Fluoranthene (150%)	Elevated RPD due to low concentration of analyte (less than 10 times the limit of reporting

Primary/Duplicate	Parameters > 30%	Comment
TP196.35-2.4 / Q03	Total Chromium (37%)	Elevated RPD due to soil heterogeneity
	Lead (79%)	Elevated RPD due to soil heterogeneity
	Zinc (65%)	Elevated RPD due to soil heterogeneity
	Fluoranthene (126%)	Elevated RPD due to low concentration of analyte (less than 10 times the limit of reporting
TP219.38-0.0	Lead (43%)	Elevated RPD due to low concentration of analyte (less than 10 times the limit of reporting

5.3.2 Assessment of QC Results

The quality assurance and quality control measures employed throughout this assessment have enabled the quality of the field sample collection and laboratory analysis procedures to be examined. Based on the RPDs calculated for the field split duplicates, the results and precision of the data is considered to be of an acceptable quality upon which to draw conclusions regarding the environmental condition of the investigation area. There is some variability in results, which is primarily attributed to soil heterogeneity, which has been taken into account in the assessment of results. As analytical results were generally well below relevant criteria, the variability evident from the quality control samples is not considered to affect the assessment.

5.3.3 Laboratory QA / QC

The NATA certified laboratory results sheets, as presented in Appendix C, refer to a quality control program comprising the analysis of spikes, method blanks and duplicate samples. Generally, the results reported indicate that the laboratory was achieving levels of performance within their recommended control limits during the period when the samples from this program were analysed, with the exception of minor duplicate RPD exceedances (acceptable range 0-20%) for copper (27%) and zinc (23%) in an anonymous sample pair. These exceedances were only minor and given copper and zinc concentrations were well below the adopted HIL F criteria, the results are not considered to affect the assessment.

6. Impact Assessment

6.1 Contamination Assessment

6.1.1 General Site Identification

Based on the historical review and site inspection, the most likely sources of contamination within the additional investigation area were considered to be the following:

- Spraying for weed and pest control.
- Use of fertilisers on rural land and vineyards.
- Importation of fill materials including ballast.
- Illegal dumping/ dumping of waste materials.
- Septic tank on residential properties.
- Use and storage of fuels, oils and greases.

6.1.2 Summary of Results

Sampling was undertaken at 14 locations in the additional investigation areas.

The typical soils encountered within the railway corridor during sampling (chainages 196.020-196.720 kilometres) were fill materials - consisting of ballast, sand, and clay. These were underlain by natural clay. Typical soils encountered within the sampled vineyard property consisted of natural clays, disturbed on the surface.

There were no exceedances of the nominate land use criteria, HIL F or TC, for the samples analysed, however several samples analysed exceeded the EILs. Arsenic in eight samples (including two duplicates) exceeded the EIL. One sample exceeded the EIL for copper, while five samples (including one duplicate) exceeded the EILs for zinc. All of the exceedances were associated with fill or disturbed surface material. While concentrations exceeding EILs may indicate some potential environmental impacts the “decision-making process for assessing urban redevelopment sites” from DEC 2006 does not require consideration of EILs when assessing the suitability of a site for commercial / industrial land use such as rail corridor and roads. Samples exceeding the EILs may present an ecological risk, but are not considered to restrict construction activities. These exceedances should be considered when determining potential re-use of excavated material along the route, particularly with respect to contamination of adjacent areas and waterways, but given the concentrations found, are unlikely to present a risk of significant impacts.

6.1.3 Preliminary Waste Classification

Several samples exceeded the General Solid Waste guidelines without TCLP analysis, which would have resulted in a waste classification of Restricted Solid Waste. However, TCLP analysis of the samples (for exceeding analytes) reported concentrations below the criteria for General Solid Waste with TCLP testing. Based on the results, the indicative waste classification for the sampled soils is therefore General Solid Waste.

6.2 Discussion

The extent of sampling of soils and subsequent analysis has been limited, and has been targeted towards areas where contamination is considered to be most likely, based on the knowledge of the site history and visual observation. The sampling density is not considered sufficient to delineate areas of contamination identified or provide sufficient information to characterise material for off-site disposal. In addition, areas of unknown potential contamination may exist within the investigation area not identified during this limited investigation, particularly within those areas that could not be accessed. It is recommended that intrusive investigations are undertaken in these areas to assess potential contamination issues. It is recommended that a management plan is prepared prior to construction to deal with unexpected contamination should it be encountered during works.

It should be noted that the preliminary waste classification above is indicative only and was undertaken for the purposes of off site disposal to landfill for the sampled soils only. Specific classification of soils for the purpose of re-use on projects off site, regarding classification as Virgin Excavated Natural Materials (VENM) or Excavated Natural Materials (ENM) (if applicable to these soils), was not undertaken as part of this investigation.

If off site disposal of soils from site is required, it is recommended that additional sampling and analysis is undertaken to specifically characterise the material prior to off site disposal. Soils to be taken off site and that are classified as either General Solid Waste, Restricted Solid Waste or Hazardous Waste, must be taken to an appropriately licensed landfill. Soils classified as either VENM or ENM may be either used on site or taken to another site with approval to receive VENM or ENM material. Soils would be managed in accordance with a contaminated soil management measures within a Spoil and Fill Management Plan prepared for the Project. This plan would document the sampling procedures and waste classification guidelines.

7. Mitigation Measures

Section 7 of the Preliminary Site Contamination Investigation (Appendix N of the Environmental Assessment). lists the mitigation measures in regard to contamination. These measures would also apply to the additional investigation area.

In addition to these measures, the following would be implemented:

- Undertake contamination assessments within the vacant property north of the corridor (chainages 195.120 to 195.190 kilometres) and industrial properties north of the corridor (chainages 194.780 to 195.120 kilometres), which could not be accessed during this investigation prior to construction activities associated with Phase 2 of the Project impacting on these areas.

8. Conclusions

Based on the results of this preliminary site contamination investigation, the following additional key areas with potential sources of contamination were identified:

- Industrial properties north of the rail corridor (chainages 194.780 to 195.120 kilometres).
- Vacant property north of the rail corridor (chainages 195.120 – 195.190 kilometres).
- Disturbed area south of the rail corridor (chainages 196.020 to 196.720 kilometres).
- Vineyard present on the southern side of the rail corridor (chainages 219.230 to 219.740 kilometres).

Limited soil sampling was carried out on the vineyard property (chainages 219.230 to 219.740 kilometres) and the disturbed area south of the rail corridor (chainages 196.020 to 196.720 kilometres). Soils within the areas sampled are considered suitable for on-site use, with regards to potential contamination risk to human health and the environment. The indicative waste classification for the soils samples on these areas was General Solid Waste.

No sampling was undertaken at the two industrial properties (chainages 194.780-194.970 and 194.970-195.120 kilometres) or the vacant property (chainages 195.120 – 195.190 kilometres) due to access restrictions.

An environmental risk assessment was carried out for the Project, in regard to contamination, and resulted in the recommendation of the following additional mitigation measures:

- Undertake contamination assessments within the vacant property north of the corridor (chainages 195.120 to 195.190 kilometres) and industrial properties north of the corridor (chainages 194.780 to 195.120 kilometres), which could not be accessed during this investigation prior to construction activities associated with Phase 2 of the Project impacting on these areas.

9. References

ANZECC/NHMRC, 1992, *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*.

Contaminated Land Management Act 1997.

Hunter 8, 2009, *Maitland to Minimbah Third Track: Preliminary Site Contamination Investigation*, Reference: H8R-REP-S2G-ENV-0010-00, December 2009.

National Environment Protection Coucil (NEPC), 1999, *National Environment Protection (Assessment of Site Contamination) Measure*.

NSW DEC, 2006, *Guidelines for NSW Site Auditor Scheme (2nd Ed.)*.

NSW DECCW, 2009, *Waste Classification Guidelines, Part 1: Classifying Waste*.

NSW EPA, 1994, *Guidelines for Assessment of Service Station Sites.*

NSW EPA, 1995, *Sampling Design Guidelines*.

NSW EPA, 1997, *Guidelines for Consultants Reporting on Contaminated Sites*.

Protection of the Environmental Operations Amendment (Scheduled Activities and Waste) Regulation, 2009.

Standards Australia, 2005, *Australian Standard Guide to the sampling and investigation of potentially commentated soil, AS4482.1, 2005*.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - S-08 TPH/BTEX/PAH/OC/PCB/8 Metals
ES1008768-001	11-MAY-2010 15:00	TP219.26-0.0		✓
ES1008768-002	11-MAY-2010 15:00	TP219.26-0.4		✓
ES1008768-003	11-MAY-2010 15:00	TP219.38-0.0		✓
ES1008768-004	11-MAY-2010 15:00	TP219.50-0.0		✓
ES1008768-005	11-MAY-2010 15:00	TP219.50-0.9		✓
ES1008768-006	11-MAY-2010 15:00	TP219.61-0.0		✓
ES1008768-007	11-MAY-2010 15:00	Q10		✓
ES1008768-008	11-MAY-2010 15:00	TP219.38-0.4	✓	
ES1008768-009	11-MAY-2010 15:00	TP219.50-0.4	✓	
ES1008768-010	11-MAY-2010 15:00	TP219.61-0.4	✓	
ES1008768-011	11-MAY-2010 15:00	TP219.61-0.9	✓	
ES1008768-012	11-MAY-2010 15:00	Q11	✓	

Requested Deliverables

MR JESSE SIMKUS

- *AU Certificate of Analysis - NATA (COA)	Email	jesse.simkus@ghd.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jesse.simkus@ghd.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jesse.simkus@ghd.com.au
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	jesse.simkus@ghd.com.au
- Chain of Custody (CoC) (COC)	Email	jesse.simkus@ghd.com.au
- EDI Format - ENMRG (ENMRG)	Email	jesse.simkus@ghd.com.au
- EDI Format - ESDAT (ESDAT)	Email	jesse.simkus@ghd.com.au
- EDI Format - GHDNEW (GHDNEW)	Email	jesse.simkus@ghd.com.au

MS MELISSA SIMPSON

- A4 - AU Tax Invoice (INV)	Email	Melissa.Simpson@ghd.com.au