Waratah Coal

China First - Preliminary Site Investigation: Contaminated Land

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13 September 2010

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Executive Summary

E3 Consulting Pty Ltd (E3) was commissioned by Waratah Coal Pty Ltd (Waratah Coal) to undertake the Preliminary Site Investigations for the Galilee Coal Project – Northern Export Facility project (China First Project). This technical report assesses the potential risk of contaminated land in the project areas provides preliminary site investigations (PSIs) of sites with contaminant potential and assesses potential impacts resulting from the China First project.

The project includes a:

- Coal mine located near Alpha in the Galilee Basin, Central Queensland;
- Rail alignment between the mine and a coal terminal located at the Abbot Point State Development Area (APSDA); and
- Coal terminal incorporated within both the APSDA and the Port of Abbot Point.

A full description of the project is provided in the EIS.

The assessment found a number of sites with potential for contamination to be present including:

- One lot on the existing rail line west of Alpha, south of the mine area was found to be listed for the hazardous contaminant arsenic;
- Hydrocarbon contamination in the mine area under an above ground diesel fuel storage tank;
- One lot on the rail alignment was listed on the EMR as a Livestock Dip/Race;
- an additional two Livestock Dips were identified in the rail alignment that were not listed on the EMR;
- a Livestock Dip was identified near the coal terminal that is not listed on the EMR; and
- Existing rail lines in the project area with a history of arsenic use for weed control.

A review of the potential sources of land contamination associated with construction, operation and decommissioning of project areas include:

- Drill fluid use;
- Liquid and solid wastes;
- Chemical/fuel/oil storage and handling; and
- Chemical/fuel/oil spills and leaks.

A risk assessment of these activities suggests that the identified impacts can be remediated with current common contaminated land practices and that these impacts are of a low risk following the adoption of proposed mitigation measures.

1 Introduction

1.1 Project Overview

Waratah Coal Pty Ltd (Waratah Coal) proposes to establish a coal mine in the Galilee Basin, Central Queensland, to supply thermal coal to overseas customers. The Co-ordinator General has declared the Galilee Coal Project – Northern Export Facility (China First Project) to be a significant project requiring an Environmental Impact Statement (EIS).

E3 Consulting Pty Ltd (E3) was commissioned by Waratah Coal to undertake an assessment of the Land Contamination component for the China First Project. Specifically, the components of the project being assessed by the study are the mine site, a rail alignment between the mine and Abbot Point Coal Terminal (APCT) located at the Abbot Point State Development Area (APSDA).

1.2 Description of Works

The project includes the following components:

- A coal mine located near Alpha in the Galilee Basin, Central Queensland;
- A rail network including a 1.6km buffer zone between the mine and the coal terminal; and
- A coal terminal at the APSDA and port loading facilities at the Port of Abbot Point.

The project study area is shown in Figure 1.1 and a full description of the project is provided in Volumes 2-4 of the EIS.

1.3 Scope of Study

This technical report addresses *section 3.2.5* (Land Contamination) of the Terms of Reference (ToR) for the Galilee Coal Project (Table 1-1). This report addresses the three major structural components of the project separately by providing a description of the existing environmental contaminated baseline results; assesses potential impacts through preliminary site investigations (PSIs) and suggest management measures to mitigate potential impacts of the project.

The technical report assesses the potential for land contamination in the project areas and assesses potential impacts at sites with potential for contamination through:

- A tiered risk assessment of land uses throughout the project areas;
- Identification of potentially contaminated sites;
- Provision of PSIs for sites with existing or potential land contamination through:
    - A desktop assessment of site information and site history from publicly available databases related to land contamination within the study area and region;
    - Field studies and collection of soil samples encompassing the mine, rail alignment and coal terminal;
    - Identifying potential contaminated impacts that may exist in the project's footprint;

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- Compiling a description of land contamination that may potentially be impacted or impact proposed works by the project; and
- Providing recommendations for measures to avoid or mitigate adverse impacts or significant land contamination at the construction phase of the project.

The report does not include marine areas associated with upgrades to the Port of Abbot Point.

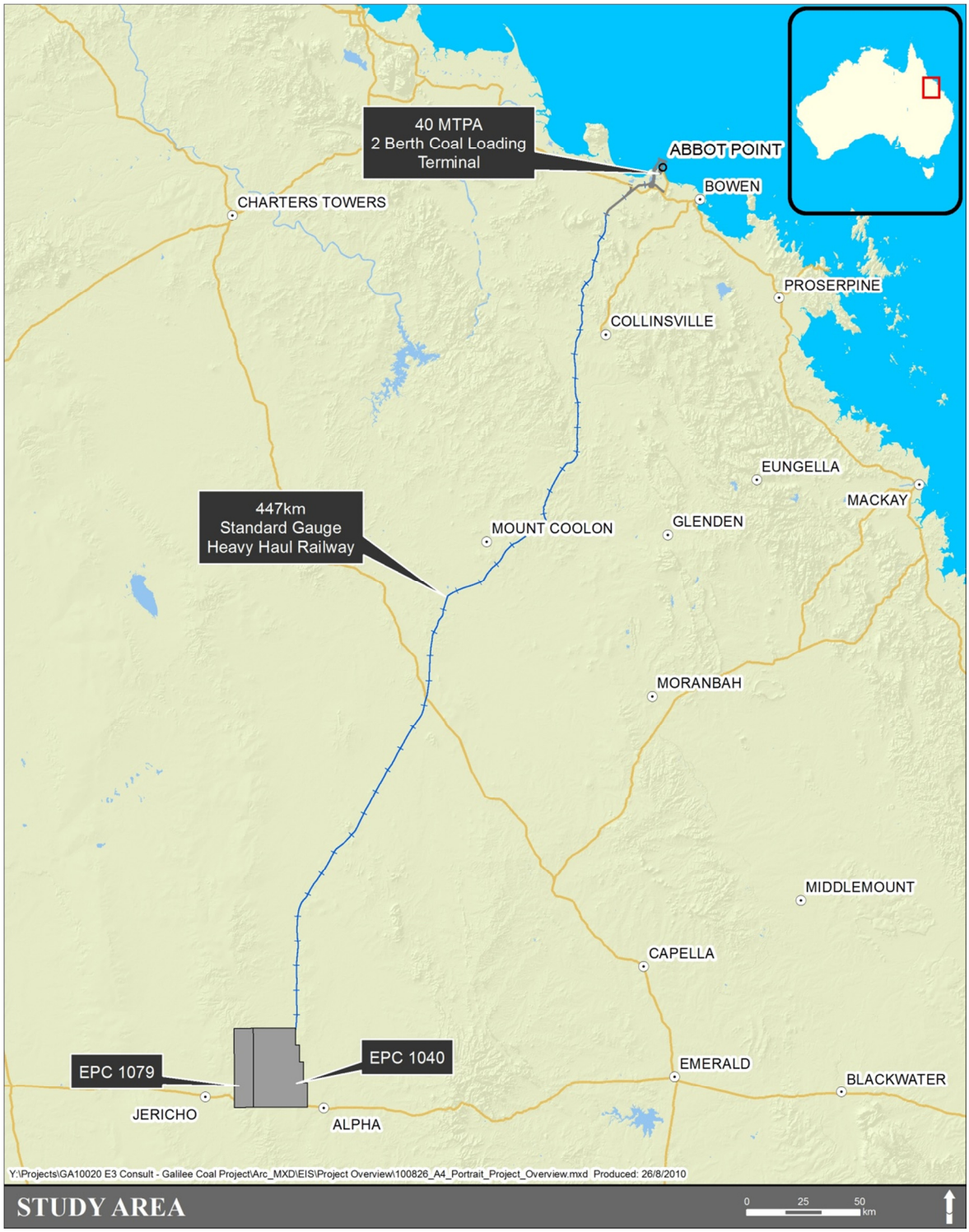


Figure 1-1: China First Project Area

Table 1-1: Terms of Reference: Cross Reference Table

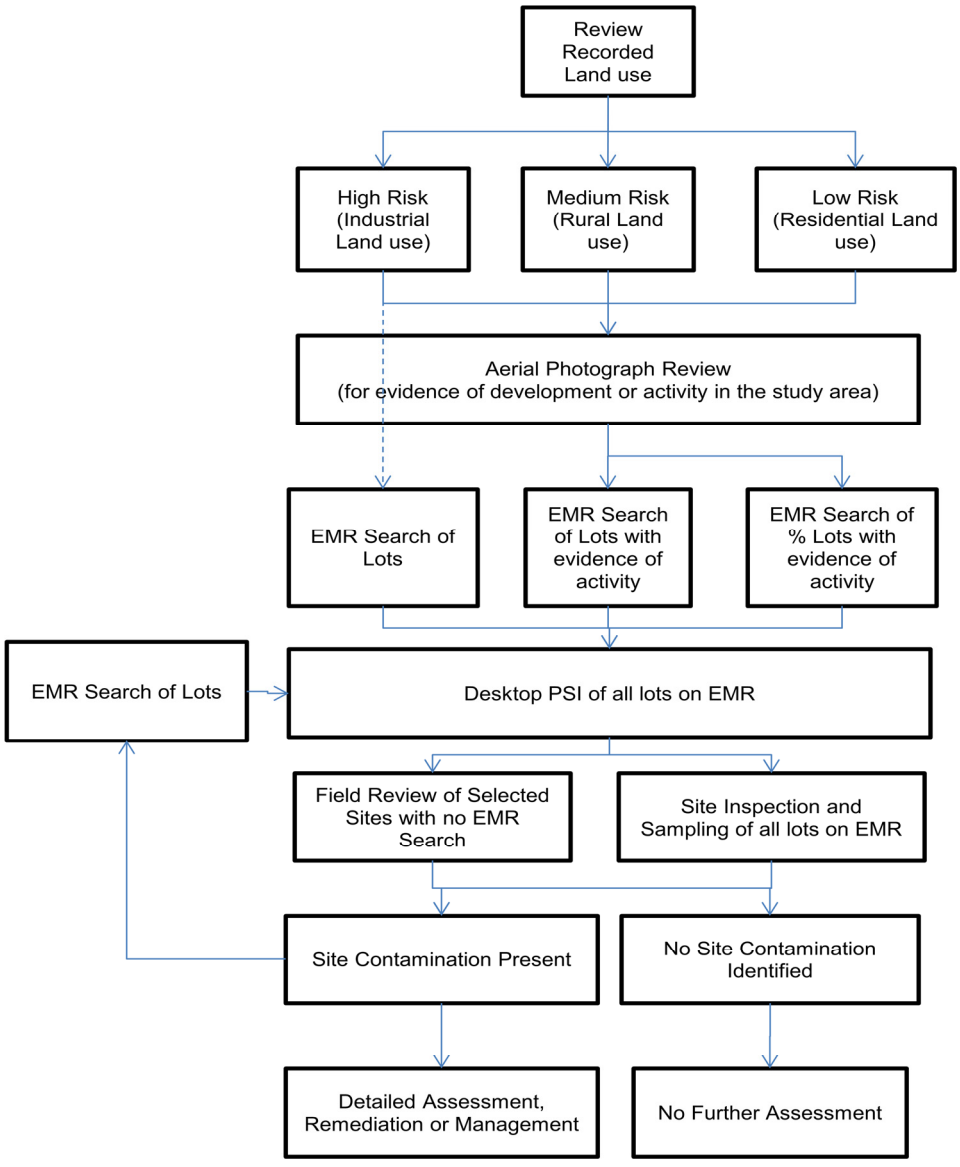
ToR Content	ToR Requirements	Technical Report Section
3.2.5.1	This section should discuss the potential for land contamination within the project area from existing and past uses, based on known land use history and the nature and concentrations of any contaminants. The review should identify land within the proposed mine, associated infrastructure corridors and any other areas affected by the proposed works, which has been used, or is being used, for a Notifiable Activity as listed in Schedule 2 of the EP Act, or is potentially contaminated, or is on the environmental management register or contaminated land register. The EIS should include a preliminary site investigation for all properties that have been impacted by existing and past land uses that could have resulted in land contamination.	Sections 3, 4, 5 and 6 Section 6 See also Soils and Geology Technical Report
3.2.5.2	The EIS should discuss the management of any contaminated land and potential for contamination from construction, commissioning and operation, in accordance with the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland (EPA, 1998)* and the *National Environment Protection (Assessment of Site Contamination) Measure 1999.* The EIS should also describe the possible contamination of land from aspects of the project, including waste, saline water from coal seam gas extraction used for dust suppression, reject coal, overburden, coal washing plant and spills at chemical and fuel storage and handling areas. This section should describe strategies and methods to be used to prevent and manage any land contamination resulting from the project, including the management of any acid generation or saline impacts from the mining activities and the management of chemicals and fuels to prevent spills or leaks.	Sections 3, 4, 5 and 6 Section 6 See also Waste Technical Report and Acid Sulfate Soils Technical Report Sections 7 and 8

2 Method of Assessment

2.1 Desktop Tiered Ranking Risk Assessment

In order to adopt an appropriate ranking system for the large number of properties across the study area, a tiered/ranking approach was adopted to assess lots with moderate or high potential for contamination and to select lots with potential impacts to the project area for more detailed investigation. These lots were then selected for PSIs. The ranking order of lots across the study area was classified accordingly to a system of *High* to *Medium* and *Low* risk. A flowchart illustrating the tiered assessment process is provided as Figure 1-1

Figure 2-1: Tiered approach to Land Contamination Assessment



In order to establish primary land use practices for narrowing down or grouping lots into high, medium or low risk rankings, a search into the Department of Environment and Resource Management (DERM)'s Queensland Valuation and Sales System (QVAS) was conducted. The search provided information on current primary land uses, tenure, property status, and sub-leased information for each lot.

Lots ranked as a "*high risk*" included industrial land use, (e.g. transport terminals, transformers, airfields, extractive industry). Lots ranked as "*medium risk*" include cattle and stock agribusinesses (potential for stock/cattle dips) and contractors/builders yards. While stock/cattle dips have the potential for contamination, these sites are generally small and occur on large rural lots. Therefore cattle dip location may have a low probability of intersecting the projects footprint but the overall risk is considered to be moderate. Lots ranked as "*low risk*" include parks, gardens and residential land as it is unlikely potentially contaminating activities would have been carried out on that land.

All sites ranked as *high risk* were subject to a search on the EMR/CLR. *Medium risk* sites were subjected to aerial imagery investigations. The aerial imagery allowed for an investigation of any previous evidence of contaminating activities or disturbances on the lot. If a lot was found to potentially have contaminating activities or disturbances based upon aerial imagery or in the course of an aerial inspection of the project areas an EMR/CLR search of that lot was conducted. EMR/CLR searches were undertaken on 48% of medium risk sites.

EMR/CLR searches were not carried out on *low risk* sites as lots subject to residential land use were considered the most sensitive land use in terms of public use and exposure. Therefore they would have a low probability of being impacted by contamination.

It is possible that lots within the study area that are not listed on the EMR/CLR could be contaminated through a non-notifiable activity. Contamination of this nature is likely to result from unscheduled accidental spills, leakages or potentially hazardous substances. The possibility remains for such sites, unidentifiable via desktop review or assessment to be present within the study area.

The tiered/ranked system is conservative in its approach. While contaminated sites may be subjected to a Notifiable Activity; the potential for the activity to occur within the study area is generally low.

2.2 Desktop Review

The desktop review included an assessment of site information and history from searches of Commonwealth, Queensland and Local databases. Specific information sources used included:

- Database searches for current legislation on the *National Environment Protection Measure 1999*;
- Online searches for Unexploded Ordinates (UXO) searches sourced from the Department of Defence website (DoD);
- Online searches of relevant historical and current Environmental Management Register (EMR) and Contaminated Land Register (CLR) sourced from the Citec online state database for *high risk sites*;
- Online database for relevant primary land use, tenure and zoning of properties within the study area, searches sourced from QVAS Property Detailed Report from the DERM;

- Database searches for Lots with current and historical title searches sourced from DERM;
- Database searches on historical aerial photography sourced from DERM;
- Online searches for property Lot numbers and Registered Plans (RP) sourced from the Regional Councils and/or Queensland geographical information systems (GIS) government website;
- Database searches for Flammable and Combustible Liquid Licenses sourced from the Regional Councils within the study area;
- Sourced information from relevant E3 technical reports, (i.e. Soils and Geology Technical Report, Hydrogeology Technical Report, Land Use and Tenure Technical Report and Waste Technical Report); and
- Site interviews conducted for land use practices and historical information pertaining from land owners.

2.3 Site Information

The site information required for a PSI included the following:

2.3.1 Site Location and Description

The site location and a description of the site details were sourced from land titles data to identify the site being investigated.

2.3.2 Environmental Management Register

An EMR search was undertaken of the China First project area for properties that exhibited evidence of being contaminated or where a risk of potentially being contaminated through land use indicators identified as '*Notifiable Activities*', in Schedule 2 under s 374 of the EP Act.

2.3.3 Contaminated Land Register

A search was conducted to establish if lots were listed on the CLR. Land is recorded on the CLR when the extent of contamination following detailed site investigation/s, is deemed by DERM to require immediate remediation or management. The search found that none of the identified potentially contaminated sites were listed on the CLR.

2.3.4 Current Activities and Proposed Activities

The current and proposed site activities (if available) are discussed based upon available land tenure information to assess the potential for contaminating activities to occur and assess the potential for risks posed by those activities.

2.3.5 Adjacent Land Use

The adjacent land uses of lots were described to assess the potential for impact to adjacent receptors and the potential for impacts from adjacent activities.

2.3.6 Geology and Soils

The available geological and soil data from publicly available mapping was discussed to provide background data for the potential for contaminant impact and migration and to assess the potential for elevated natural background concentrations to be present at a site.

2.3.7 Hydrogeology

The local groundwater data from DERM records was reviewed to assess the vulnerability of groundwater to contaminant impacts and the potential for groundwater to act a migration pathway from a contaminant source to the environment or human receptors.

2.3.8 Nearby Receptors

The nearby sensitive environmental and human receptors were discussed to assess the potential environmental and human health receptors adjacent to the site.

2.3.9 Unexploded Ordinance Search

A review of the DoD UXO mapping was conducted to assess any potential contaminating sources within the project's study area. DoD UXO contamination is categorised as being *Substantial*, *Slight* or *Other*:

- **Substantial -** A history of numerous UXO finds or heavy residual fragmentation. Areas likely to be *Substantial* include impact areas, demolition sites and areas of heavy explosive ordnance dumping;
- **Slight -** Areas with a confirmed history of military activities that have resulted in residual UXO but where DoD considers it inappropriate to assess as *Substantial*; and
- **Other –** DoD records cannot confirm whether the site was every used for live firing. UXO or explosive ordnance fragments/components have not been recovered from that site and it would be inappropriate to assess the site as being either '*Substantial'* or '*Slight'*.

2.3.10 Aerial Photography

In order to identify other sources of possible historical and/or current contaminating land use practices across the study area, a review of aerial photography was conducted.

2.3.11 Current and Historical Land Titles

A search of current and historical land titles was undertaken to assess current and historical activities that may have the potential for contaminant impacts at the site.

2.3.12 Public Library, Historical Society and Grey Literature Review

A review of available data relevant to the potential for contaminant impacts at the site was undertaken to assess types of potential contaminants and/or specific areas of prior impact.

2.3.13 Flammable Goods and Combustible Licences

The Department of Employment, Economic Development and Innovation (DEEDI) and Regional Councils were contacted to gain information on any current or previous licences which may be registered on the high and medium risk sites within the study area.

2.4 Field studies

2.4.1 Sample Location and Schedule

Sites with an identified potential for contaminant impacts to the project areas were selected for field investigations. Selection was based upon the results of EMR searches of lots following the tiered risk assessment of land uses as discussed in Section 2.1 and based upon the result of aerial and ground inspections. Sampling at five locations across the study area was undertaken (see Figure 3-1 and 3-2 for the location and GPS co-ordinates of sample sites).

Soil samples were collected from targeted locations based upon principals described in AS4482.1 - 2005: *Guide to sampling and investigation of potentially contaminated soil (Part 1: Non volatile and semi volatile compounds)* and AS4482.2-1999: *Guide to sampling and investigation of potentially contaminated soil (Part 2: Volatile compounds)*. The field study was conducted in November 2009 and April 2010.

2.4.2 Sample Collection

Sampling was conducted with either a hand auger (HA) to a maximum depth of 0.9m below ground level (mgbl) or a hand trowel. Two types of samples were collected, either a surface sample (0.0mgbl) or samples at depths of 0.3mgbl, 0.6mgbl and 0.9mgbl respectively. Any stratigraphic change within the soil profile, if observed resulted in the collection of an additional sample at that depth. Observations and data collection of soil profiles and surroundings of the site location was conducted with a handheld Juno SB Trimble data logger. All soil samples were collected and stored based upon industry standard Quality Assurance/Quality Control procedures. Augers or sampling trowels were cleaned between sample locations to minimise potential for cross-contamination.

2.4.3 Toxicant Parameters

The appropriate analyses chosen for the preliminary round of soil sampling, was based upon principles describes in *AS4482. 1-2005: Guide to Sampling and Investigation of Potentially Contaminated Soil (Part 1: Non volatile and Semi volatile Compounds).* The toxicant parameters analysed for both rounds of soil sampling is as follows:

Livestock dip or spray race operations:

- Organchlorines (OCs); and
- Organophosphate pesticides (OP);

Petroleum product or oil storage – storing petroleum products or oil:

- Total Petroleum Hydrocarbons (TPHs) C_6-C_9;
- TPH C_{10}-C_{36}; and
- Poly Aromatic Hydrocarbons (PAHs).

There is no specific reference to stockyard activities under the Australian Standards. Therefore toxicant parameters for this impact assessment have used common historical and current pesticide groups of organochlorine and organophosphate pesticides (OCs and OPs). These toxicant parameters were compared against the relevant guidelines the *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*, (Department of Environment and Resource Management (DERM), 1998). The guidelines provide both Environmental Investigation levels (EILs) and Health Based Investigation Levels (HILs). The relevant HILs to be used for the site assessment are 'F'**.** HIL – 'F' is described as Commercial/Industrial land use which entails shops, offices, factories and industrial sites. See Section 2.5 for trigger values.

The application of HIL-'F' has been adopted due to the current land use of the project area and the proposed land use when construction and operation commences in the future. Following the guidelines, HIL – 'F' was considered the most appropriate data comparison for the selected five sample locations.

DOE 1998 Guideline does not include soil petroleum hydrocarbons and BTEX trigger values for analytical parameter comparisons. The *Guidelines for Hydrocarbons* (DERM, 1999) was employed for comparison values. See Section 2.5 for trigger values.

Based upon the data collected, all existing rail alignments intersecting the project areas are considered to have potential for arsenic impacts. However, initial investigation were targeted at one lot in the mine study area and one lot in the north of the rail alignment near the Port of Abbot Point that were not recorded on the EMR. Cattle dips and extractive industry areas were identified along the rail alignment route; however, access for soil sampling was not available at the time of reporting. At the mine site, specific infrastructure with the potential for land contamination was subject to targeted sampling.

2.5 Soil Assessment Criteria

Analysis of samples and review of analytical data was undertaken in accordance with the DERM *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*, (May 1998). The guidelines provide both HILs and EILs.

HILs are given in the Draft Guidelines for four general types of land uses:

A 'Standard' residential with garden/accessible soil (home grown produce contributing less than 10% of vegetable and fruit intake; no poultry): this category includes children's day care centres, kindergartens, preschools and primary schools;

D Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats;

E Parks, recreational open space and playing fields: includes secondary schools; and

F Commercial/industrial: includes premises such as shops and offices as well as factories and industrial sites.

The application of HIL -F has been adopted due to the activities proposed at the mine, for the rail alignment and the upgrade of the Port of Abbot Point. While the Draft Guidelines contain EILs, they do not contain EIL assessment criteria for Total PAH. Therefore, HIL-A criteria for Total PAH (20 mg/kg) and Benzo(a)pyrene has been adopted for the assessment of the environmental impacts of PAH concentrations within the soil profile. Further, the HILs and EILs in the Draft Guidelines do not include TPH fractions and BTEX. Criteria for petroleum hydrocarbons have been given by the *Guidelines for Hydrocarbons* (DERM, 1999). The adopted soil assessment criteria (SAC) are detailed in Table 2-1.

Table 2-1: Site Assessment Criteria

Parameter	Assessment Criteria	
	HIL- F	EIL
Petroleum Hydrocarbons		
TPH $C_6 – C_9$	NC	100 mg/kg [(1)]
TPH $C_{10} – C_{14}$	NC	100 mg/kg [(1)]
TPH $C_{15} – C_{28}$	NC	1000 mg/kg [(1)]
TPH $C_{29} – C_{36}$	NC	1000 mg/kg [(1)]
Monocyclic aromatic hydrocarbons (BTEX)		
Benzene	NC	1 mg/kg [(2)]
Toluene	NC	NC
Ethylbenzene	NC	NC
Xylenes	NC	NC
Total BTEX	NC	7 mg/kg [(1)]
PAH		
Polycyclic aromatic hydrocarbons (PAH)	100 mg/kg [(3)]	NC
Benzo(a)pyrene	5 mg/kg [(3)]	NC
Inorganic		
Arsenic	500 mg/kg [(3)]	20 mg/kg[(2)]
Cadmium	100 mg/kg [(3)]	3 mg/kg[(2)]
Chromium	500 mg/kg (Cr VI)[(3)]	50 mg/kg[(2)]

Copper	5000 mg/kg [3]	60 mg/kg[2]
Lead	1500 mg/kg [3]	300 mg/kg[2]
Mercury	75 mg/kg [3]	1 mg/kg[2]
Nickel	3000 mg/kg [3]	60 mg/kg[2]
Zinc	35000 mg/kg [3]	200 mg/kg[2]
Organochlorine Pesticides		
Heptachlor	50 mg/kg [3]	NC
Organophosphorous Pesticides	NC	NC

Notes:

1. *Guidelines for Hydrocarbons* (1999.)
2. Environmental Investigation Levels – *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*
3. Health Based Investigation Levels for Exposure Setting "F" ('Commercial and Industrial) – *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*

2.6 Laboratory Analysis

ALS Laboratories, a National Association of Testing Authorities (NATA), conducted the laboratory analysis. Laboratory analyse was undertaken based upon the *Guideline on Laboratory Analysis of Potentially Contaminated Soils: Schedule B (3) National Environment Protection Measure (NEPM)* 1999 and ANZECC (1996) 'Guidelines for the Laboratory Analysis of Contaminated Soils'. After laboratory analysis and final results, comparisons were undertaken for discrepancies in the data.

ALS Pty Ltd (ALS), and EnviroLab Pty Ltd (EnviroLab), both NATA accredited laboratories undertook the primary and secondary laboratory analysis respectively.

Selected sample were analysed for targeted contaminants of concern based upon specific potentially contaminating activities including;

- Heavy Metals (including arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
- Total Petroleum Hydrocarbons (TPHs);
- Organochlorine Pesticides;
- Organophosphorus Pesticides;
- Triazines;
- Phenoxy acetic acid herbicides; and
- Polynuclear Aromatic Hydrocarbons (PAHs)

Laboratory analysis was undertaken in accordance with the requirements of National Environment Protection Measure (NEPM) and referenced to USEPA and APHA methods. The analytical schedule, laboratory methods, laboratory limits of reporting (LORs) and reference methods applied for the investigation are detailed Table 2-2 below.

Table 2-2: Summary of Analytical Methods

Analyte	ALS Limits of Reporting	ALS Reference Method
TPH Volatiles / BTEX	**TPH (Vol): 10 mg/kg** **BTEX: 0.2–0.5 mg/kg**	Capillary GC/MS, Extracts by Purge and Trap (USEPA SW846, 8260B)
TPH Semi Volatile Fraction	**50-100 mg/kg**	Capillary GC/FID (USEPA SW846, 8015A)
PAHs	**0.5 mg/kg**	Capillary GC/MS (USEPA SW846, 8270B)
Heavy Metals	**1 - 50 mg/kg**	Digestion and ICP/MS or ICP-AES/FIMS (Alpha 21st Ed, USEPA SW846 – 6020, ALS QWI – EN/EG020)
Mercury	**0.1 mg/kg**	FIMS – AAS (AS3350, Alpha 21st Ed, 3112 Hg-B Flow injection AAS)

Note: GC= Gas Chromatography, MS = Mass Spectrometry, ICP = Inductively Coupled Plasma, AES =Atomic Emission Spectroscopy, FI =Flame Injection

2.6.1 Quality Assurance and Quality Control (QA/QC)

The field and laboratory quality assurance and quality control plan adopted for the investigation has been designed to achieve pre-determined data quality objectives that will be assessed with respect to Data Quality Indicators (DQIs) to demonstrate the precision, accuracy, representativeness, completeness and comparability of the data set and that the data set is of acceptable quality to meet the objectives of the Site investigation.

The specific quality assurance and quality control plan for the field and laboratory components of the investigation have been developed based on the principles describes in *AS4482. 1-2005: Guide to Sampling and Investigation of Potentially Contaminated Soil (Part 1: Non volatile and Semi volatile Compounds)* and *AS4482.2-1999 Guide to sampling and investigating of potentially contaminated soil (Part 2: Volatile compounds*). These guidelines allow for varying the QA undertaken according for small sample batches.

Quality assurance sampling was undertaken during sampling and included:

- One intra-laboratory duplicate sample analysed as per primary soil sample suite outlined above;
- One inter-laboratory duplicate sample analysed as per the primary soil sample suite outlined above;
- One rinsate blank collected from one piece of re-usable equipment, analysed as per the primary soil sample suite outlined above;
- A laboratory prepared trip spike analysed for BTEX (Benzene, Toluene, Ethylbenzene and Xylene); and
- A laboratory prepared trip blank analysed as per the primary soil samples.

2.6.2 Data Quality Objectives (DQO)

The data quality objectives (DQOs) of the soil investigation were to obtain sufficient data to allow a high quality environmental assessment to be made of:

- The likelihood of impacted soil at the site;
- The risks posed to human health and the environment;
- The adequacy and completeness of all information available to be used in assessing the status of the Site in terms of potential contaminants;
- The requirements for any further investigative works; and
- To a standard consistent with generally accepted and current professional consulting practice for such an investigation.

The evaluation criteria adopted by the investigation are summarised below in Table 2-3.

Table 2-3: Data Quality Objectives

DQO	Evaluation Criteria
Documentation completeness	Completion of field calibration records, test pit logs, chain of custody documentation, laboratory test certificates from NATA-accredited laboratories.
Data completeness	Targeted sampling in accordance with QLD EPA Guidelines for potential contaminants of concern at identified areas of environmental concern. Due to the nature of the EIS to assess baseline conditions, high density grid based sampling was not considered appropriate at each of the sites. The purpose of the soil investigation was primarily to obtain a representative samples to assess the existing soil conditions and potential contaminants within the area.
Data comparability	Use of appropriate techniques for the sampling, storage and transportation of samples. Use of NATA certified laboratory using NEPM procedures.
Data representativeness	Good sampling coverage of main areas of environmental concern within the APSDA, and selection of representative samples.
Precision and accuracy for sampling and analysis	Use properly trained and qualified field personnel Blind field duplicates to be collected at a minimum rate of 1 in 10. RPD's to be less than 30% for inorganic and 50% for organic analyses. Achieve laboratory QC criteria.

2.6.3 Field Quality Objectives

The field quality assurance procedures adopted and the field quality control samples collected during the investigation and the corresponding acceptable control limits are presented in Table 2-4 below.

Table 2-4: Field QA/QC

DQO Objectives	Evaluation Criteria
Field personnel	Use of appropriately trained field personnel employing procedures listed herein.
Field data collection	Site conditions and sample locations properly described. Information recorded in field notes and well logs. Field notes appropriately completed and included in the report on the investigation.
Sample handling (storage and transport)	Soil samples collected into jars supplied by the analytical laboratory. The samples were stored on ice in a chilled, insulated container prior to sampling and immediately after sampling until receipt by the analysing laboratory. Sample numbers, dates, preservation and analytical requirements were recorded on Chain-of-Custody (COC) documentation, which was delivered to the analytical laboratory.
Calibration of Field Equipment	The hand auger used in the field is not a measuring instrument, and thus no calibration is required to determine the relationship between indicated quantities against established and known standards.
Field Intra-laboratory Duplicates Field Inter-laboratory Duplicates	Intra-laboratory duplicates were collected and analysed at a rate of 1 in 10 primary samples. Duplicate samples were labelled so as to conceal their relationship to the primary sample from the laboratory. It is expected that RPD's should be less than 50%, and where there is a non-compliance, liaison with the laboratory will be undertaken and samples will be re-analysed, if required.
Trip Blanks and Trip Spikes	One laboratory prepared Trip Blanks and one Trip Spike was utilised during the field program. The Trip Blank was used to assess the potential for cross contamination during transit of samples from the Site to the laboratory. The blank sample was prepared by the laboratory, transported to the Site under COC protocol and returned to the laboratory with the primary samples being submitted for analysis. Trip Blanks will be analysed for VOCs and semi volatile fractions. Concentrations of analytes in the Trip Blank should be less than the laboratory detection limits. The Trip Spike was used to assess for the potential of loss of volatile constituents from the soil samples whilst in transit from the Site to the laboratory. The spike sample was prepared by the laboratory, transported to the Site under COC protocol and returned to the laboratory with the primary samples being submitted for analysis. The Trip Spikes was analysed for VOCs (BTEX and TPH C_6- C_9 fraction). Concentrations of analytes in Trip Spike recoveries should be greater than 90% of original concentrations of the spiked constituents.

Rinsate Blanks	One Rinsate Blank samples (from an item of re-useable sampling equipment) was collected and analysed at a rate of one piece of re-useable equipment per day of sampling. Concentrations of analytes should be less than the laboratory detection limits.

2.6.4 Laboratory QA/QC

The laboratory quality assurance procedures adopted and the internal laboratory quality control samples analysed and the corresponding acceptable control limits are presented in Table 2-5 below.

Table 2-5: Laboratory QA/QC

Data Type	Comments and Acceptable Control Limits
Sample Analysis	All sample analyses to be conducted using NATA certified methods by laboratories which will implement a quality control plan in accordance with NEPM (1999c).
Holding times	Maximum acceptable sample holding times for VOC and metals analysis: Soil: VOCs/SVOCs - 14 days / metals – 3months. Water: VOCs/SVOCs - 14 days, metals – 3 months.
Laboratory detection limits	All laboratory detection limits to be less than the site investigation criteria.
Laboratory Method Blanks	Laboratory blanks to be analysed at a rate of 1 in 10, with a minimum of one analysed per batch. Concentration of analytes to be less than the laboratory detection limits.
Laboratory Duplicates	Laboratory duplicates to be analysed at a rate of 1 in 10, with a minimum of one analysed per batch. RPDs to be less than 50% and if not, liaison with the laboratory will be undertaken and samples will be reanalysed, if required.
Laboratory Control Samples (LCS)	LCSs to be analysed at a rate of 1 in 20, with a minimum of one analysed per analytical batch. Control limits: 70 to 130 % Acceptable Recovery and if not, liaison with the laboratory will be undertaken and samples will be reanalysed, if required.
Matrix spikes	Matrix spikes prepared by dividing a field sample into two aliquots, then spiking each with identical concentrations of the analytes at a rate of 1 in 20. Matrix spike control limits: 70–130 % Acceptable recovery and if not, liaison with the laboratory will be undertaken and samples will be reanalysed, if required.

3 Overall Tiered Risk Assessment Results

One hundred and three lots intersecting the China First project were assessed using the Tiered Risk Approach. Of these, 14 were ranked as a *high risk* and prioritised accordingly to the property's current primary use (i.e. commercial/industrial). EMR searches of all the *high risk* properties indicated that three lots were listed on the EMR. No properties were listed on the CLR.

A total of 87 lots were assessed as medium risk sites. A total of 48% of these were subject to EMR search based upon the results of review of aerial imagery, aerial inspection and/or ground inspection.

A total of two *low risk* lots were ranked either as residential or park land use. None of these sites had evidence of land disturbance or land uses inconsistent with the recorded land use based upon aerial imagery review. No sites were recorded on the EMR or CLR. A list of EMR/CL search results is provided in Appendix A and a list of all lots assessed is provided in Appendix B.

The lots assessed in each of the three project areas are discussed in the following sections.

4 Mine Site

4.1.1 Results of Tier Risk Assessment

A total of 36 lots cover the proposed mine footprint. Of these, six were considered *high risk* and comprised existing rail line lots recorded with a land use of "Transport Terminal" and one lot adjacent to the rail line with a land use recorded as "Transformer." One of the "Transport Terminal" lots was listed on the EMR (possible high level of Arsenic). The remaining 30 lots were classed for rural land use and ranked as *medium risk*. No *low risk* lots were recorded at the mine footprint (Appendix B).

A high risk rail line lot (Lot 273 SP108314) was selected for PSI with targeted soil sampling. This lot was representative of other rail line lots in the area. The transformer lot was not assessed further as it was not listed on the EMR. Further, due to the dangers of working in a live electrical facility and because it was located about 30km south of the mine site, the site was considered to pose a low risk to the project.

During an inspection of the mine site Lot 1 BF72 containing an Above Ground Storage Tank (AST) and cattle stockyard was observed. This lot was selected for a PSI with targeted soil sampling.

4.1.2 Unexploded Ordinance

A review of the Defence UXO database reported no lots intersecting the mine footprint were recorded on the DOD UXO database.

4.1.3 EMR/CLR Results

Searches were made for both EMR and CLR listed lots intersecting the mine site. Of the 36 lots reported, only one site was listed on the EMR and none on the CLR. Lot 273 on SP108314 was listed for possible Arsenic contamination (Table 4-1, Figure 4-1). A copy of the EMR search records areas provided in Table 4.1.

Table 4-1: Mine Site EMR/CLR

Lot and SP	Property Address	EMR Status	CLR Status
Lot 273 SP108314	Railway Corridor, Alpha 4724	Hazardous Contaminants - possible high levels of arsenic	Not Listed

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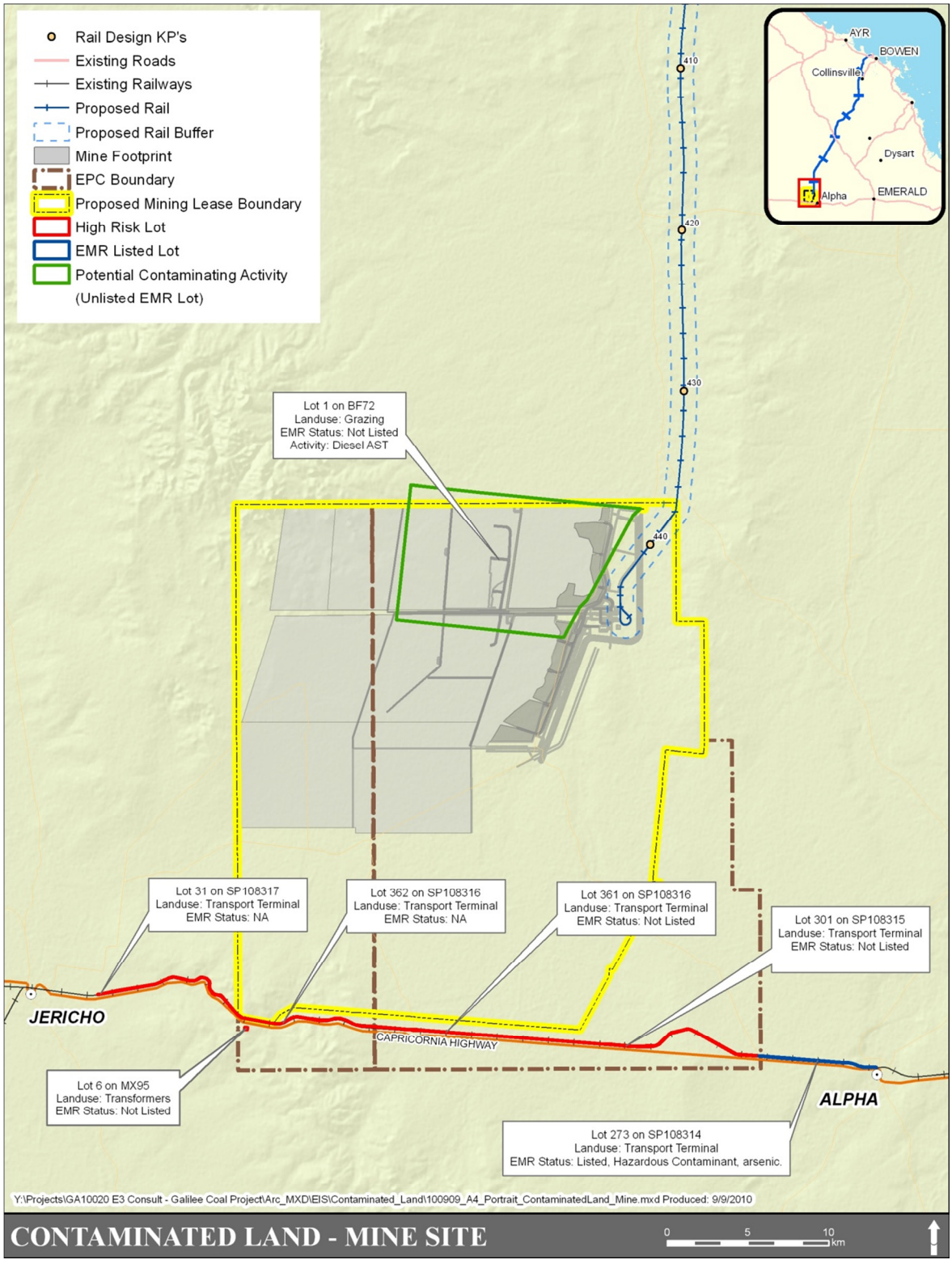


Figure 4-1: Contaminated Land - Mine Site

4.1.4 Regional Council Information

The mine's footprint is located within the Barcaldine Regional Council (BRC). There was no specific environmental information pertaining to cattle dips and/or petroleum storages listed by DERM or BRC.

4.2 Lot 1 on BF72

4.2.1 Site Location and Description

Lot 1 BF72 is a grazing property located approximately 35km northwest of the township of Alpha. The lot is a portion of the mine footprint. The lot contains a residence, farm sheds, farm bores, a vehicle/equipment storage area, cattle yards and a diesel AST. The site did not contain a cattle dip or spray race. The site is served by a septic system and potable water supply is from rain and bore water. The lot details are summarised in Table 4-2.

Table 4-2: Lot Details

Lot Number	Owners	Area (Ha)	Holding/Title
1BF72	Colleen & Lancelot Sypher	103,330	Land Lease Cattle Grazing/Breeding

4.2.2 Current Site Activities

The lot is currently under freehold title and the present activities include cattle grazing and breeding. On-site observations of the associated infrastructure reflected the current land use of the site. Most cattle grazing or breeding properties have small fuel and farm chemical storage facilities. This may result in localised impacts around storage and handling areas. A cattle stockyard and AST were present on the site. Fuel handling has the potential for impacts from spills and leaks from petroleum hydrocarbons. Cattle stockyards are areas of potential impacts from farm chemicals such as pesticides used in treating cattle.

Resource exploration on the site has resulted in an extensive drilling program. In addition to the fuels and oils used in any plant, drilling requires the use of specialised fluids designed to maintain drill hole integrity and circulation during the drilling process. Many of the fuels and oils can have an environmental impact. Information on these is provided below.

- Drill fluids recorded as being used in the mine area include:
- Liqui-pol (1L /1000L);
- Soda Ash as required to raise pH;
- Pac R (1L/1000L);
- CR650;
- Aus Plug;
- Hardset A;
- Gypset;
- Bentonite Pellets;
- Aus Trol;

- Aus Grip;
- Aus Det;
- Super Foam Xtra; and
- HD Sperse.

Most drill fluid conditioners and loss control additives include cellulose based polymers, lignites, bentonite clays, modified polysaccharides and some guar gums. Many of these are derivatives of naturally occurring compounds, e.g. cellulose and bentonite clay, used in water well drilling and therefore have low potential for deleterious impacts when used appropriately (see generally http://ausmud.com.au).

Liqui-pol, PAC-R, CR650, Aus Troll are viscosifiers used in drilling to maintain bore stability by increasing the density of the water column to assist in water circulation and drilling. They are non-hazardous and non-dangerous goods substances with minimal toxicity. Normal operating requirements relate to appropriate handling and containment. As with any synthetic compound, they should not be released into the environment. The main ingredients in these compounds are cellulose based polymers with sodium. Cellulose based compounds are designed to breakdown during sanitisation and development of water wells. The compounds have a low toxicity and its persistence in the environment is low.

Aus-Plug is an absorbent polymer that reduces water loss in drilling operations. It includes polyacrylamides and is not a listed hazardous/dangerous good.

Grouting materials used in drilling includes Hardset , Gypset and Aus Grip. Hardset is a grouting cement that sets rapidly and is used for sealing the tops of drillholes. Gypset is a gypsum based cement with a rapid setting time used for sealing the tops of drill holes or in drill circulation fluids. Aus Grip is a foaming system used to assist in grouting the tops of boreholes. It is not a dangerous good; however, it is a hazardous substance. There is no information on its environmental impacts.

Drilling detergents are used to remove solids from boreholes. Aus Det and Superfoam Extra are detergents used to disperse build up of solids that may threaten to block drill holes. They are used in water well development to help remove solids from the water column. The detergent contains nitrates and phosphates and 5 to 20% polyoxypropylene ester. Inappropriate use and/or disposal may cause adverse effects in the environment.

Superfoam Extra is a detergent, surfactant and foaming agent used similarly to Aus Det. It is biodegradable and does not pollute. The compound is a non-hazardous, non-dangerous good that contains <20% of the compound ethylene glycol monobutyl ether. Glycols are reportedly “practically non-toxic”; however, the biodegradation reactions can consume oxygen in aquatic environments that can lead to death of aquatic organisms if oxygen is depleted (see generally http://jr.chemwatch.net).

HD Sperse is a thinning product used to deflocculate muds. It is an anion acrylic polymer and is water soluble. It can be harmful to aquatic biota if not handled appropriately. Bentonite pellets are a clay product used to seal portions of drillholes, seal piezometers or backfill holes. As a derivative of natural bentonite clays it is non-toxic.

4.2.3 Adjacent Land Uses

The adjacent land uses to Lot 1 BF72 and the mine include:

- North - Native Companion Creek, Cudmore National Park and Resources Reserve, and rural/vacant land/properties;
- South - Alpha, Alpha Creek, and rural/vacant land/properties;
- East - Native Companion Creek, rural/vacant land/properties; and
- West - rural/vacant land/properties.

4.2.4 Geology and Soils

The Galilee Basin (approximately 250,000km^2) is an intracratonic basin filled with dominantly fluviatile sediment (BMR, 1972). Surface geology of the area is dominated by unconsolidated Cainozoic sediments with unconsolidated sands, silts and clay, lateralised in part, forming an extensive blanket. The local geology comprises silts, shales and sandstone with coal seams held within the Triassic and Permian intervals of the Galilee Basin.

4.2.5 Topography

The topography of the area ranges from generally flat to slightly undulating slopes from 350m to 400m Australian Height Datum (AHD) in the west. The topography includes flat, lowland Brigalow country, which has been cleared extensively for grazing.

4.2.6 Hydrogeology

There are a number of high yielding ground water bores within the region. Most of the groundwater is associated with the coal seams that are moderate to hypersaline, very high in magnesium and sulphur and are generally not suitable for stock or potable drinking water. The local aquifers include shallow Tertiary aquifers adjacent to creek and while aquifers are at depth within the Permian mining sequence. During exploratory drilling, the Permian aquifers had a mean average estimated flow rates of 6.5litres/sec based on estimates obtained from nine geological exploration bores on EPC 1090. The salinity values in the shallow Tertiary wells within the study area vary from 170mg/L to 13,400mg/L with the majority of the salinity less than 1,000mg/L. The reported static water level ranges from 30m to 95m below ground level (mgbl).

4.2.7 Nearby Receptors

The nearest sensitive receptor to the AST and Stockyards at the mine site is a creek >1km east of this infrastructure. The closed residential centre is Alpha, 30km away.

4.2.8 Site Interviews Information

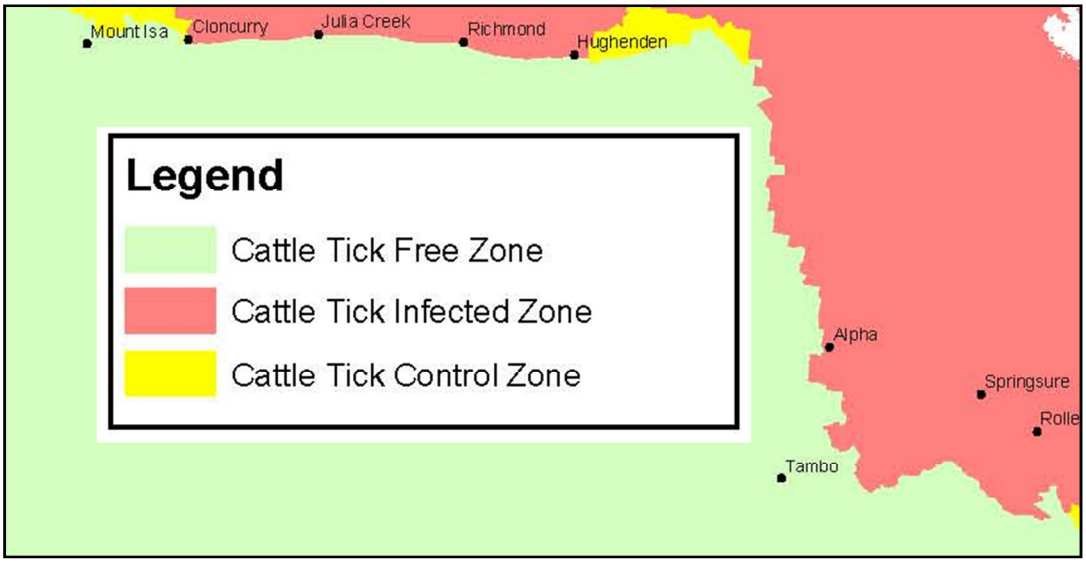
An interview with personnel from 'Kiaora Station' indicated that mine footprint does not include a cattle dip; however, site infrastructure does include an AST (Plate 4-1) and a stockyard with an associated crush.

Plate 4-1: Above Ground Storage Tank on Lot 1

4.2.9 Public Library, Historical Society and Grey Literature

A search of the John Oxley Library for media records with respect to EPC 1040 and 1079, locality names and the township of Alpha were undertaken in September 2009. Alpha was established in 1884 to serve the railway construction workers (Hoch, 1984). No information was found from local historical sources regarding potential contaminating activities at the mine site. Further, newspaper clippings and historical photos reported a train accident occurring at Alpha during the 1940's. No recent reports relating to the environmental performance of the area were found.

Alpha is approximately the eastern boundary of the Queensland Department of Employment, Economic Development and Innovation Cattle Tick Free Zone (http://www.deedi.qld.gov.au) and has a Cattle Tick Clearance facility. The tick free area boundary trends approximately north-south in this area as shown in Figure 4-2. Discussions with local landowners indicate that properties west of this boundary generally do not have cattle dips although they may have spray races for general tick control and drenching. This indicates that rural properties in the mine area are unlikely to have cattle dips.



Source: Queensland Department of Employment, Economic Development and Innovation.

Figure 4-2: Cattle Tick Zones

4.2.10 Flammable Goods and License

The search found no data regarding flammable and combustible goods licences for Lot 1 BF72.

4.2.11 Current and Historical Aerial Photographs

Historical aerial imagery for the area was available from 1951 to 2001. No significant changes for potential site contamination were present beyond those areas as identified from the site inspection. Detailed aerial photograph review is provided in Appendix C.

4.2.12 Current and Historical Land Titles

A review of historical titles pertaining to the mine area was undertaken in August 2009 to identify current and historical land owners which may have undertaken potential contaminating activities on the site. Table 4-3 provides a summary of land title information for the Lot 1 BF72. Land title records are provided in Appendix D. The site has no other recorded land use other than pastoral activities.

Table 4-3: Lot 1 BF72 Current and Historical Titles

Years	Owner Details
Current	Colleen & Lancelot Sypher

4.2.13 Site Specific Sampling

Preliminary soil sampling was conducted in April 2010. Two primary samples were collected at separate locations within the mine footprint. All preliminary soil samples were taken from the surface as a grab sample (0.0mgbl) or where visual observation of surface contamination was evident. Samples were labelled according to depth (e.g. CL5-A is 0.0mgbl). The sampling locations are as follows:

- Lot 1 on BF72:
  - Sample CL3-A (collected from stockyard); and
  - Sample CL4-A (collected from the AST).

The sample from the AST was analysed for the major contaminants of concern for diesel, being TPH and PAH. The sample from the cattle yards were analysed for potential pesticide residues including OC/OPS.

4.2.14 Analytical Results

Sample Location: CL3

The laboratory results for Petroleum Hydrocarbons reported C_{10}-C_{14} chain lengths of 240mg/kg and C_{15}-C_{28} chain lengths of 31,900mg/kg, which exceed the Draft Guidelines of a magnitude of 100mg/kg and 1,000mg/kg, respectively. No detectable C_6-C_9 hydrocarbons were reported. The absence of light end hydrocarbons (C_6-C_9) reflects the typical composition of diesel fuel. The laboratory results detected pyrene; however, Total PAH and benzo(a)pyrene results were below the DERM HIL-'F' criteria.

Sample Location: CL4

The laboratory results reported below DOE's 'HIL-F' trigger values for Heptaclor of 50mg/kg (OC's) with no exceedances for OP's. The laboratory analysis certificates are included as Appendix E.

The area of observed hydrocarbon staining was of a limited area (<2m^2). Petroleum Hydrocarbons are volatile but biodegrade naturally. Therefore, remnant impacts are often minimal where significant time has elapsed since the use of the compounds. No obvious odours were detected during sampling.

4.3 Lot 273 on SP108314

4.3.1 Site Location and Description

The existing rail line land parcel, lot 273, abuts the south-eastern portion of the EPC 1040 boundary and extends from the town of Alpha. A PSI was undertaken as the lot was listed on the EMR and classified under the Tiered Approach as a *high risk*. This lot is approximately 30km south-east of the mine footprint. The lot includes the rail line and a buffer area containing electrical lines adjacent to the rail line. The lot details are summarised in Table 4-4.

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Table 4-4: Lot 273 on SP108314

Lot Number	Owners	Area (Ha)	Holding/Title
273 on SP108314	Queensland Department of Transport and Main Roads)	22ha	Transport Terminal

4.3.2 Current Activities

Lot 273 is currently under land lease and is classified as a *Transport Terminal* for QR Central Line's existing corridor. A current and ongoing activity for the rail corridor will include line maintenance and weed management.

4.3.3 Adjacent Land Uses

The adjacent land use to the lot includes:

- North - rural/vacant land/properties;
- South – Capricorn highway, and rural/vacant land/properties;
- East - Alpha, Alpha Creek,, rural/vacant land/properties, and Narrien Range National Park; and
- West - rural/vacant land/properties and Jericho townships.

4.3.4 Geology and Soils

Surface geology of the area is dominated by unconsolidated Cainozoic sediments with unconsolidated sands, silts and clay, lateralised in part, forming an extensive blanket. The local geology comprises silts, shales and sandstone within the Triassic and Permian intervals of the Galilee Basin.

4.3.5 Topography

The topography of the area ranges is generally flat to slightly undulating with slopes generally to the east. The topography includes flat, lowland Brigalow country, which has been cleared extensively for grazing.

4.3.6 Hydrogeology

Groundwater records indicate that bores in the vicinity of the lot closer to Alpha may include domestic town supply are mostly associated with more recent shallow alluvial deposits. These are generally high yielding and provide fresh water.

4.3.7 Nearby Receptors

The nearest sensitive receptor to the rail line is Alpha Creek located approximately 700m east of the lot. The township of Alpha is immediately south of the eastern end of the rail lot with the Alpha State School approximately 500m south east of the lot.

4.3.8 Site Interview Information

No information has been currently sourced from QR regarding the existing rail easement.

4.3.9 Public Library, Historical Society and Grey Literature

A search of the John Oxley Library for media records provided results as described in is consistent with Section 4.2.9. Arsenic was historically used to control weeds along rail lines. A historical newspaper article indicates that arsenic sprays were used to kill grass along rail lines in Australia (http://newspapers.nla.gov.au).

QR documents indicate that arsenic was used between about 1940 and 1960 (QR, 2009). It is anticipated that surface spraying of an arsenic solution would generally result in surface impacts that were localised around the rail tracks.

4.3.10 Flammable Goods and License

No search records were reported that indicated lot 273 had a flammable goods licence.

4.3.11 Current and Historical Aerial Photographs

Historical Aerial imagery for the area was available from 2001 to 1951. No significant changes in the rail line lot with potential for site contamination were present beyond the rail line itself were identified from the site inspection. The description and excerpts from the aerial photograph review are provided in Appendix C.

4.3.12 Current and Historical Title Search

A review of historical titles was undertaken in August 2009 to identify current and historical land owners which may have undertaken potential contaminating activities on the site. Table 4-5 provides a summary of land title information for the lot listed on the EMR, namely Lot 273 SP108314. Land title records are provided in Appendix D.

Table 4-5: Mine - Current & Historical Title Search

Years Included	Owner Details
Lease in Perpetuity, Crown Plan, Lot 1 on CP 825707, Lease Reference: PPL 208003, County: Various Counties, Parish: Various Parishes.	
01/07/1995 – 30/06/2095	State Sub Lease from State of Queensland to Queensland Rail (Whole of Crown Plan) Purpose of Lease: Transport, purchases ancillary to transport and other commercial and community purposes.
Lot 273 on SP 108314, County of Belyando, Parish of Alpha, Title reference # 480008706.	
07/12/2000	The State of Queensland, (Represented by Department of Transport and Main Roads)

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4.3.13 Analytical Results

Sample Location: CL5

Results reported that Inorganics: Total Metals (Arsenic) was below DOE's HIL-'F' trigger values and the EIL. The laboratory analysis certificates are included as Appendix E.

4.4 Risk Assessment

A qualitative risk assessment was undertaken based upon the framework outlined in the *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazard*, enHealth June 2002. This framework was selected as it provides a general environmental health risk assessment methodology applicable to a range of environmental health hazards, with a focus on chemical hazards.

4.4.1 Potential Hazards

The soil investigation demonstrated that there were no recorded impacts from OC/OPs in soils in the cattle yards.

Soil results from the AST indicated impacts exceeding investigation thresholds for hydrocarbons.

Soil results from the existing rail alignment indicated no detectable arsenic, triazine or phenoxyacetic acid herbicides.

4.4.2 Potential Receptors

Potential human receptors have been identified as:

- Maintenance workers; and
- Rural/agricultural industry.

The nearest environmental receptors have been identified as:

- Lagoon Creek and tributaries on the mine site; and
- Drainage lines adjacent to rail lines.

4.4.3 Potential Pathways

Potential exposure pathways are likely to include:

- Overland soil transport via surface water run-off;
- Leaching of contaminants from the soil profile to the groundwater table; and
- Migration of dissolved contaminants in groundwater to the surrounding tributaries.

4.4.4 Evaluation of Risk

The laboratory results from the samples taken adjacent to the rail line and stockyards indicate no detectable concentrations of the analytes tested were present. This suggests low potential for impacts from these sources. However, the association of arsenic contamination with rail activities and the extensive rail network indicates that the presence of arsenic along other extents of the rail alignment may be likely.

The hydrocarbon impacts to soils based upon site observations of staining and the clay content of the soils present suggest a low potential for significant impacts. Based upon the extent of observed staining, distance to the nearest creeks and prior experience of spills/leakage from similar sized ASTs the potential for impacts to penetrate more than a few decimetres below ground is considered low. It is therefore considered that the impact is unlikely to comprise serious or material environmental harm and presents a low risk.

5 Rail Corridor

5.1.1 Results of Tier Risk Assessment

Fifty seven lots intersected the rail alignment buffer area. Four lots were identified as *high risk*. The primary land use for the lots was listed as *Transport Terminals* and *extractive uses*. EMR searches conducted on these lots identified one listed on the EMR for a Hazardous Contaminant (Arsenic).

A total of 52 lots were classed as rural land use and were ranked as *medium risk*. Searches of these lots on the EMR reported one as having the Notifiable Activities of a Livestock Dip or Spray (22) Race and Petroleum Product or Oil Storage (29).

One lot was classed parkland and assessed as a low risk (Appendix B).

The four *high risk* lots identified along the rail alignment included two being *Transport Terminals* and part of the existing QR's Central and North Coast Line rail corridor. North Coast rail existing easement Lot 182 on SP12234 intersects the China First Project rail alignment at KP6, north of the coal terminal (Figure 5-2). The other two lots classified as *high risk* were extractive industries (Figure 5-2). A list of all lots assessed is provided in Appendix B.

A PSI was undertaken for the lots listed on the EMR being, Lot 5 RU81 with the notifiable activities of a cattle dip and petroleum storage and Lot 211 on SP122341 with the notifiable activity of a hazardous contaminant (arsenic). No access was available at the time of reporting to Lot 5 RU81 and no sampling was undertaken at this site (Figure 5-1).

During the site inspection of the rail alignment, additional cattle dips were observed. PSI data for these lots was undertaken to assess the risk posed to the rail alignment; however, no sampling was undertaken. The lots listed for extractive industry were not listed on the EMR and desktop PSIs without soil sampling were undertaken.

5.1.2 Unexploded Ordinance

A review of the Defence UXO database reported no lots intersecting the rail alignment were listed.

5.1.3 EMR/CLR Results

Searches were undertaken for both EMR and CLR listed lots intersecting the buffer area along the rail alignment. One site was listed on the EMR and none on the CLR. Lot 5 on RU 81 was listed on the EMR for Notifiable Activities 22 and 29. Lot 211 on SP122341 (QR the Northern Rail Line) while not in the China First project rail corridor; is listed for the hazardous contaminant arsenic and this is consistent with remainder of the rail line (Figure 5-1and 5.2). EMR search records are provided in Table 5.1.

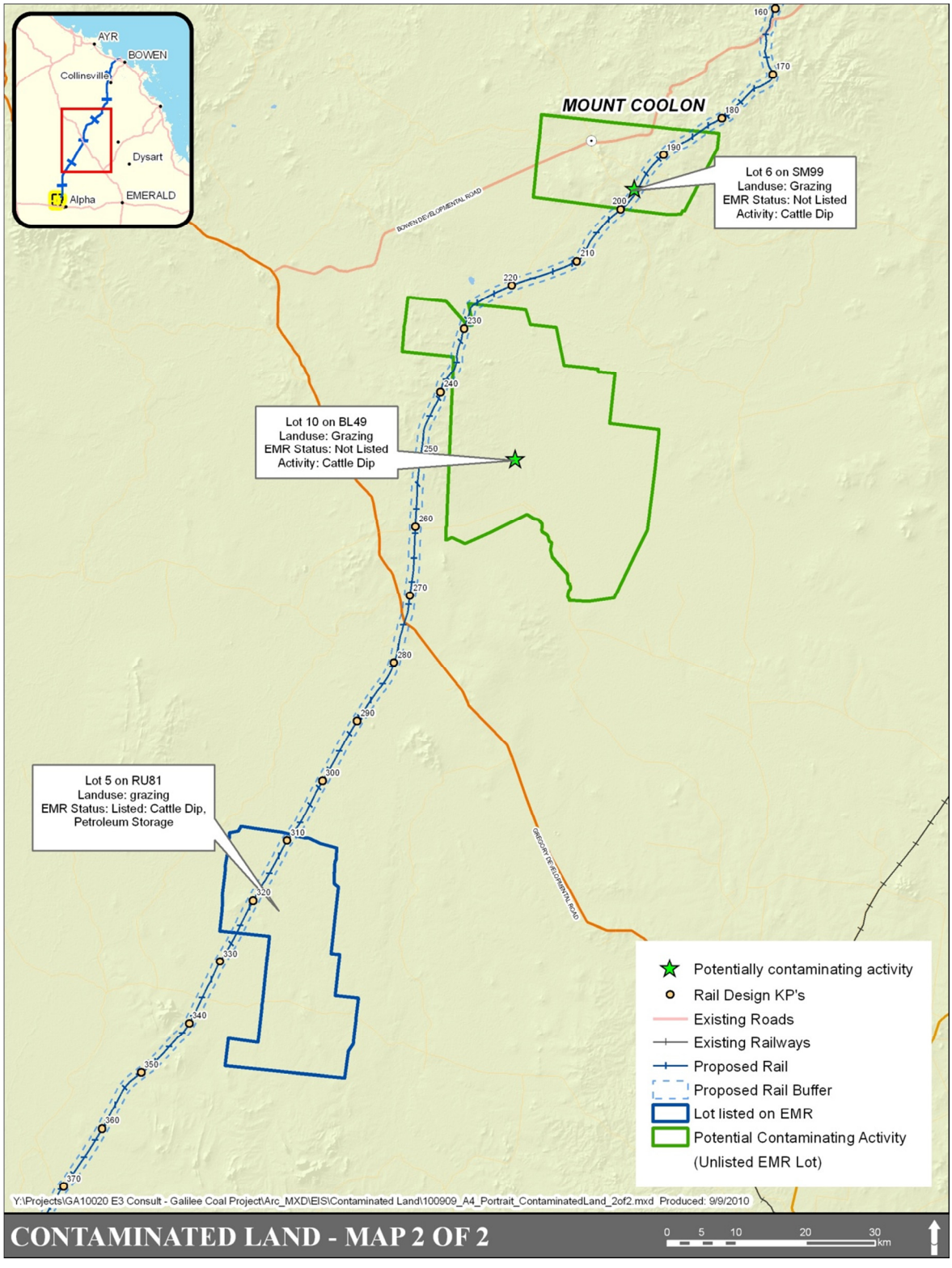

Figure 5-1: Contaminated Land - Rail alignment southern section

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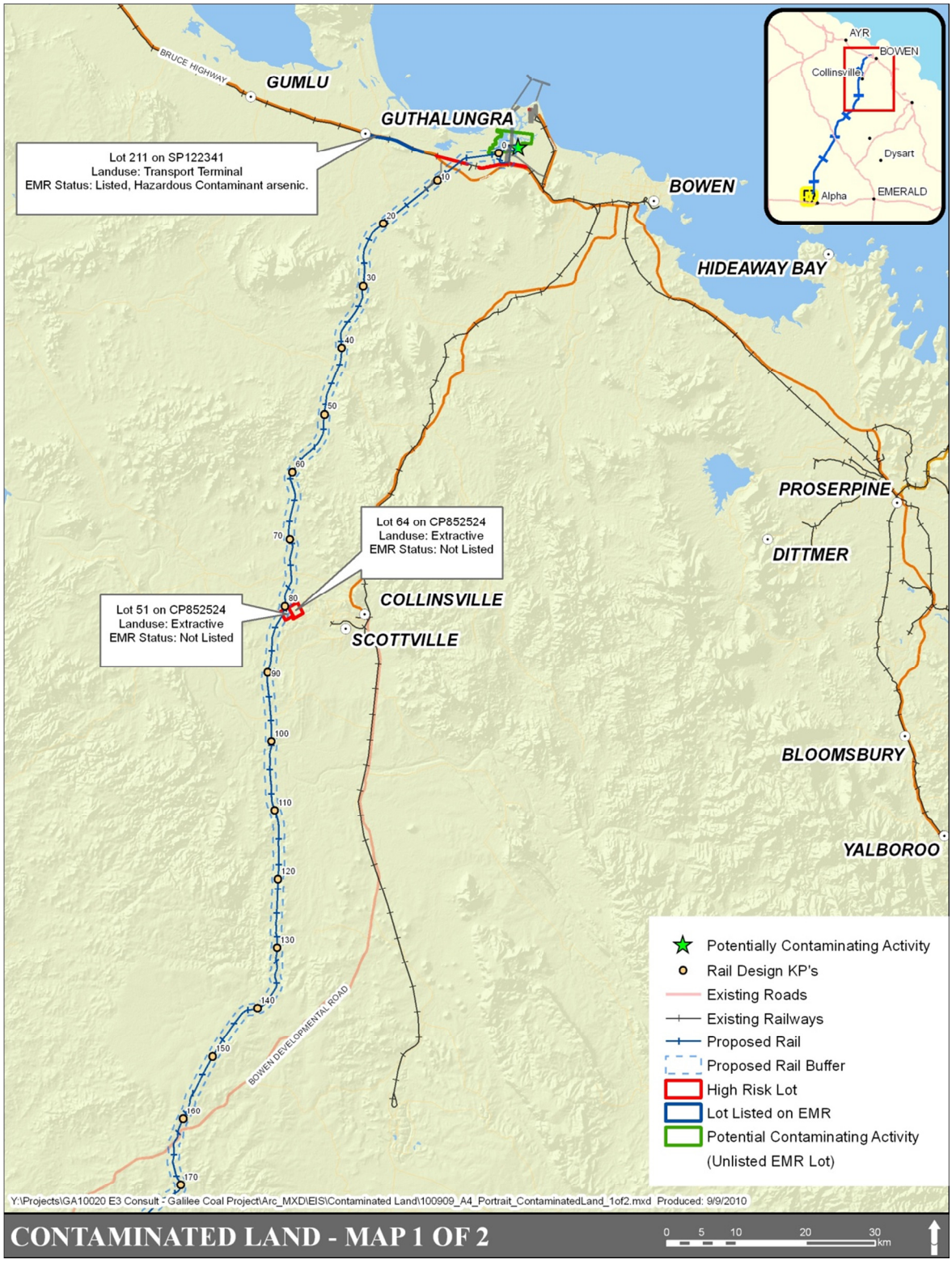

Figure 5-2: Contaminated Land - Rail alignment northern section

Table 5-1: Rail Alignment EMR/CLR Status

Lot and RP	Property Address	EMR Status	CLR Status
Lot 211 on SP122341	Rail Corridor, Boundary Road, Bowen	Hazardous Contaminants (possible high levels of arsenic along rail corridor)	Not Listed
5 RU81	Mirtna Station, Moray Road, Belyando	Livestock Dip or Spray Race and Petroleum Product or Oil Storage	Not Listed

The lots listed for the land use of extractive industry were not listed on the EMR.

5.1.4 Regional Council Information

Searches were completed for additional sources of information into possible contaminating land use practices properties which may also intersect the proposed rail alignment. The rail alignment is located within the BRC, Isaac Regional Council (IRC) and Whitsunday Regional Council (WRC). There was no specific available environmental information available pertaining to the *high risk* lots or Lot 5 RU81 listed along the rail alignment.

Site observation and sampling was not conducted on Lot 5 on RU81 during both soil sampling rounds as this site was not within the original preferred rail alignment. The rail alignment now intersects the north-west portion of the property (Figure 5-1).

5.2 Lot 211 on SP122341

5.2.1 Site Location and Description

The lot is an elongate north-west trending lot following the north coast rail line. This and adjacent rail line lots extend from the proposed coal infrastructure and extend beyond the China First project rail alignment to the north. The lot is surrounded by vacant rural land and coastal wetlands with low density grazing and road transport corridors (Table 5-2).

Table 5-2: Lot 211 on SP122341

Lot Number	Owners	Area (Ha)	Holding/Title
122 on SP122341	Queensland Department of Transport and Main Roads.	45ha	Transport Terminal

5.2.2 Current Activities

Lot 122 is currently under land lease and is classified as a *Transport Terminal* for QR Northern Line's existing corridor. A current and ongoing activity for the rail corridor will include line maintenance and weed management.

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5.2.3 Adjacent Land Uses

The lot is surrounded by the following land uses:

- North - Vacant Rural Land, Wetlands and Ocean;
- South - Rail Corridor, Bruce Highway and vacant rural land;
- West - Vacant rural land, aquaculture; and
- East - Vacant rural land, Port of Abbott Point.

5.2.4 Geology and Soils

Previous soil investigations of the area have reported the following soil types:

- Coastal sand dunes and beach ridges;
- Saline Mudflats – tidal flats and salt pans;
- Quaternary Sand Plain mainly level or very gently sloping; and
- Weathered Granite/Granodiorite with Colluvium – gentle to moderately sloping plain areas (WBM, 2006, GHD, 2008).

Acid Sulphate Soil (ASS) is discussed in the ASS technical report.

5.2.5 Topography

The topography of the surrounding area is dominated by low lying coastal flats sloping towards the Caley Valley wetland areas to the north of the site. The site also rises towards the poorly vegetated granitoid outcrops of Mount Carew and Mount Roundback to the south and south east respectively.

5.2.6 Hydrogeology

Hollingsworth and Associates (1979) noted that the Caley Valley wetlands does not receive significant recharge from groundwater reservoirs, nor does it act as a source of recharge for groundwater reservoirs. This suggests a low likelihood for shallow aquifers to occur on the site. There is; however potential for fresh groundwater reservoirs associated with the dune ridges parallel to the eastern coastline. Water supplies for the existing Port of Abbott Point operations are sourced from a borefield located near Splitters Creek on the Salisbury Downs Station, approximately 25km south west and piped to the terminal reservoir on Bald Hill.

5.2.7 Nearby Receptors

The Caley Valley Wetland is located 1km east of the lot on a privately owned cattle grazing property. While the wetland is not RAMSAR listed, it is included in the Directory of Important Wetlands of Australia (ANCA, 2001). The directory listing identifies the site as being in a good condition and contains fresh to brackish seasonally variable water with a central water body, Lake Caley. No impacts associated with the development and operation of the existing coal terminal have been observed over the wetlands due to the

runoff protection and detention storage provided by the two existing settlement ponds. This indicates that current environmental management practices are effective in managing potential impacts. No sensitive human receptors are present within 1km of the rail line.

5.2.8 Site Interview Information

No information has been sourced from QR regarding the existing rail easement.

5.2.9 Public Library, Historical Society and Grey Literature

Data gathered regarding rail lines in Queensland is discussed in Section 4.3.9. Inquiries with QR and the Townsville Historical Society did not find data relevant to the contaminated land status of the lot.

5.2.10 Current and Historical Aerial Photographs

Aerial imagery was available from DERM for 2001 until 1961. No information indicating site specific potential for contamination was evident. A summary of aerial imagery is provided in Appendix C.

5.2.11 Current and Historical Title Search

A current and historical title search was undertaken for Lot 211 on SP122341. The Lot is owned by the State of Queensland (DTMR) and prior to that, by QR as a rail corridor (1996). The current and historical land title results are summarised in Table 5-3, while land title records are provided in Appendix D.

Table 5-3: APSDA - Current & Historical Title Search

Years Included	Owner Details
Lot 211 on SP122341, County of Salisbury, Parish of Salisbury Plains, Title reference #40008706.	
A lease in Perpetuity, as part of Crown Plan, Lot 1 on CP 825707, Lease Reference: PPL 208003.	
02/07/2003	The State of Queensland, (Represented by Department of Transport and Main Roads)
01/07/1995 – 30/06/2095	State Sub Lease from State of Queensland to Queensland Rail (Whole of Crown Plan) Purpose of Lease: Transport, purchases ancillary to transport and other commercial and community purposes.

5.3 Analytical Results

5.3.1 Lot 211 on SP122341 Soil Stratigraphy

Samples CL1 and CL2 exhibited an underlying natural material that consisted of light to dark brown friable clays and poorly sorted gravels. The underlying natural material is considered to be representative of the regional geology which constitutes alluvial and deltaic deposits (see Soils and Geology Technical Report).

Soil samples were collected immediately adjacent to Lot 211 on SP122341 in which the rail alignment traverses as shown in Plate 5-1.

Plate 5-1: View of Sample Location adjacent to Existing Rail Line.

5.3.2 Site Specific Sampling

Preliminary soil sampling was conducted for the rail alignment in November 2009. Sampling locations were based upon the nature of the existing North Coast Line corridor and the merging of the China First rail corridor, where arsenic may be a contaminant along the easement. Samples were taken within 10m of where the China First rail alignment meets the existing rail corridor passes at approximately KP3. Two primary samples were collected at two separate locations 100m apart of the existing rail easement. The sampling locations were:

- at KP 3:
  - Sample Site Location CL1 (CL1-B/CL1-C) collected at easement of rail corridor; and
  - Sample Site Location CL2 (CL2-B/CL2-C/CL2-D) collected at easement of rail corridor.

Samples were labelled according to depth (e.g. CL1-B is 0.3mbgl, CL1-C is 0.6mgbl and CL1-D is 0.9mbgl). Observations of in-situ soils and raw data input were also conducted; however, there was no visual surface contamination evident during sampling period. No odours were present at time of sampling.

5.3.3 Quality Assurance

An assessment the above QA/QC protocols has been undertaken to assure both the quality and reliability of the data reported is of an acceptable accuracy and precision for interpretation. Table 5-4 presents a summary of the field and laboratory QA/QC results.

Table 5-4: QA/QC Assessment

Parameter (Field or Laboratory)	Type	Assessment
Field	Field Intra-laboratory Duplicates Field Inter-laboratory Duplicates	The Inter-laboratory duplicates reported a marginal RPD exceedances of 31% for Zinc. All other RPD results were below the acceptance criteria of 30% for inorganics and 50% for organics.
	Trip Blank	All concentrations were less than the laboratory detection limit and considered acceptable for use.
	Trip Spike	The Trip Spike laboratory and RPD results indicate the potential for losses of volatile constituents from the soil. However, the laboratory analytical results report volatile concentrations below the laboratory detection limits.
	Rinsate Blank	All concentrations were less than the laboratory detection limit and considered acceptable for use.
Laboratory	Holding Times	The following analytes were outside of prescribed holding times; ▪ SOIL; and ▪ Moisture Content.
	Laboratory detection limits	All laboratory detection limits were less than the site investigation criteria.
	Laboratory Method Blank	All concentrations were less than the laboratory detection limit and considered acceptable for use.
	Laboratory Duplicate	The laboratory duplicate frequency and reported results were compliant with the evaluation criteria and are considered acceptable for use.
	Laboratory Control Sample	The Laboratory Control Sample frequency was compliant with the proposed rate of 1 in 20. The following OP and PAH analytes were identified to be outside of the stipulated laboratory control limits; ▪ Demeton-S-methyl. ▪ Fenthion. ▪ Fluorene.
	Matrix Spike	Matrix spike frequency compliant with the rate of 1 in 20. Matrix spike results were within the control limits of 70 % - 130% and are considered acceptable for use.

Based on an assessment of QA/QC and data validation for the project, the overall data quality and accuracy is considered sufficient such that the data may be used as a basis of assessment for soil chemistry at the sample locations.

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5.4 Analytical Results

The laboratory analytical results for the soil sampling investigation have been summarised below. The laboratory analysis certificates are included as Appendix E.

5.4.1 Inorganics

The laboratory analytical results reported concentrations of chromium (total) above the adopted EIL criterion of 50 mg/kg for CrVI in the following soil samples;

- CL1 reported a chromium concentration of 61mg/kg;
- CL2 reported a chromium concentration of 70 mg/kg; and
- CL3 reported a chromium concentration of 55 mg/kg.

All other inorganic concentrations were below the adopted SAC.

Figure 5-3 below presents the chromium analytical results in comparison to the adopted SAC.

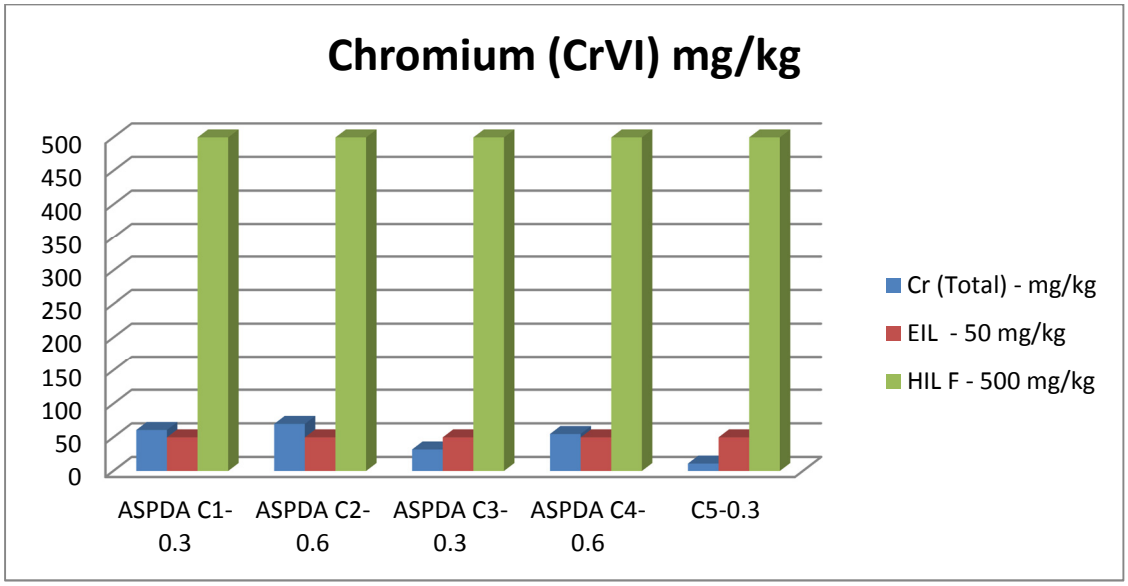

Figure 5-3: Chromium Results

5.4.2 Organics

The laboratory analytical results indicate that all soil samples collected and analysed reported organic concentrations below the laboratory detections limit and adopted SAC.

5.5 Lot 5 on RU 81

Lot 5 is a medium risk site. Desktop studies have been undertaken although no preliminary soil sampling has been conducted at the time of writing.

5.5.1 Site Location and Description

Lot 5 RU81 is located about 55km northwest of Clermont and intersects the rail alignment between KP265 to KP325. The site comprises open Brigalow and Gilgai country used for grazing. The cattle dip is located at approximately 22°16'10"S. 146°52'18"E and is about 1km west of the rail alignment (Table 5-5).

Table 5-5: Lot 5 RU81 Details

Lot Number	Owners	Area (Ha)	Holding/Title
5 RU81	Ralco Holdings Pty ltd	48,800ha	Grazing

5.5.2 Current Site Activities

Lot 5 is leased land with the primary land use activities including cattle grazing and breeding. Based on aerial imagery investigations, the location of on-site associated infrastructure is approximately 1km west of the rail alignment. Lot 5 intersects the rail alignment between KP265 to KP325 (Figure 3.1).

5.5.3 Adjacent Land Uses

Adjacent land uses to Lot 5 RU81 include:

- North - similar grazing/pastoral land and dams;
- South - similar grazing/pastoral land, dams and homesteads;
- East - similar grazing/pastoral land, cropped land and dams; and
- South - similar grazing/pastoral land, dams.

Plate 5-2: View of Surrounding Land Use.

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5.5.4 Geology and Soils

The land systems include weathered basalts and sedimentary rocks including sandstones which give rise to clay plains with dominant soils comprised of deep grey clays and deep brown clays. In some areas, these occur on Gilgai banks, and are often associated with loamy duplex soils. These soils have low permeability, and feature deep cracking of the profile when dry.

5.5.5 Topography

Lot 5 RU81 slopes gently towards the north-east towards Middle Creek and Fox Creek at 300m to 200m AHD.

5.5.6 Hydrogeology

Based upon DERM records, the groundwater in the vicinity of Lot 5 RU81 is hosted in shales, sandstones and clays. In the Suttor Formation, there is also an unconfined sandy aquifer with water levels between 10 to 80mbgl.

5.5.7 Nearby Receptors

Surface water receptors include Fox and Middle Creeks in the north west of the lot and Miclere and Mistake Creeks in the east of the lot, all being ephemeral.

The nearest sensitive human receptors are likely to include the landowner's residence. No major residential areas are present within a 10km radius of the site.

5.5.8 Anecdotal Information

No information has been currently sourced from the owners of the property.

5.5.9 Flammable Goods and License

No data was available regarding flammable goods licences for Lot 5 on RU81.

5.5.10 Public Library, Historical Society and Grey Literature

No data was found regarding the environmental performance of the site with respect to land contamination.

5.5.11 Current and Historical Aerial Photographs

Historical aerial imagery for the area was available from 1998 to 1987. No significant changes in the lot with potential for site contamination were present. The description and excerpts from the aerial photograph review are provided in Appendix C.

5.5.12 Current and Historical Title Search

A review of historical titles for Lot 5 RU81 was undertaken in August 2009 to identify current and historical land owners which may have undertaken potential contaminating activities on the site. Table 5-6provides a summary of land titles history. Land title records are provided in Appendix D.

Table 5-6: Rail Alignment - Current & Historical Title Search

Years Included	Owner Details
Lot 5 RU81 48,800 Ha	
1/10/1985-03/09/2005	Ralco Holdings Pty Ltd. - County of Rutledge Parish of Beresford, Parish of Rosherville, Isaac Shire. Lease for 50 years.
Prior to 1985	Crown Land

5.6 Extractive Industries

Two lots that intersect the rail alignment (Lots 64 on CP852524 and 2 on DK835445) are indicated to have extractive industries on them as their primary land use. As a result of the realignment of the rail line, these sites while now in or adjacent to the corridor have not been physically assessed. Adjacent lots 4914 on PH1791 and lot 51 on CP852524 are listed as having a primary land use as cattle grazing and breeding. However an investigation of current aerial imagery suggests that the whole lot is actually an extractive resource operation. None of these lots were listed on the EMR/CLR.

Lot 64 is operating under an existing mining lease and QVAS indicates the primary land use as extractive. The lot is intersected by the rail alignment within the mining lease area. The site is not listed on the EMR with respect to notifiable activities that may be being undertaken on the site. Lot 2 is listed as being for cattle breeding and fattening although it would appear that some form of mining is being undertaken on the site.

5.7 Cattle Dips - Additional Site Observations

Due to the length of the rail alignment, a helicopter survey was undertaken to identify lots which may have the potential for contamination, particularly the operation of cattle dips which are common in agricultural areas and often have not been notified to DERM. The helicopter survey identified four cattle dips of which two intersected the buffer area of the rail alignment activities while two lots were outside the rail alignment buffer (CD1 through CD4). Table 5-7 provides information on the two identified cattle dips intersecting the rail alignment (Figure 5-1 and Figure 5-2, Plate 5-3 and Plate **5-4**).

Table 5-7: Summary of Identified Cattle Dips

Lot and Plan Details	EMR Status	CLR Status
6 SM99	Not Listed	Not Listed
10 BL49	Not Listed	Not Listed

On-site observations identified these lots are primarily associated with cattle and had livestock dips or spray race and/or petroleum storage facilities. While land contamination is probable around these activities, it is typically confined to relatively small areas where the activities occur and the majority of the larger lot areas are anticipated not to be impacted from these activities.

Plate 5-3: Cattle Dip location on Lot 6 on SM 99

Plate 5-4: Cattle Dip location on Lot 10 on BL 49

The cattle dips included pens, covered yards and drying pads. Mature vegetation was observed around the vicinity of the cattle holding pens. Various access and farm tracks were also evident. Damp areas on some of the drying pads indicated that some of the dips were active. Livestock were not observed within the cattle dips in the rail buffer.

5.8 Lot 6 on SM99

Lot 6 (CD1) intersects the rail alignment between KP185 to KP200. The observed cattle dip is within the 1.6km rail buffer boundary. While site specific sampling has not been undertaken, it is recommended that the site be sampled for any existing contamination or design of the alignment be aware of the site when completing final design.

5.9 Lot 10 on BL49

The north-west portion of Lot 10 (CD4) is interested by the rail alignment between KP225 to KP235; however, the cattle dip is approximately 12 km south-east of the buffer area and will not be impacted by or impact the China First Project.

5.10 Risk Assessment

A qualitative risk assessment was undertaken based upon the framework outlined in enHealth (2002).

5.10.1 Potential Hazards

The soil investigation showed that the natural underlying soil profile within the investigation area generally satisfied the adopted SAC. It was noted that while total chromium exceeded the EIL criterion for CrVI in three samples, the results were within the DERM background range of 0.5 mg/kg to 110 mg/kg. It is therefore unlikely that the soils would significantly contribute to groundwater impacts or pose a risk to human health at the observed concentrations.

The Whitsunday Volcanic Provence, Central Queensland, Australia: lithological and stratigraphic investigations of a silicic dominated large igneous province (Journal of Volcanology and Geothermal Research, 1999) reported that trace concentrations of Chromium within dyke intrusions range from 9 to 123 parts per million (ppm) in silica rich dominated provinces within the Whitsunday Volcanic Provence of north east Australia. Based on this assessment, the observed concentrations of chromium above the EIL criterion but within DERM background criterion are considered to be attributable to naturally occurring background conditions due to underlying silicic dominated granite within the Upper Carboniferous to Lower Permian Intrusives.

Table J of *AS4482. 1-2005: Guide to Sampling and Investigation of Potentially Contaminated Soil (Part 1: Non volatile and Semi volatile Compounds*) identifies arsenic as a potential contaminant of concern associated with the use of railway yards. The laboratory analytical results reported arsenic concentrations below the adopted SAC. It should be noted however, that due to the preliminary nature of the

investigation, further assessment may be required where disturbance of the existing rail line is proposed. Thus, the relevant components of the risk assessment are discussed below.

Potential contaminants of concern at cattle dips include pesticides and arsenic. Cattle dips initially used arsenic compounds and subsequently used OC and OP. Thus given the common association of these contaminants with cattle dips, there is potential for contamination within the underlying soil stratigraphy and/or groundwater.

The potential for soil contamination from the cattle dips are likely to emanate from the following sources:

- Storage and mixing areas for chemicals;
- Drips from cattle in drying yards;
- Leakage from the bath area; and
- Disposal of waste liquid and sludge, usually from dumping adjacent to the dip.

The lateral and vertical extent of contamination surrounding a dip can vary depending on site specific factors including design, soil types, site gradient, operating practices and the frequency of use.

Potential impacts from extractive industries include acidity and heavy metals associated with the particular deposit.

5.10.2 Potential Receptors

Potential human receptors have been identified as the following:

- Site workers;
- Maintenance workers; and
- Rural/agricultural industry.

Potential environmental receptors would include nearby creek and rivers.

5.10.3 Potential Pathways

Potential exposure pathways are likely to include:

- Overland soil transport via surface water run-off;
- Leaching of contaminants from the soil profile to the groundwater table; and
- Migration of dissolved contaminants in groundwater to the surrounding tributaries.

5.10.4 Evaluation of Risk

Site specific assessments of soil and aquifer characteristics including leaching potential and hydraulic conductivity have not been undertaken and therefore the potential for the contaminants to leach to the groundwater, as well as the rate of migration of groundwater contamination is unknown. Where the subsurface profile is predominantly clay, groundwater contamination may be retarded due to the lower

hydraulic conductivity. Therefore a detailed assessment of the risk cannot be completed due to the limited sampling undertaken in comparison to the scale and extent of the rail alignment. However, a qualitative assessment of risk indicates the following potential risks.

Several sites are at some distance from the rail alignment including:

- The cattle dip on Lot 6 SM99 is located within the rail corridor and east of the rail alignment;
- The cattle dip on Lot 10 BL49 is located approximately 12 km from the rail alignment and is not considered to have a potential impact upon the project; and
- The cattle dip on Lot 5 RU81 was not sighted during aerial flyover; however, aerial imagery indicates it may be close to the rail buffer.

Where there is no complete pathway between a potential contaminant source and a receptor (in this case the project), there is low potential for risk from that contaminant source to the project. Therefore, unless the rail line directly intersects the cattle dips and associated infrastructure such as drying yards there is a low potential for risk from these contaminant sources to the project.

The laboratory results from samples adjacent to the rail line reported arsenic concentrations less than the EIL. This suggests a low potential for widespread arsenic impacts around this part of the rail alignment. However, the association of arsenic contamination with rail activities indicates that the potential for arsenic along the extent of the rail alignment and this therefore cannot be discounted and an unquantified risk remains.

The extractive industry land use has the greatest potential to pose risk to the project as soil/rock that has the potential to generate acidity or leach contaminants (ie: heavy metals), is likely to be widespread and could be disturbed by construction activities.

6 Coal Terminal

6.1.1 Results of Tier Risk Assessment

A total of ten lots cover the APSDA and Port of Abbot Point onshore infrastructure area. One lot is classified as a harbour industry; three lots are listed as transport terminal and therefore are all considered to be potentially *high risk*. Five lots were classed as Grazing, Breeding and Fattening and are a potential *medium risk* while one lot was residential, therefore a *low risk* (Appendix B for listed lots).

6.1.2 Unexploded Ordinance

A review of the UXO database indicated that no lots intersecting the area were listed.

6.1.3 EMR/CLR Results

Searches were undertaken for both EMR and CLR listed lots intersecting the coal terminal. Of the ten sites investigated, one site was listed on the EMR (but no lots were identified on the CLR), this being the existing rail line.

6.1.4 High Risk Sites

The sites at the current Port of Abbot Point are not considered a risk to the proposed project as they are outside the project footprint. A grazing property with a cattle dip was not available for inspection at the time of this report.

An existing rail line intersects the rail alignment to the coal loading area (Section 1). The existing rail line is adjacent to the coal loading stockyards and is considered to have similar potential for arsenic impacts as the adjacent rail line lots based on the reports of widespread arsenic use on rail lines discussed in Section 1.

A cattle dip is present on Lot 225 HR2027 located at approximately 19°56’43”S, 148°030’02”E is approximately 1km east of the coal loading stockyards.

A list of all lots assessed is provided in Appendix B.

6.1.5 Potentially Contaminating Activities

Based upon the historical review and site inspection the potentially contaminating activities identified in the area was arsenic that has been used for grass suppression along rail lines and a cattle dip. These have similar potential for contaminant impacts as those for similar activities discussed in Sections 1 and 1.

6.1.6 Contaminants of Concern

The contaminants of concern associated with the above activities include arsenic and OC and OP.

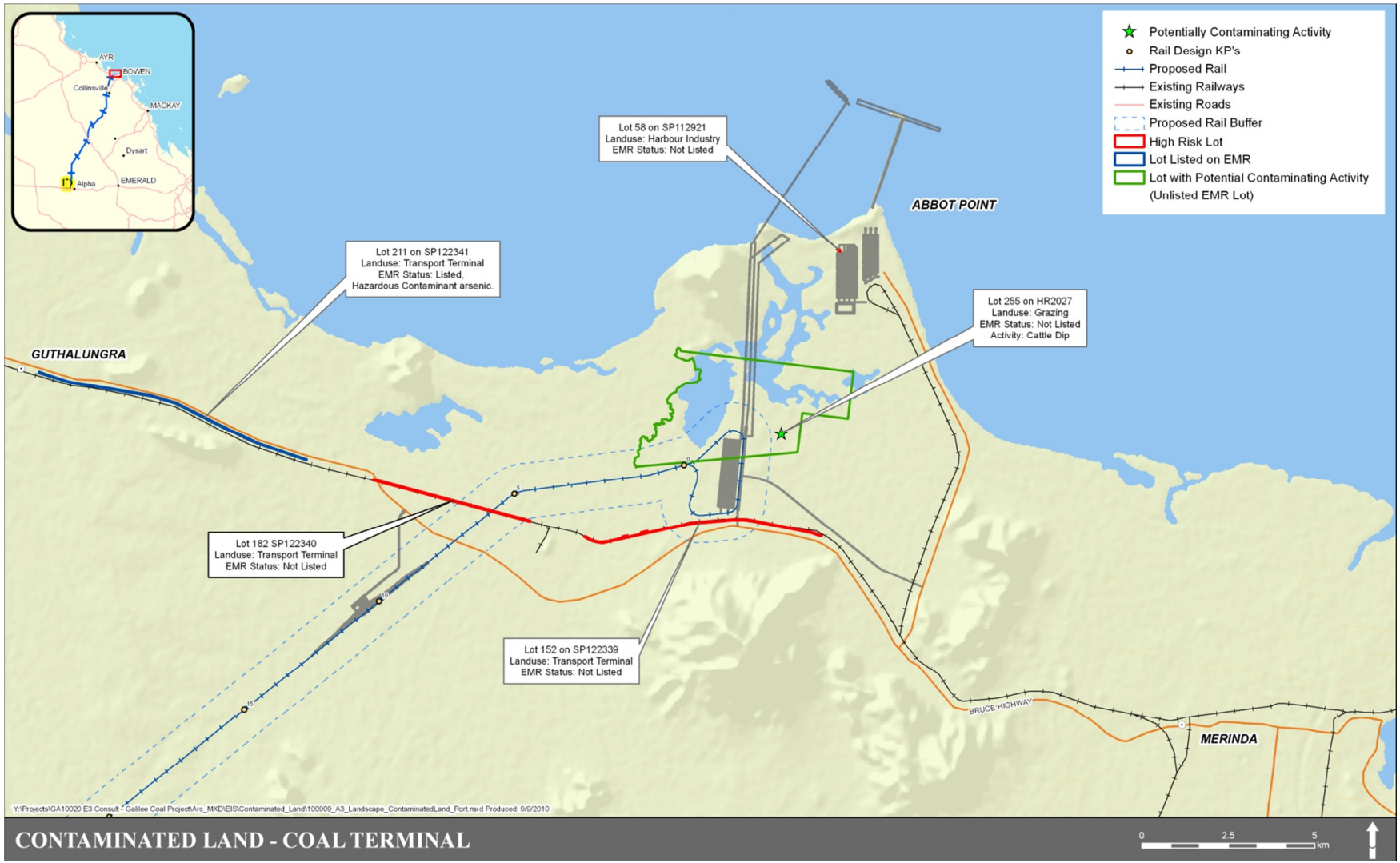

Figure 6-1: Contaminated Land - Port of Abbot Point and APSDA

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6.2 Risk Assessment

A qualitative risk assessment was undertaken based upon the framework outlined in the enHealth (2002).

6.2.1 Potential Hazards

Potential contaminants of concern at cattle dips include pesticides and arsenic. Cattle dips initially used arsenic compounds and subsequently used OC and OP. Therefore given the common association of these contaminants with cattle dips, there is potential for contamination within the underlying soil stratigraphy and/or groundwater.

The lateral and vertical extent of contamination surrounding a dip will vary depending on site specific factors including design, soil types, site gradient, operating practices and the frequency of use. In the Port of Abbot Point area, there is greater likelihood of shallow groundwater and hence a greater risks of potential impact to groundwater from the cattle dip, than form similar dips in the rail alignment.

The potential for impacts from arsenic along rail lines is considered similar to that for rail lines in other areas of the project.

6.2.2 Potential Receptors

Potential human receptors have been identified as the following:

- Site workers;
- Maintenance workers; and
- Rural/agricultural industry.

Potential environmental receptors would include nearby Caley Valley Wetlands via overland drainage paths and through groundwater migration.

6.2.3 Potential Pathways

Potential exposure pathways are likely to include:

- Overland soil transport via surface water run-off;
- Leaching of contaminants from the soil profile to the groundwater table; and
- Migration of dissolved contaminants in groundwater to the surrounding surface water.

6.2.4 Evaluation of Risk

Site specific assessments of soil and aquifer characteristics including leaching potential and hydraulic conductivity have not been undertaken and therefore the potential for the contaminants to leach to the groundwater, as well as the rate of migration of groundwater contamination is unknown. Where the subsurface profile is predominantly clay, groundwater contamination may be retarded due to the lower hydraulic conductivity. A qualitative assessment of risk is provided below.

Where there is no complete pathway between a potential contaminant source and a receptor (in this case the project) there is low potential for risk from that contaminant source to the project. The cattle dip is located about 1km east of the coal stockyards. The groundwater flow direction is anticipated to be towards the ocean and therefore potential groundwater impacts are not expected to impact the project construction area. There is therefore a low potential for risk from these contaminant sources to the project.

While the laboratory results from samples adjacent to the rail line to the north of the coal stockyards reported arsenic concentrations less than the EIL the association of arsenic contamination with rail activities indicates that the potential for arsenic along the extent of the rail alignment cannot be discounted and therefore an unquantified risk remains.

7 Potential Impacts

7.1 Mine site

Based upon the qualitative risk assessment discussed in Sections 4.4, 5.10 and 6.2, the following potential impacts are identified from identified contamination or potentially contaminated land resulting from the construction and operation works associated with the mine including:

- There is a low potential for significant contaminated soils to be encountered during earthworks which could lead to contamination being spread across the site;
- The identified hydrocarbon impact may be delineated by completing a Stage 1 and 2 Environmental Site Assessment (ESA);
- The anticipated extent of hydrocarbon impact is considered to be unlikely to be a significant impact under the EP Act and excavation, land farming and validation of hydrocarbon impacted soils may be undertaken on Lot 1 BF72 under a remedial plan;
- Should the extent of the impact be greater than anticipated, then the site may be listed on the EMR and a site management plan (SMP)/ remediation action plan (RAP) prepared to control the remediation and validation of the impact;
- Demolition of site buildings has the potential to impact soils with hazardous materials if not appropriately assessed and managed;
- Spills and leaks from various contaminating sources such as, petrol and other chemicals stored on site during operations should be managed properly. These sources may have the potential to leach and migrate into sensitive receptors such as waterways and permeate into the existing soil profile; and
- Potential contamination resulting from the coal washing plant during construction and operations, reject coal during operations, and overburden during construction phase are discussed in the Waste Technical Report.

7.2 Rail Corridor

The potential for impacts from cattle dips or arsenic impacts from existing rail lines along the rail alignment is considered low; however, potential for impacts arises from:

- Leaching of contaminants to groundwater or via overland flow to surface waters;
- Where the project construction intersects the footprint of the contaminated areas of the cattle dips, drying yards and associated infrastructure there is potential mobilisation of contaminants if not appropriately managed;
- Where the project construction intersects the existing rail lines, there is potential to encounter arsenic impacted soils. There is potential for mobilisation of this contaminant if not appropriately managed;
- Where the project construction intersects areas of extractive resources, there is potential for mobilisation of contaminants from the elevated levels of minerals, elements or compounds in the resource material;

- Demolition of buildings in the rail alignment has the potential to impact soils with hazardous materials if not appropriately assessed and managed; and

- Spills and leaks from various contaminating sources such as, petrol and other chemicals stored on site during construction and operations should be managed properly. These sources may have the potential to leach and migrate into sensitive receptors such as waterways and permeate into the existing soil profile.

7.3 Coal Terminal

Potential impacts to contaminated land resulting from the construction and operation works associated with the new coal terminal infrastructure include:

- Disturbance of arsenic impacted soils where infrastructure intersects existing rail lines;
- Spills and leakages during the construction and operation phases could impact sensitive receptors such as human health, on-site soil contamination and nearby local waterways; and
- Potential Acid Sulfate Soils (ASS) contamination resulting from disturbing soils during construction phase is discussed and addressed in the Acid Sulfate Soils Technical Report.

8 Mitigation Measures

The greatest potential impacts to the project from existing contamination arise from cattle dips and extractive resource areas within the rail alignment. Cattle dips are a source of persistent contaminants including arsenic and/or OC/OPs. Extractive resource areas pose a risk as an area from which disturbance may yield minerals with the potential to impact surface soils or surrounding receptors from leaching of the mineralised material.

The mitigation measures to manage these sites include (in order of preference):

- Re-alignment of the rail alignment to avoid these areas;
- Where re-alignment is not possible, undertake an assessment of the soils to be intersected by the rail alignment to assess the scale and extent of contamination in the soils and the potential for groundwater impacts in order to produce a DERM compliant Stage 1 and 2 ESA report for each affected lot;
- Based on the results of Stage 1 and 2 ESAs, the lots that are subject to a hazardous contaminant will be notified to DERM to be recorded on the EMR/CLR;
- Where the level of contamination exceeds the current land use a SMP will be prepared to be attached to the EMR/CLR listing;
- Where site contamination is present and remedial measures are required a SMP/RAP will be prepared in line with possible construction techniques that will minimise excavations for site preparation;
- Where site contamination must be excavated for the rail alignment, the work will be completed under a RAP and validated to assess the effectiveness of the remediation. A validation report will be prepared suitable for submission to DERM to assess the effectiveness of the remediation, the proposed management measures (if any) and allow a site suitability statement to be issued for the lot by DERM;
- No contaminated soils will be removed from a lot without a DERM disposal permit issued under s 424 of the EP Act; and
- Remedial measures will include (in order of preference) risk assessment, on-site containment, on-site treatment and/or off-site treatment or disposal.

Other potential contaminant impacts arise from the handling and storage of hazardous fuels and chemicals during project construction, operation and decommissioning and the demolition of structures containing hazardous materials. A summary of potential impacts and mitigation measures is provided in Table 8-1.

Table 8-1: Mitigation Measures

Issues/Objectives	Management requirement	Management Measure	Timing	Responsibility
Disturbing impacted contaminated soils	Minimise impacts to sensitive receptors resulting from disturbance of existing contaminated land	Re-align project boundaries to avoid potentially contaminated areas.	During design	Waratah Coal and construction contractor
		Further sampling should be carried out on potentially contaminated to assess the extent of contamination.	During pre-construction and construction	Waratah Coal and construction contractor
		In the event of potentially contaminated sites being identified prior to or during construction, site specific investigations should be carried out in accordance with NEPM 2005 and DOE 1998 Guidelines. This may also include the development of a SMP and/or RAP.	During pre-construction and construction	Waratah Coal and construction contractor
		Excavated contaminated material will be stockpiled on the lot it originates from separately to uncontaminated material in a bunded area with appropriate controls for erosion and sediment movement and fauna exclusion for assessment of appropriate treatment or disposal methods.	During construction	Waratah Coal and construction contractor
Demolition of existing infrastructure on High Risk Lots	Minimise potential for contamination to occur from existing structures.	Re-align project boundaries to avoid potentially contaminated areas.	During design	Waratah Coal and construction contractor
		Prior to the commencement of construction activities, a hazardous materials survey will be undertaken of all relevant structures to be demolished or removed. This assessment will identify the presence of hazardous materials and act as a basis to establish a hazardous materials management plan.	During pre-construction and construction	Waratah Coal and construction contractor

On-site fuel and chemical/hazardous handling and containment	Fuel and chemical storage for hazardous substances	All fuel and chemicals storage areas will be designed to meet AS 1940:2004 *Storage and Handling of Flammable and Combustible Liquids*. This includes storing materials in a roofed and bunded area and keeping MSDS forms on-site at all times. As part of the EMP, an oil contingency plan will also be developed. All fuel attendants will be trained in the prevention of and handling of fuel spills. The construction contractor will also implementation an Occupational Health and Safety Strategy.	During pre –construction, construction and operations	Waratah Coal and construction contractor
		The construction contractor should ensure that all oils, fuels and chemicals used on site are located within a roofed, bunded area with a storage capacity for hazardous chemicals in accordance with the manufacture's specifications. All empty containers will be moved to a designated waste storage area where they will be triple rinsed prior to disposal and/or recycling. All spills should be contained consistent with SMP and Environmental Management Plan (EMP) and cleaned up immediately. Spill kits should be on-site whenever necessary.	During construction	Waratah Coal and construction contractor
On-site and off-site contamination from vectors such as vehicles	Vehicle Wash down	To prevent land contamination from wash water, all wash down facilities will be constructed in accordance with AS 1940:2004 *Storage and Handling of Flammable and Combustible Liquids*. The facilities will be designed to collect sediment and hydrocarbon materials within a trap. The hydrocarbon effluent will be stored in drums and collected by a licensed waste contractor.	During construction and operations	Waratah Coal and construction contractor

Erosion and sedimentation from contaminated soils disturbed during construction	Erosion and sediment control	As part of the project, an Erosion and Sediment Control Plan (ESCP) will be developed detailing control measures that will be implemented. The ESCP will also include construction details, dimensions, materials used, expected outcomes and staging of erosion and sediment control once construction is complete.	Pre-construction	Waratah Coal and construction contractor
		Where appropriate, runoff control structures (e.g. silt fences, sediment barriers) according to '*Soil Erosion and Sediment Control- Engineering Guidelines for Queensland*' (IEAust.1994) should be incorporated into the construction and ESCP. This is be mandatory during the wet season.		
		Prevent concentrated runoff from flowing down into sand batters.	During construction	Waratah Coal and construction contractor

9 Recommendations

In order to achieve sound soil management practices and minimise the associated impacts from contaminated land which may impact the construction of the China First Project, the following commitments are made:

- Where possible the project footprint will be re-aligned to avoid areas of potential or identified contamination;
- Where identified or potential contamination is present in the project footprint, Waratah Coal will enter into agreements with the owner of the contamination to assess and appropriately manage or remediate the contamination;
- Any building to be demolished will be assessed for hazardous material content with preparation of demolition management plans for the appropriate demolition and disposal of the hazardous materials;
- Where the project footprint cannot be re-aligned, DERM compliant Stage 1 and 2 ESAs will be undertaken to assess the scale and extent of contaminant impacts;
- Where contamination is identified it will be managed and/or remediation under the EP Act with DERM approved SMPs and/or RAPs in order to make the sites suitable for the proposed use;
- Waratah Coal will appoint a Third Party Reviewer to assess all contaminated land assessment and remediation work;
- Any Notifiable Activities that are required for the project will be implemented and managed under the EP Act once construction commences and also during the operational phase. The Notifiable Activities may include:
    - Storing hazardous mine or exploration wastes, including, mine tailings, overburden or waste rock dumps containing hazardous contaminants;
    - Exploring for, or mining or processes, minerals in a way that exposes faces, or releases groundwater, containing hazardous materials;
    - Petroleum Product or Oil storage; and
    - Chemical storage.

Waratah Coal will also establish a set of environmental investigation protocols to manage gross or previously unidentified contamination encountered during project construction.

10 Conclusions

The PSI indentified existing contamination and lots with the potentially contaminating activities within the projects footprint including:

- Hydrocarbon impacts at an AST on Lot 1 BF72 at the mine;
- Evidence of widespread historical use of arsenic along existing rail lines;
- The presence of notifiable activities, these being cattle dip and petroleum storage on a farm within or immediately adjacent to the rail alignment;
- The presence of two cattle dips that are not recorded on the EMR but are within or immediately adjacent to the rail alignment; and
- The presence of four lots that have are currently active or have the potential for extractive industries.

The potential for significant impacts from identified hydrocarbon contamination is considered low. The potential for significant impacts from historical arsenic impacts is also considered low once the mitigation measures identified previously are implemented. The potential for significant impacts from potentially contaminating activities identified along the rail alignment including cattle dips and extractive land uses is considered low once the mitigation measures identified previously are implemented.

All potential impacts resulting from contaminating land can be properly managed with recommendations using the appropriate mitigation measures set in place for future construction of the project.

11 References

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Soil Erosion and Sediment Control- Engineering Guidelines for Queensland (IEAust.1994)

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Appendix A – EMR Listings

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Appendix B – Tiered Summary Tables

Appendix C – Aerial Photograph Reviews

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Appendix D – Land Titles

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Appendix E – Laboratory Analyses

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Appendix F – Legislative Tables

Queensland Department of Environment (1998) *Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland*,

Investigation Thresholds for Contaminants in Soils

Parameter	Assessment Criteria	
	HIL- 'F'	DERM
Petroleum Hydrocarbons[1]		
TPH $C_6 – C_9$	NC	100 mg/kg (1)
TPH $C_{10} – C_{14}$	NC	100 mg/kg (1)
TPH $C_{15} – C_{28}$	NC	1000 mg/kg (1)
TPH $C_{29} – C_{36}$	NC	1000 mg/kg (1)
Monocyclic aromatic hydrocarbons (BTEX)[1]		
Benzene	NC	NC
Toluene	NC	NC
Ethylbenzene	NC	NC
Xylenes	NC	NC
Total BTEX	NC	7 mg/kg (1)
PAH		
Polycyclic aromatic hydrocarbons (PAH)	100 mg/kg	NC
Benzo(a)pyrene	5 mg/kg	NC
Inorganic[2]		
Arsenic	500 mg/kg	NC
Cadmium	100 mg/kg	NC
Chromium	60% (Cr III)	NC
Copper	5000 mg/kg	NC
Lead	1500 mg/kg	NC
Mercury	75 mg/kg	NC
Nickel	3000 mg/kg	NC
Zinc	35000 mg/kg	NC
Organochlorine Pesticides		
Heptachlor	50 mg/kg	NC
Organophosphorus Pesticides	NC	NC

Abbreviations and Glossary of Terms

Abbreviations

Abbreviation	Meaning
AASS	actual acid sulfate soil
ALDD	Australian Land Disturbance Database
ALUMC	Australian Land Use and Management Classification
ANZECC	Australian and New Zealand Environment Conservation Council
AS	Australian Standard
AS/NZS	Australian Standard / New Zealand Standard
ASC	Australian Soil Classification
ASS	acid sulfate soil
BGL	below ground level
BTEX	benzene, toluene, ethylbenzene, and xylenes
CLR	Contaminated Land Register
DERM	Department of Environment and Resource Management (Qld)
DoE	Former Department of Environment (Qld)
DEH	Former Department of Environment and Heritage (Qld)
ESCP	Erosion and Sediment Control Plan
EIA	Environmental impact assessment
EIS	Environmental impact statement
EMP	Environmental management plan
EMR	Environmental management register
EP Act	*Environmental Protection Act 1994*
EPA	former Environmental Protection Agency (Qld)
LL	land leasehold
Mbgl	metres below ground level
MSDS	material safety data sheet
NEPM	National Environmental Protection Measure
OCs	organochlorine
OPs	organophosphate pesticides
PAH	Poly Aromatic Hydrocarbons
PASS	potential acid sulfate soils
Qld	Queensland
QR	Queensland Rail
QVAS	Queensland Valuation and Sales System
RAP	Remediation action plan
SMP	Site management plan
SMS	safety management system

Abbreviation	Meaning
TPH	Total Petroleum Hydrocarbons
VOC	volatile organic compounds

Glossary of Terms

Abbreviation	Meaning
A horizon	The original top layer of mineral soil divided into A1 (typically from 5 to 30cm thick; generally referred to as topsoil with a high content of organic matter, dark colour and maximum biological activity) and A2 horizons (usually 5 – 70 cm thick; similar texture to A1 but paler in colour, poorer in structure and less fertile).
Acid sulfate soils	Naturally occurring soils, sediments or organic substrates (e.g. peat) that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) 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 will react with oxygen to form sulfuric acid.
Analyte	Substance or chemical constituent that is determined in an analytical procedure.
Australian Soil Classification (ASC)	A multi-category scheme with classes defined on the basis of diagnostic horizons or materials and their arrangement in vertical sequence as seen in an exposed soil profile.
Bioaccumulation	The process by which substances accumulate in the tissues of living organisms.
Coarse particulate organic matter (CPOM)	Any organic material greater than about 1 mm in diameter; examples include twigs, leaves, fruits and flowers of terrestrial or aquatic vegetation.
Contaminant	A substance that is present in an environmental medium in excess of natural baseline concentration.
Dissolved solids	Minerals and organic matter dissolved in water.
Environmental impact assessment	The process used to assess the environmental impact of a proposed development.
Environmental impact statement (EIS)	The information document prepared by the proponent when undertaking an environmental impact assessment. It is prepared in accordance with terms of reference prepared or approved by government. EIS is the term used by the *Environment Protection and Biodiversity Conservation Act 1999* and the *Environmental Protection Act 1994*, and it is defined in Part 4 of the *State Development and Public Works Organisation Act 1971*.
Environmental Management Plan	A document developed by proponents during a project's planning and design. An EMP provides life-of-project control strategies in accordance with agreed performance criteria for specified acceptable levels of environmental harm. It may continue through the whole life of a project (e.g. preconstruction, construction, operation and decommissioning).
Fine particulate organic matter	Any organic material smaller than about 1mm in diameter. In the process of feeding, shredders often create FPOM when they consume course particulate

Abbreviation	Meaning
	organic matter (CPOM).
Groundwater	All the water contained in the pores/voids within unconsolidated sediments or consolidated rocks (i.e. bedrock).
Hazard	A source of potential harm (AS/NZS ISO 3100:2009 Risk management – Principles and guidelines).
Hydrocarbons	An organic molecule containing hydrogen and carbon; the major component of petroleum.
Hydrochemical type	The definition of a chemical composition of groundwater based on the relative percentages of major cation and anion concentrations.
In situ	A Latin phrase meaning in the place.
Leachate	Liquids that have percolated through a soil and that carry substances in solution or suspension.
Likelihood	Used as a general description of probability or frequency. Can be expressed qualitatively or quantitatively (AS/NZS ISO 3100:2009 Risk management – Principles and guidelines).
Loss of containment	Unintended spill or leak from the primary containment.
Nutrients	Any substance that promotes growth with living organisms. The term is generally applied to nitrogen and phosphorus in wastewater, but is also applied to other essential and trace elements.
Overburden	Any loose material which overlies bedrock (often used as a synonym for Quaternary sediments and/or surficial deposits) or any barren material, consolidated or loose, that overlies an ore body.
Permeability	A measure of the ability of a medium to transmit a fluid (any fluid). Similar to hydraulic conductivity that describes the ability of a porous medium to transmit water specifically.
Pollution	An alteration in the character or quality of the environment, or any of its components, that renders it less suited for certain uses. The alteration of the physical, chemical, or biological properties of water by the introduction of any substance that renders the water harmful to use.
Polycyclic aromatic hydrocarbons	A group of over 100 different organic compounds composed of several benzene rings.
Primary containment	First level of containment, eg containers, vessels, pipework.
Rehabilitation	The process of environmental restoration to a former condition or status after some process (business, industry, natural disaster etc.) has damaged it.
Remediation	Containment, treatment or removal of contaminated groundwater. May also include containment, treatment or removal of contaminated soil above the water table.
Runoff	The portion of precipitation (rain and snow) that ultimately reaches streams.
Secondary containment	Second level of containment, eg bunds, outer tanks.
Seep Point	Where seepage occurs.

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Abbreviation	Meaning
Seepage	1. The slow movement of water into or out of a body of surface or subsurface water. 2. The loss of water by infiltration into the soil from a canal, ditch, lateral, watercourse, reservoir, storage facility, or other body of water, or from a field.
Sensitivity	The relative susceptibility to adverse impacts to environments.
Soil profile	A vertical section of the soil through all its horizons and extending into the parent material.
Subsoil	The layer of weathered material that underlies the surface soil.
Surface water	Water above the surface of the land, including lakes, rivers, streams, ponds, floodwater, and runoff.
Terms of Reference	As defined by Part 4 of the *State Development and Public Works Organisation Act 1971*.
Texture contrast soils	Soils with a very strong contrast between layers of different soil types.
Topsoil	A part of the soil profile, typically the A1 horizon, containing material which is usually darker, more fertile and better structured than the underlying layers.
Total dissolved solids	Concentration of all substances dissolved in water (solids remaining after evaporation (TDS) of a water sample).
Total solids	The weight of all present solids per unit volume of water. It is usually determined by evaporation. The total weight concerns both dissolved and suspended organic and inorganic matter.
Vertosol	Clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates. Although many soils exhibit gilgai microrelief, this feature is not used in their definition.