coffey environments
SPECIALISTS IN ENVIRONMENTAL, SOCIAL AND SAFETY PERFORMANCE

UHVA
Upper Hunter Valley Alliance

PROPOSED HEXHAM RELIEF ROADS PROJECT, HEXHAM

CONTAMINATION ASSESSMENT

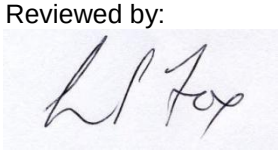
Upper Hunter Valley Alliance

GEOTWARA21045AC-AI.Hexham Contamination
5 July 2012

Written/Submitted by:

Emma Coleman
Senior Environmental Scientist

Reviewed by:



Laurie Fox
Principal Environmental Geologist

Coffey Environments Australia Pty Ltd ABN 65 140 765 902
19 Warabrook Boulevard Warabrook NSW 2304 Australia

CONTENTS

CONTENTS

CONTENTS

CONTENTS

Figures

Tables

CONTENTS

Appendices

ABBREVIATIONS

A/AS	ACM/PACM fragment sample
ACM	Asbestos containing material
AEC	Area of Environmental Concern
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment Conservation Council
ARTC	Australian Rail Track Corporation
ASS	Acid sulphate soil
bgs	below ground surface
BOD	Biological oxygen demand
BTEX	Benzenem Toluene, Ethylbenzene, Xylenes
C10-C36	Hydrocarbon chain fraction
CA	Contamination Assessment
cfu	Colony forming unit
CHA	Coffey hand auger sampling location
CMW	Coffey monitoring well
COC	Contaminant of Concern
CS	Coffey surface soil sample location
CSW	Coffey surface water sampling location
DEC	NSW Department of Environment and Conservation (now NSW OEH)
DECC	NSW Department of Environment and Climate Change (now NSW OEH)
DECCW	NSW Department of Environment, Climate Change and Water (now NSW OEH and NSW Office of Water)
DGR	Director Generals Requirements
DO	Dissolved oxygen

ABBREVIATIONS

DP	Douglas Partners Pty Ltd
EC	Electrical conductivity
EIS	Environmental Impact Statement
EPA	NSW Environmental Protection Authority (now part of NSW OEH)
ERM	Environmental Resource Management Pty Ltd
ha	Hectare
HA	Hand auger borehole
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
µg/L	micrograms per litre
NATA	National Association Testing Authority
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
OCP	Organochlorine pesticides
OEH	NSW Office of Environment and Heritage
OH&S	Occupational Health and Safety
OPP	Organophosphorous pesticides
PACM	Potential ACM
PAH	Polcyclic aromatic hydrocarbons
PCA	Preliminary Contamination Assessment
PCBs	Polychlorinated biphenyls
PID	Photoionisation detector
PPE	Personal protective equipment

ABBREVIATIONS

ppm	parts per million
QA/QC	Quality assurance / quality control
QRN	Queensland Rail National
RAP	Remedial action plan
RB	Rail ballast sampling location
RPD	Relative percentage difference
S_{CR}	Chromium reducible sulfur
SOP	Standard operating procedure
SS	Surface soil sample
SW	Surface water sampling location
TCLP	Total characteristic leachability procedure
TP	Test pit sampling location
TPH	Total petroleum hydrocarbons
TSF	Train Support Facility
UCL	Upper confidence limit
UHVA	Upper Hunter Valley Alliance

EXECUTIVE SUMMARY

This report presents the findings of a Contamination Assessment (CA), undertaken on behalf of the Upper Hunter Valley Alliance (UHVA), for the proposed relief roads and associated infrastructure at Hexham, NSW. The Proposed Project Area is approximately 39ha in size.

The Proposed Project will involve the construction of five relief roads (train lines) to the west of the existing Up and Down Main Lines and between the existing Up Coal and new Down Coal Lines. Other components will include construction of new signal infrastructure and earthworks including drainage lines. This CA is part of the Environmental Impact Statement (EIS) that has been prepared for the Proposed Project.

This report has been prepared in accordance with the relevant sections of the following:

- Contaminated Land Management Act 1997;
- The NSW Office of Environment and Heritage (OEH) (2011) *Guidelines for Consultants Reporting on Contaminated Sites*;
- NSW Department o*f Environment and Conservation (DEC) (2006) Guidelines for the NSW Site Auditor Scheme 2nd edition;*
- NSW Environment Protection Authority (EPA) (1995) *Sampling Design Guidelines*;
- National Environment Protection Council (1999) *National Environment Protection (Assessment of Site Contamination) Measure*;
- NSW Department of Environment, Climate Change and Environment (DECCW) (2009) *Waste Classification Guidelines*; and,
- The respective Director-General's Requirements (DGR's) for the EIS (Reference SSI-4992 dated 14 December 2011);

The objectives of the CA were to:

- Identify potentially contaminating activities that are currently being performed within the Project Area and that may have been performed in the Project Area in the past;
- Assess potential Areas of Environmental Concern (AECs) and Chemicals of Concern (COCs) for the Project Area;
- Assess the soil, groundwater and surface water contamination status of the Project Area through sampling and laboratory analysis;
- Provide an assessment of the suitability of soil and fill to be re-used within the Project Area;
- Provide a preliminary in-situ waste classification of soil and fill that may be disposed to landfill; and
- Provide recommendations for further investigations, remediation and/or management (if required).

Ten AECs were identified for the Project Area: rail ballast, fill materials of unknown origin and quality, fill used for access roads, former building footprints, former abandoned fuel tanks, historical rail use, adjacent industrial land use, groundwater, effluent irrigation, illegal dumping of waste, and the northern end of Woodlands Close..

EXECUTIVE SUMMARY

Soil Contamination

Based on the results of the site history assessment and the soil sampling and analysis, the potential for widespread soil contamination within the fill and natural materials in the Project Area is considered low.

Contamination in the form of TPH C10-C36 was identified at greater than 2.5 times the adopted criteria in TP528A 0.2-0.3m and TP532 0.4-0.5m. Benzo(a)pyrene and total PAHs were also identified in TP532 0.4-0.5m as greater than 2.5 times the adopted criteria. This was within ballast and coal reject fill material, within the ARTC compound area.

Contamination in the form of TPH C10-C36, benzo(a)pyrene, and total PAHs were identified in samples SS30 to SS35. This was in material that was likely imported for construction of Woodlands Close.

A former abandoned fuel tank area, AEC 4, was identified during the site history assessment. Observations in this area indicated there may be a backfilled excavation. No evidence of existing fuel tanks was observed to a depth of 1.1m bgs. Testing of hydrocarbons in this area identified elevated TPH C10-C36 concentrations from 0.0m to 1.1m bgs (471mg/kg to 995mg/kg).

One part of the Project Area, associated with the Tarro-Interchange, has not been assessed at this stage. Additional sampling is currently being undertaken for this area.

Preliminary Waste Classification

Based on an average fill depth of about 0.75m across the entire Project Area (39ha), an approximate fill volume of about 300,000m^3 has been estimated. This would equate to about one soil sample per 4,000m^3 across the Project Area.

The results of the laboratory analysis showed that the fill material classifies as general solid waste, with the exception of:

- Localised area around TP516B 0.2-0.3m (lead at 1,900mg/kg) which classifies as restricted solid waste. The potential volume of this material is 2,500m^3;
- Localised area around TP532 0.4-0.5m (benzo(a)pyrene 110mg/kg, PAHs 1,300mg/kg) which classifies as hazardous waste. The potential volume of this is estimated to be about 1,500m^3;
- Woodlands Close, where benzo(a)pyrene and total PAH concentrations classify soils around SS31, SS32 and SS34 as restricted solid waste, and around SS35 as hazardous waste. The potential volume of restricted solid waste is estimated to be about 3,500m^3, and hazardous waste is estimated to be about 900m$^{3.}$ These volumes are based on a fill depth of about 0.2m.
- A stockpile of fibre-board in the location of sample AS1 classified as asbestos waste. This stockpile has been removed from the site.

On the 27 April 2012, no obvious stockpiles of illegally dumped waste were observed on the Project Area. Two samples were collected from stockpiles located outside of the Project Area.

It is possible stockpiles of waste may be illegally dumped from time to time as the public can access the site. If this occurs, stockpiles of illegally dumped waste (AEC 9) will require waste classification prior to removal from site.

Natural material does not meet the definition of VENM due to the potential presence of acid sulfate soils. Therefore, natural soils also classify as general solid waste. Should acid sulfate soils be disposed to landfill, then it will require lime to be added prior to disposal.

Depending on the volumes of material to be excavated, and the proposed re-use, it may be appropriate to apply for site specific exemptions for re-use of natural or fill materials on other properties. This would be assessed once the volumes and types of material to be excavated are known.

Surface Water and Groundwater Contamination

Widespread contamination of surface water, in the form of faecal coliforms, E. Coli, nutrients and metals, has been identified both on site and immediately off-site. Widespread contamination of groundwater in the form of metals and nutrients has also been identified.

It is considered that the surface water contamination identified is likely to be associated with either grazing of cattle, or effluent irrigation (AEC 9) that occurs to the west of the Project Area,. The long history of industrialisation in this part of the Hexham Wetland has resulted in a degraded wetland system. The concentrations of faecal coliforms and E. Coli in surface water, and nutrients and metals in surface water and groundwater confirm that the Hexham Wetland is in a degraded state.

It is not considered practicable to remediate the surface and groundwater contamination within the Project Area, given the widespread nature of the contamination and the already degraded state of this portion of Hexham Wetland.

The surface water and groundwater contamination is considered to present a potential risk to human health for construction workers and appropriate management procedures will be required for the protection of site workers. During construction, site access will be restricted and once the initial surface water is removed and/or treated, further impacts could be less severe than the current faecal coliform concentrations which have occurred when access for cattle is not restricted.

EXECUTIVE SUMMARY

Recommendations

Coffey recommends the following, in regard to soil contamination:

- Preparation of a site specific remedial action plan by a suitably qualified contaminated land consultant. The RAP would discuss potential remediation and/or management options for the identified contaminated soils and present the preferred remediation option(s) based on the final design and construction details for the project. The RAP is presented in Appendix D;
- Implementation of the remedial action plan in order to remediate and validate affected areas;
- Remediation could comprise excavation, and disposal of the waste materials, including restricted solid waste to appropriately licensed landfill. Hazardous waste would require treatment prior to disposal. Alternatively, remediation could comprise pre-treatment, capping of contamination in combination with a risk assessment and site management plan. Additional assessment in these areas will further refine the remediation options.
- Preparation of a validation report and/or site management plan(s), depending on the remediation/management option chosen.

It is also noted that during construction, a Construction Environmental Management Plan (CEMP) would be prepared and would include measures to protect workers health during construction. The CEMP would include information on how to recognise, handle and manage contamination (including asbestos) in soil and fill materials.

A Water Quality Management Plan would also be prepared as part of the CEMP to manage the surface water and groundwater contamination, and would include, but not be limited to:

- Measures to ensure that the existing contamination in surface and groundwater is not exacerbated during construction of the Project.
- Management measures for the protection of human health and the environment;
- Monitoring protocols, including frequency of monitoring, the analytes to be tested, and the adopted assessment criteria to demonstrate that contamination is not being exacerbated; and
- Contingency plans.

The water quality management plan is further discussed in Volume 1 of the EIS.

1 INTRODUCTION

1.1 General

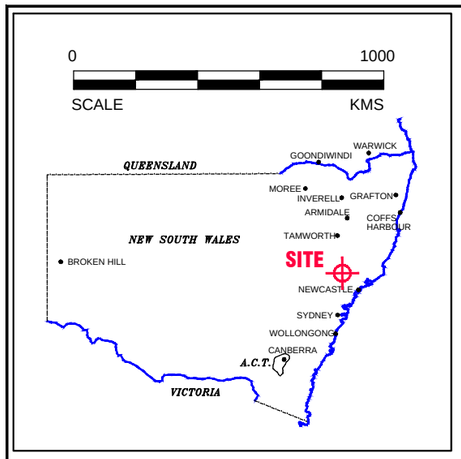
This report presents the findings of a Contamination Assessment (CA), undertaken on behalf of the Upper Hunter Valley Alliance (UHVA), for the proposed relief roads and associated infrastructure at Hexham, NSW. The Proposed Project Area is approximately 39ha in size and is shown on Figure 1.

The Proposed Project will involve the construction of five relief roads (train lines) to the west of the existing Up and Down Main Lines and between the existing Up Coal and new Down Coal Lines. Other components will include construction of new signal infrastructure and earthworks including drainage lines. This CA is part of the Environmental Impact Statement (EIS) that has been prepared for the Proposed Project.

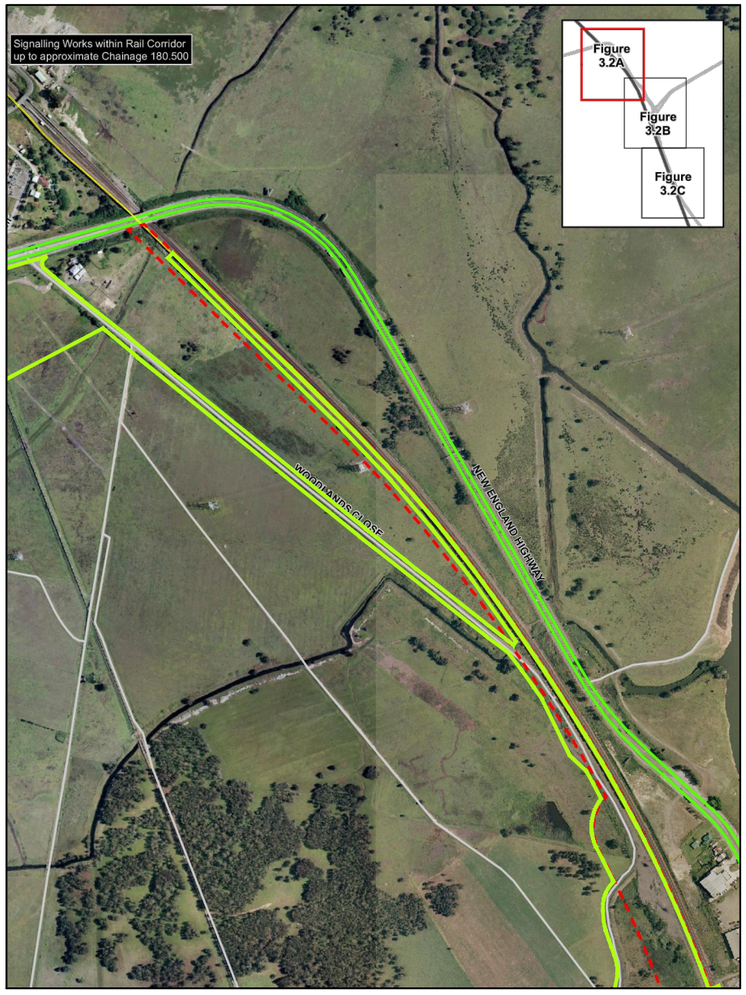
This report has been prepared in accordance with the relevant sections of the following:

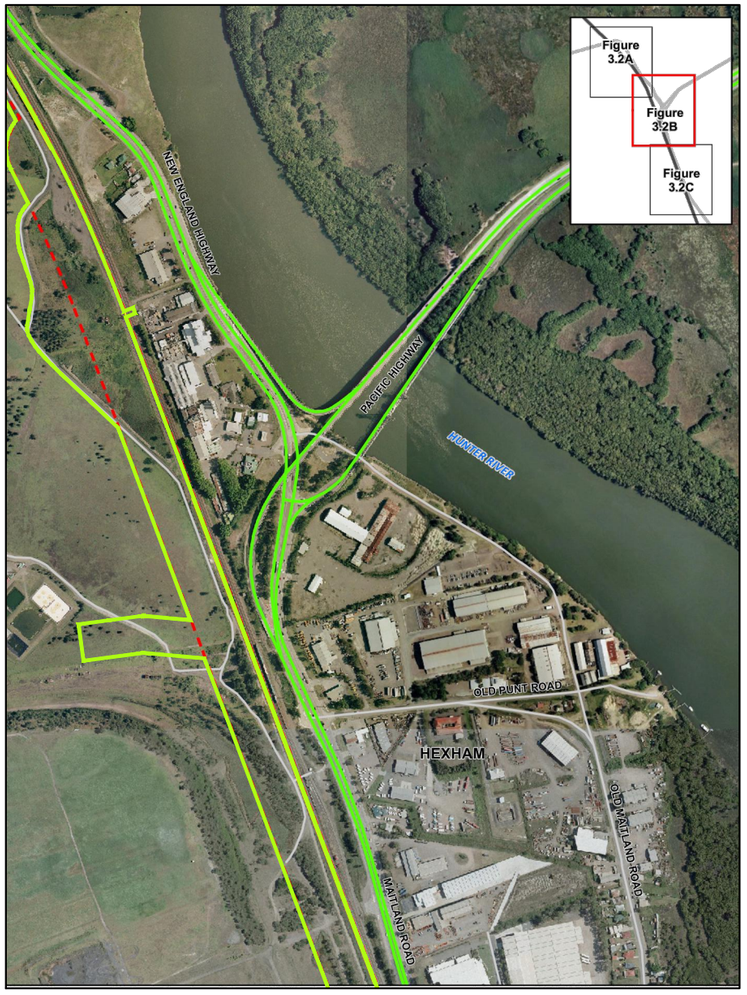
- Contaminated Land Management Act 1997;
- The NSW Office of Environment and Heritage (OEH) (2011) *Guidelines for Consultants Reporting on Contaminated Sites*;
- NSW Department o*f Environment and Conservation (DEC) (2006) Guidelines for the NSW Site Auditor Scheme 2nd edition;*
- NSW Environment Protection Authority (EPA) (1995) *Sampling Design Guidelines*;
- National Environment Protection Council (1999) *National Environment Protection (Assessment of Site Contamination) Measure*;
- NSW Department of Environment, Climate Change and Environment (DECCW) (2009) *Waste Classification Guidelines*; and,
- The respective Director-General's Requirements (DGR's) for the EIS (Reference SSI-4992 dated 14 December 2011);

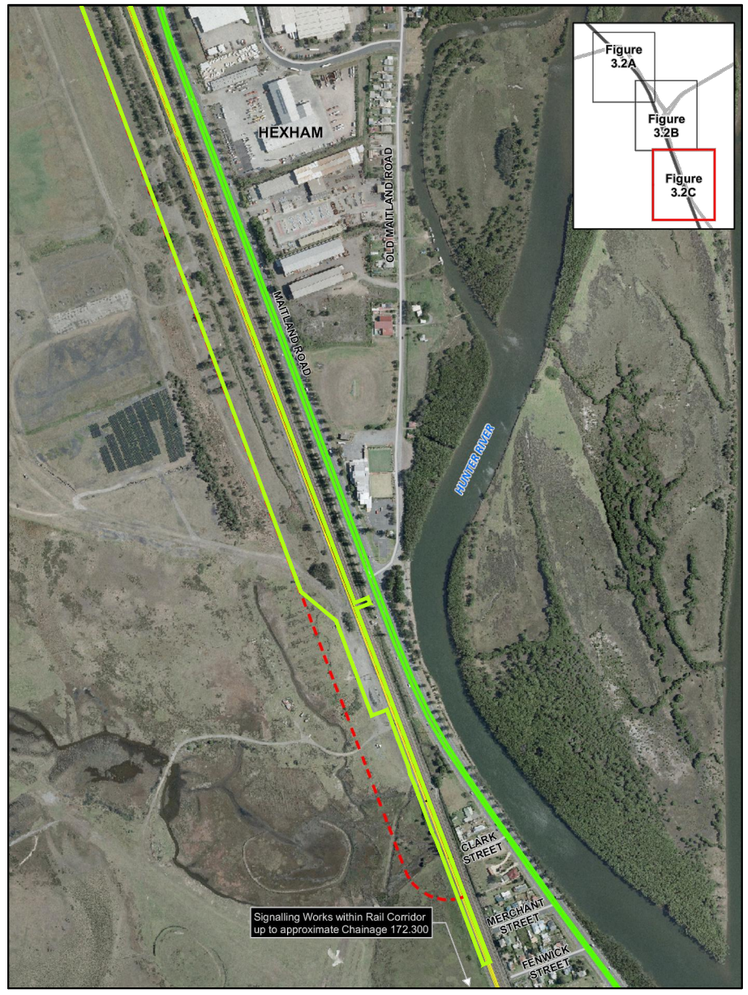
This report must be read in conjunction with the attached sheet entitled *"Important Information About Your Coffey Environmental Report"*, which can be found at the end of this report.



Existing Alignment
Major Road
Local Road
Project Area







UHVA
ARTC

ARTC
Hexham Relief Roads

Proposed Relief Roads

0 100 200 300 400 500
SCALE 1:10000 (A3) METRES

Aerial image source: Google Earth Pro 2012
Aerial image ©: Sinclair Knight Merz 2012
Image source: UHVA ARTC, Proposed Relief Roads 01/06/2011

drawn	CGT
approved	
date	04.07.2012
scale	AS SHOWN
original size	

client: UPPER HUNTER VALLEY ALLIANCE

project: CONTAMINATION ASSESSMENT HEXHAM RELIEF PROJECT

title: SITE LOCALITY PLAN

job no: GEOTWARA21045AC-D03

figure no: FIGURE 1

1.2 Director General's Requirements and Agency Letters

Director-General's Requirements (DGRs) for the EIS were provided in reference SSI-4992 dated 14 December 2011. In addition to the DGRs, several agencies also provided comments.

Director General's Environmental Impact Statement Requirements	**Location Addressed**
DGRs Soil and Land Contamination	
Soil and Land Contamination – including but not limited to:	
Land contamination and identification of the need for remediation of contaminated land, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and future land uses;	Whole report. Section 10 provides information on the need for remediation.
Where remediation of contaminated land is required, presentation of a Remedial Action Plan in accordance with relevant OEH (EPA) guidelines;	An outline remedial action plan (RAP) is presented in Appendix D. A more detailed RAP will be provided when design details for the Project are known.
Geological and soil characteristics (physical and chemical) that may impact on land stability and geological integrity;	EIS Volume 1, Chapter 12 Soils and Geology
Quantification of bulk earthworks and spoil balance and disposal of excess spoil;	EIS Volume 1.
A strategy for managing earthworks with a particular focus on those works that have the greatest potential to disturb soils that are contaminated, have a high erosion and run off hazard;	EIS Volume 1, Chapter 12 Soils and Geology.
Management of waste including handling, stockpiling and transportation, and the classification of waste taking into account the Waste Classification Guidelines (DECCW 2009)	Section 6.2, Section 7.3.2, Section 9.4.2 and Section 11.2. Also refer to EIS Volume 1, Chapter 12 Soils and Geology.

Comments in Agency Letters	**Location Addressed in Report**
NSW Office of Environment & Heritage Letter	
Waste, chemicals and hazardous material and radiation **General waste – and proposal** The EIS should:	
1) Include a detailed plan for in-situ classification of waste material, including the sampling locations and sampling regime that will be employed to classify the waste, particularly with regards to the identification of contamination hotspots.	Section 7
2) Identify, characterise and classify all waste that will be generated onsite through excavation, demolition or construction activities, including quantities of the waste. Note: All waste must be classified in accordance with *OEH's Waste Classification Guidelines.*	Section 9.4.2 and Section 11.2 provide waste classification for the materials sampled. Also refer to EIS Volume 1.
3) Identify, characterise and classify all waste that is proposed to be disposed of to an offsite location, including proposed quantities of the waste and the disposal locations for the waste. This includes waste that is intended for re-use or recycling. Note: All waste must be classified in accordance with *OEH's Waste Classifications Guidelines.*	Section 9.4.2 and Section 11.2 provide waste classification for the materials sampled. Also refer to EIS Volume 1.
4) Include a commitment to retaining all sampling and classification results for the life of the project to demonstrate compliance with *OEH's Waste Classification Guidelines.*	The results of the soil sampling and analysis included in this report will be retained for the life of the project.

Comments in Agency Letters	Location Addressed in Report
5) Provide details of how waste will be handled and managed onsite to minimise pollution, including: a) Stockpile location and management • Labelling of stockpiles for identification, ensuring that all waste is clearly identified and stockpiled separately from other types of material (especially the separation of any contamination and non-contaminated waste). • Proposed height limits for all waste to reduce the potential for dust and odour. • Procedures for minimise the movement of waste around the site and double handling. • Measures to minimise leaching from stockpiles into the surrounding environment such as sediment fencing, geofabric liners etc. b) Erosion, sediment and leachate control including measures to be implemented to minimise erosion, leachate and sediment mobilisation at the site during works. The EIS should show the location of each measure to be implemented. The Proponent should consider measures such as: • Sediment traps • Diversion banks • Sediment fences • Bunds (earth, hay, mulch) • Geofabric liners • Other control measures as appropriate The proponent should also provide details of: • How leachate from stockpile waste material will be kept separate from stormwater runoff; • Treatment of leachate through a wastewater treatment plant (if applicable); and • Any proposed transport and disposal of leachate off-site.	Not included in this report. Refer to EIS Volume 1, Chapter 4 Project Description and Chapter 12 Soils and Geology.
6) Provide details of how the waste will be handled and managed during transport to a lawful facility. If the waste possesses hazardous characteristics, the Proponent much provide details of how the waste will be treated or immobilised to render it suitable for transport and disposal.	Section 11.2.1.
7) Include details of all procedures and protocols to be implemented to ensure that any waste leaving the site is transported and disposed of lawfully and does not pose a risk to human health or the environment.	Section 11.2.1.

Comments in Agency Letters	**Location Addressed in Report**
8) Include a statement demonstrating that the Proponent is aware of OEH's requirements with respect to notification and tracking of waste.	Section 11.2.1.
9) Include a statement demonstrating that the Proponent is aware of legislative requirements for disposal of the waste, including any relevant Resource Recovery Exemptions, as gazetted by OEH from time to time.	Section 11.2.1.
10) Outline contingency plans for any event that affects operations at the site that may result in environmental harm, including: excessive stockpile of waste, volume of leachate generated exceeds the storage capacity available on-site etc.	Refer to EIS Volume 1 Chapter 12 Soils and Geology.
Contaminated sites assessment and remediation	
1) THE EIS should include an assessment of the contaminated site that is conducted in accordance with the guidelines made or approved under section 105 of the *Contaminated Land Management Act 1997, for example: Guidelines for Consultants Reporting on Contamination Sites (EPA, 2000), Guidelines for the NSW Site Auditor Scheme – 2nd edition (DEC, 2006), Sampling Design Guidelines (EPA, 1995), National Environment Protection (Assessment of Site Contamination) Measure 1999* (or update).	Whole report.
2) The EIS should provide the details on how the site contamination will be remediated and/or managed so that the site is, or can be, made suitable for the proposed use.	An outline remedial action plan (RAP) is presented in Appendix D. A more detailed RAP will be provided when design details for the Project are known.
3) All reports should be prepared in accordance with the *Guidelines for Consultants Reporting on Contamination Sites* (EPA, 2000).	Section 1.1.
4) The EIS should specify whether or not a site auditor, accredited under the *Contamination Land Management Act 1997*, has been or will be engaged to issue a site audit statement to certify on the suitability of the current or proposed uses.	No auditor has been engaged at this stage. Department of Planning and Infrastructure would indicate whether or not they require an auditor.

1.3 Project Description

The following project description was obtained from KMH Pty Ltd on 27 February 2012.

The ARTC proposes to develop five Relief Roads (tracks) and associated infrastructure at Hexham in the NSW Hunter Valley (the proposed Project). The proposed Project is located approximately 16km north west of the town of Newcastle.

Key components of the proposed Project comprise:

- Five Up Relief Roads (train lines) to the west of the existing Up Main, Down Main and Up Coal including:
    - The removal of the existing Down Coal (located to the west of the Up Coal);
    - The construction of five new train lines (tracks) for the Relief Roads;
    - The construction of a new Down Coal to the west and outside of the proposed Relief Roads;
    - Each Relief Road to accommodate trains generally comprising two or three locomotives and up to 91 wagons (1,543m long) requiring a minimum standing room of 1,670m; and
    - New turnouts, return curves and associated track changes.
- Installation of new signal infrastructure for the five Relief Roads including signal location cases, huts and gantries.
- Earth and civil works of approximately 265,000 cubic metres, including cut to fill, track formation, drainage and minor structures.
- Ancillary infrastructure including vehicle access tracks, temporary construction compounds and stockpile sites.
- Land acquisition and the upgrading of existing rail infrastructure and public utilities as required.

The estimated cost of the Project is approximately $90million and it is expected to take approximately 18 months to construct.

1.4 Objectives

The objectives of the CA were to:

- Identify potentially contaminating activities that are currently being performed within the Project Area and that may have been performed in the Project Area in the past;
- Assess potential Areas of Environmental Concern (AECs) and Chemicals of Concern (COCs) for the Project Area;
- Assess the soil, groundwater and surface water contamination status of the Project Area through sampling and laboratory analysis;
- Provide an assessment of the suitability of soil and fill to be re-used within the Project Area;
- Provide a preliminary in-situ waste classification of soil and fill that may be disposed to landfill; and
- Provide recommendations for further investigations, remediation and/or management (if required).

1.5 Scope of Works

In order to meet the above objectives, the following scope of works was undertaken:

- Review of previous reports carried out on this site and adjacent sites, including review of Douglas Partners Pty Ltd (DP) (2011) Preliminary Contamination Assessment, Proposed Hexham Redevelopment, Maitland Road and Woodlands Close, Hexham (DP, 2011);
- A site history assessment including a review of historical aerial photographs and land title documents;
- A walkover of the Project Area to assess current site conditions;
- Excavation of 28 test pits and collection of soil samples from the test pits;
- Collection of 37 surface soil samples and 20 rail ballast samples;
- Drilling of 8 hand auger boreholes, and collection of soil samples from boreholes;
- Installation of 10 groundwater wells (CMW1 – CMW10), and collection of 12 groundwater samples from newly installed wells and two wells previously installed by Douglas Partners (101 and 109);
- Collection of 20 surface water samples (CSW1 – CSW20);
- Laboratory analysis of selected soil, ballast, groundwater and surface water samples for a suite of potential COCs; and
- Data assessment and preparation of this CA report.

2 PROJECT AREA DESCRIPTION

The information in the following sections has been sourced from the following documents:

- UHVA (2011) *Proposed Hexham Relief Roads, Hexham, Preliminary Desktop Study Geotechnical Assessment* (Reference GEOTWARA21045AC-AA.Hexham Relief Roads dated 15 April 2011);
- NSW National Parks and Wildlife Service (1998) Kooragang Nature Reserve and Hexham Swamp Nature Reserve Plan of Management (August 1998);
- Published topographical and geological maps.

2.1 Project Area Location and Identification

The Project Area is situated between 173.800km and 177.600km on and adjacent to (west of) the Main North Line at Hexham, NSW. The location of the Project Area is shown on Figure 1.

The Project Area covers an area approximately 39ha. The Project Area was bounded by rural allotments to the west and by commercial and light industrial allotments to the east. Hexham Swamp is located to the south of the Project Area. The eastern side of the Project Area has been used as a railway corridor for about 150 years (Wylie, 1957).

The Project Area occupies part of a number of large lots, as listed below in Table 1.

TABLE 1 – SITE IDENTIFICATION DETAILS

Lot 100 DP 1044020	Lot 12 DP 1075150	Lot 312 DP 583724
Lot 104 DP 1084709	Lot 1 DP 1062240	Lot 1 DP 90465
Lot 1 DP 1036152	Lot 311 DP583724	Lot 1 DP 126319
Lot 113 DP 755232	Lot 1 DP 581577	

2.2 Site Topography and Drainage

Reference to the Newcastle 1:100,000 Topographic Map indicates that the regional topography consists of broad, generally flat, low lying floodplains which appear to receive tidal flows from the Hunter River via a number of creeks. The Hexham wetlands are located generally below 5.0m AHD though imported fill mounds may be encountered above this height.

Based on field observations, the tracks and adjacent land appear to be positioned on a 1 to 2m thick layer of fill, over deep estuarine and alluvial deposits associated with the Hunter River to the east and Hexham Swamp to the west and south.

Natural drainage across the Project Area has been disrupted by the placement of the rail corridor and fill and the historical industrialisation of the western portion of Hexham Wetland. Drainage of the Hexham wetland principally occurs through Iron Bark Creek which discharges to the Hunter River about 2km to the south of the Project Area. Recently tidal gates have been removed from near the confluence of the creek and the Hunter River. In the north of the Project Area, there is also some surface water flow to the east through a series of manmade drains which direct surface water under Woodlands Close, the existing rail corridor and the Pacific Highway before discharging to the Hunter River.

Drainage within the existing rail corridor is likely to occur through either land infiltration into the surface soils or via the several drainage lines and culverts constructed along the railway corridor that shed water both to the east (Hunter River) and the west (Hexham Wetland and Ironbark Creek).

2.3 Soils and Geology

Reference to the 1:250,000 scale Newcastle Geological Map indicates that the Project Area is underlain by Quaternary deposits of gravel, sand, silt and clay. These are judged to be Estuarine/Alluvial soils associated with the flood plains of the Hunter River and the Hexham Wetland.

Within the Project Area, the subsurface conditions are broadly anticipated to comprise:

- Fill, predominately comprising coal reject and rail ballast to depths of 1 to 2m, overlying;
- Estuarine/Alluvial Soils, typically comprising deep deposits of clay, silt and sand and gravel associated with sedimentary deposition from the Hunter River to depths of about 20 to 40m, overlying; and
- Weathered Sedimentary Rock – Typically Interbedded Sandstone, Siltstone, Tuff, and Mudstone.

2.3.1 Acid Sulfate Soils

Reference to the NSW DECC (2008) Acid Sulfate Soils Risk Map for the Lower Hunter indicates that the Project Area is judged to be located within an area described as having a high probability of acid sulfate soils (ASS) within 1m of the ground surface. The Project Area is indicated to be in an alluvial plain setting with ground surface levels of between 1m and 2m AHD. Possible on-site activities such as excavations have the potential to expose the estuarine soils with a high probability of being potential ASS.

ASS testing was carried out as part of the geotechnical investigation and will be reported separately in report GEOTWARA21045AC-AL. The testing carried out comprised a field screening test on 33 samples, and chromium reducible sulfur (S_{CR}) testing on 19 samples. Each sample tested was alluvial or estuarine, with the exception of one sample of fill material.

The results showed:

- pH in water ranged from 5.77 to 8.55;
- pH in hydrogen peroxide solution ranged from 1.79 to 6.19;
- Total actual acidity (TAA) ranged from <5 to 84 mole H^+/tonne;
- Chromium reducible sulfur (S_{CR}) ranged from <0.005 to 1.8%; and
- Net Acidity ranged from <5 to 970 mole H^+/tonne.

The majority of the results indicated that the alluvial/estuarine soils are potential ASS. The results were variable, and it was impractical to define particular layers, areas or materials types that were, or weren't, ASS.

Based on this, Coffey consider that the alluvial/estuarine soils should be treated as potential ASS. The potential ASS will require management during construction, particularly in areas where excavations are planned, or where the water table will be lowered by dewatering.

Management measures are included in EIS Volume 1 Chapter 12 Soils and Geology.

2.4 Hydrogeology and Local Groundwater Usage

Similar to the surface water, groundwater characteristics such as standing water level flow direction, seepage velocity and hydraulic conductivity have been disrupted by the placement of the rail corridor and fill and the historical industrialisation of the eastern portion of Hexham Wetland.

It is expected that groundwater would be encountered at a depth of 0.5m and 1.5m beneath the current surface level of the Project Area. Groundwater may also be encountered within fill mounds above the surrounding natural surface. Groundwater levels were measured on the Project Area between 0.65m to 1.5m below ground surface (bgs) during drilling of the monitoring wells in February 2012.

Groundwater conditions are also likely to be affected by tidal influences and will fluctuate seasonally due to periods of increased rainfall, temperature and other seasonal factors. It is noted that the area is prone to flooding during extreme and/or prolonged rainfall events.

Current groundwater flow is anticipated to be multi-directional depending on the amount of fill present and the proximity of discharge zones. There is likely to be a component of flow to the east towards the Hunter River and also west and south towards the Hexham Wetland.

Salinity of the groundwater would be variable depending on tidal effects and rainfall. It is anticipated that regional groundwater would be used mainly for domestic and industrial purposes, and is unlikely to be used for drinking water or irrigation. DP (2011) indicated that salinity varied, with water generally fresh to brackish.

3 PREVIOUS ASSESSMENTS

3.1 Douglas Partners Pty Ltd (DP) (2011) Preliminary Contamination Assessment, Proposed Hexham Redevelopment

DP were engaged by QR National (the freight division of Queensland Rail Ltd), to carry out a preliminary contamination assessment (PCA) for a proposed Train Support Facility, Industrial Subdivision and Intermodal Freight Facility at Woodlands Close, Hexham (ref: 39798.04, August 2011).

DP initially prepared a PCA in 2008. In 2011 DP updated the 2008 PCA, and included information from an environmental site assessment report prepared by Environmental Resource Management Australia Pty Ltd (ERM).

The area the PCA covered was approximately 250ha and comprised:

Lot 101, Lot 102 and Lot 104 DP1084709	Lot 1 DP 155530
Lot 2 735456	Lot 12 DP 1075150
Lot 10 DP 735235	Lot 1 DP 1062240
Lot 104 DP 1074709	Lot 311 DP583724
Lot 113 DP 755232	

The Project Area (the subject of this report) is located along the northern boundary of the area covered by the PCA, including parts of Lot 104 DP 1084709, Lot 113 DP 755232, Lot 12 DP 1075150, Lot 1 DP 1062240, and Lot 311 DP 583724.

This summary of the PCA report includes information which is considered relevant to the Project Area.

3.1.1 DP Site History Information

DP conducted the following site history searches:

- Review of literature and former site survey plans;
- Searches with Newcastle City Council;
- Review of historical aerial photographs;
- Searches with NSW Department of Environment and Climate Change (DECC – currently NSW Office of Environment and Heritage (OEH));
- Search of nearby registered groundwater bores through NSW Office of Water;
- WorkCover Dangerous Goods Register Search; and
- Discussions with Dairy Farmers Employee (Mr Paul Alford).

Historical information from the DP report of relevance to the Project Area, and not presented in the Site History Assessment (Section 4), has been summarised below.

Council Records

The Council records indicated that a heritage item, Minmi-Hexham Railway Line is situated on Lot 311 and Lot 12. The Council land development records indicate Lot 311 and Lot 12 may have been used for a waste emplacement facility in association with coal washery operations.

The Council records also indicated that Lot 113 was previously used for effluent treatment purposes.

Literature Review

DP reviewed '*Coal, Railways and Mines, The Story of the Railways and Collieries of J & A Brown*' by Brian Robert Andrews, Iron Horse Press, 2004, 2nd edition 2007. The former Minmi Hexham Railway embankment and the remaining stockpiles associated with the Hexham Coal Preparation Plant impact on the Project Area from Chainage 174.000km to Chainage 175.700km.

The following is a brief summary of the historical information relevant to the Project Area:

- Minmi-Hexham Railway construction commenced in 1853;
- Construction required large amounts of fill to make embankments across the swamp. The fill was sourced from a borrow area about 2 miles from Minmi, a location now known as the "Sand Cutting";
- The railway was constructed by laying brushes and logs on the swamp, which were then covered with suitable material for the formation of the railway;
- In the mid-1850's a coke works was constructed at Minmi, producing approximately 10 tonnes of coke per week, which was transported to Hexham for shipment (this is located outside of the Project Area);
- In 1859 the Great Northern Railway and Minmi-Hexham Railway were connected with two sidings and a run-around loop. By 1900 Colliery Siding (became Browns Siding) consisted of seven sidings and one loop. The Hexham Staithe and Workshop area (east of the DP site) consisted of engineers and carpenters workshops and two loading chutes (these are located outside of the Project Area);
- A plan dated 1890 indicated that there were cottages between the rail siding and Minmi-Hexham Railway;
- In 1909 a second rail line between Hexham and Minmi was constructed;
- A ninth siding was constructed in 1949 and used to access the Hexham Coal Preparation Plant;
- During the 1960's three sidings were constructed (Nos 9-11) to store trains of unwashed coal in transit to the Coal Preparation Plant;
- In 1942 work commenced on a locomotive shed to the west of the Great Northern Railway. The locomotive sheds included ash pits;
- A Bathhouse was constructed adjacent to the control cabin in 1949 (this is located outside of the Project Area);
- A crushing and sizing plant was constructed on the northern side of the sidings and operated between 1936 and 1955. A dump hopper was present below rail level on the first loop. The coal was fed by a plate feeder to a crusher and then onto a conveyor belt through to an overhead building that spanned three rail lines to facilitate loading onto rail wagons.

Hexham Coal Preparation Plant:

- Construction of the Hexham Coal Preparation Plan commenced in 1953 and began operating in 1955. The site was filled with stone and shale from collieries and from Richmond Vale Colliery for the formation of the rail sidings associated with the plant (the Coal Preparation Plant was partially located within the Project Area);
- Wagons of unwashed coal were dumped into a below rail level hopper, and taken to the plant for washing. The washing consisted of passing coal over a 'medium bath denser than coal but lighter than the stone and shale'. The stone and shale falls to the bottom and is collected as reject;
- Between 1957 and 1962 a stacking and reclaim system was constructed, comprising an elevated conveyor belt and a conveyor belt fitted in an underground tunnel below the stockpile;
- A rail crossing was constructed on the up-side of Hexham Signal box (i.e. north of Hexham Station) in 1963 (this was located outside of the Project Area);
- In 1972, the Coal and Allied Balloon Loop Siding was constructed. The area was filled with reject from the Coal Preparation Plant (this was located outside of the Project Area);
- A loading bin and conveyor were constructed along the railways depicted in a 1988 site photograph (not viewed by Coffey) (this was located outside of the Project Area);
- In the mid-1980's a conveyor system was constructed from the Coal Preparation Plant to allow coal to be road-hauled and fed into the plant using loaders (this was located outside of the Project Area);
- The Hexham Coal Preparation Plan closed in 1988.

Historical Site Plan

DP reviewed a site plan "Coal and Allied Operation Pty Limited, Hexham Coal Preparation Plant", dated March 1981. It is noted that the copy of the plan provided in DP's report is largely illegible. The plan showed the following site infrastructure:

- The Coal Preparation Plant with a number of buildings to the east and south, including an Electrical Installation Building (this is partially located on the Project Area);
- An overhead conveyor from the Coal Preparation Plant to the Coal Stockpile area (west) (this is not located on the Project Area);
- A refuelling area with three fuel storage tanks and two bowsers (this is not located on the Project Area). The refuelling area was located about 90m west of the Project Area;
- The Balloon Railway Loop with conveyor (this is not located on the Project Area);
- A loader which is depicted east of the Bathhouse (the Bathhouse is not located on the Project Area).

3.1.2 DP Field Investigations

DP excavated 66 test pits (Pit 110 to Pit 165) and drilled nine boreholes (101 to 109) in April 2008. Groundwater wells were installed in each of the nine boreholes. Eleven surface water samples were also collected. The investigation locations were based a combination of systematic and judgemental sampling pattern to investigate potential sources of contamination identified in the site history assessment.

In addition, DP also utilised four existing groundwater wells (2, 3, 5 and 7) that were installed in a previous investigation on the site.

ERM installed ten groundwater wells (MW01 to MW10) within the DP site area in 2010. Coffey has not viewed the ERM report, and has relied on information provided by DP regarding the ERM investigation.

In 2011, DP screened ponded surface water in ten locations (SW301 to SW310) for pH and electrical conductivity.

Of the locations investigated by DP and ERM, the following are located on or very close to the Project Area:

Investigation Type	**Location ID**
Test Pits	Pit 121, Pit 122, Pit 125 to Pit 128, Pit 131 to Pit 134, Pit 136, Pit 136A, Pit 140, Pit 142 to Pit 145, Pit 149, Pit 154 to Pit 157, Pit 162 to Pit 164, and Pit 166 to Pit 169.
Surface Water	SW201, SW202, SW207, SW208, SW210 and SW211
Groundwater Wells	5, 101, 107, and 109.

The above locations have been included on the Sampling Location Plans (Figures 3A to 3D).

During test pitting, DP observed the following potential contaminant sources in the test pits:

Potential Contaminant Observation	**Test Pit and Depth**
Building rubble, fill inclusions	Pit 127 0.9-1.2, trace brick fragments Pit 132A 0.0-0.2m, fill with trace terracotta tiles Pit 136 0.0-0.2m and 136A 0.0-0.6m, trace scrap metal Pit 142 0.15-0.3m, large concrete fragment Pit 145 0.6-0.9m, trace bricks Pit 149 0.9-0.95m, trace timber and brick fragments Pit 157 0.4m, scrap metal
Slight hydrocarbon odour	Pit 128 0.0-1.5m, hydrocarbon odour, located within footprint of former abandoned fuel tank Pit 131 0.7-0.9m, hydrocarbon odour around broken terracotta pipe
Rail Infrastructure	Pit 127 0.0-0.5m, rail sleepers
Ash materials	Pit 140 0.0-1.2, fill some ash Pit 155 0.0-0.25m, fill with ash Pit 157 0.65-0.85, fill with some ash Pit 163 0.0-0.5m, fill with trace ash Pit 164 0.35-0.45m, fill with some ash
Staining	Pit 126 0.7m, fill material stained green

3.1.3 DP Laboratory Testing Results

Soil

Metals, PAH, OCPs, OPPs and PCBs were below commercial/industrial land use criteria in the soil samples tested. Asbestos was not detected in the samples tested that are relevant to the Project Area.

Concentrations of TPH C10-C36 were above the adopted criteria in soil samples BH101 0.8-1.0m, BH109 0.0-0.1m, TP128 0.0-0.05m, and TP131 0.9m.

DP noted that the elevated concentrations of TPH C10-C36 were within fill materials including coal reject. TP128, with the highest TPH concentration, was within the footprint of former abandoned fuel tanks.

Water

Groundwater and surface water samples generally showed concentrations below adopted criteria, with the exception of total nitrogen, total phosphorous, faecal coliforms, and metals (cadmium, chromium, copper, iron, nickel and zinc).

DP considered the elevated nitrogen, phosphorous and faecal coliform results to be associated with effluent irrigation in the northern portion of their site. DP indicated that the elevated metals may be associated with effluent irrigation, or leached from fill material located throughout the site. DP also noted that elevated concentrations of metals are common in developed areas, and the concentrations recorded were comparable to concentrations recorded by DP in the surrounding area in other investigations.

4 SITE HISTORY ASSESSMENT

A site history assessment was undertaken as part of the CA, and included:

- A review of historical ownership of six lots on the Project Area;
- A review of aerial photography from the past 50 to 60 years; and
- A review of NSW OEH notices applying to the Project Area and nearby properties.

The information provided from the above review is summarised in the sections below.

4.1 History of Industrialisation in Hexham

Generally early European use of the Hexham Swamp area revolved around agriculture, including dairying, cattle grazing, cropping and the raising of horses. The agricultural land use resulted in the clearing of the native forests surrounding the Hexham Swamp during the 1800's. The swamp itself however, remained relatively intact.

From the turn of the twentieth century up until the late 1950's there were a number of developments around and within the Hexham Swamp including the Minmi-Hexham Railway, the Great Northern Railway and the Hunter Water Corporation pipeline. The Oak milk processing factory was built at Hexham during 1926-27, and the Coal and Allied Industries' coal dump and washing facilities were established near Hexham during the 1970's.

The first section of the Main North Line was built from the port of Newcastle to Victoria Street, Maitland in 1857 (Wylie, 1957).

4.2 Historical Titles Search

There are several lots associated with the Project Area, and numerous lots associated with industrial land uses to the east of the Project Area (see Section 4.1 for a history of industrialisation within Hexham Wetlands).

Land title documents were obtained from Advanced Legal Searchers Pty Ltd for six lots:

- Lot 100 DP 1044020;
- Lot 113 DP 755232;
- Lot 3 DP 854055
- Lot 1 DP 832660;
- Lot 1 DP 1062240; and
- Lot 311 DP 583724.

A summary of the former owner's or owner's occupations is provided in Table 2 below. The title documents can be provided upon request.

TABLE 2 - SUMMARY OF FORMER LAND OWNERSHIP

Lot and DP Number	Year	Ownership
Lot 100 DP 1044020	1922 - 1971	Graziers, farmers
	1971 - 1985	New England Minerals Industries Pty Ltd Peter R Harris & Co Pty Ltd Dovedale Pty Ltd
	1985 - 2009	Max Lynch Motor Vehicle Repairs Pty Limited
	2009 – to date	Helen Lynch-Foster
Lot 113 DP 755232	Prior to 1970	Crown Land
	1970 – 1979	Grazier
	1979 – 1993	R.W. Miller & Co Pty Ltd
	1993 – 2008	Australian Co-Operative Foods Limited
	2008 – to date	QR Limited
	2010 – to date	*Lease to Dairy Farmers Ltd*
Lot 3 DP 854055 and Lot 1 DP 832660	1856 - 1856	Innkeeper
	1856 - 1995	The Commissioners for Railways
	1995 – to date	Ronal William Harris (no occupation listed)
Lot 1 DP 1062240	1913/1916	Releasors and Trustees
	1912/1916 - 2003	Chief Commission for Railways and Tramways
	2003 – to date	State Rail Authority of NSW

Lot and DP Number	Year	Ownership
Lot 311 DP 583724	1920 - 1927	Grazier
	1927 – 1945	Executors
	1945 – 1975	Hotelkeeper J & A Brown & Abermain Seaham Collieries Limited
	1975 - 1976	The Commercial Banking Company of Sydney Limited J & A Brown & Abermain Seaham Collieries Limited
	1976 - 1993	J & A Brown & Abermain Seaham Collieries Limited
	1993 - 1997	Coal & Allied Operations Pty Ltd
	1997 - 2006	Newcastle Rail Terminals Pty Limited
	2006 - 2006	Domaine Property Funds Limited
	2006 – to date	Queensland Rail

4.3 Aerial Photography Review

A selection of historical aerial photographs of the Project Area for the years 1954, 1966, 1975, 1984, and 1992 were obtained from the NSW Land and Property Management Authority. An aerial photo image of the Project Area was also viewed on Google Earth for the year 2009. A summary of the Project Area in the aerial photography is presented in Table 3 below.

TABLE 3 - HISTORICAL AERIAL PHOTOGRAPHS

YEAR	PROJECT AREA	SURROUNDING LAND
1954	The Main Northern Railway corridor is present on the eastern side of the Project Area, and the Minmi-Hexham Railway runs parallel to the Main Northern Railway in the southern part of the Project Area, before heading towards the west at about chainage 175.7km to 175.9km. Woodlands Close is present in the northern part of the Project Area. What appears to be rail siding is present near where Woodlands Close and the rail corridor meet. A dam is present to the south of this. What appeared to be three buildings are present to the east of the dam. A building is present further south of the dam, and may be linked by railway to the rail sidings observed to the north of the dam. The Hexham Coal Preparation Plant and associated railway appears to be under construction. The plant is at about chainage 174.7km to 174.9km. The remainder of the Project Area to the south appears to be generally undeveloped, with the exception of about four buildings. Watercourses appear to run through this area, towards Hexham Swamp to the south of the Project Area.	East of the railway corridor, surrounding land is generally rural. Around the Pacific Highway bridge over the Hunter River, the land use appears to be industrial / commercial, and includes the Oak Milk Factory. A conveyor belt is present going from the rail corridor to the Hunter River, adjacent to the dam in the northern part of the Project Area. To the west the land is generally rural.
1966	The Project Area is similar to 1954, with the exception of the railway line associated with the Coal Preparation Plant which has been constructed. There appear to be stockpiled materials to the south and west of the Minmi-Hexham railway and west of the Main Northern Line railway. These stockpiles appear to be coal adjacent to the coal preparation plant. To the north-west of the coal preparation plant, the stockpiles may be of dredged material, or a tailings area for coal fines.	Surrounding land is similar to 1954, with the exception of the land to the east of the railway corridor becoming more developed, with new roads and buildings.
1975	The Project Area is similar to 1966, with the exception that the stockpiles of potentially dredged material or coal fines tailings have been replaced with stockpiles of coal. The water dam in the northern part of the Project Area is also smaller.	Surrounding land is similar to 1966 with some additional industrial development. The New England Highway is present in a similar location as currently. The Coal and Allied Balloon Rail Loop is also present within the coal stockpiling

YEAR	PROJECT AREA	SURROUNDING LAND
		area. This is located to the west of the Project Area.
1984	New power line stanchions are present running east-west across the northern portion of the Project Area. The rail siding in the northern portion of the Project Area is no longer present, although the former location of it is visible. The buildings to the east of the dam are no longer present. There are more coal stockpiles than in 1975, located in a similar location. In the southern portion of the Project Area there appears to be a disturbed area, and there may be more buildings in this area. A small dam also appears to be present.	Surrounding land is similar to 1975.
1992	There are no coal stockpiles. Most of the buildings have been removed, with the exception of a few near the railway around the former coal stockpiles, and some small structures in the southern portion of the Project Area.	Surrounding land is similar to 1984 and today.
2009	The Project Area is similar to 1992. There is less surface expression of the former railways and coal stockpile areas.	Surrounding land is similar to 1992. A sewage treatment plant is present to the west of the northern portion of the Project Area.

4.4 Project Area Observations

The following Project Area observations are based on the geotechnical desktop study and the Project Area walkover undertaken on 2 September 2011 and 12 to 20 December 2011.

- The existing railway corridor includes four tracks; the Up and Down Main lines on the up (eastern) side and the Up and Down Coal lines on the down (western) side. Railway embankments typically vary from about 1m to 1.5m in height (Photograph 1).

Photograph 1: Railway corridor.

- The Project Area is located on a broad generally flat low lying flood plain associated with the Hunter River and Hexham Wetlands, and is bounded by rural farm land on the south west side of the track and a main highway and industrial buildings on the north east side of the track. The existing four tracks are generally level and are aligned in a north west to south east direction. It is understood that the Project Area is subject to flooding during heavy rainfall events.
- From southeast to northwest along the track, the infrastructure within the track area includes one culvert at 173.930km. The culvert comprises a reinforced concrete box culvert passing beneath the four rail lines, which is understood to be 2.4m wide and 1.57m high, and was widened on the down side in 2009 using driven timber pile foundations. The culvert appeared to allow tidal flows from the Hunter River to enter the area west of the railway. Other developments on the down side include an access track and private access to a number of small industrial developments such as hardstand areas.
- The Hexham Railway platform is located at approximately 175.530km. A former rail siding was located in the vicinity of 175.4km.
- On the western side of the Project Area, there are two access tracks, running generally parallel to each other in a north-south direction. The tracks are paved with gravel in some areas. Water was observed to pond on the tracks in many locations.
- For a long section of the Project Area, 174.200km to 175.900km, a fill embankment about 1m to 2m high is present between the two tracks (likely associated with the former Minmi-Hexham Railway).

The embankment is overgrown in many locations. Where the embankment material is visible it appears to comprise rail ballast and coal washery reject (Photograph 2).

Photograph 2: Stockpiles of fill.

- An area with concrete slabs and bitumen paved areas from former buildings is present on the eastern side of the site, adjacent to approximately 173.725km to 174.865. Some potential asbestos containing material (PACM) fragments were observed in this area (Photograph 3 and 4).

Photograph 3: Area of former buildings, likely associated with the Hexham Coal Preparation Plant

Photograph 4: Area of former buildings, likely associated with the Hexham Coal Preparation Plant

- At the northern end of the Project Area, 176.500km to 176.650km, a compound is present, which at the time of the site visit contained stockpiles of gravel and rail ballast, and concrete sleepers. No machinery or vehicles were observed within the compound (Photograph 5).

Photograph 5: Compound Area in northern portion of Project Area

- At the southern end of the Project Area, 174.030km to 174.200km, a gravelled area was present, with some small stockpiles of gravel, a few concrete items and rusted railway track (Photograph 6).

Photograph 6: Gravelled area at southern end of Project Area

- Several stockpiles of waste materials dumped by the general public are present on the western side of the site. These included concrete, tyres, fibrous sheeting, metal items, and timber (Photographs 7 and 8).

Photograph 7: Illegally dumped waste materials

Photograph 8: Illegally dumped waste materials

- Several groundwater well monuments were observed in the Project Area. It is assumed these were installed for the Queensland Rail studies (Photograph 9).

Photograph 9: Groundwater well monument

- A high pressure gas main crosses the Project Area at about 175.850km. The gas main is marked with warning signs.
- Two dilapidated buildings are present adjacent to the Project Area, near the high pressure gas main. Fragments of potential asbestos containing material were present around the buildings (Photograph 10).

Photograph 10: Dilapidated building near high pressure gas main

- Vegetation within the railway corridor was generally limited to scattered weeds.
- Established grass cover and stands of trees are present in the western side of the Project Area. Vegetation within the adjacent floodplain area to the south west comprises grasses and stands of woody shrubs and trees.

4.5 NSW OEH Records

A search of NSW OEH notices issued under the Contaminated Land Management Act (1997) revealed two properties in the general Hexham area listed as having notices.

One property is located at Lot 28 Sparke Street, about 1.2km south of the Project Area, and the other property is located at 64 Old Maitland Road, about 0.5km west of the Project Area. Based on the distance from the Project Area it is not expected that these properties would affect the Project Area.

A copy of the search results can be provided upon request.

4.6 Summary of Site History

The information obtained from the site history review has been summarised below:

- It appears that the rail corridor has been present on the eastern portion of the Project Area for about 150 years. The existing railway lines are situated on ballast up to approximately 1.5m above the natural ground surface level;
- The northern portion of Lot 100 DP 1044020 currently appears to be used for rural residential purposes. Based on information from the titles search it has likely been used for dairy cattle grazing, and motor vehicle repairs in the past;
- Parts of Lot 113 have been used for effluent treatment purposes, and effluent irrigation occurs on Lot 113. This lot has a common boundary with the Project Area from about chainage 175.900km to chainage 176.500km;

- The western portion of the Project Area (non-railway corridor) appears to have been used for dairy cattle grazing in the past. The majority of the Project Area is currently undeveloped, and still used for cattle grazing. Some former buildings were present in scatter locations on the Project Area;
- The southern-middle part of the Project Area, Lot 311 DP 583724, appears to have been used for farming (dairy cattle grazing) prior to 1966 to1975. In about 1955, the Hexham Coal Preparation Plant was constructed on Lot 311. The Coal Preparation Plant operated until 1988.
- The Hexham Coal Preparation Plant included several buildings, many of which were partially located on the Project Area. The remnants of the buildings are present on and adjacent to the Project Area. An area where former abandoned fuel tanks were used is located on the Project Area, at about chainage 174.785km. Stockpiling of coal was associated with the Coal Preparation Plant, generally to the west of the Project Area;
- Waste materials appear to be illegally dumped in the Project Area by the general public from time to time. These materials may include waste hazardous building materials (i.e. asbestos);
- The surrounding land uses over the last 50 years appear to be a combination of vacant land, residential properties and commercial/industrial businesses;
- There are two existing properties in the Hexham area, about 0.5km and 1.2km distance from the Project Area, listed by the NSW OEH as having contamination notices, though it is considered that these properties are unlikely to have an influence on the Project Area.
- Surface water drainage and groundwater flow has been altered by the placement of the rail corridor and fill and the historical industrialisation of the eastern portion of Hexham Wetland; and
- The timing of the fill placement on the Project Area is not known. Based on the past uses of the Project Area, it is likely the majority of the fill was placed during the use of the Project Area for the Hexham-Minmi Railway (about 1850's), and coal processing and stockpiling (about 1950's to 1980's).

5 POTENTIAL AREAS AND CHEMICALS OF ENVIRONMENTAL CONCERN

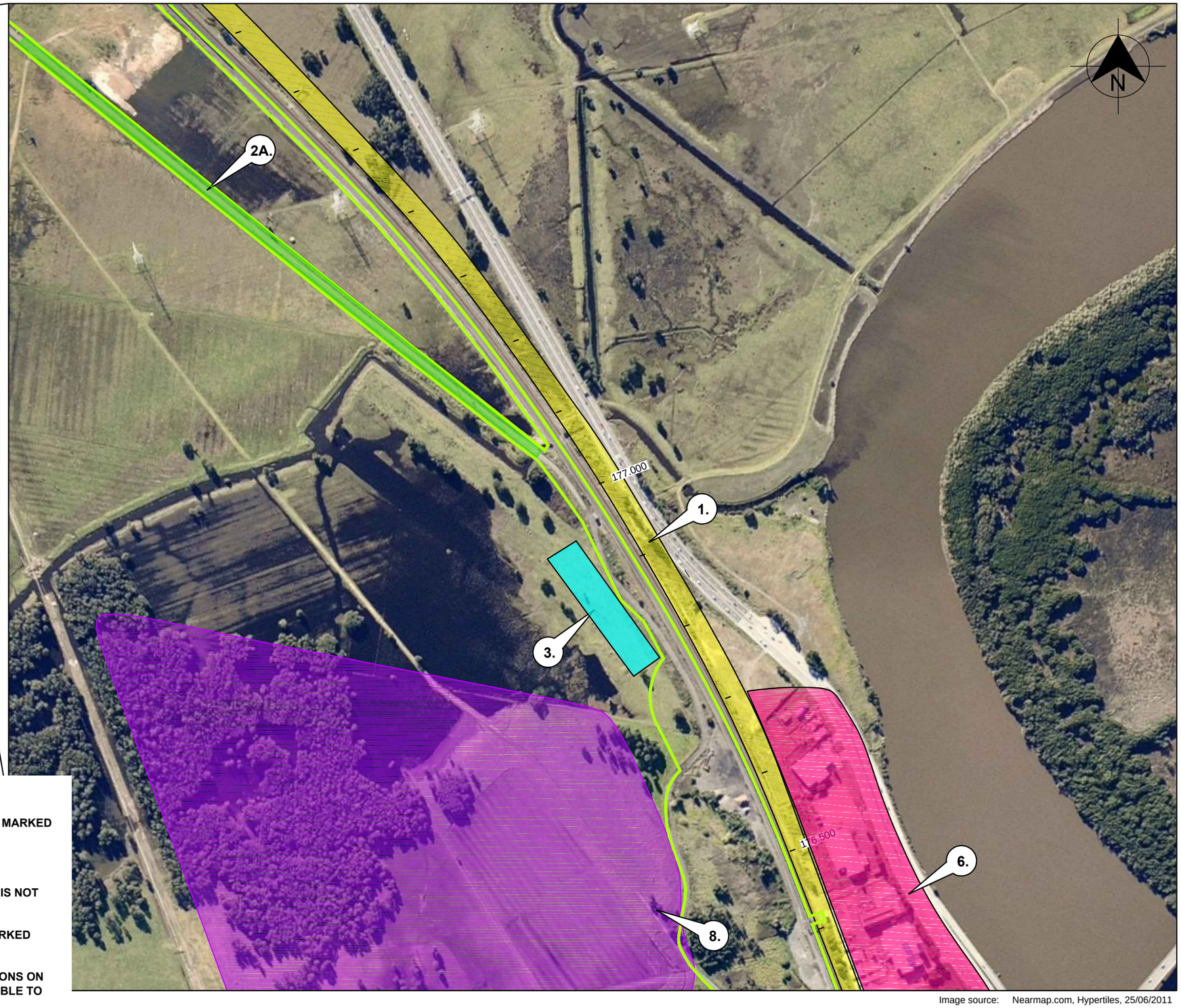
Based on the site history review and the Project Area walkover, the potential AECs and COCs identified for the Project Area are presented below in Table 4. Figures 2A to 2D show the location of the AECs.

TABLE 4 – POTENTIAL AECS AND COCS

AEC	POTENTIAL CONTAMINATING ACTIVITY	POTENTIAL COCS	LIKELIHOOD OF CONTAMINATION*	COMMENT
1. Rail Ballast	Importation of rail ballast from unknown sources. Fouling of rail ballast by rail use	PAH, asbestos	Low	
2. Fill Materials, including former rail embankments	Importation of fill materials from unknown sources	TPH, BTEX, PAHs, OCPs, PCBs, Metals, Asbestos	Low-medium	Fill materials including rail ballast, coal reject, and roadbase materials for access roads and compounds/open storage areas
2A. Northern end of Woodlands Close	Imported fill materials for access road construction	TPH, BTEX, PAHs, OCPs, PCBs, Metals, Asbestos	Low-medium	
3. Former and Existing Building Areas	Potential asbestos and lead paint usage in building construction	Asbestos, Lead, OCPs	Low-medium	Former and Existing Buildings: Coal Preparation Plant on Lot 311 DP 583724 and Lot 1 DP 1062240 . Lot 104 DP 1084709 (next to former dam 1954 to 1975 photos). Dilapidated building near high pressure gas main.

AEC	POTENTIAL CONTAMINATING ACTIVITY	POTENTIAL COCS	LIKELIHOOD OF CONTAMINATION*	COMMENT
4. Former Abandoned Fuel Tanks	Leaks and spills of fuels and oils	TPH, BTEX, PAH, Lead	High	Within the former Coal Preparation Plant area, approximately chainage 174.785km It is not known whether the tanks were stored above ground or below ground. The area appears to contain a backfilled excavation, indicating the tanks were likely stored below ground.
5. Historical Rail Use	Potential leakages of fuels and oils onto the ballast	TPH, BTEX, PAH, Lead	Medium-high	Potential risk due to the high usage of the rail lines over at least the last 50 years
6. Adjacent Industrial Land Use	Land surrounding the Project Area has been used for industrial purposes. Contamination on industrial properties may have migrated via groundwater onto the Project Area.	TPH, BTEX, PAHs, OCPs, PCBs, Metals, Asbestos	Medium-high	
7. Groundwater	Groundwater and surface water may have been contaminated by former industrial land uses, and placement of fill material, on and surrounding the Project Area.	TPH, BTEX, PAHs, OCPs, PCBs, Metals, faecal coliforms	Medium-high	

AEC	POTENTIAL CONTAMINATING ACTIVITY	POTENTIAL COCS	LIKELIHOOD OF CONTAMINATION*	COMMENT
8. Effluent irrigation on Lot 113	Groundwater and surface water may have been impacted by effluent irrigation, and this could migrate onto the Project Area	Metals, Nutrients, faecal coliforms	High	The irrigation appears to occur outside of the Project Area, however effluent may migrate onto the site
9. Illegal dumping of waste	Waste materials have been illegally dumped on the Project Area in isolated locations.	TPH, BTEX, PAHs, OCPs, PCBs, Metals, Asbestos	Medium	Waste material including fibro-board, concrete and timber were observed.
NOTES: *Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc; BTEX - Benzene, Toluene, Ethylbenzene and Xylenes; TPH - Total Petroleum Hydrocarbons; PAH - Polycyclic Aromatic Hydrocarbons; OCP - Organochlorine Pesticides; PCB – Polychlorinated Biphenyls;*				



LEGEND

APPROXIMATE PROJECT AREA

AREAS OF ENVIROMENTAL CONCERN (AECs):

1. RAIL BALLAST.
2. FILL MATERIAL COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.

2A. NORTHERN END OF WOODLANDS CLOSE.

3. FORMER BUILDING AREAS.
4. FORMER ABANDONED FUEL TANKS.
5. HISTORICAL RAIL USE COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.
6. ADJACENT INDUSTRIAL LAND USE.
7. GROUNDWATER COVERS WHOLE PROJECT AREA THEREFORE IS NOT MARKED SEPARATELY.
8. EFFLUENT IRRIGATION.
9. ILLEGAL DUMPING OF WASTE MATERIAL IS LOCATED IN RANDOM LOCATIONS ON SITE, AND NEW LOCATIONS APPEAR FROM TIME TO TIME. IT IS NOT POSSIBLE TO SHOW ALL LOCATIONS FOR AEC 9.

Image source: Nearmap.com, Hypertiles, 25/06/2011

UHVA ARTC

ARTC
Hexham Relief Roads

Proposed Relief Roads

0 50 100 150 200 250
SCALE 1:5000 (A3) METRES

Aerial image source: Google Earth Pro 2012
Aerial image ©: Sinclair Knight Merz 2012
Image source: UHVA ARTC, Proposed Relief Roads 01/06/2011

drawn	CGT
approved	
date	04.07.2012
scale	AS SHOWN
original size	

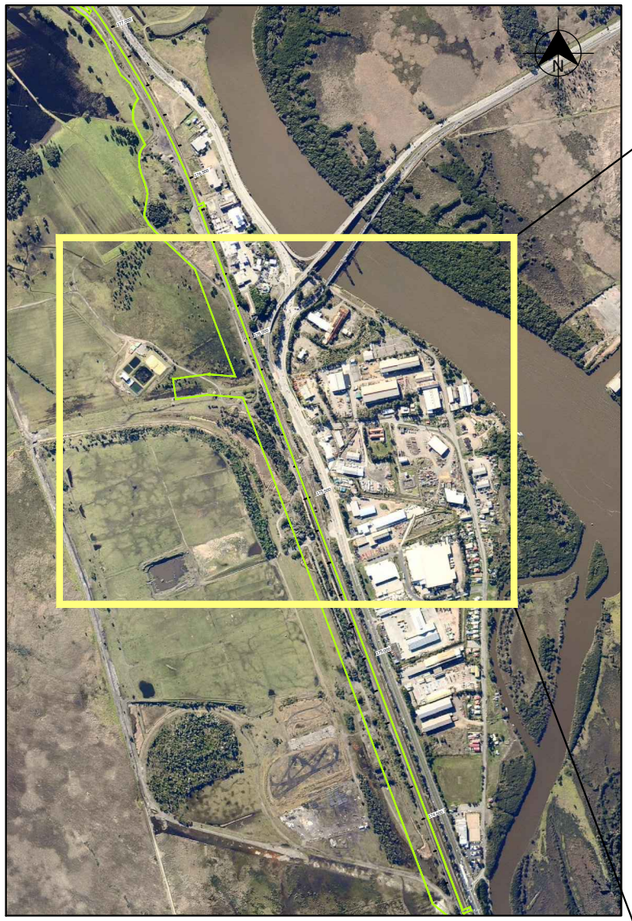
client: UPPER HUNTER VALLEY ALLIANCE

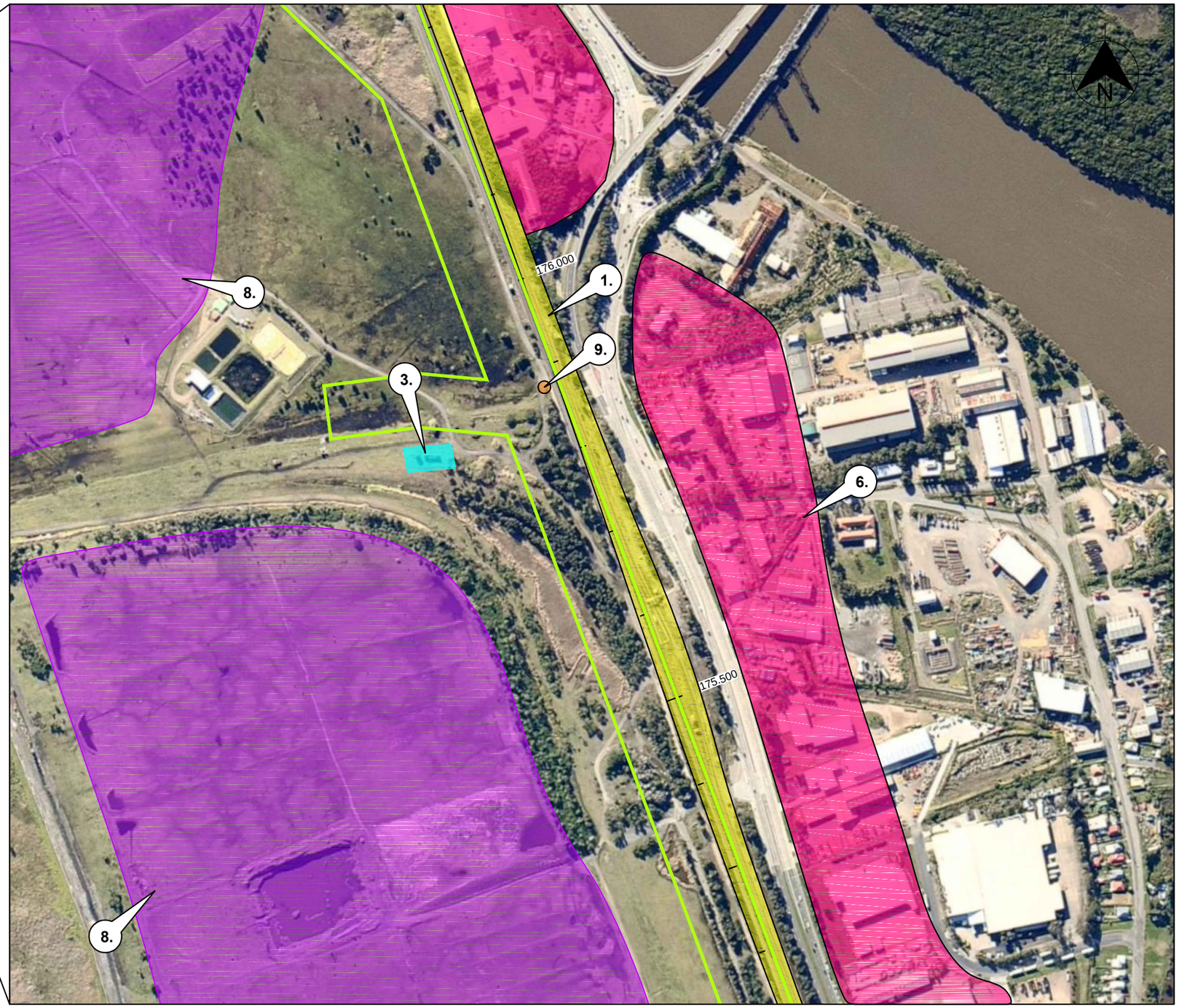
project: CONTAMINATION ASSESSMENT HEXHAM RELIEF PROJECT

title: AEC LOCATIONS

job no: GEOTWARA21045AC-D03

figure no: FIGURE 2A





LEGEND

APPROXIMATE PROJECT AREA

AREAS OF ENVIROMENTAL CONCERN (AECs):

1. RAIL BALLAST.
2. FILL MATERIAL COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.
3. FORMER BUILDING AREAS.
4. FORMER ABANDONED FUEL TANKS.
5. HISTORICAL RAIL USE COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.
6. ADJACENT INDUSTRIAL LAND USE.
7. GROUNDWATER COVERS WHOLE PROJECT AREA THEREFORE IS NOT MARKED SEPARATELY.
8. EFFLUENT IRRIGATION.
9. ILLEGAL DUMPING OF WASTE MATERIAL IS LOCATED IN RANDOM LOCATIONS ON SITE, AND NEW LOCATIONS APPEAR FROM TIME TO TIME. IT IS NOT POSSIBLE TO SHOW ALL LOCATIONS FOR AEC 9.

Image source: Nearmap.com, Hypertiles, 25/06/2011

ARTC
Hexham Relief Roads

Proposed Relief Roads

0 50 100 150 200 250
SCALE 1:5000 (A3) METRES

Aerial image source: Google Earth Pro 2012
Aerial image ©: Sinclair Knight Merz 2012
Image source: UHVA ARTC, Proposed Relief Roads 01/06/2011

drawn	CGT
approved	
date	04.07.2012
scale	AS SHOWN
original size	

client: UPPER HUNTER VALLEY ALLIANCE

project: CONTAMINATION ASSESSMENT HEXHAM RELIEF PROJECT

title: AEC LOCATIONS

job no: GEOTWARA21045AC-D03

figure no: FIGURE 2B

Image source: Nearmap.com, Hypertiles, 25/06/2011

LEGEND

APPROXIMATE PROJECT AREA

AREAS OF ENVIROMENTAL CONCERN (AECs):

1. RAIL BALLAST.
2. FILL MATERIAL COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.
3. FORMER BUILDING AREAS.
4. FORMER ABANDONED FUEL TANKS.
5. HISTORICAL RAIL USE COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.
6. ADJACENT INDUSTRIAL LAND USE.
7. GROUNDWATER COVERS WHOLE PROJECT AREA THEREFORE IS NOT MARKED SEPARATELY.
8. EFFLUENT IRRIGATION.
9. ILLEGAL DUMPING OF WASTE MATERIAL IS LOCATED IN RANDOM LOCATIONS ON SITE, AND NEW LOCATIONS APPEAR FROM TIME TO TIME. IT IS NOT POSSIBLE TO SHOW ALL LOCATIONS FOR AEC 9.

UHVA ARTC

ARTC
Hexham Relief Roads

Proposed Relief Roads

0 50 100 150 200 250
SCALE 1:5000 (A3) METRES

Aerial image source: Google Earth Pro 2012
Aerial image ©: Sinclair Knight Merz 2012
Image source: UHVA ARTC, Proposed Relief Roads 01/06/2011

drawn	CGT
approved	
date	04.07.2012
scale	AS SHOWN
original size	

client: UPPER HUNTER VALLEY ALLIANCE

project: CONTAMINATION ASSESSMENT HEXHAM RELIEF PROJECT

title: AEC LOCATIONS

job no: GEOTWARA21045AC-D03

figure no: FIGURE 2C

Image source: Nearmap.com, Hypertiles, 25/06/2011

LEGEND

APPROXIMATE PROJECT AREA

AREAS OF ENVIROMENTAL CONCERN (AECs):

1. RAIL BALLAST.
2. FILL MATERIAL COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.
3. FORMER BUILDING AREAS.
4. FORMER ABANDONED FUEL TANKS.
5. HISTORICAL RAIL USE COVERS WHOLE PROJECT AREA AND THEREFORE IS NOT MARKED SEPARATELY.
6. ADJACENT INDUSTRIAL LAND USE.
7. GROUNDWATER COVERS WHOLE PROJECT AREA THEREFORE IS NOT MARKED SEPARATELY.
8. EFFLUENT IRRIGATION.
9. ILLEGAL DUMPING OF WASTE MATERIAL IS LOCATED IN RANDOM LOCATIONS ON SITE, AND NEW LOCATIONS APPEAR FROM TIME TO TIME. IT IS NOT POSSIBLE TO SHOW ALL LOCATIONS FOR AEC 9.

UHVA ARTC

ARTC
Hexham Relief Roads

Proposed Relief Roads

0 50 100 150 200 250
SCALE 1:5000 (A3) METRES

Aerial image source: Google Earth Pro 2012
Aerial image ©: Sinclair Knight Merz 2012
Image source: UHVA ARTC, Proposed Relief Roads 01/06/2011

drawn	CGT
approved	
date	04.07.2012
scale	AS SHOWN
original size	

client: UPPER HUNTER VALLEY ALLIANCE

project: CONTAMINATION ASSESSMENT HEXHAM RELIEF PROJECT

title: AEC LOCATIONS

job no: GEOTWARA21045AC-D03

figure no: FIGURE 2D

6 ASSESSMENT CRITERIA

6.1 Soil Investigation Levels

The investigation levels for soil and ballast were established based on the following references:

- NSW DEC Guidelines for the NSW Auditor Scheme (Second Edition) (DEC, 2006);
- NSW EPA, Guidelines for Assessing Service Station Sites, (NSW EPA, 1994); and
- National Environmental Protection Council (NEPC) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) (NEPC, 1999).

The NSW DEC (2006) and NEPC (1999) present health based investigation levels for different land uses (e.g. industrial / commercial, residential, recreational etc.) as well as provisional phytotoxicity based investigation levels.

The future land use is proposed to be industrial (railway operations). Therefore the health-based investigation levels for *commercial or industrial land use* (Column 4 of Appendix II in DEC 2006) have been adopted as the investigation levels.

The NSW DEC (2006) Guidelines do not provide investigation levels for volatile petroleum hydrocarbon compounds. The NSW EPA (1994) Guidelines for Assessing Service Station Sites provide an indication of acceptable threshold levels for cleanup of total petroleum hydrocarbons (TPH) compounds at service station sites to be reused for sensitive land uses. For semi-volatile petroleum hydrocarbons (C16 – C35 and >C35) investigation levels are provided in the NSW DEC (2006) guidelines, however, these are based on the NEPC 1999 health-based investigation levels, which require the laboratory analysis to unequivocally differentiate between aromatic and aliphatic compounds. Therefore, the investigation levels provided in the NSW EPA (1994) guidelines have been adopted in this assessment.

The NSW DEC (2006) guidelines state that there are currently no national or NSW DEC endorsed guidelines relating to human health or environmental investigation of material containing asbestos on sites. Site Auditors must exercise their judgement when assessing if a site is suitable for a specific use in the light of evidence that asbestos may be a chemical of concern. Enhealth (2005) *Guidelines for Asbestos in the Non-Occupational Environment* provides some guidance on assessing and managing asbestos in soil although does not provide a threshold concentration or investigation level for asbestos. For this Project Area, Coffey propose to adopt conservative criteria for asbestos (both fibrous and cemented fragments) of 'no detectable asbestos present in surface soils'.

The relevant soil investigation levels are summarised in Table 10.

6.2 Waste Classification Assessment Criteria

In order to provide an in-situ waste classification for the material assessed, the results of the laboratory analysis were compared to assessment criteria for General Solid Waste and Restricted Solid Waste in the NSW DECCW (2009) *Waste Classification Guidelines*.

Natural materials (i.e. alluvial or estuarine soils) would be assessed against the description for VENM provided in NSW DECCW 92009) guidelines.

The NSW DECCW (2009) Waste Classification Guidelines define *"Virgin excavated natural material (eg clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:*

- *That has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities;*
- *That does not contain sulfidic ores or soils, or any other waste.*

And includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette."

The relevant waste classification assessment criteria are summarised in Table 11.

6.3 Groundwater and Surface Water Assessment Criteria

It is considered that the following uses of groundwater require assessment:

- Aquatic ecosystems down-gradient of the proposed development; and
- Workers during construction of the proposed development.

Current groundwater flow is anticipated to be multi-directional depending on the amount of fill present and the proximity of discharge zones. There is likely to be a component of flow to the east towards the Hunter River and also west and south towards the Hexham Wetland.

Based on the water quality data, the quality of groundwater in the vicinity of the Project Area is degraded and is unlikely to be used for human consumption, stock watering, or irrigation.

The nearest registered groundwater wells are located on the eastern side of the Hunter River, and therefore are considered unlikely to be affected by groundwater in the Project Area. Groundwater is not extracted currently for use on the Project Area, except for monitoring purposes, and to the best of Coffey's knowledge, is not extracted currently to the west, east or south of the Project Area to the immediate southeast of the site, except for monitoring purposes.

Construction workers will come into contact with groundwater and surface water during construction of the proposed development.

As a result of the above, for the purposes of this investigation the surface water and groundwater at the site have been assessed against the following criteria:

6.3.1 Protection of Aquatic Ecosystems

The investigation levels presented in Table 3.4.1 of ANZECC (2000) Australia and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC (2000) are considered applicable for the protection of aquatic ecosystems of the receiving waters.

ANZECC (2000) advocates a site-specific approach to developing guideline trigger values based on such factors as local biological affects data, the current level of disturbance of the ecosystem etc. The guidelines present 'low risk guidelines trigger values' which are defined as concentrations of key performance parameters below which there is a low risk that adverse biological effects will occur. It is important to note that these are not threshold values at which an environmental problem is likely to occur if exceeded. Rather, if the trigger values are exceeded, then further action is required which may include either further site-specific investigations to assess whether or not there is an actual problem or management / remedial action.

Low risk trigger values are provided for the protection of 80% to 99% of species in fresh waters (presented in Table 3.4.1 of the guidelines), with the trigger value depending on the health of the receiving waters.

It is considered that the fresh water trigger values are applicable for investigating chemical concentrations in surface water and groundwater, as the sampled water and the potential receiving bodies (Hunter River and Hexham Wetland) are fresh to brackish water bodies.

It is understood that the NSW OEH's policy is that the trigger values for the protection of 95% of aquatic ecosystems should be used except where contaminants are potentially bioaccumulative in which case the trigger values for protection of 99% of species should be used. Therefore, we have selected trigger values for protection of 95% of fresh water species for the majority of contaminants, and 99% of fresh water species for bioaccumulative contaminants for initial comparison purposes.

ANZECC (2000) states that there is currently insufficient data to derive high reliability trigger values for various contaminants. For these contaminants, low reliability trigger values have been adopted.

ANZECC (2000) states that there is currently insufficient data to derive a high reliability trigger value for TPH but propose a low reliability trigger value for TPH of 7 μg/L. This guideline is generally considered by industry to be overly conservative and is also well below the TPH detection limit which most laboratories can achieve.

No guideline concentration has been adopted for TPH in groundwater at this site.

The assessment criteria for surface water and groundwater are included with the groundwater analytical results in Tables 12 and 13.

6.3.2 Recreational Use (to Assess Construction Workers Risk)

The investigation levels presented in Chapter 5.2.3.1 and Table 5.2.3 of ANZECC (2000) are considered applicable to assess the potential risk that surface water and groundwater poses for construction workers. Whilst these criteria relate to recreational use of water, these are based on short term exposure to contaminants and do not include drinking of water, and are therefore considered to be relevant to workers that may come into contact with surface or groundwater during construction.

ANZECC (2000) Chapter 5.2.3.1 provides criteria for faecal coliforms and E. Coli for protection of human health. Table 5.2.3 provides criteria for certain metals, benzo(a)pyrene and benzene for protection of human health and these have been included with the groundwater analytical results in Tables 12 and 13.