Cockle Creek Stage 2 Environmental Assessment

Prepared for Incitec Fertilizers Limited

October 2009

Contents

1 Statement of validity

Submission of environmental assessment

Prepared under Part 3A of the *Environmental Planning and Assessment Act 1979*.

Environmental assessment prepared by

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In respect of:	Incitec Fertilizers Limited

Applicant and land details

Applicant name:	Incitec Fertilizers Limited
Applicant address:	70 Southbank Boulevard Southbank VIC 3006
Proposed development:	Incitec Fertilizers Limited proposed to undertake targeted groundwater remediation at their Site in Boolaroo, NSW.

Certification

Certification:	I/we certify that I/we have prepared the contents of the environmental assessment in accordance with the Director-General's requirements dated September 2008, and that to the best of my/our knowledge, the information contained in the environmental assessment is neither false nor misleading.
Signature:	
Name:	Janine Stablum
Date:	2 October 2009

2 Glossary

Term	Definition
ANZECC	Australian and New Zealand Environment Conservation Council
Aquifer	An underground layer of water-bearing permeable rock or unconsolidated materials (eg gravel, sand, silt, or clay) from which groundwater can be extracted using a water well.
ASLP	Australian Standard Leaching Procedure
Bunded	A bunded area is an area surrounded by a wall, erected to prevent the escape of various emissions into the environment (liquids, noise) or the exposure of views.
CEMP	Construction environmental management plan
CLM Act	*Contaminated Land Management Act 1997 (NSW).*
Containment cell	Area where contaminated materials are stockpiled and contained, generally by a capping system.
DECC	NSW Department of Environment and Climate Change
DECCW	NSW Department of Environment, Climate Change and Water (note: replaced DECC)
Dewatering	The process of separating solids from solution by sedimentation in tanks followed by filtering of the solids through a woven polypropylene membrane.
DGRs	Director-General requirements
DoH	NSW Department of Health
DoP	NSW Department of Planning
EA	Environmental assessment
EIL	Ecological investigation level
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW)*
EMP	Environmental management plan
EPA	NSW Environment Protection Authority
ESD	Ecologically sustainable development
Fill	Material that has been historically used to alter surface contours.
Gantry	Supporting structure for railways, cranes etc.
Geotube®	Woven polypropylene bag of low permeability designed to retain solids whilst allowing free water to drain away.
Gradient	The steepness of a slope.
Groundwater	Water that is held underground, usually in an aquifer.
HIL	Health investigation level
Hotspot	Area of high contamination.

Term	Definition
Hydraulic	Involves the movement by, or operation of fluid, especially water, under pressure.
IFL	Incitec Fertilizers Limited
IPL	Incitec Pivot Limited
LEP	Local environmental plan
LGA	Local government area
LHRS	*Lower Hunter Regional Strategy*
Major Projects SEPP	*State Environmental Planning Policy (Major Projects) 2005 (NSW)*
mg/L	Milligrams per litre
Mine subsidence	The caving or sinking of an area as a result of past mining activities.
NEPM	National Environment Protection (Assessment of Site Contamination) Measure
NSW	New South Wales
OHS	Occupational health and safety
PCCS	Pasminco Cockle Creek Smelter
pH	The measure of acidity or alkalinity of a solution.
PPE	Personal protective equipment
Remediation	Removal of pollutants or contaminants from the localised environment.
RAP	Remediation action plan
SEPP	A NSW State Environmental Planning Policy
Site	The Site at 13 Main Road, Boolaroo, NSW which is Lot 1 on Deposited Plan (DP) 225720 located within the Lake Macquarie local government area about 12km to the southwest of Newcastle. It should be distinguished from, and does not include, the Pasminco site which surrounds it.
SEMP	Site environmental management plan
Slag	The by-product of smelting ore to purify metals.
Surface water	Water that falls and/or collects on the surface of the ground.
TCLP	Toxicity characteristic leach procedure
US EPA	United States Environmental Protection Agency
VRA	Voluntary remediation agreement
VRP	Voluntary remediation proposal

3 Executive summary

The remediation of the Incitec Fertilizers Limited (IFL) Cockle Creek site (the 'Site') is being undertaken by IFL as a result of the decision by the Environment Protection Authority (EPA) (part of the Department of Environment, Climate Change and Water (DECCW)) to declare contamination levels at the Site to present a 'significant risk of harm'. This prompted IFL to offer a voluntary remediation proposal to DECCW, which has resulted in a voluntary remediation agreement being entered into between IFL and the EPA.

The IFL Site remediation project is being undertaken in two stages. The first stage of the project (Stage 1, Phase 1) was approved by the Department of Planning (DoP) in August 2009. The Phase 1 project application was in relation to urgent treatment of groundwater contamination 'hot spots'.

IFL is now seeking project approval for the second and final stage of the remediation project relating to the decommissioning and remediation of the Site. As part of that approval process, this is the second and final environmental assessment.

Stage 2 is broken down into three phases of work, referred to in this EA as phases 2, 3 and 4 (Phase 1 was completed as Part of Stage 1). These three phases, 2, 3 and 4 are the subject of this EA, and cover the phased remediation of the remainder of the Site. This includes demolition of the remaining structures on the Site, construction of a containment cell for disposal of contaminated materials on the Site, and filling and covering of the containment cell once contaminated materials and waste products have been deposited. IFL is also seeking approval for subdivision of the containment cell area from the balance of the IPL site. The works described in this report are referred to as the proposed project.

A number of treatment options have been considered in conjunction with DECCW. Following an assessment of these options, it was determined that a shallow containment cell was the most appropriate remediation option.

The four-phase remediation process aims to rehabilitate the Site to a standard that will allow future residential development on all but the subdivided cell area which will be used for open space. The adjoining Pasminco lands are already undergoing remediation, which has implications for the progress and impacts of the Site remediation. Ongoing liaison with Pasminco will be undertaken in order to coordinate the remediation activities.

Stakeholders have been consulted throughout the project development phase and during preparation of the environmental assessment. A stakeholder and community consultation plan has been developed to promote continued and appropriate consultation throughout the project. This plan includes information on how stakeholders and the community can provide their feedback on the proposal. Consultation with stakeholders and the community will be ongoing.

An environmental risk assessment was undertaken to determine the potential impacts involved in the proposed project that included air quality, groundwater, surface water, soil, non-indigenous heritage, waste and noise. The impacts are temporary in nature and effective management and mitigation measures are proposed. Overall, it is determined that any negative impacts are outweighed by the benefits that the project will provide once completed.

A draft statement of commitments is included in the environmental assessment and details the measures that will be undertaken to manage and/or mitigate the environmental impacts that could result from the proposed project.

4 Introduction

4.1 Proposal overview

In 2005, the Incitec Fertilizers Limited (IFL) Cockle Creek Site (herein referred to as 'the Site') located in the township of Boolaroo, New South Wales (NSW), was declared a remediation site under Part 3, Division 3 of the *Contaminated Land Management Act 1997* (CLM Act) by the NSW Environment Protection Authority (EPA), a part of the NSW Department of Environment, Climate Change and Water (DECCW). This action is referred to as the Declaration of a Remediation Site, also granting the Site remediation status.

Prior to 1969, the Site was part of the adjoining Pasminco zinc and lead smelter facility, but was subsequently excised and sold to a predecessor of IFL. IFL manufactured and distributed fertilisers from the Site until January 2009, when manufacturing activities ceased. Distribution is ongoing. A combination of the recent Site use and the surrounding historical operations has resulted in heavy metal contamination of the soil and groundwater on and under the Site.

In response to the Site's remediation status, a commitment was made by Incitec Pivot Limited (IPL), the parent company of IFL, to remediate the Site. This prompted IFL to offer a voluntary remediation proposal (VRP) to DECC in July 2008, which resulted in a voluntary remediation agreement (VRA) being executed on 7 August 2008. The VRA outlines the approach to be taken to remediate the Site and commits IPL to remediating the vacant area of the land outside the containment cell and buffer zones to a standard suitable for residential purposes. It is included at Appendix A.

The remediation program is divided into two stages, further broken down into four phases (Figure 1), outlined below.

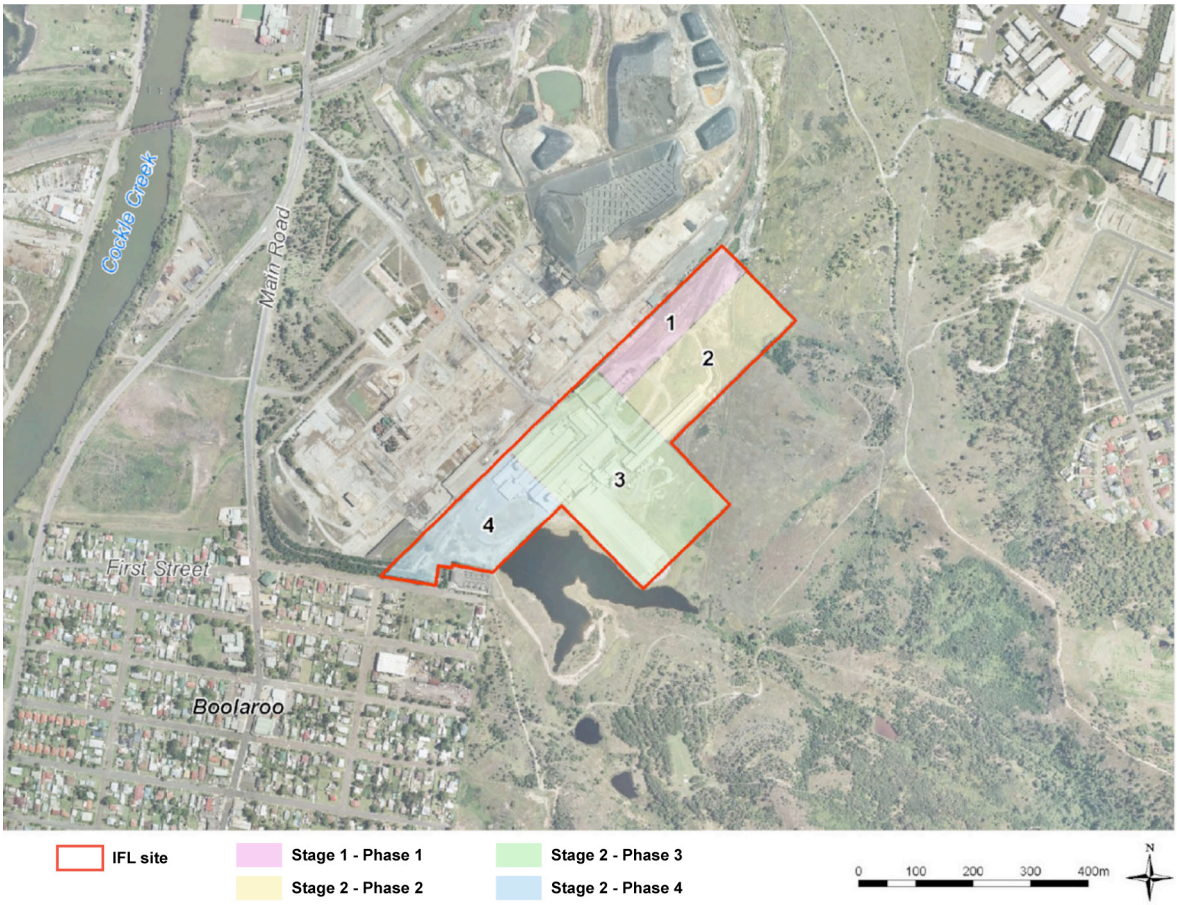
Stage 1

- Stage 1 involved only one phase of works namely the urgent installation of a groundwater treatment system to address areas of high groundwater contamination ('hot spots') in the northern portion of the Site, within the proposed cell area.
- The Stage 1, Phase 1 works were approved by the Department of Planning (DoP) as a separate submission in August 2009.

Stage 2

- Stage 2 is the subject of this EA and is broken down into three phases of work, phases 2, 3 and 4.
- Phase 2 involves the establishment of a containment cell and early remediation works in the northern portion of the Site.
- Phase 3 entails demolition of the majority of the Site buildings and infrastructure, and the remediation of the underlying soil.
- Phase 4 involves the excavation and remediation of the soil in the southern portion of the Site, in front of a dam wall shared with the neighbouring Pasminco lands.

Figure 1 Proposed remediation staging



4.2 Project need and objectives

The former smelting activities that occurred on the Site has resulted in extensive contamination of both the soil and groundwater. A detailed description of the nature and extent of contamination can be found in Chapter 7 and in Appendix B.

The primary objective of the project is to address the Declaration of Remediation Site issued by the EPA in July 2005. The declaration was made as a result of the EPA identifying that the Site fill and groundwater is contaminated with metals, in particular zinc, lead, and nickel, with the contaminated groundwater migration determined to be a significant risk of harm for the nearby Cockle Creek.

The majority of the Site will be remediated from its current industrial use to a condition suitable for low-density residential development. The engineered containment cell landform which will hold the contamination removed from the balance of the Site will be subdivided as part of this project. That will enable it to be retained and managed while the balance of the site is developed and sold off for residential purposes. It is proposed that the contamination area be remediated to a level suitable for open space with low-maintenance vegetation to ensure that erosion and sediment control measures will not be required after remediation is complete.

This remediation program is necessary to address the 'significant risk of harm' and to minimise human health and environmental impacts currently affecting the Site and its surrounding areas, and to progress planning for future use. Engineering measures will be required for stormwater, erosion and sediment

management during the site remediation works to mitigate any impacts on the environment during the active remediation phase.

Furthermore, the project will assist in the coordination of the remediation of the Site and remediation on the neighbouring Pasminco lands, which has already commenced.

4.3 Project location and site description

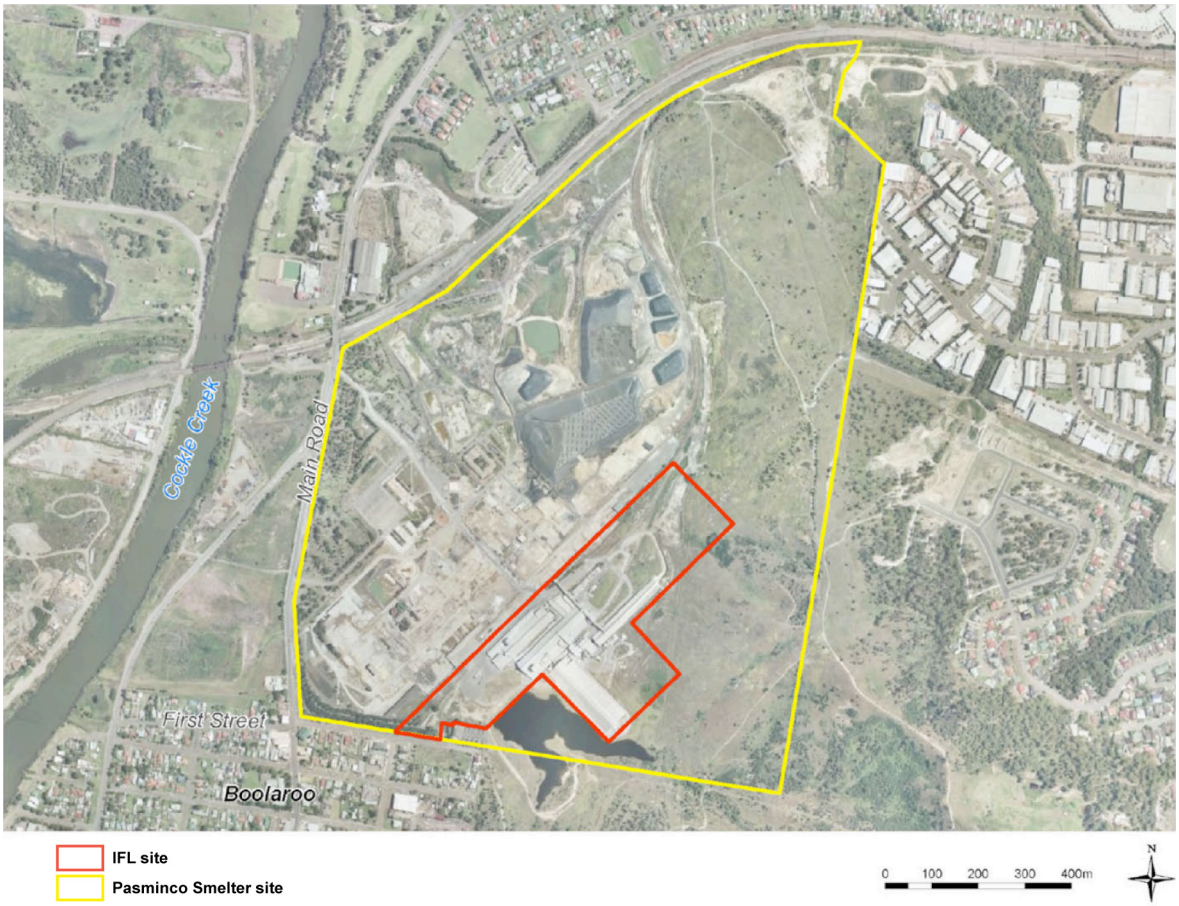
Site location

The Site is located at 13 Main Road, Boolaroo, NSW. It is Lot 1 on Deposited Plan (DP) 225720 within the Lake Macquarie local government area (LGA). The Site forms part of the Cardiff/Glendale area. It is two hours driving time north of Sydney, half an hour west of the regional centre of Newcastle (approximately 12km) and in the geographic heart of the Hunter area. Cockle Creek itself is located approximately one kilometre to the west of the Site and Lake Macquarie approximately two kilometres to the south.

Figure 2 Site location

The Site is located east of the former Pasminco zinc and lead smelter and is surrounded by Pasminco lands on all boundaries (hereafter referred to as the Pasminco Site) except that edging Boolaroo at First Street. At 19ha, the adjoining Pasminco Site is significantly larger than the IFL Site, which is 16ha. Pasminco was placed under voluntary administration in September 2001, and remains under administration.

Figure 3 Site in context



Existing land use

The main entrance to the Site occurs at the western boundary, where an access road passes through Pasminco land and connects to Main Road, Boolaroo. The Site contains numerous buildings for administration, maintenance, dispatch, manufacture and storage of fertiliser product. Internal roadways are either concrete or bitumen, and are in good condition.

The central part of the Site includes the now decommissioned superphosphate manufacturing area, with a large number of adjacent storage sheds currently being used for the dispatch of fertiliser. Other buildings on the Site house crushers and other infrastructure. The sheds and buildings are largely constructed from corrugated steel and cement sheeting containing asbestos fibre with concrete floors.

Surrounding environment

The Site is located on a sloping section of Munibung Hill, overlooking the Cockle Creek valley. The peak of Munibung Hill occurs to the east of the Site, with the topography sloping steeply to the west.

The naturally westerly sloping topography of the Site has been altered to allow the construction of the existing Site facility and infrastructure. A freshwater dam is located immediately outside the south eastern area of the Site, and falls predominantly within Pasminco land. The dam wall is located within IFL's property and is owned by IFL. The spillway occurs within the Site.

The nearest surface water body is Cockle Creek, which is located approximately one kilometre to the west of the Site, while Lake Macquarie is approximately two kilometres to the south. Groundwater flow is typically in a westerly direction, towards Cockle Creek. However, there are local variations to flow due to ongoing dewatering activities at the Teralba Colliery, to the west of the creek. Under the prevailing conditions groundwater emanating from the Site is not expected to discharge directly to Cockle Creek with groundwater levels depressed below that of the creek level. When the colliery is closed or dewatering activities cease, the regional groundwater environment would be expected to return to its natural flow pattern, with discharge to Cockle Creek or Lake Macquarie.

Boolaroo's residential area adjoins the Site and the Boolaroo village centre is approximately 0.5km away. The nearby Cardiff/Glendale area is undergoing strategic redevelopment, including the construction of a new railway station, and is identified in state and local plans as an emerging major regional centre. The centre will include new medium to high-density housing, retail and employment facilities. It already includes the largest industrial estate in the Lower Hunter.

4.4 The proponent

IFL is the proponent seeking project approval under Part 3A of the *Environment Planning and Assessment Act* (EP&A Act) to undertake Phases 2, 3 and 4 of the two staged (four-phase) remediation strategy agreed to with DECCW (and therefore the EPA).

IFL is a wholly owned subsidiary of IPL, which commenced operation in 2003 following the merger of IFL and Pivot Group. IPL is currently Australia's largest fertiliser manufacturer.

4.5 Report structure

Broadly, the structure of this EA is as follows:

Section of report	Content
Introduction	Provides a broad overview of the proposed project, a description of the Site and its surrounds, and an overview of the need for and objectives of the project (Chapter 1).
Planning framework	Provides an overview of the legislative framework, approvals process, environmental planning instruments, and strategic planning context for the proposed project (Chapter 2).
Project description	Provides an outline of the Site remediation strategy, a detailed description of each phase of the project, and construction methodology (Chapters 3 and 4).

Section of report	Content
Stakeholder consultation	Outlines stakeholder consultation undertaken for the environmental assessment (Chapter 5).
Environmental risk analysis	Provides details of a risk assessment for the potential environmental impacts of the proposed project (Chapter 6).
Environmental assessment	Outlines the assessment of potential environmental impacts associated with the project, and proposed mitigation measures (Chapters 7 and 8).
Site management	Describes the protocols in relation to management of the Site post-remediation (Chapter 9).
Draft statement of commitments	Describes proposed management and monitoring measures identified by the environmental assessment (Chapter 10).
Conclusion	Summarises the findings of the environmental assessment (Chapter 11).

Table 1 below shows where each of the 'Director General's requirements for environmental assessment', issued in November 2008 is addressed within the document.

Table 1 Director-General's requirements checklist

Director-General's requirements	Location in report
General requirements	
An executive summary	Executive summary
A description of the overall remediation strategy for the Site, including: • Objectives of the remediation strategy. • Proposed staging of the strategy. • Relationship between the various phases of the strategy.	Chapters 3 and 4

A detailed description of the project, including:
• Need for the project.
• Alternatives considered.
• Remedial action plan for the project, which includes:
  ◦ Characterisation of the nature and extent of contaminated material.
  ◦ Details of the proposed remediation process, including on-site treatment processes.
  ◦ A site validation plan.
  ◦ Details of compliance with the *Contaminated Land Management Act 1997*.
• Plans of the proposed containment cell, including:
  ◦ Demonstration that the design and integrity of the cells would be consistent with best practice standards.
  ◦ Demonstration that any material incompatibilities between the cell(s) and materials to be stored in the cell(s) have been identified. Management procedures to address incompatibility issues must be provided.
  ◦ Demonstrate that the cell(s) would adequately contain the materials to be stored without impacting on the surrounding environment.	

Director-General's requirements	Location in report
• Measures that would be implemented to ensure the project is properly coordinated with the adjoining Pasminco Cockle Creek Remediation Project.	Chapter 3
• Final landform following remediation and the compatibility of the final landform with the proposed end use(s) of the Site.	Chapter 3
• Ongoing management of the site following remediation works including ownership of the site and containment cell(s), monitoring and management responsibilities, as well as the source of funding for the monitoring and management of the site.	Chapter 11
A risk assessment of the potential environmental impacts of the project, identifying the key issues for further assessment.	Chapter 6
A detailed assessment of the key issues specified below, and any other significant issues identified in the risk assessment (see above), which includes: • A description of the existing environment, using sufficient baseline data. • An assessment of the potential impacts of all phases of the project, including any cumulative impacts that may arise from the combined remediation of the site and the adjacent Pasminco Cockle Creek Site, taking into consideration any relevant guidelines, policies, plans, and statutory provisions (see below). • A description of the measures that would be implemented to avoid, minimise, mitigate, rehabilitate/remediate, monitor, and/or offset the potential impacts of the project, including detailed contingency plans for managing any potentially significant risks to the environment.	Chapter 7
A statement of commitments, outlining all the proposed environmental management and monitoring measures.	Chapter 10
A conclusion justifying the project on economic social, and environmental grounds, taking into consideration whether the project is consistent with the objectives of the *Environmental Planning and Assessment Act 1979*.	Chapter 11
A signed statement from the author of the environmental assessment, certifying that the information contained within the document is neither false nor misleading.	Start of document
Key issues	
Strategic planning – Demonstration that the site, once remediated, would be consistent with the strategic planning for the area.	Chapter 2
Air quality – Including a specific focus on the impacts of the contaminants present on site such as heavy metals and particulates, and the proposed air quality monitoring and management procedures during remediation.	Chapter 7
Health impacts – Including an assessment of the health implications of the project, during and following remediation, including details of human exposure scenarios and demonstration that the project will not have unacceptable acute or chronic health effects.	Chapter 8
Soil and water – Including an assessment of the potential groundwater, stormwater, surface water and leachate impacts, and erosion and sediment controls.	Chapter 7
Noise – Including demolition, excavation works, and traffic.	Chapter 7
Waste	Chapter 8
Traffic	Chapter 8
Heritage	Chapter 7

Director-General's requirements	Location in report
Consultation	
During the preparation of the environmental assessment, you should consult with the relevant local, state, or commonwealth government authorities, service providers, community groups, or affected landowners. In particular, you must consult with the: • Department of Environment and Climate Change. • Department of Water and Energy. • NSW Department of Health. • Mine Subsidence Board. • Lake Macquarie City Council. • The administrators of the Pasminco Cockle Creek site. The consultation process and the issues raised must be described in the environmental assessment.	Chapter 5

5 Planning framework

The legislative framework for this proposed project and the relevant environmental planning instruments are discussed below.

5.1 Declaration of remediation site

The CLM Act aims to establish a process for investigating and remediating land where contamination presents a significant risk of harm to human health and other aspects of the environment. On 22 July 2005 the Site was declared to be a remediation site under Part 3, Division 3 of the CLM Act.

Under Section 21 of the CLM Act:

> *'The EPA may declare land to be a remediation site if the land has… been found to be contaminated in such a way as to present a significant risk of harm.'*

Following the EPA's declaration of the Site as a remediation site, IFL prepared a VRP to remediate the Site to a standard suitable for residential use. This was endorsed by the EPA on 7 August 2008. A copy of the VRA is provided in Appendix A.

Amendments have since been made to the CLM Act, whereby a voluntary remediation proposal is taken to be a voluntary management proposal approved by the EPA, and the declaration of remediation site is take to be a declaration of significantly contaminated land.

5.2 Approval requirements under Part 3A

The EP&A Act provides a framework for environmental planning and assessment in NSW. Part 3A of the EP&A Act provides an assessment and approval process for major infrastructure projects. As outlined under Section 75B of the Act, Part 3A applies to developments that are either declared:

> *'(a) by a State Environmental Planning Policy, or*
>
> *(b) by order of the Minister published in the Gazette.'*

As outlined in Clause 28 of the *State Environmental Planning Policy (Major Projects) 2005* (SEPP Major Projects), developments for which the policy applies to include:

> *'(a) premises subject to a notice requiring prescribed remedial action to be taken under section 35 or section 36 of the Environmentally Hazardous Chemicals Act 1985 (as continued in force by the Contaminated Land Management Act 1997), or*
>
> *(b) land declared as a remediation site under Division 3 of Part 3 of the Contaminated Land Management Act 1997.'*

In light of the Site being declared a remediation site in 2005 under Division 3, Part 3 of the CLM Act, it was subsequently included under SEPP Major Projects. This legislation has since been amended and now does not include all declared remediation sites. However, based on transitional provisions provided under the gazettal of the legislative amendment stating that *'The amendments made to this Policy… do*

not extend to project applications under Part 3A of the Act, and development applications under Part 4 of the Act, made but not finally determined before the commencement of those amendments', approval for the project remains subject to assessment under Part 3A of the EP&A Act.

5.3 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the central piece of Commonwealth environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places as defined in the Act as matters of national environmental significance.

The objectives of the EPBC Act are to:

- Provide for the protection of the environment, especially matters of national environmental significance.
- Conserve Australian biodiversity.
- Provide a streamlined national environmental assessment and approvals process.
- Enhance the protection and management of important natural and cultural places.
- Control the international movement of plants and animals (wildlife), wildlife specimens and products made or derived from wildlife.
- Promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.

The proposal does not have a significant impact on any matter of national environmental significance and therefore the project is not a controlled action and the EPBC Act is not relevant to this proposal.

5.4 Environmental planning instruments

Various State Environmental Planning Policies (SEPPs) and local environmental plans (LEPs) are relevant to this proposed project. There are no regional environmental plans (REPs) relevant to the proposed project.

State Environmental Planning Policy (Major Projects) 2005

SEPP Major Projects (as mentioned is Section 2.2) aims to identify developments of economic, environmental, and social significance either at a regional or state level within NSW. The policy provides consistency in the assessment and approvals process for developments identified as being of state or regional significance.

The declaration of the Site as a remediation site in 2005 under Division 3, Part 3 of the CLM Act means that the remediation of the Site is subject to inclusion under SEPP Major Projects and is therefore subject to assessment under Part 3A of the EP&A Act. As previously outlined, this legislation has been amended. However, due to the savings and transitional provisions accompanying that amendment, this project remains under Part 3A of the EP&A Act.

State Environmental Planning Policy 55 Remediation of Land (SEPP 55)

The proposed project at the Site is aligned with the aims of SEPP 55. The objective of this policy is to provide a statewide planning approach for the remediation of contaminated land, for the purpose of reducing the risk of harm to human health and the environment. Given that the Site presents a significant risk of harm as determined by the DECCW, the remediation of the Site is consistent with SEPP 55.

Lake Macquarie Local Environmental Plan (LEP) 2004

In accordance with the Lake Macquarie LEP, the Site is currently in a 4(1) Industrial (core) zone. The objectives for this zone are to:

- Provide land for a wide range of employment-generating industries, including manufacturing, processing, assembly, storage and distribution uses.
- Provide land for a range of industrial uses that, because of their nature, require large areas of land or separation from more intensive forms of employment generating industries.
- Ensure that industries are designed and located so as not to cause unacceptable environmental harm or adversely affect the amenity of the environment, including residential neighbourhoods.
- Provide for sustainable water cycle management.

The zoning does not allow for remediation activities, however, SEPP 55 overrides the LEP. Furthermore, the remediation of the Site is consistent with the zoning objectives of the LEP as it will facilitate improvements to amenity and groundwater quality and contribute to sustainable water cycle management practices. The remediation will be carried out in accordance with the VRA entered into with the EPA in addition to other EPA regulatory requirements to ensure that the significant risk of harm is abated.

While the project aims to remediate the Site so it is suitable for residential development and open space use, the project does not include any rezoning or development aspects. Rezoning of the Site is not considered as part of this EA.

Lake Macquarie Development Control Plan No 1 (Revision 02)

The *Lake Macquarie Development Control Plan – Part 2.1 Environmental Responsibility and Land Capability* aims to provide initial project guidance to all projects to ensure the retention of Lake Macquarie's environmental values.

The Council aims to ensure there is no unacceptable risk to human health or the environment from land that may have been previously contaminated. The remediation strategy for the Site will support this aim.

5.5 Strategic planning context

The Site is subject to various regional and local planning strategies. The relevance of these to the proposed project is discussed below.

Lower Hunter Regional Strategy 2006–31

The NSW Government's *Lower Hunter Regional Strategy 2006–31 (LHRS)* (DoP, 2006) is a land use planning strategy which outlines provisions for ensuring sustainable development within the Lower Hunter region over the next 25 years.

The strategy applies to five LGAs located within the Lower Hunter region, these being Newcastle, Lake Macquarie, Port Stephens, Maitland and Cessnock. The strategy identifies Glendale/Cardiff as the nearest emerging major regional centre.

Furthermore, the strategy includes provisions for ensuring sufficient land for housing and employment, the protection of high quality agricultural land and natural resources, as well as the delivery of services and infrastructure across the lower Hunter region.

The LHRS is significant to the Site as it provides a framework for future use of the Site and its surrounding lands. The strategy aims to provide for up to 115,000 new dwellings by 2031, to meet the demand for an additional 160,000 people. Remediation and decommissioning of the Site to a standard suitable for potential future residential development supports the aim of the strategy.

Draft Land Use Strategy – Munibung Hill

Lake Macquarie City Council commissioned Dickson Rothschild to prepare the *Draft land use strategy – Munibung Hill* (September 2005). The draft strategy applies to the Munibung Hill area, including the townships of Boolaroo, Argenton and large landholdings within the area, such as the Pasminco lands and the Site.

This draft strategy reviews the opportunities and constraints facing the Munibung Hill area, identifies areas where changes in land use may occur and also gives consideration to the area's future infrastructure requirements.

This draft strategy was prepared prior to IFL's decision to close its Cockle Creek operations and remediate the Site. As such, the applicability of the strategy is limited. However, this draft strategy remains relevant to the Site with regards to suggestions for the future land use of the Site and the surrounding Pasminco lands, as well as its comments on future infrastructure requirements. The high level of remediation proposed for the Site supports the proposed potential land uses within the draft strategy, such as low and medium density residential zonings.

5.6 Licensing requirements

The remediation construction works are proposed to be conducted under the current operational licence. To this end, a variation to the current environmental protection licence, to include demolition and remediation works, may be sought. This variation would apply to all current licence easements and monitoring points. This monitoring would be supplemented by any monitoring committed to as part of this environmental assessment.

The extraction licence issued as part of the Stage 1, Phase 1 works may also require variation as the cell construction advances and groundwater wells are removed. If a variation is necessary, it will be sought after consultation with DECCW and will be consistent with the detailed remediation action plan (RAP), approved by a DECCW accredited site auditor (Site Auditor).

Regulations governing asbestos removal are provided by the *Protection of the Environment Operations Amendment (Scheduled Activities and Waste) Regulation 2008*. Disposal and transport of asbestos is regulated by DECCW and local council. All asbestos removal activities will comply with relevant regulatory requirements.

6 Overall remediation strategy

6.1 Remediation action plan

A conceptual remediation action plan (Conceptual RAP) has been prepared by Soil and Groundwater Consulting to guide the remediation of the Site. The key elements of the Conceptual RAP are described in the sections below. The full document can be found at Appendix B. The Conceptual RAP has been reviewed and approved by DECCW and the DECCW-accredited Site Auditor (Site Auditor). Please note that timelines outlined in this environmental assessment supersede those included in the Conceptual RAP.

Detailed RAP documents will be prepared for each subsequent phase of the remediation program to address in detail the specific environmental issues relevant to each phase and will be subject to the same approval process as the Conceptual RAP.

A site validation plan would also be prepared to ensure that the objectives of the remediation strategy have been met. This would be undertaken in consultation with DECCW and approved by the Site Auditor.

6.2 Objectives of remediation strategy

The Site will be remediated to a condition suitable for residential development, with the exception of the cell landform and a buffer zone of 10–30m around the cell footprint. These areas would be used as controlled open space (see Appendix B Conceptual RAP).

6.3 Overview of site contamination

The extent of contamination in soil and groundwater has been identified and described following detailed soil and groundwater investigations across the Site over a number of years. Recently, Thiess Services have completed a remediation cost estimate and Soil and Groundwater Consulting have undertaken a conceptual hydrogeological model and preliminary numerical modeling report and environmental site assessment. A full summary of environmental investigation reports conducted at the Site and on the Pasminco land can be found in the Conceptual RAP, Appendix B.

The literature review and subsequent field investigations found that both the soil and groundwater the Site had been heavily contaminated and that remediation was required. Major findings of the soil investigations include:

- Elevated concentrations of heavy metals for a large number of fill soil samples with many exceeding the *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM) health-based investigation levels for commercial industrial land use (HIL F).
- Concentrations of total phosphorus were generally elevated in surface and fill samples. The maximum concentration detected was 102,000mg/kg, which significantly exceeds the NEPM ecological investigation level (EIL) of 2,000mg/kg.

- Concentrations of sulphate were generally elevated with the maximum concentration detected of 14,000mg/kg.
- Concentrations of calcium were generally elevated with the maximum concentration detected of 241,000mg/kg.
- US EPA Toxicity Characteristic Leach Procedure (TCLP) and Australian Standard Leaching Procedure (ASLP) results indicate that the metals in fill materials at the Site are highly leachable.

A similar literature review and field investigations were conducted to characterise the extent and nature of the groundwater contamination. The major findings of these investigations were:

- The primary metal contaminant of concern is zinc, with a maximum concentration detected in the 2006 investigation of 28mg/L compared with the ANZECC 2000 freshwater ecosystem protection (95 per cent level of protection) criterion of 0.015mg/L. More recent results from the northern investigation have reported zinc concentrations up to 7,000mg/L in the shallow natural aquifer.
- A range of other heavy metals including cadmium, copper, lead, mercury and nickel occur at concentrations exceeding the ANZECC 2000 ecosystem protection criteria. Elevated metal results are typically associated with relatively low pH groundwater.
- Whilst the southern area (including the in-filled gully area) was the initial concern and the reason for the issue of the *Declaration of Remediation Site,* recent investigations have indicated that the groundwater in the northern area of the Site is more heavily impacted. This may be due to the increased potential for recharge and leaching in this area due to the lack of any hardstand surface cover.
- The distribution of groundwater contamination generally indicates that the highest groundwater concentrations are located in areas where relatively large volumes of slag material are located directly hydraulically up gradient. This also tends to correspond with the highest soil concentrations and leachability results.
- The highest groundwater contaminant concentrations generally occur in the fill or shallow natural groundwaters.
- Low pH groundwater was encountered across the Site, with results ranging from 2.9 to 7.2. Almost all results were found to be below pH 7. The average groundwater pH was approximately 5.1.
- Nitrate was detected at concentrations up to 11mg/L. This is considered to be an elevated level of nitrate although unlikely to require targeted remedial activity given potential for dispersion, dilution or utilisation prior to discharge. The highest nitrate results exceed the ANZECC 2000 trigger value for freshwater ecosystems (95 per cent level of protection) of 0.16mg/L (modified for nitrate results reported as nitrogen).

A detailed analysis of the contamination can be found in the Conceptual RAP (Appendix B).

6.4 Treatment and remediation alternatives considered

The Conceptual RAP, Appendix B, identified a number of alternative treatment and remediation options available for the Site soil and groundwater. These include treatment of the contamination on-site, removal of the contamination for disposal and/or treatment off-site, and to do nothing.

These options have been developed based on an assessment by Golder Associates of the scale of remediation required and the contaminants present. They are summarised below and detailed in the Conceptual RAP at Appendix B.

Soil management options

Contaminant destruction

The primary contaminants at the Site are heavy metals associated with slag-impacted fill materials. It is not possible to destroy the primary contaminants so this approach is not considered feasible.

Metal removal

Metal contaminants may be removed from the soil by washing methods that extract the contaminants from the soil. In this case, the metals are associated with slag materials, and it would be difficult to remove the metals without removing the slag materials from the fill matrix. The clayey soil structure of the contaminated material adds an additional difficulty to this method.

It is unlikely that this treatment method would achieve the remediation goals required for this project. This process would result in another waste stream meaning that contaminants would potentially be transferred from one environment to another. In addition, the suitability of soils for re-use may be doubtful after this procedure.

Soil stabilisation

Preliminary soil stabilisation trials were undertaken to assess the suitability of chemical stabilisation of the soils in addition to the containment cell remediation approach. The testing focussed on the leachability of fill materials, as this would be the primary objective of the soil stabilisation approach.

The trials concluded that the various chemicals tested for this approach were either ineffective, or too expensive. This approach was seen to have only a marginal benefit, and therefore not justified on a cost basis.

Off-site disposal

Off-site disposal is a relatively simple management approach and involves the transfer of waste from one site to another. This approach removes contamination from the Site to a specifically designed and controlled landfill environment that is licensed and administered by regulatory authorities. This approach provides a high level of assurance that contamination will be managed in the longer term.

The primary disadvantages of this option are the risk of dispersion of waste materials during transport and handling, and the high costs associated with removal and transport of the contaminated materials. The large volume of materials to be disposed of at the Site mean that there would be a considerable economic and environmental cost associated with applying this treatment method. This approach would result in a substantial increase in heavy vehicle traffic volumes over the remediation period. Retaining the contaminated fill on-site within a containment cell can mitigate these impacts. Off-site disposal is not considered to provide the best environmental outcome for the Site. An on-site approach would have a lower environmental impact as a result of reduced energy, resource and noise impacts.

Deep burial

This approach involves burying the contaminated material within a deep, fully-lined and capped cell. A large volume of clean excavated material would be produced as a result of this method, which could then be used as fill around the Site. Management of the groundwater levels and flow paths around the cell might be required to minimise impacts of the contained materials on the groundwater system and ensure compliance with the adopted remediation criteria at the Site boundary. Such groundwater

management would require significant ongoing system operation and monitoring and as a result was not considered appropriate.

Shallow burial

A shallow cell built above the natural water table is a less management-intensive and lower-cost approach than a deep cell. The shallow cell would be fully lined with a composite HDPE and GCL liner, and capped with a similar liner, to completely encapsulate fill materials. This approach limits the potential for interaction of the fill materials with the groundwater system, and reduces the need for ongoing monitoring and management of environmental impacts.

The shallow cell would emerge above the natural landform, resulting in a slight visual impact, however this approach is also being adopted on the adjoining Pasminco site so a visual precedent for such a structure exists. Height restrictions may result in the cell footprint area being larger than if a deep burial approach was implemented.

The shallow burial approach is the preferred soil remediation approach for the Site as it:

- Minimises the risks to groundwater by restricting potential contact between the cell and the groundwater system.
- Meets the remediation objectives for the Site.
- Is broadly consistent with the DECCW-approved approach for the adjacent Pasminco site.

Groundwater management

Interim groundwater management options for contaminated 'hot spots' at the Site are addressed in the Stage 1 EA, and in the Conceptual RAP at Appendix B. Phases 2–4 of the project will provide long-term groundwater remediation, by isolating the source of the groundwater contamination from the Site.

Asbestos-containing waste management options

A large number of the existing buildings on the Site are constructed from asbestos-containing material, which requires disposal as part of the demolition works. The volume of asbestos-containing material is estimated to be in the order of 2,000m^3.

The two options for disposal of this material are:

Management and transport off-site

This option involves removing the asbestos off-site, minimising the risk of ongoing impacts at the Site. However, the transport of the materials off-site will result in a minor risk to the environment from potential spillages during transit. The asbestos-containing material would be disposed to an appropriate licensed landfill and would be buried within other waste materials as a part of the landfill disposal process.

Inclusion within the proposed containment cell on the Site

This option manages the asbestos-containing materials on-site and minimises risks associated with transport of contaminants, while a small risk is retained, as the materials will remain on-site. Provided that the material is completely encapsulated by the containment cell, the asbestos material is unlikely to pose a risk. The disposal method is similar to that which would be adopted for the offsite landfill disposal, in that waste would be buried within a controlled cell.

It is proposed that the asbestos-containing materials are buried within the fill materials included in the containment cell in order to limit environmental impacts. The location of the asbestos containing material within the containment cell will be surveyed for future reference.

Do-nothing approach

There is an option to leave the Site as is, without any form of remediation. However, this is in direct contradiction to declaration of remediation site, the VRA, and the objectives of the project. Without remediation of the contaminated soils and other materials on the Site groundwater will continue to become contaminated as a result of leaching from the contaminated soil. This would limit the success of the Phase 1 remediation activities and would not resolve the significant risk of harm. Treatment of the groundwater hotspots in Phase 1 alone would not remove the significant risk of harm associated with the Site as the contamination source would remain and most likely re-contaminate the groundwater, following cessation of Phase 1 works.

Leaving the Site as is would not address:

- The significant risk of harm declared by DECCW.
- The declaration of a remediation site.
- The requirements of the VRA.

This option would not result in the Site being suitable for residential or open space use. As a result, the do nothing approach is not considered a valid option and is therefore not considered further.

Preferred alternative

Based on the above analysis, it is considered that the most appropriate and effective option is to contain the contaminated source material on-site, in a specially designed containment cell. A detailed description of this option is provided in Chapter 4.

6.5 Remediation strategy description

An assessment of a number of remedial options was undertaken. The remediation option selected for the Site included removal of the metal contaminated soils, the primary source of the identified groundwater contamination, to a fully lined and sealed containment cell. Further detailed information is provided in the VRA in Appendix A and the Conceptual RAP in Appendix B.

As part of the remediation works, targeted and short-term groundwater remediation is proposed to be undertaken. These works are Stage 1, Phase 1 of the remediation strategy and the subject of a separate EA approved by DoP in August 2009. The groundwater remediation is being undertaken in the northern area of the Site, which is located in the proposed containment cell area. The groundwater remediation is being undertaken prior to commencing the remediation works associated with the containment cell to reduce the contaminant mass present in the groundwater system beneath the proposed containment cell.

To ensure ongoing environmental management of the containment cell and a suitable buffer zone, IFL will seek the subdivision of the cell from the remainder of the Site and will retain the ownership and responsibility for this cell area, including the groundwater environment. This will ensure accessibility to the area for any future management requirements and provide a viable entity for future implementation of the Site Environment Management Plan (SEMP).

The remainder of the Site, outside the designated containment cell and buffer areas, is likely to be divested for development purposes with the expectation that the area will be suitable for residential use after the remediation works have been completed. IFL has engaged a Site Auditor for the duration of the remediation works. On completion of the works, Auditor sign-off would be as agreed in the VRA. Remediation criteria will be defined in the detailed RAPs, completed in accordance with the Conceptual RAP and the DECCW-endorsed VRA. The detailed RAPs will also be audited by a Site Auditor.

Due to the difficulty in remediating groundwater across the Site, it is noted that the groundwater in various parts of the area which may later be divested for residential development may contain contaminant concentrations that preclude extraction and use. However, there is a low potential for groundwater use in the residential setting given the presence of a reticulated potable water supply, the moderate salinity of the shallow groundwater and the low yield obtainable from the shallow aquifer. The groundwater contamination does not pose a volatile risk to users of the land surface. As such, it is anticipated that the groundwater contamination can be appropriately addressed through the imposition of a condition that restricts the use of the groundwater at the Site to minimise any potential risk to site users through interaction with potentially contaminated groundwater.

The most relevant beneficial use (or environmental value, as defined in the DECC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*) of groundwater at the Site is that of aquatic ecosystems. It is expected that any residual site groundwater contamination, once the complete remediation strategy has been implemented, will not preclude this environmental value. If this cannot be achieved then appropriate remediation or management measures would be put in place to ensure this environmental value is protected and the outcome of the audit with respect to this matter is suitably addressed.

Significant risk of harm

In July 2005, the Site was subject to a declaration of remediation site by the EPA. The declaration states that groundwater contamination at the Site presents a significant risk of harm to the environment, and that the contaminated groundwater is migrating from the Site towards Cockle Creek.

The proposed overall remediation strategy addresses this declaration and significant risk of harm by removing the source of the groundwater contamination by placing impacted soils in a containment cell, thereby preventing further contamination. In addition, targeted groundwater remediation works to remove identified groundwater contamination hotspots will be undertaken as part of the strategy. It is anticipated that these remediation works will reduce the risk posed by groundwater contamination such that the significant risk of harm declaration can be lifted.

Remediation criteria

The remediation criteria are detailed in the Conceptual RAP, Appendix B. Table 2 below summarises the proposed remediation criteria, and provides a brief explanation of each criterion.

It should be noted that specific site remedial objectives will be developed in accordance with the ANZECC guidelines, in agreement with the Site Auditor and DECCW. The standard NEPM and ANZECC criteria are conservative triggers for ‘further action’ only, and not intended as site remediation objectives. They are included here as preliminary or screening level criteria in the first instance.

Table 2 Remediation criteria summary

Environmental element	Land use	Adopted criteria/guidelines
Soil	Residential	NEPM HIL A criteria
	Open space (containment cell surface)	NEPM HIL E criteria
	Ecological	NEPM EIL
	Aesthetics	NSW DECC Site Auditor Guidelines 2nd edition
	Leachability	Demonstrate acceptable risk to groundwater from residual soils
	Buildings and structures	AS2159/NEPM EIL
Groundwater	All uses (on and off-site)	ANZECC 2000
Surface water	All uses	ANZECC 2000
Air	All uses	DECCW

Criteria explanation

Below is a brief explanation of the remediation criteria:

- NEPM HIL – *National Environment Protection Measure human health-based investigation levels*. The HILs are based on generally conservative assumptions for the estimated exposure of site occupants in the proposed land-use scenario. An exceedence of such a level does not indicate a definite risk to human health, rather that further site-specific assessment would be required to quantify the potential risk to human health.
- NEPM EILs – *National, Environment Protection Measure urban ecological intervention levels*. These indicate screening level assessment of ecological impacts of contamination based on phytotoxicity. The EILs aim to protect ecological values in developed areas.
- NSW DECC *Site Auditor Guidelines* – These guidelines identify various environmental values of groundwater which may be required to be protected depending on the location of the Site.
- AS2159 – *Piling- design and installation* – Specifies the minimum requirements for the design, construction and testing of piled footings for civil engineering and building structures on land. Section 6 deals with durability of piles in soils under various exposure classifications.
- ANZECC 2000 – In this context, ANZECC 2000 refers to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. This guideline provides criteria for assessment for aquatic ecosystems, aquaculture, agricultural waters, and recreational water uses. Default ANZECC contaminant criteria are intended as a trigger for further assessment only; site-specific remediation criteria will be developed in accordance with the recommendations in the ANZECC guidelines, pursuant to approval by DECCW.

6.6 Proposed remediation staging

Operational constraints affect certain portions of the Site and as such a staged approach to remediation is required, with those stages further broken down into phases. This will also address urgent environmental control requirements to accommodate the early phases of the Pasminco remediation

program. A summary of the proposed staging and objectives of the remediation process is presented below and illustrated in Figure 1. In general, the works will be undertaken in the stages outlined below, however due to the need to coordinate some components of the remediation works with Pasminco it may be necessary to modify the sequence of some works. All works will be completed under the oversight of the Site Auditor.

Stage 1

Phase 1

Phase 1 involves establishment of initial groundwater recovery and treatment facilities to remediate local areas of highly impacted groundwater along the northwestern Site boundary. The EA for Phase 1 has been approved by DoP. No further assessment of this phase is required within this document.

Stage 2

Phase 2

The objectives of Phase 2 include establishment of a containment cell and associated environmental controls in the northern portion of the Site, and the remediation of accessible contaminated fill and soil material to the north of the operational areas of the facility. The contaminated material beneath the containment cell footprint will be removed before the cell is constructed so that all contaminated material is contained within the cell. The containment cell would be designed to create a low-maintenance repository structure for on-site contaminated fill, soil and building materials with limited potential for impacts to the surrounding environment in the future.

Phase 3

The objectives of Phase 3 are the decommissioning of the majority of site infrastructure, once site operations are completed (including demolition of most structures), and placement of underlying contaminated fill material located across the central portion of the Site within the northern containment cell.

Phase 4

The objective of Phase 4 is the remediation of the in-filled gully in the southern portion of the Site, including any final landform rehabilitation required to ensure the Site is suitable for its proposed future residential land use. This will involve the removal of all contaminated material across the southern portion of the Site and placement within the northern containment cell.

6.7 Relationship between various phases

The northern portion of the Site will be the focus of both the Stage 1 (Phase 1) and Stage 2, Phase 2 remediation activities as it is relatively unaffected by current commercial operations.

It is anticipated that the Phase 3 and 4 remedial activities under Stage 2 will progress in that order, but the implementation of Phase 4 will require careful coordination with Pasminco in regard to slope stability along the southwestern Site boundary. The current freshwater dam wall will need to be removed during remediation, the majority of which is located within the Site.

The containment cell will be constructed and filled progressively during phases 2 to 4 of the Stage 2 works.

6.8 Coordination of remediation activities

While most aspects of the Pasminco and IFL remediation programs can progress independently, it is recognised that there are certain cross-boundary issues that should be coordinated between the projects as far as practicable. In general, the works will be undertaken in sequence, however due to the need to coordinate some components of the remediation works with Pasminco it may be necessary to modify the sequence of the phases. The primary cross-boundary issues include:

- Communication and scheduling of planned remediation activities along the common property boundaries.
- Control of discharge of potentially contaminated media (surface water, groundwater and soil/sediment) across the common property boundaries.
- Coordination of remediation activities in the in-filled southern gully, where large retaining walls currently support a significant topographic difference between ground levels along the common property boundary. There is a potential risk that excavation close to the foot of the retaining structures on Pasminco property could destabilise retaining the walls. As such, close coordination will be required for the remediation of this area to ensure that slope stability along the common property boundary in this area is not compromised.
- Coordination regarding management of the freshwater dam adjacent to the southern end of the property. The dam wall is largely within the Site, while the dam itself is on Pasminco land. Remediation of fill material in the in-filled gully on the Site would require removal of the current dam wall, and as such, control measures for water entering the dam must be coordinated between IFL and Pasminco.
- Agreement regarding provision or reinstatement of basic services (water, sewer, gas and power) as required throughout the remediation program.
- Agreement regarding easement requirements for discharge of various water streams such as surface water runoff and treated groundwater.
- Establishing consistent and compatible post-remediation ground levels and land use across the common property boundaries.

Remediation activities with cross-boundary implications continue to be openly discussed between IFL and the Pasminco administrators and their project managers to ensure that the relevant issues are identified in advance and managed appropriately. The specific communication methods will include mutual attendance at regular project status and cross-boundary coordination meetings.

It may be, for example, that the Phase 2 and 4 works need to be undertaken at the same time in order to coordinate with the Pasminco remediation works program.

7 Project description

As described in Chapter 3, the Stage 2 remediation strategy would be undertaken in a number of phases. The Stage 1 EA (involving Phase 1) was approved by DoP in August 2009. This chapter provides details of the construction and operational aspects of Phases 2 to 4 of the proposed project as part of Stage 2.

In order to assess the maximum potential impact of the project, and to give IFL flexibility to coordinate activities with the Pasminco land remediation, this EA conservatively assumes that Phases 2, 3 and 4 of Stage 2 will occur concurrently. This would represent a highly conservative assessment of the impacts of the proposed project. In reality however, it is unlikely that all phases of the proposed project would occur at the same time. This conservative approach to the EA was adopted to accommodate flexibility in the remedial staging, as management of cross-boundary issues may require certain aspects of separate phases to occur concurrently depending on the progress of the IFL and Pasminco remediation programs. Refer to Chapter 3 for more detail.

7.1 Construction methodology

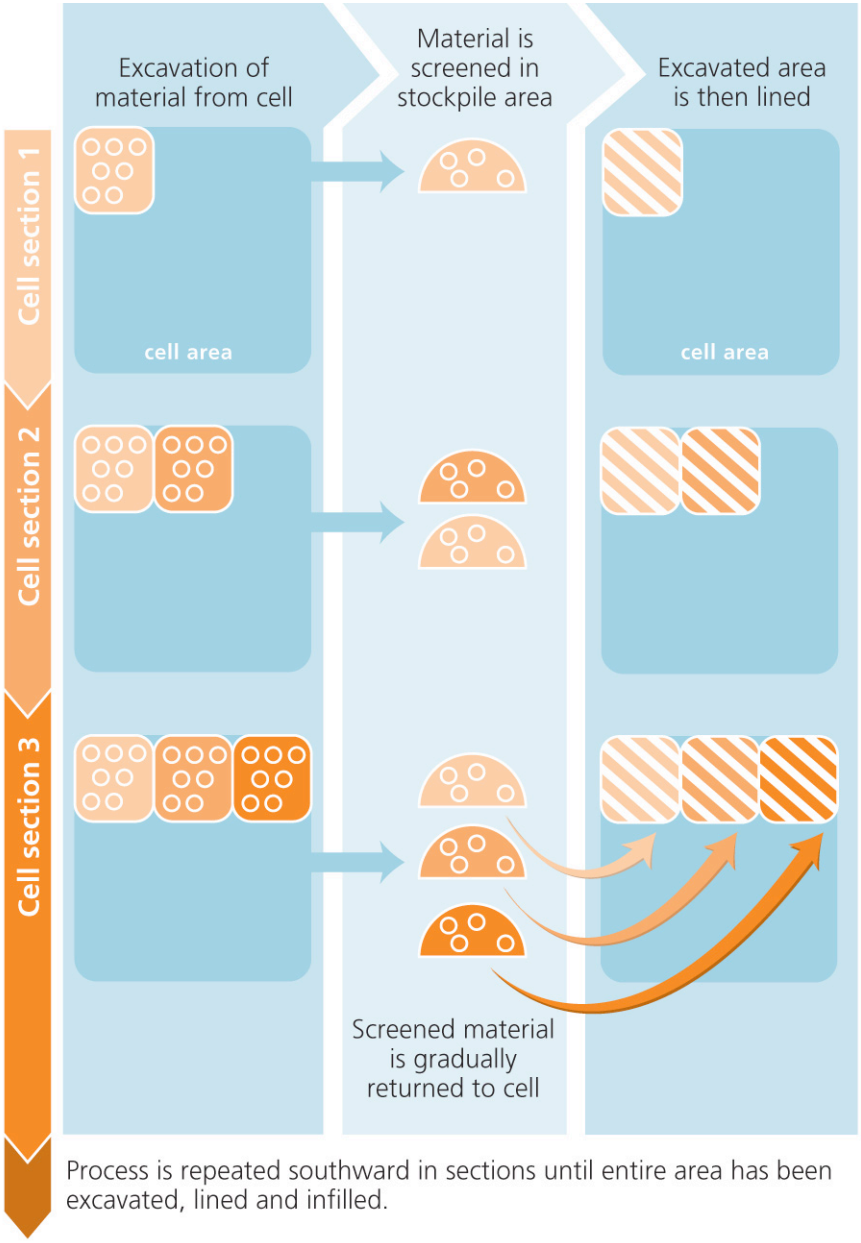
Stage 2 – Phase 2

Phase 2 of the Stage 2 remediation program would involve the remediation of the contaminated fill and soil in the northern area of the Site, and the progressive construction of the containment cell that will be the final repository for the contaminated material.

The cell landform will generally be rectangular in shape, approximately 150m wide by 400m long, with a shaped north-east corner to allow for free surface water drainage around the cell. It would have a maximum elevation of 46m (AHD) and would be set back from property boundaries by 10–20m on the east, 20m on the north side, and 30m on the west side. The proposed cell footprint is presented in Figure 8 of the Conceptual RAP in Appendix B.

The excavation for and construction of the containment cell would be the key tasks in Phase 2 of the Stage 2 remediation program. The cell would be built progressively in sections, starting at the northern end of the Site and working southwards. As each section of the cell is excavated, the material would be transferred to dedicated on-site stockpile areas, where materials would be screened. Following excavation and validation of the base of the cell in that section, installation of the cell lining system (as described below) would begin. On completion of the lining system, the screened material would be placed in the cell, in the same order that construction of the cell occurred, such that the volume of stockpiled excavated material is kept to a minimum throughout the cell construction process. This process is demonstrated conceptually in Figure 4 .

Figure 4 Cell construction process



The excavated fill and soil would be visually inspected for the presence of asbestos containing material, screened to remove oversize or deleterious material, and stockpiled in dedicated areas. The oversize and deleterious materials, such as steel and large rocks, would be either recycled or disposed at an appropriate waste facility, in accordance with the *Waste Classification Guidelines* (DECC, 2008). Alternatively, the material could be placed within the cell, upon approval by the Site Auditor. Screening methods will depend on the potential presence of asbestos-containing material in the fill.

The final excavated surface of the cell would be validated in accordance with the protocol broadly described in the Conceptual RAP (Appendix B). The detailed validation plan would be prepared prior to construction commencing and would be approved by the Site Auditor.

It is expected that removal of the contaminated material would result in site surface (outside the containment cell footprint) levels resembling the previous natural site surface prior to the deposition of the waste fill materials from the smelter operations. The remediation would therefore generally restore the natural shape of the landform for areas outside the cell footprint.

As the construction of the containment cell moves progressively southwards, the cell would eventually begin to encroach on the groundwater treatment plant installed as part of Stage 1 of the Site remediation program. The sequence of cell construction will be adapted to maintain the groundwater treatment plant until the completion of the remediation program. This will provide maximum flexibility for management of potentially contaminated water during the remediation program.

The groundwater treatment facility would be used to continue treating groundwater, and potentially seepage water from stockpiles and leachate from within completed portions of the cell, during this phase of the project.

Phase 2 of the Stage 2 remediation program would also involve removal of some redundant concrete pavement. This would be either recycled off-site, or crushed on-site and placed within the cell. If the quality of this material is suitable, options for on-site reuse of crushed concrete (eg roadbase) will be considered in the context of future land use or for temporary road construction during remediation.

The northern part of Shed 4 may also be demolished as part of this phase. This would involve the removal of asbestos-containing materials, which would be stored and managed appropriately, potentially within the remaining portion of Shed 4, until disposed within the containment cell.

Prior to construction commencing, site establishment activities would include the following:

- Mobilisation of site office and site amenities within existing IFL buildings, or demountable units as required.
- Construction of a sediment control dam and biofiltration system in the south-western corner of the area.
- Preparation of stockpiling areas, including establishment of silt fencing and surface water run-off collection and treatment controls where appropriate.
- Excavation of approximately 25,000m^3 of fill and soil in the vicinity of the northern boundary of the Site, and excavation of natural material along the perimeter to achieve suitable falls for passive drainage.
- Relocation of overhead power lines currently crossing the north-eastern corner of the Site to the site boundary to accommodate cell construction.
- Installation of a surface water collection pipe or culvert along the north-eastern corner of the proposed cell area to direct surface water run-off around the construction site.

Containment cell design

The cell would be located in the northern portion of the Site. This location was selected based on intended cell configuration, the existing contaminated soil distribution, and site operational constraints. The cell design described below is considered consistent with best practice standards for this type of structure. The final detailed design will be approved by the Site Auditor and DECCW. The cell will be designed in accordance with an expected lifespan in the order of 100 years. The Site Auditor will validate and approve all steps in the cell construction, ensuring the cell's integrity.

The basic configuration of the containment cell is a moulded landform. The proposed cell landform would be set back from the property boundaries by 10–30m, to provide for site drainage and surface water management, easement relocation, and as a contingency to accommodate potential future contingency/remediation works.

The base of the cell would be constructed below the current surface level, within the natural soil profile, beneath the excavated fill. The cell base would also generally be above the groundwater level of the shallow natural aquifer. The cell base gradients would provide for gravity draining through a granular blanket draining layer installed immediately above the cell liner (as described below). The base of the cell would be validated prior to installation of the liner in accordance with the protocol established for the area and approved by the Site Auditor. An underdrain will be included beneath the containment cell to account for long-term groundwater variations, which may infrequently intersect the base of the cell, in response to extreme climatic events/periods. The underdrain is expected to be dry in all but the most extreme climatic events.

The cell liner would be a geosynthetic composite liner, comprising a welded high-density polyethylene (HDPE) geomembrane with an overlying geotextile cushion for puncture protection and with an underlying geosynthetic clay liner (GCL), and soil-bearing layer. A GCL is a manufactured product made up of a layer of bentonite clay sandwiched between two geotextile layers.

Both HDPE and GCL materials have extremely high resistance to chemical attack and degradation. These materials are considered appropriate in this case given the low pH conditions with high dissolved metal concentrations. Further investigations into the durability of the cell liner system will be undertaken during detailed design.

The capping system would consist of a geosynthetic composite cap with a linear low-density polyethylene (LLDPE) geomembrane, an overlying drainage system and revegetation layer. This would be underlain by a GCL and seal-bearing layer. The LLDPE membrane would be textured on both sides where installed on the cell batters, to increase slope stability of the capping system. The resistance of LLDPE to chemical degradation is very high and would be adequate for the capping system.

A description of the materials compatibility assessment (MCA) to be prepared for the site can be found at Appendix G. The MCA will include:

- A general description and characterisation of the material intended to be emplaced within the containment cell, based on the results of the environmental assessments performed across the site and published information on typical slag properties.
- An evaluation of potential physical and chemical reactions or reaction by-products generated by storage of the contaminated fill material within the cell, including a compatibility assessment of the proposed liner materials with the reaction by-products.
- An evaluation of the potential for contaminant flux across the proposed composite liner system due to chemical diffusion from leachate (and possible related changes to the GCL).

A drainage system would overlie the cap, to minimise direct build-up of water on the cap, ensuring cap stability and reducing leakage into the cell. The cell landform would be sloped to provide surface water drainage, and would include engineered channels to control water flow. Appropriate local vegetation such as grasses would be established on the cell surface to minimise and control surface erosion. The total cap thickness would be approximately one metre, providing physical separation between contaminated soil materials and the cell surface.

The materials to be placed in the cell are predominantly fill and soil, contaminated with elevated concentrations of metals, phosphorous, and sulphates, as well as certain contaminated building materials from demolition of site structures. These materials are considered compatible with the proposed cell lining and capping materials. Detailed assessment of the compatibility of the waste materials with the cell liner system will be undertaken during detailed design, with final signoff by the Site Auditor.

The preliminary cell design allows for a cell volume of approximately 270,000m^3. This is generally consistent with previous conservative estimates of the volume of waste material requiring remediation at the Site. As the excavated material is previously placed fill, a significant difference between *in-situ* volume and volume after compaction in the cell is not anticipated. In the event that the volume of contaminated soil requiring placement in the containment cell is less than anticipated, the cell may be reduced in size by a reduction in cell length, from south to north.

It is likely that compaction of the contaminated soil placed in the cell would achieve a relatively high density, approximately 95 per cent of standard maximum dry density. This would ensure that post-remediation settlement of the landform would be in the normal range for earthwork structures and would be able to be tolerated by the capping system.

Further detailed cell design will be undertaken and documented as part of the detailed RAP documents, approved by the Site Auditor.

Key construction elements

- Personnel on site during this phase would include: site manager, leading hand, subcontractors (electrician, plumbers), environmental and geotechnical consultants. Total personnel are estimated between seven to ten people.
- Standard working hours throughout all phases would be: 7am to 5pm, Monday to Friday. If required, Saturday work hours would be 8am to 1pm.
- Construction machinery is likely to include one bulldozer (D8), two 20–30 tonne excavators, two 30–40 tonne articulated dump trucks, and one water cart.
- Concrete crushing plant and mechanical screens.
- Total internal truck movements throughout Phase 2 would be approximately 8,000–10,000.
- Total external truck movements would be approximately 800.
- Estimated timeframe to undertake the works would be 10–12 months.
- Waste produced: approximately 10,000m^3 of screened oversize inert materials to be disposed off-site progressively.
- Total amount proposed to be excavated during Phase 2 is in the order of 100,000m^3.

Stage 2 – Phase 3

Phase 3 of the Stage 2 remediation program would involve the demolition of all site buildings and infrastructure within the central area of the Site. This would include removal of all manufacturing and storage facilities and hardstand areas not required for traffic movements as part of the remediation program.

Uncontaminated waste materials would be disposed off-site to appropriate handling or disposal facilities, in accordance with the *Waste Classification Guidelines* (DECC 2008). It is expected that the asbestos-containing materials would be buried within an area of the containment cell to be established

during Phase 3, pending appropriate approvals. If these approvals cannot be obtained, the materials would be disposed off-site to an appropriately licensed landfill.

Following removal of the Site buildings, pavements and infrastructure, the contaminated soil materials from this area of the Site would be excavated and placed within the containment cell. The final excavated site surface would undergo testing and be validated in accordance with the validation protocol as described in the Detailed RAP (in general accordance with that described in the Conceptual RAP), and to the satisfaction of the Site Auditor.

Excavated material would be screened, and oversize inert material (metal, rock, rubble) would be segregated, to then be classified under the *Waste Classification Guidelines* (DECC 2008) and either disposed of or recycled off-site at an appropriate facility. Concrete may be crushed on site or recycled off-site. Clean crushed concrete may be stockpiled on site for later use.

The final landform of this area of the Site would approximate the previous natural site surface prior to the deposition of the waste fill materials from the smelter operations, aside from the areas excavated for building construction.

Phase 3 would involve the disconnection of services (including electricity, water, etc) to the main site buildings. Mitigation measures such as additional dust and noise-monitoring locations would also be installed. Further details are provided in Chapter 7.

The site establishment procedures undertaken for Phase 2 would continue for Phases 3 and 4.

Key construction elements

- Personnel on site:
  - Waste contractor (up to four personnel).
  - Demolition and other contractors (30–40 personnel).
  - Appropriately trained electricians, plumbers, subcontractors (assume ten personnel).
  - Environmental and geotechnical consultant (two personnel).
  - Civil contractor.
- Machinery used would include:
  - Bulldozer, excavator, two dump trucks and two water carts.
  - Two to four mobile cranes, low loaders, oxy-acetylene torches, grinders, two loaders, two bobcats (with street sweeper attachment), two to four forklifts and waste recycling receptors.
  - Scissor lifts and four elevated work platforms.
  - Four 20–30 tonne excavators with shears, hydraulic hammers and crushing jars.
  - Telescopic forks.
  - Four 30–40 tonne articulated dump trucks.
  - Concrete crushing plant and mechanical screens.
- Total internal truck movements throughout Phase 3 would be approximately 20,000–25,000 (estimated average of 60 per day).
- Total external truck movements would be approximately 1,650–1,700:

- Estimated 600 truck movements for delivery of cell capping material (average 40 per day, maximum of 60 in any one day, for a period of three to four weeks).
- Estimated 680 truck movements for off-site disposal of deleterious material (average 170 per week for four one-week events).
- Estimated 360–420 external truck movements for miscellaneous purposes (average one per day for 12–14 months).

- Estimated timeframe to undertake the combined works would be 12–4 months, assuming some overlap of demolition and fill excavation activities.
- Waste produced: approximately 10,000m^3 of deleterious material to be disposed off-site progressively.
- Total amount proposed to be excavated during Phase 3 is in the order of 100,000m^3.

Stage 2 – Phase 4

Phase 4 of the Stage 2 remediation program would involve demolition of all remaining site infrastructure, particularly that occurring in the southern area of the Site.

Uncontaminated waste materials would be disposed off-site to appropriate handling or disposal facilities, in accordance with the *Waste Classification Guidelines* (DECC 2008). It is expected that asbestos-containing materials would be buried within the containment cell, pending appropriate approvals. If these approvals cannot be obtained for on-site disposal within the cell, the asbestos containing materials would be disposed off-site to an appropriately licensed landfill.

Following removal of the Site infrastructure, the contaminated soil materials from this area of the Site, including those in the in-filled gully and the contaminated material within the dam wall, would be excavated and placed within the containment cell. The steep grade near the Site boundary and the extension of fill materials in this area onto the Pasminco site would require liaison with the adjacent site operators to facilitate the effective removal of the contaminated soil from this area.

Excavated material would be screened, and oversize inert material would be segregated to be classified under the *Waste Classification Guidelines* (DECC 2008) and either disposed or recycled off-site at an appropriate facility. Concrete may be crushed on site or recycled off-site. Clean crushed concrete may be stockpiled on site for later use.

The final excavated site surface would be validated in accordance with the validation protocol and to the satisfaction of the Site Auditor.

The final landform of this area of the Site would approximate the previous natural site surface prior to the deposition of the waste fill materials from the smelter operations, aside from areas excavated for building construction. This would reinstate the former gully area across the southern section of the Site, which may form a natural drainage course as part of the Site redevelopment. It is anticipated that the dam wall occurring within the IFL property would not be required for future water management and would be removed as part of these works.

Key construction elements

- Personnel on site:
  - Waste contractor (up to four personnel).
  - Demolition and other contractors (30–40 personnel).

- Appropriately trained electricians, plumbers, subcontractors (assume ten personnel).
- Environmental and geotechnical consultant (two personnel).
- Civil contractor.

- Machinery used would include:
  - Four 20–30 tonne excavators.
  - Four 30–40 tonne articulated dump trucks.
  - Water cart.
  - Front-end loader/backhoe.
  - Concrete crushing plant and mechanical screen.
  - Dozer/grader.
  - Bobcat with street sweeper attachment.
- Total internal truck movements would be approximately 13,900.
- Total external truck movements would be approximately 2,100.
- Estimated timeframe for completion of this phase would be five to seven months.
- Waste produced would be approximately 10,000m^3 of deleterious material to be disposed off-site progressively.
- Total amount to be excavated and stockpiled would be in the order of 100,000m^3.

7.2 Maintenance and monitoring

Prior to the commencement of phase 2 of the Stage 2 works program, a baseline groundwater monitoring program would be conducted in the area of interest. Periodic groundwater monitoring of selected wells located across the Site would be conducted throughout the remediation program to characterise the influence of the remediation program on groundwater contaminant concentrations and to provide a temporal record of the variation in groundwater concentrations.

The groundwater monitoring process would continue throughout Phases 3 and 4, and into the post-remediation phase to validate the results of remediation.

A site environmental management plan (SEMP) would be prepared for the cell area and implemented once remediation is complete. The SEMP will include measures for ongoing dust, odour, surface water, and sediment management, fencing and boundary maintenance, and other issues. This would also be approved by the Site Auditor.

7.3 Subdivision of the containment cell

Overview of subdivision

As part of the Project, IFL is seeking approval for a two-lot subdivision as shown in the proposed plan of subdivision at Appendix H.

This is explained below together with a discussion of the easements which the subdivided lot will enjoy.

The proposed subdivision

IFL is proposing a two-lot plan of subdivision as illustrated in Figure 5 below. The subdivision will separate the containment cell at the northern end of the Site (Lot 1) from the balance of the IFL Site (Lot 2).

Figure 5 Proposed subdivision

The subdivision will enable the engineered containment cell in Lot 1 to be retained and responsibly managed by IFL in perpetuity whilst Lot 2 is free to be sold and developed for low density residential development and other supporting uses. It is important to note two further matters.

- First, that the subdivision will not create an additional developable lot. Only Lot 2 will be capable of development. The containment cell in Lot 1 will be remediated to a level suitable for open space with low-maintenance vegetation to ensure that erosion and sediment control measures will not be required after remediation is complete.
- You will note that Figure 5 shows a dotted line across Lot 1. Although IFL is seeking that the southern boundary of Lot 1 is as shown, approval may be sought at a later stage to move the southern boundary to the location of the dotted line. This is because of the inability to precisely determine the extent of the fill area. The cell design allows for a cell volume of approximately 270,000m^3. This is generally consistent with previous conservative estimates of the volume of waste material requiring remediation at the Site. As the excavated material is previously placed fill, a significant difference between *in-situ* volume and volume after compaction in the cell is not anticipated. In the event that the volume of contaminated soil requiring placement in the containment cell is less than anticipated, the cell may be reduced in size by a reduction in cell length, from south to north. This in turn would mean that IFL could apply for a reduction in the southern boundary of Lot 1 to increase the developable land area on Lot 2.

Access and services

Both of the lots created by the proposed subdivision will be provided with appropriate access and services.

Lot 1 (containment cell) will enjoy three points of ongoing access:

- The first is through a right of carriageway that IFL enjoys across the centre of the Pasminco site. This easement was allowed for in the Settlement Agreement entered into on 28 March 2006 between IFL and the receivers and managers of Pasminco.
- The second point of access will be via a right of carrieageway that IFL, as owner of Lot 2 will grant to the owner of Lot 1 to traverse across Lot 2 from First Street This will provide ongoing access to the subdivided cell in the short to medium term.
- Thirdly, in the future master planning of the area, roads will be constructed around Lot 1 and appropriate road access to the containment cell can be secured at that time. However, in the meantime, the rights of carriageway above will provide appropriate access to Lot 1.

IFL will require electricity and drainage services to Lot 1 for the monitoring and leachate collection system that will be installed as part of the cell design. During the remediation, these services will be provided from Lot 2. However, prior to completion of the cell, and before Lot 2 is sold for development, the services to the cell on Lot 1 will be finalised by IFL.

Lot 2 (the developable lot) currently enjoys access from First Street as well as a right of carriageway across the Pasminco site as well as access off First Street. This easement is allowed for in the Settlement Agreement entered into on 28 March 2006 between IFL and the receivers and managers of Pasminco. It is also serviced by power and water.

Easements over containment cell

The subdivision plan in Appendix G shows that a number of easements currently exist over the proposed containment cell area in Lot 1. Table 3 below shows all of these easements. With the exception of the electrical easements in favour of Energy Australia, the rest of the easements were created to facilitate the joint manufacturing operations of Pasminco and IPL on the two sites. Now that the manufacturing operations for both companies have ceased, these easements are no longer required. A number of these easements traverse the proposed containment cell in Lot 1 and need to be extinguished as rights of drainage and railway access are inconsistent with an engineered containment cell.

Table 3 Overview of easements

Easement reference	Description of easement	Future requirement for this easement
A	Easement for railway purposes	This railway is no longer required because due to the cessation of manufacturing on the Pasminco site, no rail cars run along this track.
B	Easement for drainage	Dealing K 749194 states that the terms of the easement are to allow water from the saltwater dam to flow through the easement for drainage purposes. As the salt water dam is to be demolished then this easement will no longer be needed.

Easement reference	Description of easement	Future requirement for this easement
C	Easement for drainage of salt water and fresh water	Dealing K 749194 states that the terms of the easement are for water supply affecting the drainage of the salt water pipes and the dam freshwater supply pipes. Considering that the salt water and fresh water dams will be demolished, this easement will no longer be required.
D	Easement for electricity purposes in favour of Energy Australia	The high-tension electricity power cable will be diverted around the cell so as to not obstruct the cell construction. IFL will realign this easement after discussions with Energy Australia.
E	Easement for bulk hoppers	The easement for the bulk hoppers and conveyor belt system is no longer required now that the manufacturing operations have stopped.
F	Right of carriageway	This carriageway is no longer required due to the cessation of manufacturing.
G	Easement for electricity purposes in favour of Energy Australia	The electricity transmission lines will be diverted around the north-east corner of the cell so as to not obstruct the cell construction. IFL will realign this easement after discussions with Energy Australia.

Easements D and G are electricity easements in favour of Energy Australia. IPL has had discussions with Energy Australia and these easements will be moved to facilitate the containment cell construction on Lot 1. Easements A, B, C, E and F are redundant as noted above and would normally be extinguished as part of the overall master planning process. However, they may need to be extinguished prior to construction of the cell or a work around found. Discussions are underway with the adjoining landowner who historically enjoyed the benefit of the easements for their extinguishment.

8 Stakeholder consultation

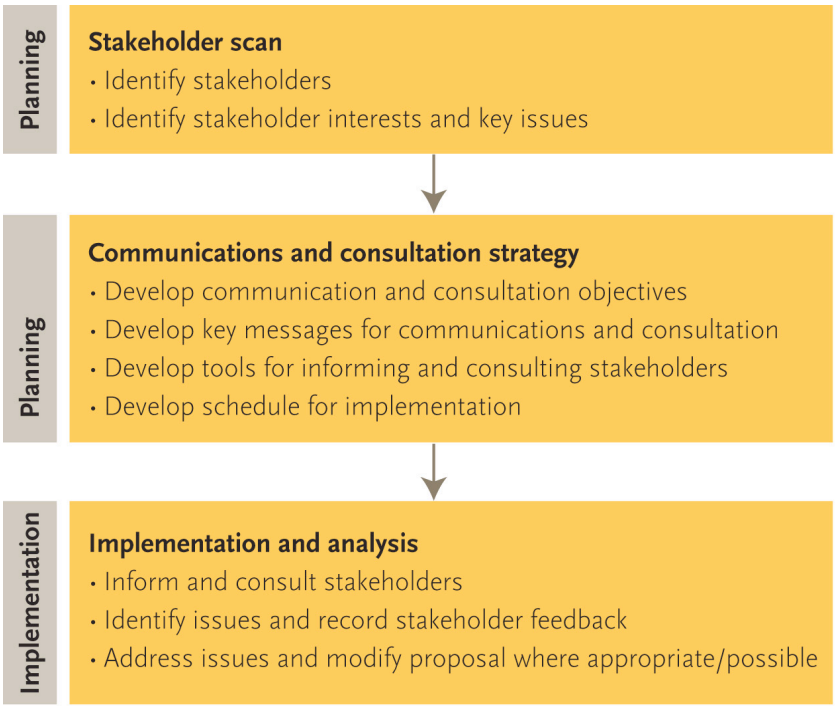
8.1 Methodology

Figure 6 illustrates the methodology adopted for communicating and consulting with stakeholders about the proposed project.

As shown in Figure 5, the first step in the process involved preparing a stakeholder scan to identify the various stakeholders involved in the proposed project including government agencies, local residents, community and environment groups. The stakeholder scan also included a preliminary assessment of stakeholders' key issues and level of interest in the proposal.

The results of the stakeholder scan were used to prepare a communications and consultation strategy, which identifies the objectives, key messages, tools and methods of communicating and consulting with stakeholders. A range of communication and consultation tools have been used, including meetings, newsletters, newspaper advertisements and website information, to meet the differing characteristics and needs of stakeholders.

Figure 6 Communication and consultation methodology



8.2 Objectives

The primary objective of the communication and consultation process for the proposed project is to meet the DGRs for stakeholder consultation. The DGRs state:

> *'During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners.*
>
> *In particular you must consult with the:*
>
> - *Department of Environment and Climate Change.*
> - *Department of Water and Energy.*
> - *NSW Department of Health.*
> - *Mines Subsidence Board.*
> - *Lake Macquarie City Council.*
> - *The administrators of the Pasminco Cockle Creek site.*
>
> *The consultation process and the issues raised must be described in the Environmental Assessment.'*

In addition to the consultation requirements of the Director-General, the stakeholder communication and consultation process was designed to meet the following objectives:

- Gain stakeholder input and support for the project so that proposed demolition and remediation works at the Site can be carried out effectively.
- Ensure that relevant project information is shared with stakeholders, including customers, in an accessible format.
- Ensure that communications activities are undertaken in coordination with key project milestones.
- Ensure that IFL employees are kept up to date with latest information regarding the Cockle Creek remediation project.

8.3 Outcomes

Key stakeholders

Consultation with key stakeholders, including state government agencies, local council and the administrators of the Pasminco Cockle Creek site, has been ongoing since the commencement of the project in approximately 2006.

As part of the preparation of this EA, key stakeholders were consulted through letters, phone calls and meetings. In February 2009, IFL wrote to (then) DECC, DWE, NSW Health, the Mines Subsidence Board and Lake Macquarie City Council, to advise of the works involved in Stage 2 of the proposed project and to invite stakeholders to meet with the project team to discuss key issues. As a result, IFL met with DECC, DWE and Lake Macquarie City Council.

The issues raised by the key stakeholders generally related to staging and timing of the remediation program, licensing conditions for groundwater extraction, public health risks, heritage issues, and monitoring and management of the containment cell once complete. Table 3 provides the results of consultation undertaken with key stakeholders and the specific issues raised. A reference to where each issue is addressed within this EA is also included.

Table 4 Consultation with key stakeholders

Stakeholder	Consultation method	Key issues	Where addressed within this EA
DECCW (Sydney)	• Meetings • Phone calls • Letters	• Staging of the remediation project and Part 3A planning process. • Timing of remediation works. • Details of IFL's Voluntary Remediation Agreement with DECCW. • Monitored natural attenuation.	• Section 3.5 • Appendix A
DECCW (Newcastle)	• Meetings • Phone calls • Letters	• Environment Protection Licence conditions.	• Appendix A
DWE (Newcastle)	• Meetings • Phone calls • Letters	• Need for a groundwater monitoring program on Site. • Bore Licence conditions (for groundwater extraction and injection) and IFL responsibilities for maintaining compliance. • Request to be kept informed about the project. • Lifespan of the containment cell. • Potential ongoing surface water management at the southern end of the Site.	• Chapters 3 and 4 • Section 2.5
NSW Health	• Letters	• Public health risks associated with the liberation of contaminated dust. • Public health risks from potential exposure to residual contaminated soil, post remediation. • Responsibility for ongoing management of the containment cell.	• Sections 7.1 and 7.6 • Chapter 9
Mines Subsidence Board	• Phone calls • Letters	• Mine subsidence design parameters. • Certification of the containment cell.	• Section 7.14

Stakeholder	Consultation method	Key issues	Where addressed within this EA
Lake Macquarie City Council	• Meetings • Phone calls • Letters	• Staging and timing of remediation works. • Part 3A planning process. • Heritage issues and the retention of heritage items from the Site. • Evidence of contamination for heritage items that cannot be retained. • Public access to the containment cell. • Management of aquatic species in the dam and future management of the dam. • Request to be kept informed about the project. • Coordination with the Pasminco Cockle Creek site.	• Chapter 2 • Section 7.5 • Chapter 9 • Section 3.7
Administrators of the Pasminco Cockle Creek site	• Meetings • Phone calls • Letters	• Staging and timing of remediation works. • Cross boundary issues.	• Chapter 3

Local community

Communications and consultation with the local community has been ongoing since approximately 2007. There has been a relatively low level of interest in the project from the local community. Informal feedback from residents suggests that the community is relatively supportive of the plans for the Site's remediation. The primary issues of interest from the local community relate to heritage conservation and plans for the future use of the Site following completion of remediation.

A summary of the communications and consultation undertaken with the local community is provided below.

Community newsletters

IFL has prepared and distributed regular community newsletters to over 3,000 residents in the neighbouring suburbs of Boolaroo, Macquarie Hills, Speers Point and Argenton. The newsletters provided residents with information about what's involved in the proposed project and details on how to provide feedback to the project team. Copies of the newsletters were displayed at Lake Macquarie City Council and the local library and were also mailed to stakeholders, including local council staff, local Aboriginal land councils, government agencies and community and environment groups. Copies are also available on the IPL website.

Copies of community newsletters are provided in Appendix C. A further issue of the community newsletter will be prepared and distributed during the public exhibition period for this EA.

Media program

A proactive media program (including the issuing of media statements and newspaper advertisements) has been implemented to raise community awareness about the proposed project and key project milestones. Several stories have been published in the local newspapers in response to this media program. The media program will continue through the public exhibition period for this EA, as appropriate. Copies of media statements issued by IFL are also available on the IPL website.

Website information

A dedicated page has been developed on the IPL website for information regarding the proposed project (refer to www.incitecpivot.com.au in the 'About Us/HSEC' section). This information is updated regularly as new information and communication materials are produced. Copies of community newsletters are available from the website, as well as a link to the EA documents on the DoP's website.

Community information display

During the public exhibition period for the Stage 1 EA, a community information display was held in the nearby shopping area of Argenton highlighting the key aspects of the proposed project. The purpose of the information display was to provide the community with the opportunity to meet members of the project team, find out more about the proposed project, ask questions and provide feedback. Approximately ten people attended the information display including local residents and neighbouring landowners. A further community information display will be held during the public exhibition period for this EA, to help raise community awareness of the project and the exhibition period.

8.4 Ongoing consultation

IFL is committed to communicating and consulting with stakeholders throughout the life of the proposed project. Feedback received from stakeholders will continue to inform the proposed project and will continue to be used to assist in managing potential adverse impacts.

During public exhibition of this EA, IFL will continue to communicate and consult with stakeholders and the community via the following methods:

- Further meetings will be held with key stakeholders and community groups as appropriate.
- A further issue of IFL's community newsletter will be prepared and distributed to publicise the public exhibition period.
- Newspaper advertisements will be published and a media statement will be issued to raise awareness of the public exhibition period.
- A community information display will be held to provide stakeholders and the community with information on the proposed project, and an opportunity to ask questions and provide feedback.
- Website information will be updated on an ongoing basis.

The Statement of Commitments (SOC) provided in Chapter 9 provides further detail regarding IFL's commitment to ongoing communication and consultation with stakeholders and the community in relation to the proposed project.

9 Environmental risk assessment

9.1 Environmental risk assessment

Overview and environmental risk assessment methodology

The environmental risk assessment is an important step in the process of assessment of environmental impacts and is required as part of the DGRs. In particular it is used to guide the scoping of environmental investigations and assessments, assist in identifying appropriate mitigation measures and management responses, and to identify potentially significant residual impacts.

The environmental risk assessment has been performed in accordance with the principles of *AS/NZS4360:2004-Risk Management*. The risk of each identified potential impact has been ranked by identifying the consequences of the impact and the likelihood of it occurring. The probable effectiveness of the proposed mitigation measures is then considered to determine the residual risk of each impact.

The risk rating categories determined through the analysis are summarised in Table 5 .

Table 5 Risk rating categories

Risk rating score	Risk category	General description
1, 2 or 3	High	Detailed assessment and planning necessary to develop appropriate measures to mitigate and manage the potential impacts.
4 or 5	Medium	Potential impacts can be mitigated through the application of relatively standard environmental management measures.
6	Low	Potential impacts either require no specific management measures or are mitigated adequately through other working controls (such as detailed design requirements, normal working practice, quality and safety controls).

The consequence definitions used in determining the risk rating are given in Table 6 .

Table 6 Risk assessment consequence definitions

Consequence level	Definition
Catastrophic	• Would result in a major prosecution under relevant environmental legislation. • Would cause long-term and irreversible impacts.
Major	• Would result in a fine or equivalent under relevant environmental legislation. • Would cause medium-term, potentially irreversible impacts.
Moderate	• Would result in a medium-term, reversible impacts.
Minor	• Would result in short-term, reversible impacts.
Insignificant	• Would not result in any impacts.

By considering the frequency of activities that may cause the impact and the probability of the impact occurring during that activity, the likelihood of each identified impact occurring is also used in determining the risk rating and has been classed as:

- Very likely – almost certain to occur in the course of normal or abnormal operating circumstances.
- Likely – event is likely to occur in the course of normal operations.
- Unlikely – event could occur in the course of normal or abnormal operating circumstances.
- Very unlikely – event may occur in exceptional circumstance.

The risk rating of each potential impact is then determined through combining the consequence and likelihood according to the following matrix presented in Table 6.

Table 7 Risk matrix

		Likelihood			
		Very likely	**Likely**	**Unlikely**	**Very unlikely**
Consequences	**Catastrophic**	1	1	2	3
	Major	1	2	3	4
	Moderate	2	3	4	5
	Minor	3	4	5	6
	Insignificant	4	5	6	6

The potential effectiveness of the mitigation measures proposed in the following chapters were then assessed and the degree of effectiveness of mitigations classed as either:

- Very effective – increases risk rating score by three points (eg from 3 – high to 6 – low).
- Effective – increases risk rating score by two points (eg from 2 – high to 4 – medium).
- Partly effective – increases risk rating score by one point (eg from 3 – high to 4 – medium).
- Not effective – no change in risk rating.

A combination of mitigation measures would allow a further increase in risk rating for any given risk.

Environmental risk assessment analysis

The risk assessment was based on information from the impact assessment and construction experience on similar remediation projects. A workshop to review the potential risks associated with the project was conducted with key members of the project team and the environmental assessment team. The assessment took specific regard to the mitigation and management measures developed and to the principles for ecologically sustainable development. The results of the environmental risk workshop are summarised below in tables 7 and 8.

The majority of the risks identified will occur in all phases of the project. However, some will only occur in one phase. Risks specific to each phase are noted in the tables below.

Table 8 Construction risk assessment

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Soil						
Exposure to contaminated soil	• Soil excavated during construction may be contaminated. • Workers may be exposed to contaminated soil. • Presence of asbestos-containing materials.	Major	Very likely	1	• Wear safety gear. • Occupational health and safety (OHS) plan. • Delineate/control contamination zones. • Construction Environmental Management Plan (CEMP)/RAP.	5
Uncontrolled release of contaminated soil	• Spillage of contaminated soil during transportation. • Escape of soil from stockpile areas.	Moderate	Very likely	2	• CEMP/RAP. • Positioning of stockpiles close to access points. • Traffic management procedures.	5
Uncertainty of existing fill depth	• Increase excavation volumes, depth and size of cell.	Major	Likely	2	• Reasonable worst case number used for cell design. • Conservative estimate. • Waste reduction procedures (materials management plan).	4
Instability of excavations or stockpiles	• Slippage occurs during construction, destabilisation of slopes, disruption to neighbouring properties, risk to personnel. • Stockpiles experience slippage.	Major	Likely	2	• Batters. • Guidelines for excavation design. • Dewatering. • WorkCover requirements for excavation depths. • CEMP.	6

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Imported material for cell cap/ site grading is contaminated	• Unsuitable for construction purpose. • Increased likelihood of exposure to contaminated material.	Moderate	Likely	3	• Material management plan. • Validation sampling prior to importing to site.	6
Storage and spillage of hazardous substances and fuel, hosing down of plant, failure of environmental controls	• Potential for further contamination of soil. • Potential off-site movement of contaminated soil.	Moderate	Unlikely	4	• All refuelling via mobile plant, rather than storage. • Spill kits. • Bunded refuelling areas. • Storage of hazardous materials in accordance with Australian Standards. • CEMP/RAP	6
Non-indigenous heritage						
Removal of heritage items	• All heritage items will be removed during construction works.	Major	Very likely	1	• Photographic recording.	4
Destruction of unknown heritage items	• Unknown heritage items may be discovered during construction works.	Major	Very unlikely	4	• Heritage report. • CEMP to contain a ‘stop-work’ statement.	6
Waste and resource management						
Generation of construction waste	• Increased demand on local resources. • Workers generate domestic waste. • Excavation of non-contaminated material during construction works.	Minor	Very likely	3	• Waste management plan.	6

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Generation of contaminated waste during construction	• Excavation of unknown contaminated materials. • Release of contaminants from hazardous building materials during demolition of Shed 4.	Moderate	Likely	3	• Materials management plan. • Hazardous materials assessment prior to demolition to determine appropriate handling methods and controls required.	6
Greenhouse gas emissions resulting from plant operation	• Operation of plant generates greenhouse gas emissions.	Minor	Very likely	3	• Regular maintenance and inspection of equipment.	6
Stage 2 – Phase 3 only						
Removal of surplus hazardous liquids from above ground storage tanks (ASTs)	• Spillages during removal and disposal of surplus liquids. • Potential soil and surface water impacts if ASTs are damaged during site works. • Hazardous vapours (risks to human health/workers. • Potential impacts from unidentified underground storage tanks during site works (human health and environment).	Moderate	Likely	3	• CEMP/Decommissioning Plan for site infrastructure. • Licensed waste contractors used to remove and transport surplus materials. • Material safety data sheets.	6

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Stage 2 – Phase 4 only						
Removal of surplus hazardous liquids from above ground storage tanks (ASTs)	• Spillages during removal and disposal of surplus liquids. • Potential soil and surface water impacts if ASTs are damaged during site works. • Hazardous vapours (risks to human health/workers). • Potential impacts from unidentified underground storage tanks during site works (human health and environment).	Moderate	Likely	3	• CEMP/Decommissioning Plan for site infrastructure. • Licensed waste contractors used to remove and transport surplus materials. • Material safety data sheets.	6
Groundwater						
Construction activities encounter contaminated perched groundwater	• Exposure to and release of groundwater.	Major	Likely	2	• CEMP/RAP. • Water treatment plant (Phase 1).	5
Spillage of fuel or other hazardous substance into groundwater	• Additional contamination of groundwater.	Moderate	Unlikely	4	• CEMP/RAP.	6
Stage 2 – Phase 2 only						
Localised depressurisation of shallow aquifer required during cell construction	• Exposure to contaminated groundwater. • Locally depressed water table.	Moderate	Likely	3	• CEMP/RAP. • Water treatment plant.	5
Surface water and stormwater						
Construction activities impact surface water regime	• Civil works may impact on surface water regime. • Potential for increased erosion.	Moderate	Very likely	2	• Surface water management plan (SWMP).	5

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Surface water impacts on construction activities	• Surface water migration may disturb civil works. • Surface water erosion during construction.	Moderate	Likely	3	• SWMP. • CEMP.	5
Surface water runoff in disturbed areas becomes contaminated	• Additional contaminated water requiring management. • Potential off-site movement of contaminated water.	Major	Unlikely	3	• SWMP. • CEMP. • Dam system to capture contaminated runoff will be implemented.	5
Failure of water storage dams or insufficient system capacity for storm events	• Release of potentially contaminated water off-site.	Major	Very unlikely	4	• Surface water management plan. • Design of dam to accommodate potential storm flows. • CEMP.	5
Release of contaminated pore water to the surface	• Contaminated water released to the environment. • Human health risks – contact with contaminated water.	Minor	Very likely	3	• CEMP.	5
Uncertain seepage rate into excavations, and increased excavation size could lead to increased seepage inflow	• Water management infrastructure is not adequate for increased volumes of groundwater. • Greater potential for exposure to contaminated water.	Moderate	Likely	3	• CEMP. • Scaleable treatment options to mitigate increasing flows. • Pre-draining of fill areas where appropriate.	6

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Stage 2 – Phase 4 only						
Demolition of freshwater dam wall	• Contaminated soil may enter uncontaminated freshwater dam. • Potential to flood operational and/or remediation areas of the Site.	Major	Likely	2	• Establish bypass culvert to redirect surface water runoff to intended discharge location before demolishing dam wall. • CEMP/RAP.	5
	• Encounter live high-voltage power lines present in dam wall that currently supply power to the plant.	Catastrophic	Very unlikely	3	• Disconnect and reroute (if necessary) power lines currently running through dam wall.	6
Noise and vibration						
Noise and vibration impacts community during construction	• Noise levels during construction may exceed existing noise levels from the plant. • Noise from equipment used during construction may affect local businesses and residents. • Vibration during construction may cause damage to built structures.	Major	Very likely	1	• CEMP. • Silencers, screens, acoustic housing, muffle equipment.	5
Indigenous heritage						
Discovery of an indigenous heritage item	• Unknown indigenous heritage items may be uncovered during construction works.	Minor	Very unlikely	6	• Stop work if item discovered.	6
Destruction of an indigenous heritage item	• Unknown indigenous heritage items may be inadvertently destroyed during construction works.	Major	Very unlikely	4	• AHIMS search of the Site. • Stop work if items discovered.	6

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Flora and fauna						
Discovery of unknown flora/fauna species	• Significant flora and/or flora species may be unearthed during construction works.	Moderate	Very unlikely	5	• Stop work, record and rescue item.	6
Impact on flora/fauna arising from construction works	• Accidental death of fauna. • Potential for invasion of weeds.	Moderate	Likely	3	• Appropriate weed control procedures. • Mulching on vulnerable areas. • Replanting with native species wherever possible.	5
Hazards and risks						
Impact on personnel or property arising from construction works	• Physical hazards during construction works may cause injury to personnel or damage property.	Major	Likely	2	• CEMP. • OHS plan.	6
Hazardous materials or substances encountered during excavation or demolition	• Personnel or environment exposed to flammable or acidic material. • Removal of substances may expose personnel to hazardous material.	Moderate	Unlikely	4	• Materials management plan. • CEMP.	6
Impact on environment arising from construction works	• Potential for grass fires as a result of ‘hot works’ during construction.	Minor	Unlikely	5	• CEMP.	6
Proximity of overhead power lines to construction areas	• Damage to powerlines.	Moderate	Unlikely	4	• CEMP. • Coordination of relocation as required.	6
	• Potential for machinery to come into contact with powerlines causing electrical disruption or electrocution of personnel.	Catastrophic	Unlikely	2	• CEMP. • Coordination of relocation as required.	5

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Stage 2 – Phase 3 only						
Services on site	• Disconnection may impact existing site operations. • Underground services may be encountered or damaged during excavation.	Minor	Unlikely	5	• Undertake services investigation prior to excavation. • Disconnection plan. • CEMP.	6
Visual amenity						
Decrease in visual amenity during construction works	• Equipment and fencing present during construction may reduce visual amenity for surrounding users.	Minor	Very likely	3	• Use neutral coloured fencing. • Store plant equipment in sheds or buildings on-site.	6
Decrease in visual amenity as a result of project	• Cell landform may change visual landscape.	Major	Very likely	1	• Re-planting of vegetation at completion of project. • Cell design to promote integration with existing landscape.	6
Land-use impacts						
Ineffective coordination of cross-boundary issues (with Pasminco)	• Remediation schedules may be delayed.	Moderate	Likely	3	• Ongoing liaison with Pasminco administrators.	4
Socio-economic impacts						
Construction works impact on local residents	• Disruption to the local community may occur during construction works.	Minor	Unlikely	5	• Ongoing community consultation program. • Work hours and procedures in line with CEMP.	6

Environmental issues	Assessment of potential impacts				Assessment of proposed mitigation measures	
Issue	**Potential impacts**	**Overall consequence**	**Overall likelihood**	**Risk rating**	**Proposed mitigation measures**	**Residual risk rating**
Traffic and access						
Disruptions in traffic	• Increased traffic to and from the Site may disrupt local road traffic during construction. • Increased internal traffic disrupts site operations.	Minor	Unlikely	5	• Traffic management plan.	6
Air quality						
Dust generation during construction	• Dust may be disturbed/produced during excavation stockpiling, screening, and general materials transfer/placement. • Dust may be contaminated.	Major	Very likely	1	• Stockpiles covered with sheeting or watered down, or stored in buildings. • No work on windy days. • Workers to wear masks where risk of contamination inhalation.	5
Emissions generation	• Greenhouse gas emissions may be produced by equipment. • Emissions may be released from equipment.	Moderate	Very likely	2	• Equipment to be kept in good working order and maintained. • Equipment not left standing idle when not in use. • Make efficient trips to minimise number of vehicle trips.	6
Odours generated or encountered during construction	• Offensive odour may disturb amenity of residents and site personnel.	Minor	Very unlikely	6	• Odour masking/suppressants if required.	6

Table 9 Operational risk assessment

Issue	Potential impacts	Overall consequence	Overall likelihood	Risk rating	Proposed mitigation measures	Residual risk rating
Groundwater						
Loss of integrity in base liner (degradation, damage)	• Groundwater contaminated from leachate (water level below cell base). • Groundwater ingress into cell – increase in leachate generation (water level above cell base).	Major	Unlikely	3	• Composite liner system to minimise potential for liner failure. • Materials compatibility assessment. • Cell base above shallow aquifer water table to reduce potential for unacceptable impacts from leakage. • Setback between cell and downgradient the Site boundary to accommodate contingency remedial action if warranted.	6
Leachate collection system failure (clogging, pipe collapse)	• Groundwater contaminated from leachate.	Major	Unlikely	3	• Use of appropriate low reactivity aggregate for drainage layer. • Geochemical modelling to assess potential for scale formation. • Regular purge of leachate sumps to minimise residence time and reduce potential for scale formation.	6
Mine subsidence						
Mine subsidence	• Settlement results in cap or liner failure. • Escape of leachate – impact to groundwater. • Exposure pathway to contaminated fill.	Major	Unlikely	3	• Maximum subsidence conditions for future mining imposed by Mine Subsidence Board. • Cell designed to tolerate maximum subsidence condition.	6
Seismic activity	• Rupture of cell cap or base. • Escape of leachate – impact to groundwater. • Exposure pathway to contaminated fill.	Major	Unlikely	3	• Cell designed to tolerate reasonable level of ground movement.	6

Issue	Potential impacts	Overall consequence	Overall likelihood	Risk rating	Proposed mitigation measures	Residual risk rating
Cell integrity						
Materials compatibility within cell	• Generation of gas. • Reactivity with cell liner materials. • Clogging of leachate drainage system.	Major	Unlikely	3	• Materials compatibility assessment. • Prepare site procedures to manage impacts in the event materials are found to be incompatible. This would be included in the SEMP and finalised prior to Site Auditor sign off.	5
Siltation of leachate collection sumps	• Reduced efficiency for leachate removal. • Greater leachate head within cell – increased risk of liner failure.	Moderate	Unlikely	4	• SEMP. • Regular maintenance of leachate collection sumps.	6
	• Escape of leachate – impact to groundwater.	Major	Unlikely	3	• SEMP. • Regular maintenance of leachate collection sumps.	5
Capping drainage system fails	• Scouring of cap. • Exposure pathway to contaminated fill material. • Transport of contaminated sediment.	Major	Unlikely	3	• SEMP. • Regular maintenance and inspection program for cell and drainage infrastructure. • Repair drainage infrastructure as necessary.	6
Cell cap cracks Differential settlement of cap	• Exposure pathway to contaminated fill material. • Slippage of cap material into adjacent property.	Major	Unlikely	3	• Waste materials compacted following emplacement within cell. • Cap designed to tolerate reasonable degree of differential settlement. • SEMP. • Regular maintenance and inspection program for cell. • Repair cap as necessary.	6

Issue	Potential impacts	Overall consequence	Overall likelihood	Risk rating	Proposed mitigation measures	Residual risk rating
Cap disturbed by excavation	• Exposure pathway to contaminated fill material.	Moderate	Unlikely	4	• SEMP. • Perimeter access controls and signage around cell.	6
Capping system instability (static, earthquake)	• Cap failure (cracking, slippage). • Exposure pathway to contaminated fill material.	Moderate	Likely	3	• Slope stability assessment during detailed design. • Cap designed to tolerate reasonable level of ground movement. • Regular maintenance and inspection regime to assess cap condition and repair if necessary.	5
Underdrain fails	• Increased hydraulic pressure on bottom of cell (note: only if groundwater level is above cell base). • Impact to cell liner integrity.	Major	Unlikely	3	• Appropriate design specification. • Construction quality assessment program during construction. • Contingency allowance for perimeter hydraulic controls if warranted.	6
Erosion of cell cap	• Exposure pathway to contaminated fill material. • Slippage of cap material into adjacent property.	Major	Unlikely	3	• SEMP. • Cell cap designed with vegetated cover for stability. • Surface water management to reduce potential for scour or other erosion of cap. • Regular maintenance and inspection program, including leachate sump pump out.	6
Ongoing maintenance of cell area not performed	• Weed infestation. • Unapproved excavation and access.	Major	Likely	2	• SEMP. • Perimeter controls eg fencing and signage.	6

Issue	Potential impacts	Overall consequence	Overall likelihood	Risk rating	Proposed mitigation measures	Residual risk rating
Surface water and stormwater						
Surface water drain blockage	• Scouring of cap. • Exposure pathway to contaminated fill material. • Transport of contaminated sediment.	Major	Unlikely	3	• SEMP. • Regular maintenance and inspection program for cell and drainage infrastructure. • Unblock drain as necessary.	6
Leachate sump overflow	• Exposure to leachate at ground level. • Potential impact to groundwater.	Major	Unlikely	3	• SEMP. • Regular maintenance and inspection program, including leachate sump pump out.	6
Flora and fauna						
Vegetation loss	• Impact to visual amenity. • Enhanced erosion of cell cap.	Moderate	Unlikely	4	• SEMP. • Regular maintenance and inspection program. • Appropriate landscaping design for cap.	6

9.2 Outcomes of environmental risk assessment

The environmental risk analysis identified nine items of high risk for the proposed project. These are:

- Soil.
- Non-indigenous heritage.
- Waste and resource management.
- Groundwater.
- Surface water and stormwater.
- Noise and vibration.
- Visual amenity.
- Land use.
- Air quality.

The following items were determined to have a medium or low risk for the proposed project:

- Indigenous heritage.
- Mine subsidence.
- Flora and fauna.
- Hazards and risks.
- Socio-economic impacts.
- Traffic and access.

The residual risk ratings demonstrate that all mitigation measures are effective or very effective at reducing all risks to either low or medium level.

Environmental issues that were determined to be high risk were considered in this EA in more detail in Chapter 7. Those indicated to be medium or low risk have been briefly considered in Chapter 8. This approach is based on the fact that issues exhibiting medium to low risks can be mitigated through the application of standard environmental management measures which would be employed at the Site in any case.

There will be minimal socio-economic impacts associated with the proposed project. This issue has therefore not been further considered in this EA.

Impacts on flora and fauna, hazards and risks, and landuse will be addressed as part of a CEMP. This will be finalised prior to construction occurring. The non-key issues of Indigenous heritage, visual amenity and mine subsidence are addressed in Chapter 8. The risks associated with land use are addressed in Section 3.7 above.

10 Environmental assessment

10.1 Soil

Existing environment

A detailed description of the existing soil characteristics of the Site is provided in the Conceptual RAP at Appendix B. Table 9 provides a summary of the key features of the recent extensive soil investigations at the Site.

Table 10 Summary of soil contamination at the Site

Contaminant	Criteria	Maximum contaminant concentration	Exceedance of relevant criteria
Total phosphorus	2,000mg/kg [1]	102,000mg/kg	Yes
Sulphate	667mg/kg[1]	14,000mg/kg	Yes
Calcium	No criteria	241,000mg/kg	N/A
Ammonia	No criteria	71mg/kg	N/A
Nitrate	No criteria	39mg/kg	N/A
Arsenic	20mg/kg[1]	6,800mg/kg	Yes
Cadmium	3mg/kg[1]	3,500mg/kg	Yes
Chromium	400mg/kg[1]	2,700mg/kg	Yes
Copper	100mg/kg[1]	8,900mg/kg	Yes
Lead	600mg/kg[1]	46,000mg/kg	Yes
Mercury	1mg/kg[1]	52.3mg/kg	Yes
Nickel	60mg/kg[1]	1,300mg/kg	Yes
Zinc	200mg/kg[1]	229,000mg/kg	Yes
TPH (C6-C9)	65mg/kg – C10-C36 [2]	Below laboratory reporting limits	No
TPH (C10-C36)	1,000mg/kg – C10-C36[2]	230mg/kg	No
Benzene	1mg/kg[2]	0.4mg/kg	No
Toluene	1.4mg/kg[2]	0.3mg/kg	No
Ethyl benzene	3.1mg/kg[2]	0.2mg/kg	No
Xylenes	14mg/kg[2]	0.7mg/kg	No
PAHs	20mg/kg [3]	3.2mg/kg	No
OCP	No group criteria	Below laboratory reporting limits	N/A
PCB	10mg/kg[3]	Below laboratory reporting limits	No
VHC	No group criteria	Below laboratory reporting limits	N/A

[1] NEPM EIL | [2] NSW EPA sensitive use guideline | [3] NEPM HIL A guideline

US EPA TCLP and ASLP leach tests were undertaken on selected samples and indicated that the metals in fill materials at the Site were highly leachable. In particular, lead and zinc leachability showed that all fill materials are potentially moderately to highly leachable and therefore will be required to be managed as part of the overall remediation strategy. For a detailed discussion of the contamination status of the soils at the Site, refer to Appendix B, Conceptual RAP.

The results illustrate a high level of soil contamination, exceeding guideline levels for ten contaminants. This level of contamination presents a human health and environmental risk and, as such, requires the effective, long-term containment and management strategy outlined in Chapter 3.

Potential impacts

Construction

It is considered very likely that without cautionary measures, site personnel would be exposed to contaminated soils during the construction of the cell and demolition of the site infrastructure. Given the nature of contamination, this may lead to chronic health problems, such as respiratory illnesses.

The potential for uncontrolled release of contaminated soil during excavation and placement in the cell is regarded as likely to occur without appropriate mitigation measures in place. During rain events the release of contaminated soil on-site presents a risk to areas down-gradient as it is likely to be washed onto neighbouring properties. Also any contaminated spoil that is not adequately contained and managed could leach and impact the groundwater system during rain events.

While extensive testing has been undertaken, there is still some uncertainty regarding the depth of the existing fill and contamination across the site as this has only been extrapolated from known data points. Whilst the investigations have provided a reasonable estimate of the expected depth, there is some potential for variations to occur beyond that anticipated from the available data set. This may lead to an underestimation of the depth, amount and severity of contamination on-site and require a larger containment cell. This variation is not expected to result in a review of containment methods as the contamination profile is well understood. The containment method proposed is suitable for a broad range of contaminant concentrations which would readily accommodate those concentrations that may occur at the Site.

Stockpiling of material will be required. This presents the risk of stockpile instability. Potential impacts include slippage of a large stockpile resulting in injury and material entering drainage channels and contaminating off-site areas.

There is the potential for imported material, for cell capping and site grading, to be contaminated. The use of contaminated material for these purposes would result in the contamination of remediated or exposed surfaces and pose a human health and environmental risk for the ongoing management of the Site.

Operation

During operation there is some risk that materials within the cell may be incompatible. This could lead to the generation of gas, reactivity with cell liner materials or the clogging of the leachate drainage system. These impacts would compromise the cells structural integrity and may lead to cell degradation and the escape of sediment. This is expected to be a remote possibility due to the works conducted to date and to be undertaken as part of the detailed cell design.

There also may be silt build-up within the internal leachate collection sumps within the cell. This could result in reduced efficiency for leachate removal, creating a greater amount of leachate within the cell leading to an increased risk of seepage through the liner and the potential for leachate to escape and impact the groundwater.

In the event that the capping drainage system fails potential impacts could include scouring of the cap, exposing a pathway to contaminated fill material, and the transport of contaminated sediment into waterways.

A crack in the cell cap may develop as a result of differential settlement of the cap, the cap being disturbed by excavation, or by seismic activity. This would create an exposure pathway to contaminated fill material and could also result in slippage of cap material into adjacent property. Similarly, if the cell cap erodes a likely impact would be the creation of an exposure pathway to contaminated fill material and could also result in slippage of cap material into the adjacent property. Failure of the cap could also result in greater infiltration which may increase leachate generation.

Management and mitigation measures

Details of the management and mitigation measures proposed for impacts on soil are provided in Table 10 below.

Table 11 Proposed management and mitigation measures for soil impacts

Potential impact	Proposed management and mitigation measure
Construction impacts	
Exposure to contaminated soil	All site personnel will be provided with all necessary personal protective equipment (PPE).
	An OH&S plan will be developed and implemented.
	The Site will have delineated and controlled contamination zones.
	Environmental controls will be considered under a site CEMP and a detailed RAP.
Uncontrolled release of contaminated soil	Environmental controls will be considered under a site CEMP and a detailed RAP.
	Positioning of stockpiles close to access points to minimise the amount of spoil movement.
	A traffic management plan will be developed to designate traffic routes and material movement on-site.
	Erosion and sediment control measures will be implemented in accordance with Landcom's *Soils and Construction, Managing Urban Stormwater* (Blue Book).
Uncertainty of existing fill depth	A reasonable 'worst-case' estimation for contaminated material on-site is considered in cell design.
	Waste reduction procedures will be implemented to remove uncontaminated, deleterious material and ensure only contaminated material is placed in the cell.
	The surface will be validated after excavation is completed and approved by a DECCW accredited site auditor.
Instability of excavations or stockpiles	All stockpiles will be battered back to prevent stockpile slippage or collapse.
	Relevant guidelines for excavation design will be adhered to.
	A dewatering procedure will be developed for excavations to ensure any contamination encountered is managed and excavations maintain their structural integrity.

Potential impact	Proposed management and mitigation measure
	Any WorkCover requirements for excavation depths will be adhered to.
	Environmental controls will be considered under a site CEMP and a detailed remediation action plan RAP.
Imported material for cell cap/site grading is contaminated	A material management plan will be developed and implemented to ensure all imported materials are not contaminated.
	Prior to importing any material to site, validation sampling will be undertaken.
Storage and spillage of hazardous substances and fuel, hosing down of plant, failure of environmental controls	All refuelling will be with mobile plant with appropriate spill kits available, removing the need for storage.
	Spill kits will be placed around the Site to ensure any unforseen spills can be managed effectively.
	All refuelling areas will be bunded.
	All storage of hazardous materials will be in accordance with Australian Standards.
	Environmental controls will be considered under a site CEMP and a detailed remediation action plan RAP.
Operation	
Incompatibility of materials within cell	A materials compatibility assessment will be completed prior to containment cell construction.
	Site procedures will be prepared to manage impacts in the event materials are found to be incompatible. This would be included in the SEMP and finalised prior to Site Auditor sign off.
	A maintenance and monitoring plan will be included in the SEMP to ensure cell integrity.
Siltation of leachate collection sumps	An SEMP will be prepared and will include all necessary environmental controls to reduce silt build up.
	Sumps will be subject to a regular maintenance program.
Capping drainage system fails	An SEMP will be prepared and will include all necessary environmental controls to maintain drainage system.
	There will be a regular maintenance and inspection program for the cell and drainage infrastructure.
	Any damage noted to cap will be repaired in a timely manner.
Cell cap cracks due to differential settlement of cap	Waste materials will be compacted following placement within cell.
	Cap design will tolerate a reasonable degree of differential settlement.
	An SEMP will be prepared and will include procedures to minimise the risk of differential settlement.
	There will be a regular maintenance and inspection program for the cell.
	Any damage noted to cap will be repaired in a timely manner.
Cap disturbed by excavation	An SEMP will be prepared and will include procedures to minimise the risk of cap disturbance.
	Perimeter access controls and signage around cell will be installed.

Potential impact	Proposed management and mitigation measure
Capping system instability (static, earthquake)	Slope stability assessment will be completed as part of the detailed design.
	The cap will be designed to tolerate a reasonable level of ground movement.
	There will be a regular maintenance and inspection regime to assess cap condition and repair if necessary.
Underdrain fails	Appropriate design specification.
	Construction quality assessment program during construction.
	Contingency allowance for perimeter hydraulic controls if warranted.
Erosion of cell cap	An SEMP will be prepared and will include procedures to minimise the risk of cap disturbance.
	The cell cap will be designed with vegetated cover for stability.
	Surface water will be managed to reduce potential for scour or other erosion of the cell cap.
	There will be a regular maintenance and inspection regime to assess cap condition and repair if necessary.
Ongoing maintenance of cell area not performed	A maintenance and monitoring plan will be included in the SEMP to ensure cell integrity.

10.2 Groundwater

Existing environment

Regional hydrogeological assessments conducted for the neighbouring Pasminco site suggest that the regional groundwater system does not currently discharge to surface waters at Cockle Creek. These assessments assumed that this is due to dewatering activities at a nearby colliery. The potential for the discharge from the groundwater system to Cockle Creek was considered given the possibility that dewatering activities may cease and the groundwater levels may rebound, resulting in discharge to the creek. It is not expected that groundwater will continue to discharge to points lower than sea level as these points will no longer occur, and sea level will become the new benchmark. Water levels in Cockle Creek are tidally influenced and are close to sea level. Therefore, this appears the most probable point for groundwater to discharge once the natural balance is restored. This is consistent with the regional hydrogeology which includes the recharge area associated with Munibung Hill. It is expected that the long-term levels will result in groundwater emanating from the Site discharging to the creek.

Further to the regional assessment, targeted groundwater investigations were conducted on the northern section of the Site in preparation for assessment of the overall remediation strategy. The key findings of the investigations are summarised in Table 11.

Table 12 Groundwater contamination of the Site

Contaminant	Criteria	Maximum contaminant concentration	Exceedance
Zinc	0.015mg/L[1]	6,600mg/L	Yes
Cadmium	0.0055mg/L[1]	17mg/L	Yes
Copper	0.0013mg/L[1]	2.3mg/L	Yes
Lead	0.0044mg/L[1]	0.64mg/L	Yes
Mercury	0.0004mg/L[1]	0.049mg/L	Yes
Nickel	0.07mg/L[1]	0.62mg/L	Yes
Ammonia	0.91mg/L[1]	6.6mg/L	Yes
Nitrate	0.7mg/L[2]	12mg/L	Yes
PAH	Not specified	Below laboratory reporting limits	No
Cyanide	0.004mg/L[1]	Below laboratory reporting limits	No
Organochlorine pesticides	Not specified	Below laboratory reporting limits	No
Phenols	Not specified	Below laboratory reporting limits	No
Polychlorinated biphenyls	Not specified	Below laboratory reporting limits	No
Volatile halogenated compounds	Not specified	Below laboratory reporting limits	No

[1] *ANZECC 2000 95 per cent marine trigger*

[2] *ANZECC 2000*

Further characteristics of the groundwater contamination at the Site are:

- Whilst the southern area of the Site (the infilled gully area) was the initial concern and the reason for the issue of the *Declaration of Remediation Site,* recent investigations have indicated that the groundwater in the northern area of the study area is more heavily impacted. This may be due to the increased potential for recharge and leaching in this area as a result of the lack of any hardstand surface cover.
- The distribution of groundwater contamination generally indicates that the highest groundwater concentrations are located in areas where relatively large volumes of slag material are present directly hydraulically up gradient. This also tends to correspond with the highest soil contamination concentrations and leachability results.
- The highest groundwater contaminant concentrations generally occurred in the fill or shallow natural groundwaters at each location.
- Low pH groundwaters were encountered across the Site with results ranging from 2.9 to 7.2. Almost all results were found to be below pH 7. The average groundwater pH was approximately 5.1.
- During sampling events, there were no odours apparent or visually impacted groundwater indicative of gross organic contamination. The contamination appears to be restricted to pH and metals and to a lesser extent, nutrients.

It is noted that the regional groundwater occurs in shallow and deeper aquifers located beneath the site. The relative groundwater levels between the shallow and deeper aquifers suggest there is a vertical downward gradient and this has persisted over the monitoring rounds conducted at the site over a

number of years. The shallow groundwater has been assessed to occur below the base of the fill material and the base of the proposed containment cell over the period of monitoring conducted at the site. However, given the long term nature of the proposed containment cell, the auditor had requested a more detailed assessment of possible groundwater levels in response to extreme and/or persistent climatic events that would lead to elevated shallow aquifer groundwater levels.

A numerical groundwater modelling assessment was conducted by Heritage Computing, and this indicated that under some conditions it was possible for the proposed containment cell base level to be swamped by shallow groundwater. As the groundwater is relatively shallow compared to the design containment cell base level, the frequency at which this might occur could not be confidently assessed due to the inherent error in the model predictions. Consequently, the auditor has required that the containment cell design include a suitable underdrainage system. The purpose of the underdrain will be to ensure that the containment cell base is not inundated by rising watertable, as the underdrain will drain any shallow groundwater away from the base of the cell and prevent any head build up beneath the cell base. This will prevent any reverse flow of seepage into the containment cell through the basal liner from elevated groundwater levels.

It should be noted that the model predictions are that the containment cell base would only be impacted by shallow rising watertable at infrequent periods and mostly likely for relatively short periods of time, dependent on the frequency of exceptionally high rainfall years. Given the very low permeability of the containment cell liner, the volume of water entering the containment cell over these shorter periods with relatively low hydraulic driving heads would be small. Any seepage entering the containment cell by this path should be collected by the containment cell internal seepage collection system so the groundwater related seepage would not readily flow back out from the containment cell during periods with a lower underlying watertable, when the hydraulic gradient was reversed.

The inclusion of the underdrain in the cell design is therefore considered to provide a very high level contingency against seepage entering the cell from a periodic rising watertable and provides a high level of assurance that changes in the shallow watertable elevation will essentially have no significant impact on the operation of the containment cell. The prediction of a typical watertable elevation therefore has no significant bearing on the design process or the risks of watertable interactions with the containment cell as this has been effectively mitigated by the inclusion of the underdrain. The detail of the underdrain system will be included in the containment cell design information incorporated in the Phase 2 Detailed RAP.

The proposed remediation works will remove the source of the groundwater contamination and, as such, prevent continued contamination of the groundwater being discharged from the Site. Therefore it is considered that the planned remediation works will have a long-term benefit, by ensuring that the source of groundwater contamination is removed from the system and the risk of any potential impacts to Cockle Creek decreases over time.

Potential impacts

Construction

Potential exposure to contaminated groundwater could result in the recontamination of validated surfaces or the contamination of the area surrounding the Site. The contaminated groundwater also presents a health risk to personnel as contact could cause respiratory illness if it is inhaled or body accumulation of metals if it is ingested.

The contaminated perched water within the fill will be removed or excavated as part of the construction works. Dewatering of this layer is expected to occur as part of construction and so contact with the contaminated perched water is possible.

The water table is likely to be depressed in the cell area as a result of dewatering activities off-site. This could result in potential problems if the dewatering activities cease and groundwater rebounds into the cell excavation area. However, the cell is to be constructed above the typical watertable elevation and the potential for any rebound to impact on the construction works is limited.

Further contamination of the groundwater is a potential impact of the proposed works due to events such as spillages on-site, or failure of environmental controls. However, due to the high level of contamination already present in the groundwater it is considered unlikely that this would have a deleterious impact on the existing groundwater quality.

Operation

Loss of integrity in the base liner either through degradation or damage is a potential impact arising from the operation of the cell. If this was to occur, groundwater may become contaminated from leachate (if the groundwater level was below the cell base) or there may be groundwater ingress into the cell and an increase in leachate generation (if the groundwater level was above the cell base).

There is also the potential for the internal leachate collection system to fail as a result of clogging or pipe collapse. The likely consequence of this failure would be build up of leachate within the cell which may increase the possibility of escape of leachate from the cell and subsequent impacts on groundwater quality.

Management and mitigation measures

Table 12 below describes the proposed management and mitigation measures for the potential impacts to groundwater arising from the construction and operation of the remediation program, as described above.

Table 13 Proposed management and mitigation measures for groundwater impacts

Potential impact	Proposed management and mitigation measures
Construction	
Exposure to and release of groundwater	Environmental controls will be considered under a site CEMP and a detailed RAP. The RAP will also consider personnel safety during construction of the cell.
	The groundwater treatment plant constructed as part of Phase 1 will be operational during the construction of the cell and can be used to treat impacted water.
	All site personnel will be provided with appropriate PPE.
Additional contamination of groundwater	Environmental controls will be considered under a site CEMP and a detailed RAP.
Operation	
Loss of integrity in base liner (degradation, damage)	A composite liner system will be used to minimise potential for liner failure.
	A materials compatibility assessment will be completed prior to cell construction beginning.
	The cell base will be above the shallow aquifer water table to reduce potential for impacting the groundwater or the groundwater contacting the liner.

Potential impact	Proposed management and mitigation measures
	The cell will be setback from the down gradient site boundary to accommodate contingency remedial action if necessary.
Leachate collection system failure (clogging, pipe collapse)	An appropriate low reactivity aggregate for the drainage layer will be used.
	Geochemical modelling will be undertaken to assess potential for scale formation.
	The sumps will be subject to a regular inspection and maintenance under the SEMP.

10.3 Surface water and stormwater

Existing environment

The nearest naturally occurring surface water body to the Site is Cockle Creek, approximately one kilometre to the west. The creek drains directly to Lake Macquarie, approximately two kilometres to the south. There is also a fresh water dam adjacent to the south-eastern boundary of the Site. The dam wall is located within the Site boundary, while the remainder of the dam and a spill way directs any discharge from the dam to Cockle Creek.

Storm water management at the Site differs by area, as shown in Figure 6. The arrangements for the northern area are summarised as follows:

- Run off from the undeveloped northern area is generally captured by two open drainage channels that convey water to a point on the northern Site boundary with Pasminco. From here, the surface water drains to large dams on the Pasminco lands, where it is treated as part of the Pasminco remediation project.
- A number of drainage easements exist on the Site in favour of Pasminco. These easements are intended to provide for drainage of water for Pasminco activities located on the eastern (uphill) side of the Site.

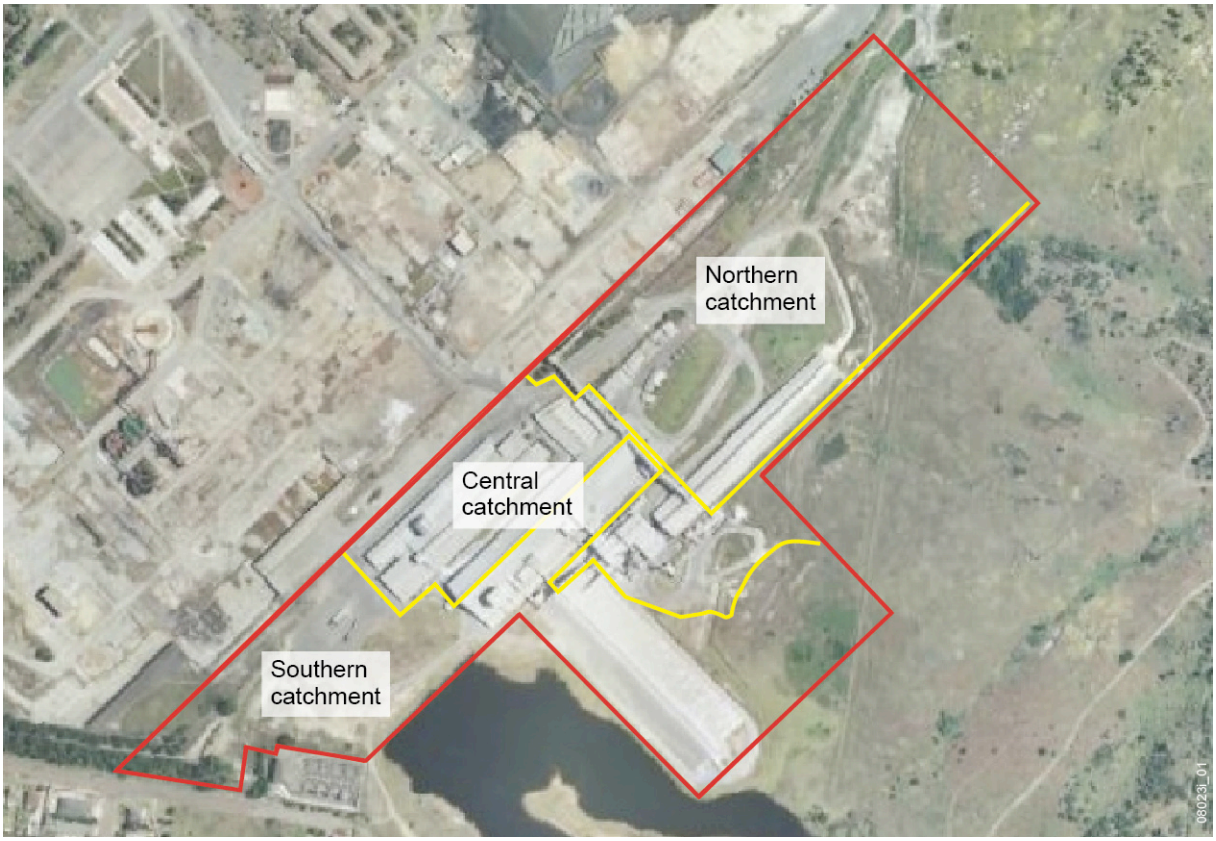
The arrangements for the central area are summarised as follows:

- The area around storage Shed one drains through this area. This is shown in Figure 6.
- Runoff from the central catchment is currently treated before discharge down the central easement by soda ash dosing plant, which raises the pH of the water.

The arrangements for the southern area are summarised as follows:

- Storage Sheds two and three, as well as the truck turning circle, drain to this area. This is shown in Figure 6.
- Currently excess run-off from the adjoining south east Pasminco site is discharged through an easement at the southern end of the Site, via the ‘six-foot drain’ installed through the IFL Cockle Creek Site which is effectively the spillway for the dam.

Figure 7 Catchment areas on-site



Potential impacts

Construction

The likelihood of a large storm event could result in a significant impact for the IFL Cockle Creek remediation program. A large storm event could result in the eroding of the open cell footprint area and the mobilisation of contamination to areas down-gradient of the Site.

A large storm event may also cause mobilisation of contaminants from any exposed surfaces undergoing remediation. These contaminants would flow down-gradient and could contaminate adjoining properties.

Operation

A surface water drain blockage may result in the scouring of the cell cap, an exposure pathway to contaminated fill (albeit though various impermeable layers) and the potential transport of contaminated sediment. This could lead to the migration of contaminants down-gradient of the Site. Similarly, if there was a failure of the internal cell leachate system, the contaminants could leak from the cell and may re-contaminate the soil surface and could potentially leach into the local groundwater system and contaminate areas down-gradient.

Cumulative impacts

The interface between surface water and groundwater is a key impact that will need to be carefully managed, particularly as the water will migrate from the Site to the adjoining site if uncontrolled. If the water interface is not effectively managed, there is the potential for contaminated materials to migrate

off-site and contaminate areas down-gradient. Also, the ineffective management may result in the contamination of otherwise clean water on-site.

Management and mitigation measures

Construction

Outlined below in Table 13 are the proposed surface water and stormwater mitigation measures.

Table 14 Proposed management and mitigation measures for surface and stormwater impacts

Potential impacts	Proposed management and mitigation measures
Construction	
A large storm event eroding the cell footprint and mobilising contaminants	A water storage pond will be constructed, with a capacity of 6,530m^3 to accommodate flow from a 1 in 100 year storm event. This will receive the majority of water falling up-gradient of the Site. Water stored in this pond will be pumped out through the central easement, where it will be monitored to ensure it is within EPA licence limits.
	A smaller pond will be constructed and receive water falling on the northern and central areas on site. This water will be treated using the groundwater treatment facility installed as part of Phase 1 or disposed of via the central easement if it is within EPA licence limits.
	Erosion and sediment control measures will be implemented in accordance with Landcom's *Managing Urban Stormwater: Soils and Construction,* (Blue Book).
Mobilisation of contaminants from areas undergoing remediation	Surface water from the remediation areas will be collected and diverted into a water storage pond and treated through the treatment plant method outlined above.
	Surface water management for the southern area depends on the final masterplanning for the area. Remediation activity for the southern portion of the Site will coordinate with the adjoining Pasminco site, to prevent the mobilisation of contaminants down-gradient of the Site.
Operation	
A surface water drain blockage resulting in scouring of the cell cap, an exposure pathway to contaminated fill and the transport of contaminated sediment	A management plan will be prepared for the surface water management system, including a regular maintenance and inspection regime, with repairs if necessary.
	The cell cap will be designed with vegetated cover for stability.
Leachate collection system failure (clogging, pipe collapse)	A management plan will be developed to ensure the on-site leachate collection system is maintained.
	An appropriate low reactivity aggregate for the drainage layer will be used.
	Geochemical modelling will be undertaken to assess potential for scale formation.
	The sumps will be subject to regular inspection and maintenance.
Cumulative impacts	
Cross contamination or contamination of down-gradient waters	A detailed drainage and water management plan will be prepared for the Site at each phase of the works.

10.4 Non-indigenous heritage

A statement of heritage impact was developed for the Site in order to establish its heritage significance, and to assess the potential impacts on the heritage values that may occur as a result of the proposed project. The key features of the statement of heritage impact are detailed below, while the full document can be found in Appendix D.

Existing environment

Overall historical background

The settlement and development of the Boolaroo area is closely tied with the development of the Pasminco lands and Site. Historical land uses in the vicinity of the Site include farming and orchards, fishing, logging, and coal mining. Land was cleared for the first stage of the Cockle Creek works in 1895, and the first buildings were constructed between 1896 and 1897. As a result of the construction of the plant, a railway siding was established at what became known as 'Sulphide Junction', in 1897.

The IFL superphosphate plant was established in order to utilise the by-product from other industrial processes. The original plant was established in 1913, with two main sheds, a sandstone office, and brick assay labs. The Site was expanded and refurbished a number of times during the 1930s and 1950s; these works included the addition of two more sheds.

Existing historical context

The Site is considered locally significant as it is representative of early industry in the Hunter region. Much of the importance of the Site comes from its relationship and early connection with the Pasminco sulphide plant. The establishment of the plant was instrumental in the development of the local surrounding community, as such it is considered historically and culturally significant on a local level.

The Site itself is also a significant resource for the history of industrial manufacture. The manufacturing process of phosphate fertiliser is important, as this has largely remained unchanged since the plant first began production. The Site presents an ongoing industrial process of fertiliser manufacture starting in the early twentieth century and continuing to this day. In addition, the layout and architecture of the Site presents an intact example of early twentieth century industrial landscape, and demonstrates the key characteristics of manufacturing procedures and industrial architecture. These heritage values manifest through the built heritage features of the study area and the current (and original) manufacturing process.

Items of significance

A desktop background study determined that no previously recorded historic heritage items exist within the Site. An inspection was carried out in order to undertake a heritage impact assessment for the Site. The complete heritage impact assessment can be found in Appendix D. A number of site elements of local historical significance were identified. These are described in Table 14

Table 15 Items of heritage significance

Item	Description
Sandstone and brick building	• Currently stands at the centre of the Site, functions as offices for IPL staff. • Made of machine bricks with sandstone foundations and corners. • First item constructed on the Site, circa late 1890s. • External condition is fair, inside modified for office use.
Sheds 1–4	• Sheds 1 and 2 are made of galvanised iron and asbestos or fibro sheeting. Shed 1 has a railway line running parallel to the interior wall of the shed through the northern side. • Shed 3 is made of asbestos and steel, and is in poor condition with the roof appearing brittle and flaking at the top. • Shed 4 is a large rectangular shed with a sloping roof made from corrugated sheets of asbestos cement sheeting and steel.
Railway line	• Runs north-east/south-west along the western boundary of the Site, abutting the Pasminco site. • Connects to Cockle Creek station and 'Sulphide Junction', runs partly into Shed 1. • Built entirely to service the IFL fertiliser plant, and does not have further significance other than its direct connections to the study area.
Gantry	• Runs parallel to the railway line and are in a dilapidated state. • Consists of a wooden 'A' frame gantry with steel pegs, support pegs, and a series of poles and beams. • Elevated to approximately 2.5–3m.

Indigenous heritage

An Aboriginal heritage Information Management System (AHIMS) search was conducted (see Appendix D). While items of indigenous heritage significance were found in the vicinity of the Site, the study area itself was found to have no registered aboriginal sites within its boundary. Refer to Section 8.2 for more information.

Potential impacts

Phase 3 of the remediation process would result in the demolition of all existing buildings and infrastructure on the Site, and industrial fabric relating to the operation and function of the Site.

The buildings on site are highly likely to be contaminated with heavy metals, and chemical and asbestos dust as a result of the use of the Site as a fertiliser plant. In addition, all buildings on the Site are constructed from or feature asbestos-containing materials, and are in poor, friable condition. The buildings would pose a significant public health risk if not removed. As a result, the buildings on-site are not suitable for adaptive re-use purposes and would require removal as part of this project.

The structures contributing to the local heritage will be removed, but an archival recording will be undertaken to ensure that the contribution that the Site makes to local heritage will be permanently recorded.

Management and mitigation measures

Table 16 describes the proposed management and mitigation measures for the potential heritage impacts of the project.

The contamination of the Site and subsequent removal of historical structures means that these mitigation measures should be carried out prior to demolition and remediation.

Table 16 Proposed management and mitigation measures for non-indigenous heritage impacts

Potential impact	Proposed management and mitigation measures
Unidentified archaeological relics may be unearthed during construction	Work will stop and the Heritage Council will be notified.
Removal of all heritage items and buildings	An archival photographic recording will be undertaken in accordance with the Department of Planning (Heritage Office) Guidelines 2001 (revised 2005) *Photographic recording of heritage items using film or digital capture*. The recording will focus on the industrial process, capture modes and methods of manufacturing superphosphate, and record the standing structures associated with the Site.
	Ongoing consultation with Lake Macquarie City Council regarding site heritage.
	Community consultation including an open day could be undertaken to record the significance of the Site and its history to the local community.
	An interpretation strategy could be prepared for the Site. This may include interpretive signage to be placed in any new development.

10.5 Air quality

Existing environment

An assessment of potential air quality impacts relating to the project was undertaken. The full document is provided in Appendix D. The key features of the assessment are described below.

Industrial and mining activities operating within five kilometres of the Site include the Pasminco site remediation operations, West Wallsend Colliery, Macquarie Coal Preparation Plant, Inghams Cardiff Feedmill and Works Infrastructure. These operations effect the background concentrations of contaminants present in the surrounding neighbourhoods.

Due to the nature and proximity of the Pasminco site remediation operations, they hold the greatest potential for cumulative impacts. Pasminco site remediation is due to be completed by mid 2010. The proposed IFL remediation is scheduled to start in early to mid 2010. A potential exists for a limited period of overlap in the Pasminco and IFL remediation works during 2010.

Figure 7 shows the existing Pasminco and IFL air quality monitoring locations. The closure of the Pasminco smelter in September 2003 and implementation of additional dust control measures resulted in significant reductions in particulate and heavy metal concentrations and deposition rates. It is further noted that air pollution concentrations recorded during 2007 and 2008 are likely to have been influenced by the Pasminco site remediation activities. Background suspended particulate and heavy metal

concentrations estimated for use in the assessment of cumulative air quality impacts are shown in Table 16 below.

Particulate is characterised as three size fractions: total suspended particulate (TSP), and particulate less that or equal to ten and 2.5 microns in aerodynamic diameter (PM_{10} and $PM_{2.5}$ respectively).

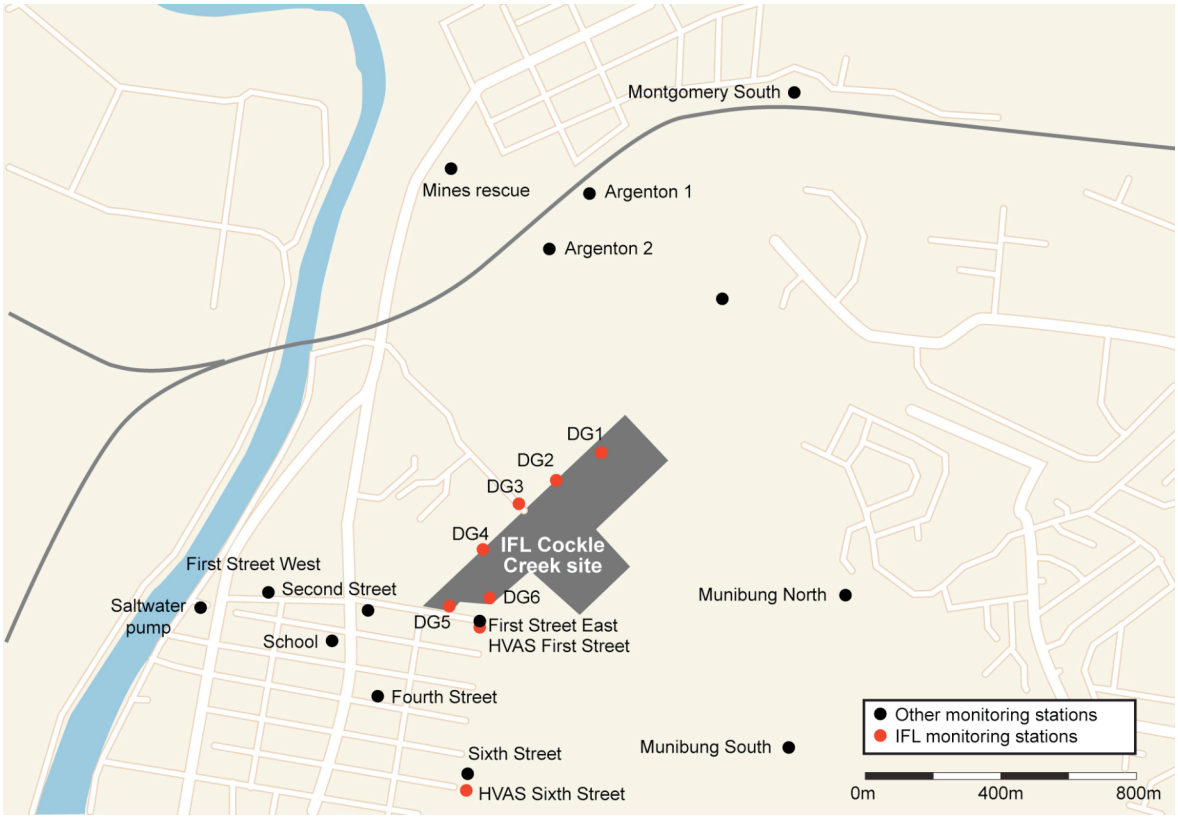
Table 17 Background air quality levels for the IFL Site

Background particulate concentrations for cumulative assessment purposes			
Averaging period	**Ambient TSP concentrations**	**Ambient PM_{10} concentrations**	**Ambient $PM_{2.5}$ concentrations**
Highest daily average	60–230µg/m^3 (a)	45–65µg/m^3	25–30µg/m^3
Exceedances of daily limit	NA	0–2 days per year	0–2 days per year
Annual average	25–50µg/m^3 (a)	18–19µg/m^3	10µg/m^3
Exceedances of annual limit	None	None	All years exceeded
Background heavy metal concentrations for cumulative assessment purposes			
Substance	**Maximum 24-hour concentrations (µg/m^3)**	**Range of average concentrations (µg/m^3)**	**Basis**
Lead	1.26	0.013–0.110	Monitoring at Pasminco High Volume Air Sampler (HVAS) stations for period 2005–2007.
Zinc	1.33	0.021–0.117	
Cadmium	0.10	0.001–0.004	
Arsenic	0.04	0.003–0.004	
Mercury	0.7	0.0001–0.002	
Copper	2.06	0.012–0.390	Monitoring across PCCS HVAS stations for 2005.
Nickel	0.011	0.0018–0.0023	Monitoring across PCCS HVAS stations for 2003.
Chromium	0.013	0.0017–0.0022	

(a) Based on the assessment of TSP concentrations measured during periods prior to and following closure of the IFL Cockle Creek facility in mid January 2009, 10 per cent to 25 per cent lower TSP levels were observed at monitoring stations situated in close proximity and to the south of the plant. The length of the period available for analysis is insufficient to demonstrate the reduction conclusively and PM_{10} monitoring is not undertaken at these sites, but it is conceivable that closure of the IFL Plant will have reduced airborne particulate concentrations in this area. Current TSP and PM_{10} concentrations may therefore be lower than have been characterised based on historical air quality monitoring information.

Average annual baseline dust deposition rates were observed to be in the range of 0.7g/m^2/month to 1.8g/m^2/month across all IFL and Pasminco monitoring sites.

Figure 8 Existing monitoring stations



Potential impacts

The greatest potential air quality impacts are the atmospheric emissions associated with the excavation, material handling, and screening of contaminated soils, wind entrainment from stockpiled contaminated material, berm construction and blow off from trucks while material is in transit. This presents an environmental and health risk as it could affect the air quality for personnel on-site and lead to contaminated material being deposited in nearby areas, including the residential areas of Boolaroo.

The site buildings pose a potential risk as they contain asbestos and their demolition may result in site personnel being exposed to asbestos particles and result in chronic health problems. Airborne asbestos particles may also present an offsite risk.

The transfer of materials on-site may result in dust creation and deposition of material on roadways, which can generate silt laden stormwater. As such, the transfer of material can affect both air and water quality.

Dust may be generated as a result of concrete crushing on-site. The concrete dust has the potential to impact upon the health of those working near the machinery.

Vehicle exhaust releases may also impact the air quality. This is a result of the emissions of potentially harmful gases and the release of greenhouse gases into the atmosphere.

Cumulative impacts

The Stage 2 remediation program described in this EA (comprising phases 2, 3 and 4) are the major phases of the Site remediation works, involving excavation, transport and placement of significant quantities of contaminated soils into the proposed engineered containment cell in addition to building demolition works and associated waste management.

Major sources of atmospheric emissions associated with Phase 2, 3 and 4 works will include:

- Excavation, material transfer, and storage related emissions during the construction of the on-site 270,000m^3 capacity containment cell.
- Excavation, handling, screening, stockpiling, and placement of contaminated soils.
- Berm construction.
- Building demolition (including asbestos related issues).
- Recovery, transfer and placement of clean fill to establish post-remediation surface levels.
- Wind erosion of exposed and disturbed areas.
- Vehicle exhaust releases.

The most significant sources of heavy metal releases are likely to be associated with the excavation, material handling and screening of contaminated soils, wind entrainment from stockpiled contaminated material and blow off from trucks while material is in transit.

To assess the maximum potential impact of the project, the Environmental Assessment as a whole assumes that the Stage 2 works (phases 2, 3 and 4) will occur concurrently. This represents a reasonable worst-case assessment of the impacts of the proposed project, as based on current timing projections, periods may occur where activities are undertaken within each phase of the project concurrently.

Accordingly, the emissions inventory and scenario modelling refers to Phase 2, Phase 3 and Phase 4 occurring concurrently.

Suspended particulate concentrations

Annual average concentrations for all size fractions were predicted to be low (less than 25 per cent of the corresponding air quality goal). Taking background particulate concentrations into account it is not expected that the Phase 2, 3 and 4 works as part of the Stage 2 operations will cumulatively give rise to levels above annual air quality goals.

Baseline air quality data indicates that exceedances of air quality goals given for maximum daily PM_{10} and advisory thresholds for daily $PM_{2.5}$ already occur in the region on typically one to two days per year. In this region, such exceedances are primarily due to episodic emissions from bushfires or dust storms. It is therefore evident that limited potential exists for increments in ambient PM_{10} and $PM_{2.5}$ concentrations due to the proposed remediation.

Greater than 99 per cent of predictions for incremental daily average PM_{10} concentrations at the nearest sensitive receptor sites (those on First Avenue, Boolaroo) are anticipated to be less than 15µg/m^3 (expressed as a 24-hour average). Given the low frequency of occurrence of predicted concentrations in excess of 15µg/m^3 at First Street (two occasions), the likelihood that increments attributable to the project will cause any additional exceedance of the project air quality goal of 50µg/m^3 when combined with existing background air quality is deemed low (approximately one occasion).

The incremental maximum daily average $PM_{2.5}$ concentrations at the nearest sensitive receptor sites due to concurrent Phase 2, Phase 3 and Phase 4 emissions are predicted to be of the order of 20% of the 24-hour air quality goal of 25µg/m^3 and as such are not anticipated to contribute to additional exceedances of this parameter.

Dust Deposition

A maximum *incremental* annual average dust deposition rate of 0.04g/m^2/month was predicted to occur across the receptor locations due to concurrent Phase 2, Phase 3 and Phase 4 operations. This rate is well within the NSW DECC incremental dust deposition limit of 2g/m^2/month. Taking background average dust deposition levels into account (estimated to be in the order of 0.8 to 1.8g/m^2/month), maximum *cumulative* annual average dust deposition rates are expected to be within the NSW DECC cumulative dust deposition limit of 4g/m^2/month.

Heavy metal concentrations

High heavy metal concentrations have historically been measured in the study area, with concentrations of lead, arsenic and cadmium of concern. Although levels of heavy metals have significantly reduced following the closure of the Pasminco lead smelter in 2003 and dust mitigation improvements, recently measured arsenic and cadmium concentrations remain elevated.

A review of maximum *incremental* 99.9th percentile hourly and annual average heavy metal concentrations predicted to occur due to concurrent Phase 2, Phase 3 and Phase 4 operations across all discrete receptor locations was undertaken. No exceedances of the relevant DECC impact assessment criteria for principal toxic air pollutants were predicted to occur. Predicted peak arsenic and cadmium concentrations comprise 28 per cent and 34 per cent of the DECC impact assessment criterion respectively.

The DECC air quality goal given for lead is specific for cumulative concentrations. Background lead concentrations are estimated to be in the range 0.0135 to 0.1128µg/m^3. Given the comparatively low maximum increments in annual lead increments due to the proposed project (0.0013µg/m^3), the annual lead goal is not expected to be exceeded. Maximum incremental project-related concentrations and maximum background concentrations projected from monitoring data were summed to provide an approximation of potential maximum *cumulative* concentrations. Such concentrations were screened against widely applied inhalation health risk assessment criteria. Although projected cumulative arsenic and cadmium levels were noted to be elevated, primarily due to existing background concentrations, the levels of individual constituents were predicted to be within the inhalation health thresholds. Limited potential exists for increments in ambient concentrations of these metals due to the proposed project, it is recognised that the project will ultimately reduce exposure potentials associated with the Site in the longer term.

Management and mitigation measures

The proposed management and mitigation measures for air quality are provided in Table 18 below.

Table 18 Proposed management and mitigation measures for air quality impacts

Potential impact	Proposed management and mitigation measure
Inadequate planning measures implemented to ensure air quality is managed effectively	An air quality management plan will be prepared to cover construction and operation of the cell.
Wheel generated dust emissions	A wet or chemical suppression program, consistent with the application of water sprays to roads in excess of 2L/m^2/hour.
	The use of wheel washers, where necessary.
Wind erosion of stockpiles	Stockpiles are to be compressed and partially sealed by tracking over with machinery. Stockpiles may be covered with plastic sheeting, stockpile wind screens may be applied, exposed and disturbed surfaces will be minimised or other stabilisation methods may be employed.
	Natural material stockpiles will be effectively seeded/covered before the material dries out.
	IFL will use a coordinated approach for containment cell construction to allow as much material as possible to be excavated, screened and placed directly in the cell without the need for temporary stockpiling and double handling.
Dust generated from concrete crusher activities	The crusher will be sited in the area of the Phase 2 cell, at a significant separation distance from the closest residential receptors at First Avenue, Boolaroo.
	Crushing activities will be conducted only when other low dust generating activities are being conducted, and not conducted during early morning or late afternoon periods when inversion conditions may arise.
	The specification for the crusher is proposed to include dust controls to a standard equivalent to water spraying during crushing.
Dust emissions arising from in situ fill	Fill material in-situ will be kept adequately moist to maintain moisture levels above the 20 per cent assumption made in the Air Quality Assessment (appendix E). Note: Geotechnical investigations to date (Golder Associates, November 2008) indicate that average in situ fill moisture contents are of the order of 24%.
Dust emissions arising from transport of uncovered loads within the site	Fill materials should be sufficiently moist to prevent blow off of material during truck transit. Freeboards will be increased or trucks covered, if necessary.

Potential impact	Proposed management and mitigation measure
Contaminated material deposited on roadway becoming re-entrained	Moisture content of material will be regulated or trucks will use freeboards or covers, if necessary.
	In the event that fill material is deposited it will be cleaned up in a timely manner to reduce entrainment potential.
	Truck traffic and unpaved road lengths will be minimised to reduce the potential for vehicle entrainment.
Wind erosions at material transfer points	Wind screens will be used at material transfer points.
Inadequate air quality monitoring during construction	IFL will replace or modify the high volume sampler at First Street to allow for PM_{10} monitoring at this location. PM_{10} samples will be sent to an accredited laboratory for metals analysis. In the event that regular exceedances of this parameter are observed, IFL may consider the introduction of a real-time, continuous PM_{10} monitor be placed within the vicinity of the sensitive receptors predicted to experience the highest impacts of this parameter.
	IFL dust deposition monitoring at sites DG1 to DG6 will be continued throughout the remediation project. See Appendix E.
	IFL will cooperate with Pasminco to share data and explore the potential of continuing long-term operations of certain Pasminco HVAS (and metals analysis) until the IFL remediation project is complete.
	All compliance monitoring will be conducted in accordance with Australian Standards as referenced in the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales* (DECC, 2005b). Of specific relevance are: • AS 3580.10.1-2003 Methods for Sampling and Analysis of Ambient Air – Determination of Particulates – Deposited Matter – Gravimetric Method (DEC Method AM-19). • AS 3580.9.6-2003 Particulate Matter – PM10 – high volume sampler with size-selective inlet (DEC Method AM-18).

Note: Alternatively, crushing of concrete may be conducted off-site, however this is not considered a good environmental outcome if on-site reuse of concrete materials is anticipated.

10.6 Noise and vibration

Existing environment

In order to understand existing noise levels at and surrounding the Site, a baseline monitoring program was conducted for the proposed Cockle Creek project from 14 August 2008 to 27 August 2008, while the Site was operational (manufacturing and distribution) and remediation works were being undertaken on the adjoining Pasminco site. The full noise report can be found at Appendix F, while the key features are summarised below. The location of the monitoring sites included a residence on Second Street in Boolaroo and a residence on Hillview Crescent in Macquarie Hills.

Noise recorded at the Boolaroo site during monitoring included:

- Distant highway traffic.
- Local residential traffic.
- Minor industrial noise from the Pasminco site.
- Wind through the trees.
- Birds chirping.
- Humans talking and walking around.

Noise recorded at the Macquarie Hills site during monitoring included:

- Distant construction activities (sawing metal).
- Wind chimes from resident next door.
- Distant highway traffic.
- Wind through the trees.
- Earth-moving equipment from the Pasminco site.

Meteorological conditions during monitoring for both locations were wind speeds of 4km/h with gusts of up to 11km/h, wind direction was from the southwest; temperature was 18°C and skies were clear.

Measurements and guidelines

Noise monitoring is conducted using a condensed scale of units from 0–120 and given the units of decibels dB.

Because noise varies with time, a single noise value cannot adequately define the ambient noise. For this reason, the acoustic environment is described using a number of noise level descriptors as follows:

Measurement	Description
L_{A1}	The sound pressure level that is exceeded for 1 per cent of the time for which the given sound is measured.
L_{A10}	The sound pressure level that is exceeded for 10 per cent of the time for which the given sound is measured.
L_{A90}	The level of noise exceeded for 90 per cent of the time. The bottom 10 per cent of the sample is the L_{A90} noise level expressed in units of dB. This is normally referred to as the background noise level.
L_{Aeq}	Equivalent sound pressure level – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
L_{max}	Maximum noise levels.

The criteria used for the assessment of noise impacts follows the NSW DECCW Interim Construction Noise Guideline (July 2009). The guideline noise level limits are summarised in Table 19 .

Table 19 Noise level guidelines for construction

Period of construction	Noise level (dB)
Within standard recommended hours	$L_{Aeq,\ 15\ min}$ <background + 10dB Special management required for noise levels above 75 dB
Outside standard recommended hours	$L_{A10,\ 15\ min}$ < background + 5dB

According to the guideline, noise management levels are calculated by using the measured $L_{A90(15min)}$ plus an allowance depending on the time of day on which the activities are performed. This calculated value is to be used to compare against a predicted value or operational measured value (once the project is underway). For the purposes of this assessment, a predicted value will be used.

Monitoring Results

Day-time, evening and night-time levels were collected and calculated from the two locations described above. The results of the monitoring included calculating daytime (07:00 to 18:00), evening (18:00 to 22:00) and night-time (22:00 to 07:00) L_{A90}, L_{A10} and L_{Aeq} sound levels (AS1055.1-1997 and DECC 2008a). Table 20 summarises the results of the two monitoring locations.

Table 20 Existing noise levels near the Site

Location	Period	L_{A90}	L_{A10}
Boolaroo (Second Street)	Day	43	48
	Evening	43	48
	Night	41	47
Macquarie Hills (Hillview Crescent)	Day	40	48
	Evening	39	44
	Night	36	41

Note: L_{A90} and L_{A10} values calculated by taking the median of the specified time period.

The values indicate that the Boolaroo residential area is likely influenced by a constant noise source, such as the highway in the distance or from the small sub-station close by. The Macquarie Hills residential area shows typical values for quiet, suburban areas.

Potential impacts

Modelling for the noise assessment was based on assumptions made with regards to scheduling of activities and type and size of equipment used. These assumptions were made based on the information provided in Chapter 4, Project description. A ‘worst case scenario’ was used to complete this assessment in order to provide the most conservative approach.

The table below provides a summary of activities for each phase of the project, which provided the basis of assumptions made during the noise modeling process.

Table 21 Summary of remediation activities

Phase	Activities
2	Construction of containment cell. Excavation and screening of impacted material. Placement of impacted material in cell.
3	Demolition of buildings and processing plant. Excavation of impacted material and screening. Placement of impacted materials in containment cell. Construction of containment cell.
4	Excavation of impacted material and screening. Placement of impacted material in containment cell. Reinstatement of the Site, including containment cell. Construction of containment cell.

Construction activities will not be continuing into the evening or night time period. Therefore, only day-time values are provided in the results below.

Phase 2

The predicted L_{Aeq} noise results from Phase 2 activities are 49dB for the Boolaroo residents and 38dB for the Macquarie Hills residents. Applying the 3dB adjustment to calculate L_{A10} values gives Boolaroo a predicted value of 52dB and for Macquarie Hills a value of 41dB.

Table 22 presents and compares the monitored values to the predicted Phase 2 noise results.

Table 22 Phase 2 monitoring results and predicted noise levels

Residential area	Monitored L_{A90} (dB)	Predicted L_{A10} noise levels (dB)
Boolaroo	43	52
Macquarie Hills	40	41

Phase 3

The predicted L_{Aeq} noise results from Phase 3 activities are 55dB for the Boolaroo residents and 35dB for the Macquarie Hills residents. Applying the 3dB adjustment gives Boolaroo a predicted L_{A10} value of 58dB and for Macquarie Hills a value of 38dB.

Table 23 presents and compares the monitored values to the predicted Phase 3 noise results.

Table 23 Phase 3 monitoring results and predicted noise levels

Residential area	Monitored L_{A90} (dB)	Predicted L_{A10} noise levels (dB)
Boolaroo	43	58
Macquarie Hills	40	38

Phase 4

The predicted L_{Aeq} noise results from Phase 4 activities are 55dB for the Boolaroo residents and 33dB for the Macquarie Hills residents. Applying the 3dB adjustment gives Boolaroo a predicted value of 58dB and for Macquarie Hills a value of 36dB.

Table 24 presents and compares the monitored values to the predicted Phase 4 noise results.

Table 24 Phase 4 monitoring results and predicted noise levels

Residential area	Monitored L_{A90} (dB)	Predicted L_{A10} noise levels (dB)
Boolaroo	43	58
Macquarie Hills	40	36

Boolaroo summary of results

Background noise measurements concluded that the L_{A90} value during day time hours was 43dB in the Boolaroo residential area. Project activities will be occurring for four years in duration in accordance with Table 17, therefore, a 5dB allowance is added to the background level. This gives a guideline value of L_{A10} 48dB at the Boolaroo residential area. Predicted L_{A10} levels for this area during Phase 2 is 52dB with both phases 3 and 4 predicted to be 58dB.

All phases of Stage 2 of the project are predicted to exceed recommended noise levels at Boolaroo. Depending on the location of the equipment on site, Boolaroo residents will distinguish the construction sounds from other sounds in the area. Sound levels are expected to be higher than current baseline conditions. Phase 4 activities will be the closest to the residential area, therefore there will generally be the potential for higher sound levels. These activities will only take place during daytime hours and will not affect evening or nighttime levels. A noise management plan has been prepared to provide a management strategy for the predicted noise impacts.

The assessment was conducted with each phase occurring separately. In reality, it is likely that phases 2, 3 and 4 of the Stage 2 program will overlap. This is not expected to increase the noise predictions for the worst case (phases 3 and 4) work at the Boolaroo area as the major noise-producing activities for each of the phases are unlikely to be happening at the same time, even if the phases overlap.

Macquarie Hills summary of results

Background measurements collected indicate that sound levels during daytime hours were 39dB in Macquarie Hills. The guideline sound level for the project at this receptor is LA_{10} 44dB during daytime hours. Predicted sound levels from project activities show a value of 41dB and 38dB respectively for phase 2 and 3, and 36dB for phase 4 activities. The project activities will not exceed the daytime noise guideline at Macquarie Hills.

Cumulative impacts

Demolition works on the Pasminco site that occur while IFL remediation works are in progress, may result in cumulative noise impacts. Both of these projects will occur for extended periods of time, each undertaken in phases. Determining the precise timing of each phase of the respective projects is difficult, therefore, it is not possible to quantify potential cumulative noise impacts. However, a general description of potential impacts is provided below.

If concentrated activity (including the use of rock hammers etc) was to occur in the south western part of the Pasminco site at the same time as Phase 4 demolition works on the Site, then the predicted wost case Phase 4 noise levels could be exceeded at nearby residences in Boolaroo. However, current scheduling provides that work on the Pasminco site close to Boolaroo should be completed before the phase 3 and 4 works on the Site commence.

If active demolition works in the southwest parts of both sites was to occur simultaneously, then joint management and control measures will be required for both projects to ensure that impacts to residents at Boolaroo are kept to acceptable levels.

Management and mitigation measures

Table 25 below details the management and mitigation measures proposed for predicted noise impacts relating to the project.

Table 25 Proposed management and mitigation measures for noise and vibration impacts

Potential impact	Proposed management and mitigation measures
Increased noise levels for local residents during construction	A noise management plan will be developed.
	Scheduled activities remain between Monday – Friday from 7am to 6pm and Saturday 8am to 1pm. No work is to occur on Sundays or public holidays.
	Noisy work will be performed during less sensitive time periods.
	A community consultation, information, participation and complaint response strategy will be developed and implemented, including a complaints feedback line, and measures to notify residents when noise guideline exceedences are expected to occur.
	The following noise reduction measures will be considered as necessary: • Training workers and contractors to use equipment in ways to minimise noise. • Establishing stringent noise emission limits for specific equipment. • Implementing a noise monitoring audit program to ensure equipment remains within specified limits. • If deemed necessary, stagger activities and equipment to reduce noise so only one activity at a time is taking place. • Where possible, concentrate noisy activities at one location and move to another as quickly as possible. • Ensure equipment is well maintained and fitted with adequately maintained silencers, which meet the design specifications. • Use only necessary size and power.

10.7 Waste minimisation

Construction and operation waste

Waste will be produced both in the construction and operation phases of Stage 2 of the project.

The following waste is likely to be produced throughout all phases of construction:

- Waste produced by demolition of buildings.
- Green waste from clearing of grass and shrubs on the Site.
- Waste fuels and oil from machinery and vehicles used during construction.
- General domestic waste produced by workers on-site.
- Contaminated soil as a result of excavation for cell construction.
- Oversized material from screening of excavated materials.
- Contaminated soil, displaced as a result of trenching or drilling of wells for the groundwater treatment system.
- Treated groundwater, as a result of being passed through the groundwater treatment system.

The Phase 3 and 4 works as part of Stage 2 are likely to produce additional waste as a result of building and infrastructure demolition. This waste would include asbestos-containing materials, building materials including wood, steel, and other metals, concrete from pavements and flooring and contaminated concrete materials from the dam wall.

The groundwater treatment plant installed in Stage 1 (Phase 1) of the remediation program would produce contaminated waste material for the duration of its operation. However, production of this waste would cease as the groundwater treatment plant is decommissioned during construction of the containment cell. The plant may be used for processing other contaminated waters generated during the cell construction phase.

Once the remediation of the Site is complete, any waste produced on-site will be negligible. Ongoing maintenance of the containment cell structure would be required in the future, and this may result in small amounts of maintenance-related waste being produced.

Waste regulations

Waste management in NSW is regulated by a number of acts including the *Protection of the Environment Operations Act 1997* and the *Waste Avoidance and Resource Recovery Act 2001*. The generation and management of waste during construction and operation of the project will be subject to the requirements of these acts, and other policy measures, such as the ‘waste hierarchy’, that encourage the efficient use of resources, avoid environmental harm, and provide for the continual reduction in waste generation.

Management and mitigation measures

Proposed waste management and mitigation measures are provided in Table 26 below.

Table 26 Proposed management and mitigation measures for waste impacts

Potential impact	Proposed management and mitigation measures
Generation of contaminated soil waste/ contaminated fill	Contaminated fill will be stored on site in Shed 4, a secure storage area with sufficient capacity to accept the contaminated fill on a temporary basis prior to cell construction and placement or alternatively in controlled stockpiles.
	Store in accordance with *Managing Urban Stormwater: Soils and Construction* manual (Landcom, 2006). May include mitigation measures such as watering down the stockpile and covering prior to completing each days work, to prevent the escape of any contaminated dust or sediment.
Generation of construction and building material waste	Building materials will be disposed within the containment cell, or at an appropriate waste facility, in accordance with the Waste Classification Guidelines (DECC, 2008b).
Generation of general waste	Waste will be disposed of in accordance with the legislation as described above.
	There will be 100 per cent recovery for re-use of waste classified as virgin excavated natural material (VENM).
	Where immediate re-use is not possible, spoil suitable for stockpiling will be stored, and the location, quality and quantity of spoil will be documented. Any additional environmental assessment or approval requirements for the stockpile will be undertaken as necessary.
	Secondary waste materials will be re-used on site where reasonable and feasible.
	Where disposal is required, waste will be classified, handled, stored and disposed of in accordance with relevant guidelines.

10.8 Visual amenity

Existing environment

The major built form elements on the Site include:

- Four large industrial buildings in the centre of the Site – three running in a northeast-southwest direction and one perpendicular to these.
- Various roads accessing the buildings on the northeast and southwest ends of the Site, and associated vehicle layover areas.
- Two railway gantries, as described in Section 7.4 (Heritage).

The natural landform of the Site has been modified to allow construction of the industrial buildings. The ground immediately east of the Site rises steeply up to Munibung Hill.

The land on the Site is predominantly built-out or heavily disturbed. A large area of open space exists at the northern end of the Site, and is comprised of disturbed ground with some grass cover, and some tracks. A smaller area of open space exists at the southern end of the Site, adjoining an electricity substation.

A freshwater dam lies immediately to the east of the southern open area, although it is generally not visible from the south. Some trees exist sporadically around the Site, but none are readily viewed from off-site at present.

The key viewpoints are:

- Oblique views from the easternmost residences on First to Fourth streets, Boolaroo.
- Views from the south, east, and northeast in the open space that borders the eastern side of the Site on the western slopes of Munibung Hill.

Potential impacts

Several elements of the project may be visible during construction. These include:

- Remediation contractor's compound and contractor parking.
- Construction signage and fencing.
- Temporary earthworks, stock piling, and temporary erosion control.
- Major construction vehicles accessing and exiting the sites.
- Disturbance to ground for earthworks.
- Lighting of construction site during dark hours for security.

These impacts will be managed by ensuring fencing is a dark colour such as grey or black, operational lighting is fixed to avoid light spill towards residential areas, storage areas are out of direct line of sight from residential dwellings. Uphill land to be protected from earth disturbance, erosion control is monitored, and work will be completed as soon as possible.

There are also impacts arising from the final site topography. It is noted that at the southern end of the Site, if the creek line is to be reinstated, should be replanted with riparian vegetation.

However, the final cell landform presents the largest potential visual impact to the surrounding community, as it is a large, permanent structure. Impacts to the views from the easternmost residences on First to Fourth Streets will be primarily a result of the cell landform appearing artificial against the natural spurs and valleys of Munibung Hill.

The views of the cell from the open ground on the western slopes of Munibung Hill to the south, southeast and northeast of the Site, whilst having a closer view of the cell, are likely to be subject to a similar impact.

These impacts have been assessed and determined to be low to moderate. This is coupled with the overall improvement of the landscape by removing the industrial operations from the Site. However, to minimise any potential impact on the surrounding community the design of the cell is flexible enough to allow for refinement and contouring, to complement the surrounding Munibung Hill. Where possible, plantings on the hill will be varied. Furthermore, any fencing that remains beyond the construction phase will be recessive in colour and maintained.

Management and mitigation measures

Proposed mitigation and management of potential impacts to visual amenity are presented in Table 26.

Table 27 Potential management and mitigation measures for visual amenity impacts

Potential impact	Proposed management and mitigation measures
Construction	
Construction elements of the project including parked cars, signage, fencing, and temporary earthworks may be visible during construction	Fencing to be in a dark colour such as grey or black.
	Operational lighting to be fixed to avoid light spill towards residential areas.
	Storage areas to be out of direct line of Site from residential dwellings; uphill land to be protected from earth disturbance.
	Erosion control to be monitored.
	Complete work as soon as possible.
Operation	
Final cell landform	Design refinements to the cell should, where possible address the final landform in a manner that reduces the more artificial appearance of this feature when compared with the adjoining topography.
	Planting on the cell should where possible be varied in nature and grouped to assist in breaking down the visual prominence of the landform. The use of low shrubs (where these can be shown not to disturb capping layers) may also assist in this regard. Groups of trees in other parts of the Site close to the base of the containment cell may also break down the monolithic nature of the cell.
	Any restoration of the former creek leading to the location of the existing dam should adopt riparian style planting.
	All temporary fencing for securing the works and other temporary structures should be recessive in colour where possible.

11 Assessment of non-key environmental issues

11.1 Traffic and access

Existing environment

Access to the Site is currently via a right of carriageway through the Pasminco site.

The surrounding road network generally operates well during both the AM and PM peak periods with minimal delays.

Survey show typical traffic volumes surrounding the Site to be:

- TC Frith Avenue – 1,695 vehicles per hour (20,650 vehicles per day).
- Lake Road – 2,147 vehicles per hour (26,155 vehicles per day).
- Main Road – 464 vehicles per hour (5,650 vehicles per day).

There are relatively moderate traffic volumes, typical of arterial roads. Traffic generally flows well, as indicated by the performance of key intersections in the vicinity of the Site.

Potential impacts

Construction

It is expected that Stage 2, Phase 2 works will occur concurrently with the remediation of the adjoining Pasminco site, which is scheduled for completion by mid 2010. The ongoing distribution activities from the Site are scheduled to continue until September 2009.

The vehicle movements predicted for each phase of Stage 2 of the project are described below:

Phase 2

- Average of four to six truck movements per day.
- Ten to 20 personnel.

Phase 3

- Up to 60 truck movements (maximum) associated with removal of building waste and delivery of capping material (6–8 week period).
- Thirty-four trucks per day for off-site disposal of deleterious material (four one-week events).
- One truck per day for miscellaneous purposes.
- Between 30–40 personnel during demolition and on going excavation and placement of cell material. A reduced number of between 20–30 contractors will be on-site at other times.

Phase 4

- Average of 21 truck movements per day.
- Between 10–20 personnel.

It is anticipated that the Stage 2 remediation works will result in up to 202 vehicle movements per day. An average car occupancy of two people per car is anticipated for worker arrival/departures with truck movements distributed across a ten-hour working day. This results in up to 52 (46 in, six out) vehicle movements during the morning with these flows reversed during the evening peak period.

It should be noted that these flows would occur post completion of the Pasminco remediation, which has previously been assessed to result in approximately 27 vehicles per hour. As such the relative impact of movement associated with the Site remediation will be less. Furthermore, the IFL operations will have finished. They currently contribute an additional five articulated truck movements per hour and are accommodated by the existing road network. Therefore, the cumulative operation of the IFL remediation phases will result a net increase of 20 vehicles per hour above that previously associated with the Site.

The proposed heavy vehicle access routes are consistent with existing access routes. This access has operated effectively throughout the IFL plant's operational history. There is ample internal storage capacity within the Site and no potential exists for on-street queuing or waiting.

The internal road network utilised by off-road dump trucks (operating within the Site only) will vary throughout the various phases of the works and on a daily basis due to practical circumstances such as weather, and tipping location. In addition, trucks will not be limited to the existing internal road system and will traverse unsealed areas.

Operation

It is not expected that there will be any ongoing traffic impacts associated with the operational phase of the project. In order to provide ongoing maintenance and monitoring of the cell vehicles may need to periodically access the Site.

Management and mitigation measures

The project is not expected to have any measurable negative impact on the road network surrounding the Site, or on the local community. However, a number of traffic management measures are proposed in order to ensure traffic safety standards are maintained throughout the project.

These measures are outlined in Table 28 below.

Table 28 Proposed management and mitigation measures for traffic impacts

Potential impact	Proposed management and mitigation measures
Traffic congestion in and around the Site	Signposting clearly displayed throughout the Site.
	15km/h speed limit is recommended throughout the Site.
	Signs should be installed along Lake Road prior to the main site access to warn traffic of possible heavy vehicle movements entering and exiting the Site.
	Warning signs saying 'Trucks turning' with supplementary '120m on left/right' located 120m on both approached, and truck symbol sign should be located 60m on both approaches to the Site access.
	Prepare internal traffic management plan.
	All contractors and sub-contractors are to be fully licensed and all members visiting the Site will be required to attend site induction training.

11.2 Indigenous heritage

Existing environment

A heritage assessment that considered Indigenous heritage was carried out for the Site, this can be found in Appendix D. An AHIMS search identified several Aboriginal heritage sites in the vicinity of the IFL Site, the closest at a distance of one kilometre. No items were located immediately within the IFL Site. The study area is heavily impacted by ongoing industrial activities and very unlikely to yield any archaeological resources or Aboriginal objects.

Potential impacts

The Site has been assessed as unlikely to contain any items of Aboriginal heritage significance. Therefore, there is unlikely to be any impact on indigenous heritage as a result of any phase of the proposed project.

Mitigation measures

The proposed mitigation and management measures for indigenous heritage impacts are described in Table 29 below.

Table 29 Proposed management and mitigation measures for Indigenous heritage impacts

Potential impact	Proposed mitigation and management measures
Potential discovery of items of Aboriginal cultural significance	All personnel working on site will be made aware of their legal obligations for the protection of Aboriginal cultural materials under the *National Parks and Wildlife Act 1997*.
	In the event that any unknown Aboriginal objects or items are located during the works, all work will cease in the vicinity of the find until specialist Aboriginal heritage advice is received.

11.3 Mine subsidence

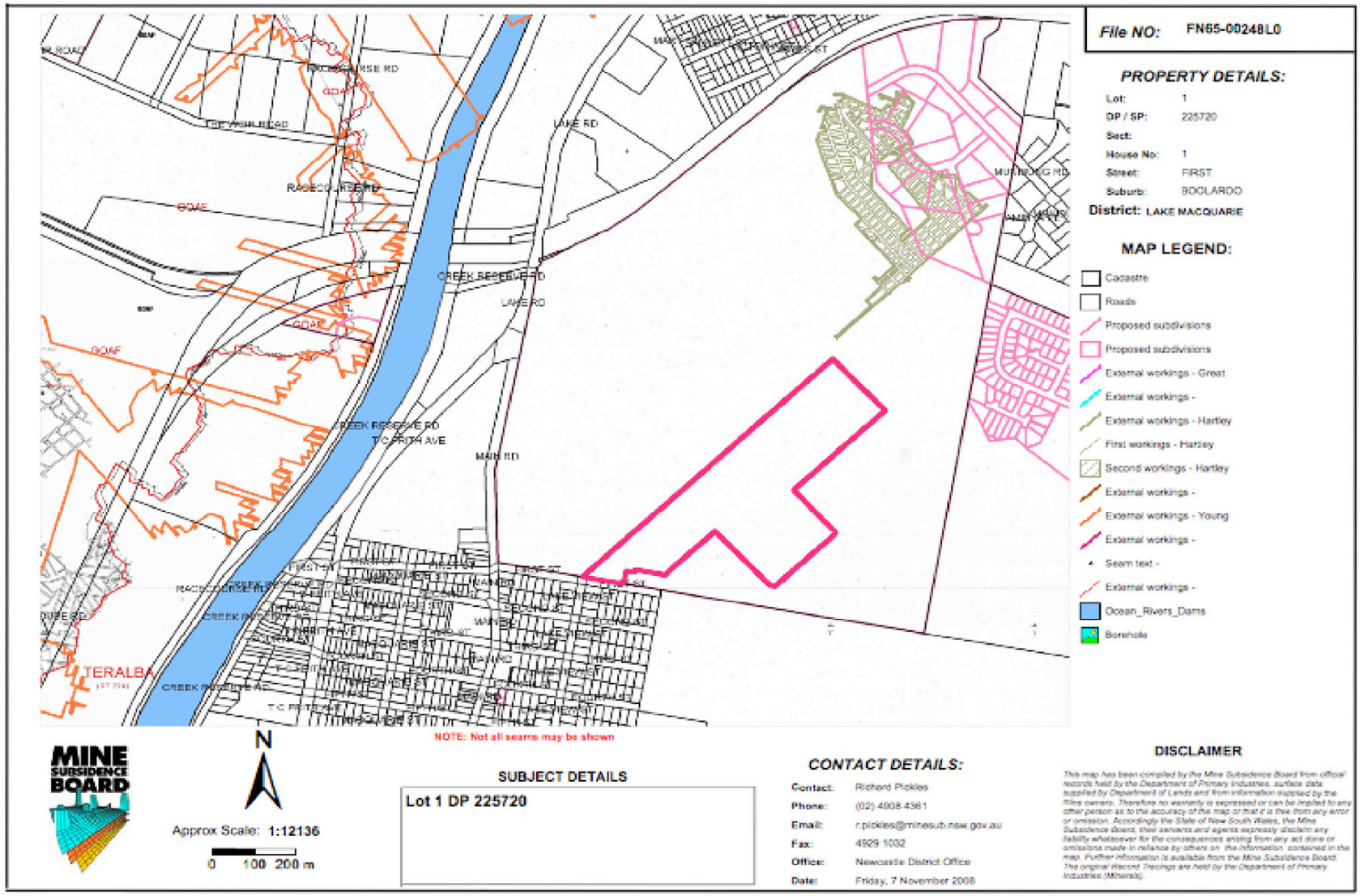
Existing environment

The Site falls within the Lake Macquarie Mine Subsidence District, under the *Mine Subsidence Compensation Act 1961*.

No mining has occurred within the immediate vicinity of the Site or on the Site itself. The mine subsidence map provided in Figure 9 demonstrates that there are no areas of subsidence risk relating to the proposed project, or the Site as a whole.

Two mining leases and one petroleum exploration licence apply to the subject site, indicating the potential for mining to occur underneath the Site in the future.

Figure 9 Mine subsidence areas in the vicinity of the Site



Potential impacts

Construction

The environmental risk assessment carried out as part of this EA determined that the risk of a mine subsidence event occurring would have major consequences but is very unlikely due to the large distance between the Site and the nearest mines.

Two mining leases and one petroleum exploration licence apply to the subject Site, indicating the potential for mining to occur underneath the Site in the future. Design and construction of the cell therefore have the potential to interfere with future mining activities.

Operation

The likely impacts in the event of mine subsidence is that a settlement of materials results in cap or liner failure, that leachate could escape, impacting on the groundwater or that a pathway to contaminated fill is exposed. In the event of seismic activity, the cell cap or base may rupture, potentially resulting in the escape of leachate or the exposure of contaminated fill.

Management and mitigation measures

Table 30 provides proposed measures to avoid impacts relating to mine subsidence due to the proposed project.

Table 30 Proposed management and mitigation measures for mine subsidence impacts

Potential impact	Proposed mitigation and management measures
Construction	
A mine subsidence event could occur during construction activities	Identification of mine subsidence areas in the vicinity and ensure the Site is not likely to be affected.
	Undertake excavation and drilling activities with caution.
Cell structure interferes with future mining activities	Cell design will meet design parameters established by the Mine Subsidence Board.
Operation	
Mine subsidence event could occur once cell construction is complete	Cell designed to tolerate maximum subsidence condition, and a reasonable level of ground movement.

11.4 Hazards and risks

Potential hazards and risks

A number of hazards and risks may arise as a result of the project. However, the environmental risk assessment undertaken determined that with adequate mitigation measures, these risks are unlikely to occur, and would only have minimal impacts if the did occur. The following were identified:

- Construction works may result in physical impact or injury to personnel or property during construction works.
- Personnel or the environment may become exposed to flammable or acidic material, through the excavation and/or demolition process.
- Grass fires may occur as a result of ‘hot works’ during construction.

Mitigation and management measures

The measures proposed to mitigate the hazards and risks outlined above are described in the table below.

Table 31 Hazards and risks mitigation and management measures

Potential impact	Management and mitigation measures
Construction works may result in physical impact or injury to personnel or property during construction works.	A CEMP and OHS plan detailing safety measures will be prepared prior to construction.
Personnel or the environment may become exposed to flammable or acidic material, through the excavation and/or demolition process.	A materials management plan and CEMP will be prepared prior to construction.
Grass fires may occur as a result of 'hot works' during construction.	A CEMP will be prepared prior to construction.

11.5 Health

The DGRs require that human health be considered as part of the environmental assessment. Risks to human health are assessed in relation to soil and groundwater, surface water, and air quality, in the previous chapters. These impacts were determined to be minor and temporary in nature, and not likely to cause any unacceptable acute or chronic health impacts. Each chapter described the potential impacts on humans, and proposed measures to mitigate and manage these impacts. The objective of the remediation program is to make the site suitable for ongoing uses included residential use and public open space.

In relation to air quality and associated emissions, given the compliance of incremental metal concentrations with DECCW assessment criteria and cumulative concentrations being projected to be within inhalation health risk criteria, it is not expected that a further health risk assessment would be required due to project-related metal exposures. Therefore, a detailed human health risk assessment was not considered necessary for the project.

12 Future site management

12.1 Planning and development

The Site will be remediated to a standard suitable for residential development, with the exception of the containment cell, which will be suitable for open space. A draft masterplan that includes both the Pasminco and IFL Sites has been developed by the administrators for Pasminco. This masterplan is currently under review by IFL and Lake Macquarie City Council.

There are no pending development applications pertaining to the Site.

Planning arrangements for future use of the Site will be coordinated with the Pasminco site administrators and Lake Macquarie City Council, and the Department of Planning where required. This environmental assessment addresses only the remediation aspects of the Site.

12.2 Future ownership and management

The proposed remediation approach will create a fully lined containment cell in the northern section of the Site that will consolidate and contain all materials that are unsuitable for use in a residential environment. That cell area will then be subdivided and retained in IFL ownership. It will be suitable for restricted open space use. The remainder of the Site is expected to be developed for residential use.

A site environment management plan (SEMP) will be developed for the area of the Site incorporating the containment cell and a suitable buffer zone. If a separate SEMP is required for the residential area then one will be developed for this purpose. The SEMP will outline the environmental management procedures to ensure that the soils contained at the Site and groundwater system are managed appropriately to ensure that the remediation approach does not pose any unacceptable risks to human health or the environment in the future. Detailed management procedures will be developed in conjunction with the Site Auditor.

To ensure this outcome, IFL will retain the ongoing ownership and responsibility for the portion of the Site containing the cell, and a suitable buffer zone, including the groundwater environment. This will ensure accessibility to the area for any future management requirements and will provide a viable entity for the implementation of the cell area SEMP in the future.

The remainder of the Site will be subdivided and then sold in the future for development. To facilitate this process, part of this proposal is an application for approval for the subdivision of the cell area in the Site. If the Site is subdivided, then this will ensure certainty in the future as to the ownership of the cell. The subdivision is not to instigate immediate development of the Site for residential purposes; rather it is to remove the burden of the cell from the future sale of the Site.

The subdivision is discussed further at Chapter 4, section 4.3 above.

Given that the containment cell area will be subdivided and retained by IFL, the works required under the SEMP will continue to be funded through its parent company IPL which is a large public company listed on the Australian Stock Exchange. It is not proposed to create any trust structures or similar, but rather simply to retain the cell area in the ownership of IFL and to manage it responsibly in accordance

with the SEMP and other applicable legislation. Following the subdivision of the containment sell and the remediation of the remainder of the Site, the main Site area is likely to be divested for development purposes with the expectation that the area will be suitable for residential use as a result of the soil remediation works conducted. The groundwater beneath various parts of this divested area may contain contaminant concentrations that preclude some activities, particularly those associated with extraction and use. The salinity of the groundwater would likely limit its use for most environmental values without treatment for the removal of salts. Due to the difficulty in remediating groundwater across the entire site, the low potential for use in the residential setting, and the presence of a reticulated potable water supply system, it is anticipated that a condition may be imposed that restricts the use of shallow groundwater at the Site to minimise and potential risk to site users.

13 Draft statement of commitments

The environmental assessment considers the project's potential environmental impacts and identifies the desired outcomes, as assessed in Tables 7 and 8. Furthermore, the EA highlights the management measures required to avoid or reduce environmental impacts. The potential impacts of the project were considered, and measures to ensure the impacts are mitigated were established and are presented in Tables 12, 13, 15, 17 and 24–30. The management and mitigation measures reflect the desired environmental outcomes of the project. IFL is committed to implementing these measures through mechanisms such as detailed RAPs, the CEMP, and the SEMP.

The commitments listed in Table 31 are designed to avoid, manage, mitigate, offset and/or monitor the environmental impacts of the proposed Stage 2 remediation project. Additionally, the proposed management measures aim to provide surety during pre-construction, throughout construction and into the operational phase.

These measures form the basis of IFL's draft statement of commitments (SoC), which is fully outlined in Table 31. The draft SoC specifically contains the following:

- The desired environmental outcomes.
- The actions that IFL is committed to undertaking to achieve the environmental outcomes.
- The timing of implementation of each commitment.

The commitments are based on the need to:

- Meet future planning approvals and associated environmental and planning investigations.
- Develop environmental management and mitigation measures during planning and design.
- Develop a strong systems culture during community consultation and engagement.
- Implement, monitor and review the management measures during construction and operation.

Table 32 Draft statement of commitments

Objective	Ref #	Commitment	Timing	Reference
General				
Minimise the potential impacts of the project	G1	Detailed RAPs will be prepared and endorsed by the Site Auditor.	Prior to construction	
	G2	A CEMP, including specific issue plans as necessary, will be prepared outlining management and mitigation measures to be followed during the site construction works.	Prior to construction	
	G3	A SEMP will be prepared for the ongoing management of the containment cell area retained by IFL.	Before operation	
	G4	Modify the sequence of works as necessary, to coordinate with PCCS to maximise the environmental outcomes of the project. All works will be undertaken with the oversight of the Site Auditor.	Construction	
Soil and water				
Minimise exposure of environment to excavated contaminated material	S1	Excess soil will be managed on-site within managed stockpiles or located within an existing site shed. Any contaminated material will be stockpiled within the existing site shed or appropriately managed. Any stockpiles will be managed to prevent erosion and dust.	Construction	Landcom (2006) *Managing Urban Stormwater: Soils and Construction*.
Minimise spillage of stored contaminated materials, and hazardous materials	S2	All materials will be stored in accordance with Australian Standards and the Site will stock the required spill kits.	Construction	
Minimise detrimental impacts from contamination or sediment in surface waters	S3	Surface water will be managed during construction to limit or prevent contact with contaminated materials. Sediment entrained in stormwater will be managed using sediment control measures adjacent to potential source areas. Additional measures will be implemented as required to provide adequate management.	Construction	
Undertake monitoring to ensure ongoing integrity of containment cell structure	S4	Undertake routine monitoring and maintenance of the containment cell structure to ensure effectiveness of cell design.	Operation	Monitoring plan to be written and agreed to by a DECCW accredited Site Auditor.

Objective	Ref #	Commitment	Timing	Reference
Heritage				
Retain record of heritage items and structures on site	H1	An archival photographic recording will be undertaken in accordance with the Department of Planning (Heritage Office) Guidelines 2001 (revised 2005) *Photographic Recording of heritage items using film or digital capture*.	Pre-construction	NSW Department of Planning (Heritage Office) Guidelines 2001 (revised 2005) *Photographic recording of heritage items using film or digital capture*.
		Liaise with Lake Macquarie City Council regarding site heritage.	Pre-construction	Not applicable.
		In the event that an unknown heritage item is discovered, work will cease temporarily to allow for archival recording of the item.	Construction	To be included in CEMP to be prepared prior to work commencing.
Air quality				
Minimise dust generation during construction and operation of proposed project	A1	An air quality management plan will be prepared to ensure air quality impacts are minimised.	Pre-construction	To be included in CEMP to be prepared prior to work commencing.
	A2	Appropriate dust control measures including covering or wetting of fill will be undertaken to ensure dust generation is minimised.	Construction	To be included in CEMP to be prepared prior to work commencing.
Minimise emissions from vehicles and plant equipment during construction and operation	A3	Vehicles and equipment will be maintained and kept in good working order and switched off when not in use.	Construction and operation	To be included in CEMP to be prepared prior to work commencing.
Noise and vibration				
Minimise noise and vibration from excavation and drilling during construction of proposed project	N1	A noise management plan will be prepared to ensure noise impact are minimised.	Pre-construction	To be included in CEMP to be prepared prior to work commencing.
	N2	Works will be undertaken during standard working hours only in order to minimise disruptions to local residences. Working hours will be 7am to 6pm Monday to Friday and Saturday 8am to 1pm. No work is to occur on Sundays or public holidays.	Construction	To be included in CEMP to be prepared prior to work commencing.

Objective	Ref #	Commitment	Timing	Reference
Visual amenity				
Reduce visual impact of construction elements of the proposed project	V1	Measures including neutral coloured fencing, appropriate storage of plant and materials, and strategic lighting placement will be undertaken to minimise visual impacts of construction of the proposed project.	Construction	To be included in CEMP to be prepared prior to work commencing.
Reduce visual impact of the containment cell landform	V2	By its nature the cell will sit above the existing land form and this is reflected in the master planning for the Site and the Pasminco site. However the Proponent will take reasonable measures to blend in the finished cell area landform with the existing environment where practicable to do so, including the use of appropriate landscaping.	Pre-construction and construction	
Mine subsidence				
Avoid a mine subsidence event during construction of the proposed project	M1	Mine subsidence areas within the vicinity of the project have been identified and assessed as not likely to pose a risk to the project.	Pre-construction	To be included in CEMP to be prepared prior to work commencing.
Traffic and access				
Minimise impact of increased construction traffic on the local community	T1	Appropriate signage will be installed along Main Road to warn local drivers of trucks turning and any other changed conditions.	Pre-construction	To be included in CEMP to be prepared prior to work commencing.
Waste management				
To minimise waste produced during construction of the proposed project, and maximise re-use of materials	W1	To minimise waste, the 'waste hierarchy' (avoid/resource recovery/disposal) will be maximised during construction. The way in which the waste hierarchy will be maximised will be documented and, where relevant to work activities, will be incorporated into work programs and site inductions.	Construction	*Waste Avoidance and Resource Recovery Strategy 2007* (DECC 2007). To be included in CEMP to be prepared prior to work commencing.
Safely dispose of waste produced by operation of the treatment plant	W2	Waste produced during operation of the groundwater treatment plant will be disposed of inside the containment cell or disposed off site in accordance with the prevailing guidelines as agreed with the Site Auditor.	Construction	In accordance with DECCW requirements.

Objective	Ref #	Commitment	Timing	Reference
Services supply to the cell				
To ensure that prior to completion of the remediation, services to the cell will be finalised.	C1	Appropriate drainage and electricity supply will be installed during the remediation to ensure service supply in the short term. In the long term, it will be a condition of sale of the Site to a developer that the drainage and electricty supply be provided for in their planning, such as through easements.	Construction	

14 Conclusion

14.1 Project justification

Economic, social, and environmental justification

Project-level justification considers the project and its interaction with the immediate environment. It is concerned with the degree to which the project objectives are satisfied, and the performance of the project against a range of environmental, social and economic factors.

The key project objective of these Stage 2 works is to remediate the contaminated IFL Site, determined by DECCW to present a 'significant risk of harm', to an acceptable level for residential and open space use and to remove the designation of the Site as a significant risk of harm to the environment.

A number of potential impacts are expected to occur as a result of the project. However, mitigation measures have been proposed to address each of the impacts identified as part of this EA.

It is anticipated that the impacts of the project on the local community will be minor and temporary. Some of these impacts will include:

- A minor increase in heavy vehicle traffic in the vicinity of the Site.
- Minor visual impacts due to visible construction equipment and fencing on the Site.
- Noise impacts associated with construction activities at the Site.
- A potential minor change in air quality within the Site.

These will be mitigated by the measures outlined in Chapters 7 and 8.

Overall it is considered that the minor impacts associated with the proposed project will be outweighed by the substantial benefits of remediating a significantly contaminated site.

Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The principles of ESD have been an integral consideration throughout the development of the project.

The EP&A Act recognises that ESD requires the effective integration of economic and environmental considerations in decision-making processes. There are four main principles supporting the achievement of ESD:

- Precautionary principle.
- Inter-generational equity.
- Conservation of biological diversity and ecological integrity.
- Improved valuation and pricing of environmental resources.

These principles are discussed below.

Precautionary principle

The precautionary principle deals with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

The environmental risk analysis documented in Chapter 6 covers the potential impacts of the project. That analysis and the EA as a whole identify no threat of serious irreversible environmental damage.

Inter-generational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

While the project will have some impacts, they are not of a nature or extent that will result in disadvantage to any specific section of the community or to future generations. The project aims to provide benefits to present and future generations through the remediation of soil and groundwater, and improved environmental outcomes. In addition, a contaminated industrial site will be transformed into potential residential and open space.

The project effectively limits the otherwise ongoing legacy associated with the contaminated materials placed at this site as part of its former history when environmental impacts were not recognised. The highly engineered containment strategy will provide a long term, stable and effective management of the risk posed by the contaminated materials without an undue burden on the current generation.

Conservation of biological diversity and ecological integrity

This project will occur in a highly modified and contaminated environment that contains little potential habitat for biodiversity. As a result, potential impacts on biodiversity are not anticipated. It is expected that the project will lead to an improvement in environment quality.

Improved valuation and pricing of environmental resources

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by a project, including air, water, land and living things.

It is difficult to place a reliable monetary value on the residual environmental and social effects of the project. However, the value placed on environmental resources within and around the Site is evidence of the project's resource-improving goals. Undertaking the project demonstrates the improved value of environmental resources for example, soil, groundwater, and air quality.

Consistency with objectives of the EP&A Act

The objects of the EP&A Act provide a framework within which the justification of the project can be considered. Table 33 presents these objectives and their relevance to the project.

Table 33 Objectives of the EP&A Act

EP&A Act objective	Comment
Encourages the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The project will encourage proper management and improvement of the environment by remediating contaminated materials and soils on the Site, and by reducing or preferably removing the 'significant risk of harm' identified by DECCW.
Encourages the promotion and coordination of the orderly and economic use and development of land.	The project will reduce contamination at the Site, improving the quality of the land and increasing its potential for future redevelopment.
Encourages the protection, provision and coordination of communication and utility services.	The project is designed to minimise impacts on communications and utility services.
Encourages the provision of land for public purposes.	The cell area is likely to be zoned for public open space use.
Encourages the provision and coordination of community services and facilities.	The project will improve the quality of the land on the Site, removing and containing the source of contamination. This will benefit the local community and in the long term.
Encourages the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats.	The project will improve the environmental values of the Site and the surrounding environment.
Ecologically sustainable development.	See section *Ecologically sustainable development* above.
The provision and maintenance of affordable housing.	The project will provide suitable land for residential development. The provision of affordable housing is outside the scope of this EA.
Promotes the sharing of the responsibility for environmental planning between the different levels of government in the State.	The environmental planning for this project has been completed in consultation with Lake Macquarie City Council as well as state government departments including DECCW and DoP.
Provides increased opportunity for public involvement and participation in environmental planning and assessment.	Consultation has been undertaken with the local community throughout the development of the proposed project, and will be ongoing. This is described in Chapter 5.

14.2 Conclusion

The proposed project satisfies the objectives of remediating the project Site to a standard suitable for residential and open space use (cell area), and aims to remove the significant risk of harm currently attributed to the Site. The project will result in isolation of contaminated soils and removal of structures at the Site in a contained cell structure, which will contribute to ongoing reduction in groundwater contamination at and emanating from the Site.

Potential adverse impacts of the project have been fully assessed. Strategies to avoid, minimise, and mitigate those impacts have been an integral part of the project development process. It is considered that the overall beneficial improvement of the groundwater quality and the isolation of contaminants from the Site, leading to a site suitable for residential use and open space use, will far outweigh any potentially negative environmental impacts, which are only of a limited and temporary nature. Furthermore, a number of commitments have been made to ensure the best possible environmental outcomes are achieved during the construction phase and subsequent operational phase of the project.

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