Port Kembla Gas Terminal

Contaminated Spoil Protocol
Stage 2A Marine Berth Construction and Onshore Receiving Facilities

Australian Industrial Energy

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→ The Power of Commitment

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Acronyms

Acronym	Definition
ACM	Asbestos containing materials
AEC	Area of environmental concern
AF	Asbestos fines
AHD	Australian Height Datum
AIE	Australian Industrial Energy
AMP	Asbestos Management Plan
ANZG	Australian and New Zealand Guideline
ASLP	Australian Standard Leaching Procedure
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soil Management Plan
BaP	Benzo(a)Pyrene
Berth 101	MBD Site Compound
BTEXN	Benzene, toluene, ethyl benzene and xylenes plus naphthalene
CD	Chart Datum
CLM Act	*Contaminated Land Management Act 1997*
COPC	Contaminant of potential concern
CRS	Certified Reference Standard
CSM	Conceptual Site Model
CSP	Contaminated Spoil Protocol
CSSI	Critical State Significant Infrastructure
CTMP	Construction Traffic Management Plan
CT1 etc	Contaminant Threshold (waste classification criteria)
DGV	Default Guideline Values
DP	Deposited Plan
DPIE	Department of Planning, Industry and Environment
DQI	Data quality indicators
DQO	Data quality objectives
EIL	Ecological Investigation Level
EIS	Environmental Impact Statement
EMP	Environment Management Plan
EMS	Environmental Management Strategy
ENM	Excavated Natural Material
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environmental Protection Licence
FA	Fibrous asbestos
FSRU	Floating Storage and Regasification Unit
GHD	GHD Pty Ltd

Acronym	Definition
GV-high	Upper guideline value
HAT	Highest Astronomical Tide
HIL	Health Investigation Level
HSE	Health, Safety and Environment
HSL	Health Screening Levels
KPIs	Key Performance Indicators
LAA	Licenced Asbestos Assessor
LAT	Lowest Astronomical Tide
LNG	Liquified natural gas
LOR	Limit of reporting
LTEMP	Long Term Environment Management Plan
MBD	Marine Berth Construction and Dredging
MHW	Mean High Water
MLAs	Marine Loading Arms
MLW	Mean Low Water
mbgl	Metres below ground level
mg/kg	Milligrams per kilogram
NAPL	Non-aqueous phase liquid
NATA	National Association of Testing Authorities of Australia
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NOHSC	National Occupational Health and Safety Commission
NVMP	Noise and Vibration Management Plan
ORF	Onshore Receiving Facilities
PAH	Polycyclic aromatic hydrocarbons
PASS	Potential Acid Sulfate Soils
PCB	Polychlorinated Biphenyl
PFAS	Per- and polyfluoroalkyl substances
PIRMP	Pollution Incident Response Management Plan
PKCT	Port Kembla Coal Terminal
PKGT	Port Kembla Gas Terminal
PKGT EIS	Port Kembla Gas Terminal Environmental Impact Statement
PKHD	Port Kembla Height Datum
POEO Act	*Protection of the Environment Operations Act 1997*
QA/QC	Quality assurance/quality control
RPD	Relative percentage difference
RWP	Remediation Work Plan
SCC	Specific contaminant concentration (waste classification criteria)
Senversa	Senversa Pty Ltd
SMP	Spoil Management Plan
SPR	source-pathway-receptor
SRD SEPP	State Environmental Planning Policy State and Regional Development

Acronym	Definition
SVR	Site Validation Report
TCLP	Toxicity Characteristics Leaching Procedure
TEQ	Toxicity Equivalence Quotient
The Project	Port Kembla Gas Terminal
The site	Berth 101
TOC	Total organic carbon
TRH	Total recoverable hydrocarbons
UCL	Upper Confidence Limit
UFP	Unexpected Finds Protocol
UST	Underground storage tank
VENM	Virgin Excavated Natural Material
WA DoH	Western Australian Department of Health
WHS	Work Health and Safety
WHS Act	*Work Health and Safety Act 2011* (NSW)
WHS Codes of Practice	*Work Health and Safety Codes of Practice 2011*
WHS Regulations	*Work Health and Safety Regulations 2017* (NSW)
WHSP	Work Health and Safety Plan
WQMP	Water Quality Management Plan

Contents

1. Introduction **7**
1.1 Overview 7
1.2 Background 7
1.3 Purpose of the CSP 8
2. Project overview **9**
2.1 Site description 9
2.2 Project construction scope of works 11
2.3 Construction of quay wall (MBD – Land Based) 14
2.4 Power, communications, and water connections 16
2.5 Construction of ORF 16
3. Roles and responsibilities **18**
4. Legislative requirements **20**
4.1 Guidelines 22
5. Planning requirements **24**
5.1 Conditions of approval 24
6. Assessment criteria **26**
6.1 Relevant guidelines 26
6.2 Assessment/validation criteria - soil 26
6.3 Assessment criteria – sediment 28
6.4 Application of selected criteria 29
6.5 Waste classification criteria 29
7. Summary of site conditions **30**
7.1 Site identification 30
7.2 Port Kembla Chart Datum and tidal fluctuations 30
7.3 Sensitive environments 32
7.4 Topography and drainage 32
7.5 Soil landscape 32
7.6 Acid Sulfate Soils 33
7.7 Geology 33
7.8 Hydrogeology 34
7.9 Site conditions 35
8. Review of previous investigations **37**
8.1 Contamination assessment for Berth 101 (GHD, 2018a) 37
8.2 Data review and gap analysis for Fill and Unit 1 Material (GHD, 2020) 38
8.3 Baseline contamination assessment (GHD, 2021a) 39
8.4 Targeted assessment – Berth 101 (GHD, 2021b) 42
9. Site contamination status **45**
9.1 Soils 45
9.2 Data gaps 45
9.3 Source-pathway-receptor linkages 46

10. Remediation works plan **47**
10.1 Site mobilisation for Stage 2A 47
10.2 MBD Site Compound 47
10.3 Additional investigation/validation 47
10.4 Excavation 48
10.5 Site management 49
11. Validation **51**
11.1 Data quality objectives 51
11.2 Data quality indicators 52
11.3 Validation methodology 53
11.4 Reporting 56
12. Protection of environment and community **58**
12.1 Interim controls 58
12.2 Hours of operation 58
12.3 Contact details during remediation 58
12.4 Soil and water management 58
12.5 Noise 59
12.6 Vibration 59
12.7 Waste management 59
12.8 Air quality 59
12.9 Fuelling of machinery 60
12.10 Traffic movements and management 60
12.11 Unexpected finds protocol 60
12.12 Environmental protection and incident management 63
13. Health and safety **64**
13.1 Work health and safety 64
13.2 Community health and safety 64
14. CSP conclusions **65**
15. Communication and complaints **66**
15.1 Internal communications 66
15.2 External communications 66
15.3 Complaints management 67
16. Inspections, monitoring and audits **68**
16.1 Environmental inspections 68
16.2 Monitoring 68
16.3 Auditing 69
16.4 Environmental reporting 69
16.5 Compliance tracking register 69
16.6 Non-conformance, corrective, and preventative actions 70
17. Incident management and emergency response **71**
17.1 Incident management 71
17.2 Emergency response 72
18. Document management and review **73**
18.1 Record management 73
18.2 Review and revision of CSP 73

18.3 Access to information 73
References **75**
Limitations **78**

Table index

Table 2.1 Construction stages/work packages 11
Table 2.2 Marine berth and wharf structures to be constructed during Stage 2A 14
Table 2.3 Construction of power connections for Stage 2A 16
Table 2.4 Structures to be constructed for ORF during Stage 2A 16
Table 3.1 Roles and responsibilities of Project team 18
Table 4.1 Legislation and relevant policy applicable to this CSP 20
Table 5.1 Approval conditions 25
Table 6.1 Human Health assessment criteria 27
Table 6.2 Asbestos assessment criteria 28
Table 6.3 Sediment assessment criteria 29
Table 7.1 Site identification details 30
Table 7.2 Explanation of terms and datums used in Australian ports 31
Table 7.3 Generalised material descriptions for Fill and Unit 1 34
Table 8.1 Summary of contamination and potential risks to receptors 41
Table 12.1 Air Monitoring Action Levels 60

Figure index

Figure 2.1 Site overview 10
Figure 2.2 Stage 2A works and location of MBD Site Compound and Emplacement Cell Construction Site 12
Figure 2.3 Layout of MBD Site Compound 13
Figure 2.4 Location of quay wall and layout of MBD and ORF 15
Figure 7.1 Monthly Tidal Range in LAT Port Kembla Harbour (source: BOM website) 32
Figure 7.2 Acid sulfate soil risk map (DLWC, 1997) 33
Figure 7.3 Registered groundwater bores (Lotsearch, 2020) 35
Figure 12.1 Unexpected finds decision process 62

Appendices

Appendix A Figures
Appendix B Summary of table results

1. Introduction

1.1 Overview

This Contaminated Spoil Protocol (CSP) has been developed as a sub-plan to the Port Kembla Gas Terminal Project (the Project) Spoil Management Plan (SMP). The SMP is sub-plan to the Project's overarching Environmental Management Strategy (EMS)). This CSP has been prepared by GHD Pty Ltd (GHD) on behalf of Australian Industrial Energy (AIE) to apply to construction activities associated with Stage 2A construction of the Port Kembla Gas Terminal (PKGT) (the Project).

This CSP interfaces with the other associated sub-plans, which together describe the proposed structure for environmental management and monitoring requirements for the Project. This CSP addresses the requirements of the Port Kembla Gas Terminal Environmental Impact Statement (PKGT EIS) and associated Infrastructure Approval (SSI 9471) and Environmental Protection Licence (EPL) No. 21529.

1.2 Background

AIE is developing the Project which involves the development of a liquefied natural gas (LNG) import terminal at Port Kembla, south of Wollongong, NSW. The Project will be the first of its kind in NSW and will provide a simple and flexible solution to the state's gas supply challenges.

NSW currently imports more than 95 percent of the natural gas it uses from other eastern states. In recent years, gas supplies to the Australian east coast market have tightened, resulting in increased natural gas prices for both industrial and domestic users.

The Project provides an immediate solution to address the predicted shortages and will result in significant economic benefits for both the Illawarra region and NSW. The Project will have a capacity to deliver more than 100 petajoules of natural gas, equivalent to more than 70 percent of NSW gas needs and will provide between 10 to 12 days of natural gas storage in case of interstate supply interruption. LNG will be sourced from worldwide suppliers and transported by LNG carriers to the gas terminal at Port Kembla where it will be re-gasified for input into the NSW gas transmission network.

The Project has been declared Critical State Significant Infrastructure (CSSI) in accordance with Section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW) and Schedule 5 of the State Environmental Planning Policy State and Regional Development (SRD SEPP). The Project received Infrastructure Approval from the Minister for Planning and Public Spaces on 29 April 2019.

The construction of the Project is primarily associated with the establishment of a new berth facility at Port Kembla to enable an LNG carrier to berth alongside the Floating Storage and Re-gasification Unit (FSRU) and new infrastructure to connect the terminal to the existing gas network. Excavation and dredging would be required to establish the new berth facility, with spoil deposited in a cell (referred to as the 'Emplacement Cell') in the Outer Harbour.

The development has progressed to Stage 2A works located at Berth 101 (referred to as 'the site' or 'MBD Site Compound'). The Stage 2A works include land-based construction works associated with the Marine Berth Construction and Dredging (MBD) and Onshore Receiving Facilities (ORF). The Stage 2A works include:

– Construction of the quay wall at the MBD Site Compound incorporating finalisation of excavation works undertaken during Stage 1 (including transport of spoil materials to Emplacement Cell Construction Site).
– Installation of, and commissioning of, power, communications, and potable water line.
– Construction of the ORF at the MBD Site Compound (including construction of Wharf Topside Area, Utility Area, and Common Area).
– Installation of gas pipeline within the MBD Site Compound as part of ORF.

At this stage, material excavated as part of the remediation process has been segregated into contaminated and uncontaminated materials, with contaminated materials either disposed off-site or segregated for further

management and uncontaminated materials stockpiled and managed at the southern end of the MBD Site Compound or at the Emplacement Cell Construction Site for use in construction of Stage 2A.

GHD previously carried out a contamination assessment of Berth 101 (also referred to as the MBD Site Compound) in 2018 as part of the PKGT EIS. The contamination assessment identified two benzo(a)byrene (BaP) toxicity equivalence quotient (TEQ) hotspots at depths at 4.20 metres and 4.75 metres below ground level (bgl) (1.74 metres and 0.13 metres Port Kembla Height Datum (PKHD)) within fill/reclaimed sands with concentrations above the criteria for human health (commercial/industrial land use). These hotspots were further investigated by GHD as part of an additional targeted investigation (GHD, 2021b) to refine the lateral and vertical extent of the hotspots and assess the significance of the contamination identified and potential risks it may pose to marine ecosystems in the Outer Harbour. In addition to the hotspots, GHD (2021b) also provided further assessment of leachability of fill materials (Fill, Unit 1, and Unit 2) present on site and limited investigation of the extent of Polychlorinated Biphenyl (PCB) contamination in the vicinity of the substation that remains on site. Data gaps remain beneath the substation.

The following investigations have been prepared for the MBD Site Compound since 2018 and have been used in preparation of this CSP:

– GHD (2018a), *Contamination Assessment report for Berth 101.* GHD, October 2018).
– GHD (2021a), *Baseline Contamination Assessment. Southern Part of Lot 22 DP 1128396, Port Kembla*. GHD, February 2021.
– GHD (GHD, 2021b), *Port Kembla Gas Terminal. Additional Targeted Investigation – Berth 101*

The above reports/specifications may be part of the review being undertaken by the NSW Environment Protection Authority (EPA) accredited site auditor, Melissa Porter of Senversa Pty Ltd (Senversa), who has been appointed by AIE to review various documentation associated with the contaminated land aspects of the Project.

1.3 Purpose of the CSP

This CSP has been prepared in accordance with the PKGT EIS and associated Infrastructure Approval (SSI 9471) and EPL No. 21529. It describes how the management measures and commitments in the PKGT EIS, Infrastructure Approval (SSI 9471) and EPL No. 21529 relating to contaminated spoil are to be implemented by the Principal Contractor during Stage 2A construction of the Project. Specifically, this plan includes requirements to:

– Set remediation goals relevant to subsequent removal and off-site emplacement of material, so that material can be appropriately managed and will pose no unacceptable risk to human health or the environment under those designated end uses.
– Document the particular remediation techniques and procedures selected to address the identified site contamination issues.
– Document a sampling and analysis plan to validate or characterise material exposed or excavated as part of the remediation works, including to address data gaps remaining from existing investigations.
– Document procedures to enable appropriate management of material prior to removal from site as part of subsequent stages of work. This CSP is not intended to provide procedures for the subsequent stages of material movement or off-site emplacement.
– Establish the various safeguards required to complete aspects of the remediation and materials handling work relating to contamination in a safe and environmentally acceptable manner.
– Identify the necessary approvals and licences required by regulatory authorities in order to enable Stage 2A works to proceed (in relation to contamination issues only).

AIE and its contractors acknowledge that maintaining spoil and waste in the vicinity of the MBD Site Compound is paramount to the successful delivery of the construction phase of the Project. AIE is committed to ensuring this CSP is implemented, reviewed and updated regularly to ensure its objectives are met and that the approval conditions outlined in the Infrastructure Approval (SSI 9471) and EPL No. 21529 are achieved. Staging of the CSP has been approved in accordance with Condition 3 of Schedule 4 of Infrastructure Approval SSI-9471.

This CSP is applicable to all staff, employees, subcontractors, and any statutory service authorities undertaking the Stage 2A works described in Section 2.2 of this CSP. The CSP implementation and on-going development will be managed by the Project Team (refer to Section 3).

2. Project overview

2.1 Site description

The site of the Project is situated at Port Kembla within the Illawarra region of NSW, about 80 kilometres south of Sydney. Port Kembla is mainly characterised by an existing import and export terminal and multiple other business, cargo, logistics, bulk goods, and heavy industrial facilities in the vicinity.

Port Kembla is situated about two kilometres south of the centre of Wollongong. Other localities surrounding Port Kembla and the Project site include Mangerton, Mount St. Thomas and Figtree to the north-west; Unanderra to the west; Berkeley to the south-west; and Cringila, Lake Heights, Warrawong and the residential region of Port Kembla to the south.

The zoned land use in the region includes special use and industrial use at Port Kembla and a mix of primarily residential and commercial uses at the surrounding localities. Major infrastructure in the region of Port Kembla includes the Princes Highway, which is a major state and regional highway connecting Sydney and Wollongong and regional areas further south. Princes Highway provides access to Port Kembla through turnoffs at Masters Road, Five Islands Road and Northcliffe Drive and is broadly utilised including by heavy vehicles from the port.

The South Coast railway line runs along the periphery of Port Kembla including the stations Port Kembla, Port Kembla North, Cringila and Lysaghts. The rail line services commuters and is also used to transport bulk solid goods like coal, grain, copper and steel from Port Kembla. The environmental features of Port Kembla and the surrounding region are limited given the extensive industrial, commercial and residential development. Waterways in the region include the Gurungaty Waterway, Allans Creek, American Creek and Byarong Creek. Green space includes JJ Kelly Park and Wollongong Golf Club to the north and a larger open area to the south-west.

The Project will be predominantly located within land zoned for dedicated port and industrial uses. Berth and wharf facilities, as well as the FSRU, would be situated at Berth 101 at the Inner Harbour, while the gas pipeline would extend around the periphery of port operations from Berth 101 to a tie-in point at Cringila. The Emplacement Cell will be located in the Outer Harbour. A site overview is provided as Figure 2.1.

Figure 2.1 Site overview

2.2 Project construction scope of works

2.2.1 Overview

The Project construction scope of work has been divided into the three main packages (with associated activities), as outlined in Table 2.1. This CSP applies only to the works associated with Stage 2A.

Table 2.1 Construction stages/work packages

Stage	Package	Proposed commencement	Activities
1	Early Enabling Works	May 2021	Demolition of Berth 101, removal of structures and land based excavation works, and Cone Penetration Testing (CPT) in the Outer Harbour to inform Emplacement Cell design and relocation of Bunker Oil Pipeline.
2A	Marine Berth Construction – Land Based	January 2022	Completion of excavation works undertaken during Stage 1. Transport of spoil materials to Emplacement Cell Construction Site.
			Quay wall construction.
		February 2022	Installation of communications conduit, potable water line, and 11kV power cable and Padmount Substation within MBD Site Compound.
		April 2022	Construction of the ORF, which comprises three areas: Wharf Topside Area; Utility Area; and Common Area.
		June 2022	Pipeline construction and associated ancillary infrastructure within MBD Site Compound delivered as part of ORF scope.
2B	Marine Berth Construction and Dredging – Land and Marine Based	March 2022	Continuation of Stage 2A with addition of the following activities:
			Excavation/dredging and construction of the Emplacement Cell in the Outer Harbour.
			Marine based construction activities including installation of navigational aids and revetment shore protection.
3	Pipeline Installation including tie-ins (NGP)	June 2022	Construction of an 18” onshore natural gas pipeline approximately 6.3km in length from the Berth 101 site boundary to Tie-in Facility at Cringila or connection to the Eastern Gas Pipeline. Pipeline construction to occur concurrently with Jemena, subject to separate set of management plans.

The construction of Stage 2A works is located within the former Port Kembla Coal Terminal (PKCT) Bulk Products Berth (Berth 101). As part of the Early Enabling Works the removal of existing structures and services and excavation was undertaken to facilitate subsequent development stages of the Project.

The following will be undertaken as part of the Stage 2A land-based works:

– Construction of the quay wall at MBD Site Compound incorporating finalisation of excavation works undertaken during Stage 1 (including transport of spoil materials to Emplacement Cell Construction Site).
– Installation of and commissioning of power, communications, and potable water line.
– Construction of ORF at MBD Site Compound (including construction of Wharf Topside Area, Utility Area, and Common Area).
– Installation of gas pipeline within MBD Compound site.

An outline of the tasks associated with Stage 2A is provided in Section 2.3 through Section 2.5. The site of the works includes the MBD Site Compound with materials being transported to the Emplacement Cell Construction Site. The location of the Stage 2A works, MBD Site Compound, and the Emplacement Cell Construction Site is shown in Figure 2.2.

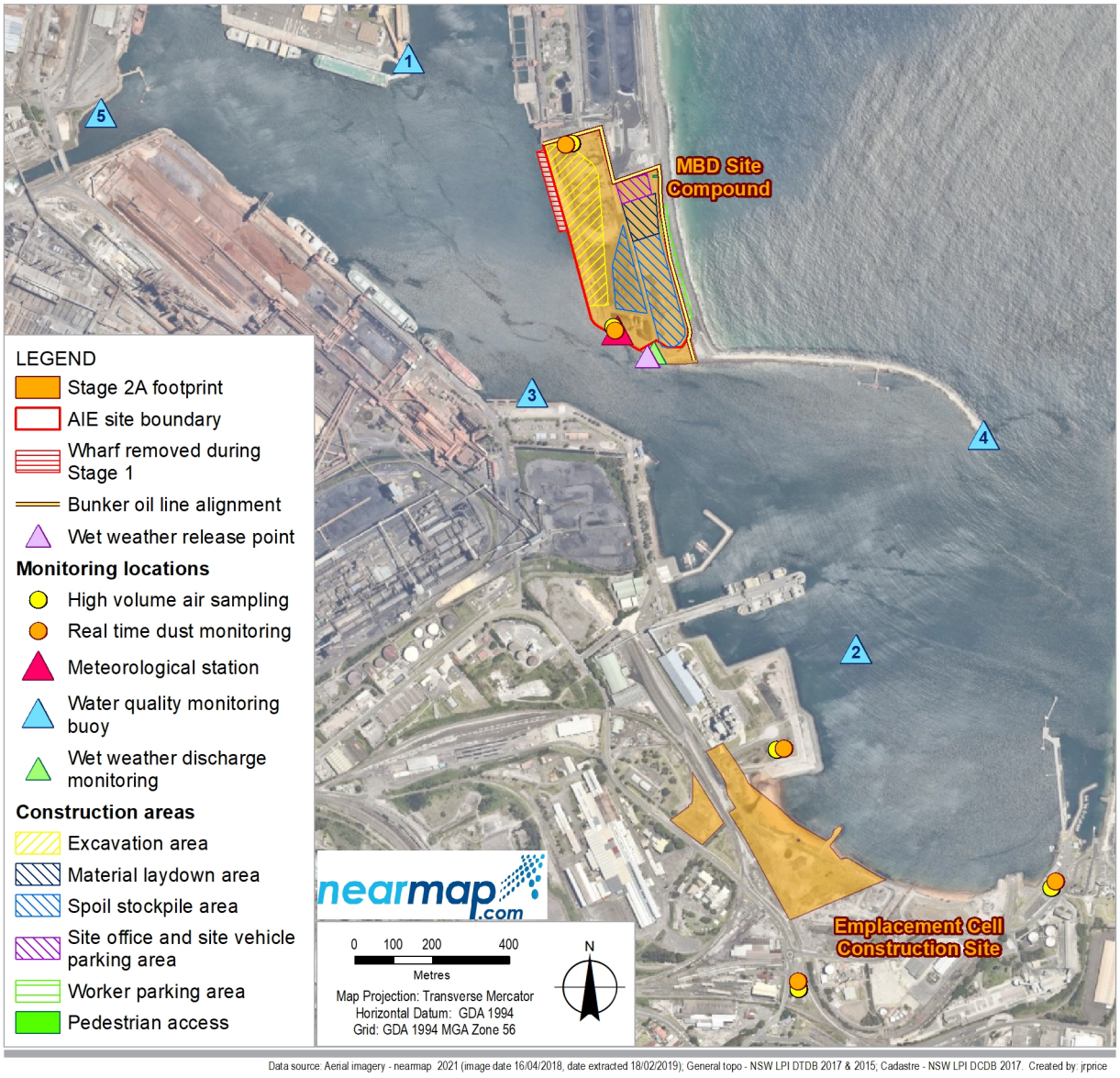

Figure 2.2 Stage 2A works and location of MBD Site Compound and Emplacement Cell Construction Site

2.2.2 Traffic

Traffic generated by Stage 2A will be controlled through the gate on Sea Wall Road. Heavy vehicle movements will be generated by the delivery of materials, equipment, and plant to the MBD Site Compound and transport of stockpiled material to the Emplacement Cell Construction Site.

There may be a requirement to transport and tip up to 8000m³ of crushed concrete and up to 2000m³ of crushed heavily bound base course to the Emplacement Cell Construction Site via road to increase the storage footprint area within the East Stockyard and to facilitate for later use during the construction of the Emplacement Cell.

The activities associated with this task will involve loading, road transportation via truck and trailer (approximately 30-tonne capacity), unloading, stockpiling, and management of the stockpiles.

Light vehicle movements will be generated from construction workers accessing the MBD Site Compound. Parking will be provided for up to 76 workers on the MBD Site Compound (refer to Figure 2.3).

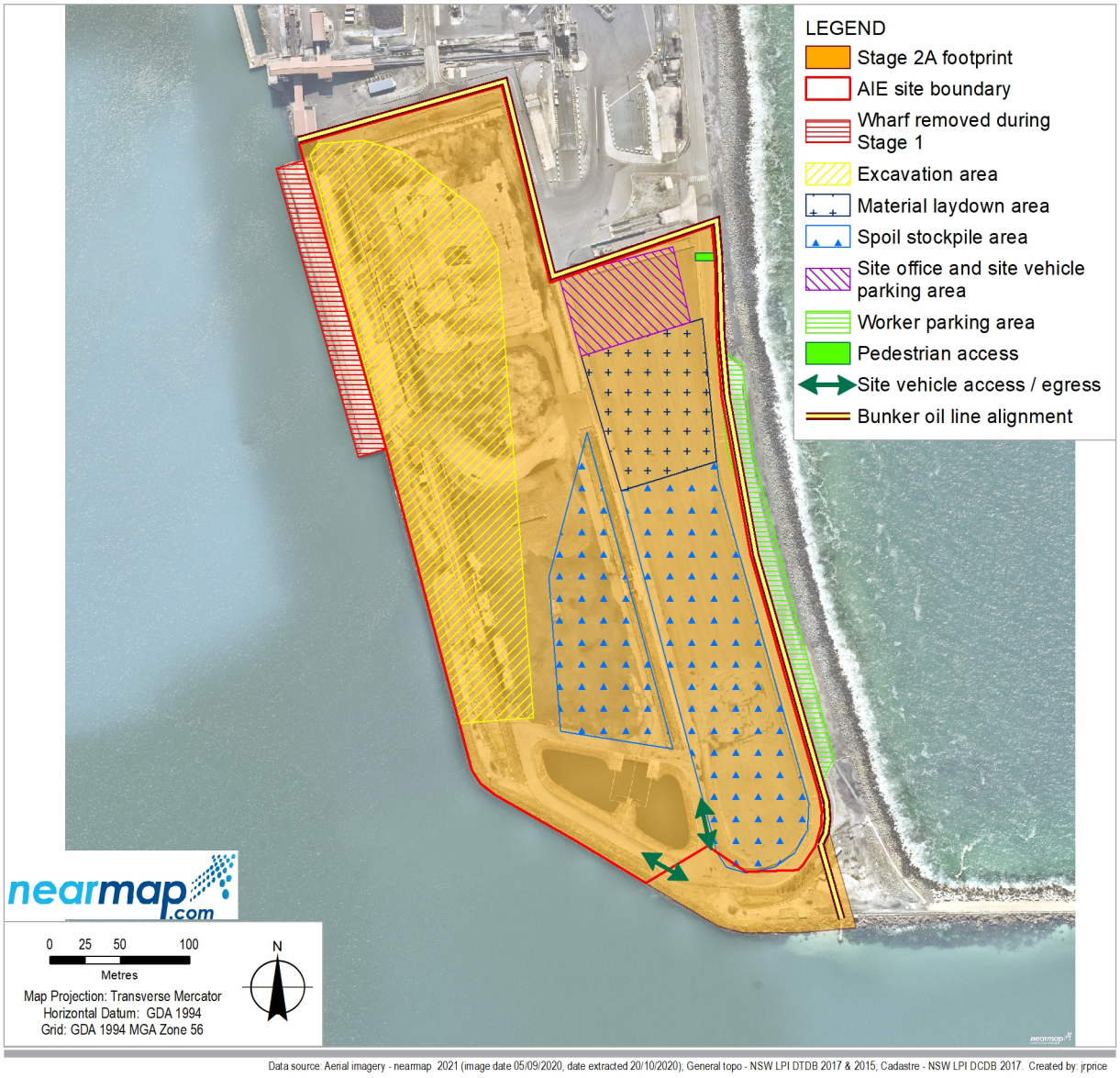

Figure 2.3 Layout of MBD Site Compound

2.2.3 Program

The Stage 2A works are anticipated to commence in January 2022. Stage 2B which includes the continuation of land-based construction and water-based works) are then anticipated to commence in March 2022 (refer to Table 2.1).

2.3 Construction of quay wall (MBD – Land Based)

A number of structures will be constructed within the MBD Site Compound to accommodate the FSRU and LNG carrier for the Project. Excavation and stockpiling activities from the Stage 1 Early Enabling Works will continue on-site during Stage 2A to lay the platform for ongoing construction activities at the MBD Site Compound.

The new structures that will commence construction during Stage 2A are summarised in Table 2.2. The location of the quay wall and layout of the marine berth and wharf facilities is shown in Figure 2.4.

Table 2.2 Marine berth and wharf structures to be constructed during Stage 2A

Component	Works required
Earthworks and stockpiles	– Completion of excavation and backfilling works from Stage 1 Early Enabling Works. – A nominal 15-metre-wide section on the northern end and a circa 60-metre 'wedge' at the south- west corner of the excavation zone was left to facilitate contractor access and will required completion at commencement of Stage 2A. – Excavated materials from the Early Enabling Works have been stockpiled within the Eastern and Western Stockyards of the MBD Site Compound and the Emplacement Cell Construction Site. – The excavated materials stockpiled include: • Approximately 15,000m³ of demolished concrete crushed to nominal 70mm minus. • Approximately 30,000m³ of heavily bound base course crushed to nominal -150mm minus. • Approximately 25,000³ of mixed slag, general fill, and coal nominally < 150mm in size. • Approximately 10,000m³ of predominantly sand with some slag and coal. – The excavated materials will be used/reused for quay wall construction and to backfill the landside area of the quay wall or transported to the Emplacement Cell Construction Site for storage and use in construction of the Emplacement Cell.
Quay wall	– Construction of a new piled quay wall keyed into bedrock complete with sheet pile anchor wall, capping beam and tie rods to the south of the existing coal terminal. – Excavated and processed materials from the Stage 1 Early Enabling Works are stockpiled within the MBD Site Compound and will be used during construction of the quay wall and to backfill on landside area of the wall. – Installation of a marine fender system attached to the capping beam along the quay wall to protect the quay wall from berthing and mooring loads. – Installation of a cathodic protection system to the quay wall and associated elements, including assessment of the potential impacts the FSRU and pipeline cathodic protection will have on quay wall. – Backfilling and compaction on landside area of wall utilising the site stockpiled materials.
Mooring dolphins	– Installation of landside mooring dolphin structures on reinforced concrete platforms supported by steel piles. – Mooring equipment will be installed and comprise the following: • 20 load sensing quick release hooks. • Up to four land-based mooring winches on mooring dolphins may be required. • Up to four swivel fairleads may be required to enable each mooring line to land-based winches to be fed in a horizontal alignment.
Marine Loading Arm foundations	Construction of a new reinforced concrete foundation supported on steel piles, located behind the new quay wall.
Gangway tower foundation	Construction of foundation for Gangway tower
Fire monitor foundation	Fire monitor foundations, subject to risk studies.

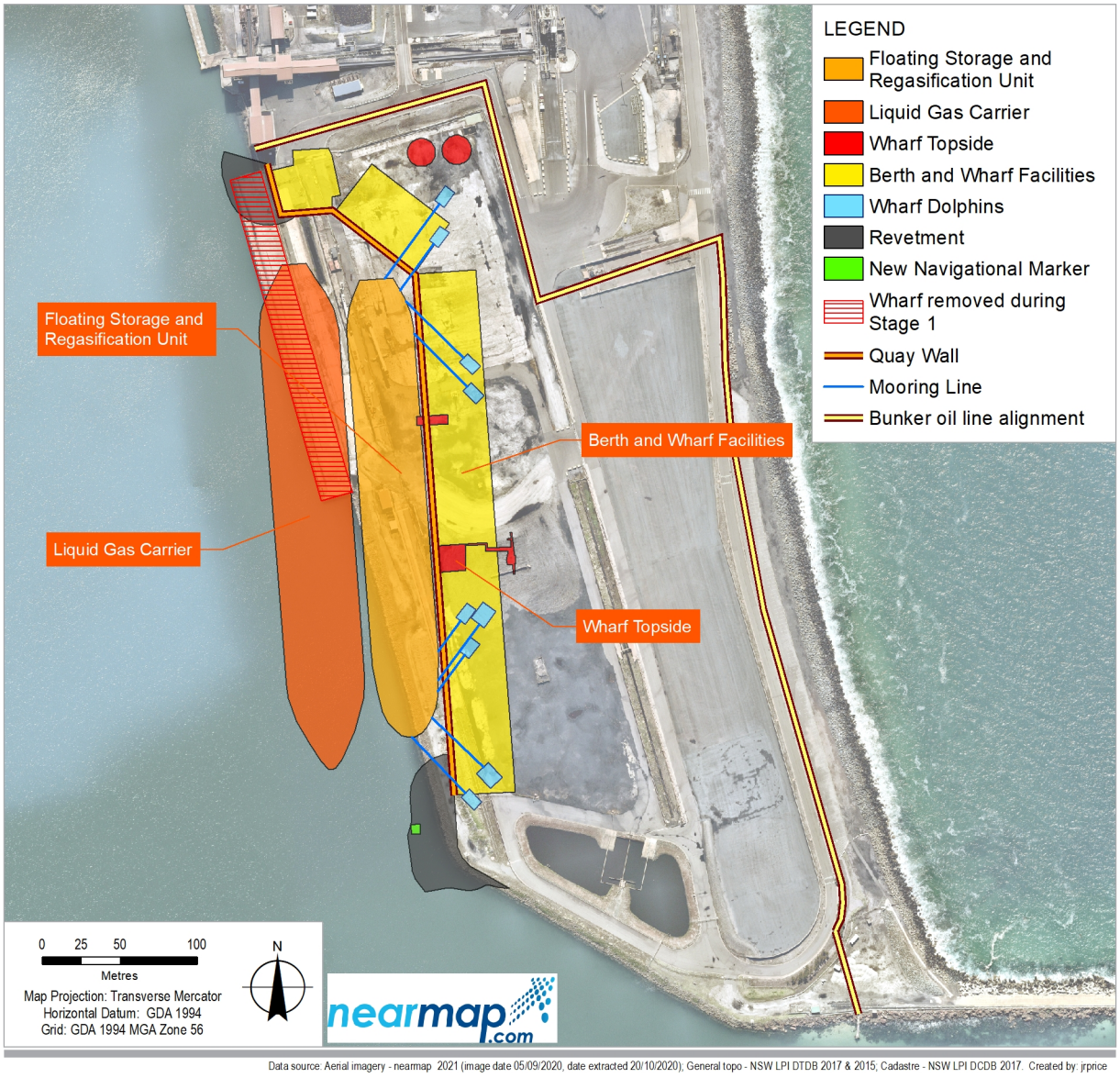

Figure 2.4 ***Location of quay wall and layout of MBD and ORF***

2.4 Power, communications, and water connections

Works required for power, communications, and water connections are summarised in Table 2.3.

Table 2.3 Construction of power connections for Stage 2A

Component	Works required
Power and communications	– Construction and installation of a new 11kV power cable in a buried conduit and Substation. – Energisation of the Padmount Substation and 415kV Temporary Building Supply. – Installation of communication conduit and pits.
Potable water	– Extension of existing potable water line within MBD Site Compound.

2.5 Construction of ORF

The general layout of the ORF areas is shown in Figure 2.4. Works required for the three ORF areas are summarised in Table 2.4.

Table 2.4 Structures to be constructed for ORF during Stage 2A

Component	Works required
Wharf Topside Area	
Marine Loading Arms (MLAs)	Installation of MLAs, including: – Civils and structures. – Associated works such as piping, hydraulics, electrical, instrumentation, and auxiliary systems.
Piping and valving	– All necessary piping and valving. – Odorant injection facilities. – Pig launcher, downstream of the MLAs to tie-in to the Natural Gas Pipeline.
Gangway	– Gangway access tower to provide connection between the wharf and FSRU.
Utility connections	FSRU utilities connections for: – Communications. – Marine Diesel Oil. – Freshwater. – Sewage, bilge, and grey water.
Utility Area	
Site Utilities	Site utilities including: – Potable water and sewerage. – Instrument air and bottled nitrogen. – Diesel storage. – Electrical distribution (including UPS and emergency diesel generators). – Control and instrumentation. – Telecommunications.
Common Areas	
Firefighting systems and equipment	Firefighting equipment including: – Firewater storage. – Pumps. – Firewater monitors.
Security systems and equipment	– CCTV. – Fencing and gates. – Security access and monitoring systems.
Equipment housing	Equipment shelters and buildings to house:

Component	Works required
	– Electrical, control, and operating equipment, critical spares, emergency response and site monitoring facilities. – Buildings will include appropriate building services e.g., HVAC, potable water, amenities, sewerage etc.
Site roadways, lighting and drainage	– Roads and car parking areas. – General lighting, earthing, lightning system. – Drainage system to tie into the existing Port Kembla drainage system.
Gas Pipeline	A section of gas pipeline will be installed within the MBD Compound site as part of the Stage 2A works. Final safety studies will be prepared prior to the construction of the gas pipeline and prior to commencement of operation as per Schedule 3, Condition 21 of Infrastructure Approval (SSI 9471).

3. Roles and responsibilities

The Project Team is responsible for all activities associated with Stage 2A, including the implementation and maintenance of the various mitigation/management measures outlined in this CSP. Relevant roles and responsibilities of the Project Team are outlined in Table 3.1.

Table 3.1 Roles and responsibilities of Project team

Project Role	Responsibility
AIE Project Director	– Responsible for the overall funding and direction of civil and environmental works associated with Stage 2A. – Ensuring provision of adequate resources to achieve the environmental objectives for the project including ensuring sufficient resourcing for the Environmental Team, Engineering and Construction Teams.
AIE Construction Manager	– Proactively stewards the effective implementation of Stage 2A in accordance with requirements of the Infrastructure Approval (SSI9471), this CSP, EMS, and all related Sub-Plans. – Demonstrate proactive support for environmental requirements.
AIE HSE Manager	– Develops and update all Health, Safety and Environmental (HSE) Management Strategies and Sub-Plans. – Ongoing liaison and engagement with government agencies and point of escalation for any environmental incidents. – Identifying environmental issues as they arise and proposing solutions. – Coordinate and facilitate weekly environmental inspections with the key contractors. – Environmental Reporting.
Principal Contractor Project Manager	– On-site Project management and control. – Decision-making authority relating to environmental performance of the construction program. – Authority over Project construction and site activities in accordance with the EMS. – Ensure relevant training is provided to all Project staff prior to commencing individual activities. – Reports to AIE Construction Manager on environmental matters. – Ensures appropriate Contractor resources are allocated to implement the environmental requirements. – Responsible for planning and scheduling of construction, and to ensure operations are conducted in accordance with statutory requirements and the EMS. – Monitors performance against environmental Key Performance Indicators (KPI's). – Ensures that all environmental objectives associated with the Project are achieved. – Day-to-day decision-making authority relating to environmental performance of construction activities and direct site activities and construction. – To provide resources to ensure environmental compliance and continuous improvement. – Ensure all personnel are aware of any changes to EMS, this CSP and improved procedures. – Ensure this CSP is implemented for the duration of Stage 2A.
Principal Contractor Construction Foreman	– Implement requirements contained in the EMS and Sub-Plans, work procedures and standard drawings. – Maintaining open and transparent communication with other Project discipline managers and other areas of the Project. – Reporting of hazards and incidents and implementing any rectification measures. – Ensures appropriate contractor resources are allocated. – Orders STOP WORK for any environmental breaches and reports incidents to the Project Manager. – Ensure this CSP is implemented for the duration of Stage 2A.

Project Role	Responsibility
Principal Contractor Environmental Representative	– Delivers environmentally focussed toolbox talks and provides applicable site inductions. – Provides environmental advice, assistance, and direction to Project Manager to ensure construction activities are conducted in accordance with regulatory legislation and this EMS. – Participate and cooperate with AIE HSE Manager with regards to undertaking of joint weekly environmental site inspections. – Coordinate / undertake wet-weather inspections as per EPL No. 21529 and report accordingly to the AIE HSE Manager. – Develop strong working relationships with the AIE team and Consultants. – Ensure environmental risks are appropriately identified, communicated, and effectively managed. – Ensure communication of relevant environmental information to Project personnel. – Provide specialist advice and input as required. – Ensure construction manager, superintendents and field supervisors fully understand the environmental constraints and how construction practices must ensure any such constraints are considered and mitigated against during construction. – Orders STOP WORK for any environmental breaches and immediately reports incidents to Principal Contractor Project Manager and AIE HSE Manager.
AIE Environmental Representative	– Develop strong working relationships with the Principal Contractor Team and Consultants. – Ensure environmental risks are appropriately identified, communicated, and effectively managed. – Instruct and advise management team on compliance issues. – Provide specialist advice and input as required. – Co-ordinate internal audits of this CSP. – Conduct audit review as required. – Reports on the performance of this CSP and recommends changes or improvements to Project Manager. – Orders STOP WORK for any environmental breaches and immediately reports incidents to the AIE Construction Manager and AIE HSE Manager. – Conducts investigation and response to environmental complaints and inquiries, where required.
Subcontractors and construction personnel	– Undertake an environmental induction prior to accessing to site. – Comply with legislative requirements. – Participate in weekly inspections and audits. – Follow environmental procedures. – Report all environmental incidents and hazards. – Introduce environmental topics to prestart meetings. – Ensure that all relevant permits and clearances are in place prior to commencing work.
NSW EPA Accredited Site Auditor	– Reviews various documentation associated with the contaminated land aspects of the Project. – Prepares and issues a Section A site audit statement confirming the suitability of the site for its intended use at the completion of dredging, excavation and disposal.
Environmental Consultant	– Responsible for validation and preparation of the site validation report

4. Legislative requirements

The legislative requirements applicable to Stage 2A are listed in Table 4.1.

Table 4.1 Legislation and relevant policy applicable to this CSP

Legislation and Regulation	Description	Applicability
Federal		
National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM)	The *National Environment Protection (Assessment of Site Contamination) Measure 1999* (referred to here as the NEPM) was produced by the federal National Environmental Protection Council (NEPC) in 1999 and was revised and updated in 2013 by way of the National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013 (NEPC, 2013). The amended NEPM is still referred to as the NEPM 1999. The NEPM provides a national framework for conducting assessments of contaminated sites in Australia. The purpose of the NEPM is to "*establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry."* The desired environmental outcome for this NEPM is "*to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination."*	The NEPM addresses assessment of contamination and does not provide specific guidance for remediation or management of risk, although principles for remediation and management of contaminated sites are presented in Volume 1 of the NEPM. The NEPM includes two Schedules: Schedule A comprises a flowchart of the recommended general process for the assessment of site contamination and its relationship to the management of site contamination and Schedule B consists of technical guidelines about site assessment criteria, site investigation procedures, laboratory analyses, human health risk assessment, ecological risk assessment, derivation of investigation levels, groundwater risk assessment, community engagement and risk consultation and competencies and acceptance of environmental auditors and related professionals. In broad terms, the assessment process can be described as: – Tier 1 Preliminary investigation, laboratory analysis and interpretation, development of a conceptual site model (CSM) and assessment of results with reference to investigations or screening levels. The need for risk-based remediation assessment to derive response levels and/or the need for remediation is evaluated. – Where required, Tier 1, Tier 2 or 3 Detailed investigation/Site specific risk assessment, laboratory analysis and interpretation are completed, and the requirement for remediation is evaluated.
Work Health and Safety Act 2011	The Federal *Work Health and Safety Act 2011* provides a nationally consistent framework to ensure the health and safety of workers and workplaces. AIE has a duty under the Act to provide the highest level of protection possible against harm to health, safety and hazards and risks to all workers.	As there is a potential for asbestos to be encountered within fill or as subsurface structures at the site, the primary legislative requirements detailing AIE's obligations regarding the presence of asbestos (if it is encountered) on the site are listed as follows: – *Work Health and Safety Act 2011*(NSW) (WHS Act) – *Work Health and Safety Regulations 2017* (NSW) (WHS Regulations) – How to Manage and Control Asbestos in the Workplace, 2019 SafeWork NSW (SafeWork NSW, 2019a) – How to Safely Remove Asbestos, 2019 SafeWork NSW. (SafeWork NSW, 2019b).

Legislation and Regulation	Description	Applicability
Work Health and Safety Codes of Practice 2011 (WHS Codes of Practice)	The WHS Codes of Practice are instruments which provide detailed information on specific hazards and risks, such as management and control of asbestos, safe removal of asbestos and hazardous chemical management.	The WHS Codes of Practice are made under the Federal *Work Health and Safety Act 2011* and applies to all persons who have a duty under the Act. The Codes of Practice provide guidance on meeting obligations under the WHS Act and WHS Regulations.
State		
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act establishes a process for investigation and remediation of land that the EPA considers to be significantly contaminated. The Act sets out contamination management protocols, outlines the role of the EPA in the assessment and supervision of contaminated land and provides for accreditation of site auditors. The CLM Act has a comprehensive suite of guidelines related to assessment and management of contamination administered by the EPA, including: – NSW EPA (1995), *Contaminated Sites: Sampling Design Guidelines*. (NSW EPA, 1995) – NSW EPA (2020), *Consultants reporting on contaminated land – Contaminated land guidelines.* (NSW EPA, 2020) – NSW EPA (2017), *Contaminated Sites: Guidelines for NSW Site Auditor Scheme (3rd ed.).* (NSW EPA, 2017) – NSW EPA (2014a). *Waste Classification Guidelines Part 1: Classification of Waste.* (NSW EPA, 2014a) – NSW EPA (2014b). *Waste Classification Guidelines Part 4: Acid sulfate soils* (NSW EPA, 2014b) Guidelines approved under the CLM Act also include: – *National Environment Protection* (Assessment of Site Contamination) Measure 1999 as amended 2013 (NEPC, 2013). – *Australian and New Zealand - Toxicant Default Guideline Values for Sediment Quality* (ANZG, 2018a) – *Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Canberra ACT, Australia and New Zealand Governments and Australian state and territory governments* (ANZG, 2018b) – Friebel, E and Nadebaum, P (2011). *Health screening levels for petroleum hydrocarbons in soil and Groundwater*. CRC CARE Technical Report no. 10. CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia, 2011. (Friebel & Nadebaum, 2011).	Contamination assessment for the Project has been undertaken in accordance with the CLM Act and its guidelines. An EPA accredited site auditor, Melissa Porter from Senversa, has been appointed as the auditor for the Project.
Protection of the Environment Operations Act 1997 (POEO Act)	The objectives of the POEO Act are to protect, restore and enhance the quality of the environment, in recognition of the need	Clause 9 of Schedule 1 applies to chemical storage facilities and includes developments with capacity to store more than 200 tonnes of liquefied gases. The FSRU will be permanently

Legislation and Regulation	Description	Applicability
	to maintain ecologically sustainable development. The POEO Act provides for an integrated system of licensing and contains a core list of activities requiring an EPL from the NSW EPA. These activities are called 'Scheduled Activities' and are listed in Schedule 1 of the POEO Act.	moored at the MBD Site Compound and will therefore likely constitute a scheduled activity requiring an EPL. Clause 15 of Schedule 1 applies to contaminated soils treatment which includes treatment or storage of more than 30,000 m^3 of contaminated soils. EPL No 21529 has been issued for the Project by the EPA.
WHS Regulations	The WHS Regulations set out the specific requirements for hazards and risks related to workplaces in NSW.	Division 6 of the WHS Regulations outlines the duties for health monitoring. Part 8.3 provides management of asbestos and associated risks.

4.1 Guidelines

The framework for the management of spoil for the Project was developed with reference to guidelines listed below, with detailed assessment criteria included in Section 6.

4.1.1 National Environmental Protection (Assessment of site Contamination) Measure 1999 (as amended 2013) (NEPC, 2013)

The NEPM was produced by the Federal (NEPC in 1999 and was revised and updated in 2013 by way of the National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013 (NEPC, 2013). The amended NEPM is still referred to as the NEPM 1999. The NEPM provides a national framework for conducting assessments of contaminated sites in Australia.

The purpose of the NEPM is to "*establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry.*"

The desired environmental outcome for this NEPM is "*to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.*"

The NEPM addresses assessment of contamination and does not provide specific guidance for remediation or management of risk, although principles for remediation and management of contaminated sites are presented in Volume 1 of the NEPM, as discussed in Section 10.

The NEPM includes two Schedules:

– Schedule A comprises a flowchart of the recommended general process for the assessment of site contamination and its relationship to the management of site contamination.
– Schedule B consists of technical guidelines about site assessment criteria, site investigation procedures, laboratory analyses, human health risk assessment, ecological risk assessment, derivation of investigation levels, groundwater risk assessment, community engagement and risk consultation and competencies and acceptance of environmental auditors and related professionals.

In broad terms, the assessment process can be described as:

– Tier 1 Preliminary investigation, laboratory analysis and interpretation, development of a CSM and assessment of results with reference to investigations or screening levels. The need for risk-based remediation assessment to derive response levels and/or the need for remediation is evaluated.
– Where required, Tier 1, Tier 2 or 3 Detailed investigation/Site specific risk assessment, laboratory analysis and interpretation are completed, and the requirement for remediation is evaluated.

4.1.2 State guidelines

NSW has a comprehensive suite of guidelines relating to assessment and management of contamination, administered by the EPA under the CLM Act and the POEO Act. These include the following:

– NSW EPA (1995), *Contaminated Sites: Sampling Design Guidelines* (NSW EPA, 1995).
– NSW EPA (2020), *Consultants reporting on contaminated land – Contaminated land guidelines* (NSW EPA, 2020).
– NSW EPA (2017), *Contaminated Sites: Guidelines for NSW Site Auditor Scheme (3rd ed.)* (NSW EPA, 2017).
– NSW EPA (2014a). *Waste Classification Guidelines Part 1: Classification of Waste* (NSW EPA, 2014a).
– NSW EPA (2014b). *Waste Classification Guidelines Part 4: Acid Sulfate soils* (NSW EPA, 2014b).

Guidelines approved under the CLM Act also include:

– Nat*ional Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013 (NEPC, 2013).
– Australian and New Zealand - *Toxicant Default Guideline Values for Sediment Quality* (ANZG, 2018a).
– Australian and New Zealand *Guidelines for Fresh and Marine Water Quality*. Canberra ACT, Australia and New Zealand Governments and Australian state and territory governments (ANZG, 2018b).
– Friebel, E and Nadebaum, P (2011). He*alth screening levels for petroleum hydrocarbons in soil and Groundwater*. CRC CARE Technical Report no. 10. CRC for *Contamination Assessment and Remediation of the Environment,* Adelaide, Australia, 2011. (Friebel & Nadebaum, 2011).

As there is a potential for asbestos to be encountered within fill or as subsurface structures at the site, the primary legislative requirements detailing AIE's obligations regarding the presence of asbestos (if it is encountered) on the site are listed as follows:

– *Work Health and Safety (National Uniform Legislation) Act 2011* (NSW).
– WHS Regulations.
– *How to Manage and Control Asbestos in the Workplace,* 2019 SafeWork NSW (SafeWork NSW, 2019a).
– *How to Safely Remove Asbestos,* 2019 SafeWork NSW (SafeWork NSW, 2019b).

5. Planning requirements

5.1 Conditions of approval

The planning requirements and the corresponding contaminated spoil management measures applicable to Stage 2A are listed in Table 5.1. Management measures are detailed in Section 9 through Section 11.

The planning requirements include the conditions set out in the Infrastructure Approval (SSI 9471) dated 24 April 2019, EPL No. 21529 and the mitigation/management measures outlined in the PKGT EIS.

Table 5.1 Approval conditions

Requirement	Reference	Responsibility	Evidence	Applicability to this CSP
Infrastructure Approval Requirements (SSI 9471)				
Spoil Management Plan Prior to the commencement of construction, the proponent must prepare a Spoil Management Plan to the satisfaction of the Planning Secretary and in consultation with the EPA, Department of Planning, Industry and Environment (DPIE) Water, NSW Ports, Port Authority of NSW and an EPA accredited contaminated site auditor. The plan must be consistent with the Emplacement Cell Report and include: (a) Contaminated Spoil Protocol that includes: – procedures for identifying and managing unexpected finds of contaminated or asbestos containing materials along the pipeline route and at Berth 101. – a strategy for addressing any contamination that has been encountered, if required (including the remediation and/or removal of contaminated soil or groundwater); and – details on how environmental and health risks will be mitigated and managed.	Schedule 3, Condition 11	– AIE HSE Manager – Principal Contractor Environmental Representative – Principal Contractor Construction Foreman	Sec 12.11 Sec 9.2 Sec 10.4 Sec 11.4.2 Sec 10.2.1	Applicable
PKGT EIS Management Measures				
Inclusion of an unexpected finds protocol for contamination in the EMS for the work associated with construction activities.	EIS Measure C03	– AIE HSE Manager – Principal Contractor Project Manager	Sec 12.11	Applicable

6. Assessment criteria

6.1 Relevant guidelines

The framework for the contamination assessment was developed with reference to relevant guidelines relating to assessment and management of contamination, as detailed in Section 4.

In the first instance, the most sensitive assessment criteria will be compared with the concentrations of any contamination identified at the site. If these are exceeded, the specific land use and exposure scenarios relevant to the area and depth at which the subject material is located will be examined, and the concentrations compared with the appropriate criteria for those circumstances. If the relevant criteria are exceeded, the material will be managed or remediated in accordance with this CSP.

6.2 Assessment/validation criteria - soil

6.2.1 Health investigation and screening levels

The assessment criteria proposed for the CSP were sourced from the following references:

– NEPM.
– CRC CARE Technical Report No. 10 – Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater (Friebel & Nadebaum, 2011).

The NEPM presents health-based investigation levels for different land uses (e.g., industrial / commercial, residential, recreational, etc.) as well as ecological investigation levels.

The MBD Site Compound is situated within a heavy industrial area of Port Kembla. The site land use has been and will continue to be industrial. If any material is transported off-site for reuse as capping material in the Emplacement Cell, the land use would be similar.

The potential secondary receptors are site workers in a commercial/industrial land use setting. It is expected during remediation, site workers may be in direct contact with soil for short periods.

Based on the likely receptors identified for this site, the following assessment criteria will be adopted for soil assessment purposes:

– Health investigation level (HIL) for remaining Contaminants of Potential Concern (COPC) (Table 1A(1) HIL D (NEPC, 2013))
– Direct contact screening values for petroleum hydrocarbons listed in Tables B3 and B4 (Friebel & Nadebaum, 2011)

The assessment criteria selected for the key COPC are listed in Table 6.1.

Table 6.1 Human Health assessment criteria

COPC	HIL (mg/kg)	Direct contact screening values (HSL-D) (mg/kg)
Heavy Metals		
Arsenic	3,000	
Cadmium	900	
Chromium (III+VI)	3,600	
Copper	240,000	
Lead	1,500	
Mercury	730	
Nickel	6,000	
Zinc	400,000	
TRH		
F1 (C6-C10)		
F1 (C6-C10 less BTEX)		26,000
F2 (>C10-C16)		
F2 (>C10-C16 less naphthalene)		20,000
F3 (>C16-C34		27,000
F4 (>C34-C40)		38,000
PAH		
Carcinogenic PAHs (as BaP) TEQ	40	
Total PAH	4,000	
PCB	7	

In addition to human health risks, ecological risks also need consideration for the above land uses. The ecological risks consider contaminant impacts to vegetation and transitory wildlife. The risk to those receptors is dependent on the exposure pathway and site activities, which may degrade ecological values. The site and surrounding areas have been used for heavy industrial activities for over 50 years, which has significantly reduced the potential habitat value for ecological receptors. Therefore, terrestrial ecological values are considered to be significantly degraded and are not considered to be required for further site assessment or validation in relation to land-based use of materials.

6.2.2 Asbestos

The NEPM provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) *Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH, 2021).

The NEPM guidance emphasises that the assessment and management of asbestos contamination should take into account the condition of the asbestos materials and the potential for damage and resulting release of asbestos fibres. Therefore, for the purposes of assessing the significance of asbestos in soil contamination, three terms are used as summarised below:

– Bonded asbestos containing material (ACM) – sound condition although possibly broken or fragments and the asbestos is bound in a matrix.
– Fibrous asbestos (FA) – friable asbestos materials such as severely weathered ACM and asbestos in the form of loose fibrous materials such as insulation.
– Asbestos fines (AF) – including free fibres of asbestos, small fibre bundles and also fragmented ACM that passes through a 7 millimetres x 7 millimetres sieve.

From a risk to human health perspective, FA and AF are considered by the NEPM to be equivalent to “friable” asbestos in Safe Work NSW Codes of Practice (SafeWork, 2019). Bonded ACM in sound condition represents a low human health risk. However, both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres and may represent a significant human health risk if disturbed and fibres are made airborne.

As per Section 6.2.1, the commercial / industrial (D) Health Screening Levels (HSLs) were adopted as the most appropriate to the site, as presented in Table 6.2.

Table 6.2 Asbestos assessment criteria

Form of Asbestos	HSL (w/w)
	Commercial/industrial D
Bonded ACM	0.05%
FA and AF[a] (friable asbestos)	0.001%
All forms of asbestos	No visible asbestos for surface soil

The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres.

A tiered approach to risk assessment of asbestos contamination is recommended, including the development of an appropriate CSM. A weight of evidence approach is recommended with consideration given to factors such as the distribution of different fill types, the heterogeneity of the contamination and the uncertainty associated with the sampling methodology.

The NEPM states that if the Tier 1 screening levels are not exceeded, and an appropriate level of investigation has been carried out, then no contamination management actions are required except for ensuring the surface soil is free of visual asbestos. Final visual inspection of the assessment and remediated areas should not detect any visible asbestos.

GHD notes that these HSLs do not necessarily equate to requirements under the WHS Regulation or WHS Codes of Practice, which may impose requirements regardless of the concentration or proportion of asbestos in soil.

6.3 Assessment criteria – sediment

For soils that may be re-used in an aquatic environment, the assessment criteria selected for this assessment were sourced from the following reference: Australian and New Zealand - Toxicant Default Guideline Values for Sediment Quality (ANZG, 2018a).

ANZG (2018a) provides criteria that allow for the assessment of toxicant effects on sediment biota. Toxicant concentrations reported below the Default Guideline Values (DGVs) are considered to present a low risk of unacceptable effects to aquatic ecosystems. However, toxicant concentrations exceeding the upper guideline value (GV-high) are an indicator of potential high-level toxicity problems, and therefore not a guideline value that will ensure protection of ecosystems without further lines of evidence with respect to toxicity affects. Based on the aquatic receptors identified in Section 8.4 of the Stage 1 Remediation Work Plan (Terminal Site) (GHD, 2021), these guidelines are considered appropriate for the purposes of this assessment.

In addition to the assessment criteria, the guideline also recommends that “the <2 millimetre sediment particle size fraction should be used for chemical analyses for comparison with sediment quality guideline values so that the potential risk posed by contaminants is not diluted by a large mass of larger materials (gravel and other debris). The <63 µm sediment particle size fraction (clay and silt) is considered a suitable representation of the sediment materials that are mostly readily resuspended or potentially ingested by organisms” (ANZG, 2018a).

Because the bioavailability and toxicity of contaminants is influenced by sediment grain size and organic carbon content, particle size distribution and total organic carbon (TOC) testing will also be carried out on selected samples representing a particular sediment unit. Total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) and PCB concentrations will be normalised to 1% OC based on the TOC result.

The sediment assessment criteria selected for the COPC identified on site in GHD (2021a) and (2021b) are listed in Table 6.3.

Table 6.3 Sediment assessment criteria

COPC	DGV (mg/kg)	GV-high (mg/kg)
Chromium (III+VI)	80	370
Copper	65	270
Lead	50	220
Nickel	21	52
Zinc	200	410
Total TRH	280	550
Total PAH	10	50
PCB	0.034	0.28

6.4 Application of selected criteria

The methodology used when assessing contamination levels in soils during remediation/characterisation and validation at the site will be to use the relevant HSLs, HILs, sediment (DGV and GV-high) where required as cut off points to classify materials either as:

– Not contaminated, which pose no risk to the environment or human health and warrant no further action, i.e., concentrations less than or equal to the selected criteria.
– Containing elevated concentrations of contaminants, which may pose a risk to the environment (in particular aquatic ecosystems) but pose no risk to human health under the proposed land use scenario i.e., concentrations greater than the DGVs and less than the adopted HILs or HSLs. A qualitative risk assessment may be sufficient to evaluate the potential impact for the proposed land use.
– Significantly contaminated which pose a risk to both human health and aquatic ecosystems, i.e., concentrations significantly greater than relevant health investigation or DGVs. Soils or sediment in this category would likely require management or disposal off site (including potential containment within the Emplacement Cell), or further assessment by way of site-specific health and/or ecological risk assessment (Tier 2 or 3) carried out as appropriate for the proposed land use. This may require the collection of additional site data.

6.5 Waste classification criteria

Materials that may require offsite disposal as part of site remediation will be classified using the six-step process and criteria detailed in *Waste Classification Guidelines – Part 1: Classification of Waste* (NSW EPA, 2014a).

In accordance with the Waste Classification Guidelines (NSW EPA, 2014a), the applicable classification principles include (but are not limited to) the following:

– “If asbestos waste is mixed with any other class of waste, all the waste must be classified as asbestos waste. For example, asbestos waste mixed with building waste, must be managed as asbestos waste.”
– ‘Special waste’ is a class of waste that has unique regulatory requirements. The potential environmental impacts of special waste need to be managed to minimise the risk of harm to the environment and human health.
– Special wastes are:
  - Clinical and related waste.
  - Asbestos waste.
  - Waste tyres.

Producers of special waste do not need to make any further assessment of their waste if it falls within the definitions of special wastes, except for asbestos waste. Asbestos waste means any waste that contains asbestos. Chemical classification of soil contaminated with asbestos is still required.

Materials that may comprise Acid Sulfate Soils (ASS) will be classified and handled as per the *Waste Classification Guidelines – Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).

7. Summary of site conditions

The following summary is based on information from the previous GHD investigations (GHD, 2018a), (GHD, 2021a) and (GHD, 2021b). Reference should be made to these reports for more detailed information including aerial photographs and site photographs.

7.1 Site identification

The site for Stage 2A work is shown in Figure 2.2 and Figure 2.3, located within the MBD Site Compound. The MBD Site Compound is bounded by PKCT to the north and the shoreline and breakwater to the south. Seawall Road along the eastern shore currently allows public access.

Site identification details and surrounding land uses are summarised in Table 7.1.

Table 7.1 Site identification details

Address:	Berth 101 and Bulk Product Area, Port Kembla, NSW
Site co-ordinates:	307013 m E; 6184616 m N (southern point of excavation area)
Title identification:	Part Lot 22 DP 1128396
Approximate area:	3 ha (excavation area)
Current owner	NSW Ports
Zoning:	SP1 – Special Activities SEPP (Three Ports) 2013
Local government area:	Wollongong
County / Parish :	Camden / Wollongong
Current land use:	Industrial – Ports
Adjoining land uses:	Industrial including coal terminal

7.2 Port Kembla Chart Datum and tidal fluctuations

The Australian Tides Manual Special Publication No 9 Version 5 (ICSM, 2018) summarises the various datums used around Australia to predict tidal behaviour. An understanding of the tidal terminology is required when comparing chart datums, tidal effects on ASS and the potential for acid production. Table 7.2 provides a definition of the relevant terminology and gives the average limits observed at Port Kembla, and Figure 7.1 shows the tidal variation at Port Kembla from 1957 to 2020 (Fox Environmental Consulting, 2020).

Table 7.2 Explanation of terms and datums used in Australian ports

Term	Purpose	Definition[1]	Port Kembla
Highest Astronomical Tide (HAT)	Landward limit of the tidal interface.	The highest level of water which can be predicted to occur under any combination of astronomical conditions.	2.33m CD (+1.458m AHD)[2]
Lowest Astronomical Tide (LAT)	Baseline for the purposes of defining Australia's maritime boundaries.	The lowest tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.	-0.0217m CD (-0.655 m AHD)
Mean High Water (MHW)	Common datum for cadastral mapping and common limit for topographic mapping.	The average of all high waters observed.	~1.80m CD (+1.458m AHD)[2]
Mean Sea Level	Average limit of tides.	Arithmetic mean of hourly heights of sea over a sufficient period of time.	~0.910m CD (0.0m AHD)[3,4]
Mean Low Water (MLW)	Used as the limit of Australian States As definition of 'low water'.	Arithmetic mean of all low water heights of sea over a sufficient period of time.	~0.20m CD (-0.655m AHD)[2]
Australian Height Datum (AHD)	National vertical Datum of Australia and refers to Australian Height Datum 71 for Australian Mainland.	AHD71 is a surface that passes through approximate MSL measured between 1966 and 1968 at 30 tide gauges around the Australian mainland.	0.0mAHD (0.872m CD)[3,4]
Chart Datum (CD)	Local Port Kembla Sea Level Datum.	In use since at least 1957.	0.0m CD (-0.872m AHD)[3,4]

Table notes:

[1] Definitions taken from Australian Tides manual v5 (ICSM, 2018)

[2] Mean High Water and Mean Low Water taken from monthly recorded sea levels for Port Kembla - 1957 to 2020 http://www.bom.gov.au/ntc/IDO70000/IDO70000_60420_SLD.shtml

[3] Chart Datum from http://www.bom.gov.au/oceanography/projects/abslmp/data/data.shtml

[4] MSL at Port Kembla also given as 0.910m CD on http://www.bom.gov.au/ntc/IDO70000/IDO70000_60420_SLD.shtml

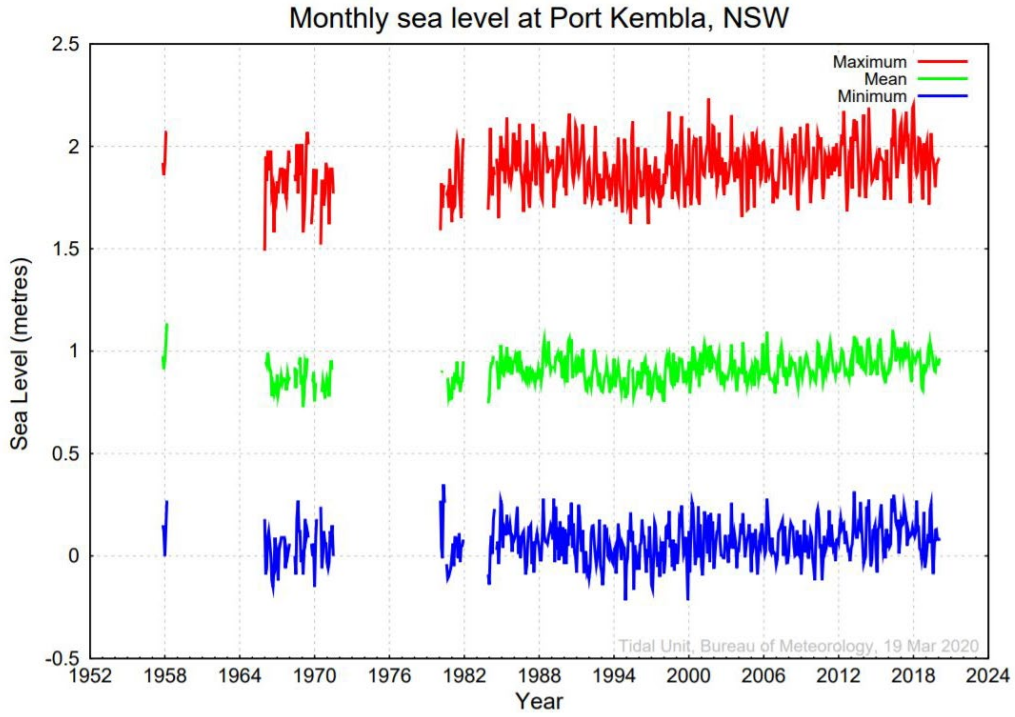

Figure 7.1 Monthly Tidal Range in LAT Port Kembla Harbour (source: BOM website)

7.3 Sensitive environments

Port Kembla Inner Harbour is located immediately west of the site. Port Kembla Outer Harbour is located immediately south-east of the site.

The Inner and Outer Harbours are highly modified and industrial settings receiving stormwater runoff and waste discharge from neighbouring industries. Prior to 1955, the Inner Harbour was previously Tom Thumbs Lagoon, a remnant saline coastal lagoon, which has been progressively reclaimed by the Port Kembla Steelworks. Originally 500 ha in area, the lagoon is now 50 hectares (GHD, 2018a).

The Tasman Sea is located east of the site.

7.4 Topography and drainage

Google Earth Pro indicates the site lies at an elevation between 3 metres and 5 metres AHD. The elevation of previous investigation locations was surveyed by a registered survey and was recorded between 4.073 metres and 6.708 metres AHD (GHD, 2018a).

Information obtained from Google Earth Pro indicates that the berth gently slopes down towards the south and west.

Surface water is generally directed to the PKCT stormwater system, which includes a settlement pond located immediately south-east of the MBD Site Compound (Southern Pond). It is expected in high rainfall events that surface water will flow directly into the harbour.

7.5 Soil landscape

The Wollongong-Port Hacking 1:100 000 Soil Landscape Series Sheet 9029-9129 (Soil Conservation Service of NSW, 1990) indicates the site is situated within a disturbed terrain soil landscape, which is described as:

– Disturbed terrain:
  - The topography varies from level plains to undulating terrain and has been disturbed by human activity to a depth of at least 100 centimetres. The original soil has been removed, greatly disturbed or buried. Most

of these areas have been levelled to slopes of<5%. Landfill includes soil, rock, building and waste material. The original vegetation has been completely cleared.

- Limitations are dependent on nature of fill material and include subsidence resulting in a mass movement hazard, soil impermeability leading to poor drainage, and low fertility. Care must be taken when these sites are developed. A survey at a suitable scale as well as geotechnical analysis should be undertaken because of variability of materials throughout the sites. Seek advice from local councils concerning localised areas of disturbed terrain.

7.6 Acid Sulfate Soils

The ASS Risk Map (DLWC, 1997) indicates that the MBD Site Compound area (in red outline) is situated in an area mapped as disturbed terrain at an elevation >4 metres (shown in grey shading) in Figure 7.2 below. Estuarine sediments exist within the harbour and are mapped as high probability of ASS.

Low risk ASS was identified in probable reclaimed sands and alluvial / tidal sands encountered at depths between 0 metres and 25 metres below ground level (mbgl). The probable reclaimed sands had pockets and lenses of high-risk ASS. Estuarine material encountered at depths between 0.4 metres and 25 mbgl, typically below the alluvium, was assessed as high-risk ASS.

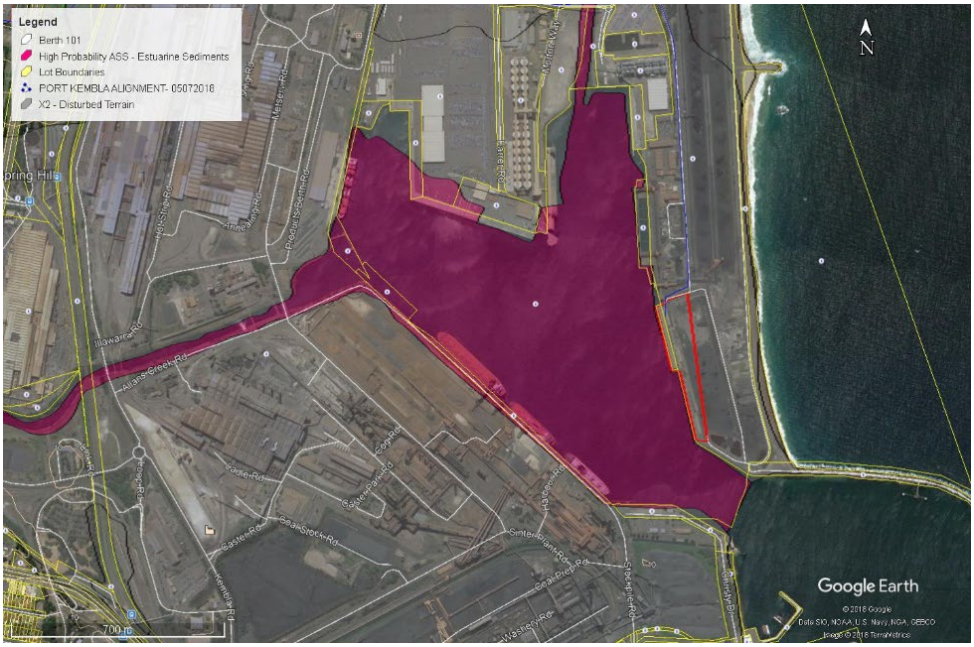

Figure 7.2 Acid sulfate soil risk map (DLWC, 1997)

7.7 Geology

7.7.1 Regional geology

The 1:100,000 Geological Series Sheet of Wollongong-Port Hacking (Geological Survey of NSW, 1985) indicates that the regional underlying geology is Quaternary sediments described as quartz and lithic fluvial sand, silt, and clay. The Quaternary sediments are likely to be underlain by the Budgong Sandstone which is described as red, brown, and grey lithic sandstone.

7.7.2 Site specific geology

Fill was encountered at all previous investigation locations up to 5.5 metres depth, typically comprising gravelly sand and sandy gravel (Fill) overlying sand (probable reclaimed sand –Unit 1A/1B). Natural sands, assumed to be likely alluvium, were encountered from 3.2 metres, graduating to finer alluvial deposits (silts and clays) to the maximum depth of investigation. (GHD, 2018a).

The Worley Parsons geotechnical investigation extended below GHD's target investigation depths and encountered residual deposits of sandy clay and clay which were logged from 12 metres to 29.7 mbgl.

Bedrock is understood to have been encountered at the geotechnical boreholes from a depth of 17.6 metres to 29.5 metres.

The Fill and Unit 1A/1B materials encountered during the GHD 2018 investigation are summarised in Table 7.3.

Some variability was observed in the fill unit however the material encountered in Unit 1 was reasonably consistent across the site.

Table 7.3 Generalised material descriptions for Fill and Unit 1

Stratigraphic Unit	Generalised Description	Corresponding Stratigraphic Unit	Depth range (mbgl)
Fill	Gravelly sand, sand, silt, black, dark brown, grey, some to trace, silts and cobbles. Foreign materials, coalwash, coal, slag, steel, wood, concrete.	Fill	Surface to 2.5 mbgl
Probable Reclaimed Sands	SAND, brown, pale brown, yellow, orange, fine to coarse grained, trace amounts of shell fragments, fine to coarse gravel, silt bands and layers, clayey sand layers, trace iron stained sand, fine black sand layers (probable heavy mineral sands), rounded to sub-rounded gravel, clay lenses and layers. Foreign materials: charcoal, wood and coal.	1A / 1B This was categorised as 'Fill Unit 2' in the GHD 2018 investigation but has since been reassigned as Unit 1	2.5 m to 5.5 mbgl
	Clayey SAND, black, dark grey, grey, fine to coarse grained sand, medium to high plasticity clay, trace silt, shell fragments, gravel.	1B	
	Gravelly CLAY, black, dark grey, grey, low to medium plasticity, fine to coarse grained angular to sub-angular gravel, trace of fine to coarse grained sand.	1B	
Possible Alluvium / Tidal Sands	SAND, brown, pale brown, yellow, orange, fine to coarse grained, trace amounts of shell fragments, fine to coarse gravel, silt bands and layers, clayey sand layers, trace iron stained sand, fine black sand layers (probable heavy mineral sands), rounded to sub-rounded gravel, clay lenses and layers.	1A	

7.8 Hydrogeology

7.8.1 WaterNSW database

Lotsearch report (Lotsearch, 2020) indicates there are six registered groundwater bores east of the site, five of which are in Part Lot 22 as shown in Figure 7.3. The bores were registered for monitoring purposes and installed in 2011 and 2012 to depths between 6 metres and 7.5 mbgl. No information on salinity, standing water level, or yield was recorded. The locations of these monitoring bores are generally consistent with those installed by Douglas Partners, except for GW112710 and Douglas Partners monitoring well 205 (Douglas Partners, 2014). Monitoring well 205 is located south-west of GW1127709 but does not appear to be registered.

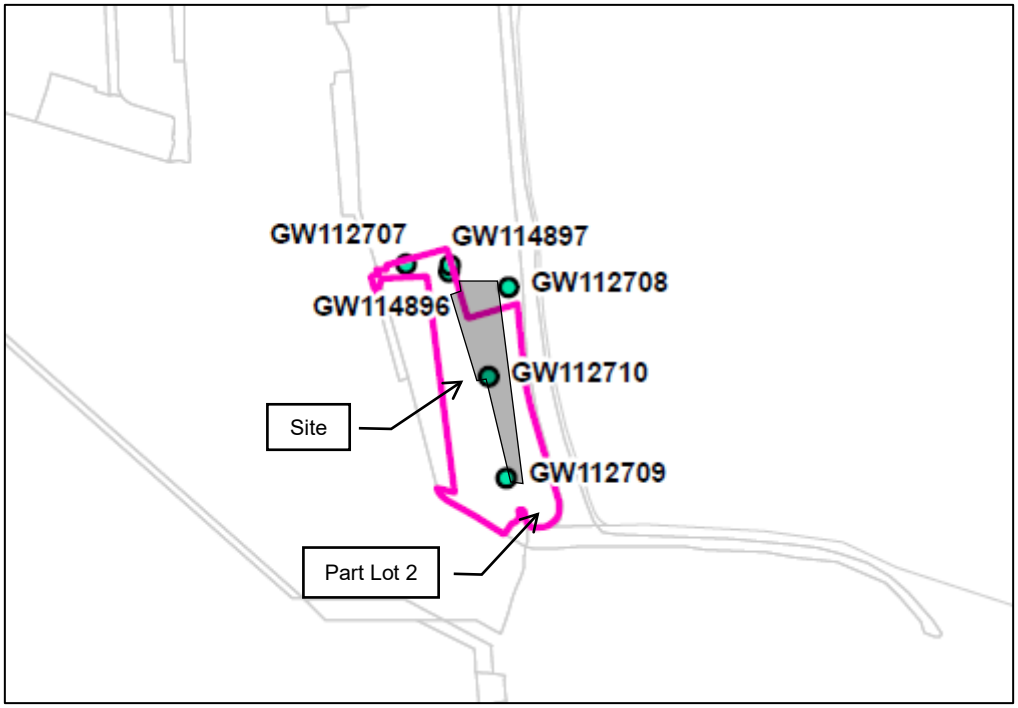

Figure 7.3 Registered groundwater bores (Lotsearch, 2020)

7.8.2 Site specific

Groundwater inflows were encountered in all boreholes, except GBH34 and GBH36, at depths between about 3.7 m and 5.0 mbgl. GBH36 refused at 0.15 mbgl. Six groundwater monitoring wells (MW2, MW3, MW6, 201, 204, 205) were installed on-site as part of previous investigations undertaken by Douglas Partners in 2011 and more recently by GHD in 2018. Groundwater was measured at depths between 4.01 metres and 4.90 mbgl on 18 October 2018.

No hydrocarbon odours were noted in groundwater during drilling or sampling at any of the wells. No evidence of non-aqueous phase liquid (NAPL) was observed during groundwater sampling. No odours or sheens were noted on the surface of the groundwater from monitoring wells during purging and sampling for the remaining locations.

Douglas Partners (2014) stated that groundwater flow direction was towards the south-west, that is, towards the Inner Harbour. However, it was further stated that groundwater flow direction was unlikely to be homogeneous across the site due to water bodies along three sides, various filling material and tidal influences. These factors were considered to form localised flow patterns.

New groundwater wells were installed by GHD in 2020 and are documented in the Environmental Condition Report (GHD, 2021a). This report and the targeted site investigation also document the groundwater strikes in a number of boreholes. Groundwater inflows were recorded between 4.0 m to 7.2 m bgl, with the exception for GBH067 and GBH069, where apparent perched groundwater was encountered at 2.2 m and 1.6 m bgl, respectively.

7.9 Site conditions

Following the completion of the Stage 1 Early Enabling Works (proposed completion date of December 2021) the existing above and underground structures within the MBD Site Compound will have been demolished. Excavation down to level of RL +2.5 metres PKHD has been undertaken and the following materials stockpiled for Stage 2A works:

- Approximately 5,000m³ of demolished concrete crushed to nominal 70mm minus.
- Approximately 30,000m³ of heavily bound base course crushed to nominal -150mm minus.
- Approximately 25,000³ of mixed slag, general fill, and coal nominally < 150mm in size.
- Approximately 10,000m³ of predominantly sand with some slag and coal.
- Approximately 9000 m³ of asbestos-impacted soils

The volumes provided above are approximate and may vary. Exact numbers will be determined after the completion of Stage 1 works.

8. Review of previous investigations

Several investigations have been undertaken at the site. The key findings of the investigation reports reviewed are summarised below. Reference should be made to the specific documents for more detailed information.

8.1 Contamination assessment for Berth 101 (GHD, 2018a)

A contamination assessment for Berth 101 was carried out as part of the PKGT EIS for the proposed LNG import terminal and FSRU, visiting LNG carriers, wharf offloading facilities and the installation of a new pipeline to connect to the existing gas transmission network.

The relevant objectives of the contamination assessment were to:

– Assess the likelihood for contamination to exist on the site from past or present activities.
– Provide recommendations for further investigation and/or options management in relation to the proposed development (if applicable).

The scope of work developed to meet this objective included a review of site history information, site walkover, soil sampling from 39 environmental boreholes, opportunistic observations, and soil sampling from the ten geotechnical boreholes, installation of three groundwater monitoring wells, sampling, and analysis of groundwater from the newly installed wells and three existing monitoring wells. Selected samples were tested for key contaminants of potential concern to inform the assessment. The results of the historical review, site walkover, field and laboratory testing were interpreted and assessed with respect to the above objectives.

Based on site history information, Berth 101 (also known as the MBD Site Compound) was constructed in 1964 and commissioned for the loading of coal, coke, and slag. Dredge material from the Inner Harbour and steelworks slag may have been used in the berth's construction, although the source of fill could not be confirmed. The berth had an array of surface infrastructure including substation, conveyors, and diesel underground storage tank (UST). The majority of the surface infrastructure was removed c2011 and the UST was removed in the early 1990's. No evidence of contamination was observed at the time of UST removal. Previous investigations at the site were undertaken by Douglas Partners in 2014, which assessed the former UST location, substation, fill and groundwater. Douglas Partners concluded that the site was suitable for continued industrial land use. GHD notes that the assessment of the former UST was limited due to shallow refusal and collapsing ground conditions, thus limiting the depth of investigation to the upper 2.6 metres of the soil profile. The base of the UST was 5 mbgl.

Contamination in the fill material within the area excavated within Berth 101 was relatively minor, and generally consistent, as indicated in the results summary table (Table LR1) in Appendix B. Only two soil samples exceeded adopted criteria; these were at GBH09 and GBH26 and were for BaP TEQ (health criterion) and for heavy end petroleum hydrocarbons (TRH F3, $>C_{16}$-C_{34}) (Management Limits) near the inferred base of fill material between 4 metres to 5 mbgl. Review of potential source-pathway-linkages for this contamination indicates that it is unlikely to pose any significant constraints to the proposal, subject to further assessment of the extent of BaP TEQ hotspots and mitigation measures developed to manage potential health impacts during construction works. Potential risks to marine environmental receptors from relocation of the berth material are considered low and acceptable based on measured concentrations of contaminants.

Asbestos was identified on-site in the form of fragments of ACM on the ground surface. These are assumed to be associated with historical demolition on site. No asbestos was identified in samples below the ground surface, and it is therefore unlikely that asbestos containing materials are present in the fill, although this cannot be precluded.

Some relatively minor impacts from heavy metals and ammonia were identified in a perched fresh to brackish groundwater lens within Berth 101. The size of the lens is not well understood; however, the proposed piling and excavation works will limit the amount of perched water discharging into the marine environment, which will in any event significantly attenuate the concentrations of contaminants observed in this investigation.

8.2 Data review and gap analysis for Fill and Unit 1 Material (GHD, 2020)

GHD carried out data review and gap analysis for Fill and Unit 1 material in response to a request by the appointed site auditor. The auditor requested an evaluation of the existing data to consider potential implications of any identified contamination with respect to the planned reuse of fill and alluvium as a perimeter bund in the Emplacement Cell.

The objectives of the data review and gap analysis were to:

– Summarise the chemical characteristics of the Fill and Unit 1A/1B material to be used in the emplacement bund; and
– Provide recommendations for additional investigation to close identified data gaps (if any).
– To meet the above objectives the following scope of work was carried out:
– Review SMP prepared by GHD.
– Review laboratory results from the contamination assessment (GHD, 2018a) and summarise the number of samples, analytes, and results for Fill and Unit 1 per depth interview.
– Provide conclusions and recommendations in relation to the above objectives.

Based on the available information, the majority of Fill and Unit 1A/1B are considered to pose a low risk to the marine aquatic environment based on the characterisation carried out, however some limited supplementary assessment would be beneficial to confirm this.

Based on this data analysis, the following was concluded and recommended:

– Fill:
    - There is considered to be sufficient data to chemically characterise the fill material for the majority of COPC. However, PCBs, DGV and GV-high values in the vicinity of the substation and therefore may present a risk to marine aquatic ecosystem. Soils from around the substation should be separated from materials intended for construction of perimeter bund. The resulting excavation within the vicinity of the substation will require validation to confirm no residual PCBs remain for the purposes of constructing the bund.
– Unit 1A/1B:
    - Unit 1 was relatively homogeneous in respect of material type, and it is expected that the available data is representative of material quality. However, the two TRH and PAH hotspots suggest some variability does exist within Unit 1 materials. (Note, the GBH09 hotspot sample was logged within fill near the inferred base of fill material between 4 metres to 5 mbgl, with the GBH26 hotspot sample within possible alluvium at a similar depth).
    - The TRH and PAH hotspots are driving exceedances of DGV and GV-high. A preliminary review of Toxicity Characteristic Leaching Procedure (TCLP) suggests that leachability of these COPC is low and would be expected to be much lower in less aggressive marine conditions.
    - Some limited supplementary assessment would be beneficial to further confirm the likely low risks posed by TRH, PAH and PCB to marine aquatic ecosystems from the material in Fill and Unit 1 which will form part of the perimeter bund.
– Unit 1C:
    - GHD carried out ASS sampling and analysis of the stratigraphic units within the MBD Site Compound and its surrounds (GHD, 2018). The report found dark grey clayey sands and gravelly clays occurring as discrete layers within Units 1A and 1B. Unit 1C has been defined as thin ASS layers or lenses occurring within Unit 1A and Unit 1B. The total volume of Type 1C material has been conservatively estimated as potentially up to 10,000 metres^3. The Type 1C materials represent less than 4% of the total volume of Type 1A and Type 1B sands which recorded net acidities below the adopted ASS Action Criteria (0.03%S) with an average of 0.024%S.(Fox Consulting, 2020).

The gap analysis also identified potential toxicity problems associated with chromium, lead, nickel, and zinc as some concentrations exceeded DGV and/or GV-high. However, lead and chromium concentrations in groundwater

did not exceed 95% species protection for groundwater. Conversely, copper and zinc concentration did exceed 95% species protection for groundwater.

8.3 Baseline contamination assessment (GHD, 2021a)

This baseline contamination assessment investigated the proposed lease area of 12.3 hectares associated with the planned PKGT. Results from previous and concurrent investigations were used to inform the baseline conditions of the site being assessed.

The objectives of the baseline contamination assessment were to:

– Assess the likelihood for contamination to exist on the site from past or present activities.
– Establish baseline conditions of the lease area with respect to contamination.
– Assess whether soil or groundwater contamination at the site presents a potential risk to human health, and whether any risk is posed to ecological receptors from groundwater contamination, associated with the proposed redevelopment of the site.
– Provide recommendations for further investigation and/or contamination management for areas considered to pose an unacceptable risk to human health and/or the environment in the context of the proposed development (if applicable).

The scope of work included a review of site history information, site walkover, soil sampling from 127 locations (boreholes and shallow hand augers), two sediment samples, installation of five groundwater monitoring wells, sampling, and analysis of groundwater from the newly installed wells and five existing monitoring wells. Selected soil and sediment samples were tested for key contaminants of potential concern to inform the assessment. Leachability testing was also carried out using sea water reagent for selected samples.

8.3.1 Summary of previous investigations

As above, GHD (2021a) included a summary of the investigation findings from GHD (2018a) as described above in Section 8.1. This investigation identified two hotspots of contamination (GBH09 and GBH26) with BaP TEQ and heavy end petroleum hydrocarbons. Review of potential source-pathway-linkages for this contamination indicated that it is unlikely to pose any significant constraints to the proposal, subject to further assessment of the extent of the contamination and mitigation measures developed to manage potential health impacts during construction works.

8.3.2 Potential contamination and risks to receptors

For the site and proposed works therein, the primary receptors are considered to be workers involved in construction and excavation on the site. This exposure scenario provides an increased likelihood that workers will be in direct contact with soil and exposed via inhalation to dust and vapours generated during excavation, or by dermal contact and ingestion during construction works and excavation. Therefore, the source-pathway-receptor (SPR) linkages are possibly complete if contamination exists. The site and surrounding areas have been used for heavy industrial purposes for 50 to 100 years and use of chemicals in settlement ponds is unlikely to encourage terrestrial ecological receptors to inhabit the site. Therefore, the SPR linkages are likely to be incomplete. For marine ecological receptors, SPR linkages could be complete if contamination exists.

Based on investigation results, for the majority of area of environmental concern (AECs) the SPR linkages have been reassessed as incomplete, due to absence of contamination. Although contamination, buried waste, demolition waste, ACM and former infrastructure were not identified, boreholes only provide a one-dimensional view of the soil profile and are between 20 metres and 30 metres apart, therefore it cannot be precluded that contamination, waste, ACM, and former infrastructure may exist in areas between borehole locations. For AEC 1, contamination was present and therefore the SPR linkages were still potentially complete. For AEC 2, the assessment is incomplete due to the energised status of the substation, therefore SPR linkages could still exist. The risk posed by the respective contaminants at AEC 1 and AEC 2 is being assessed as part of the targeted investigation. For AEC 10, the low-pressure oil pipeline and ACM water pipe in their current undisturbed state do not pose an unacceptable risk to receptors. However, during removal inadvertent release of oil or liberation of asbestos fibres could occur, thus significantly increasing the exposure risk to receptors. A summary of potential risk to receptors and associated recommendations for each AEC is provided in Table 8.1 below.

For groundwater, minor exceedances of arsenic were reported at each monitoring well location, and at two locations for mercury. Copper concentrations exceeded assessment criterion at one location.

Table 8.1 Summary of contamination and potential risks to receptors

AEC	Description	Contamination identified in excess of assessment criteria	Likelihood of contamination posing an unacceptable risk*		Conclusions/ Recommendation
			Human Health	Ecological	
1	TRH and BaP TEQ hotspots in western portion of the site (Area A)	Yes	Moderate	High	Further assessment is still required of SPR linkages and risk to receptors
2	Substation in western portion of the site (Area A)	No	Moderate	Moderate	Further investigation at depth is still required to assess SPR linkages and risk to receptors
3	UST in the central northern portion of the site	No	Low	Low	EMS including Unexpected Finds Protocol (UFP)
4	Buried waste (south-east corner, west side of Conveyor No. 7)	No	Low	Low	EMS including UFP
5	Fill of unknown quality and origin (entire site)	No	Low	Low	EMS including UFP
6	Former railway line in eastern portion of the site (Area B)	No	Low	Low	EMS including UFP
7	Sediment in retention ponds (Southern Ponds and T3 Pond)	No	Low	Low	None
8	Chemical, hydrocarbon and ammonia odours (north-eastern portion of the site)	No	Low	Low	EMS including UFP
9	Former structure (south-east corner of the site)	No	Low	Low	EMS including UFP
10	Hazardous building materials (western portion of the site near former infrastructure), ACM water pipe and other underground services	Yes (ACM fragments at the surface in 2018) Otherwise, no.	Low (current state) High (during removal)	Low (current state) High (during removal)	EMS including Asbestos Management Plan (AMP) Licenced asbestos removalist to supervise ACM water pipe removal
11	Truck wash located north-east of the site	No	Low	Low	including UFP
12	Migration of coal dust and fallout from the steelworks	No	Negligible	Negligible	None

Notes: *Likelihood is the probability of an unacceptable risk being present, categorised on a scale from high (near 100% probability of being present) to very low (near 0% probability of being present).

8.3.3 Preliminary waste classification

The preliminary waste classification identified that fill across the site can be classified as General Solid Waste. Whilst total chromium exceeded the hexavalent chromium Contaminant Threshold 1 (CT1) and CT2 criteria in a number of locations, with isolated exceedances of the CT1 criteria for lead and BaP, TCLP results were below the TCLP1 thresholds in all samples analysed and were considered representative of leachability of fill materials across the site, therefore, the Specific contaminant concentration (SCC) with TCLP can be applied. The 95% Upper Confidence Limit (UCL) of all contaminants that reported exceedances of the CT1 criteria were less than the SCC1.

Results from Berth 101 (GHD, 2018a) indicate that materials may contain some ASS and may need to be managed in accordance with the requirements of (NSW EPA, 2014b) *Classifying Waste:* Part 4.

8.3.4 Recommendations

Based on the results of the baseline assessment with respect to contamination and waste classification matters, the following was recommended:

– Preparation of a CSP (this Plan) to manage the occurrence of potential contamination, buried waste, demolition waste, ACM, and former infrastructure in all parts of the site. The CSP also includes an UFP (refer to Section 12.11).
– For AEC 1 and AEC 2, further assessment is still required of SPR linkages and risk to receptors.
– For AEC 10, preparation of an AMP prior to decommissioning of these particular services. An appropriately licenced asbestos removalist contractor will need to be engaged to supervise the removal of the ACM water pipe.
– For groundwater, further assessment is recommended of the potential risk arsenic, mercury and copper concentrations pose to ecological receptors.
– Supplementary waste classification assessment of any surplus materials requiring disposal, following excavation.

8.4 Targeted assessment – Berth 101 (GHD, 2021b)

GHD completed a targeted investigation of locations where hotspots of contamination were previous identified (GHD, 2018a). The objectives of the targeted assessment included:

Fill:

– Obtain additional samples to assess the leachability of TRH, PAH and/or heavy metals in a marine environment.
– Based on the leachability results, refine the risks of TRH, PAH and heavy metals leaching from the bund to the marine aquatic environment.

Unit 1:

– Refine the lateral and vertical extent of the potential PAH and TRH hotspots at borehole locations GBH09 and GBH26 and leachability of TRH and PAH in the marine environment.
– Based on the leachability results, refine the risks of TRH and PAH concentrations leaching from the bund to the marine aquatic environment.
– Increase the dataset in respect of material quality between 5 metres and 14 metres (excavation level for reuse of material) within the southern half of the site.

Electrical substation:

– Assess lateral and vertical extent of PCB associated with electrical substation number 1 and leachability of PCBs in a marine environment.
– Based on the leachability results, refine the risks of PCB leaching to the marine aquatic environment from bund materials.

8.4.1 Scope of work

The scope of works included:

– Hotspot GBH09 – Four locations (GBH09A – GBH09D) to a maximum depth of 6 mbgl and analysed for TRH, PAH, TOC and Australian Standard Leaching Procedure (ASLP).
– Hotspot GBH26 - Four locations (GBH26A – GBH26D) with GBH26A to 14 mbgl and GBH26b to GBH26d drilled to 6 mbgl and analysed for analysed for TRH, PAH, TOC and ASLP.
– Substation – Seven locations GBH141 to GHB143, GBH145 to GBH148 and re-sampling of four previous locations (DP, 2014) 216 – 219, sampled as 216A to 219A. Due to the presence of underground services, locations were hand augered to a maximum depth of 0.3 mbgl. Samples were analysed for PCBs and TOC.
– Fill – GBH13A drilled to 3.0 mbgl, GBH22A drilled to 14 mbgl, GBH24A drilled to maximum depth 0.5 mbgl and GBH39 (A/B) drilled to a maximum depth of 2.5 mbgl. Selected samples were analysed for heavy metals, TRH, benzene, toluene, ethyl benzene and xylenes plus naphthalene (BTEXN), PAHs, TOC, selected ASLP.

8.4.2 Results

Subsurface conditions

Observations of subsurface material, were, in general, consistent with the observations made in the previous investigation (GHD, 2018a). Fill was encountered at all locations, with the exception of GBH22A, where reclaimed sands were observed to 8 metres depth. Fill typically comprised gravelly sand and/or sandy gravel (Fill Unit 1) overlying sand (probable reclaimed sand – Fill Unit 2) with varying proportions of clay and silt. Fill Unit 1 was typically black to dark brown in colour comprising sandy gravel or gravelly sand with varying quantities of silt and contained foreign materials including coal and slag at a number of locations.

Fill Unit 2 primarily comprised fine to coarse sand, which was encountered in the majority of boreholes. Varying quantities of clay were present as either lenses or within the unit as clayey sand. Thinner distinct units of clay or gravelly material were also present in some boreholes.

Natural sands, interpreted to be likely alluvium, graduating to finer alluvial and/or estuarine deposits (silts and clays) to the maximum depth of investigation. In GBH22A, a unit of clay with extremely weathered sandstone was encountered from 13 to 14 metres, which was interpreted to be estuarine clays overlying extremely weathered bedrock. In GBH132, highly weathered was encountered at 8.3 mbgl, which was the shallowest occurrence of weathered rock at the site.

TRH and BaP hotspots

Based on previous investigation results, the likelihood for contamination within these areas was assessed as high. Additional targeted investigations were completed to further assess the vertical and lateral extents, and leachability potential of TRH and BaP TEQ impacts specifically at GBH09/4.2-4.4 metres and GBH26/4.75-4.9 metres (1.74 metres and 0.13 metres PKHD). Based on the excavation plan, hotspots are below planned excavation levels of 2.5 metres PKHD for Stage 2A works.

TRH and BaP TEQ concentrations at GBH026C/4.7-4.8metres were lower than those reported in the 2018 investigation but elevated with respect to other samples outside of the identified hotspot area. Concentrations at GBH09A to 09D were low and/or below the limit of reporting (LOR), inconsistent with the 2018 results.

The impacts appear to be associated with Fill Unit 2 (reclaimed sands) and possible alluvium soil units. However, the soil types differ for each sample where TRH and BaP TEQ impacts have been identified. The laboratory results indicate that the vertical extent of TRH and BaP TEQ at GBH26 is approximately 4.8 mbgl. The lateral extent for GBH26 is unknown in the eastern and western directions. TRH and BaP TEQ impacts were not identified at GBH09 radial step outs indicating the hotspot is relatively localised.

Leachability testing, using seawater sampled from the Inner Harbour, indicated TRH and BaP TEQ is leachable and exceeds water quality assessment criteria. The risk posed by leachable concentrations to marine ecology have been assessed, however groundwater monitoring results indicate soil is not having an impact on groundwater.

Based on the results of GHD (2021a), it is likely that the TRH and BaP TEQ impacts are relatively localised and more likely to be associated with the western portion of the site, that is, Berth 101.

Substation

For the substation area, previous investigations detected PCBs, however concentrations were below the human health assessment criteria (HIL-D). However, because material from this area is to be excavated and then placed in the Emplacement Cell, these concentrations were also compared to sediment DGV (ANZG, 2018a) and exceeded the DGV for PCBs.

The additional targeted investigation was carried out to further assess the vertical and lateral extents, and leachability potential of PCBs. Sampling was limited to the upper 0.2 metres of the soil profile due to the presence of underground services with ten surface samples collected. Detectable concentrations of PCBs, all below HIL-D, were reported at locations 217A, 219A and GBH143. PCB concentrations reported at 217A, 219A and GBH143 exceeded sediment DGV and DGV high (ANZG, 2018a) but were not leachable.

Detectable concentrations of PCBs were reported in samples closer to the substation, suggesting the lateral extent of PCBs is not widespread and relatively localised to the immediate vicinity of the substation. The vertical extent was assessed when the substation and underground services were decommissioned and disconnected during

Stage 1 Early Enabling Works. The risk posed by detectable PCB concentrations to marine ecology is currently being assessed.

General Fill

Site history and previous investigation results have identified fill of unknown quality and origin, which affects the entire site. The Berth 101 area was constructed using dredged sediments (reclaimed sands) from the adjoining Inner Harbour. Overlying the reclaimed sands (Fill unit 2), was fill material described as gravelly sand, sands and silts, and coalwash (Fill unit 1). This fill material was identified west of the No. 7 conveyor and contained trace amounts of slag, coal, concrete and/or wood. Fill was encountered in all boreholes and the type of fill was generally consistent across the site; however, its thickness was variable.

Evidence of potential contamination was identified during sampling and included a pale green-grey fill layer at GBH09A at depths between 0.2 metres and 0.7 mbgl.

The above evidence of contamination was targeted with soil samples analysed for TRH, Benzene, toluene, ethyl benzene and xylenes plus naphthalene (BTEXN), PAH and/or heavy metals. The majority of these COPCs were reported at concentrations below the LOR. Detectable concentrations of ammonia, heavy metals, BTEX, TRH and PAH were reported but again well below the guideline values.

Sample GBH13A/2.8-3.0m (western fill area) reported elevated TRH and BaP TEQ concentrations, relative to other samples outside the hotspot areas. Concentrations of BaP TEQ in sample GBH13A/2.8-3.0metres were below HIL-D, but above DGV (ANZG, 2018a). Concentrations of BaP TEQ in deeper sample GBH13A/3.4-3.5 metres, were above both HIL D and the DGV (ANZG, 2018a). The vertical extent on contamination GBH13A has not been delineated.

As material from Berth 101 is scheduled to be excavated and material to be reused within the Emplacement Cell, analytical results from this area were also compared to the sediment criteria. The following is noted:

– Where concentrations were reported above the laboratory limit of reporting, hydrophobic organic contaminants were normalised to 1% organic carbon to account for preferential partitioning at higher organic carbon concentrations.
– Concentrations of TRH (sum total) potentially exceeded the normalised hydrophobic organic contaminants (1% organic carbon) for GBH09A_5-5.3, GBH09D_4.7-5.0, GBH022A_8.0-8.5, GBH026B_5.7-6.0, and GBH039B_1.9-2.1, as the normalised LOR of <500 mg/kg exceeded the guideline of 280 mg/kg.
– Copper, lead and zinc exceeded the DGV (ANZG, 2018a) in GBH024A_0.0-0.3.
– PAH concentrations were above the DGV (ANZG, 2018a) at GBH13A_2.8-3.0, GBH13A_3.4-3.5, GBH026B_5.7-6.0, and GBH026C 4.7-4.8.
– PAH concentrations exceeded the DGV (ANZG, 2018a) at GBH13A_3.4-3.5. The normalised concentration was 1,162 mg/kg.

No asbestos or other forms of potential contamination were observed. While asbestos was previously identified on-site in the form of fragments of ACM on the ground surface near the substation (GHD, 2018a), no asbestos was identified in samples below the ground surface in the entire lease area at the test locations, and it is therefore unlikely that ACM is present in the fill, although this cannot be precluded.

Based on laboratory results from the previous and current investigations, and with the exception of TRH and BaP impacts in the western portion of the site, the likelihood for contamination within fill was assessed as low.

This assessment excluded stockpiles currently stored in the south-western corner of the site as described in Section 7.9.

9. Site contamination status

The following review of the site contamination status is based on the results from GHD (2018a), (2021a) and (2021b). Further details of contamination investigations completed for the site are included in Appendix B.

9.1 Soils

Based on the review of all previous investigations at the site, the following areas were identified as potentially posing a risk to human health and/or the environment for redevelopment of the site, and were remediated and/or managed during Stage 1 works, to allow for continued commercial/industrial land use:

– Identified hotspots:
  - GBH09 – BaP and TRH above HIL/HSLD. Following additional investigations, delineated vertically and in all directions and deemed to be localised.
  - GBH26 - BaP and TRH above HIL/HSL D. Following additional investigations, the lateral extent for GBH26 is unknown in the eastern and western directions.
– Substation:
  - PCB concentrations above DGVs in surface soils. Depth of investigations limited, not delineated vertically.
– Fill across the site:
  - One location within the MBD Compound Site area (GBH13A) was identified with elevated BaP TEQ above the HIL-D and not vertically delineated and some odorous and discoloured soils were identified with a potential for unidentified hotspots of contamination to exist. Further, on the western side of conveyor No. 7. fill was noted to contain coal, concrete timber, and slag.
– Subsurface structures / services:
  - Existing subsurface oil pipeline and ACM water pipe identified on site and ACM building materials on site (substation)
– Stockpiles
  - Two large stockpiles with a potential to contain contaminated materials.

Other contaminants

Per- and polyfluoroalkyl substances (PFAS) are not considered to be a potential contaminant of concern for the site. GHD understands that no storage of PFAS chemicals or firefighting activities have occurred at the Site. There has been no evidence of disposal of other wastes or products that may contain PFAS chemicals (e.g., household waste) identified. Based on this PFAS has not been included in the sampling program.

Acid Sulfate Soils

There is a potential for ASS and Potential Acid Sulfate Soils (PASS) to be disturbed during the excavation phase of the works. ASS and PASS will be managed under the Acid Sulfate Soil Management Plan (ASSMP).

9.2 Data gaps

All areas identified for additional investigation in the Remediation Works Plan for Stage 1 Early Enabling Works have been addressed during Stage 1 of the Project and will be validated prior to Stage 2A commencing. The UFP will be continued to be implemented for any unexpected contamination finds (refer to Section 12.11).

9.2.1 Excavated fill

As the presence of unidentified contaminated fill materials in investigation areas of the site cannot be discounted, it is recommended that excavation of the fill to the required levels is inspected by the environmental representative with unexpected finds protocols in place. Materials displaying distinct odours, unusual colour changes or

containing suspected contaminated fill materials (ACM, extensive slag, or coke, etc.) should be segregated and analysed as required prior to a decision made for re-use or disposal off site.

9.2.2 Waste classification

During the Stage 2A works, any soils segregated and proposed for disposal off-site must be classified in accordance with the *Waste Classification Guidelines Part 1: Classifying Waste* (NSW EPA, 2021a) and *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).

9.3 Source-pathway-receptor linkages

Initial receptors are considered to be site workers involved with earth works associated with excavation activities, that is, those coming into direct contact with soil or potentially hazardous materials. Earthworks are to involve shallow to deep excavations across the site to achieve required construction levels or to remove identified contamination, stockpile management, including stockpiled materials which have been identified as unsuitable for placement in the Emplacement Cell Construction Site. This exposure scenario provides an increase likelihood that workers will be in direct contact with soil and exposed to dust via inhalation generated during excavation and stockpiling.

Based on results of the previous investigation, vapours and gases have not been identified as exposure pathways. Therefore, the SPR linkages are assessed incomplete for vapour inhalation as this form of contamination has not been identified. Based on review of the potential SPR linkages, the proposed development may provide direct contact/ingestion exposure pathways to contamination, if present, to workers involved in remediation of impacted soils and to aquatic ecosystems.

Remediation works for identified contamination have been completed during Stage 1 Early Enabling Works construction, so potential SPR linkages are significantly reduced for ongoing construction activities at the site.

10. Remediation works plan

This section provides a description of the remediation works steps and procedures required to protect health, safety, and the environment for Stage 2A works.

The roles and responsibilities of the AIE Project Manager and Principal Contractor are outlined in Section 3.

10.1 Site mobilisation for Stage 2A

Management of the site mobilisation process is to be included in Principal Contractor's work plans including the following:

– Site access and security: Principal Contractor will be responsible for ensuring the security of all work areas and all plant and equipment maintained on-site during remediation works. This includes signage, control of site access (authorised personnel and vehicles only) and safety inductions and documentation.
– Plant re-fuelling/maintenance/cleaning: Principal Contractor will be responsible for designating locations/areas for equipment refuelling, maintenance, and cleaning activities undertaken during the site works (as required) and to ensure all vehicles leaving the site are free of any contaminated material. Some equipment, such as static generators, drill rigs and cranes, may require re-fuelling in situ and not within designated areas. The refuelling procedure will be followed with spill controls outlined in the Emergency Spill Plan.
– Traffic control: Principal Contractor will be responsible for ensuring adequate traffic control measures are in place to ensure site safety and take into consideration the entry and egress of vehicles from the main site entrance in accordance with the Construction Traffic Management Plan (CTMP).
– Environmental controls: Principal Contractor will be responsible for installing and maintaining environmental controls consistent with relevant management plans.

10.2 MBD Site Compound

10.2.1 Asbestos-containing materials

AIE is required to appropriately manage the occurrence of unexpected finds to satisfy condition S5.7 *Discovered Contamination* under the *Deed of Surrender and Grant of New Lease between Port Kembla Operations Pty Ltd as trustee of Port Kembla Unit Trust and Port Kembla Coal Terminal Limited and Australian Industrial Energy Pty Ltd (*Surrender Deed), and also from a land contamination aspect, as the lease area (southern part of Part Lot 22 DP 1128396) requires a site audit statement at the completion of construction.

A Remediation Work Plan (RWP) addendum ('the addendum') has been prepared to provide remediation and validation methodologies for ACM, specifically addressing asbestos impacts associated with the discovered contamination. The addendum was approved by the independent site auditor, and the methodologies within it and the RWP it supports, will be applied going forward if ACM is encountered during Stage 2A works.

10.3 Additional investigation/validation

Soils beneath the above and below ground infrastructure were being investigated following their progressive removal as a part of Stage 1 Early Enabling Works. Any additional investigation and/or validation of material as a part of Stage 2A work is to occur if there are any unexpected finds, and as such is to be managed per this CSP.

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10.4 Excavation

Completion of excavation and backfilling from Stage 1 Early Enabling Works will be required prior to construction of structures within the MBD Site Compound. A nominal 15-metre-wide section on the northern end and a circa 60-metre 'wedge' at the south- west corner of the excavation zone was left to facilitate contractor access and will required completion at commencement of Stage 2A. Excavation during Stage 2A does not relate to remediation but to construction of the new wharf and land based facilities. However, any unexpected finds that will require removal of contamination and excavation will follow the unexpected finds protocol detailed in Section 12.11.. Excavated materials from the Stage 1 Early Enabling Works have been stockpiled within the Eastern and Western Stockyards of the MBD Site Compound and within Emplacement Cell Construction Site (refer to Figure 2.2).

– The excavated materials stockpiled include:
  - Approximately 5,000m³ of demolished concrete crushed to nominal 70mm minus.
  - Approximately 30,000m³ of heavily bound base course crushed to nominal -150mm minus.
  - Approximately 25,000m³ of mixed slag, general fill, and coal nominally < 150mm in size.
  - Approximately 10,000m³ of predominantly sand with some slag and coal.
  - Approximately 9000 m³ of asbestos impacted soils

10.4.1 Validation sampling

Where material has not been adequately characterised by existing investigations, characterisation sampling of stockpiles including those to be disposed off-site will involve sample collection and analysis in accordance with the Vic EPA IWRG 702 (2009) as referenced in the NEPM Schedule B2. The assessment criteria are outlined in detail in Section 11.3.

10.4.2 Backfill or reinstatement requirements

On completion of excavation and subsequent validation approval, backfilling of excavations may be required (i.e., for site levelling or safety reasons). Significant backfilling at the site is not anticipated during the Stage 2A works. If required, backfilling procedures will be as follows:

– Excavations should be backfilled with either:
  - Materials excavated during Stage 1 Early Enabling Works which includes crushed concrete, heavily bound base course, mixed slag, general fill and coal (refer to Section 10.4). Reused crushed concrete and fill has been validated to be free from contamination prior to stockpiling for reuse, and thus is deemed to be free from asbestos. Asbestos impacted material will have its designated containment area/ cell at the MBD Site and to be ensured not mixed with other clean backfill material. Containment of these asbestos impacted material will follow the relevant guidelines and legislation for managing asbestos impacted material on site.
  - If required, Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) can be sourced externally. Material considered to be VENM or ENM should be assessed by an appropriately qualified environmental consultant to confirm that the material meets the relevant regulatory requirements, or by review of any associated waste classification documentation obtained. Analytical results must report non-detects for all contaminants with exception of heavy metals, which would be representative of background concentrations.
  - Materials sourced from commercial/ licensed premises that are deemed clean, uncontaminated and suitable for purpose. Materials may include but are not limited to; quarry aggregates, sand materials, and landscaping materials.
– Backfill material must be of suitable composition and must meet geotechnical and other material property requirements for the area of use and not present hazards to future development. It must be validated to confirm suitability for use from a contamination perspective with the sampling density and suite of analysis commensurate with import source/material type, supported by appropriate source documentation and visual inspection to confirm free from contamination.
– VENM or ENM materials are not to be stockpiled in areas still undergoing remediation or come in contact with contaminated soils either through storage or from equipment/plant handling contaminated materials.

– Validation samples should be collected from on-site or imported material (if required) to confirm its suitability for use.
– It is understood that it is also intended to use fill material and concrete suitable for reuse for the wharf construction. Materials will be crushed on site and stockpiled at the MBD Site Compound or Emplacement Cell Construction Site. This material will be segregated and validated for use.

Reinstatement, compaction, and further redevelopment works will be undertaken in accordance with the requirements of AIE.

10.4.3 Material tracking control

A critical aspect of Stage 2A is the manner by which materials are controlled throughout all stages of the works. The following tracking control requirements for each stage shall be implemented by the Principal Contractor to ensure all materials are accounted for:

– Excavation:
  - The area to be excavated shall be clearly delineated.
  - Qualified supervision shall be used during excavation to ensure that all contaminated materials are removed but disturbance of uncontaminated soils is minimised.
  - Materials shall be segregated to the extent practical during excavation to minimise mixing of materials with different degrees or types of contamination.
  - The final extent of excavation and location of validation sampling points shall be measured and recorded by GPS or survey, as required by AIE.
– Stockpiling/backfilling:
  - Stockpiles shall be kept separate, to minimise mixing of materials (as above).
  - All stockpiling and backfilling operations will only move material from one location to another when approved by the Principal Contractor Environmental Representative. All such movements shall be clearly documented by the Principal Contractor in a material tracking register equivalent. The materials tracking register shall document (at a minimum) the following information:
    – Stockpile identification.
    – Source of material.
    – Volume of material.
    – Destination (including on-site locations for intermediate movement).
    – Date of movement.
    – Authorisation.
    – Material description.

10.5 Site management

10.5.1 Interim site management

As the site is secure with limited potential for unauthorised access and based on the current site usage (former port operations), occupation of the site for current land uses is considered acceptable to continue until remediation commences. However, the proposed remediation works may generate exposure hazards to sensitive receptors. Mitigation measures shall be included as part of the Work Health and Safety Plan (WHSP) as prepared by the Principal Contractor.

10.5.2 Long term site management

Implementation of a long-term site management plan for any contamination that remains on site, including potential contamination remaining at depths not disturbed by the redevelopment and the Emplacement Cell, would likely be required.

A long-term management plan for the Emplacement Cell will be developed as part addressing relevant approval conditions.

11. Validation

The process as outlined in the following sections applies to all areas of the site proposed for remediation and/or validation and will be based on aesthetic issues/visual observations combined with collection of soil samples from the walls and base of excavation and trenches with analysis for the contaminants of concern as discussed in Section 7. It is noted that the validation process was developed for Stage 1 of the construction process and remediation works are largely complete. The validation process will continue to apply for any unexpected finds of contamination identified within the remaining areas of excavation for Stage 2A.

11.1 Data quality objectives

Data Quality Objectives (DQOs) have been established for this CSP to assist the design and implementation of data collection activities, to ensure the type, quantity and quality of data obtained are appropriate and address the project objectives. The DQO process as described in Schedule B2, Appendix B, of the NEPM (NEPC, 2013) was adopted for this project. The DQO process involves seven steps as described below.

The DQO steps defined above have been addressed as follows.

Step 1 - State the problem

AIE intend to redevelop Berth 101 of PKCT with the construction of facilities for an LNG import facility. The development will involve the excavation of hardstand and fill materials to RL 2.5 m PKHD (this equates to approximately 1.6 metres to 4.2 mbgl), and the excavation of piles and footing that extend into bedrock.

Uncontaminated materials previously identified as fill (“Fill”), reclaimed sands and alluvium (“Unit 1”) will be used to develop the Emplacement Cell perimeter bund wall which will then contain remaining excavated materials (i.e., estuarine sands, residual soils, harbour sediments and muds).

Contamination has been identified at the site that may adversely impact the suitability of the fill to be used in the Emplacement Cell and/or may have adverse impacts upon environmental receptors.

There is also a potential for contamination to be present in inaccessible areas beneath remaining structures (substation, ponds, pits and drains).

GHD carried out an evaluation of existing data to assess the suitability of Fill and Unit 1 to be reused in the perimeter bund wall. It was concluded that “*the majority of Fill and Unit 1 are considered to pose a low risk to the marine aquatic environment based on the characterisation carried out, however some limited supplementary assessment would be beneficial to confirm this*.” (GHD, 2020).

Construction of the Emplacement Cell and redevelopment of the site as an LNG facility (continued commercial/industrial land use) requires appropriate management of contaminated soils.

Step 2 – Identify the decisions

The decisions are those required to ensure the successful management or remediation of contamination at the site and consequently the protection of the environment and human health. Key decisions include:

– Have the identified data gaps been adequately addressed?
– Have the surface and subsurface structures and services been removed, and appropriate assessment of previously inaccessible soils been undertaken?
– Have known areas of contamination been remediated and validated to achieve residual concentrations of contamination less than the adopted criteria?
– Has excavated materials (hardstand, fill, sands etc) been adequately segregated and validated suitable for reuse on site, in the Emplacement Cell perimeter bund or capping or for placement with the Emplacement Cell?
– Have any unexpected finds encountered during site works been appropriately managed or remediated?

Step 3 – Identify inputs to the decision

Data to be input to the decision-making process includes:

– Information from previous investigations.
– Information from additional investigations proposed in Section 10.3.
– Current assessment criteria as discussed in Section 6.
– Consideration of future land use / material placement.
– Monitoring the Principal Contractor's work and site conditions.
– Review of relevant documentation to be provided by the remediation contractor.
– Observations and analyses to be undertaken during the site remediation and validation works.

Step 4 - Define the study boundaries

The lateral boundaries of the study area are defined by the extent of the excavation area which extends from Road No. 7 at the northern end of the West Stockyard to the South Ponds and across to Road No. 9 and includes the MBD Site Compound area as shown in Figure 2.2.

The vertical boundaries of the study are the vertical extent of proposed earthworks, generally noted between the surface and approximately 20 mbgl (depth of piles).

Step 5 – Develop a decision rule

Review of previous site investigations has been used to identify the main contaminants of concern and areas requiring remediation or management prior to site redevelopment.

Concentrations of contaminants for validation (where required) will be compared with the criteria discussed in Section 6, giving consideration to the proposed use or placement of material, to assess the success of the remediation and/or screening processes and/or to assess waste disposal requirements.

In order to decide whether the data obtained is precise, accurate, reliable and reproducible for the site at the time of the investigation, field and laboratory quality control and quality assurance (QA/QC) procedures will be utilised throughout the sampling programs. All sampling work will be carried out in accordance with Standard Operating Procedures for field activities, based on standard industry practices. QA/QC results will be compared to nominal acceptance limits (as outlined in in Section 11.2).

Step 6 - Specify limits on decision errors

The guidelines as listed in Section 6 will be used to assess the contamination status of the soils within the subject site. Data quality indicators (DQIs) as described in Section 11.2 will be used to evaluate the acceptability of the data.

Where quantitative data is used as a basis for decisions, data will be evaluated on a statistical basis as described in the NEPM (NEPC, 2013), to a 95% confidence level.

Step 7 - Optimise the design for obtaining data

To optimise the design of the remediation, a sampling and analytical program for remediation validation has been prepared as included in Section 11.3 below.

11.2 Data quality indicators

The DQIs for sampling techniques and laboratory analysis of collected samples defines the acceptable level of error required for this investigation. The data quality objectives will be assessed by reference to data quality indicators as follows:

– **Data Representativeness** - expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples in an appropriate pattern across the site, and by using an adequate number of sample locations to characterise the site. Consistent and repeatable sampling techniques and methods are utilised throughout the sampling.
– **Completeness** - defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study. If there is insufficient valid data, then additional data are required to be collected.

– **Comparability** - is a qualitative parameter expressing the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples and ensuring analysing laboratories use consistent analysis techniques and reporting methods.
– **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

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

Where Co = Analyte concentration of the original sample
Cd = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criterion of ± 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criterion of ± 50% RPD for field duplicates and splits for organics, however it is noted that this will not always be achieved, particularly in heterogeneous soil or fill materials, or at low analyte concentrations.

– **Accuracy:** measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analysis techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards. The nominal “acceptance limits” on laboratory control samples are defined as follows:
  - Laboratory spikes – 70-130% for metals/inorganics 60-140% for organics.
  - Laboratory duplicates - <30% for metals/inorganics, <50% for organics.
  - Laboratory blanks - <practical quantitation limit.

Accuracy of field works is assessed by examining the level of contamination detected in equipment blanks. Equipment blanks should return concentrations of all organic analytes as being less than the practical quantitation limit of the testing laboratory.

The individual testing laboratories will conduct an assessment of the laboratory QC program, internally; however, the results will also be independently reviewed and assessed by the Environmental Consultant.

11.3 Validation methodology

11.3.1 Validation following asbestos removal

Validation for asbestos is primarily concerned with asbestos remediation works related to removal of the ACM building materials and conduit in the substation and removal of the ACM water pipeline (estimated to be 418 m in length) which has now been completed as a part of Stage 1 works.

Handling, transporting, storing and disposing of ACM or any contaminated material in general are described in Section 8 of the SMP. Any identified ACM fragments will be managed in accordance with the AIE Unexpected Finds Protocol, including the removal of any visible fragments by a licenced removalist in accordance with relevant SafeWork NSW codes of practice. Following removal, a licenced asbestos assessor should inspect the site and provide a clearance certificate confirming removal of asbestos.

11.3.2 Validation of excavations

Where required, validation of the remediation excavations will be undertaken in accordance with the NSW EPA (1995) *Contaminated Sites: Sampling Design Guidelines*.

The Environmental Consultant will record and document the excavation and removal activities of contaminated soils from the excavations and trenches. Systematic sampling will be undertaken on the base and walls of the excavations. The validation sampling procedure will comprise:

– Documentation of the excavation activities.
– Visual confirmation that the extent of excavation has removed all contaminated fill material (stained and odorous).

– Validation will be required following excavation of impacted soils. The resultant excavations will be validated to confirm the removal of the contaminated material with collection of at least five samples (four wall samples, one base sample) from any excavation and analysis for contaminants of concern (based on the results of previous investigations and observations during the remediation). Base samples will be collected at a minimum rate of 1 per 25 metres^2, and wall samples at a minimum rate of one per 5 linear metres, with samples collected from each distinct strata of soil.
– Ensuring detailed material tracking by maintaining and reviewing a material tracking register (including on-site soil movement) and waste disposal dockets, to be provided by the Principal Contractor.

Validation sampling locations will be systematic, or biased towards areas of apparent contamination, if present (to provide a conservative approach). Photographs of the excavation will be taken as part of the validation works. The extent and depth of the completed excavation shall be measured by the environmental consultant, with reference to site boundaries or physical features.

11.3.3 Validation of imported material

Significant importation of materials at the site is not anticipated during this phase of the redevelopment. However, in the event that materials will be imported to site, options include VENM (as defined by NSW EPA (2014a)), ENM or other materials subject to a Resource Recovery Order and Exemption.

Materials may only be classified as VENM if they have been excavated from an area that is not contaminated with other waste materials or by manufactured chemicals. Imported materials should be validated as VENM, ENM or otherwise suitable for importation to site by an appropriately qualified environmental professional. Classification of all imported materials involves the following steps:

– The history of the site of origin of the material should be understood and documented to identify whether any potentially contaminating activities have been undertaken at that location.
– An inspection of the source site or materials should be undertaken by an appropriately qualified environmental professional, including a visual inspection of the stockpiled materials. Findings of the inspection should be fully documented.
– Validated as suitable for use with reference to NEPM Schedule B2 / EPA Victoria Industrial Waste Resource Guidelines 702 (Vic EPA IWRG 702) (2009) which may involve collection of samples at a prescribed rate depending on the volume of material, with at least three samples from any particular source.
    - VENM samples would be analysed for a general contamination suite including heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), TRH, BTEXN, PAH and OCPs. Results would be compared to the relevant HILs and Ecological Investigation Levels (EILs) for the proposed land use.
    - ENM samples would be analysed for the suite of contaminants as listed in Column 1 of Table 4 of the NSW EPA Excavated natural material order 2014. Results would be compared to the concentrations listed in Columns 2 and 3 of the same Table 4.
– A visual inspection of the VENM, ENM or any other imported materials should be undertaken as it is imported onto site to ensure that the material is consistent with documented observations.
– Materials tracking of any imported materials to confirm imported material source, volume imported and final location on site.

11.3.4 Validation of excavated material stockpiles

Where material has not been adequately characterised by existing investigations, characterisation sampling of stockpiles including those to be disposed off-site will involve sample collection and analysis in accordance with the Vic EPA IWRG 702 (2009) as referenced in the NEPM Schedule B2. Characterisation sampling of stockpiles will involve sample collection and analysis at a minimum rate of 1 sample per 25 metres^3, or at least three samples from each distinct area of excavation or “batch” of material.

Material exhibiting visual evidence of heterogeneity may require sampling at a higher rate to ensure all characteristic elements of the material are sampled. “Procedure B” from the *Sampling Design Guidelines* (NSW EPA, 1995) will be used to assess if the number of samples is adequate to show that the average concentrations of contaminants are below the relevant criteria.

Analysis will be undertaken for contaminants of potential concern to include heavy metals, TRH, BTEXN, PAHs, PCBs and asbestos for the “batch” of material being tested and results compared to the following:

– Re-use on site – Results compared to relevant health and ecological criteria and use of the segregating materials decision tree (refer to Figure 9-1 in the SMP).
– Disposal off site – Results compared to the NSW EPA Waste Classification Guidelines (2014a and/or 2014b). If necessary for additional waste classification purposes or for assessment of potential environmental impacts, a TCLP test for selected parameters will be undertaken in conjunction with total concentration analysis.

11.3.5 Quality assurance

All fieldwork will be conducted in general accordance with Standard Operating Procedures for field activities, which are aimed at collecting environmental samples using uniform and systematic methods. Key requirements of these procedures are as follows:

– Decontamination procedures - including the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling location and the use of dedicated sampling containers provided by the laboratory.
– Sample identification procedures - collected samples will immediately be transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers will be clearly labelled with a sample number, sample location, sample depth and sample date. The sample containers will then be transferred to a chilled cooler for sample preservation prior to and during shipment to the testing laboratory.
– Chain of custody information requirements - a chain-of-custody form, for each batch of samples, will be completed and forwarded to the testing laboratory.
– Sample duplicate frequency approximately 10% (5% each for intra and inter laboratory duplicates) – for chemical analysis only.

Field quality control procedures to be used during the project include the collection and analysis of the following (for chemical analysis only):

– **Intra Laboratory (Blind) duplicates/replicates:** Comprise a single sample that is divided into two separate sampling containers. Both samples are sent anonymously to the project laboratory. Blind duplicates/replicates provide an indication of the analytical precision of the laboratory but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity. It is proposed to collect and analyse blind duplicate samples at a rate of at least 5%.
– **Inter Laboratory duplicates/replicates:** Individual samples are split in two in the field by the sampling crew and are placed in two separate containers. One sample is sent to the project laboratory and one sample is sent to an independent check laboratory. Field split duplicate samples provide an indication of the analytical accuracy of the project laboratory but may be affected by other factors such as sampling methodology and the inherent heterogeneity of the sample medium. It is proposed to collect and analyse blind duplicate samples at a rate of at least 5%.

Rinse blanks will be collected where sampling equipment is used but may not be analysed daily unless cross contamination is considered an issue.

It is noted that based on the contaminants of concern for the site (i.e., no volatile contaminants have been identified), the use of trip blank and trip spike samples is not required.

11.3.6 Laboratory program

The National Association of Testing Authorities of Australia (NATA) accredited project laboratory will use their internal procedures and NATA accredited methods in accordance with their quality assurance system. The environmental consultant is to ensure that the laboratory analytical methods and limits of reporting are acceptable for analysis required.

Laboratory quality control procedures used during the project should include (where relevant):

– **Laboratory duplicate samples**: Duplicate sub samples collected by the laboratory from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one

sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the test result.

- **Spiked Samples**: An authentic field sample is spiked by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. Spiked samples will be analysed for each batch where samples are analysed for organic chemicals of concern.
- **Certified Reference Standards**: A reference standard of known (certified) concentration is analysed along with a batch of samples. The Certified Reference Standard (CRS) or Laboratory Control Spike provides an indication of the analytical accuracy and the precision of the test method and is used for inorganic analyses.
- **Surrogate Standard/Spikes**: These are organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds are spiked into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Surrogate Standard/Spikes provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.
- **Laboratory Blank**: Usually an organic or aqueous solution that is as free as possible of analytes of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank is carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.

The individual testing laboratories will conduct an assessment of the laboratory QC program, internally; however, the results will also be independently reviewed and assessed by the Environmental Consultant.

Laboratory duplicate samples should return RPDs within the NEPM acceptance criteria of ±30%. Per cent recovery is used to assess spiked samples and surrogate standards. Per cent recovery, although dependent on the type of analyte tested, concentrations of analytes and sample matrix; should normally range from about 70-130%. Method (laboratory) blanks should return analyte concentrations as ‘not detected’.

11.3.7 Dispatch and transport of samples

All samples will be dispatched and transported in accordance with laboratory procedures and requirements. The Environmental Consultant will conduct a review of these procedures and requirements to ensure that all statutory requirements are complied with.

The Environmental Consultant will seek to ensure that the specified holding times for analytes are not exceeded due to delays between sample dispatch and laboratory receipt.

11.4 Reporting

11.4.1 Site Validation Report

Where remediation has been carried out, the site must be ‘validated’ to ensure that the objectives stated in the CSP have been achieved. A Site Validation Report (SVR) is required to be prepared in accordance with the relevant requirements of NSW EPA (2020) detailing extent of remediation and validation results. Because areas of the site will be progressively remediated and validated, SVRs will be prepared and submitted to the Site Auditor, Melissa Porter of Senversa, for review and approval.

The SVR will assess the results of the validation observations and sampling against the assessment criteria stated in the CSP and approved addendums. Where validation has not been achieved, reasons must be stated, and additional site work proposed to achieve the CSP objectives. The SVR will also include information confirming that all NSW EPA and other regulatory conditions and approvals have been met. In particular, the SVR will document evidence to confirm that any disposal of waste materials off-site has been completed in accordance with the CSP and relevant regulatory requirements.

Once confirmation of adequate remediation and validation is communicated by the Environmental Consultant, remediation work may continue in the area that was subject to remediation and validation. Conditions may be imposed for particular areas.

The final SVR will be in a form of a letter that briefly describes the remediation and validation activities carried out at the site and the documents prepared recording these activities (i.e., the Interim SVRs). The summary will also include the corresponding interim audit advice reference and the Site Auditor's acceptance of the documents produced. The SVR letter will reference the CSP and any addenda and verify that remediation and validation activities undertaken were in substantial compliance with these documents. Any unexpected finds that will require removal of contamination and excavation will follow the unexpected finds protocol detailed in Section 12.11. The letter will provide a concluding statement on site suitability with respect to ongoing industrial / commercial land use.

11.4.2 Long Term Environment Management Plan

Once the installation of any capping layers required are complete, the interim site Environment Management Plan (EMP) will be revised and converted to a LTEMP. The LTEMP will be expanded to include:

– A drawing clearly identifying the locations of remaining impacted materials and the capping details (works as executed drawings).
– Advice on how to recognise if the cap has been breached.
– A long term maintenance and monitoring/inspection program for the cap.
– Provision of additional control measures and their application for any future works that may penetrate through the cap including road repair/maintenance.

Information to be provided by the Contractor during the preparation of the EMP shall include the details of any standard protocols relevant to the EMP.

The LTEMP will require review and approval by the Site Auditor, Melissa Porter.

12. Protection of environment and community

Remediation activities have the potential to disturb contaminated soils, particularly during the earthworks stage. If inadequately managed, the disturbance of any areas of contamination has the potential to impact on human health and surrounding environment. A major part of the site management will involve the installation and maintenance of environmental protection and pollution control measures designed to achieve the following objectives:

– Protection of the surrounding environment during all phases of remediation works.
– Protection of the local community during all phases of the remediation works.
– The containment of all contaminated and potentially contaminated materials (soils, sludge, run-off etc.) to the site.

As per Section 10, prior to commencing works, the Principal Contractor must possess plans, programmes, licences, certificates, notifications and other documents necessary for the commencement of the work, addressing as a minimum the requirements of this CSP. These documents shall be subject to review by the AIE Project Manager and the Environmental Consultant, and are to be included in the future validation reporting.

The remediation program shall be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the site. Where approved plans exist (as prepared by AIE or the Principal Contractor), the more stringent requirements will apply.

12.1 Interim controls

Prior to the commencement of site remediation works, the following interim controls should be put in place:

– The Principal Contractor is responsible for the construction and/or maintenance of permanent fences around the subject area meeting appropriate specifications to prevent unauthorised entry.
– The Principal Contractor is responsible for the construction of silt and sediment controls around the remediation site, meeting appropriate specifications to prevent erosion and runoff.

12.2 Hours of operation

Remediation works will typically be undertaken during standard construction hours including:

– Monday to Friday: 7:00 am –6:00 pm
– Saturdays: 8:00 am – 1:00 pm
– No work undertaken on Sundays or Public Holidays.

It is noted that AIE have received approval for 24-hour to be undertaken for specific activities associated with project development including earth-moving at the MBD Site Compound and the Emplacement Cell Construction Site (refer to the Noise and Vibration Management Plan (NVMP) for Stage 2A). Remediation activities can therefore be undertaken outside of standard construction hours where required in accordance with the Out of Hours Works approval issued by DPIE.

12.3 Contact details during remediation

During remediation works, the Principal Contractor shall have team members available to be contacted at all times. Section 8 of the EMS details the incident reporting procedure for reporting environmental incidents during the project. Additionally, the WHSP as prepared by the Principal Contractor will detail contact numbers for key project contacts once confirmed, emergency services and utility authorities.

12.4 Soil and water management

All remediation works will be undertaken in accordance with the SMP and Water Quality Management Plan (WQMP, Appendix B of SMP). The Principal Contractor shall be responsible for the implementation and maintenance of soil and water management measures throughout the remediation works. A summary of relevant measures is presented below:

– Surface runoff control – may include diversion drains, silt fences, sumps, and pumping systems to prevent runoff entering or leaving excavation areas and to prevent runoff/suspended solids entering or leaving land farm or stockpile areas.
– Stockpiles - are not to be placed on walkways or roads and shall be placed away from drainage lines, water's edge, gutters or stormwater pits or inlets. Stockpiles likely to generate dust or odours shall be covered and stockpiles of contaminated soil shall be stored in a secure area.
– Vehicle access - Movement of excavation equipment and trucks to and from the site will be strictly controlled, restricted to a minimum and will only take place during the designated working hours. Controls must be in place to prevent any material being tracked onto offsite roads including wheel washing and sediment barriers. Soil, earth, mud, and other similar materials must be removed from the roadway preferably by dry methods (sweeping, shovelling).

12.5 Noise

It is the responsibility of the Principal Contractor to minimise noise generated from the remediation operations in accordance with the approved NVMP and Out of Hours Works Approval for the Project.

12.6 Vibration

The use of any plant and/or machinery shall not cause vibrations that can be felt or are capable of being measured at any off-site premises.

12.7 Waste management

The Principal Contractor shall establish appropriate waste disposal containers as part of site mobilisation, which shall be maintained on site for the duration of the works. All waste materials (e.g., garbage) must be disposed of using safe waste disposal practises. No waste shall be disposed of on-site. The waste disposal containers shall be emptied as necessary to avoid overflowing, and the contents disposed of to a waste disposal facility approved for the relevant waste type.

A Waste Management Plan (Section 9 of the SMP) has been prepared that identifies materials that can be re-used or recycled, and how these will be managed during the remediation works.

All potential pollutant materials shall be stored well clear of any poorly drained areas, flood-prone areas, and stormwater drainage areas. Such materials should be stored in a designated area. Containment bunds should be constructed with provision for collection and storage of any spilt material.

12.8 Air quality

General

Dust emissions shall be confined within the site boundary. The following dust control procedures may be employed to comply with this requirement (as required):

– Erection of dust screens around the perimeter of the site.
– Covering of all stockpiles of contaminated soil remaining for periods longer than 24 hours.
– Keeping excavation surfaces moist.

Asbestos

Where works are undertaken involving disturbance of asbestos containing materials, airborne fibre monitoring shall be conducted in accordance with the SafeWork NSW *Code of Practice: How to Safely Remove Asbestos* (2019a) and the WHS legislation (NSW). The monitoring should be conducted in accordance with National Occupational Health and Safety Commission (NOHSC) *Guidance Note on the Membrane Filter Method for Estimating Method Airborne Asbestos Fibres* 2nd Edition (NOHSC:3003, 2005). Any material that is proposed to be crushed, grinded or screened at the premises will not contain any ACM.

Air monitoring requirements vary depending on the type of asbestos being removed, the location/position of the asbestos, if an enclosure is used and whether the asbestos removal work is within a building or outside.

– Friable asbestos – Air monitoring is mandatory for all friable asbestos removal and includes prior to dismantling an enclosure and for the purposes of the clearance inspection. An independent licensed asbestos assessor must be engaged to carry out air monitoring.
– Non-friable asbestos (>10 metres²) – Air monitoring is not required but may be considered to be carried out by an independent licensed asbestos assessor or competent person to ensure compliance with the duty to eliminate or minimise exposure to airborne asbestos and to ensure the exposure standard is not exceeded.
– Public Location – Air monitoring should be considered where the asbestos removal work is being undertaken in or next to a public location.
– Exposure air monitoring – Air monitoring should be carried out at other times to determine a worker's exposure to airborne asbestos if, based on reasonable grounds, there is uncertainty as to whether the exposure standard may be exceeded and a risk assessment by a competent person indicates it is necessary. Since most uses of asbestos are prohibited, exposure monitoring should not be required frequently.

Air monitoring may be required when:

– It is not clear whether new or existing control measures are effective.
– There is evidence (for example, dust deposits are outside the enclosure) the control measures have deteriorated as a result of poor maintenance.
– Modifications or changes in safe work methods have occurred that may adversely affect worker exposure.
– There has been an uncontrolled disturbance of asbestos at the site.

Table 12.1 Air Monitoring Action Levels

Action Level	Action
< 0.01 fibres/mL	Continue with control measures
At 0.01 fibres/mL or ≤ 0.02 fibres/mL	Review control measures, investigate cause and implement controls to minimise exposure and prevent further release.
> 0.02 fibres/mL	– Stop removal work – Notify relevant regulator (phone followed by written statement) – Investigate the cause – Implement controls to eliminate or minimise exposure and prevent further release – Do not recommence removal work until further air monitoring is conducted and fibre levels are < 0.01 fibres/ml

Odours

No odours should be detected at any boundary of the property relying purely on a sense of smell. Techniques that may be employed to reduce odours include covering stockpiles, use of mist sprays, use of hydrocarbon mitigating agents such as surfactants and adequate maintenance of machinery to minimise exhaust emissions.

12.9 Fuelling of machinery

Fuelling is perceived to be a high-risk activity, in particular when near water. The Principal Contractor shall include fuelling plan for approval by AIE as part of the work plan prior to start of works.

12.10 Traffic movements and management

No major traffic disruptions are expected to result from the entry and egress of vehicles from the main site entrance. Any heavy equipment or machinery will be transported to the site in accordance with the standard regulatory requirements.

12.11 Unexpected finds protocol

The site has been investigated for contamination as detailed in previous investigation reports. However, a degree of uncertainty is inherent in any site contamination investigation and a potential exists for undetected contaminated soils or wastes to be identified during the proposed remediation works. There is a potential for previously

unidentified contamination to be present beneath the remaining above and below ground structures and services and also with the extensive fill units across the site. Indications of potential contamination may include:

– Stained or discoloured fill, soils, or seepage water.
– Odorous fill, soils, or seepage waters.
– Construction wastes such as concrete, bricks, timber, tiles, asbestos sheeting, fragments, and pipes.
– General rubbish such as plastic, glass, packaging.
– Imported materials.

An UFP has been developed and is illustrated below in Figure 12.1, which outlines the suggested procedures that should be followed in the event of an unexpected find.

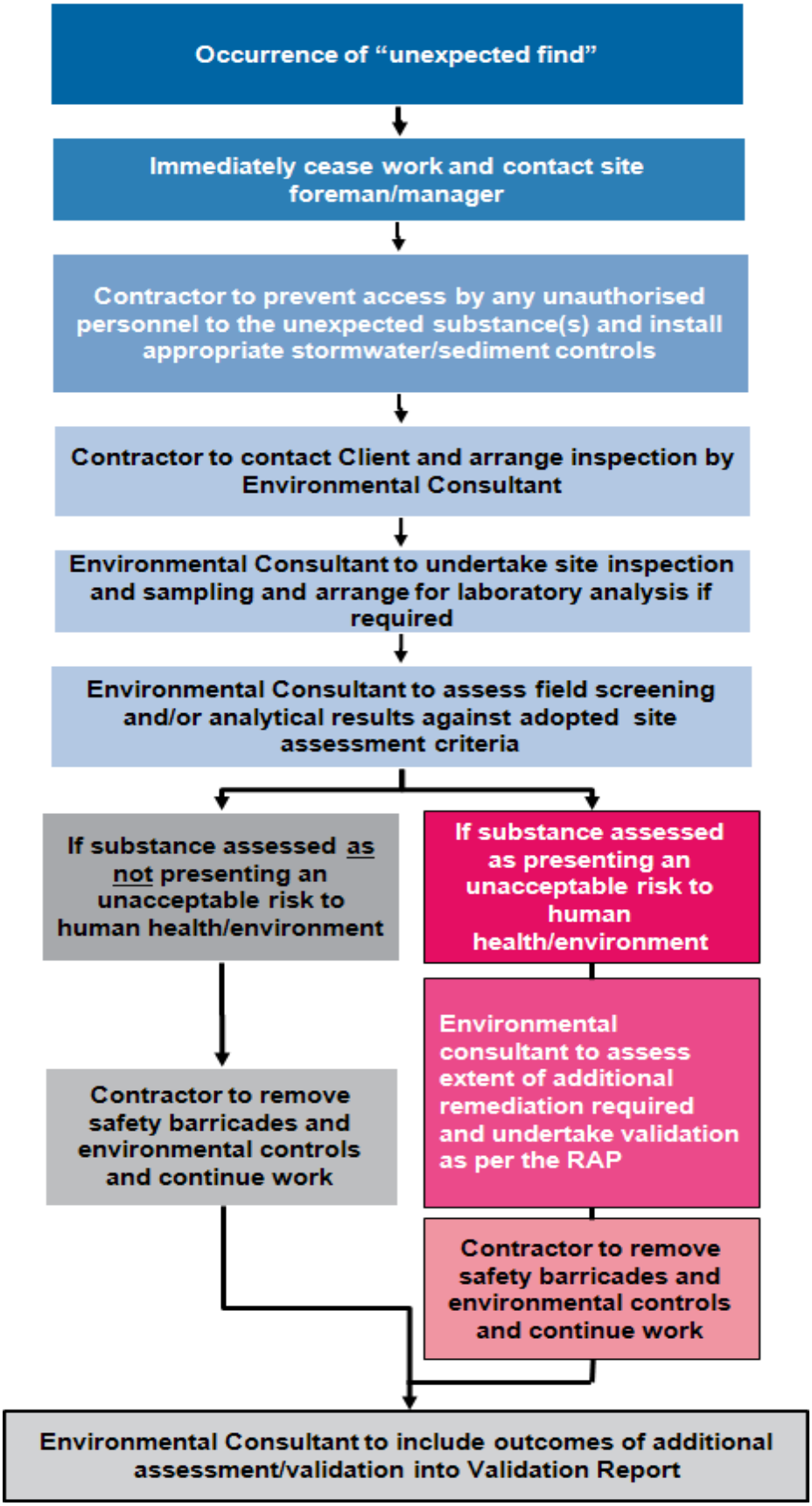

Figure 12.1 Unexpected finds decision process

12.12 Environmental protection and incident management

The Principal Contractor will follow the incident management and emergency response process (see Section 8 of the EMS and Emergency Spill Plan). The following outlines some of the unexpected situations that may arise:

– Spills or leaks.
– Adverse weather conditions.
– Dust, noise, odour levels measured at site boundary may exceed acceptable levels.
– Surface runoff may leave the site.

The Principal Contractor shall have available measures to counter these contingencies. In such cases the AIE Project Manager will stop work and appropriate situation specific action will be taken.

13. Health and safety

13.1 Work health and safety

Work Health and Safety (WHS) is a necessity on all remediation projects to ensure the health and safety of all personnel working/visiting the site. Therefore, work shall be carried out in accordance with a site-specific WHSP. The Principal Contractor shall prepare a site specific WHSP (or combined HSE Plan) for the remediation works, addressing as a minimum the requirements of this CSP, and shall appoint a Site Safety Officer for the duration of the works.

The purpose of the plan is to provide all relevant health and safety information for all personnel undertaking work at the site and to provide and maintain safety standards and practices which offer the highest practical degree of personal protection to the on-site workers, based on current knowledge.

The plan will recognise the legislative obligations of the Principal Contractor and of AIE and will in particular:

– Recognise that the work to be undertaken as part of the CSP may involve a “construction project” (as defined in the relevant legislation) in respect of which AIE and/or the Contractor has obligations as Principal Contractor. These obligations will be expressly dealt with in the plan.
– Recognise that the work to be undertaken as part of the CSP includes “high risk construction work” (as defined in the relevant legislation) in respect of which both the Principal Contractor and AIE have obligations. These obligations will be expressly dealt with in the plan.

It is the responsibility of the Principal Contractor and the AIE Project Manager to take all necessary practicable actions to safeguard the safety and health of all employees and subcontractors while they are on the site.

All work undertaken shall be performed in accordance with the provisions of the WHS Act, the WHS Regulations and any other relevant regulations or directions issued by regulatory authorities.

13.2 Community health and safety

To ensure the protection of the local community, the Principal Contractor shall control the exposure pathways identified in this section.

Control mechanisms will include the following:

– Site security measures to control direct contact with the contamination.
– Dust suppression measures to control inhalation exposure.
– Cleaning and tarping trucks to control direct contact from migration of contaminated soils.

These measures are described in Section 12. and shall be documented in detail in relevant management plans prepared by the Principal Contractor.

14. CSP conclusions

AIE commissioned GHD to prepare a CSP for the Stage 2A works for the Project. The purpose of this CSP is to manage contamination issues during excavation of material and transfer to the off-site areas of the Project.

This CSP provides a summary of identified site contamination issues, and a description of the proposed remediation, procedures and standards which are to be followed during the course of the works to ensure the successful remediation, segregation and management of excavated materials and consequently the protection of the environment and human health.

The investigations that have been undertaken are considered sufficient to develop this CSP, which, if appropriately implemented, will enable the successful segregation of excavated and stockpiled materials with re-use of suitable materials for construction of, and placement within the Emplacement Cell. Additional areas may require excavation / remediation based on results of the investigations to be completed beneath structures and services as part of the preliminary remediation works.

15. Communication and complaints

Effective communication between the Principal Contractor and construction personnel, AIE project team, sub-contractors and external stakeholders will be undertaken throughout the Project to ensure effective implementation of this CSP.

Project communication can be categorised into internal and external communications, as well as communications specifically dealing with complaints. The specific communication methods for each category are discussed below.

15.1 Internal communications

Communication on environmental issues related to contaminated spoil management within the Project team will be maintained, as a minimum, through the following forums (organiser as noted):

– Weekly project construction team meetings (AIE Construction Manager or delegate).
– Weekly Environmental management team meetings with relevant contractors (AIE HSE Manager or Delegate).
– Toolbox talks and daily pre-start briefings (Principal Contractor Project Manager or delegate).
– Minutes of formal meetings will be taken and distributed to record issues raised and actions required, with action status established at subsequent meetings.
– Monthly review of the internal AIE Environmental Compliance Tracking register (AIE HSE Manager or delegate).

All internal meetings include appropriate documentation in the form of agenda and formal distribution via the Project's document system.

In addition to the above, the AIE Environment Team will also undertake informal planning sessions and resource review meetings to plan and forecast for upcoming key construction dates, critical issues and other relevant matters associated with environmental planning and approvals.

15.2 External communications

AIE is committed to keeping the local community and relevant agencies informed about the development of the Project. The principal external communication objectives are, therefore, to:

– Continue to maintain open communication with relevant stakeholders.
– Minimise environmental impacts.
– Be proactive in addressing any concerns that the community / external stakeholder may express.

AIE will build upon the stakeholder and community engagement phase undertaken during project development including multiple group or one on one briefings. A project website (www.ausindenergy.com) has been developed and provides comprehensive, clear, and accessible information that is updated on a regular basis.

As well as the local Port Kembla and broader community of the Wollongong region, extensive engagement was also undertaken with a range of other interested key stakeholders, such as local commerce organisations, the Port Authority of NSW and local and state government.

Consultation with key stakeholders and the wider community on the Project will continue throughout Stage 2A and subsequent construction phases. These measures will ensure the stakeholders, including the wider community, remain informed of the project's progress.

Key methods of engagement are provided in the Stage 2A EMS.

15.3 Complaints management

All complaints where a third party has identified a construction activity as being unsatisfactory or unacceptable will be dealt with promptly and efficiently in accordance with the complaint and dispute response outlined in the Project's Stage 2A EMS.

AIE will operate a free 24-hour Community Information Line (1800 789 177) where members of the community can leave details about an inquiry, they may have regarding construction activities related to contamination and spoil. This message will be passed on to site personnel and/or the Stakeholder Engagement Team, as appropriate.

Initial responses to complaints will be provided within 24 hours of the complaint being received. As part of the response, a review of the activity will be undertaken. If required and possible, immediate changes will be made to reduce any impact on the community. In some cases, the issues cannot be resolved immediately, and ongoing actions might be required to resolve the issue.

All complaints related to contaminated spoil will be recorded in a Complaints and Disputes Register. The following information will be recorded for each complaint:

1. The date and time of the complaint.
2. The method by which the complaint was made.
3. Any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect.
4. The nature of the complaint.
5. The action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant.
6. If no action was taken by the licensee, the reasons why no action was taken.

The Complaints and Disputes Register will be maintained by the Project's HSE Manager or delegate, and will detail what the issue was, initial response provided, how and when the issue was resolved, and by whom.

Where resolving a complaint with a third party is protracted or develops into a dispute, the AIE HSE Manager shall escalate proactively to Senior Project Leadership (e.g., AIE Project Manager and/or Project Director) to assist with resolution. AIE will work proactively with the complainant to resolve the dispute including having face to face meetings, site familiarisation sessions and agreeing on actions to resolve the dispute. All communications and agreed actions shall be documented.

For the management and reporting of corrective actions (which may be required in response to a complaint), refer to the Project's Stage 2A EMS.

16. Inspections, monitoring and audits

Monitoring and auditing will be undertaken to determine the impact on the environment and identify opportunities for improvement. Monitoring to be implemented for specific actions or environmental issues (e.g., water quality monitoring, air quality monitoring) will be detailed in their relevant sub-plan and will specifically address the monitoring requirements for those issues.

16.1 Environmental inspections

16.1.1 AIE and Principal Contractor joint environmental weekly inspection

As a minimum, the AIE HSE Manager (or nominated delegate) will undertake weekly inspection of the work sites with the relevant Principal Contractor's environmental personnel (Environmental Representative or similar) to evaluate the effectiveness of environmental controls (inclusive of erosion and sediment control measures) and general compliance with the implementation of the CSP for site-based activities.

If any maintenance and/or deficiencies in environmental controls or in the standard of environmental performance are observed, they will be recorded on the checklist form. Records will also include details of any maintenance required, the nature of the deficiency, any actions required and an implementation priority.

Actions raised during inspections will be documented on the *Weekly Environmental Site Checklist* and will be issued formally through the Project's document management system to the relevant Contractor for action. If they represent an actual or potential significant environmental risk, these issues shall be reviewed at the Project Planning meetings and will have non-conformances raised if not closed out in the nominated timeframe (Nonconformance Report).

16.1.2 Contractor environmental inspections

In addition to the joint weekly environmental site inspection with AIE, the Principal Contractor will be required to undertake daily site environmental inspections, targeting key environmental risks commensurate with the activity being undertaken. The daily environmental site inspection will be documented on a checklist, or similar, to be prepared and completed by the Principal Contractor.

Copies of the daily environmental site inspection records are to be provide to AIE on request.

The HSE Manager is responsible for the initial reporting of significant non-compliances with the CSP or relevant legislation to the AIE Project Director and government authorities (refer to Section 17).

16.2 Monitoring

Monitoring will be undertaken to validate the impacts predicted for the work, to measure the effectiveness of management plans, environmental controls, and implementation of this CSP, and to address approval requirements.

Monitoring requirements applicable to the CSP include:

– Remediation goals relevant to subsequent removal and off-site emplacement of material, so that material can be appropriately managed and will pose no unacceptable risk to human health or the environment under those designated end uses.
– Document the particular remediation techniques and procedures selected to address the identified site contamination issues.
– Document a sampling and analysis plan to validate or characterise material exposed or excavated as part of the remediation works, including to address data gaps remaining from existing investigations.

– Document procedures to enable appropriate management of material prior to removal from site as part of subsequent stages of work. This CSP is not intended to provide procedures for the subsequent stages of material movement or off-site emplacement.
– Establish the various safeguards required to complete aspects of the remediation and materials handling work relating to contamination in a safe and environmentally acceptable manner.
– Identify the necessary approvals and licences required by regulatory authorities in order to enable Stage 2A works to proceed (in relation to contamination issues only).

16.3 Auditing

AIE will conduct internal audits at frequencies as determined in the risk-based auditing schedule. The purpose of auditing is to verify compliance with:

– The EMS and this CSP.
– Compliance with the requirements of relevant components outlined within the EMS and CSP, including but not limited to, site inspection compliance, document control / management, non-compliance, and incident management etc.
– Monitoring and reporting requirements as set out under EPL No. 21529.

Additional details regarding the auditing process are detailed in the Project's Stage 2A EMS.

16.4 Environmental reporting

16.4.1 DPIE reporting

Regular reports on compliance and other matters will be provided during the construction phase of the Project. This will include reporting to the DPIE in accordance with Schedule 4, Conditions 7 and 8 of the Infrastructure Approval (SSI 9471), with specific reference to the *Compliance Reporting Post Approval Requirements* (2020).

In addition, DPIE will be notified in writing of the date of commencement of each of the relevant phases of the Project in accordance with Schedule 2, Condition 8 of the Infrastructure Approval (SSI 9471).

Reporting applicable to this CSP will consist of:

– Contamination monitoring results.
– Requirements of EPL No. 21529.
– Construction works progress and appraisal of contaminated spoil quality controls.
– Environmental Incident Report(s), as required.
– Annual returns, as required by EPL No. 21529.

16.4.2 Other reporting requirements

A monthly environmental monitoring report will be developed for each calendar month which will include details of the monitoring results and frequencies and inclusion of any exceedance of EPL No. 21529 contamination monitoring limits / criteria. A copy of the monthly environmental monitoring report will be made available on the AIE Project website.

Further reporting requirements are provided in Section 16.6 and Section 17.

16.5 Compliance tracking register

A Compliance Tracking Register has been developed as a monitoring tool to assist with the compliance reporting requirement as set out under Condition 7, Schedule 4 of the Infrastructure Approval (SSI 9471) as follows:

Compliance Reporting

The proponent must provide regular compliance reports to the Department on the development in accordance with the relevant requirements of the Department's guideline Compliance Reporting Post Approval Requirements (2020), or its most recent edition.

The compliance tracking register includes a breakdown of the requirements from the following key approval and project documents:

– Infrastructure Approval (SSI 9471).
– EPL No. 21529.
– Requirements of this CSP.

The Compliance Tracking Register includes tabulation of reference conditions, the requirements, responsibility, status (i.e., ongoing, close-out, not triggered, etc.) and supporting evidence where required.

A routine review of the Compliance Tracking Register is undertaken by the AIE HSE Manager (or delegate) with input sought from the relevant contractors as required. The Compliance Tracking is a live document which is kept up to date for each stage of the construction works.

16.6 Non-conformance, corrective, and preventative actions

Non-conformances or potential non-conformances are situations or events that do not comply with the safeguards and procedures stipulated in the EMS or this CSP.

– As part of site inspections, supervision or monitoring of construction activities.
– During internal audits.
– Following justified / supported verbal or written third party complaints.

All non-conformances related to contaminated spoil will be managed and reported using the non-conformance function of the Project's document management system. Each non-conformance event and follow-up action will be documented and traceable, including identification of key dates and responsible personnel.

Additional details regarding corrective and preventative actions are outlined in the Project's Stage 2A EMS.

The Department must be notified in writing to compliance@planning.nsw.gov.au within 7 days after the identification of any non-compliance issue. The notification must identify the development, including the application number, set out the condition of approval that the development is non-compliant with, the way in which it does not comply, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non -compliance.

17. Incident management and emergency response

17.1 Incident management

17.1.1 Overview

Incidents are defined as an occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance. The consequences of such incidents may result in material environmental harm, damage, or asset loss. 'Near misses' are extraordinary events that could have reasonably resulted in an incident.

All incidents related to contaminated soil, including those of the Principal Contractor, its subcontractors, and visitors, that occur during the undertaking of the construction works for the Project will be managed to satisfy the requirements of AIE's Incident Reporting and Investigation System Requirements. Whilst it is noted that key Contractors will be implementing their own environmental management system procedures and processes, AIE will be responsible for ensuring that these systems and processes satisfy the requirements of the AIE EMS, including the incident management components. The Contractor will be responsible for providing all necessary documentation with regards to the incident investigation and close-out actions where required. The timing of the provision of this documentation is to align with the AIE requirements.

The AIE HSE Manager must be notified immediately of any environmental incident or near miss related to contamination and spoil. These may include, but are not limited to the following:

– Spill of any dangerous goods or hazardous substance to ground or water.
– Substantiated complaints received from members of the community or regulatory authorities.
– Regulatory breaches such as fines, prosecutions, improvement notices, breaches of licence conditions.
– All incidents of third-party property damage or loss.
– Incidents involving impact or potential damage to items or places of cultural heritage significance.
– Land-based off-site sediment loss to the environment, including sediment tracking onto the roadway.

The AIE HSE Manager will be responsible for regulatory notification of all notifiable environmental incidents (refer to Section 17.1.2 for notifiable incidents). All environmental incidents will be reported immediately to DPIE in writing via the Planning Portal after AIE becomes aware of the incident, as per Schedule 4 Condition 5 of the Infrastructure Approval (SSI 9471). The notification must identify the development, including the application number, and set out the location and nature of the incident.

In the event of a notifiable non-compliance incident arising, the Principal Contractor will notify the AIE HSE Manager immediately to allow the AIE HSE Manager to notify DPIE in writing (via the Planning Portal) within 7 days of AIE becoming aware of the non-compliance, as per Schedule 4 Condition 6 of the Infrastructure Approval (SSI 9471).The notification must identify the development, including the application number, set out the condition of approval that the development is non-compliant with, the way in which it does not comply, the reasons for the non- compliance (if known) and what actions have been taken, or will be taken, to address the non- compliance.

17.1.2 Notifiable incident under the POEO Act

In the event of a Notifiable Incident as defined under the POEO Act, AIE is responsible for immediately notifying the EPA, and any other relevant authority, of pollution incidents on or around the site via the EPA Environment Line (telephone 131 555) in accordance with Part 5.7 of the POEO Act. The circumstances where this will take place include:

– *If the actual or potential harm to the health or safety of human beings or ecosystems is not trivial.*

– *If actual or potential loss or property damage (including clean-up costs) associated with an environmental incident exceeds $10,000.*

Follow-up written notification to the EPA and any other relevant authorities will be required in accordance with the POEO Act and requirements of the EPA. This includes the provision of written details of the notification to the EPA within 7 days of the date on which the incident occurred.

All notifiable incidents will also be managed, documented, and reported in accordance with the AIE *Incident Reporting and Investigation System Requirement*.

In addition, an authorised officer of the EPA has the right to request a written report (in accordance with Condition R3 of the EPL No. 21529) if they suspect on reasonable grounds that an event has occurred at the licensed premises which has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies). The written report is to address all the requirements under Condition R3 of the EPL.

17.1.3 Notifiable incident under the Infrastructure Approval (SSI-9471)

In accordance with Condition 5 of Schedule 4, DPIE must be notified in writing to compliance@planning.nsw.gov.au immediately after AIE becomes aware of an incident on site.

Additional details regarding notifiable incidents and procedures are outlined in the Project's Stage 2A EMS.

17.2 Emergency response

Actual or potential emergency situations will vary in type and severity. The required level of response and notification will be at the discretion of the AIE Construction Manager in consultation with the AIE HSE Manager.

Any emergency situation may require only isolated containment and control or may require the complete evacuation of the site and notification of relevant emergency services. Consideration should be made of the response requirements for different situations. If at any time there is uncertainty on how to proceed, response should be for the worst possible scenario. Ultimately, the AIE Construction Manager or representative has authority and responsibility to instigate an evacuation if he/she feels it is warranted.

In the event of an emergency, the following plans shall be consulted and implemented, as relevant:

– The Principal Contractor's site-specific Emergency Response Plan.
– AIE Port Kembla Gas Terminal Emergency Spill Plan.
– Pollution Incident Response Management Plan (PIRMP).
– AIE Emergency Management Procedures.

18. Document management and review

18.1 Record management

Records and registers specified in this CSP for Stage 2A shall be maintained. Records to be kept may include but will not be limited to the following:

– Environmental Inspection Checklist.
– Environment Reporting.
– Environmental Monitoring Reports / Records.
– Fauna and Weed Register.
– Internal Audit Reports.
– Incident Reports and Register.
– Toolbox Talk Records.
– Induction Presentation and Register.
– Environmental Activities Safe Work Method Statement (SWMS).
– Corrective Actions Register.
– Waste and Resource Register.
– Material Tracking Register.
– Training Register / Matrix.
– Complaints Register.

18.2 Review and revision of CSP

This CSP will be reviewed and updated, as required under Condition 3 of Schedule 4 of Infrastructure Approval (SSI 9471) to ensure the objectives of the applicable approval conditions contained within are being met throughout Stage 2A.

In addition, as required under Condition 4 of Schedule 4 of Infrastructure Approval (SSI 9471), the CSP must be reviewed, and if necessary, revised within 3 months (unless otherwise agreed with DPIE) for any of the following:

– Following the submission of an incident report as per Condition 5, Schedule 4 4 of Infrastructure Approval (SSI 9471) (refer to Section 17).
– Following approval of any modification to the conditions of approval outlined in Infrastructure Approval (SSI 9471).
– At the direction of the Planning Secretary as per Condition 4, Schedule 2 4 of Infrastructure Approval (SSI 9471).

18.3 Access to information

AIE will make the following information publicly available on the PKGT website, as per Schedule 4, Condition 12 of the Infrastructure Approval (SSI 9471) and the requirements as set-out under the Project EPL No. 21529:

– The PKGT EIS.
– Current statutory approvals for the Project.
– Approved strategies, plans or programs required under the conditions of Infrastructure Approval (SSI 9471).
– A comprehensive summary of the monitoring results of the development, reported in accordance with the specification of any conditions, or any approved plans and programs relating to Infrastructure Approval (SSI 9471).
– A summary of complaints (updated monthly).
– Any independent environmental audit, and responses to the recommendations in any audit.

– The approved premises map (EPL No. 21259, Condition A2.4).
– PIRMP (EPL No. 21529, Condition E2).
– Any other matter required by the Planning Secretary.

This information will be kept up to date by AIE when required.

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Limitations

This Berth 101 Contaminated Spoil Protocol ("CSP"):

- Has been prepared by GHD Pty Ltd ("GHD") for Australian Industrial Energy (AIE).
- May be used and relied on by AIE.
- May be used by and provided to the Site Auditor acting as an agent of AIE in this respect.
- May be used by and provided to the NSW EPA and the relevant planning authority for the purpose of meeting statutory obligations in accordance with the relevant sections of the CLM Act 1997 or the Environment Planning and Assessment (EP&A) Act 1979.
- May only be used for the purpose as stated in Section 1 of the CSP (and must not be used for any other purpose).

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than AIE arising from or in connection with this CSP.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the CSP are excluded unless they are expressly stated to apply in this CSP.

The services undertaken by GHD in connection with preparing this CSP:

- Were limited to those specifically detailed in Section 8 of this CSP.
- Were undertaken in accordance with current profession practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this CSP and any previous site investigations referred to in the CSP.

The opinions, conclusions and any recommendations in this CSP are based on assumptions made by GHD when undertaking services and preparing the CSP ("Assumptions"), as specified throughout this CSP.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the CSP, the opinions, conclusions and any recommendations in this RAP are based on conditions encountered and information reviewed at the time of preparation of this CSP and are relevant until such times as the site conditions or relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this CSP arising from or in connection with those opinions, conclusions and any recommendations."

This CSP is based solely on the investigations and findings contained in the reports referenced in the CSP and on the conditions encountered and information reviewed at the time of each Report. This CSP should be read in conjunction with the referenced Reports. It is also subject to all the limitations and recommendations in the referenced Reports.

GHD has prepared this CSP on the basis of information provided by AIE and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked ("Unverified Information") beyond the agreed scope of work.

GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the CSP, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

The opinions, conclusions and any recommendations in this CSP are based on information obtained from, and testing undertaken at or in connection with, specific sampling points and may not fully represent the conditions that may be encountered across the site at other than these locations. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this CSP are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this CSP.

GHD has considered and/or tested for only those chemicals specifically referred to in this CSP and makes no statement or representation as to the existence (or otherwise) of any other chemicals.

Site conditions (including any the presence of hazardous substances and/or site contamination) may change after the date of this CSP. GHD expressly disclaims responsibility:

– Arising from, or in connection with, any change to the site conditions
– To update this CSP if the site conditions change

Except as otherwise expressly stated in this CSP GHD makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials ("ACM") on the site. If fill material has been imported on to the site at any time, or if any buildings constructed prior to 1970 have been demolished on the site or material from such buildings disposed of on the site, the site may contain asbestos or ACM.

Subsurface conditions can vary across a particular site and cannot be exhaustively defined by the investigations carried out prior to this CSP. As a result, it is unlikely that the results and estimations expressed or used to compile this CSP will represent conditions at any location other than the specific points of sampling. A site that appears to be unaffected by contamination at the time of the reports attached to this CSP may later, due to natural causes or human intervention, become contaminated.

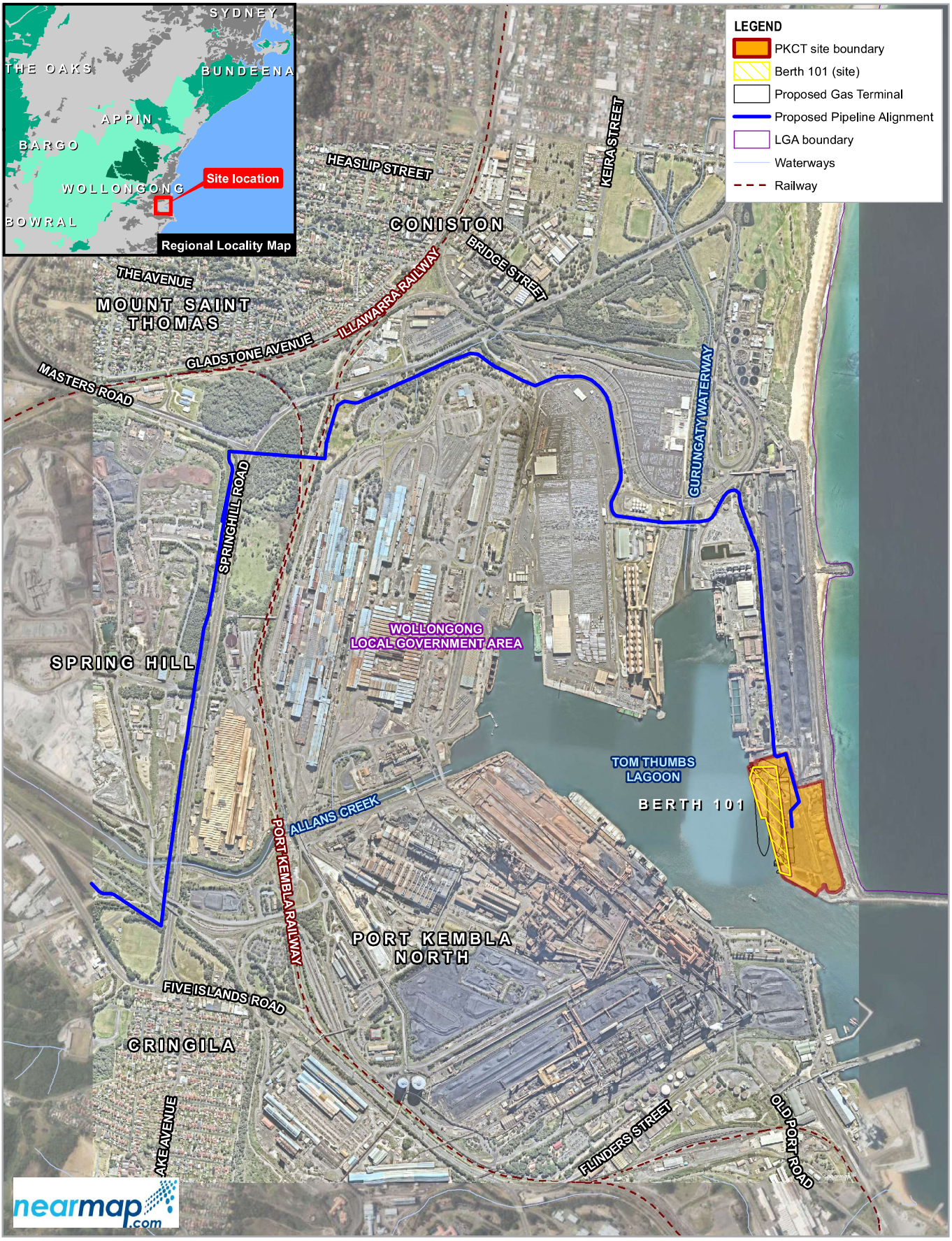
Except as otherwise expressly stated in this CSP, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

These Disclaimers should be read in conjunction with the entire CSP. This CSP must be read in full and no excerpts are taken to be representative of the findings of this CSP.

Appendices

Appendix A

Figures



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Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Australian Industrial Energy
Berth 101 LNG Facility, Port Kembla, NSW
Remediation Works Plan

Project No. **21-27477**
Revision No. **-**
Date **25/02/2021**

Remediation Works Plan – Berth 101

FIGURE 1

Data source: Aerial imagery - nearmap 2021 (image date 16/04/2018, date extracted 01/08/2018) & sixmaps 2021 © Department of Customer Service 2020; General topo - NSW LPI DTDB 2017, 2015 & 2015; Inset map - Geoscience Australia; Berth footprint - Australian Industrial Energy. Created by: kschroder-turner

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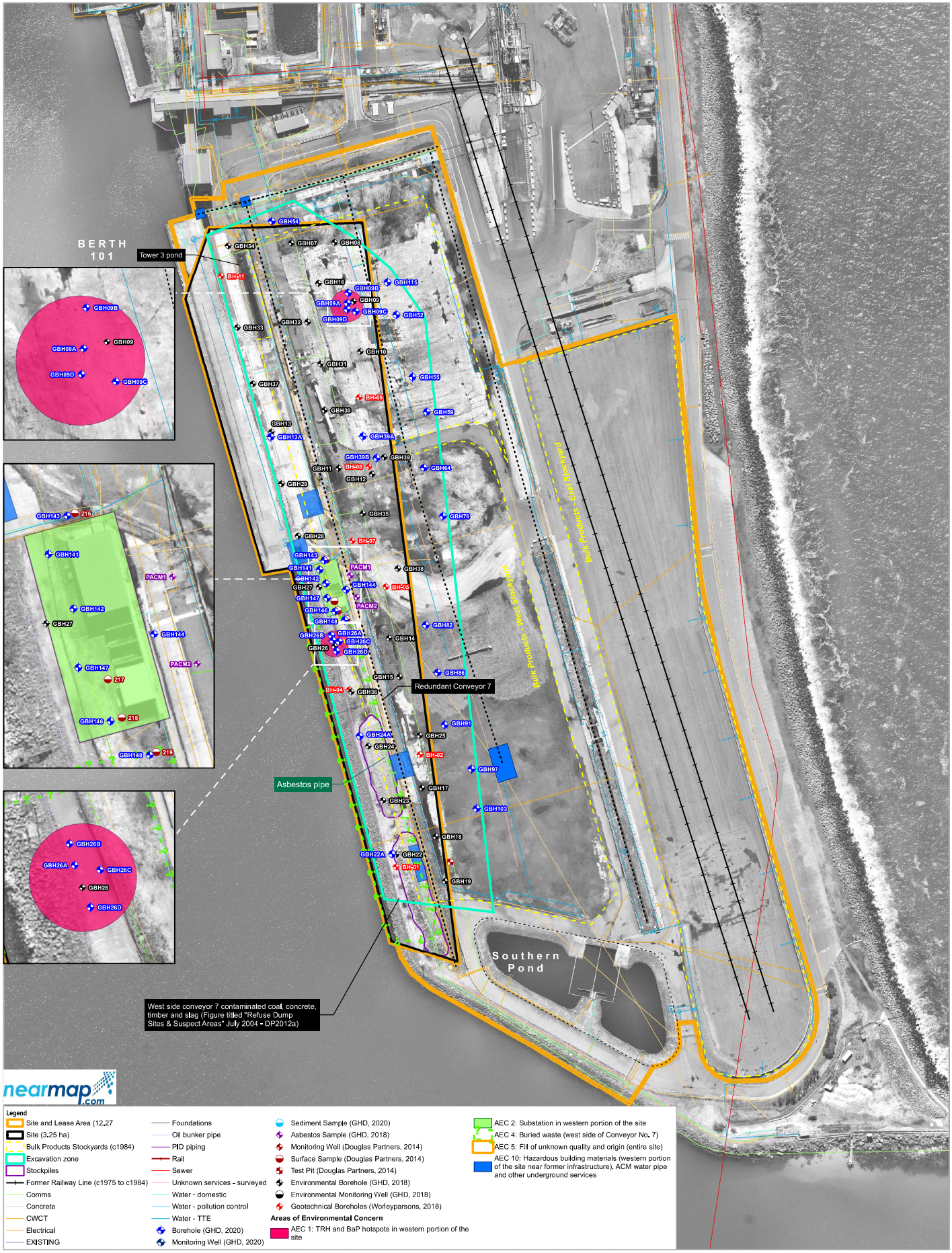

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Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Australian Industrial Energy
Berth 101 LNG Facility, Port Kembla, NSW
Baseline Contamination Assessment

Project No. 21-27477
Revision No. A
Date 25/02/2021

Site Layout Plan showing AECs

FIGURE 2

N:\AU\Sydney\Projects\21\27477\GIS\Maps\Deliverables\Contam\BerthRW\21_27477_Z002_RWP_SampleLayoutPlan.mxd

Data source: Aerial imagery - nearmap 2021 (image date 05/09/2020, date extracted 20/10/2020); General topo - NSW LPI DTDB 2017, 2015 & 2012; Berth footprint - Australian Industrial Energy; Survey - PKCT 2020. Created by: kschroder-turner

Appendix B

Summary of table results

Appendix B

Table LR1

Summary of soil analytical results - Proposed excavation area in remediation works plan

	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand*				NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil
								0-1m	*1-2m*	*2-4m*	*>=4m*	
Metals												
Arsenic	mg/kg	2					3,000[#2]					
Cadmium	mg/kg	0.4					900					
Chromium (III+VI)	mg/kg	5					3,600[#3]					
Copper	mg/kg	5					240,000					
Lead	mg/kg	5					1,500[#4]					
Mercury	mg/kg	0.1					730[#5]					
Nickel	mg/kg	5					6,000					
Zinc	mg/kg	5					400,000					
BTEXN												
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*	
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
TRH - NEPM 2013												
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL[#1]*	
C6-C10 Fraction	mg/kg	10										700[#9]
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
>C10-C16 Fraction	mg/kg	50										1,000[#9]
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000
TRH - NEPM 1999												
C6-C9 Fraction	mg/kg	10										
C10-C14 Fraction	mg/kg	20										
C15-C28 Fraction	mg/kg	50										
C29-C36 Fraction	mg/kg	50										
PAHs - standard 16												
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]					
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]					
OTHER												
Ammonia (as N)	mg/kg											
Cyanide (total)	mg/kg						1,500					
ASBESTOS												
PCBs												
Arochlor 1016	µg/kg	500										
Arochlor 1221	µg/kg	100										
Arochlor 1232	µg/kg	500										
Arochlor 1242	µg/kg	500										
Arochlor 1248	µg/kg	500										
Arochlor 1254	µg/kg	500										
Arochlor 1260	µg/kg	500										
PCBs (Total)	µg/kg	100					7,000					

Location Code	BH05	BH08	BH09	BH11				PACM1	PACM2	GBH07		GBH08	GBH09			GBI
Date	23-Aug-18	28-Aug-18	23-Aug-18	13-Aug-18		14-Aug-18	15-Aug-18	21-Aug-18	21-Aug-18	10-Sep-18		23-Aug-18	23-Aug-18			18/1
Field ID	BH05/15.5-15.95	BH08/16.0-16.45	BH09/16.0	BH11/0.2-0.3	BH11/1.5-2.0	BH11/9.1-9.5	BH11/19.6-20.0	PACM1	PACM2	GBH07/6.7-7.0	GBH07/8.7-9.0	GBH08/0.1-0.3	GBH09/0.1-0.3	GBH09/0.75-1.0	GBH09/4.2-4.4	GBH 09A 5.0-5.3
Depth	15.5-15.95	16.0-16.45	16.00	0.2-0.3	1.5-2.0	9.1-9.5	19.6-20.0	Surface	Surface	6.7-7.0	8.7-9.0	0.1-0.3	0.1-0.3	0.75-1.0	4.2-4.4	5 - 5.3
Sample Type	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Metals																
Arsenic	6.5	17	15	-	5.2	5.9	15	-	-	5.6	54	< 2	-	2.4	16	-
Cadmium	< 0.4	< 0.4	< 0.4	-	< 0.4	< 0.4	< 0.4	-	-	< 0.4	< 0.4	< 0.4	-	< 0.4	< 0.4	-
Chromium (III+VI)	8.2	15	18	-	5.7	< 5	25	-	-	< 5	< 5	6.9	-	87	11	-
Copper	9.0	22	17	-	9.4	< 5	29	-	-	< 5	< 5	5.5	-	8.1	20	-
Lead	< 5	12	9.8	-	9.0	< 5	10	-	-	< 5	< 5	< 5	-	9.8	20	-
Mercury	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	-
Nickel	< 5	7.5	11	-	< 5	< 5	< 5	-	-	< 5	< 5	< 5	-	8.3	7.6	-
Zinc	12	24	29	-	35	30	11	-	-	< 5	6.2	9.8	-	32	76	-
BTEXN																
Benzene	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	<0.1
Toluene	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	<0.1
Ethylbenzene	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	0.1	-	< 0.1	< 0.1	<0.1
Xylene Total	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	<0.3
TRH - NEPM 2013																
F1 (C6-C10 minus BTEX)	< 20	< 20	< 20	-	< 20	< 20	< 20	-	-	< 20	< 20	< 20	-	< 20	< 20	<20
C6-C10 Fraction	< 20	< 20	< 20	-	< 20	< 20	< 20	-	-	< 20	< 20	< 20	-	< 20	< 20	<20
F2 (>C10-C16 minus Naphthalene)	< 50	< 50	< 50	-	< 50	< 50	< 50	-	-	< 50	< 50	< 50	-	< 50	130	<50
>C10-C16 Fraction	< 50	< 50	< 50	-	< 50	< 50	< 50	-	-	< 50	< 50	< 50	-	< 50	130	<50
F3 (>C16-C34 Fraction)	< 100	< 100	< 100	-	< 100	2,600	< 100	-	-	< 100	< 100	< 100	-	< 100	5,400	<100
F4 (>C34-C40 Fraction)	< 100	< 100	< 100	-	< 100	1,100	< 100	-	-	< 100	< 100	< 100	-	< 100	500	<100
TRH - NEPM 1999																
C6-C9 Fraction	<20	<20	<20	-	<20	<20	<20	-	-	<20	<20	<20	-	<20	<20	<20
C10-C14 Fraction	<20	<20	<20	-	<20	<20	<20	-	-	<20	<20	<20	-	32	42	<20
C15-C28 Fraction	<50	<50	<50	-	<50	1300	<50	-	-	<50	<50	72	-	78	3800	<50
C29-C36 Fraction	<50	<50	<50	-	<50	1800	<50	-	-	<50	<50	<50	-	<50	1600	<50
PAHs - standard 16																
Naphthalene	< 0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	< 0.5	-	-	< 0.5	< 0.5	< 0.5	-	< 0.5	4.4	<0.5
PAHs (Sum of total)	< 0.5	< 0.5	< 0.5	-	12.4	< 0.5	< 0.5	-	-	< 0.5	< 0.5	< 0.5	-	< 0.5	1,552	1.6
Total 8 PAHs (as BaP TEQ) (half LOR)	0.6	0.6	0.6	-	1.8	0.6	0.6	-	-	0.6	0.6	0.6	-	0.6	150	0.6
OTHER																
Ammonia (as N)	< 5	-	5	-	-	< 5	16	-	-	-	-	-	-	-	-	-
Cyanide (total)	< 5	-	< 5	-	-	< 5	< 5	-	-	-	-	-	-	-	-	-
ASBESTOS	-	-	-	ND	-	-	-	**Chrysotile, amosite, crocidolite**	**Chrysotile, amosite**	-	-	ND	ND	-	-	-
PCBs																
Arochlor 1016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code																													
Date																													
Field ID																													
Depth																													
Sample Type																													
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil	H09A 1/2020 C18 5 - 5.3 Field_D	H09A 1/2020 QC18A 5 - 5.3 Interlab_D	GBH09B 18/11/2020 GBH 09B 4.9-5. 4.9 - 5 Primary	GBH09B 19/11/2020 GBH 09B 4.2-4. 4.2 - 4.4 Primary	GBH09C 17/11/2020 GBH 09C 4.3-4. 4.3 - 4.5 Primary	GBH09C 17/11/2020 GBH 09C 5.3-5. 5.3 - 5.5 Primary	GBH09D 17/11/2020 GBH 09D 4.7-5. 4.7 - 5 Primary	GBH09D 19/11/2020 GBH 09D 4.2-4. 4.2 - 4.4 Primary	GBH10 24-Aug-18 GBH10/0.1-0.3 0.1-0.3 Primary	GBH10 24-Aug-18 QC8 0.1-0.3 Field_D	GBH10 24-Aug-18 QC8A 0.1-0.3 Interlab_D	GBH11 24-Aug-18 GBH11/0.05-0.3 0.05-0.3 Primary	GBH11 24-Aug-18 GBH11/1.4-1.6 1.4-1.6 Primary	GBH12 24-Aug-18 GBH12/0.5-0.7 0.5-0.7 Primary	GBH12 27-Aug-18 GBH12/1.7-1.2 1.7-1.2 Primary	GBH13 22-Aug-18 GBH13/1.0-1.1 1.0-1.1 Primary	GBH13 22-Aug-18 GBH13/2.7-3.0 2.7-3.0 Primary
Metals																													
Arsenic	mg/kg	2					3,000[#2]						-	-	-	-	-	-	-	-	< 2	< 2	<5	< 2	< 2	-	3.9	< 2	5.8
Cadmium	mg/kg	0.4					900						-	-	-	-	-	-	-	-	< 0.4	< 0.4	<1	< 0.4	< 0.4	-	< 0.4	< 0.4	< 0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]						-	-	-	-	-	-	-	-	< 5	8.1	3.0	< 5	8.3	-	9.3	6.8	< 5
Copper	mg/kg	5					240,000						-	-	-	-	-	-	-	-	< 5	< 5	<5	200	25	-	11	< 5	< 5
Lead	mg/kg	5					1,500[#4]						-	-	-	-	-	-	-	-	< 5	< 5	<5	11	< 5	-	16	< 5	7.9
Mercury	mg/kg	0.1					730[#5]						-	-	-	-	-	-	-	-	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Nickel	mg/kg	5					6,000						-	-	-	-	-	-	-	-	< 5	< 5	<2	< 5	< 5	-	< 5	< 5	< 5
Zinc	mg/kg	5					400,000						-	-	-	-	-	-	-	-	< 5	< 5	<5	61	17	-	75	< 5	29
BTEXN																													
Benzene	mg/kg	0.1	430	1,100	77	160		3	3	3	3		<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.2	<0.2	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.2	<0.5	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.2	<0.5	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		230	NL[#1]	NL[#1]	NL[#1]		<0.3	<0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	< 0.3	< 0.6	<0.5	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3
TRH - NEPM 2013																													
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	NL[#1]		<20	<10	<20	<20	<20	<20	<20	<20	< 20	< 40	<10	< 20	< 20	-	< 20	< 20	< 20
C6-C10 Fraction	mg/kg	10										700[#9]	<20	<10	<20	<20	<20	<20	<20	<20	< 20	< 40	<10	< 20	< 20	-	< 20	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<50	<50	<50	<50	<50	<50	<50	<50	< 50	< 50	<50	< 50	< 50	-	< 50	< 50	< 50
>C10-C16 Fraction	mg/kg	50										1,000[#8]	<50	<50	<50	<50	<50	<50	<50	<50	< 50	< 50	<50	< 50	< 50	-	< 50	< 50	< 50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	<100	<100	<100	<100	<100	<100	<100	<100	< 100	< 100	<100	< 100	< 100	-	< 100	< 100	170
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	<100	<100	<100	<100	<100	<100	<100	<100	< 100	< 100	<100	< 100	< 100	-	< 100	< 100	< 100
TRH - NEPM 1999																													
C6-C9 Fraction	mg/kg	10											<20	<10	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	<20	<20	<20
C10-C14 Fraction	mg/kg	20											<20	<50	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	<20	<20	<20
C15-C28 Fraction	mg/kg	50											<50	<100	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	65	-	<20	<20	130
C29-C36 Fraction	mg/kg	50											<50	<100	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	62
PAHs - standard 16																													
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	< 0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	47
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-	0.6	0.6	6.5
OTHER																													
Ammonia (as N)	mg/kg												-	-	-	-	-	-	-	-	< 5	< 10	< 20	-	< 5	-	-	-	< 5
Cyanide (total)	mg/kg						1,500						-	-	-	-	-	-	-	-	< 5	< 5	*	-	< 5	-	-	-	< 5
ASBESTOS													-	-	-	-	-	-	-	-	ND	-	-	-	ND	ND	-	ND	-
PCBs																													
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
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#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code													GBH13A			GBH14	GBH15	GBH16		GBH17		GBH18		GBH19	GBH20		G
Date												31-Aug-18	17/11/2020			10-Sep-18	27-Aug-18	12-Sep-18		27-Aug-18		27-Aug-18		27-Aug-18	10-Sep-18		22
Field ID													GBH 13A 2.8-3.0	GBH13A_3.4-3.5		GBH14/1.7-2.0	GBH14/2.7-3.0	GBH16/5.7-6.0	GBH16/9.7-1.0	GBH17/1.5-1.7	GBH17/3.7-4.0	GBH18/0.5-0.7	GBH18/4.7-5.0	GBH19/0.5-0.7	GBH20/6.7-7.0	GBH20/8.7-9.0	GBH21/0.5-0.7
Depth													2.8 - 3	3.4-3.5		1.7-2.0	2.7-3.0	5.7-6.0	9.7-10.0	1.5-1.7	3.7-4.0	0.5-0.7	4.7-5.0	0.5-0.7	6.7-7.0	8.7-9.0	0.5-0.7
Sample Type													Primary	Primary		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil															
Metals																											
Arsenic	mg/kg	2					3,000[#2]						7.2	-	-	3.3	5.6	4.8	2.2	4.4	5.9	3.8	6.0	< 2	4.4	6.0	6.2
Cadmium	mg/kg	0.4					900						< 0.4	-	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]						< 5	-	-	< 5	< 5	< 5	< 5	6.3	< 5	9.7	< 5	8.3	< 5	< 5	21
Copper	mg/kg	5					240,000						< 5	-	-	< 5	< 5	< 5	< 5	5.7	< 5	6.1	< 5	18	8.7	5.7	17
Lead	mg/kg	5					1,500[#4]						< 5	-	-	< 5	7.3	< 5	< 5	7.3	11	12	< 5	< 5	13	16	16
Mercury	mg/kg	0.1					730[#5]						< 0.1	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Nickel	mg/kg	5					6,000						< 5	-	-	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	9.7
Zinc	mg/kg	5					400,000						< 5	-	-	13	50	< 5	< 5	57	68	93	21	21	83	83	81
BTEXN																											
Benzene	mg/kg	0.1	430	1,100	77	160		3	3	3	3		-	<0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		-	<0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		-	<0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		230	NL[#1]	NL[#1]	NL[#1]		-	<0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
TRH - NEPM 2013																											
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	NL[#1]		-	<20	<20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
C6-C10 Fraction	mg/kg	10										700[#9]	-	<20	<20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		-	<50	50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
>C10-C16 Fraction	mg/kg	50										1,000[#8]	-	<50	50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	-	110	1700	< 100	< 100	< 100	< 100	< 100	< 100	100	< 100	< 100	< 100	< 100	< 100
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	-	<100	360	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100
TRH - NEPM 1999																											
C6-C9 Fraction	mg/kg	10											-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C10-C14 Fraction	mg/kg	20												<20	26	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C15-C28 Fraction	mg/kg	50												71	1300	<20	<20	<20	<20	<50	<50	86	<50	50	<50	<50	<50
C29-C36 Fraction	mg/kg	50												52	600	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
PAHs - standard 16																											
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		-	<0.5	1.1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						-	28.9	581	< 0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						-	4.9	65	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
OTHER																											
Ammonia (as N)	mg/kg												-	-	-	-	-	-	-	-	< 5	-	-	-	-	< 5	-
Cyanide (total)	mg/kg						1,500						-	-	-	-	-	-	-	-	< 5	-	-	-	-	< 5	-
ASBESTOS													-	-	-	-	-	-	-	-	-	ND	-	ND	-	-	ND
PCBs																											
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
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Appendix B

Table LR1

Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code													BH21	GBH22			GBH22A			GBH22A					
Date													Aug-18	22-Aug-18		31-Aug-18	20/11/2020			20/11/2020					
Field ID													GBH21/1.5-1.8	GBH22/0.4-0.5	GBH22/3.2-3.5	GBH22/5.2-5.5	GBH 022A 0.4-0.5	GBH 022A 6.2-6.5	GBH 022A 8.0-8.5	GBH 022A 10.0-10.3	GBH 022A 12.0-12.5	GBH 022A 13.5-14.5	GBH23/0.5-0.7	GBH23/8.7-9.0	
Depth													1.5-1.8	0.4-0.5	3.2-3.5	5.2-5.5	0.4 - 0.5	6.2 - 6.5	8 - 8.5	10 - 10.3	12 - 12.5	13.5 - 14	0.5-0.7	8.7-9.0	
Sample Type													Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand*				NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil														
								0-1m	*1-2m*	*2-4m*	*>=4m*														
Metals																									
Arsenic	mg/kg	2					3,000[#2]						6.1	5.2	4.9	9.0	-	6.4	3.3	5.9	<2	2.4	3.9	9.2	
Cadmium	mg/kg	0.4					900						< 0.4	< 0.4	< 0.4	< 0.4	-	<0.4	<0.4	<0.4	<0.4	<0.4	< 0.4	< 0.4	
Chromium (III+VI)	mg/kg	5					3,600[#3]						16	13	< 5	< 5	-	<5	6.4	5.9	<5	9.5	13	20	
Copper	mg/kg	5					240,000						21	16	< 5	< 5	-	<5	<5	<5	<5	14	25	31	
Lead	mg/kg	5					1,500[#4]						33	11	11	< 5	-	<5	<5	<5	<5	11	25	69	
Mercury	mg/kg	0.1					730[#5]						< 0.1	< 0.1	< 0.1	< 0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1	
Nickel	mg/kg	5					6,000						6.7	6.8	< 5	< 5	-	<5	<5	<5	<5	<5	< 5	14	
Zinc	mg/kg	5					400,000						170	62	81	22	-	5.5	<5	<5	<5	16	230	520	
BTEXN																									
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*		< 0.1	< 0.1	< 0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1	
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.1	< 0.1	< 0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1	
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.1	< 0.1	< 0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1	
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.3	< 0.3	< 0.3	-	-	<0.3	<0.3	<0.3	<0.3	<0.3	< 0.3	< 0.3	
TRH - NEPM 2013																									
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL[#1]*		< 20	< 20	< 20	-	-	<20	<20	<20	<20	<20	< 20	< 20	
C6-C10 Fraction	mg/kg	10										700[#9]	< 20	< 20	< 20	-	-	<20	<20	<20	<20	<20	< 20	< 20	
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 50	< 50	< 50	-	-	<50	<50	<50	98	<50	55	< 50	
>C10-C16 Fraction	mg/kg	50										1,000[#8]	< 50	< 50	< 50	-	-	<50	<50	<50	98	<50	55	< 50	
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	< 100	< 100	< 100	-	-	<100	<100	<100	<100	<100	170	< 100	
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	< 100	< 100	< 100	-	-	<100	<100	<100	<100	<100	< 100	< 100	
TRH - NEPM 1999																									
C6-C9 Fraction	mg/kg	10											<20	<20	<20	-	-	<20	<20	<20	<20	<20	<20	<20	
C10-C14 Fraction	mg/kg	20											<20	<20	<20	-	-	<20	<20	<20	35	<20	45	<20	
C15-C28 Fraction	mg/kg	50											<50	<50	<50	-	-	57	<50	<50	130	<50	140	<50	
C29-C36 Fraction	mg/kg	50											<50	<50	<50	-	-	<50	<50	<50	<50	<50	52	<50	
PAHs - standard 16																									
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.5	< 0.5	< 0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	1.4	
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						< 0.5	20	< 0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.2	2.0	
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						0.6	1.8	0.6	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
OTHER																									
Ammonia (as N)	mg/kg												-	-	< 5	-	-	-	-	-	-	-	-	-	
Cyanide (total)	mg/kg						1,500						-	-	< 5	-	-	-	-	-	-	-	-	-	
ASBESTOS													-	ND	-	-	-	-	-	-	-	-	-	-	
PCBs																									
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	-	

Table notes:

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration

#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).

#3 In the absence of a guideline value for total chromium, chromium VI value adopted

#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be

#5 Elemental mercury: HIL does not address elemental mercury, a site specific assessment should be considered if elemental mercury is present, or suspected to be

#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &

#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its

#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.

#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code																										
Date																										
Field ID																										
Depth																										
Sample Type																										
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil	GBH23 11-Sep-18 GBH23/9.7-10.0 9.7-10.0 Primary	GBH23 11-Sep-18 QC18 9.7-10.0 Field_D	GBH23 11-Sep-18 QC18A 9.7-10.0 Interlab_D	GBH24 21-Aug-18 GBH24/0.0-0.3 0.0-0.3 Primary	GBH24 21-Aug-18 GBH24/3.7-3.9 3.7-3.9 Primary	GBH24A 20/11/2020 GBH 024A 0.0-0.3 0 - 0.3 Primary	GBH25 27-Aug-18 GBH25/2.5-2.7 2.5-2.7 Primary	GBH26 21-Aug-18 GBH26/0.05-0.4 0.05-0.4 Primary	GBH26 21-Aug-18 GBH26/0.4-0.6 0.4-0.6 Primary	GBH26 21-Aug-18 GBH26/4.75-4.9 4.75-4.9 Primary	GBH026A 18/11/2020 GBH 026A 0.1-0.3 0.1 - 0.3 Primary	GBH026A 18/11/2020 GBH 026A 5.0-5.3 5 - 5.3 Primary	GBH026A 18/11/2020 GBH 026A 5.4-5.5 5.4 - 5.5 Primary	GBH026A 19/11/2020 GBH 026A 5.8-6.0 5.8 - 6 Primary	GBH026A 19/11/2020 GBH 026A 9.0-9.5 9 - 9.5 Primary
Metals																										
Arsenic	mg/kg	2					3,000[#2]						2.8	6.4	8	2.3	5.1	3.2	5.0	2.3	3.2	7.5	<2	4.4	-	-	3.9
Cadmium	mg/kg	0.4					900						< 0.4	< 0.4	<1	< 0.4	< 0.4	<0.4	< 0.4	< 0.4	< 0.4	< 0.4	<0.4	<0.4	-	-	<0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]						< 5	11	10	17	< 5	25	< 5	15	< 5	7.3	8.2	<5	-	-	7.1
Copper	mg/kg	5					240,000						< 5	18	9	140	< 5	180	< 5	220	< 5	6.1	<5	<5	-	-	<5
Lead	mg/kg	5					1,500[#4]						< 5	42	25	50	9.1	180	9.7	11	5.1	19	<5	<5	-	-	<5
Mercury	mg/kg	0.1					730[#5]						< 0.1	< 0.1	<0.1	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	-	-	0.1
Nickel	mg/kg	5					6,000						< 5	10	5	9.9	< 5	15	< 5	6.5	< 5	< 5	<5	<5	-	-	<5
Zinc	mg/kg	5					400,000						< 5	350	235	330	68	1,300	76	76	27	140	8.4	35	-	-	<5
BTEXN																										
Benzene	mg/kg	0.1	430	1,100	77	160		3	3	3	3		< 0.1	< 0.1	<0.2	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 0.1	< 0.1	<0.5	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 0.1	< 0.1	<0.5	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		230	NL[#1]	NL[#1]	NL[#1]		< 0.3	< 0.3	<0.5	< 0.3	< 0.3	<0.3	< 0.3	< 0.3	< 0.3	< 0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TRH - NEPM 2013																										
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	NL[#1]		< 20	< 20	<10	< 20	< 20	<20	< 20	< 20	< 20	< 20	<20	<20	<20	<20	<20
C6-C10 Fraction	mg/kg	10										700[#9]	< 20	< 20	<10	< 20	< 20	<20	< 20	< 20	< 20	< 20	<20	<20	<20	<20	<20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 50	< 50	<50	98	< 50	<50	< 50	< 50	< 50	160	<50	<50	<50	<50	<50
>C10-C16 Fraction	mg/kg	50										1,000[#8]	< 50	< 50	<50	98	< 50	<50	< 50	< 50	< 50	160	<50	<50	<50	<50	<50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	< 100	< 100	<100	390	< 100	180	< 100	290	< 100	**4,100**	<100	<100	<100	<100	<100
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	< 100	< 100	<100	< 100	< 100	<100	< 100	290	< 100	350	<100	<100	<100	<100	<100
TRH - NEPM 1999																										
C6-C9 Fraction	mg/kg	10											<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C10-C14 Fraction	mg/kg	20											<20	<20	<20	61	<20	<20	<20	31	<20	45	<20	<20	<20	<20	<20
C15-C28 Fraction	mg/kg	50											<50	<50	<50	290	<50	130	<50	140	<50	3000	<50	<50	<50	<50	<50
C29-C36 Fraction	mg/kg	50											<50	<50	<50	150	<50	<50	<50	240	<50	1200	<50	<50	<50	<50	<50
PAHs - standard 16																										
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 0.5	0.6	<0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	< 0.5	3.4	-	<0.5	<0.5	<0.5	<0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						< 0.5	0.6	15.8	9.4	< 0.5	2	< 0.5	1.5	< 0.5	1.111	-	<0.5	<0.5	<0.5	<0.5
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						0.6	0.6	1.8	0.7	0.6	0.6	0.6	0.6	0.6	110	-	0.6	0.6	0.6	0.6
OTHER																										
Ammonia (as N)	mg/kg												< 5	< 5	-	-	< 5	-	-	-	< 5	-	-	-	-	-	-
Cyanide (total)	mg/kg						1,500						< 5	< 5	-	-	< 5	-	-	-	< 5	-	-	-	-	-	-
ASBESTOS													-	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-
PCBs																										
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury, a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98), HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code													GBH26A		GBH026B	GBH026B	GBH026C		GBH026D				GBH27			
Date													19/11/2020		18/11/2020	18/11/2020	17/11/2020		18/11/2020				28-Aug-18		29-Aug-18	
Field ID													GBH 026A 11.0-11.5	GBH 026A 13.5-14.0	GBH 026B 4.7-4.9	GBH 026B 5.7-6.0	GBH 026C 4.7-4.8	GBH 026C 4.8-5.0	GBH 026D 4.7-4.8	GBH 026D 5.7-6.0	QC20	QC20A	GBH27/1	GBH27/5.7-6.0	GBH27/8.7-9.0	GBH28/1.4-1.6
Depth													11 - 11.5	13.5 - 14	4.7 - 4.9	5.7 - 6	4.7 - 4.8	4.8 - 5	4.7 - 4.8	5.7 - 6	4.7 - 4.8	4.7 - 4.8	1.7-2.0	5.7-6.0	8.7-9.0	1.4-1.6
Sample Type													Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Field_D	Interlab_D	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand* 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil															
Metals																										
Arsenic	mg/kg	2					3,000[#2]						<2	<2	-	-	-	-	-	-	-	-	-	6.0	3.1	2.9
Cadmium	mg/kg	0.4					900						<0.4	<0.4	-	-	-	-	-	-	-	-	-	< 0.4	< 0.4	< 0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]						<5	<5	-	-	-	-	-	-	-	-	-	< 5	8.7	< 5
Copper	mg/kg	5					240,000						<5	6.2	-	-	-	-	-	-	-	-	-	< 5	< 5	< 5
Lead	mg/kg	5					1,500[#4]						<5	<5	-	-	-	-	-	-	-	-	-	< 5	6.0	5.3
Mercury	mg/kg	0.1					730[#5]						<0.1	<0.1	-	-	-	-	-	-	-	-	-	< 0.1	< 0.1	< 0.1
Nickel	mg/kg	5					6,000						<5	<5	-	-	-	-	-	-	-	-	-	< 5	< 5	< 5
Zinc	mg/kg	5					400,000						<5	<5	-	-	-	-	-	-	-	-	-	< 5	< 5	30
BTEXN																										
Benzene	mg/kg	0.1	430	1,100	77	160		3	3	3	3		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	< 0.1	< 0.1	< 0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	-	< 0.1	< 0.1	< 0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	-	< 0.1	< 0.1	< 0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		230	NL[#1]	NL[#1]	NL[#1]		<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	-	< 0.3	< 0.3	< 0.3
TRH - NEPM 2013																										
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	NL[#1]		<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	-	< 20	< 20	< 20
C6-C10 Fraction	mg/kg	10										700[#9]	<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	-	< 20	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	< 50	< 50	< 50
>C10-C16 Fraction	mg/kg	50										1,000[#8]	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	< 50	< 50	< 50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	<100	<100	<100	<100	410	<100	<100	<100	<100	<100	-	< 100	< 100	< 100
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	< 100	< 100	< 100
TRH - NEPM 1999																										
C6-C9 Fraction	mg/kg	10											<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	-	< 20	< 20	< 20
C10-C14 Fraction	mg/kg	20											22	<20	<20	<20	<20	<20	<20	<20	<20	<50	-	< 20	< 20	< 20
C15-C28 Fraction	mg/kg	50											75	<50	<50	<50	300	<50	<50	<50	<50	<100	-	< 20	< 20	< 50
C29-C36 Fraction	mg/kg	50											<50	<50	<50	<50	88	<50	<50	<50	<50	<100	-	< 50	< 50	< 50
PAHs - standard 16																										
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	-	-	< 0.5	< 0.5	< 0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						<0.5	<0.5	<0.5	15.4	137.6	<0.5	1.4	<0.5	<0.5	<0.5	-	< 0.5	< 0.5	< 0.5
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						0.6	0.6	0.6	2.3	18	0.6	0.6	0.6	0.6	0.6	-	0.6	0.6	0.6
OTHER																										
Ammonia (as N)	mg/kg												-	-	-	-	-	-	-	-	-	-	-	< 5	-	-
Cyanide (total)	mg/kg						1,500						-	-	-	-	-	-	-	-	-	-	-	< 5	-	-
ASBESTOS													-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																										
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B

Table LR1

Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code								GBH28		GBH29		GBH30		GBH31	GBH32				GBH33				GBH34	
Date								21-Aug-18		21-Aug-18		24-Aug-18		10-Sep-18	23-Aug-18				20-Aug-18				20-Aug-18	
Field ID								GBH28/3.8-4.0	QC4	GBH29/0.03-0.2	GBH29/2.4-2.5	GBH30/0.3-0.5	GBH30/1.2-1.4	GBH31/4.7-5.0	GBH32/1.0-1.2	GBH132/4.1-4.2	QC7	QC7A	GBH33/0.05-0.2	GBH33/0.2-0.4	QC2	QC2A	GBH34/0.1-0.4	QC1
Depth								3.8-4.0	3.8-4.0	0.03-0.2	2.4-2.5	0.3-0.5	1.2-1.4	4.7-5.0	1.0-1.2	4.1-4.2	4.1-4.2	4.1-4.2	0.05-0.2	0.2-0.4	0.2-0.4	0.2-0.4	0.1-0.4	0.1-0.4
Sample Type								Primary	Field_D	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Field_D	Interlab_D	Primary	Primary	Field_D	Interlab_D	Primary	Field_D
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil														
Metals																								
Arsenic	mg/kg	2					3,000[#2]																	
								5.8	5.4	< 2	5.7	< 2	4.5	4.9	2.0	6.0	4.9	<5	2.8	4.4	4.5	<5	4.1	4.0
Cadmium	mg/kg	0.4					900	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	<1	< 0.4	< 0.4	< 0.4	<1	< 0.4	< 0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]	< 5	< 5	5.8	< 5	390	14	< 5	190	< 5	< 5	<2	15	< 5	7.7	3.0	15	14
Copper	mg/kg	5					240,000	< 5	< 5	< 5	< 5	12	54	< 5	9.2	< 5	< 5	<5	81	7.8	17	11	120	130
Lead	mg/kg	5					1,500[#4]	7.4	8.6	< 5	9.0	< 5	13	< 5	< 5	5.3	< 5	<5	15	7.3	8.9	11	38	26
Mercury	mg/kg	0.1					730[#5]	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	<0.1	< 0.1	< 0.1
Nickel	mg/kg	5					6,000	< 5	< 5	< 5	< 5	24	10	< 5	11	< 5	< 5	<2	9.8	< 5	< 5	2.0	9.9	9.5
Zinc	mg/kg	5					400,000	22	21	< 5	34	58	54	< 5	46	20	16	14	140	28	36	31	130	130
BTEXN																								
Benzene	mg/kg	0.1	430	1,100	77	160		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.2	< 0.1	< 0.1	< 0.1	<0.2	< 0.1	< 0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	<0.5	< 0.3	< 0.3	< 0.3	<0.5	< 0.3	< 0.3
TRH - NEPM 2013																								
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<10	< 20	< 20	< 20	<10	< 20	< 20
C6-C10 Fraction	mg/kg	10						< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<10	< 20	< 20	< 20	<10	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	<50	< 50	< 50	< 50	<50	< 50	< 50
>C10-C16 Fraction	mg/kg	50						< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	<50	< 50	< 50	< 50	<50	< 50	< 50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000				< 100	< 100	< 100	< 100	< 100	< 100	< 100	150	< 100	< 100	<100	< 100	< 100	< 100	<100	220	250
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000				< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	<100	< 100	< 100	< 100	<100	150	160
TRH - NEPM 1999																								
C6-C9 Fraction	mg/kg	10						<20	<20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<20	< 10	< 20	< 20	< 20	< 10	< 20	< 20
C10-C14 Fraction	mg/kg	20						<20	<20	< 20	< 20	< 20	< 20	< 20	23	< 20	<20	< 50	< 20	< 20	< 20	< 50	< 20	< 20
C15-C28 Fraction	mg/kg	50						<50	<50	< 50	61	< 50	< 50	< 50	110	< 50	<50	<100	81	< 50	63	<100	130	120
C29-C36 Fraction	mg/kg	50						<50	<50	< 50	< 50	< 50	< 50	< 50	59	< 50	<50	<100	< 50	< 50	< 50	<100	160	180
PAHs - standard 16																								
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]	6.4	9.0	< 0.5	19	< 0.5	< 0.5	< 0.5	1.1	< 0.5	< 0.5	<0.5	< 0.5	13	26	15.7	1.3	0.6
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]	1.1	1.3	0.6	3.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.0	3.3	2.0	0.6	0.6
OTHER																								
Ammonia (as N)	mg/kg							-	-	-	< 5	-	-	-	< 5	-	-	-	-	< 5	< 5	< 20	-	-
Cyanide (total)	mg/kg						1,500	-	-	-	< 5	-	-	-	< 5	-	-	-	-	< 5	< 5	< 1	-	-
ASBESTOS								-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																								
Arochlor 1016	µg/kg	500						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:

#1 Not limiting: Derived soil HSL exceeds soil saturation concentration

#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).

#3 In the absence of a guideline value for total chromium, chromium VI value adopted

#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be

#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be

#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &

#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its

#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.

#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code																															
Date																															
Field ID																															
Depth																															
Sample Type																															
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand				NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil																			
								0-1m	1-2m	2-4m	>=4m																				
Metals																															
Arsenic	mg/kg	2					3,000[#2]						5.4	2.5	-	3.8	5.6	2.3	4.9	2.4	3.7	2.3	6.4	-	-	-	-			
Cadmium	mg/kg	0.4					900						< 0.4	< 0.4	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	-	-	-	-			
Chromium (III+VI)	mg/kg	5					3,600[#3]						< 5	< 5	-	9.1	< 5	90	< 5	44	51	<5	11	-	-	-	-			
Copper	mg/kg	5					240,000						< 5	< 5	-	24	< 5	13	< 5	78	7.5	<5	11	-	-	-	-			
Lead	mg/kg	5					1,500[#4]						8.8	< 5	-	6.2	< 5	< 5	5.1	380	6.1	<5	21	-	-	-	-			
Mercury	mg/kg	0.1					730[#5]						< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	-	-	-	-			
Nickel	mg/kg	5					6,000						< 5	< 5	-	5.7	< 5	< 5	< 5	8.4	<5	<5	<5	-	-	-	-			
Zinc	mg/kg	5					400,000						32	5.4	-	27	< 5	40	18	96	37	5.6	110	-	-	-	-			
BTEXN																															
Benzene	mg/kg	0.1	430	1,100	77	160		3	3	3	3		< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	<0.1	-	-	-	-			
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 0.1	< 0.1	-	< 0.1	< 0.1	0	< 0.1	< 0.1	-	-	<0.1	-	-	-	-			
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 0.1	< 0.1	-	< 0.1	< 0.1	0.9	< 0.1	< 0.1	-	-	<0.1	-	-	-	-			
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		230	NL[#1]	NL[#1]	NL[#1]		< 0.3	< 0.3	-	< 0.3	< 0.3	2.7	< 0.3	< 0.3	-	-	<0.3	-	-	-	-			
TRH - NEPM 2013																															
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	NL[#1]		< 20	< 20	-	< 20	< 20	30	< 20	< 20	-	-	<20	-	-	-	-			
C6-C10 Fraction	mg/kg	10										700[#9]	< 20	< 20	-	< 20	< 20	34	< 20	< 20	-	-	<20	-	-	-	-			
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 50	< 50	-	< 50	< 50	88	< 50	300	-	-	<50	-	-	-	-			
>C10-C16 Fraction	mg/kg	50										1,000[#8]	< 50	< 50	-	< 50	< 50	89	< 50	300	-	-	<50	-	-	-	-			
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	110	< 100	-	< 100	< 100	190	< 100	560	-	-	<100	-	-	-	-			
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	< 100	< 100	-	< 100	< 100	< 100	< 100	100	-	-	<100	-	-	-	-			
TRH - NEPM 1999																															
C6-C9 Fraction	mg/kg	10											< 20	< 20	-	< 20	< 20	23	< 20	< 20	-	-	<20	<25	-	<25	-			
C10-C14 Fraction	mg/kg	20											< 20	< 20	-	< 20	< 20	62	< 20	220	-	-	<20	<50	-	<50	-			
C15-C28 Fraction	mg/kg	50											90	< 50	-	< 50	< 50	160	< 50	420	-	-	<50	<100	-	<100	-			
C29-C36 Fraction	mg/kg	50											< 50	< 50	-	< 50	< 50	59	< 50	200	-	-	<50	<100	-	<100	-			
PAHs - standard 16																															
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		NL[#1]	NL[#1]	NL[#1]	NL[#1]		< 0.5	< 0.5	-	< 0.5	< 0.5	1.5	< 0.5	< 0.5	-	-	-	-	-	-	-			
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						34	< 0.5	-	< 0.5	< 0.5	2.5	< 0.5	4.3	-	-	-	-	-	-	-			
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						4.1	0.6	-	0.6	0.6	0.6	0.6	0.6	-	-	-	-	-	-	-			
OTHER																															
Ammonia (as N)	mg/kg												< 5	-	-	< 5	-	-	< 5	< 5	-	-	-	-	-	-	-			
Cyanide (total)	mg/kg						1,500						< 5	-	-	< 5	-	-	< 5	< 5	-	-	-	-	-	-	-			
ASBESTOS													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
PCBs																															
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500			
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100			
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500			
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500			
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500			
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	300	<500	500	<500			
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	1,500			
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	300	<500	500	1,900			

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#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code													218	218A	219	219A	GBH141	GBH142	GBH143			GBH145	GBH146	GBH147	GBH148
Date													24/11/2011	18/11/2020	24/11/2011	18/11/2020	18/11/2020	18/11/2020	18/11/2020			18/11/2020	18/11/2020	18/11/2020	18/11/2020
Field ID													218/0.0-0.1	218A 0.0-0.2	219/0.0-0.1	219A 0.0-0.2	GBH141_0.0-	GBH142_0.0-0.2	GBH143_0.0-0.2	QC23	QC23A	GBH145_0.0-0.15	GBH146_0.0-0.2	GBH147_0.0-0.2	GBH148_0.0-0.2
Depth													0.0-0.1	0.0-0.2	0.0-0.1	0.0-0.2	0 - 0.2	0 - 0.2	0 - 0.2	0 - 0.2	0 - 0.2	0 - 0.15	0 - 0.2	0 - 0.2	0 - 0.2
Sample Type													Primary	Primary	Primary	Primary	Primary	Primary	Primary	Field_D	Interlab_D	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand*				NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil														
								0-1m	*1-2m*	*2-4m*	*>=4m*															
Metals																										
Arsenic	mg/kg	2					3,000[#2]						-	-	-	-	-	-	-	-	-	-	-	-	-	
Cadmium	mg/kg	0.4					900						-	-	-	-	-	-	-	-	-	-	-	-	-	
Chromium (III+VI)	mg/kg	5					3,600[#3]						-	-	-	-	-	-	-	-	-	-	-	-	-	
Copper	mg/kg	5					240,000						-	-	-	-	-	-	-	-	-	-	-	-	-	
Lead	mg/kg	5					1,500[#4]						-	-	-	-	-	-	-	-	-	-	-	-	-	
Mercury	mg/kg	0.1					730[#5]						-	-	-	-	-	-	-	-	-	-	-	-	-	
Nickel	mg/kg	5					6,000						-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc	mg/kg	5					400,000						-	-	-	-	-	-	-	-	-	-	-	-	-	
BTEXN																										
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*		-	-	-	-	-	-	-	-	-	-	-	-	-	
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL [#1]*	*NL [#1]*	*NL [#1]*	*NL [#1]*		-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL [#1]*	*NL [#1]*	*NL [#1]*	*NL [#1]*		-	-	-	-	-	-	-	-	-	-	-	-	-	
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL [#1]*	*NL [#1]*	*NL [#1]*		-	-	-	-	-	-	-	-	-	-	-	-	-	
TRH - NEPM 2013																										
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL [#1]*		-	-	-	-	-	-	-	-	-	-	-	-	-	
C6-C10 Fraction	mg/kg	10										700[#9]	-	-	-	-	-	-	-	-	-	-	-	-	-	
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL [#1]*	*NL [#1]*	*NL [#1]*	*NL [#1]*		-	-	-	-	-	-	-	-	-	-	-	-	-	
>C10-C16 Fraction	mg/kg	50										1,000[#8]	-	-	-	-	-	-	-	-	-	-	-	-	-	
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	-	-	-	-	-	-	-	-	-	-	-	-	-	
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	-	-	-	-	-	-	-	-	-	-	-	-	-	
TRH - NEPM 1999													-	-	-	-	-	-	-	-	-	-	-	-	-	
C6-C9 Fraction	mg/kg	10											<25	-	<25	-	-	-	-	-	-	-	-	-	-	
C10-C14 Fraction	mg/kg	20											<50	-	<50	-	-	-	-	-	-	-	-	-	-	
C15-C28 Fraction	mg/kg	50											<100	-	200	-	-	-	-	-	-	-	-	-	-	
C29-C36 Fraction	mg/kg	50											<100	-	<100	-	-	-	-	-	-	-	-	-	-	
PAHs - standard 16													-	-	-	-	-	-	-	-	-	-	-	-	-	
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL [#1]*	*NL [#1]*	*NL [#1]*	*NL [#1]*		-	-	-	-	-	-	-	-	-	-	-	-	-	
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						-	-	-	-	-	-	-	-	-	-	-	-	-	
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						-	-	-	-	-	-	-	-	-	-	-	-	-	
OTHER																										
Ammonia (as N)	mg/kg												-	-	-	-	-	-	-	-	-	-	-	-	-	
Cyanide (total)	mg/kg						1,500						-	-	-	-	-	-	-	-	-	-	-	-	-	
ASBESTOS													-	-	-	-	-	-	-	-	-	-	-	-	-	
PCBs																										
Arochlor 1016	µg/kg	500											<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	
Arochlor 1221	µg/kg	100											<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	<100	<100	
Arochlor 1232	µg/kg	500											<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	
Arochlor 1242	µg/kg	500											<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	
Arochlor 1248	µg/kg	500											<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	
Arochlor 1254	µg/kg	500											200	<500	400	500	<500	<500	<500	<500	-	<500	<500	<500	<500	
Arochlor 1260	µg/kg	500											<100	<500	<100	1,800	<500	<500	<500	<500	-	<500	<500	<500	<500	
PCBs (Total)	µg/kg	100					7,000						200	<500	400	2,300	<500	<500	<500	700	<100	<500	<500	<500	<500	

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