Technical Report B

Dredged sediment disposal options assessment

Part 1

Viva Energy Gas Terminal Project

Prepared for
Viva Energy Gas Australia Pty Ltd
ABN: N/A

Technical Report B: Dredged Sediment Disposal Options Assessment

Viva Energy Gas Terminal Project Environment Effects Statement

25-Feb-2022
Viva Energy Gas Terminal Project

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Technical Report B: Dredged Sediment Disposal Options Assessment

Viva Energy Gas Terminal Project Environment Effects Statement

Client: Viva Energy Gas Australia Pty Ltd

ABN: N/A

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Executive summary

This technical report provides a Dredged Sediment Disposal Options Assessment (DSDOA) undertaken to support the Environment Effects Statement (EES) for the Viva Energy Gas Terminal Project (the project).

In December 2020, the Victorian Minister for Planning determined that the project requires assessment through an EES under the *Environment Effects Act 1978* (Vic). The reasons for the decision were primarily related to the potential for significant adverse effects on the marine environment of Corio Bay and the potential for contributing to greenhouse gas emissions. Secondarily, the EES was required to assess the effects of the project on air quality, noise, land use, Aboriginal and historic heritage, native vegetation, groundwater, traffic and transport as well as visual amenity.

In January 2021, the project was also determined to require assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to the potential for the project to have a significant impact on wetlands of international importance, listed threatened species and communities, and listed migratory species. The EES process is the accredited environmental assessment process for the controlled action decision under the *EPBC Act* in accordance with the bilateral agreement between the Commonwealth and Victorian governments.

Overview

Viva Energy Gas Australia Pty Ltd (Viva Energy) is planning to develop a gas terminal using a ship known as a floating storage and regasification unit (FSRU), which would be continuously moored at Refinery Pier in Corio Bay, Geelong. The key objective of the project is to facilitate supply of a new source of gas for the south-east Australian gas market where there is a projected supply shortfall in coming years.

The FSRU would store liquefied natural gas (LNG) received from visiting LNG carriers (that would moor directly adjacent to the FSRU), and regasify the LNG as required to meet industrial, commercial and residential customer demand. A 7-kilometre (km) gas transmission pipeline would transfer the gas from the FSRU to the Victorian Transmission System (VTS) at Lara.

The gas terminal would be located adjacent to, and on, Viva Energy's Geelong Refinery in a heavily industrialised setting and would benefit from Viva Energy's experience and capability as an existing Major Hazard Facility (MHF) operator and potential synergies between the two facilities such as reuse of the FSRU seawater discharge within the refinery operations.

Methodology

For any proposed sediment dredging in internal waters, within the limits of the state of Victoria, the proposed dredging approach must be evaluated in accordance with the Victorian Environment Protection Authority (Vic EPA) Publication 691 (2001) *Best Practice Environmental Management – Guidelines for Dredging.*

While the Vic EPA Publication 691 is applicable to Victorian internal waters, the Commonwealth of Australia *National Assessment Guidelines for Dredging* (NAGD, 2009), applicable to Australian coastal waters, generally aligns with this Vic EPA publication, and provides more detailed guidance on assessing appropriate dredged material management options. As such, the NAGD (2009) was used as the primary guidance document for DSDOA, and this approach was agreed to with the Vic EPA.

The options considered as part of the DSDOA are presented below.

Disposal / Reuse Option	Description
Offshore	
Disposal at the Point Wilson Disposal Ground	Unconfined disposal of dredged sediment.
Disposal at the Port of Melbourne Disposal Ground	Unconfined disposal of dredged sediment.

Disposal / Reuse Option	Description
Onshore	
Reuse on Viva Energy-owned land	Dewatering and reuse of dredged sediment on Viva Energy owned land surrounding the Geelong Refinery.
Reuse for habitat creation	Dewatering and reuse of dredged sediment to create additional near shore habitats.
Disposal at a licensed landfill	Dewatering and reuse of dredged sediment at a licensed landfill.
Treatment at a licensed thermal treatment facility	Dewatering and transfer of the material to one of Victoria's licensed thermal treatment facilities.

The DSDOA focused on the technical, environmental, social and financial feasibility of each option considered.

The options assessment identified that disposal of dredged sediment at the Point Wilson Disposal Ground would be the preferred option, subject to a sediment quality assessment. Discussion with Ports Victoria identified that sufficient space is available at the Point Wilson Disposal Ground and unconfined disposal would be considered appropriate subject to the contamination status of the material proposed to be dredged.

A sediment quality assessment was undertaken in accordance with national regulations and guidelines; primarily the NAGD, 2009. The sediment quality assessment evaluated whether sediment proposed to be dredged from an adjacent to the Refinery Pier (i.e., the Loading Site) is suitable for relocation to the existing Point Wilson Disposal Ground.

Fieldwork was conducted by AECOM between 19 August and 8 September 2021 to collect sediment, porewater and seawater samples to inform the assessment in accordance with a *Sampling, Analysis and Quality Plan* (SAQP) (AECOM, 2021), which was reviewed, and feedback provided by Vic EPA. Data generated from these fieldworks were combined with data reported by Coffey (2020) and AMA (2020) (within the Loading Site) as all three data sets were required to satisfy the NAGD (2009) assessment and reporting requirements.

Sediment Quality Assessment

While initial results from the sediment sampling and analysis identified some chemical concentrations that exceeded the assessment criteria, the *NAGD* (2009) phased approach sets out a process to further examine the potential toxicity to ecological receptors. Further test results identified no potential adverse impacts to ecological receptors at both the Loading Site and the Point Wilson Disposal Ground for the proposed dredging activities.

Preferred Dredged Sediment Disposal Option

On the basis of the dredged sediment disposal options assessment and the sediment quality assessment, disposal at the Point Wilson Disposal Ground is the preferred option for the management of sediment proposed to be dredged as part of the project.

The potential impacts on the environment at the Loading and Disposal Sites were assessed as part of Technical Report A: *Marine ecology and water quality impact assessment*. Monitoring and management measures to avoid, minimise and manage these potential impacts were also addressed in the aforementioned report.

Abbreviations and glossary of terms

Abbreviation/Term	Definition
AMA	Australasian Marine Associates
ANZG	Australian and New Zealand Guidelines
ASS	Acid Sulfate Soils
CEE	Consulting Environmental Engineers
DELWP	Victorian Department of Environment, Land, Water and Planning
DGV	Default Guideline Values
DSDOA	Dredged Sediment Disposal Options Assessment
EES	Environment Effects Statement
EMF	Environmental Management Framework
EP Act	*Environment Protection Act 2017*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ERS	Environment Reference Standard (2021)
FSRU	Floating Storage and Regasification Unit
HDD	Horizontal Directional Drilling
HEPA	Heads of EPA Australian and New Zealand
IWRG	Industrial Waste Resource Guidelines
LNG	Liquified Natural Gas
LOR	Limit of Reporting
MACA	*Marine and Coastal Act 2018*
MHF	Major Hazard Facility
MLA	Marine Loading Arm
NAGD	National Assessment Guidelines for Dredging (2009)
NEPC	National Environment Protection Council
NEPM	*National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended in 2013
NM	Nautical Miles
PFAS	Per- and polyfluoroalkyl substances
PFOS	Perfluorooctane sulfonate
ROW	Right of Way
SAQP	Sampling, Analysis and Quality Plan

Abbreviation/Term	Definition
SWI	Seawater intake
SWP	South West Pipeline
SWTP	Seawater Transfer Piping
TRG	Technical Reference Group
Vic EPA	Victorian Environment Protection Authority
Viva Energy	Viva Energy Gas Australia Pty Ltd
VRCA	Victorian Regional Channel Authority (now Ports Victoria)
VTS	Victorian Transmission System

1.0 Introduction

This technical report provides a Dredged Sediment Disposal Options Assessment (DSDOA) conducted to support the Environment Effects Statement (EES) for the Viva Energy Gas Terminal Project (the project).

Viva Energy Gas Australia Pty Ltd (Viva Energy) is planning to develop a gas terminal using a ship known as a floating storage and regasification unit (FSRU), which would be continuously moored at Refinery Pier in Corio Bay, Geelong. The key objective of the project is to facilitate supply of a new source of gas for the south-east Australian gas market where there is a projected supply shortfall in coming years.

The FSRU would store liquefied natural gas (LNG) received from visiting LNG carriers (that would moor directly adjacent to the FSRU) and would convert LNG back into a gaseous state by heating the LNG using seawater (a process known as regasification) as required to meet industrial, commercial, and residential customer demand. A 7-kilometre (km) gas transmission pipeline would transfer the gas from the FSRU to the Victorian Transmission System (VTS) at Lara.

The project would be situated adjacent to, and on Viva Energy's Geelong Refinery, within a heavily developed port and industrial area on the western shores of Corio Bay between the Geelong suburbs of Corio and North Shore. Co-locating the project with the existing Geelong Refinery and within the Port of Geelong offers significant opportunity to minimise potential environmental effects and utilise a number of attributes that come with the port and industrial setting.

In December 2020, the Victorian Minister for Planning determined that the project requires assessment through an EES under the *Environment Effects Act 1978* (Vic). The reasons for the decision were primarily related to the potential for significant adverse effects on the marine environment of Corio Bay and the potential for contributing to greenhouse gas emissions. Secondarily, the EES was required to assess the effects of the project on air quality, noise, land use, Aboriginal and historic heritage, native vegetation, groundwater, traffic and transport as well as visual amenity.

In January 2021 the project was also determined to require assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to the potential for the project to have a significant impact on the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site (a wetlands of international importance), listed threatened species and communities, and listed migratory species. The EES process is the accredited environmental assessment process for the controlled action decision under the EPBC Act in accordance with the bilateral agreement between the Commonwealth and Victorian governments.

1.1 Purpose

This DSDOA considers and evaluates management options for dredged sediment associated with the proposed dredging for the project. The DSDOA focusses on evaluating the technical, environmental, social and financial feasibility of each option that was considered.

The DSDOA, along with the report *Viva Energy Gas Terminal Impact Assessment of Dredging*, (Consulting Environmental Engineers, 2021a) identifies and recommends mitigation measures to avoid, minimise and manage potential impacts which will inform the development of an Environmental Management Framework (EMF) for the project. The mitigation measures listed in the EMF would be implemented in the approvals and management plans for the project.

1.2 Why understanding dredged sediment disposal options is important

As required by the Victorian Environment Protection Authority (EPA) Publication 691 (2001) *Best Practice Environmental Management - Guidelines for Dredging,* when a project involves any proposed dredging, the objective should be to minimise environmental impacts both at the loading site and at the disposal site. To that end, all alternatives to offshore disposal need to be evaluated, including the environmental, social and economic impacts of each disposal option. The DSDOA provides this assessment with the objective of identifying an environmentally and cost-effective solution for management of dredged sediment.

1.3 Project area

The project would be located adjacent to, and on, the Geelong Refinery and Refinery Pier in the City of Greater Geelong, 75 km south-west of Melbourne. The project area is within a heavily developed port and industrial area on the western shores of Corio Bay between the Geelong suburbs of Corio and North Shore. The Geelong central business district is located approximately 7 km south of the project.

Corio Bay is the largest internal bay in the south-west corner of Port Phillip Bay and is a sheltered, shallow basin at the western end of the Geelong Arm, with an area of 43 square kilometres (km^2). The Point Wilson/Limeburner's Bay section of the Port Phillip Bay (Western Shoreline) and Bellarine Peninsula Ramsar site is located along the northern shoreline of Corio Bay, approximately one kilometre to the north-east of the project.

The Port of Geelong has been in operation for over 150 years and is the largest industrial bulk cargo port in Victoria, attracting over 600 ship visits and handling more than 14 million tonnes of product annually. Geelong's shipping channels extend 18 nautical miles through Corio Bay from Point Richards through to Refinery Pier. Ports Victoria manages commercial navigation in the port waters in and around Geelong and is responsible for the safe and efficient movement of shipping, and for maintaining shipping channels and navigation aids. The channels are man-made having been deepened and widened through periodic dredging to support port trade development.

Refinery Pier is the primary location within the Port of Geelong for movement of bulk liquids. Vessels up to 265 metres (m) in length currently utilise the four berths at Refinery Pier which service Viva Energy refinery operations. The majority of ship visits to the port are to Refinery Pier, with Viva Energy accounting for over half of the trade through the Port of Geelong.

The Geelong Refinery has been operating since 1954 with both the refinery and the co-located LyondellBasell plant being licensed Major Hazard Facilities (MHFs). A range of industrial activities are situated in the Port environs including wood fibre processing and chemical, fertiliser and cement manufacturing.

To the north of the Geelong Refinery, along the proposed underground pipeline corridor, the area is predominantly rural. There are several other existing Viva Energy-owned underground pipelines running between the refinery and the connection point to the South West Pipeline (SWP) at Lara. The proposed pipeline route follows already disturbed pipeline corridors, where possible, through a mix of land uses.

The project area is shown in **Figure 1**.

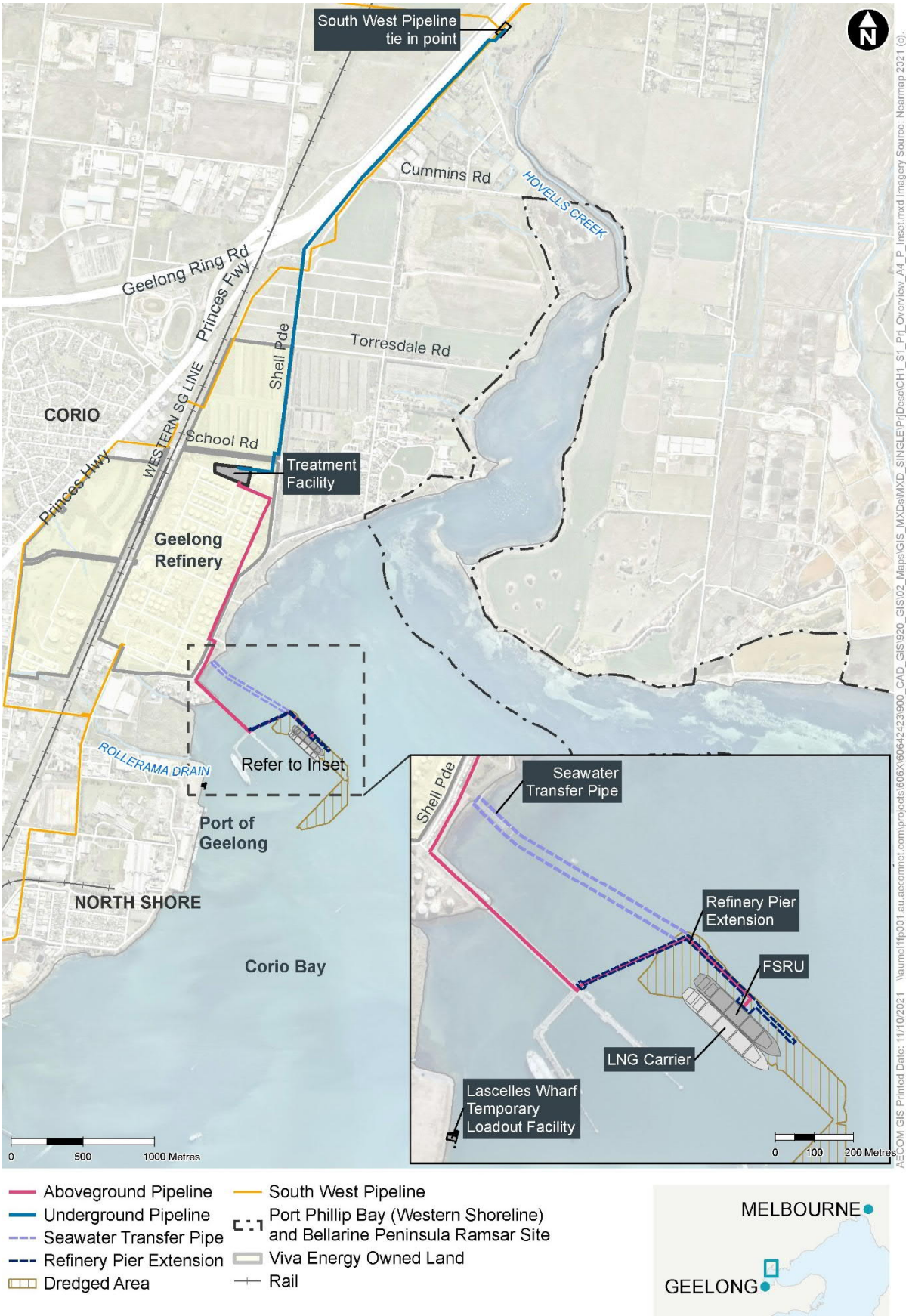

Figure 1 Project overview

1.4 Project description

This section summarises the project as described in Chapter 4: *Project description*. Key components of the project include:

- extension of the existing Refinery Pier with an approximately 570 m long angled pier arm, new berth and ancillary pier infrastructure including high pressure gas marine loading arms (MLAs) and a transfer line connecting the seawater discharge points on the FSRU to the refinery seawater intake
- continuous mooring of an FSRU at the new Refinery Pier berth to store and convert LNG into natural gas. LNG carriers would moor alongside the FSRU and unload the LNG
- construction and operation of approximately 3 km of aboveground gas pipeline on the pier and within the refinery site connecting the FSRU to the new treatment facility
- construction and operation of a treatment facility on refinery premises including injection of nitrogen and odorant (if required)
- construction and operation of an underground gas transmission pipeline, approximately 4km in length, connecting to the SWP at Lara.

The Refinery Pier extension would be located to the north-east of Refinery Pier No. 1. The new pier arm would be positioned to allow for sufficient clearance between an LNG carrier berthed alongside the FSRU and a vessel berthed at the existing Refinery Pier berth No. 1. Dredging of approximately 490,000 cubic metres of seabed sediment would be required to allow for the new berth pocket and swing basin.

The FSRU vessel would be up to 300 m in length and 50 m in breadth, with the capacity to store approximately 170,000 cubic metres (m^3) of LNG. The FSRU would receive LNG from visiting LNG carriers and store it onboard in cryogenic storage tanks at about -160 °C.

The FSRU would receive up to 160 petajoules (PJ) per annum (approximately 45 LNG carriers) depending on demand. The number of LNG carriers would also depend on their storage capacity, which could vary from 140,000 to 170,000 m^3.

When gas is needed, the FSRU would convert the LNG back into a gaseous state by heating the LNG using seawater (a process known as regasification). The natural gas would then be transferred through the aboveground pipeline from the FSRU to the treatment facility where odorant and nitrogen would be added, where required, to meet Victorian Transmission System (VTS) gas quality specifications. Nitrogen injection would occur when any given gas cargo needs to be adjusted (diluted) to meet local specifications. Odorant is added as a safety requirement so that the normally odourless gas can be smelt when in use. From the treatment facility, the underground section of the pipeline would transfer the natural gas to the tie-in point to the SWP at Lara.

1.4.1 Key construction activities

Construction of the project would occur over a period of up to 18 months. The key construction activities relate to:

- localised dredging of seabed sediments to enable the FSRU and LNG carriers to berth at Refinery Pier and excavation of a shallow trench for the seawater transfer pipe
- construction of a temporary loadout facility at Lascelles Wharf
- construction of the new pier arm and berthing infrastructure, and aboveground pipeline along Refinery Pier and through the refinery
- construction of the treatment facility on a laydown area at the northern boundary of the refinery site
- construction of the buried pipeline
- construction at the tie-in point to the SWP at Lara.

There are no construction activities required for the FSRU component of the project. The vessel would be built, commissioned and all production and safety systems verified prior to being brought to site.

An estimated 490,000 m^3 of dredging would be required, over an area of approximately 12 hectares (ha), adjacent to the existing shipping channel to provide sufficient water depth at the new berth and within the swing basin for visiting LNG carriers to turn. Dredging within the new berth would be undertaken to a depth of 13.1 m and the swing basin would be dredged to a depth of 12.7 m. The dredging footprint is shown in **Figure 2**.

The temporary loadout facility at Lascelles Wharf would be the first construction activity to take place in order to facilitate the Refinery Pier extension. This would involve the installation of 10 piles using hydraulic hammers.

Construction of the pier arm would be carried out once dredging was complete, primarily from the water using barge-mounted cranes. Steel piles would be driven into the seabed by barge-mounted cranes and pre-cast concrete and pre-fabricated steel components would be transported to site by barge and lifted into position. The installation of pier infrastructure such as the marine loading arms (MLAs), piping from the FSRU to the existing refinery seawater intake (SWI) and aboveground pipeline would also be undertaken from the water using barge-mounted cranes and construction support boats.

Installation of the 3 km above ground pipeline along the pier and through the refinery is anticipated to take 3.5 months to complete. The above ground pipeline would run along the pier to the existing pipe track east of Shell Parade within the pier foreshore compound. It would then pass through a road under-crossing to the existing refinery pipe track. The pipeline would then run north along the existing refinery pipe track to an existing laydown area where the treatment facility would be located.

The treatment facility would be located within an existing laydown area and cover an area of approximately 80m x 120m. Construction of the treatment facility would take up to 18 months and would be undertaken by specialist crews across distinct phases of work. These would include initial earthworks and civil construction, mechanical installation and electrical and instrumentation works.

The 4 km underground pipeline would be installed in stages over an approximate 4 month period within a corridor which has been selected so as to avoid watercourses or other environmental sensitivities, where possible. Firstly, a construction right of way (ROW) would be established, clearly identified and fenced off where required. Typically, this would be between 15 and 20 m wide, and minimised where possible to reduce disturbance. Once the construction ROW is established, vegetation would be removed, and a trench excavated to a maximum depth of 2m and a maximum width of 1 m for the pipeline to be placed. Following the placement of the pipeline, the construction ROW would be rehabilitated to its pre-existing condition as far as practicable for the purposes for which it was used immediately before the construction of that part of the pipeline.

Trenchless construction (including thrust boring or horizontal directional drilling (HDD)) would be used to install the underground pipeline in areas that are not suited to open trenching techniques, such as at intersections with major roads, which would be confirmed during detailed design. Trenchless construction would involve boring or drilling a hole beneath the ground surface at a shallow angle and then pushing or pulling a welded length of pipe through the hole without disturbing the surface. It is anticipated that the maximum depth of the trenchless section would be 25 m.

Construction at the tie-in point to the SWP at Lara would be undertaken by specialist crews across the distinct phases of works, as with the treatment facility.

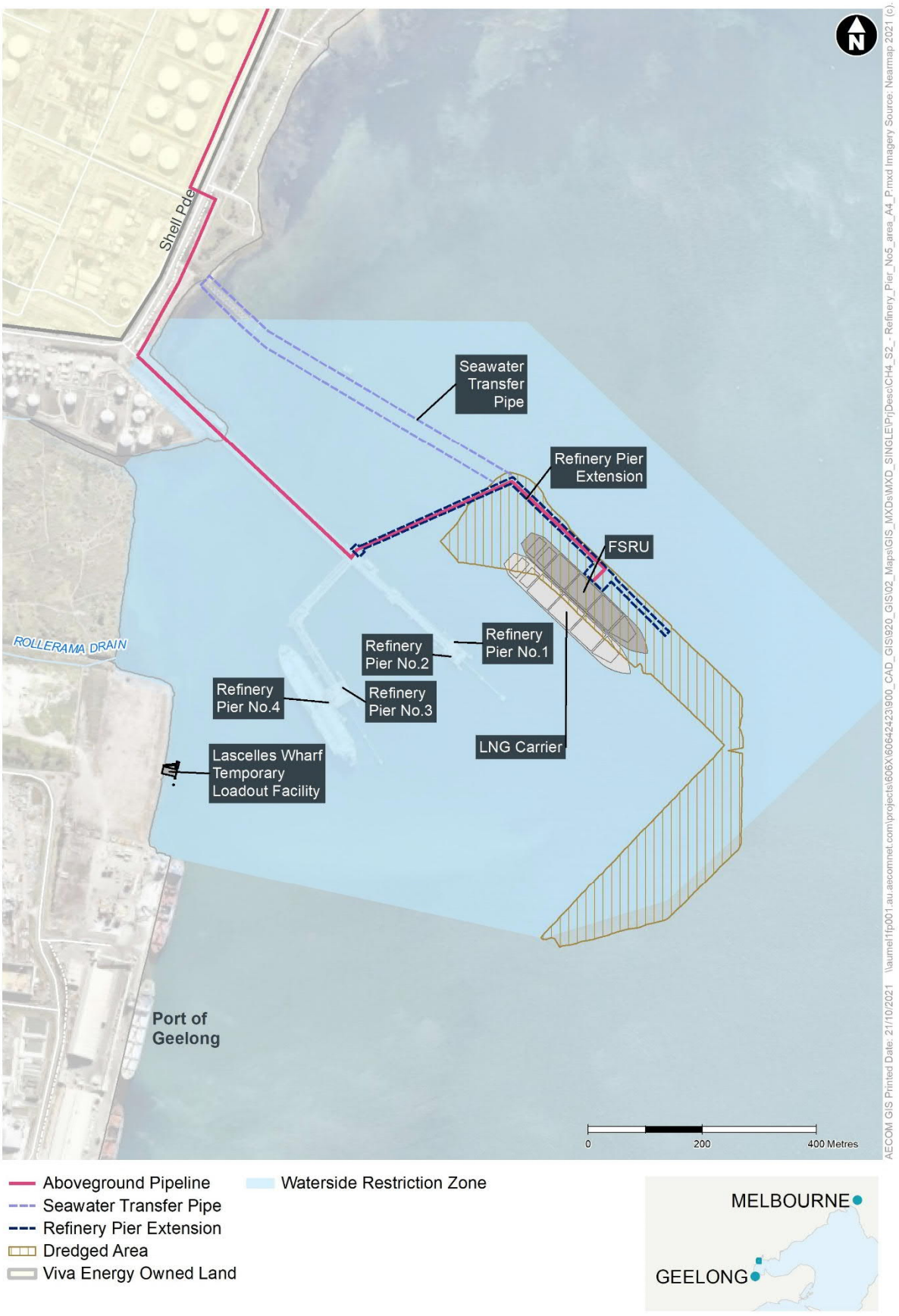

Figure 2 Proposed Dredge Footprint

1.4.2 Key operation activities

The project is expected to be in operation for approximately 20 years. Key activities relating to project operation include:

- receipt of up to 45 LNG carriers each year at Refinery Pier – the number and frequency of LNG carriers arriving each year would depend on their storage capacity and gas demand
- regasification of LNG onboard the FSRU using seawater as a heat source, which would then be reused within the refinery as cooling water
- injection of nitrogen and odorant into the gas prior to distribution via the VTS
- monitoring and maintenance of the pipeline easement.

1.4.3 Key decommissioning activities

The FSRU, which continues to be an ocean-going vessel throughout the operation of the project, would leave Corio Bay on completion of the project life to be used elsewhere.

It is anticipated that the Refinery Pier berth and facilities would be retained for other port related uses. The underground pipeline would likely remain *in situ* subject to landholder agreements and either decommissioned completely or placed into care and maintenance arrangements.

Decommissioning activities may be subject to change, subject to legislative requirements at the time and potential repurposing of the infrastructure at the end of the project.

1.4.4 Project activities relevant to the assessment

The localised dredging of seabed sediments in the Loading Site to enable the FSRU and LNG carriers to berth at Refinery Pier and their subsequent deposition in the Disposal Area is the main activity relevant to the assessment.

2.0 Scoping requirements

The scoping requirements for the EES set out the specific environmental matters to be investigated in the EES. The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the Project.

The following evaluation objective is relevant to the DSDOA:

- **Waste management** – To minimise generation of wastes by or resulting from the project during construction and operation, including dredging and accounting for direct and indirect greenhouse gas emissions.

The scoping requirements of relevance to this DSDOA and where they are addressed in the report are shown in **Table 2-1**.

Table 2-1 Scoping requirements relevant to dredging and offshore contamination management assessment

Aspect	Scoping requirement	Section addressed
Key issues	Potential for adverse environmental or health effects from waste materials/streams generated from project works including dredging and disposal of material in dredge spoil management grounds.	This requirement is addressed in **Sections 5.3** and **6.0**.
	Potential for disturbance of contaminated soil or acid sulfate soil particularly during dredging.	This requirement is are addressed in Section 4.2.3 of the AECOM, 2021b, *Dredging and Offshore Contamination Assessment* (**Appendix A**).
Existing environment	Identify the potential occurrence of contaminated groundwater, contaminated soil/sediment, or potential acid sulfate soils within the area where project works may occur.	This requirement is addressed in detail in the AECOM 2021b *Dredging and Offshore Contamination Assessment* **Appendix A**). A summary is provided in **Section 5.5**.
Likely effects	Identify potential environmental effects resulting from the generation, storage, treatment, transport and disposal of solid waste, including contaminated or potential acid sulfate soil and contaminated sediment from project construction and operation.	This requirement is addressed in detail in the *Viva Energy Gas Terminal Project Impact Assessment of Dredging* report (Consulting Environmental Engineers, 2021b). Details are provided in **Section 5.4.**
Mitigation measures	Describe available options for treatment or disposal of solid and liquid wastes generated by the project.	This requirement is addressed in **Sections 5.1** and **5.4**.
	Describe how the waste hierarchy will be applied to control and manage waste.	This requirement is addressed in **Sections 5.1** and **5.4**.
	Identify suitable off-site disposal options for waste materials.	This requirement is addressed in **Section 5.5.**
Performance objectives	These requirements are addressed separately in the EES Technical Report A: *Marine ecology and water quality impact assessment* (Section 13 Mitigation and Management Strategies).	

3.0 Legislation, policy and guidelines

Table 3-1 summarises the key environmental legislation and policy that apply to the project in the context of this DSDOA, as well as the implications for the project and the required approvals (if any).

Additional guidelines and technical criteria relevant to the DSDOA are described in **Sections 3.1** to **3.1.4**.

Table 3-1 Primary environmental legislation and associated information

Legislation/policy	Description	Implications for the project	Approval required
Commonwealth Legislation			
Environment Protection (Sea Dumping) Act 1981	Under the *Sea Dumping Act*, the Australian Government regulates the dumping, and loading for the purposes of dumping, of wastes and other matter at sea. If dumping will occur in the sea, a Sea Dumping Permit is required. The *Sea Dumping Act* applies to Australian Waters, from the low water mark to the limits of the Exclusive Economic Zone, apart from internal waters, within the limits of a state or territory (such as Port Phillip Bay).	The project will not require a Sea Dumping Permit to dispose of dredged sediment in the existing Ports Victoria - Point Wilson Disposal Ground (Disposal Ground) as this is located entirely within internal waters (i.e., Port Phillip Bay) under the jurisdiction of the state of Victoria.	No approval required
Environment Protection and Biodiversity (EPBC) Act 1999	The *EPBC Act* is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage Matters of National Environment Significance (MNES) including, but not limited to, World Heritage Properties, National Heritage Places, Ramsar wetlands, nationally listed threatened species and ecological communities and listed migratory species. The *EPBC Act* states that 'controlled' actions i.e. actions that are determined as likely to have a significant impact on a MNES are subject to assessment and approval under the *EPBC Act*.	The project is a 'controlled actions' requiring assessment and approval under the *EPBC Act*, due to the following relevant controlling provisions: • wetlands of international importance (Sections 16 and 17B) • listed threatened species and communities (Sections 18 and 18A) • listed migratory species (Sections 20 and 20A).	*EPBC Act* approval
State Legislation			
Marine and Coastal Act 2018	Provides an integrated and coordinated approach to planning and managing the marine and coastal environment by: • enabling protection of the coastline and the ability to address the long-term challenges of climate change, population growth and ageing coastal structures • ensuring that partners work together to achieve the best outcomes for Victoria's marine and coastal environment.	Application for consent to use or develop marine and coastal Crown Land is required to be made to the Minister. Provision of a bond and/or payment of a periodic management charge may be a condition of the consent as security for carrying out the use, development or works.	Consent from the Minister (via DEWLP) under s. 68. EPA Vic acts as a technical advisor. DELWP/ EPA technical review of the report: *Dredging and Offshore Contamination Assessment* (AECOM, 2021b), and DSDOA.
Environment Protection Act 2017 (EP Act) and *Environment Protection Amendment Act 2018*	Sets out a framework for the protection of human health and the environment by reducing the harmful effects of pollution and waste and provides and framework for the management of waste. Central to the *EP Act* is the General Environmental Duty (GED). The GED is an ongoing duty to prevent the risk of harm to human health and the environment. According to Section 25(1) of the *EP Act*, the GED requires that a person or entity who is engaging in an activity that may give rise to risks of harm to human health or the environment, to minimise those risks, so far as reasonably practicable.	The *Environment Reference Standard* [ERS] (2021) is a tool made under the *EP Act* that identifies environmental values on both land and water that need to be protected and provides a way to assess the relevant environmental values. For the assessment of environmental values for the offshore disposal option, the ERS identifies species protection levels for the location where the Point Wilson Disposal Ground is situated within Port Phillip Bay.	Approval from EPA is required if dredged sediment is taken onshore.
Policy			
The Marine and Coastal Policy 2020	Guides decision makers in the planning, management and sustainable use of Victoria's coastal and marine environment. Provides direction to decision makers, including local councils and land managers on a range of issues such as dealing with the impacts of climate change, population growth and ageing coastal structures.	Applicable policies include the: • management and minimisation of environmental impacts of dredging and spoil disposal by following State and national best-practice guidelines • minimisation of the need for capital and maintenance dredging • Prevention, management and minimisation of pollution and discharge from industry use and development in the marine environment.	

3.1 Guidelines

The following guidelines apply to the DSDOA:

- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT.
- EPA Victoria (2001) *Best Practice Environmental Management - Guidelines for Dredging*.
- EPA Victoria (2021) *Waste Disposal Categories – Characteristics and Thresholds,* Publication 1828.2, March 2021.
- HEPA, 2020. *PFAS National Environmental Management Plan 2.0*, February 2020. Heads of EPA Australian and New Zealand (HEPA).
- NAGD (2009) *National Assessment Guidelines for Dredging*, Commonwealth of Australia, Canberra, ACT.
- NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended in 2013. National Environment Protection Council.
- Simpson SL and Batley GE (2016) *Sediment Quality Assessment: A Practical Guide*, Second Edition. CSIRO.
- Simpson et al (2018) *National Acid Sulfate Soils Guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management.* Department of Agriculture and Water Resources, Canberra ACT. June 2018.
- Victorian Government (2021), *Environment Reference Standard, No. S245,* 26 May 2021.

Key guidelines are discussed further below.

3.1.1 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (2018) provides guidance on managing water quality or sediment quality (ANZG, 2018). These include default guideline values (DGV) for water quality and sediment quality as well as a framework for deriving guideline values. The DGVs are referenced by other guidelines that apply to the DSDOA, such as the NAGD (2009).

3.1.2 Best Practice Environmental Management – Guidelines for Dredging

The *Best Practice Environmental Management – Guidelines for Dredging*, Publication 691 (Victorian EPA, 2001) describe the issues that should be addressed in order to minimise the environmental impacts of dredging and suggest measures to minimise impacts.

3.1.3 National Assessment Guidelines for Dredging

The NAGD (2009) provides guidance on the assessment and management of dredged material to protect and preserve the marine environment from pollution related to dumping at sea in Australian coastal waters.

While the Victorian EPA Publication 691 (2001) is applicable to Victorian state waters, the NAGD (2009) generally aligns with this Vic EPA publication, and provides more detailed guidance on the staged approach to assessing the suitability of the preferred disposal option based on the contaminant status of the sediment. As such, the NAGD (2009) has been used as the primary guidance document for both the sediment quality assessment (AECOM, 2021b) and the DSDOA and this approach was agreed to with the Vic EPA.

3.1.4 National Acid Sulfate Soils Guidance

The *National Acid Sulfate Soils Guidance* (NASSG, 2018) provides national guidance regarding the assessment and management of acid sulfate soils and sediments (ASS). The NASSG includes the following key guidance document of relevance to the DSDOA:

- *National Acid Sulfate Soils Guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management* (Simpson et al, 2018).

This guideline provides a framework for the assessment and management of ASS during dredging projects to avoid environmental harm and includes a tiered assessment framework, which is shown in **Plate 1**.

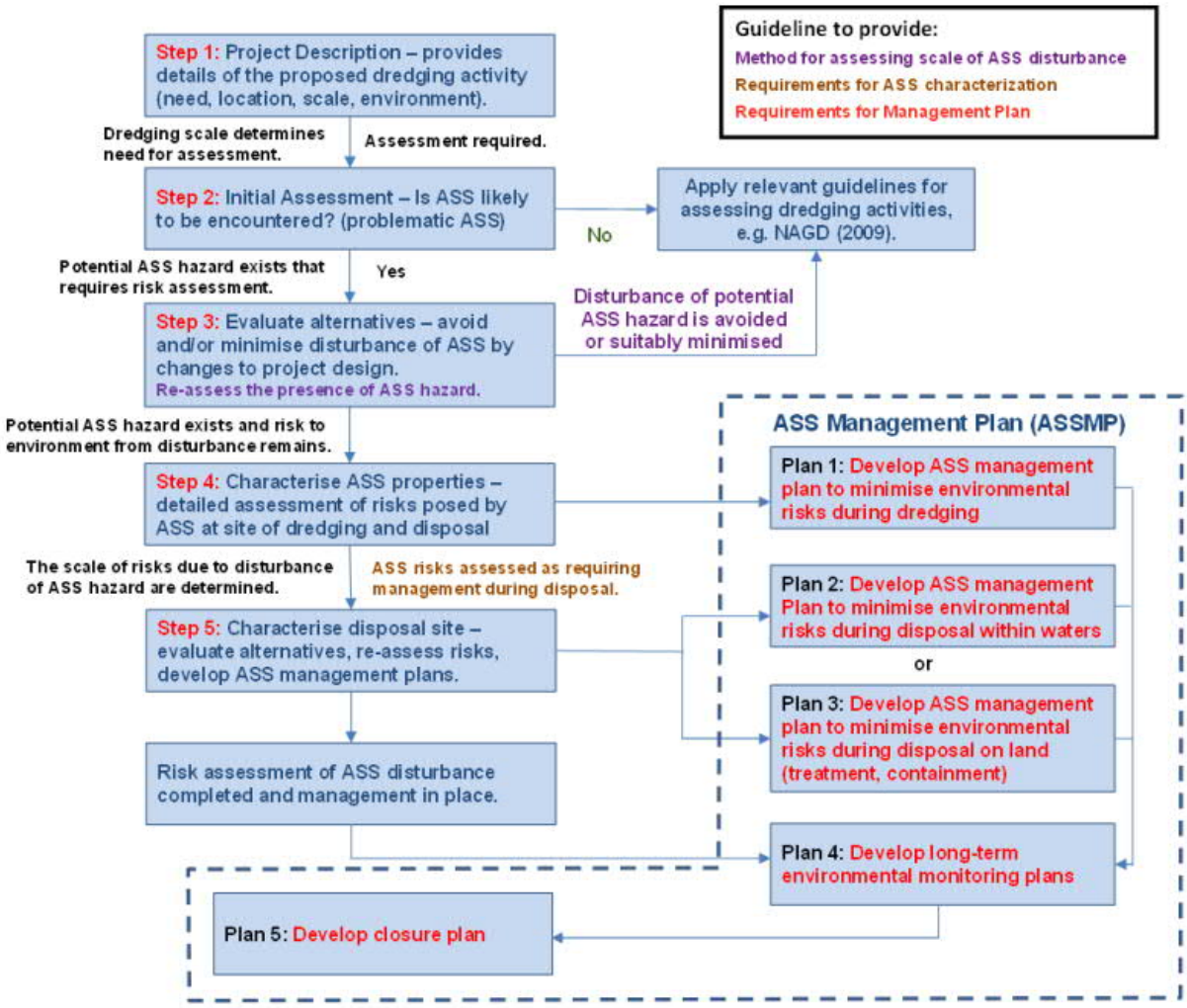

Plate 1 Flowchart for Proposed Assessment Framework (Simpson et al., 2018)

Step 1 and 2 from the assessment framework outlined in the NASSG were addressed in the *Dredging and Offshore Contamination Assessment* (AECOM, 2021b) (attached as **Appendix A**), whilst Step 3 is addressed in the EES Technical Report A: *Marine ecology and water quality impact assessment*.

4.0 Methodology

4.1 Risk screening method

A risk-based screening approach has been used for the EES assessment in accordance with the requirements outlined in the 'Ministerial guidelines for assessment of Environmental Effects under the *Environment Effects Act 1978*' (page 14). The risk screening is undertaken to ensure that the level of investigation conducted in each technical study is adequate to inform an assessment of the significance and acceptability of the project's potential environmental impacts.

An environmental, social and economic issues risk screening tool has been used to prioritise and focus the proposed investigations, assessments and approaches to avoiding, minimising or managing potential impacts. The issue screening process involved an evaluation of the potential environmental, social and economic issues associated with the project based on the information collected through a series of initial assessments undertaken into the potential effects of the project.

A risk workshop convened by a qualified risk practitioner and comprising technical specialists from the proponent, project design team and EES team conducted the initial risk screening. The risk screening process utilised knowledge of the project infrastructure and design, existing environment and land use setting to assess potential risks based on the specialised knowledge of the technical experts.

The purpose of the issues screening approach was to assist in identifying:

- significant issues, uncertainties and/or potential impacts that require more detailed characterisation and/or assessment within the EES
- matters or potential impacts considered to be already well understood or less significant.
- a high, medium, or low screening value was assigned to potential issues to determine the level of assessment required to identify and investigate impacts.

Each potential issue was given a score (1, 2 or 3) against the categories of:

- community and stakeholder interest
- significance of assets, values and uses
- potential impact (spatial, temporal and severity).

The scores were added together, or the highest score across the three contributing categories was used, to give a 'screening value' of high, medium or low, which gives an indication of the level of impact assessment that is required. Issues that were assigned a screening value of high or medium required detailed assessment in the EES at a level commensurate with them being considered primary level issues.

Issues that were assigned a screening value of low were proposed to be documented and managed with some investigation and assessment in the EES at a level commensurate with them being considered secondary level issues.

4.1.1 Criteria and consequence ratings

Risks, issues, and potential impact pathways were identified for both construction and operation of the project.

Table 4-1 defines the criteria and consequence ratings for each of the three categories that have been used to inform the issues screening. The sum of the scores against each of the three categories or the highest rating across any of the three contributing categories gives the 'screening value'.

Table 4-1 Issues screening criteria and consequence ratings

Rating	Community and stakeholder interest	Significance of assets, values and uses	Potential impact (spatial, temporal and severity)
1	Low interest and perceived impact	Locally significant asset, value or use	Potential for localised, temporary impact
2	Some interest and targeted perceived impacts	Regionally significant asset, value or use	Potential for significant temporary, or localised permanent impact
3	Broad community and stakeholder interest or impacts	State or nationally significant asset, value or use	Potential for significant permanent impact

The screening values are then used to determine the level of assessment required as shown in **Table 4-2**.

Table 4-2 Issue investigation categories

Screening score	Screening value	Potential consequences	Complexity of mitigation	Level of assessment
7, 8 or 9 or the highest rating across any one of the three contributing categories is 3	High	Potential for elevated, longer term impacts, significant assets or values may be affected with enduring changes. Considers both impacts and benefits, or Issue may not be well defined and insufficient information is available for the impact assessment, or High level of community interest.	Stringent management measures may be required	Detailed assessment required
4, 5 or 6 or the highest rating across any one of the three contributing categories is 2	Medium	Potential for moderate level impacts, significant assets or values may be affected over an extended time frame with some resultant changes. Considers both impacts and benefits, or Issue may be moderately understood, and some information is available, however more is required for the impact assessment, or Medium level of community interest.	Standard management measures are available that can be adopted with some modification	Moderate assessment required
3 or the highest rating across any one of the three contributing categories is 1	Low	Potential for short term and localised impact. Asset or values may be temporarily affected but recovery expected, or Issue is well understood and there is enough information available for the impact assessment, or Low level of community interest.	Standard management measures are available.	Some assessment required

Further information about the risk screening process is detailed in Chapter 7: *Assessment framework.*

Outcomes from the risk screening process are outlined in **Section 4.1.2**.

4.1.2 Risk screening results

Table 4-3 provides the key potential issues related to dredging and offshore contamination identified as part of the risk screening process for the project and presents the screening value for each issue.

Table 4-3 Dredging and offshore contamination issues screening result

Aspect	Issue	Community & stakeholder perceived impacts	Significance of assets, values & uses	Potential impact (spatial, temporal & severity)	Screening Score	Screening Value
Construction						
Offshore contamination	Potential impact on the environment from dredge spoil, piling cuttings	3	3	3	9	High

The screening value of "High" for the potential impact on the environment from dredge spoil and piling cuttings required that a detailed assessment of the potential impact be undertaken as part of the EES.

4.2 Options assessment method

This section describes the staged assessment approach performed to evaluate options for disposal of the dredged sediments. The staged assessment approach is performed in accordance with the *National Assessment Guidelines for Dredging* (NAGD, 2009), and follows the phased approach illustrated in **Plate 2**.

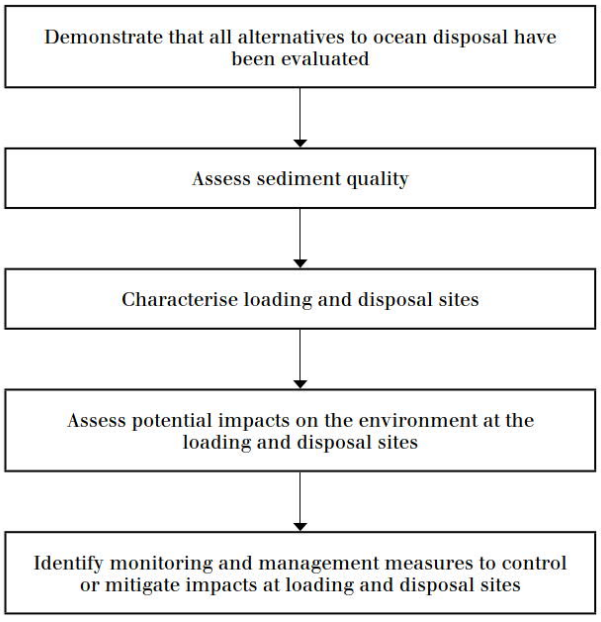

Plate 2 NAGD Assessment Framework

This report describes the evaluation of alternatives to ocean disposal (step 1) and utilises information from the *Dredging and Offshore Contamination Assessment* (AECOM, 2021b) to address steps 2-4 and

from the EES Technical Report A: *Marine ecology and water quality impact assessment* (CEE, 2021c) to address Step 5.

An initial screening assessment of options identified that disposal to the Point Wilson Disposal Ground was the preferred option for the management of the dredged sediment. To assist with the more detailed assessment of this option the sediment quality assessment (AECOM, 2021b) was undertaken (refer to **Section 5.5** for further detail).

4.3 Stakeholder and community engagement

Stakeholders and the community were consulted to support the preparation of the project's EES and to inform the development of the project and understanding of its potential impacts.

Table 4-4 summarises the stakeholder engagement activity relating to the DSDOA.

Table 4-4 Stakeholders and approvals

Stakeholder	Role	Consents / Approvals Provided
Viva Energy Gas Australia Pty Ltd	Project Owner Viva Energy Jetty Controller and Security	Approval to access waters around Viva Energy jetty (Refinery Pier), provision of shipping schedule & information pertaining to potential structures and services in the area.
Victorian Department of Environment, Land, Water and Planning (DELWP)	Review of project Environmental Management Plan and SAQP (AECOM 2021a)	Consent for use and development of Coastal Crown Land for disposal of dredged sediment if on coastal Crown land under the *Marine and Coastal Act 2018* (MACA) (DELWP reference: SP471963)
Environment Protection Authority Victoria (EPA Vic)	Technical review of the SAQP (AECOM 2021a) and the Sediment Assessment (AECOM 2021b, **Appendix A**) on behalf of DELWP	Discussion and close out of comments on SAQP and Sediment Assessment.
Ports Victoria (formerly Victorian Regional Channels Authority)	Harbour Master Development Manager	Victorian Notice to Mariners regarding the sediment sampling works (No. 244(T) – 2021) Confirmation was provided that there is sufficient space available for unconfined disposal at the Point Wilson Disposal Ground (subject to outcome of the *Dredging and Offshore Contamination Assessment* [AECOM, 2021b]) & subsequent provision of data regarding the Point Wilson Disposal Ground. It is noted that a MACA Consent would be required to use and dispose of dredged material at this disposal ground.

In accordance with the scoping requirements, a Technical Reference Group (TRG) was convened and chaired by DELWP on behalf of the Minister for Planning. The TRG has provided input throughout the EES process. Chapter 6: *Stakeholder and community engagement* provides a summary of the project's key engagement activities.

It is also noted that preliminary discussions were held with Ports Victoria (prior to the EES process) regarding the potential for habitat creation using the dredged material in collaboration with Deakin University. However, following the discussions it became apparent that the work that Ports Victoria have been undertaking with Deakin University is in its early stages and that no suitable site had been identified.

4.4 Assumptions and limitations

Assumptions and limitations relating to this DSDOA are as follows:

- Based on discussions with Ports Victoria, an initial assumption was made that the Point Wilson Disposal Ground was the preferred option, subject to the outcome of the *Dredging and Offshore Contamination Assessment* (AECOM, 2021b) (**Appendix A**). Therefore, a qualitative assessment was undertaken for the other options (refer to **Section 5.0**).
- Various Commonwealth and State Standards and Guidelines may be updated as the project progresses.

4.4.1 Linkages to other studies

Data, results and conclusions from the following EES technical studies were used to inform this DSDOA:

- AECOM Australia Pty Ltd (AECOM), 2021b. *Dredging and Offshore Contamination Assessment,* October 2021 (attached as **Appendix A**).
- Consulting Environmental Engineers (CEE), 2021a*. Investigation of Benthic Ecological Habitats in Corio Bay*, February 2021
- CEE, 2021b. *Viva Energy Gas Terminal Project Impact Assessment of Dredging*, September 2021
- CEE, 2021c. Technical Report A*: Marine ecology and water quality impact assessment*, October 2021
- Worley Services Pty Ltd, 2021, *Viva Geelong Gas Terminal Dredge Study Report*, April 2021

In addition, the following early studies were used to inform the project development prior to the EES and contain data that were included as part of the *Dredging and Offshore Contamination Assessment* (AECOM, 2021b):

- Coffey Services Australia Pty Ltd, 2020. *Sediment Contamination Assessment, Geelong LNG Regasification Terminal Project*, 4 December 2020
- Australasian Marine Associates, 2020. *Targets Sediment Investigation, Project Vega 'Privileged and Confidential',* 12 October 2020.

5.0 Disposal Options Assessment

5.1 Dredging methodology

Sediment dredging is proposed to be undertaken in Corio Bay to the east of the Geelong Refinery, adjacent to the existing Refinery Pier and shipping channel. The proposed localised dredging is required to remove sediments to:

- create a berth pocket for the proposed extension to Refinery Pier for Berth No. 5
- to increase the existing swing basin.

An estimated 490,000 m^3 (*in-situ* volume) of dredged material would be required to be removed adjacent to the existing shipping channel to provide sufficient water depth at the new berth and within the swing basin for visiting LNG carriers to manoeuvre (Worley, 2021a). This area is referred to as the "Loading Site" in this report. The proposed dredging extent is shown in **Figure 3**. The new berth pocket would be dredged to a depth of -13.1 metres Inner Harbour Chart Datum (shown in purple on **Figure 3**) and the shipping channel and swing basin (shown in red on **Figure 3**) would be dredged to a depth of -12.7 metres Inner Harbour Chart Datum (Worley, 2021b). The berth and channel section of dredging is approximately 600 m long and an average of 130 m wide. The turning basin is approximately 500 m long and an average of 160 m wide (CEE, 2021b).

It is expected that the dredging would be carried out by a backhoe dredge operating from a barge with three jack-up piles or spuds. The backhoe has a large bucket (ranging in possible sizes from <10 m^3 to 40 m^3) and excavated a semi-circle in front of the barge. When this is completed, the spuds are lifted, the barge moves forward, the spuds are re-set in the seabed and dredging re-commences. The dredge operates 24 hours per day, 7 days a week and at normal production rates, should be able to remove the planned 490,000 m^3 of sediment in approximately 8 weeks (CEE, 2021b).

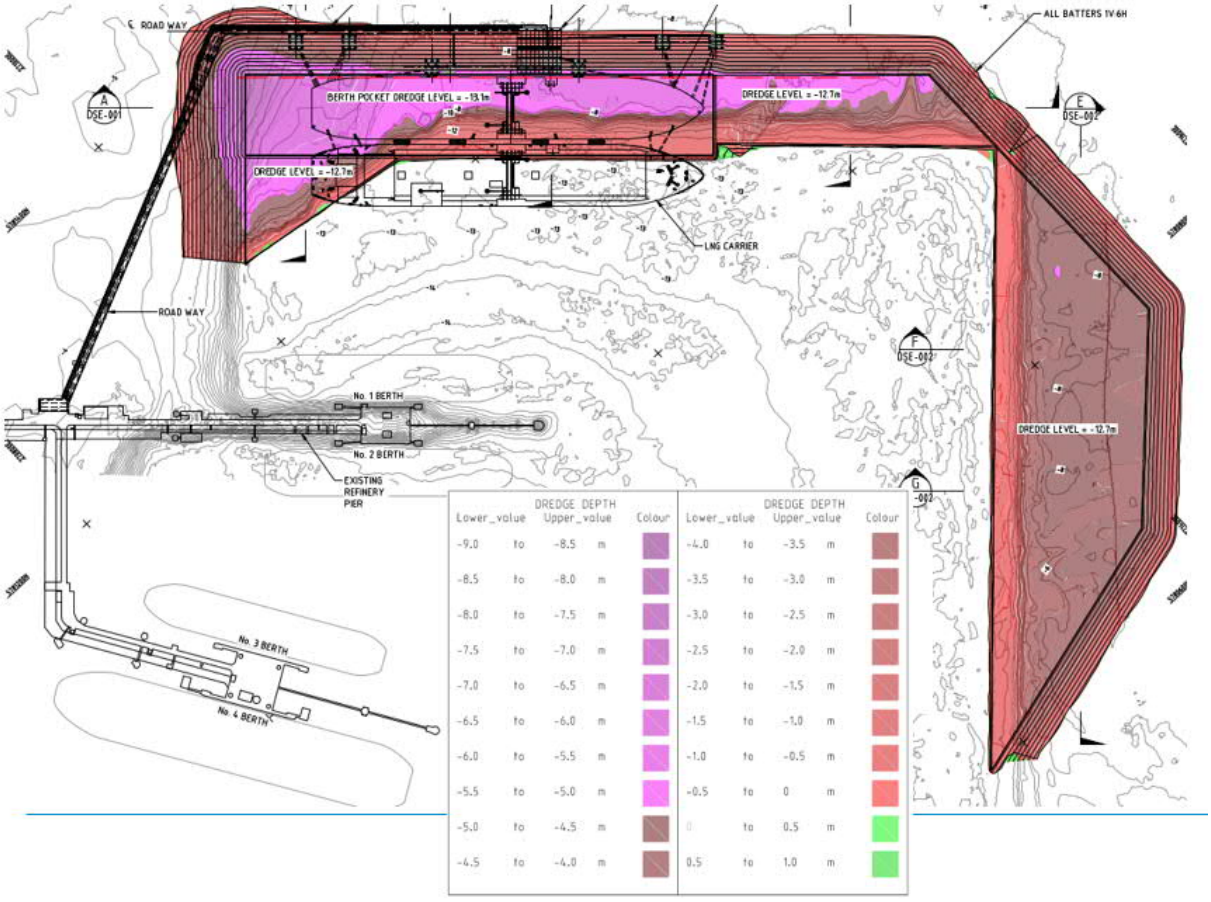

Figure 3 Extent of Proposed Dredging (from Consulting Environmental Engineers, 2021b).

In addition to the dredging of sediment associated with the berth pocket and swing basin, the design of the FSRU includes a seawater transfer pipe from the FSRU to the shoreline for use of the FSRU discharge water as cooling water in the refinery (refer to **Figure 1**). The current design indicates that approximately 8,800 m^3 of sediment will need to be excavated in order to install the pipe below the seabed. At this stage, it is proposed that the excavated material be reused to backfill the excavation, creating a mound over the pipe.

5.2 Disposal Options

The disposal options considered for the DSDOA are presented in **Table 5-1**. The options presented were those considered to generally provide more proven and practical solutions to the contaminant impacts identified in the sediment, particularly with respect to PFAS impacts. Other on shore treatment / management options are possible (e.g., treatment via stabilisation), however, these options have not been included in the table below due to their limited implementation in Australia, relative infancy, and/or the experimental stage of the technology.

Table 5-1 Disposal Options

Disposal / Reuse Option	Description
Offshore	
Disposal at the Point Wilson Disposal Ground	Unconfined disposal of dredged sediment.
Disposal at the Port of Melbourne Disposal Ground	Unconfined disposal of dredged sediment.
Onshore	
Reuse on Viva Energy-owned land	Dewatering and reuse of dredged sediment on Viva Energy owned land surrounding the Geelong Refinery.
Reuse for habitat creation	Dewatering and reuse of dredged sediment to create additional near shore habitats.
Disposal at a licensed landfill	Dewatering and reuse of dredged sediment at a licensed landfill.
Treatment at a licensed thermal treatment facility	Dewatering and transfer of the material to one of Victoria's licensed thermal treatment facilities.

To compare each of the disposal / reuse options in more detail, a screening assessment was undertaken and is presented in **Section 5.4**. The screening assessment focuses on the technical, environmental, social and financial feasibility of each option.

As part of the screening process, consideration was given to waste management hierarchy outlined in Part 2.3 – Principles of Environment Protection, of the *EP Amendment Act, 2018*:

- avoidance
- reuse
- recycling
- recovery of energy
- containment
- waste disposal.

As part of the initial screening phase of the project, both onshore and offshore regasification and storage technologies were considered. The onshore option would avoid the requirement for dredging. A

comparative assessment was undertaken for onshore and offshore alternatives to determine the most suitable option for the project (refer to EES Chapter 3: *Project alternatives and development*). This screening process determined that the offshore FSRU-based approach provided a number of advantages over the onshore approach as it would have a smaller footprint, would not require decommissioning of and/or modification to existing refinery equipment and layout, would have a lower safety risk, less complex construction requirements, can be developed in a shorter timeframe and would provide greater flexibility to be able to respond to a change in gas market demand. Therefore, avoidance of dredged material management cannot be considered as sediment dredging will be a requirement for the project.

Initial designs estimated approximately 1.1 million m^3 of sediment would need to be dredged, however, the project was able to minimise the dredge footprint and reduce the estimated dredge volume down to 490,000 m^3 through berthing simulations and design development. Recycling is not a relevant option for the dredged sediment. While offshore disposal is lowest on the Vic EPA's waste hierarchy, in the context of dredged sediment, it is not considered to be as environmentally impactful as onshore disposal to an engineered facility.

5.3 Disposal Options Assessment Screening Framework

The NADG (2009) states that '*All alternatives to ocean disposal need to be evaluated, including the environmental, social and economic impacts of each disposal option.*' Specific advice on how the options assessment should be undertaken is not provided in the NADG (2009).

With consideration to the NADG (2009) requirement above, and referral to the key Australian guidance document regarding remediation options assessments; i.e., the *National Remediation Framework* (CRC CARE, 2019), the following evaluation factors were adopted in order to assess each option and to identify a preferred option:

- ***Technical***:
  - Applicability of the sediment management option to the identified contamination.
  - Ability of the sediment management approach to meet regulatory compliance requirements.
  - Evidence of the option to have previously managed the identified contamination (e.g., proven and practicable solution, not an experimental approach that is not yet commercially available and/or licensed).
- ***Environmental***:
  - Consideration of the EPA's waste hierarchy.
  - Assessment of whether the option could result in adverse risks to human health or the environment.
  - The environmental sustainability of the option; e.g., consideration of resource and energy consumption, and production of by-products or wastes.
  - Potential to be able to reuse the dredged sediment as a resource and not a waste.
- ***Social***:
  - Potential community perceptions of the sediment management option.
- ***Financial***:
  - Relative comparison of the sediment management cost with regard to the other options presented.

The application of the disposal options assessment screening framework is presented in **Section 5.4**.

5.4 Screening Assessment

Table 5-2 Screening Assessment

Dredged Sediment Disposal / Reuse Option	Technical	Environmental	Social	Financial
Disposal at the Offshore Point Wilson Outer Harbour Disposal Ground	**Positive Aspects**			
	Ports Victoria confirmed that there is sufficient vertical and lateral space available for the disposal of sediment to the Point Wilson Disposal Ground, subject to the *Dredging and Offshore Contamination Assessment* (AECOM, 2021b). It is noted that a MACA Consent would be required to use and dispose of dredged material at this disposal ground. Costly dewatering and on shore material management would not be required. This option is relatively low complex material management approach which reduces the risk of encountering problems that other options may present (e.g., dewatering, obtaining approval for disposal to landfill). The Disposal Ground is located in close proximity to the Loading Site (i.e., approximately 26 km).	Aside from fuel to power the dredging vessel, and disposal plant and equipment, there is significantly lower resource and energy requirements compared to the other options assessed. The *Dredging and Offshore Disposal Assessment* (AECOM, 2021b) identified no potential medium or long term adverse impacts to ecological receptors at both the Loading Site and Disposal Ground during dredging activities (therefore a confined disposal option was not considered as part of this screening assessment as there was no reason to segregate sediments based on the low levels of sediment contamination and attendant impacts).	The material to be disposed is consistent with significant quantities of sediment dredged from nearby areas at Corio Bay over many years. Management of the sediment offshore avoids interaction with the public located onshore.	This option would be the lowest cost compared to the other options assessed. There is no specific cost that Ports Victoria charges to dispose sediment at the Disposal Ground.
	Negative Aspects			
	There are negligible technical negative aspects associated with this sediment management approach compared to the other options assessed.	The dredged material is being managed as a waste rather than a beneficial reuse approach being adopted. Some short term impacts as a result of turbidity may occur but previous studies and modelling conducted for the EES suggest that these have no lasting effects. This option is low on Vic EPA's waste hierarchy.	There may be negative perception of transferring the sediment to a waste disposal area rather than identifying a reuse option for the material.	There are negligible negative financial aspects when compared to the other options.
Disposal at the Offshore Port of Melbourne Disposal Ground	**Positive Aspects**			
	Costly dewatering and on shore material management would not be required. Relatively low complex material management approach which reduces the risk of encountering problems during the disposal process.	Similar positive aspects to the Point Wilson Disposal Ground option.	Similar positive aspects to the Point Wilson Disposal Ground option.	Similar positive aspects to the Point Wilson Disposal Ground option, however it is unclear whether Port of Melbourne would impose a cost to dispose.
	Negative Aspects			
	The Port of Melbourne disposal ground is located a greater distance away than the Point Wilson Disposal Ground (i.e., approximately 20 km further away). The Port of Melbourne disposal ground is	Given the greater distance to the Port of Melbourne disposal ground compared to the Point Wilson Disposal Ground, more fuel would be consumed shipping the material. This option is low on Vic EPA's waste hierarchy.	Similar negative aspects to the Point Wilson Disposal Ground option, however there may be a negative perception given the increased distance that the sediment will need to be transported.	It is unclear whether Port of Melbourne would impose a cost to dispose at their disposal ground. Nonetheless, additional costs would be incurred due to transport of the sediment to this disposal ground approximately a further 20 kms away.

Dredged Sediment Disposal / Reuse Option	Technical	Environmental	Social	Financial
	located approximately 15 km south of the Melbourne CBD[1]. An additional sediment quality assessment would have to be undertaken to assess the suitability of dredged sediment disposal at this disposal ground.			
Reuse on Viva Energy-owned land	**Positive Aspects**			
	Provided sufficient land was available in areas surrounding Viva Energy's refining facility, dredged sediment could be dried and placed over this land. Based on the *Dredging and Offshore Contamination Assessment* (AECOM, 2021b), there would not be a requirement to manage potential acid sulfate soils. Generally, the contaminant levels are below human health and ecological guideline values applicable for Viva Energy's land. The reuse of soil with detectable PFAS concentrations would have to be discussed with EPA Vic.	The soil would be viewed as a resource rather than as a waste product. Subject to the position on PFAS, no additional treatment to address contaminants would likely be required. Water resulting from dewatering of the sediment could likely be returned to the Loading Site, without needing treatment. This option is higher on Vic EPA's waste hierarchy.	The option may be viewed favourably as there would be fewer off-site heavy vehicle movements compared to an alternative on shore disposal/ treatment option. Soil with relatively low contaminant levels would not consume valuable landfill space.	Aside from the dewatering cost, the only remaining significant costs would be for plant and equipment to place the sediment across the Viva Energy land. Some costs may be incurred for conditioning the soil to support vegetation growth.
	Negative Aspects			
	There is insufficient land available on the Refinery site to accommodate the drying out and re-use of the sediment. Existing vacant areas of Viva Energy-owned land adjacent to the refinery site are currently earmarked for future Energy Hub uses. The 'paddocks' along Shell Parade / School Road may be an option, however, there are restrictions on how this land can be used. An assessment of post-backfill height implications on future uses has also not been made therefore, the feasibility of this option is unclear.	The sediment is being removed from a saline environment and these characteristics may inhibit future vegetation growth. Significant infrastructure and energy consumption would be required to handle and dewater the dredged sediment.	Certain community members, particularly nearby neighbours, may not be supportive of this option, particularly with regard to the presence of low concentrations PFAS in the sediment.	Costs would be incurred for the infrastructure and handling requirements for the dewatering of the sediment and management of the run-off water.
Reuse for habitat creation	**Positive Aspects**			
	Beneficial reuse of dredged sediment could be used to enhance or expand habitats existing near shore wetland areas or create new habitats in degraded areas or areas without sufficient sediment. Limited dewatering would be required due to the nature of material reuse.	This reuse approach would aim to provide additional near shore / marine habitats to provide areas for bird roosting and feeding, particularly for shorebirds. This option is higher on Vic EPA's waste hierarchy.	Likely support from various agencies and groups in creating additional near shore / marine habitats to provide areas for bird roosting and feeding, particularly for shorebirds.	Limited dewatering requirements and costs.
	Negative Aspects			
	Currently no suitable sites have been identified, therefore it has not been possible to undertake an	Habitat creation can be complex in natural systems. The selection of a suitable area would need to	This option would require additional approvals from DELWP (wetland and RAMSAR team).	There may be logistical issues associated with the type of vessels required to transfer the dredged material into relatively shallow environments. These

[1] Following discussions with Ports Victoria where it was confirmed that there is sufficient space to dispose of the dredged material at the Point Wilson Disposal Ground (which is closer in distance to the Loading Site than the Port of Melbourne Disposal Ground), no enquires have been made with Port of Melbourne about possible access to their disposal ground and whether sufficient space would be available as the closer disposal ground has been assessed as having no environmental constraints.

Dredged Sediment Disposal / Reuse Option	Technical	Environmental	Social	Financial
	assessment of whether the dredged material can be used for this purpose. A risk assessment and trial would be required to determine if the dredged sediment is suitable for creating on shore habitats. It is also unclear whether all the material is suitable for reuse or if there would be a requirement to segregate material, which may not be feasible whilst dredging. A suitable area may be required to dewater and store the dredged sediments until they are required for use.	consider whether the habitat would not be eroded or dissipated by currents, tides or storm events. Although the contaminant levels are relatively low in the sediment proposed to be dredged, it still may present a constraint for placement at some areas.	The process would likely be lengthy and would likely not meet project timelines.	access issues may require specialised and costly plant and equipment.
Disposal at a licensed landfill	**Positive Aspects**			
	The contaminant levels in the sediment are relatively low and the material could readily be disposed of to landfill, subject to a separate Vic EPA approval for PFAS.	The chemicals within the sediment would be safely contained in an appropriately licensed landfill.	The removal of the sediment and placement within a landfill could give confidence to some community members that the sediment is safely contained.	Landfill disposal fees would be lower compared to thermal destruction at a soil treatment facility, subject to approval of PFAS disposal.
	Negative Aspects			
	The presence of PFAS, albeit at low concentrations, would require a separate approval by Vic EPA for disposal. Timelines for Vic EPA approval (if provided) are unclear. The dredged sediment would have to be dried on shore, and sufficient space would likely be required to store significant quantities of dried sediment prior to its transfer to the selected landfill.	Landfill disposal would consume valuable landfill airspace for soil/sediment with relatively low contaminant levels. High resource and energy requirements to dewater and transport the material to a landfill facility. Landfill disposal is the lowest on the EPA's waste management hierarchy.	Multiple truck movements would be required. Use of valuable landfill airspace that should be used for more highly impacted material. There may be negative community perception of using significant resources and energy to treat the material when the overarching environmental benefit is low compared to other options (e.g., offshore disposal).	Costly to dewater, haul and dispose to landfill in comparison to other options such offshore disposal.
Treatment at a licensed thermal treatment facility	**Positive Aspects**			
	Thermal soil treatment facilities are appropriately licensed and capable of treating PFAS present in the sediment. No further approvals would be required. Based on the sediment sampling results excluding PFAS, the sediment would be classified as fill material, and there would be no additional treatment requirements other than for PFAS.	The thermal treatment facility would result in the destruction of PFAS. Treatment is the higher on the EPA's waste management hierarchy.	The destruction of PFAS in sediment rather than the transfer of the material to another location may be preferable for some community members.	PFAS would be destroyed, and the contamination liability associated with PFAS will be eliminated.
	Negative Aspects			
	The throughput treatment rates for the thermal treatment facilities vary from approximately 1,500-2,000 tonnes per week. This would mean that it could take 6-8 years to treat material. The material would also require a suitable storage location until such time that it could all be treated. The dredged sediment would have to be dried on shore, and sufficient space would be required to store significant quantities of dried sediment to facilitate the staggered transfer of the material to the selected treatment facility.	Considerable energy would be required to treat the relatively low concentrations of PFAS. High resource and energy requirements to dewater and transport the material to a treatment facility.	Multiple truck movements would be required. There may be negative community perception of using significant resources and energy to treat the material when the overarching environmental benefit is low compared to other options (e.g., offshore disposal).	The costs to dewater, haul and treat at a thermal treatment facility will likely present the highest cost compared to the other options assessed.

The screening assessment in **Table 5-2** reviewed a number of environmental, social and economic considerations. It was determined that a quantitative assessment was not required for the onshore options and the Port of Melbourne disposal ground for the following reasons:

- The low potential environmental impacts associated with disposal at the Point Wilson disposal ground. No potential adverse impacts associated with the low level of sediment contamination were identified to ecological receptors at both the Loading Site and Disposal Ground from the proposed dredging and spoil disposal activities. Further detail is provided in **Section 5.3.2** of the report.
- Dredged sediments from previous dredging campaigns in Corio Bay have been disposed of at the Point Wilson Disposal Ground and the characteristics of the sediments from the proposed dredging are very similar and compatible.
- The Point Wilson Disposal Ground is close in distance to the Loading Site reducing the energy usage (fuel) which would be required to transport the dredged sediment to the more distant Port of Melbourne Disposal Ground and generating less greenhouse gas emissions.
- Marine modelling indicates that there will only be localised, short-term impacts during the dredging and disposal of sediment (refer to *Viva Energy Gas Terminal Project Impact Assessment of Dredging* report (Consulting Environmental Engineers, 2021b)).
- Ports Victoria has confirmed that there is sufficient space to accommodate the disposal of the dredged sediments and has identified a specific area within the Point Wilson Disposal Ground (which was subsequently assessed as part of the Sediment Assessment – refer to **Section 5.4.2**).
- On-shore sediment management options would require the dredged sediment to be transported to land, dewatered and then trucked to the storage / management / treatment facility and the works would likely need to be staged given the volume of sediments, requiring multiple handling and movement events. These options were therefore qualitatively assessed to have a greater potential for environmental impact (e.g. noise, dust, contaminant mobilisation, increased fuel and greenhouse gas emissions and increased potential for health and safety incidents).
- Treatment of the dredged sediment would be energy intensive. Disposal of these sediments at a landfill would take up valuable space that should be used for more highly impacted material.
- Although the option for reuse for habitat creation was considered to be a favourable option in terms of environmental, social and economic considerations, discussions with Ports Victoria (prior to the EES process) indicated that they are in the process of working with Deakin University on potential habitat sites but that no suitable sites have been identified, which could be assessed as part of the Sediment Assessment process to determine whether the sediment at the Loading Site would be suitable for reuse. This Ports Victoria – Deakin University habitat creation project is still in its early stages and does not align with the timeframes of this project.

5.5 Preferred Dredged Sediment Disposal Approach

Based on the screening assessment in **Section 5.4**, the Point Wilson Disposal Ground is the preferred disposal option due to:

- The *Dredging and Offshore Contamination Assessment* (AECOM, 2021b) has identified that the material is suitable for disposal at the Point Wilson Disposal Ground. No potential adverse impacts were identified to ecological receptors at both the Loading Site and Disposal Ground for the proposed dredging activities, associated with contaminant impacts. Further detail is provided in **Section 5.3.2** of the report.
- An offshore solution will provide a more sustainable solution compared to onshore disposal options as significant infrastructure will not be required for dewatering and transportation requirements would be minimised as multiple truck movements would not be required to transfer the dried sediment to a landfill or thermal soil treatment facility.
- There is no apparent environmental benefit to be gained by the onshore disposal or treatment options, compared to the offshore disposal option. Costly dewatering and haulage to a landfill or treatment facility is a disproportional commitment of resources and energy use relative to the risks posed by very low concentrations of PFAS and other contaminants in the sediment.
- Onshore reuse on Viva Energy owned land or in a wetland scenario provides significant uncertainty with regard to technical feasibility, timing for approvals processes, and potential negative perceptions by some community members (e.g., reuse of slightly contaminated soil (even though below guideline values) which could be proximal to sensitive receptors depending on the location selected).
- The Point Wilson Disposal Ground approach is consistent with dredging campaigns conducted over several years in the Corio Bay area, the most recent being circa 2014-2017. Ports Victoria has confirmed there is sufficient space for the material proposed to be dredged from the Disposal Ground.
- Disposal at Point Wilson is the lowest cost option.

5.5.1 Point Wilson Disposal Ground Description

The Point Wilson Disposal Ground is approximately 14 nautical miles (26 km) from the Loading Site (refer to **Figure 4**). It is estimated that a bulked volume of approximately 530,000 m^3 of dredged material would need to be placed at the Disposal Ground (Worley, 2021a).

Placement of dredge material is assumed to be by bottom dumping from barges (as has previously occurred at the Disposal Ground), with no requirements for bunding, layering or capping of material (Worley, 2021a) as the *Dredging and Offshore Disposal Assessment* (AECOM, 2021b) has identified no potential medium or long term adverse impacts to ecological receptors at both the Loading Site and Disposal Ground during, or from, dredging activities

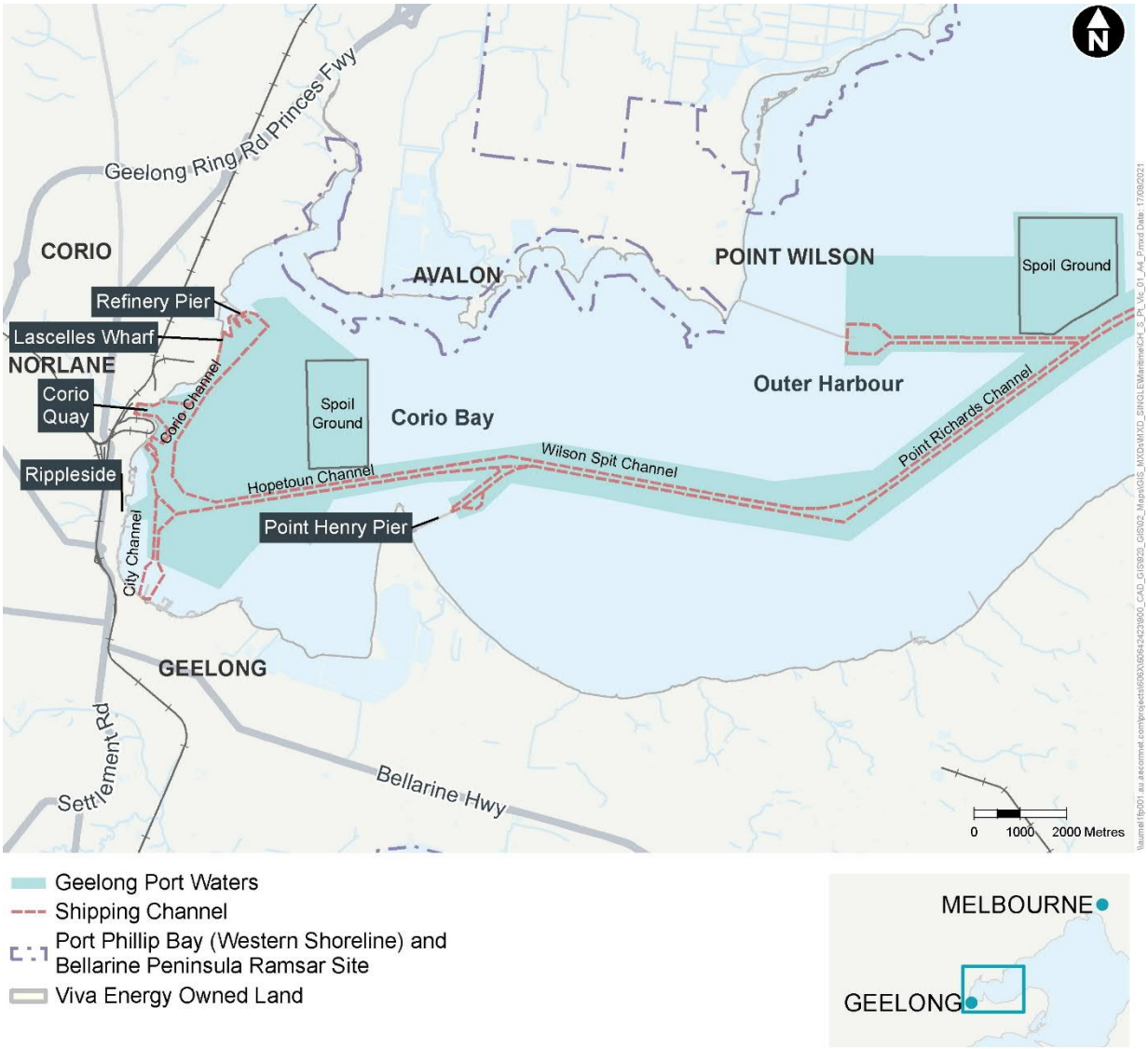

Figure 4 Location of Point Wilson Disposal

5.5.2 Suitability for disposal – *Dredging and Offshore Contamination Assessment*

A sediment quality assessment (**Appendix A**) was undertaken to assess whether sediment from the Loading Site would be suitable for relocation to the Point Wilson Disposal Ground.

Initial sediment sampling and analysis was completed by Coffey (2020) and AMA (2020). As the dredging design was refined in 2020-2021, some data gaps were identified in these initial sediment works, and further works were undertaken in 2021 to address these data gaps and to comply with the *National Assessment Guidelines for Dredging* (NAGD, 2009).

A *Sampling, Analysis and Quality Plan* (SAQP) (AECOM, 2021a) was prepared to provide details of the sediment quality assessment. EPA Victoria reviewed and provided feedback on the SAQP.

5.5.2.1 Sediment assessment guidelines

In Victorian waters, the Vic EPA has published *Best Practice Environmental Management - Guidelines for Dredging* (Publication 691, 2001). For any proposed sediment dredging in coastal waters around Australia, sediment quality must be evaluated in accordance with national regulations and guidelines; primarily the *National Assessment Guidelines for Dredging* (NAGD, 2009). The NAGD is generally

consistent with Vic EPA Publication 691, albeit more rigorous with sediment sampling densities and approach to the various phases of assessing sediment quality.

For the purpose of the sediment quality assessment, general adherence was made to Vic EPA Publication 691, but also to the NAGD. Furthermore, current state and national guidance for the sediment, surface water and porewater sampling methodologies, laboratory analysis, QA/QC, and assessment criteria, was applied.

5.5.2.2 Fieldwork

Fieldwork was conducted by AECOM between 19 August and 8 September 2021 to collect sediment, porewater and seawater samples to inform the assessment in accordance with the SAQP.

The fieldwork undertaken included:

- collection of sediment and porewater samples at the Loading Site (13 sediment sampling locations)
- collection of sediment samples at ambient site locations, in the vicinity of the Disposal Ground (14 sediment sample locations)
- collection of sediment and seawater samples at the proposed Disposal Ground (6 sediment sample locations, 3 seawater sample locations).

Data generated from fieldwork was combined with data reported by Coffey (2020) and AMA (2020) (within the Loading Site) because all three data sets were required to satisfy the NAGD (2009) assessment and reporting requirements.

5.5.3 Characterisation of the Loading and Disposal Sites

The following details were identified regarding the existing sediment conditions at the Loading Site, Disposal Ground and ambient baseline locations in Corio Bay:

- The physical characteristics of the sediment at the Loading Site and Disposal Ground are generally very similar (which could be expected given that the sediments from past dredging programs in Corio Bay were disposed of at the Disposal Ground). Sediment physical characteristics at the ambient baseline locations in the vicinity of the Disposal Ground are also broadly similar but with a higher percentage of fine sands. Similar sediment characteristics assist the growth of existing biological communities at Disposal Ground following the placement of dredged sediment.
- Sediments at the Loading Site reported 95% upper confidence limit (UCL) and/or mean concentrations greater than the default guideline values (DGV) for antimony, arsenic, lead, mercury and nickel (e.g. concentrations of these metals exceeded the assessment criteria). As a result, these metals were carried forward into the next phase of assessment as per the NAGD (2009). Sediment elutriate analysis was subsequently performed for these metals/metalloids and the mean elutriate concentrations within the AECOM dataset were below the DGV indicating a low potential for bioavailability (and hence ecotoxicity) to marine biota. Silver and zinc elutriate concentrations were reported above the DGV in the Coffey (2020) data set however these were not considered to be significant exceedances that would contribute to adverse impacts to aquatic biota.
- Low levels of perfluorooctane sulfonate (PFOS) were detected in sediments at the ambient baseline locations, Loading Site and Disposal Ground; and in seawater collected within the outer harbour of Corio Bay (all below the adopted default guideline value [DGV]). In addition, per- and polyfluoroalkyl substances (PFAS) were reported in seawater above the laboratory limit of reporting (LOR) at concentrations ranging between 0.0004 and 0.0009 µ/L. With the exception of PFOS, the PFAS detected in seawater were not recorded in the sediment samples collected from any location (including the Loading Site) indicating ubiquitous concentrations of PFAS in seawater across Corio Bay.
- Coffey (2020) performed a preliminary acid sulfate (ASS) assessment to identify the ASS status of the sediments to be dredged, primarily to assess suitability for onshore disposal (i.e., drying or significant oxidation would occur). The results identified the presence of sulphides and acid generating potential in sediments within the proposed dredging depth profile. However,

considerable acid neutralising capacity (ANC) was also reported, and when the ANC was considered, the net acidity values were below the ASS action criteria. Coffey (2020) noted that the neutralising capacity exceeded the acid generating capacity by more than 15 times in most samples. Coffey (2020) concluded that:

- all sediments could be classed as non-ASS for onshore management
- further sampling and analysis would be required if the sediments are to be dried or significant oxidation is likely. This statement is consistent with Simpson et al (2018) which states that "When ASS are below the water table, they are generally considered harmless…".

Furthermore, it is understood that at the Loading Site, sediment will be loaded into split hopper barges and transported to the Disposal Ground within approximately two hours of dredging (CEE, 2021a). Given the relatively short time where the external layer of sediments in the barge would be exposed to the atmosphere, minimal 'drying' and oxidation of sediment would occur, and consequently potential ASS generation would be limited.

5.5.4 Sediment quality assessment conclusions

While initial results from the sediment sampling identified some chemical concentrations that exceeded the assessment criteria, the NAGD (2009) phased approach sets out a process to further examine the potential toxicity to ecological receptors. These further test results identified no potential adverse impacts to ecological receptors at both the Loading Site and Disposal Ground during the proposed dredging activities.

On the basis of the sediment quality assessment (AECOM, 2021b) undertaken in accordance with the NAGD (2009), it was concluded that the sediments proposed to be dredged at the Loading Site are suitable for offshore disposal at the Point Wilson Disposal Ground.

Further details of the sediment quality assessment are provided in *Dredging and Offshore Contamination Assessment* (AECOM, 2021b) (**Appendix A**).

6.0 Potential Impacts, Monitoring & Mitigation Measures

As per the Assessment Framework outlined in the NAGD (2009), the potential impacts on the environment at the Loading and Disposal Sites were assessed as part of EES Technical Report A: Marine *ecology and water quality impact assessment* (Section 13 Mitigation and Management Strategies).

Monitoring and management measures to control and/or mitigate these impacts were also addressed in the aforementioned report.

7.0 Conclusion

The DSDOA was undertaken to assess management options for sediment proposed to be dredged as part of the Viva Energy Gas Terminal Project.

The dredged sediment management options included the assessment of:

- offshore disposal at the Point Wilson Disposal Ground
- offshore disposal at the Port of Melbourne Disposal Ground
- reuse on Viva Energy owned land
- reuse for habitat creation
- disposal at a licensed landfill
- treatment at a licensed thermal treatment facility.

The screening assessment focused on the technical, environmental, social and financial feasibility of each option. The options assessment identified that disposal of dredged sediment to the Point Wilson Disposal Ground would be the preferred option, subject to a sediment quality assessment. Discussion with Ports Victoria identified that sufficient space is available at the Disposal Ground and unconfined disposal would be considered subject to the contamination status of the material proposed to be dredged and receipt of a MACA consent.

An initial sediment quality assessment was undertaken in 2020. Following a data gap assessment and refinement of the dredging design in 2021, further sediment, porewater and seawater sampling and analysis was completed in 2021.

While initial results from the sediment sampling identified some chemical concentrations that exceeded the assessment criteria, the *National Assessment Guidelines for Dredging* (2009) phased approach sets out a process to further examine the potential toxicity to ecological receptors. Further test results identified no potential adverse impacts to ecological receptors at both the Loading Site and Disposal Ground for the proposed dredging activities.

On the basis of the dredged sediment disposal options assessment and the sediment quality assessment, disposal at the Point Wilson Disposal Ground is the preferred option for the management of sediment proposed to be dredged as part of the project.

8.0 References

AECOM (2021a) *Sampling, Analysis and Quality Plan, Viva Energy Gas Terminal Project,* 7 July 2021

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AMA (2020) *Targeted Sediment Investigation, Project VEGA*. 12 October 2020.

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CEE (2021a)*. Investigation of Benthic Ecological Habitats in Corio Bay*, February 2021

CEE (2021b) *Viva Energy Gas Terminal Project Impact Assessment of Dredging,* September 2021

CEE (2021c) Technical Report A: *Marine Ecology and Water Quality Impact Assessment*, October 2021

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Simpson et al (2018) *National Acid Sulfate Soils Guidance: Guidelines for the dredging of acid sulfate soil sediments and associated dredge spoil management.* Department of Agriculture and Water Resources, Canberra ACT. June 2018

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