

To: Impact Assessment Unit,  
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Submitted by email to [environment.assessment@delwp.vic.gov.au](mailto:environment.assessment@delwp.vic.gov.au)

## Re: AGL APA Gas Import Jetty and Pipeline

We are pleased to contribute to the Draft Scoping Requirements to ensure AGL and APA's Gas Import project undergoes a comprehensive Environment Effects Statement (EES). This project has raised significant concern in the local and wider Victorian community due to its likelihood of increasing Victoria's greenhouse gas emissions and posing risks to the natural values of Westernport Bay. It is therefore critical that the EES is able to adequately assess the significant environmental risks associated with this project.

Environment Victoria is one of Australia's leading independent environment charities. With more than 40 member groups and 150,000 individual Victorian supporters, we've been representing Victorian communities on environmental matters for almost 50 years. We inspire, empower and lead people to solve the climate crisis, achieve a healthy environment and secure a fair and thriving Victoria.

### Overview

There are a number of critical issues with the draft scoping requirements that must be amended in order to provide a proper assessment of this project.

Key issues include accurately characterising the scope of greenhouse gas emissions associated with this project. If operating at full capacity, the import terminal and pipeline could double the amount of gas coming into Victoria, which is presumably being done with the intention of enabling increased gas *consumption* in Victoria. It is vital that the emissions associated with additional gas consumption are measured and factored into the impacts of this project.

It is also important to include the additional emissions associated with the processing and importing of LNG. By AGL's own admission, the imported gas will effectively be 20 percent more polluting than Victoria's existing gas supply. This is because the gas is imported from overseas in liquid form, stored and then heated to convert it back into gas. This requires large amounts of energy (and therefore emissions), and at each step there will be fugitive emissions leaking out.

Another theme of the scoping requirements is the unchallenged assertion by AGL that this project is needed to “augment” Victoria’s gas supply. If this is the case, AGL should be required to present evidence that there is no alternative to meeting the needs of Victoria’s gas consumers.

Finally the principle of avoidance must be given priority in the hierarchy of harm reduction and waste management. This should be emphasised by the language used throughout the final scoping document.

#### Recommendation for Technical Reference Group

As this project has significant implications for Victoria’s greenhouse gas emissions it is critical that the climate implications are properly taken into account. Currently, despite a wide number of government organisations represented on the Technical Reference Group, there is no one from the Climate Change team at DELWP. This is despite the *Climate Change Act 2017* being recognised as applicable legislation for the project to be assessed against, not to mention that the project may be inconsistent with commitments the government has made to limit global warming to well under two degrees as part of the Paris Pledge.

**Recommendation 1:**

DELWP - Climate Change must be represented on the Technical Reference Group

Comments on draft evaluation objects:

We submit the following comments on five of the six draft evaluation objectives.

1. Energy efficiency, security, affordability and safety

The framing of this draft evaluation objective is highly biased in favour of AGL’s justification for the project. The purpose of an EES is to assess the potential environmental impacts of a project, not to present the opportunity for the proponent to justify these impacts in the very first objective.

Unlike all the other draft evaluation objectives, this objective has no bearing on environmental impacts. It should therefore be removed from the scope of the EES.

**Recommendation 2:**

Remove the first draft evaluation objective, as the “safe and cost-effective augmentation of Victoria’s natural gas supply” does not actually address the environmental impact of the project. Or in the alternative, significantly amend the wording to include environmental considerations.

In the event that this objective is not deleted, we have the following recommendations on

how the language and requirements could be amended to serve the environmental purpose of the instrument.

We suggest the following changes to the objective heading:

Draft evaluation objective 1	Suggested rewording
<p><b>Energy efficiency, security, affordability and safety</b>            To provide for safe and cost-effective augmentation of Victoria’s natural gas supply in the medium to longer term, having regard to projected demand and supply of natural gas in context of the State’s overall energy needs and management</p>	<p><b>Energy efficiency, security, affordability and safety</b>            To avoid, minimise or offset potential adverse effects on Victoria’s environment while supplying gas to meet the needs of AGL’s customers, having regard to the clean energy transition underway in Victoria in the context of the climate emergency.</p>

While we are not necessarily suggesting our exact language be adopted, we wish to highlight the highly biased framing of the original objective, by demonstrating the opposing polarity.

### 1.1 Key issues

Rationale:

While we agree that it is important for the rationale for this project to be understood by all parties, it is important this is based on evidence rather than just the proponent’s word. AGL has repeatedly said that they need this project in order to meet obligations to their customers but they have consistently refused to provide any real information on this. Additionally the AEMO gas projections consistently used to justify this project are quite out of date given recent developments in the gas and electricity market and must also be updated in an evidence based manner.

**Recommendation 3:**  
 AGL should be required to provide the number and nature of their gas customers, including how many customers they have, whether they are residential or industrial, what quantities of gas they consume and whether the gas needs of these customers could be met in other less environmentally destructive ways, such as energy efficiency upgrades, fuel switching from gas to electricity and installing renewable energy. If the cost benefits of AGL’s projects are going to be evaluated, so too should the financial benefit (ie. cost savings) of these alternatives.

Capacity:

While capacity for a positive impact on Victoria’s energy market is considered, its potential negative impact has not been considered. Victoria is in the midst of a clean energy transition. Gross gas consumption has fallen by 20 percent in the last 7 years.

Creating new terminal and pipeline infrastructure and investing in a project of this scale (while risking major environmental impacts) has the potential to entrench gas's role in the market and undermine the transition which has been set out in established legislative and policy imperatives such as the Victorian Renewable Energy Target, Climate Change Act, Victorian Energy Upgrades Program and the ban on unconventional gas.

**Recommendation 4:**

Insert the following under 'key issues' in 'draft evaluation objective 1':

- The capacity of the project to exert a negative impact on Victoria's transition to clean energy, for example by entrenching the state's reliance on gas and reducing incentives for customers to adopt clean energy technology and efficiency solutions.

## 1.2 Priorities for characterising the existing environment

Again while this section focuses on gas supply issues, it ignores key aspects of the market and certain emerging scenarios. At present approximately two thirds of Australia's gas is exported onto the international market where AGL proposes to buy some of the gas back for this project. Therefore scenarios that address this absurdity should be considered when characterising the existing and emerging market environment. This should take into account environmental considerations such as climate change implications on the gas market and Victoria's ban on fracking.

**Recommendation 5:**

Insert the following under 'Priorities for characterising the existing environment' in 'draft evaluation objective 1':

- Characterise the potential for meeting the need for gas by scaling up demand-side measures such as energy efficiency upgrades and fuel-switching
- Characterise Victoria's existing and anticipated demand for natural gas relative to existing anticipated and emerging supply scenarios **including legislative interventions such as a gas reservation policy**
- Characterise how gas consumption contributes to Victoria's climate emissions
- Characterise the risk that this project will result in fracked gas being imported into Victoria, having regard to the state's ban on unconventional gas.

## 1.3 Design and mitigation measures

The EES process requires the project proponent to detail consideration of relevant alternatives. However the draft scoping document shows no sign that AGL has investigated alternative ways of meeting their projected shortfall. This section should include considerations or real alternatives that minimise environmental impacts of the gas industry such as helping their larger gas customers to electrify or increase energy efficiency, piping gas south from NSW/QLD along existing pipelines (rather than this pipeline taking gas from south to north).

There are significant opportunities for Victorian gas consumers to dramatically reduce their

gas consumption, in a short period of time, through efficiency measures and fuel switching - both of which are likely to also result in cost savings to those consumers. Presumably AGL's preference for gas imports as the solution is based on their ability to make more money from this, despite the fact that it comes at the expense of environmental damage. In our view, this is an unacceptable trade-off when there exist adequate alternatives to meeting the gas needs of Victorian consumers.

As above, while the evaluation objective is framed to suggest that the project will assist with both security and affordability, it does not prompt AGL to respond to concerns that the project may actually lead to higher, not lower, gas prices for Victorians. This view is supported by Macquarie Bank's thorough analysis of the price impacts of gas import terminals which outlines their concern "that any import terminal will not lower prices on the East Coast of Australia, and could potentially set a higher floor price."<sup>1</sup> The floor price is set higher because gas imports would embed into the domestic price the costs of shipping, liquefaction and re-gasification.

**Recommendation 6:**

Insert the following under 'Design and mitigation measures' in 'draft evaluation objective 1':

- Describe alternative options considered for meeting projected gas shortfalls, including considerations that minimise environmental impacts such as
  - supporting both large and small gas customers to electrify or increase their energy efficiency
  - piping gas south from NSW/QLD along existing pipelines
  - Support gas reservation policies to reduce the loss of domestic supply through LNG export
- Describe proposed measures to ensure the security and affordability of gas supply, including responding to claims that gas import terminals will increase the cost of gas

## 2. Biodiversity

Overall this draft evaluation objective is quite strong and reflects the high degree of caution and investigation that is necessary to protect this unique and threatened ecosystem.

However it should be noted that an overall issue with the EES process is that it requires the proponent to commission studies itself and this carries an inherent degree of risk that the research will be biased. This risk is real, as outlined by experts at Australia Marine Ecology who reviewed AGL's previously commissioned studies for this project. They found a number of serious issues, including that AGL's documents were inaccurate, misleading and with findings biased by omission of contemporary studies and information. We have attached this report to this submission.

We submit the following recommendations to improve this objective.

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<sup>1</sup> Macquarie Wealth Management, East Coast Gas and Infrastructure 6 July 2018

## 2.1 Key issues

### **Recommendation 7:**

Include the Ramsar Convention concept of 'wise use' in addition to 'ecological character' in the key issues in draft evaluation objective 2.

### **Recommendation 8:**

Amend the following dot point to include species listed under the Environment Protection and Biodiversity Act and other international agreements

- Direct loss of, or degradation to, habitat for flora and fauna species listed as threatened or migratory under the FFG Act, DELWP advisory lists, **EPBC listed species, having regard to international agreements such as JAMBA, CAMBA, ROKAMBA, Bonn Convention, ACAP, Australasian Flyway Partnership and the International Convention on Biodiversity**

### **Recommendation 9:**

When considering the availability of suitable offsets, ensure the offsets are genuine and appropriate. EG. Westernport has already lost 70% of seagrass so it is not possible to offset any further loss. As always, offsets are problematic: removing vegetation leads to immediate loss of habitat, which is replaced only very slowly as new plantings grow. There should be a requirement that work towards establishing offsets commences as soon as possible and well prior to the removal of existing habitat.

## 2.2 Priorities for characterising the existing environment

### **Recommendation 10:**

Insert the following under 'Priorities for characterising the existing environment' in 'draft evaluation objective 2':

- As appropriate, identify the different uses which significant species may make of different habitat areas that could be affected by the project at different times or life-cycle stages, **including the key requirements for local and migratory species.**

## 2.3 Design and mitigation measures

### **Recommendation 11:**

Ensure clear distinction is drawn between design options that avoid, minimise, mitigate or manage significant effects - noting that this is a hierarchy of options with the desired outcome always being to avoid adverse impacts in the first instance.

## 2.4 Assessment of likely effects

It is positive that assessment of cumulative impacts on biodiversity has been included in this section. However it is unclear from the dot point what factors will be considered in this assessment. For example will it include shipping and industrial development? How will the cumulative impacts be assessed so that it is not a token exercise?

## 2.5 Approach to manage performance

### **Recommendation 12:**

Identify and describe the monitoring and management program in the instance of catastrophic events such as a gas leak or tanker explosion and the impact this would have on biodiversity.

## 3. Water

This project poses serious risk to the marine environment of Westernport so it is critical that environmental effects are closely scrutinised.

As this project would be Australia's first floating gas import terminal, it is critical we understand the impacts of FSRUs around the world. Therefore in addition to the criteria outlined in this objective, AGL should also present independent analysis on current impacts (marine and other) on the environment in the vicinity of FSRUs currently in operation in other parts of the world.

### **Recommendation 13:**

AGL should provide data and analysis on the environmental impacts of other FSRUs operating around the world.

## 3.1 Key issues

### **Recommendation 14:**

In the "key issues" section, insert a dot point that has a greater focus on the essential characteristics that provide the ecological character of the Ramsar site, e.g. fish stocks, mudflats, mangroves, intertidal habitat etc.

### 3.2 Priorities for characterising the existing environment

**Recommendation 15:**

Insert the following under 'Priorities for characterising the existing environment' in 'draft evaluation objective 3:

- Characterise the interaction between freshwater and marine environments within the project and broader area.

### 3.3 Assessment of likely effects:

**Recommendation 16:**

Insert the following under 'assessment of likely effects' in 'draft evaluation objective 3:

- Assess likely cumulative effects on the waters of Westernport Bay that might result from the project in combination with other projects or actions taking place or proposed nearby.

## 5. Social, economic, amenity and land use

Many of the environmental issues so far raised in this submission have social elements, climate change, the energy transition and pollution to natural environments all have significant social impacts associated with them. It is important that this draft evaluation objective contains an environmental justice lens that seeks to minimise environmental harm on communities across Victoria.

### 5.1 Key issues

**Recommendation 17:**

Amend the language in dot point one as follows:

- Potential for project works **and on-going activities** to affect business (including farming) operations or other existing or approved facilities or land uses.

**Recommendation 18:**

Include in key issues:

- The potential for negative impacts on the local tourism economy
- The impact of the project on Victoria's transition to clean energy, including the potential for households and businesses to receive less support as they transition away from gas
- The impact of climate change on the Victorian economy and on regional communities across the state

## 5.2 Priorities for characterising the existing environment

### **Recommendation 19:**

Include in priorities:

- Identify potential impacts from any dredging associated with the project, including on beaches around the bay and Phillip Island.
- Identify the economic value of the tourism industry that relies on Westernport Bay's unique and pristine environment.
- Identify AGL and APA's performance as responsible corporate citizens, including a summary of breaches of environmental laws and compliance fines in Victoria and other jurisdictions as well as documented instances of causing conflict in local communities.

## 6. Waste management

The additional greenhouse gas emissions associated with this project is one of its biggest environmental impacts. It is therefore crucial that this section of the EES adequately characterise the scope of these emissions and appropriately deals with measures and strategies to 'avoid' them.

### 6.1 Key issues

Scope: LNG imports

The scope of the greenhouse gas (GHG) emissions associated with this project are much larger than this draft evaluation objective suggests. We are concerned not just with the emissions caused by the re-gasifying and processing at the Crib Point site, but with the fact that the entire LNG import process results in far more emissions than if the gas was sourced locally in Victoria.

The production of LNG is incredibly resource and GHG intensive. The production, liquefaction and transmission of gas to LNG at Gladstone uses approximately 150 PJ of gas (25% of domestic supply) and around 600 GWh of electricity.<sup>2</sup> This is *before* the gas is shipped and regasified or burned at point of consumption, which obviously leads to even more emissions.

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<sup>2</sup>[https://www.aemo.com.au/-/media/Files/Gas/National\\_Planning\\_and\\_Forecasting/GSOO/2018/Projections-of-Gas-and-Electricity-Used-in-LNG-2017-Final-Report-19--12-17.pdf](https://www.aemo.com.au/-/media/Files/Gas/National_Planning_and_Forecasting/GSOO/2018/Projections-of-Gas-and-Electricity-Used-in-LNG-2017-Final-Report-19--12-17.pdf) (p.10)

AGL has confirmed via correspondence that because of this extensive process, the gas from their import terminal would be 20 percent more polluting than gas supplied to Victoria from Bass Strait.<sup>3</sup>

In order to adequately assess the climate implications of this project, AGL should confirm the higher emissions associated with their proposed gas supply and provide all relevant available data.

**Recommendation 20:**

The scope of direct and indirect GHG emissions considered in the key issues must include additional emissions caused by the process of liquifying, shipping, reshipping and regasifying the LNG.

Scope: Gas consumption

This project will increase the amount of gas coming into and being burned in Victoria. This will result in increased GHG emissions, which must be accounted for as part of the EES, especially considering that an alternative to this project (ie. energy efficiency) would actually *reduce* emissions.

AGL's own rationale for this project is that they would otherwise not be able to supply sufficient gas to their customers. According to their logic, it follows that but for this project, less gas would be consumed in Victoria. Therefore every tonne of GHG from the gas supplied by this project should be treated as additional to Victoria's current GHG emissions.

**Recommendation 21:**

The scope of direct and indirect emissions considered in the key issues must include GHG emissions associated with the consumption of 100% of the gas that would be imported through this project. The assessment should also have regard to Victoria's commitment to reach zero net emissions by 2050 and commitments to keep warming to well below two degrees.

## 6.2 Priorities for characterising existing environment

This section omits the importance of characterising this project in the context of Victoria and Australia's response to the global challenge of climate change.

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<sup>3</sup> Email from Jasmine Doak, AGL, to Environment Victoria on August 8 2018.

**Recommendation 22:**

Insert the following under 'Priorities for characterising the existing environment' in 'draft evaluation objective 6:

- Characterise the impacts of this project in the context of the local and global response to the climate crisis, having regard to the IPCC's 1.5 degree report, Australia's progress towards achieving the objectives of the Paris Agreement and Victoria's progress towards fulfilling our obligations under the Paris Pledge - that is, keeping global warming to well below two degrees.

### 6.3 Design and mitigation measures

This section is anomalous from the other draft evaluation objections because of the conspicuous absence of the important mitigation concept of "avoidance."

While it is true that it will be very hard to avoid many of the GHG emissions associated with this project if it goes ahead, that does not mean the options should not be modeled and considered. In fact AGL is required to consider alternatives to this project and one alternative must be the decision not to go ahead with this project at all, therefore avoiding all GHG emissions. This could be paired with other solutions to perceived gas supply issues such as supporting large customers to deploy energy efficiency and fuel switching technology.

**Recommendation 23:**

Insert into dot point four:

- Identify options for **avoiding and** reducing direct and indirect greenhouse gas emissions resulting from the construction and operation of the project.

### 6.4 Assessment of likely effects

Again the issues with this section relate to inadequate characterisation of the scope of emissions involved in this project.

**Recommendation 24:**

Amend the language in the second dot point to say the following:

- Quantify anticipated greenhouse gas emissions from the project, including:
  - **additional emissions caused by processing, liquifying, shipping, reshipping and regasifying the LNG.**
  - **the total GHG associated with the burning or other consumption of all the gas delivered by the project**

## 6.5 Approach to manage performance

**Recommendation 25:**

Amend the language in the second dot point to say the following:

- Describe proposed measures to **avoid**, reduce, monitor and audit greenhouse gas emissions from the project.

## Conclusion

Thank you for the opportunity to make submission to this project. We would be happy to discuss our recommendations with any of the relevant decision makers.

Sincerely,

Nicholas Aberle

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Environment Victoria

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**Attachment 1:**

***Review of EES Referral for AGL Floating Storage and Regasification Unit in Western Port***

*Dr Matt Edmunds*

*Australian Marine Ecology*

Report to VNPA and Environment Victoria  
October 2018

*Review of EES Referral for AGL Floating Storage  
and Regassification Unit in Western Port*

*Matt Edmunds*



*Australian Marine Ecology Report No. 561*

Version 01

Report to VNPA and Environment Victoria

October 2018



AUSTRALIAN  
MARINE  
ECOLOGY

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# ***Review of EES Referral for AGL Floating Storage and Regassification Unit in Western Port***

## **Document Control Sheet**

### **Description**

This document reviews the marine ecology component of the AGL EES referral for the installation and operation of a floating storage and regassification unit at Crib Point, Western Port. This report was submitted in conjunction with a separate table of specific review comments.

### **Keywords**

EES referral, floating storage and regassification unit, FSRU, Western Port, Crib Point, ecological impact assessment, environmental management, cumulative impact assessment, saltmarsh, mangroves, tidal mudflats, shore birds, water birds, seagrass, sediment epibiota, listed species, species of conservation concern, ecosystem processes, natural assets, ecological features, habitats, biotopes, DPSIR, EBM, FEAST, activity-pressure-sensitivity-feature, ecosystem state, monitoring, ecosystem services, responsive monitoring, adaptive management.

### **Citation**

Edmunds M (2018) *Review of EES Referral for AGL Floating Storage and Regassification Unit in Western Port*. Report to Victorian National Parks Association and Environment Victoria. Australian Marine Ecology Report No. 561. Melbourne.

### **Cover Images**

Left to right: diver underwater visual fish census and stereo video fish census; intertidal quadrat counts of snails; and humpback whale fluke photo-ID record (David Donnelly).

### **Amendments**

<b>Version</b>	<b>Section</b>	<b>Date</b>	<b>Amendment Details</b>
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## Executive Summary

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AGL Wholesale Gas proposes to install a floating gas storage and regassification unit (FSRU) at Crib Point. Western Port has many natural values of high conservation and ecosystem services value. This is reflected in the various conservation listings of species, communities, marine protected areas and special management areas. The area is also highly valued for a variety of ecosystem services. The FSRU project has the potential for hazards with the risks of bay-wide and ecosystem-level impacts. The AGL Referral for evaluation for an Environment Effects Statement (EES) was reviewed, including for scientific validity and completeness and the provision of information for assessing impacts.

The marine component of the FSRU Referral was not comprehensive or systematic. The reviewed documents were inaccurate and misleading. With findings strongly biased by:

- omission of contemporary studies and information;
- lack of inventory of significant ecosystem components, assets and features;
- selective consideration of only some impact effects;
- arbitrary spatial restriction of assessments to the vicinity of the jetty;
- exaggeration of habitat isolation between the jetty and shore;
- selective consideration of only some impact receptors, predominantly listed species;
- oversimplification of ecosystem entities; and
- few predictions of biological outcomes.

The Referral documentation does not meet the information needs for the assessment of environmental effects. Key aspects not addressed included:

- identification / inventory of the types and values of natural assets, features and ecosystem services;
- production, dispersal and impacts of secondary organochlorine and organobromine toxicants through the use of free chlorine as a biocide;
- levels of pressures associated with habitat removal, sediment scouring and resuspension, disturbances from light, noise, vibration and visual presence;
- spatial scales of impacts, particularly through tidal currents and animal movements;
- wider ecosystem level impacts, including through water quality, sediment and biological pathways;
- prediction of impacts on important biological features, including susceptible features such as lamp shell beds;
- risks and controls of catastrophic events associated with the FSRU and increased shipping activity;
- assessment of cumulative impacts, including the combined pressures from the FSRU operation and other activities in the region;
- critical knowledge gaps for understanding and managing risks and impacts.

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# 1 Introduction

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## 1.1 Background

AGL Wholesale Gas proposes to install a floating gas storage and regassification unit (FSRU) at Crib Point. The operation involves delivery of liquid natural gas (LNG) to the unit via vessels approximately once a week. The LNG is stored in cold liquid form in the FSRU and is regassified on demand and delivered via a pipeline connected to the FSRU. The gas is produced by passing the LNG through a heat exchanger, using ambient seawater for the gas exchange. A flow-through system is used, with seawater drawn in through intakes on the side of the vessel, passed through the heat exchanger which decreases its temperature and the is proposed to be discharged through a 6-port outlet/jet system along both sides of the hull. The discharge will be reduced to three effective ports when delivery vessels berthed alongside. The discharge jets provide momentum for initial dilution to approximately 20:1 and temperature 0.3 degrees below ambient. The effluent has momentum and higher density, leading to a benthic trajectory with seabed disturbance and occasional pooling at slack water. The effluent would then be dispersed by tidal currents well to the north and south of Crib Point. The heat exchanger is protected from biofouling by dosing the seawater with free chlorine (produced by electrolysis) and bromine (produced from the free chlorine), both of which act as biocides and rapidly degrade into secondary compounds. Residual free chlorine and bromide and the secondary products are discharged in the cooled effluent and dispersed in the initial dilution and tidal current processes. The operation also includes activities that incur various noise, light, vibration, visual and other disturbances.

The proposed installation would be at Crib Point in North Arm of Western Port. Western Port is a tidally flushed embayment with a high diversity of biotopes. The location has extensive wetland and littoral habitats, including extensive areas of saltmarsh, mangroves, littoral seagrass and littoral mudflats. These habitats are vulnerable to disturbance and are important for shorebirds and the whole bay is listed as a Ramsar site. The subtidal habitats are generally structured by tidally-influenced sediment channels and plains, however the sublittoral biotopes are also relatively diverse and include types and species that only occur within Western Port.

Western Port has many natural values of high conservation and ecosystem services value. This is partially reflected in the various conservation listings of species, communities, marine protected areas and special management areas. The project has the potential for hazards with the risks of bay-wide and ecosystem-level impacts.

A Referral, including referral form and technical appendices, was submitted for the consideration of whether the project requires an Environment Effects Statement.

Australian Marine Ecology was commissioned by the Victorian National Parks Association and Environment Victoria to review the Referral documents.

## 1.2 Scope of Review

The scope of the review comprised:

An urgent appraisal (within 2 days) of the documents:

- AGL EES referral;
- Chlorine in seawater heat exchange process at Crib Point by CEE;
- Modelling and assessment of biological entrainment into the heat exchange system;
- Marine ecosystem protected matters report;
- Effects of LNG facility on sea level and seabed at Crib Point jetty;
- Assessment of effects of cold water discharge on marine ecosystem;
- Other pertinent documents where feasible.

Directions for the review were:

- Review of the analyses of impacts and comparing to available and most up-to-date evidence, to determine if an adequate analysis was done for the Referral studies.
- Gaps or weaknesses in the above studies, including any uncertainties in the underlying scientific knowledge of likely or possible impacts.
- Has the potential impacts of Chlorine on marine fauna, mangroves and seagrass been taken into account, and are there any gaps or further studies that should have been undertaken that weren't? Are there cumulative impacts on Chlorine over time?
- Modelling and assessment of biological entrainment into seawater heat exchange system: Has marine life being sucked into the intake pipes, significant fauna been taken into account adequately enough?
- Are there any fauna/flora that have been overlooked?
- What about downstream effects on the food chain if plankton and other small creatures are being sucked up. What about eggs and effects on fish stock?
- Assessment of effects of cold water discharge on marine ecosystem: Given not much is known about this, are the reports reflective of that?
- Other matters
  - Are the references up to date and quoting the correct information?
  - Are there any studies that aren't listed that should have been done?
  - Or any potential impacts that have not been considered by AGL?
  - Could this affect the Ramsar Listing of Western Port Bay?
- Appraisal against the Ministerial Guidelines for the Assessment of Environmental Effects.

Outputs to consist of a short report detailing:

- Key concerns with AGL's project; and
- Gaps and concerns with their EES submission and research study, including any uncertainties.

## 2 Methods

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### 2.1 Reviewed Documents

The review focussed on the marine ecosystem components of the Referral, including littoral and sublittoral habitats.

Primary reviewed documents were:

AGL (2018) Referral of a project for a decision on the need for assessment under the Environment Effects Act 1978. AGL Gas Import Jetty Project.

Attachment 04. Jacobs (2018) AGL Gas Import Jetty Project. Environmental Noise Assessment. Report by Jacobs. Melbourne.

Attachment 05. Jacobs (2018) AGL Gas Import Jetty Project. Flora and Fauna Assessment. Report by Jacobs. Melbourne.

Attachment 10a. AGL Gas Import Jetty Project. Crib Point, Western Port. Plume Modelling of Discharge from LNG Facility. Report by CEE to Jacobs Group. Melbourne.

Attachment 10b. AGL Gas Import Jetty Project. Crib Point, Western Port. Chlorine in seawater heat exchange process at Crib Point. Report by CEE to Jacobs Group. Melbourne.

Attachment 10c. AGL Gas Import Jetty Project. Crib Point, Western Port. Assessment of effects of cold-water discharge on marine ecosystem. Report by CEE to Jacobs Group. Melbourne.

Attachment 10d. AGL Gas Import Jetty Project. Crib Point, Western Port. Modelling and Assessment of Biological Entrainment into Seawater Heat Exchange System. Report by CEE to Jacobs Group. Melbourne.

Attachment 10e. CEE (2018) AGL Gas Import Jetty Project Crib Point, Western Port. Marine Ecosystem Protected Matters Assessment. Report to Jacobs by CEE Pty Ltd, Melbourne.

Attachment 10f. CEE (2018) AGL Gas Import Jetty Project Crib Point, Western Port. Effects of LNG Facility on Sea Level and Seabed at Crib Point Jetty. Report by CEE Pty Ltd. Melbourne.

Attachment 18. Cumulative Impact Assessment Report. APA Crib Point Pakenham Pipeline Project and AGL Gas Import Jetty Project. Report by AECOMM to APA Transmission and AGL Wholesale Gas. Melbourne.

Secondary reviewed documents were:

Attachment 11. Ethos Urban (2018) AGL Gas Import Jetty Project. Landscape and Visual Impact Assessment, Crib Point. Report by Ethos Urban to Jacobs Group. Melbourne.

Attachment 12. AGL (2018) AGL Gas Import Jetty. Consultation Summary, July 2017 to August 2018. Report by AGL. Melbourne.

Attachment 13. AGL Environment Policy

Attachment 06. Jacobs (2018) Greenhouse Gas Emissions Assessment (including Climate Change). Report by Jacobs. Melbourne.

Attachment 09. Jacobs (2018) AGL Gas Import Jetty Project. Desktop Social Impact Assessment. Report by Jacobs. Melbourne.

AGL (2018) Fact sheet: AGL gas import jetty.

AGL APA (2018) Referral of AGL Gas Import Jetty Project and APA Crib Point Pakenham Pipeline Project for decision on the need for assessment under the Environment Effects Act 1978. Cover letter to the Minister for Planning, State of Victoria. Melbourne.

## 2.2 Review Criteria

The referral documents were reviewed with respect to the scope questions. The review specifically considered reliability, completeness and veracity of the provided information. This included adherence to scientific principles of objective and evidenced-based reasoning, repeatability of surveys and measurements and use of best-practice ecosystem impact assessment approaches.

The content of the referral was also reviewed for provision of the appropriate information to assess the need for an EES. Expectations of the referral included:

1. An overall systematic approach to ensure all potential impact effects and responses are identified and investigated.
2. Comprehensive evaluation of activities and pressures associated with the project.
3. Comprehensive evaluation of the natural assets and features, including key species, key biotopes, key ecosystem process, including but not limited to listed species.
4. An appropriate ecosystem concept model that links ecosystem components and environmental drivers.
5. An assessment of the sensitivities of each identified key component or feature with respect to the level of each of the potential disturbances, pressures or risks.
6. The incorporation of prior knowledge, experience and learnings, including contemporary information on the Western Port environment and ecosystem and on activity-pressure relating the operation and risks of FSRUs (and similar activities).
7. The filling of identified knowledge gaps through appropriate field surveys, experiments, measurements and modelling.
8. Identification of residual knowledge gaps that inform decisions for the need for an EES.

9. Proposals for the responsive monitoring and management for maintenance of the ecosystem and likelihood controls for catastrophic risks – in the event an EES is not commissioned.

### **2.3 Specific Comments**

Review comments for each document were provided on a separate spreadsheet:

AME-2018-1171-VNPA\_EV-Western Port FSRU review-181006.xlsx

These comments include the veracity or accuracy of particular statements in the Referral documents. These specific comments include identification of bias by omission of important information. There is also some cross referencing of comments that are inconsistent or contrary within and between documents.

### **2.4 General Comments**

The overarching assessment of the Referral Review combined issues identified in the specific review of each document and the criteria for evaluation in the brief. The findings are provided in Section 3 below.

## 3 Referral Review

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### 3.1 Specific Issues

Specific issues with the information provided in the referral documents are presented in the accompanying spreadsheet:

AME-2018-1171-VNPA\_EV-Western Port FSRU review-181006.xlsx

These specific findings were compiled into key general issues of the referral, presented below.

### 3.2 General Issues

#### 3.2.1 No Systematic Approach

The referral document did not implement any systematic framework for identifying, documenting and addressing all potential impact effects and responses. This has led to considerable gaps in the information provided, with serious implications for misleading and bias by omission.

Of particular concern was the arbitrary, biased selection of only a few potential impact effects for consideration and only some ecosystem components. This is bias by omission and all components should have been considered and the level of consideration governed by evidence and good reasoning.

Just some of the systematic-related omissions include:

- Arbitrary spatial limiting of considerations to just a small area near Crib Point, despite evidence within the Referral and elsewhere that values, dispersal and impact effects need to be considered over a larger area;
- Partial ecosystem concept model, excluding key components and not consistent with extant models for Western Port;
- Lack of identification and mapping of key natural assets, particularly subtidal biotopes – the only focus was on listed species, including irrelevant listed species such as turtles and whales;
- Lack of consideration of fish, habitat requirements, movement routes and fisheries;
- No consideration of the environmental drivers and sensitivities of the natural assets;
- Selective bias to consider only three activity pressures (entrainment, chlorine and temperature), even when other pressures were identified in the Referral (noise, visual disturbance, sediment bed scouring).
- No consideration of some catastrophic bay-wide risks (explosions, oils spills, chemical spills, ship grounding, Undaria from Port Phillip Bay).

- No consideration of combined or cumulative impacts for a proper ecosystem-based impact appraisal – the cumulative impact assessment actively rejected consideration of any combined impacts outside the project.

The lack of a systematic assessment framework has led to inconsistent, contrary conclusions and statements of the Referral.

### **3.2.2 Lack of Evidence from Contemporary Sources**

The Referral is notably lacking in any review of contemporary ecological literature, studies and data. At a general level, habitat and biotope mapping in recent years is not included and there have been considerable advancements in knowledge of key ecosystem components and processes in Western Port.

The Referral does not reference any substantive ecological work done in Western Port in the last ten years.

The Referral does not provide any indication that the extent of available knowledge was sought, nor does it systematically consider knowledge gaps that require filling by specific field surveys.

An example of the lack of research and synthesis of extant information is the ecological concept model used by the Referral. This is provided without any reference to the range of existing models in the literature. Moreover, it is provided without any evidence or rationale at all. It is inconsistent with existing ecosystem concept models for Western Port. The Referral model is highly deficient (*e.g.* birds, tidal mudflats and current dispersal are not included). Similarly, the lack of review has meant key ecosystem assets and features were not identified and assessed.

The Referral claims that AGL has adequate experience and expertise in the implementation of the FSRU, however no pertinent knowledge is brought forward into the Referral. There is no appraisal of the risks and risk management from elsewhere. There is no appraisal of the environmental monitoring from elsewhere, the findings and how that relates to this project. It is expected that there are other projects elsewhere that could have informed the environmental considerations of this proposal.

The Referral does not consider case studies and monitoring from other FSRU installations or similar activities, such as cooling and desalination water discharges. This is particularly relevant for understanding the impacts of releases of secondary toxic products, such as organochlorines and organobromines resulting from the use of chlorine as a biocide. This issue is not addressed in the Referral, but is evident from even the most cursory literature review. There are other issues that would be well informed by a review of other cases.

### 3.2.3 Selective Assessment of Threats and Pressures

The referral is heavily biased in its consideration of potential threats and pressures. There is an arbitrary, biased selection of the pressures that were assessed and not all of the limited number of pressures identified were assessed in detail. For example, noise was identified, but only assessed for human populated areas, but not for birds or the underwater environments. Similarly, visual disturbance was assessed for human impacts, but visual, light and vibration disturbances were not assessed for obvious key ecosystem features such as shore birds or migrating fish, squid or mammals past the facility.

The modelling in the referral indicated seabed scouring from density flows will occur – the biological impacts arising from this were ignored. It was stated such impacts would be within Port limits, implying further consideration was not necessary, but the Port limits do not provide a licence to arbitrarily damage important ecosystem components and environmental health. The modelling indicated the (obvious) pressure that effluent from the FSRU will be dispersed considerable distances with tidal currents. The implications of this was not addressed. The Referral was spatially blinkered did not consider chronic toxicant impacts.

There is potential for chronic, long-term, irreversible ecosystem impacts in the release of contaminants and toxicants, particularly those that can bioaccumulate and magnify up the food chain, but also those that may pool or concentrate in a particular habitat or environmental sink. Although the Referral considers the fate of free chlorine, it ignores the secondary chemical products that arise from reactions of chlorine in seawater. Secondary products are also toxic, including various types of organochlorines and organobromines depending on the seawater quality at the time of free chlorine formation. Some of these, such as bromoform, disperse widely before dissipation and, while most are not thought to biomagnify up the food chain, some do. Given the consequences observed from accumulation of organochlorine pesticides in the marine environment, particularly for birds, mammals and apex predators in general, the appraisal of chemical releases by the FSRU must be taken seriously.

The referral avoids consideration of potential large scale, bay-wide and catastrophic risks and impacts. It does consider marine pests in the context of listed species, but in a cursory way. There is no systematic consideration of what such threats could be and how to provide confidence that they managed to an acceptable level. Potential catastrophic events include increased shipping leading to increased risks of oil spills, groundings and marine pests. The facility presents a pathway for catastrophic explosion, contaminant release and marine pest translocation. There have been catastrophic explosions, oil spills, chemical spills and marine pest releases elsewhere

– all such events have happened in the Bass Strait region even. These are very real threats and the Referral should have addressed them directly and comprehensively.

Other pressures that should have been considered include (but not limited to): barriers to migration; substratum disturbances and removal; sediment resuspension and water clarity/sedimentation; and other substance releases;

#### **3.2.4 Selective Spatial Assessment**

The referral is heavily biased in its spatial consideration of potential threats and pressures. There is a persistent restriction in the evaluation to just the Crib Point area. This is despite the Referral noting that tidal currents connect the activity area to the wider ecosystem components.

The area of spatial assessment is, however, inconsistent and contrary throughout the Referral. Some listed species, such as blue whale and turtles, are considered at sub-continent scales, the Flora and Fauna assessment does at least highlight that shorebirds connect the whole embayment, but sensitive vegetation and marine biotopes are not generally considered beyond the vicinity of the jetty (for the few components actually considered).

There is a notable discord between the Referral form submission and the technical appendices. The Referral claims, without evidence, that jetty environs are ecologically and environmentally isolated from the shore and littoral habitats, based on the distance alone. The appendices note that these habits are in fact connected, by at least tidal currents and by noise. A cursory literature review would have revealed many other ecological linkages between these two areas. The assumed spatial segregation in the Referral form was used to eliminate consideration of impacts from the FSRU operation and near-shore features and components. This was unsubstantiated information and highly misleading.

#### **3.2.5 Exclusion of Key Natural Assets and Features**

A credible ecological impact assessment requires the identification and mapping of the key components. The components include those needed to maintain ecosystem functioning, natural assets and features of particularly high value and species and components that would be particularly sensitive to one or more of the suite of pressures from the activity.

The Referral excludes the identification of such key ecosystem components, features and assets, with the exception of listed species in the protected matters report and the flora and fauna report. There is no systematic review or discussion of key features for consideration, let alone any identification of sensitive receptors. There was no survey work to observe, document and map existing conditions in the North Arm area, so there was no potential to discover important assets.

Examples of exclusion of important features of high conservation value includes consideration of lamp shell beds, *Magellania flavescens*. This is an unusual brachiopod shell and in Victoria, their distribution is restricted to the channels of Western Port. Recent mapping work by DELWP in Western Port indicated lamp shell beds are uncommon and patchy in distribution. Although not listed, they fulfil the criteria for listing and impacts on lampshell biotopes would be cause for concern. The Referral notes the presence of lampshell bed at the Jetty at Crib Point, but fails to recognise the significance, establish the distribution in the potential area of impact, or indeed assess any form of impacts on them.

With respect to exclusion of features important to ecosystem functioning, examples include the lack of consideration of loss of epibiotic biotopes on fish foraging, sheltering and movement. Following from this, there is no assessment of impacts on any species of fishes, including valuable fished species such as snapper, King George Whiting and calamari. Such species frequent and move through the area, and rely on certain types of seabed features. It was noted the consultation process did not involve fishing and fishery stakeholders and contemporary scientific studies were not reviewed.

Western Port has substantial littoral sediment habitats, including saltmarsh, mangroves, sediment flats, and seagrass. These areas have high production rates through sediment microalgae (microphytobenthos), organic input, infauna and bird interactions. There are both top-down and bottom-up trophic effects between wading birds and infauna and the whole littoral ecosystem is intrinsically linked with the sublittoral ecosystem. Such processes and linkages were not raised as features and values for impact assessment.

In general, the Referral overly-simplified (dumbed-down) the nature of ecosystem components and processes. For example, 'sediment epibiota' was used to represent a wide range of biotopes, which could potentially include sponge clumps, *Caulerpa* seaweed beds, seagrass beds, octocoral beds, seapen beds or ascidian clumps (the Referral had no specific inventory). Each of these biotope types have different ecosystem functional properties, susceptibility to impacts and ecosystem services. The oversimplification was also reflected in the Referral ecological concept model.

### **3.2.6 Limited Ecological Impact Prediction**

The limitation of coverage of both pressures and ecological features severely restricted the scope of impact predictions and implications. The predictions indicated that plankton would be affected in some way by entrainment and there would be impacts on seabed biota where the effluent plume pooled. The spatial extent and magnitude of impact responses on these biota and ecosystem components was not described. The spatial confinement of the Referral assessment also had a direct

limitation on the prediction of impacts and determining ecological implications of the FSRU operation.

Ideally, cumulative and whole ecosystem impacts should be considered. This can be done by combining the set of pressures related to the project with pressures from other human activity and natural environmental drivers. The cumulative impact appendix of the Referral did the opposite, openly rejecting the consideration of ecosystem-wide cumulative, synergistic or threshold impact effects. This included rejecting consideration of associated works around the Crib Point Jetty, in the same habitat and space as the FSRU operation, works which are required for the FSRU operation to occur.

There were no clear statements of biological impact prediction types, magnitudes and locations. There are clear claims that biological components would not be impacted, however they are often contradicted by other portions of the Referral. An example is noted above where the Referral form claims nearshore habitats could not be impacted because of the distance of the jetty, but is contradicted by the appendix documents. Other confounding statements occur, such as circular references in the case of bird impacts. The protected matter appendix report defers impacts on birds to the flora and fauna report, which in turn defers bird impacts back to the protected matters report.

### **3.2.7 Knowledge Gaps**

The confidence of impact predictions and the completeness of relevant knowledge are important considerations as to whether the Referral should trigger an EES.

As discussed in above sections, the Referral provided no synthesis of the contemporary status of knowledge and impact predictions were restricted to a select few impact effects (pressures). The Referral appendices flag the need for further investigations (such as noise on birds, entrainment on plankton and baseline monitoring surveys), but there is also a considerable omission of information not identified in the Referral. These omissions pertain to information on key impact pressures, specific ecosystem features and assets, consideration of susceptibility and biological impact responses and predictions. Contemporary biological information was not used and there was no attempt to examine and compare other case studies.

There should be further effort to provide a comprehensive ecological impact assessment to inform the decision-making process. The Referral defers the collection of some information as part of baseline monitoring, however this would prohibit informed decisions and adequate monitoring design – field surveys should be implemented beforehand.

### 3.3 Answers to Scope Items

***Was analysis for the marine Referral studies adequate and use up-to-date information?***

No - there was inadequate information review and exclusion of available and contemporary information from the last 10 years. The impact assessments were not comprehensive or systematic – they encompassed an arbitrary and limited selection of impact effects. The consideration of biological and ecosystem responses was largely absent. The analysis did not follow best practice for ecosystem impact assessment.

***What were the gaps or weaknesses in the above studies, including any uncertainties in the underlying scientific knowledge of likely or possible impacts?***

There were substantial gaps arising from the limited analysis approach – see specific and general comments. The Referral is substantially biased by omission.

***Has the potential impacts of Chlorine on marine fauna, mangroves and seagrass been taken into account, and are there any gaps or further studies that should have been undertaken that were not? Are there cumulative impacts on Chlorine over time?***

The assessment of the use of chlorine as a fouling biocide was extremely limited and blinkered. It addressed the fate of residual free chlorine in discharged effluent, but failed to recognise and assess the implications for production of secondary contaminants which are toxic and can disperse more widely. This can include a variety of organochlorines and organobromines and would be dispersed by tidal currents. The Referral actually contains a figure on bromoform production, but there was no appraisal of the significance of bromoform to the environment. Some secondary products may dissipate over time while others may bioaccumulate and biomagnify up the food chain, or collect in environmental pools. There was no account in the referral of such toxicants, or indeed any potential impact beyond the initial benthic pooling of discharged effluent.

***Modelling and assessment of biological entrainment into seawater heat exchange system: Has marine life being sucked into the intake pipes, significant fauna been taken into account adequately enough?***

No, and the Referral admits this in that further field studies are required. An issue is that plankton are not easily modelled by passive particle modelling. Estimates of entrainment require knowledge of plankton behaviour and concentration in particular parts of the water column and lateral position across the channel. Where species are concentrated in the water column, or adult populations are restricted in dispersal abilities, there are risks of larval recruitment shadows. Part of this process requires documenting the specific components at risk – the Referral is highly generalised and does not include any specific biological properties.

***Are there any fauna/flora that have been overlooked?***

Yes – whole parts of the ecosystem are overlooked. The Referral ecosystem concept model is overly simplified and does not include important components. Ecosystem linkages and pathways are not considered in the impact assessment, even though some are listed in the concept model. The biological components are grouped into confounded categories in the referral, caused by the lumping of different natural values with different susceptibilities and ecosystem roles into a single category (such as sediment epibiota). Most of the biological focus is on listed species, but does not even provide an inventory of other key features of value and importance. An example is lamp shell beds unique in Victoria to Western Port. These are a relatively rare biotope and there a photo of a bed in the Referral at the Crib Point jetty. This is an item of high conservation value but does not receive any attention apart from the photo in the documents. See specific and general comments for more detail.

***What about downstream effects on the food chain if plankton and other small creatures are being sucked up. What about eggs and effects on fish stock?***

There is potential for an impact, this potential is presently unknown and has not been examined yet. The discharge may not affect eggs that are near-surface or floating, but may affect larvae and eggs within the water column if they are concentrated on the western side of the channel. There are other more likely impacts on larval supply and recruitment that also should be considered. These include physical removal and disturbance of benthic biotopes, behaviour barriers caused by the discharge plume (different chemistry and temperature) and toxic effects of the plume on all aspects of the ecosystem, including plankton.

***Assessment of effects of cold water discharge on marine ecosystem: Given not much is known about this, is this report reflective of that?***

There is enough known about effects of temperature on physiology and natural thermal variations to indicate the slight decrease in temperature following mixing (0.3 degrees difference at 20:1 dilution) would have little physiological effect. Note that no supporting information was provided to substantiate this in the Referral. The impact pathways of the colder water are more likely to include: a barrier to movement, scouring and disturbance of the seabed from density flows and toxic secondary chlorine and bromine compounds. It should be noted that the Referral did not attempt to characterise natural temperature regimes and fluctuations, including thermoclines in Western Port. Neither did the Referral attempt to determine a temperature impact threshold from the literature.

***Are the references up to date and quoting the correct information?***

No – the references do not use key information from the last 10 years. There was essentially no synthesis of extant biological information from the literature and case

studies. This meant there was no inventory of key natural values for consideration, no indication of susceptibilities of these assets to pressures and no incorporation of information from case studies.

***Are there any studies that are not listed that should be have been done?***

Yes – as per above, there was a paucity of biological information included. Some examples that should have been included are contemporary ecosystem concept models for Western Port, assessment of similar impacts elsewhere and inventory and mapping of key natural assets, features and values. A review of the chemistry of secondary products from chlorine and the dissipation and accumulation pathways in the environment is essential.

***Are there any potential impacts that have not been considered by AGL?***

Yes – the Referral only considered an arbitrary subset of the possible impacts that could occur. Examples are provided in the general discussion above. Key ones include seabed disturbances, sediment resuspension and secondary product contaminants. These have potential to act on components throughout Western Port. No catastrophic risks were considered properly, including oil spills, chemical spills, ship grounding, explosions and translation of marine pests (including *Undaria* from Port Phillip Bay to Western Port). Other potential impacts can occur from visual, light, noise and vibration disturbances, particularly on birds but also on marine life.

***Could this affect the Ramsar Listing of Western Port Bay?***

The potential impacts could cause major changes to the Ramsar characteristics, but may not affect the qualification for listing. Western Port has many features that qualify it for listing. There would have to be extensive and drastic impacts on a range of features to disqualify Western Port from listing because it has many components that fulfil the criteria. Many of the features that contribute to the listing are vulnerable to particular pressures, so the ecosystem can incur major change if certain pressures are not managed. Regardless, there is reasonable potential for impacts on a variety of listed species, marine protected areas, species of high conservation concern, fished species such as calamari and King George Whiting and a wide variety of ecosystem services to human society. There are potential processes that have bay-wide implications.

### 3.4 Appraisal of Ministerial Guidelines

***a) Potential long-term loss of a significant proportion (e.g. 1 to 5 percent depending on the conservation status of the species) of known remaining habitat or population of a threatened species within Victoria***

Yes – the project is in the vicinity of two listed marine species. There is potential to affect vulnerable beds of lamp shells. There are impact processes that can affect shore birds and tidal mud flats.

***b) Potential long term change to the ecological character of a wetland listed under the RAMSAR Convention***

Yes – the project has the capacity to affect shore and wader birds, including fly-way species. This may be through toxicants, sediment suspension and water clarity, changes to sediment dynamics, changes to infauna recruitment. Shore habitats can also be affected by shipping wave erosion, biota can be affected by disturbances from noise, light, visual and vibration. There can be ecosystem changes from changes in fish movements and recruitment.

***c) Potential extensive or major effects on the health or biodiversity of aquatic, estuarine or marine ecosystems over the long term***

There are potential extensive or major effects on health and biodiversity through pressures of toxicants, seabed removal and disturbance and secondary trophic effects. There are increased risks of catastrophic events associated with the FSRU, service vessels and LNG delivery vessels, including oil spills, chemical spills, explosions and introduction of marine pests – events that have occurred elsewhere in Bass Strait and are therefore credible risks.

***d) Potential greenhouse gas emissions exceeding 200,000 tonnes of carbon dioxide equivalent per annum***

Not evaluated in this review.

***e) A combination of 2 or more of the following potential effects:***

***i. Potential significant effects on habitat values of a wetland supporting migratory bird species;***

***ii. Potential significant effects on the amenity of a substantial number of residents due to extensive or major long term changes in visual, noise or traffic conditions.***

Yes – as per the processes described above on wetland supporting migratory bird species.

Note there is potential risk to amenity of residents, arising from damage to ecosystem services provided by the marine environment. These services range from erosion control, provision of food (fisheries), bioregulation (nutrient and carbon cycles, wastewater processing and air quality regulation, recreation (fishing, boating, nature experiences) and cultural (sense of place, spiritual, inspiration, cultural, etc.).

## 4 Conclusions

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The marine component of the FSRU Referral was not comprehensive or systematic. The reviewed documents were inaccurate and misleading. The findings were strongly biased by:

- omission of contemporary studies and information;
- lack of inventory of significant ecosystem components, assets and features;
- selective consideration of only some impact effects;
- arbitrary spatial restriction of assessments to the vicinity of the jetty;
- exaggeration of habitat isolation between the jetty and shore;
- selective consideration of only some impact receptors, predominantly listed species;
- oversimplification of ecosystem entities; and
- few predictions of biological outcomes.

The Referral documentation does not meet the information needs for the assessment of environmental effects. Key aspects not addressed included:

- identification / inventory of the types and values of natural assets, features and ecosystem services;
- production, dispersal and impacts of secondary organochlorine and organobromine toxicants through the use of free chlorine as a biocide;
- levels of pressures associated with habitat removal, sediment scouring and resuspension, disturbances from light, noise, vibration and visual presence;
- spatial scales of impacts, particularly through tidal currents and animal movements;
- wider ecosystem level impacts, including through water quality, sediment and biological pathways;
- prediction of impacts on important biological features, including susceptible features such as lamp shell beds;
- risks and controls of catastrophic events associated with the FSRU and increased shipping activity;
- assessment of cumulative impacts, including the combined pressures from the FSRU operation and other activities in the region;
- critical knowledge gaps for understanding and managing risks and impacts.