6 March 2020

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Department of Planning, Industry and Environment
320 Pitt Street, Sydney NSW 2000

Dear Rose-Anne

Port Kembla Gas Terminal — Modification 1
Response to request for additional information

The Port Kembla Gas Terminal received Critical State Significant Infrastructure (CSSI) approval from the Minister for Planning and Public Spaces in April 2019. A modification application for the project was subsequently made (SSI-9471-Mod-1) in November 2019 and the accompanying environmental assessment placed upon public exhibition in December 2019.

Eight submissions on the proposed modification were received following the completion of the public exhibition period and a Submissions Report responding to comments was prepared in January 2020. Following the completion of the Submissions Report, a request for additional information on the proposed modification has been received from a number of government agencies.

The table below provides responses to the requests for additional information from the Department of Planning, Industry and Environment; Environment Protection Authority (DOC20/115960-2), and the Department of Primary Industries — Fisheries (C20/99 and C19/696).

We are happy to meet with any of the agencies in regards to their subsequent questions should the response below require additional clarification.

Table 1 Department of Planning, Industry and Environment

<table>
<tr><th>Issue</th><th>Response</th></tr>
<tr><td>
<u>Base case risk contours</u>

The submission makes reference to the preliminary hazard analysis of the proposed modification.

It states that the risk contours in the preliminary hazard analysis of the proposed modification are smaller than the risk contours in the environmental impact statement.

It requests clarification on the assumptions for each modelled scenario and a comparison of the risk contours in the proposed modification and the environmental impact statement.
</td><td>
The assumptions for each modelled scenario in the preliminary hazard analysis of the proposed modification are summarised below. It should be noted that the preliminary hazard analysis of the proposed modification also includes a refined location of the regasification unit within the FSRU based on refined design information placing it about 37 metres from the front of the vessel, compared to 46 metres from the front of the vessel in the EIS.
<table>
<tr><th>EIS base case</th><th>Modification base case</th><th>Low</th><th>High</th><th>High (sensitivity)</th></tr>
<tr><td>2 regasification trains
2 booster pumps</td><td>2 regasification trains
2 booster pumps</td><td>1 regasification train
1 booster pump</td><td>2 regasification trains
2 booster pumps</td><td>2 regasification trains
2 booster pumps</td></tr>
<tr><td>26 shipments per year</td><td>52 shipments per year</td><td>26 shipments per year</td><td>52 shipments per year</td><td>52 shipments per year</td></tr>
<tr><td>Peak release rate with corresponding ignition probability</td><td>Peak release rate with corresponding ignition probability</td><td>Peak release rate with corresponding ignition probability</td><td>Peak release rate with corresponding ignition probability</td><td>Averaged release rate with corresponding ignition probability</td></tr>
<tr><td>Assumed infinite release volume (large isolatable inventory)</td><td>Assumed infinite release volume (large isolatable inventory)</td><td>Assumed infinite release volume (large isolatable inventory)</td><td>Assumed infinite release volume (large isolatable inventory)</td><td>Assumed largest topside isolatable inventory for all above deck scenarios</td></tr>
<tr><td>Figure 1</td><td>Figure 2</td><td>Figure 3</td><td>Figure 4</td><td>Figure 5</td></tr>
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Issue	Response
	The risk contours for the EIS base case and modification base case are shown for comparison in Figure 1 and Figure 2. As shown, there is some increase in the outer risk contours to the west and the south-east from the EIS base case to the modification base case, which is attributable to the increase in assumed shipments per year from 26 per year in the EIS base case to 52 per year in the modification base case. The inner risk contours have not materially changed in extent but have moved slightly to the south as a result of the refined location of the regasification unit in the preliminary hazard analysis of the proposed modification discussed above. Further, risk contours for the low season (Figure 3) were considerably reduced compared to the modification base case while risk contours for high season sensitivity analysis (see Figure 5) were similar to the modification base case. As discussed in the proposed modification hazard and risk assessment, the proposed modification would not introduce additional hazardous inventories or scenarios. Consistent with the findings of the EIS, the assessment found criteria for sensitive areas, residential areas and commercial development would be met in all cases, as would the criteria for injury and propagation. Limited risks to open space and industrial areas have been identified which, consistent with the risks identified in the EIS, would include a section of Seawall Road and the small offsite area west of the truck washing facility associated with the coal terminal adjacent to Berth 101.

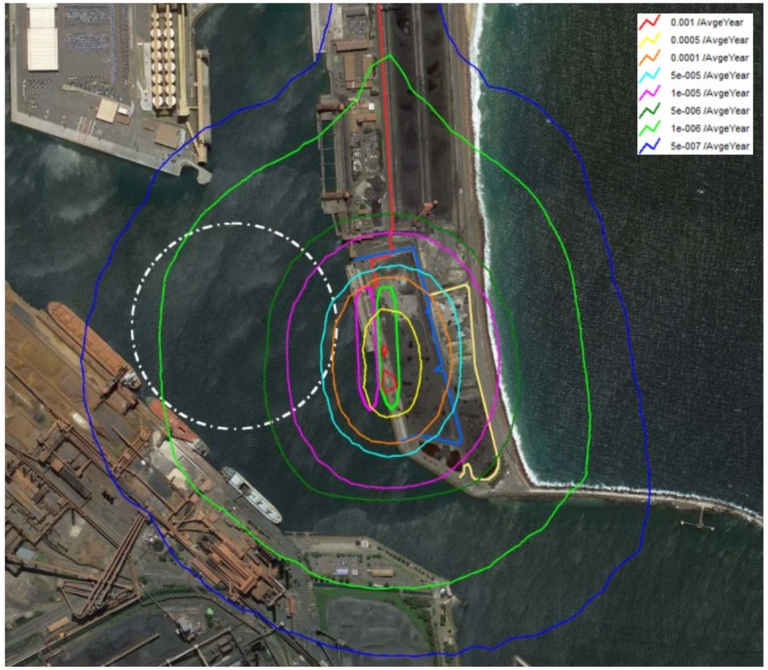

Figure 1 Risk contours (EIS base case)[1]

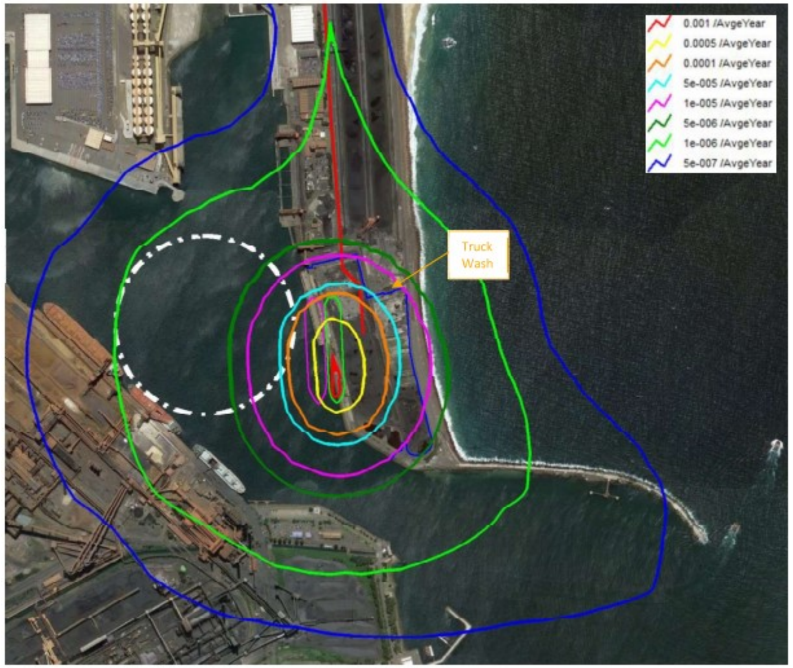

Figure 2 Risk contours (modification base case)[2]

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[1] WorleyParsons 2019, Port Kembla Gas Project, Preliminary Hazard Analysis Addendum, 401010-01496-SR-TEN-0002, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSI-9471%2120190429T020154.073%20GMT

[2] WorleyParsons 2020, Port Kembla Gas Project, Preliminary Hazard Analysis Addendum — Seasonal Variations, 401010-01496-SR-TEN-0003, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-2634%2120200131T045326.675%20GMT

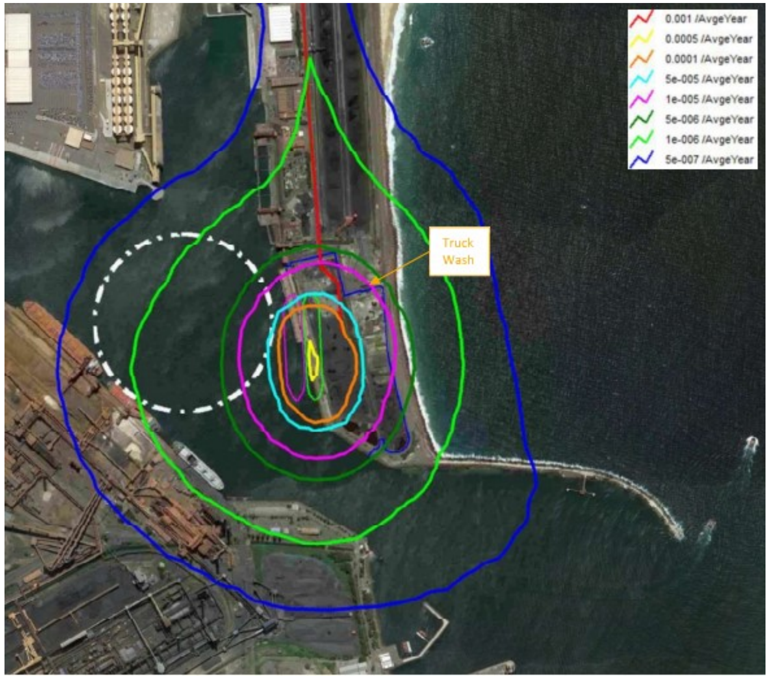

Figure 3 Risk contours (modification low scenario)[3]

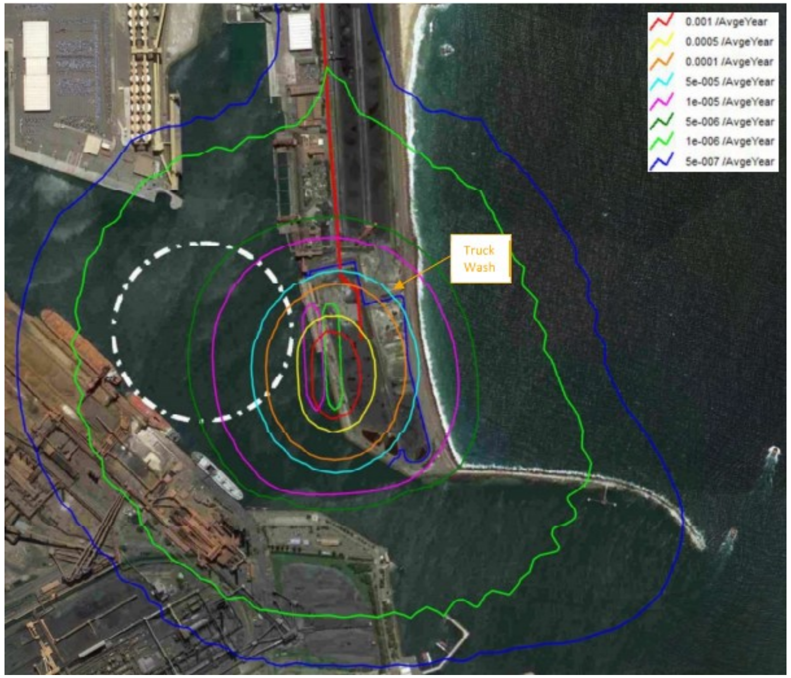

Figure 4 Risk contours (modification high scenario)[4]

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[3] WorleyParsons 2020, Port Kembla Gas Project, Preliminary Hazard Analysis Addendum — Seasonal Variations, 401010-01496-SR-TEN-0003, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-2634%2120200131T045326.675%20GMT

[4] WorleyParsons 2020, Port Kembla Gas Project, Preliminary Hazard Analysis Addendum — Seasonal Variations, 401010-01496-SR-TEN-0003, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-2634%2120200131T045326.675%20GMT

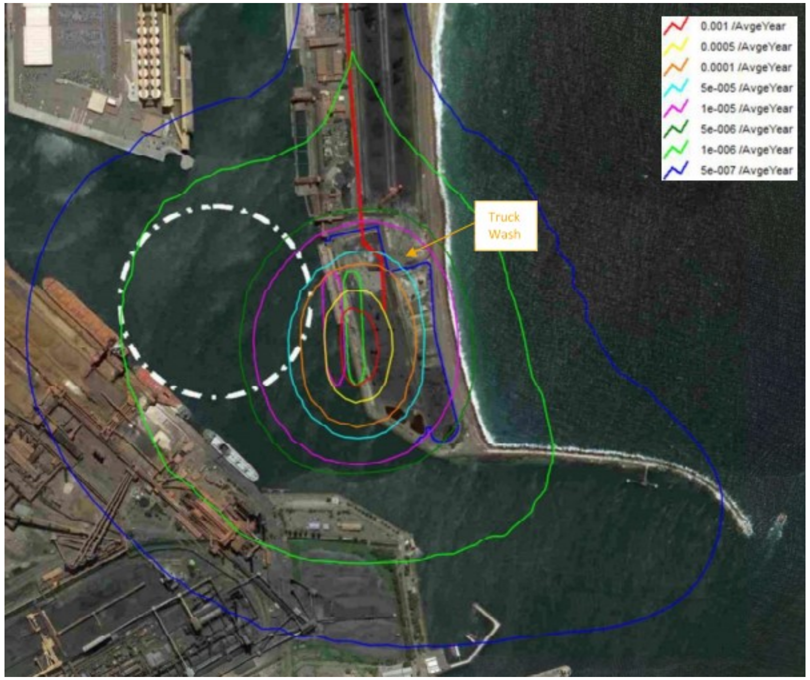


Figure 5 Risk contours (modification high sensitivity scenario)[5]

[5] WorleyParsons 2020, Port Kembla Gas Project, Preliminary Hazard Analysis Addendum — Seasonal Variations, 401010-01496-SR-TEN-0003, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=EXH-2634%2120200131T045326.675%20GMT

Table 2 Environment Protection Authority

Issue	Response
Evaluation of alternative technologies and measures The submission requests further information on the evaluation of alternative technologies and measures such as closed loop, cold water diffusers, measures to avoid biota entrainment, and alternative discharge locations such as ocean outfall or BlueScope Steel.	The modification requests permission to run the currently approved vessel at a variable rate of production versus a steady rate of production and does not require a change in vessel type. As a result, based on the EIS, associated Infrastructure Approval dated 24th April 2019 and discussions with the FSRU supplier, an open loop regasification vessel was ordered and has been built. It was not ordered with, and does not have, closed loop capabilities. Key considerations that were taken into account in selecting an open loop regasification vessel are provided below. - Open loop vessels have a considerably lower emissions footprint than closed loop systems. In open loop systems, the natural heat from sea water can be used to warm up and regasify the LNG, instead of having to create an artificial heat source. - Adopting a closed loop system would increase fuel consumption up to 400% when compared to an open system, resulting in significantly greater greenhouse gas emissions, as well as an increase in operational costs. - FSRUs are not typically ordered with both open and closed loop regasification capabilities. It is one or the other. - Closed loop FSRU technology is typically only used in very cold climates where the use of the ambient water temperature differential is not great enough to efficiently warm the LNG. - There are a number of closed loop FSRUs in the world today, built for operations in cold climates such as the Independence in Lithuania, Esparanza in China, Cape Ann and Neptune intended for Boston, FSRU in Kaleningrad etc.

Issue	Response
	Based on the considerations summarised above, a closed loop operation was deemed unfeasible and an open loop vessel has been secured. We noted the EPA's view that to minimise environmental impacts and improve operational efficiency there appears to be a growing trend for FSRUs worldwide to incorporate both "open loop" and "closed loop" heat exchange capabilities. Advice received from specialist FSRU suppliers indicates that the EPA's view is not correct, and as noted above typically a choice is made prior to construction and based on the expected operating environment. Where sea temperatures support open loop, that arrangement is preferred for a number of environmental and economic reasons. As discussed in further detail below, cold water dilution with diffusers has been found to be of little environmental benefit with regard to the predicted impacts of the project and the proposed modification. The operation of the FSRU is not likely to cause a significant impact on marine biota, including potential for entrainment, due to the existing condition of the marine environment in the Inner Harbour and characteristics of water intake structures of the FSRU. The alternative release locations including ocean outfall and diversion to BlueScope steel are not considered to provide material environmental benefits and may introduce additional impacts associated with their construction and operation. An ocean outfall in particular would potentially involve construction of a pipeline in the order of 300 metres length across adjacent industrial and operational land and Seawall Road to reach the ocean plus an additional length potentially in the order of a hundred metres of more into the ocean to reach a suitable discharge location. The marine habitat of the open ocean would also likely be of higher value than the inner harbour creating potential for further construction and operational impacts.

Issue	Response
<u>Cold water discharge conditions</u>	
The submission makes reference to the exceedance of ANZECC ambient temperature guidelines predicted by the assessment of cold water discharge. It suggests that the project may be conditioned for a high season scenario and low season scenarios within defined months, discharge rates, maximum water temperature differential and defined mixing zones along with a monitoring and verification program to confirm predicted outcomes. It also notes that alternate approaches could be developed and recommends further discussion between the proponent, the Department of Planning, Industry and Environment and the Environment Protection Authority to further develop and refine any additional conditions of consent.	It should be noted that the purpose of the proposed modification was to provide for operational flexibility including a variable rate of production between high season and low seasons. Whilst two scenarios were assessed, being a high season and low season, these were for the purposes of assessment and would not necessarily exactly reflect the operating capacity and profile within and between seasons. It is noted in particular that the assessed low season at 120 TJ/day and associated operating parameters is substantially lower than the 300 TJ/day and associated operating parameters that was assessed and has already been approved as part of the EIS. Accordingly, it is not considered appropriate that the project be conditioned based on the indicative low season scenario in particular. It is important to note that the numerical modelling of the proposed modification included an assessment of the high season scenario across all seasons in order to assess the maximum impact during any season and including a number of conservative assumptions. The numerical modelling has been based on a maximum temperature differential of 7°C cooler, which is a conservative upper estimate. In reality, a train operating at full capacity has a maximum temperature differential at 6.3°C cooler even in the most conservative conditions including rich LNG and low send out pressure. Similarly, the volumetric discharge rate has been based on the maximum rate achievable using the equipment fitted to the built vessel. It is assumed that the EPA’s interest in conditioning seasonal production is based on a desire to ensure impacts do not exceed approved impact limits. As such, conditions which focus on the limits of impacts approved (outcomes) not the operations of the vessel are preferred so the vessel operators can deliver the best outcome for regulators, gas customers and

Issue	Response
	the community. For example, as per the existing approval a maximum discharge of sodium hypochlorite has been set. It is now up to the operational expertise of the vessel operator to ensure that limit is not exceeded. The consent does not specify the manner in which the vessel must be operated in order to achieve that result. Consequently, rather than conditions based on an indicative seasonal production schedule, the proponent would be prepared to accept conditions relating to the maximum volumetric discharge rate and temperature differential since it is not possible for the built vessel to exceed the modelled limits. It is also highlighted that a Water Discharge Quality Verification Program is required under the existing conditions of approval that would, among other things, verify that impacts from water discharges from the FSRU are not greater than predicted in the environmental assessment.
<u>Cold water dilution with diffusers</u> The submission makes reference to statements in the proposed modification regarding the exceedance of ANZECC ambient temperature guidelines in the far field mixing zone and at the edge of the near field mixing zone. It states that these statements appear to be contradictory and request clarification on the nature of the predicted exceedance and the effect of cold water dilution with diffusers in that regard.	 Near field modelling was undertaken to estimate the plume width, height and dilution at the end of the near field region. In accordance with the EPA definition of the near field mixing zone, the model considers the effects of density difference, receiving water velocity, depth of the jet(s) below the surface, merging of jets, wind mixing, discharge port configuration and discharge rate. The near field modelling results predicted that largest decrease in temperature predicted at the edge of the near field meets the ANZECC ambient temperature guidelines. As near field models are steady state they do not include effects such as accumulation of pollutants or recirculation between the intake and the outfall. To assess the potential for these effects, far field modelling using a 3-dimensional hydrodynamic modelling was undertaken. The far field modelling predicted exceedances within the mixing zone due to recirculation of cool water on the seabed back into the mixing zone over

Issue	Response
	successive tidal cycles. Such exceedances would not be avoided by improving the initial discharge behaviours through diffusers since the cool waters would continue to recirculate back into the mixing zone over successive tidal cycles. It should be noted that under the spring high season production scenario, these temperature exceedances of the guideline values were limited to a thin 2% layer of the water column between -13.2 to -13.5 m (below low tide) and were predicted to be approximately 0.5°C colder at the edge of the nearfield mixing zone and met the guideline values beyond the berth development area.
Industrial discharges The submission makes reference to the warm water industrial discharge from the BlueScope facility. It seeks clarification of the rationale for the inclusion of discharge from two blast furnaces instead of the current single blast furnace. It states that the rationale for assessing two blast furnaces was contrary to the expectation of the EPA that they would raise ambient temperature and that their removal would result in a greater cold water discharge due to a lower ambient temperature in the Inner Harbour.	The modelling was undertaken to conservatively capture the upper and lower bounds of BlueScope discharge, i.e. scenarios running two blast furnaces and scenarios with zero BlueScope discharges and allows for a "like for like" comparison of the predicted impacts associated with the original development and the proposed modification. This approach ensures that the assessment considers the possible future discharge operations of BlueScope and covers the current state of the Inner Harbour. We note the potential for misinterpretation of the results depending upon whether ambient conditions consider existing discharges given that artificially raised temperatures create a greater temperature differential between discharge waters and ambient harbour temperatures. In order to address this issue, model simulations for each of the four seasons considered scenarios with and without Bluescope ambient discharges (for comparison to FSRU discharge with and without Bluescope future discharges). This approach describes the maximum potential impacts under either of these scenarios and therefore any intermediate scenarios.

Issue	Response
	As such, the potential impacts of BlueScope operating a single blast furnace would be encompassed by the predicted impacts in the assessment.
Marine biota entrainment The submission states that the predicted intake velocities at the FSRU would have the potential to result in marine biota entrainment, particularly during the high season scenario. It recommended liaison with the Department of Primary Industries — Fisheries concerning the development of appropriate approval conditions and assessment of mitigation options.	Refer to responses to the submissions from the Department of Primary Industries — Fisheries in Table 3.
Gas engine utilisation The submission recommends that the operation of the FSRU and LNG carriers be limited to 2 engines to be consistent with the scenarios in the air quality assessment of the proposed modification. It states that in the absence of additional assessment the EPA will recommend conditions for engine utilisation on any environment protection licence. It states that if the proponent raises operational challenges with a limit of two engines, further information on engine utilisation and/or a revised assessment of air quality impacts may be requested.	The assessment of potential air quality impacts of the proposed modification assumed the operation of two engines on board the FSRU and LNG carrier respectively, which is considered to be representative of normal operations. It found that there would be no incremental or cumulative exceedance of the relevant criteria at receptor locations as a result of the modelled operations. While the scenario assessed is considered to be representative of normal operations, it is preferred that the project be conditioned based on potential impacts rather than operating parameters such as a number of engines. Such an approach would not support operational flexibility such as operating 1 engine at 50% and 2 others at 25%, or any other mix of engine utilisation. As such, setting emissions limits at the emissions source in accordance with relevant regulations and guidelines is considered more appropriate. It should also be noted that the EIS for the initial Infrastructure Application included a conservative assessment to model four engines operating simultaneously which also indicated compliance with relevant criteria at all surrounding sensitive receivers.

Issue	Response
<u>Marine diesel oil</u> The submission makes reference to the requested modification of the condition that limits the operation of the FSRU on marine diesel oil to 72 hours. It states that the requested modification would instead require limiting use of marine diesel oil to as low as practicable.	As stated in the response to submissions, a condition limiting use of marine diesel oil to “as low as practicable” would be considered suitable as suggested in the submission from the Environment Protection Authority.

Table 3 Department of Primary Industries — Fisheries

Issue	Response
<u>Entrainment of marine biota</u> The submission requests an assessment of the potential for entrainment of marine biota through the water intake structures of the FSRU, including the potential scale of potential impacts, approach velocity near the intake, and mitigation measures.	The operation of the FSRU is not likely to cause a significant impact on marine biota, including potential for entrainment, due to the existing condition of the marine environment in the Inner Harbour and the characteristics of the water intake structures of the FSRU. The FSRU and water intake structures have been designed to balance outcomes including intake velocity, risk of entrainment, biofouling, maintenance, vessel draft at berth, and seagoing capabilities. The structures would incorporate meshed strainers to prevent entrainment of marine biota. Design information for the water intake structures and strainers is provided in Attachment A. Discussions with the FSRU supplier have indicated that installing additional retro-fitted strainers would have the potential to affect the handling of the vessel, and would limit the ability to quickly remove the strainers and/or safely navigate away in an emergency situation.

Issue	Response
	The water intake structures would have an opening of about 2.3 m^2, noting the installation of the above meshed strainers, and would be situated at a depth of about 13 m beneath the surface while the vessel is fully loaded. The water intake velocities at the openings of the strainers would vary between about 0.39 m/s in the low season and 0.785 m/s in the high season. It should be noted that these velocities supersede those described in earlier responses to submissions which indicated that the maximum intake velocity during high season operations was greater than 0.785 m/s. Since that time, additional information provided by the vessel manufacturer has confirmed that the maximum high season intake velocity is based on the maximum flow capacity of each seawater intake. This means that when the maximum flow capacity of one of the seawater intakes is reached, the FSRU begins using additional seawater intakes, which ensures the intake velocity remains at or below 0.785 m/s at all times. The Inner Harbour is highly developed and subject to ongoing disturbance from various industrial and port activities. The existing marine habitat is limited to hard and soft substrates with biofouling community structures that are reflective of a highly disturbed environment. The fish assemblages understood to be present are common across the region and do not include threatened species. As noted in the EIS, the Inner Harbour in particular is not known to support as many species as the Outer Harbour. Potential impacts on fish species present would be further limited due to the depth of the intake and the tendency for fish species to inhabit shallower parts of the water column due to the availability of light and food.

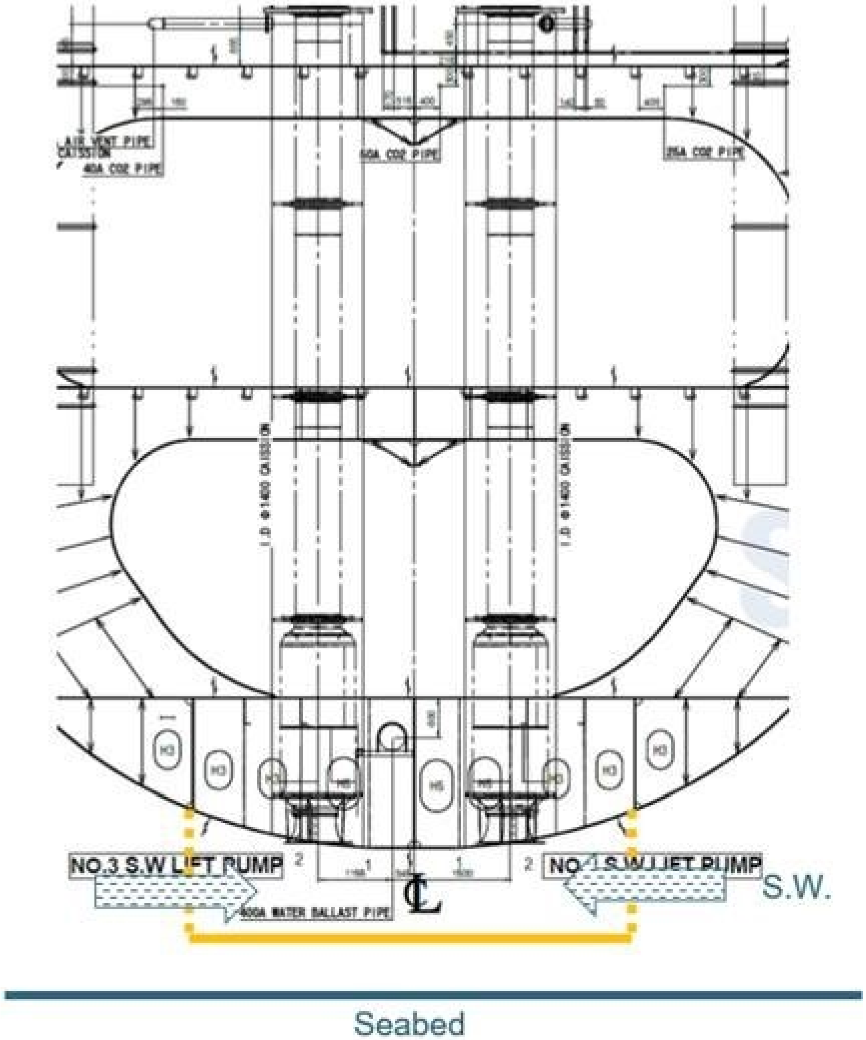
Issue	Response
	The environmental impact assessment of the Sydney Desalination Plant[6] provides some context concerning the potential impacts of a water intake structures. That facility was assessed as operating at a greater intake volume, being 500 ML/day compared to the 312 ML/day assessed for the proposed modification, and within a substantially more sensitive rocky reef environment at Cape Solander. It was found that the water intake would potentially result in the entrainment of about 2 per cent of the larval population occupying an area surrounding the intake. It is expected that any larval populations that could be potentially affected in the Inner Harbour would be substantially less dense than at Cape Solander. Further, it was found that entrainment associated with the Sydney Desalination Plant would be effectively minimised or eliminated at intake velocities at 0.6 m/s and 0.3 m/s respectively[7]. The predicted intake velocities of the proposed modification would be in the order of these velocities and accordingly would limit entrainment. While there would be some limited risk of impact, the water intake structures would not be expected to have a significant impact on marine biota due to the existing disturbed marine environment and the characteristics of the water intake structures, including their depth.
<u>Design of intake structure</u> The submission requests Department of Primary Industries Fisheries be consulted concerning the design of the water intake structure.	Design information for the water intake structures and strainers is provided in Attachment A.

[6] Clark, G., Knott, N., Miller, B., Kelaher, B., Coleman, M., Ushiama, S., Johnston, E. (2018). *First large-scale ecological impact study of desalination outfall reveals trade-offs in effects of hyper salinity and hydrodynamics*. Water Research, 145, 757-768.

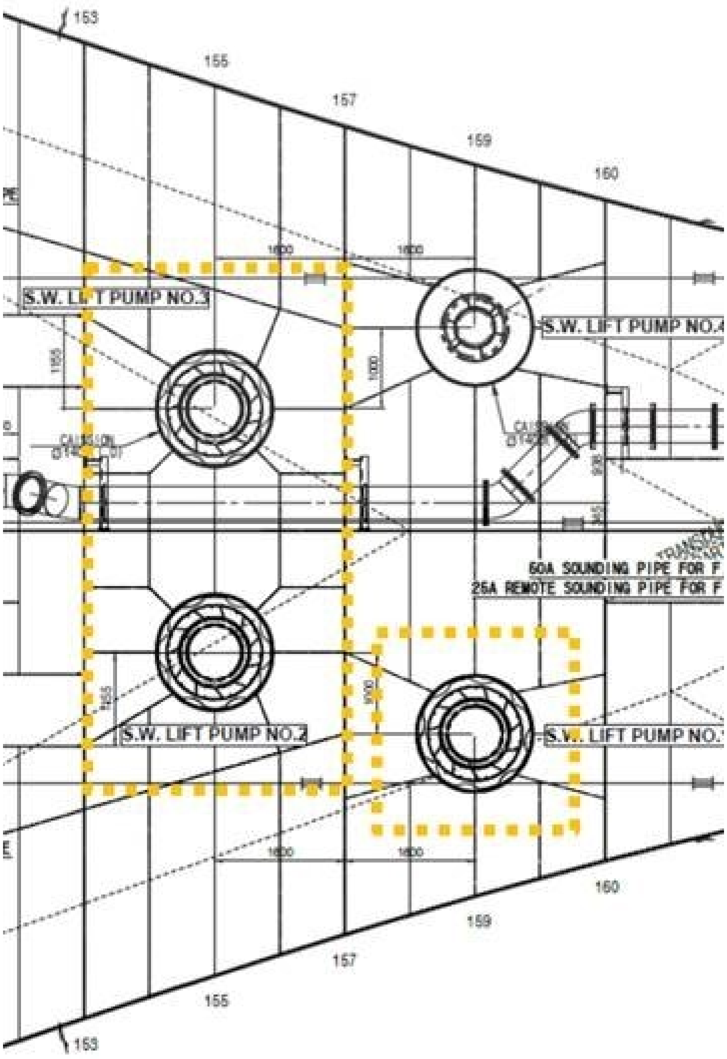
[7] Ibid.

Issue	Response
<u>Monitoring during operation</u> The submission states the Department of Primary Industries Fisheries may request monitoring of the intake system during operation to verify its potential impacts and determine whether further mitigation measures may be required. The submission recommended the monitoring of plankton, fish and invertebrate communities around the FSRU to quantify the level of impact and determine whether any further mitigation measures are required.	We acknowledge the potential request for monitoring of the intake system during operation to verify its potential impacts and determine whether further mitigation measures may be required. We suggest that these requirements be discussed and agreed as part of the ongoing discussions regarding the development of the Water Discharge Quality Verification Program under the existing conditions of approval for the project.

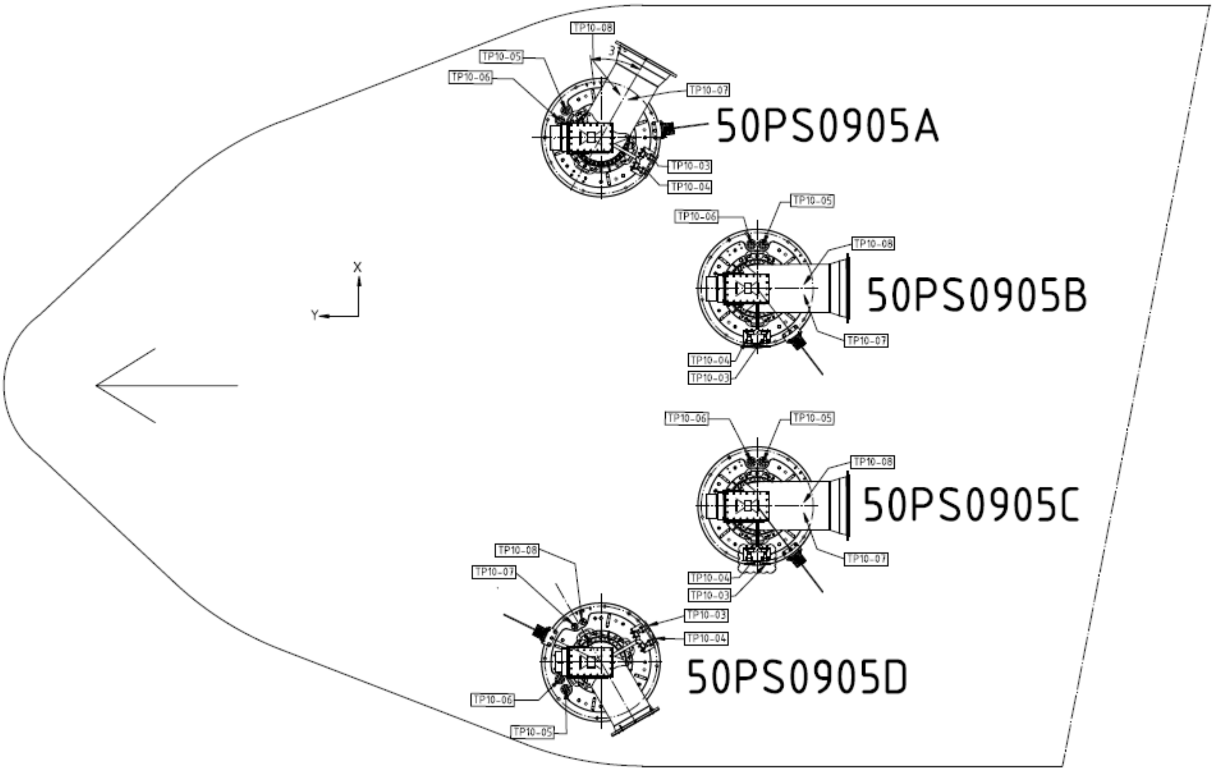
Attachment A — Technical details of water intake structures



FSRU cross section showing location of seawater intakes



FSRU plan view showing location of seawater intakes



General arrangement of seawater intakes

FSRU seawater strainer prior to fitting to each seawater pump (mesh size of 12 x 25mm)