

Trans-Tasman Resources Limited's Fast-Track Application - Taranaki VTM, 2025

Scientific Peer Review in Relation to Underwater Noise and Marine Mammals

JASCO Applied Sciences (Australia) Pty Ltd

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Contents

1. Introduction	1
2. Review of the Fast-Track Application.....	3
2.1. Can you review the reports provided by TTR for the Taranaki VTM project in support of their Fast Track proposal (https://www.fasttrack.govt.nz/projects/taranaki-vtm) to consider your responses to the following questions in writing your report to us?	3
2.2. With respect to marine mammals in the area of interest:	4
2.3. What are the potential impacts on marine mammals from activities of this sort e.g. the effect of noise on feeding, calving, nursing etc?	7
2.3.1. Noise Effect Criteria	10
2.4. From your professional experience can you describe how these potential impacts may affect individuals or populations, including migratory species that are exposed to them?	11
2.5. From your professional experience can you describe best practice management measures that have been used to mitigate from these potential impacts?	13
2.6. Can you review the noise modelling provided in the reports and consider:	15
2.7. Does the marine mammal management plan as described follow best practice? In your experience, are there gaps that should be addressed?	17
2.8. Can you review and comment on the conditions proposed for monitoring and mitigating underwater noise impacts?	18
2.8.1. Standards and Guidelines.....	18
2.8.2. Methodology robustness.....	19
Literature Cited	21
Appendix A. Relevant Conditions Within the Fast-Track Application	A-1

1. Introduction

On 15th April 2025, Trans-Tasman Resources Limited (TTR) submitted an application under the New Zealand Fast-track Approvals Act 2024 to undertake the 'Taranaki VTM Project', which seeks to enable *'all activities associated with the recovery of iron sand deposits containing the critical minerals vanadium and titanium (vanadiferous titanomagnetite ("VTM") resource) from the South Taranaki Bight ("STB")'*.

JASCO Applied Sciences (JASCO) have been engaged by the New Zealand Department of Conservation / Te Papa Atawhai (DOC) to undertake a review of the application with regard to the aspects that fall under JASCO's area of expertise, namely underwater acoustics, marine mammals, impacts of underwater noise on marine mammals, and best practice for managing such impacts. A panel of experts from within JASCO was established to provide the review. A summary of their relevant expertise is provided below.

- Craig McPherson – Craig is the Director of JASCO Applied Sciences APAC and has almost two decades of experience in underwater noise monitoring, modelling and measurements with a particular focus on offshore industries and marine mammals. Craig is an author of peer reviewed papers in this space, and is a leading expert in the field of underwater noise effect criteria, prediction and monitoring.
- Dr Capri Jolliffe – Capri is the Technical Director of Marine Science for JASCO Applied Sciences APAC and is a marine mammal scientist and bioacoustician with over a decade of experience in the study of marine mammal behaviour and bioacoustics, underwater noise mitigation and management and environmental regulation. Capri is skilled in the design of large scale research programs, marine fauna management plans and is one of the leading experts in underwater noise regulation. Capri is also one of Australia's leading blue whale experts.
- Dr Victoria Warren – Victoria is a project scientist with JASCO Applied Sciences and is a marine mammal scientist and bioacoustician with extensive experience in underwater noise monitoring and modelling. Victoria resides in New Zealand and completed her PhD studies studying the marine mammals of central New Zealand using passive acoustics, with a particular focus on baleen whales. Victoria is skilled in passive acoustic monitoring approaches and underwater noise modelling to inform impact prediction for marine mammals.

DOC provided JASCO with eight questions to focus on for this assessment, which are as follows:

1. Can you review the reports provided by TTR for the Taranaki VTM project in support of their Fast Track proposal (<https://www.fasttrack.govt.nz/projects/taranaki-vtm>) to consider your responses to the following questions in writing your report to us?
2. With respect to Marine Mammals in the area of interest:
 - a. Does the baseline data that they provide accurately represent the presence and use of marine mammals in the area over which there would be likely impacts from this project?
 - b. Are there other sources of information you are aware of that are available and should be considered?
3. What are the potential impacts on marine mammals from activities of this sort e.g. the effect of noise on feeding, calving, nursing etc?
4. From your professional experience can you describe how these potential impacts may affect individuals or populations, including migratory species that are exposed to them?
5. From your professional experience can you describe best practice management measures that have been used to mitigate from these potential impacts?
6. Can you review the noise modelling provided in the reports and consider:

- a. Is the approach taken best practice?
 - b. Do you agree with the comment at page 203 - 204 AEE that notwithstanding the forementioned results, "it is possible for TTS or PTS to potentially occur within 500m of the operation"?
 - c. Are there factors that may influence the noise of the operation that have not been considered?
 - d. Are there additional elements that need to be considered to properly evaluate the noise outputs from the activity?
7. Does the marine mammal management plan as described follow best practice? In your experience, are there gaps that should be addressed?
8. Can you review and comment on the conditions proposed for monitoring and mitigating underwater noise impacts?
 - a. Is their proposed methodology appropriate, robust, and achievable?
 - b. Will these achieve their proposed objectives?
 - c. Are there available standards or guidelines, including from other jurisdictions that could be considered to inform the appropriateness of conditions?

This review document is structured to consider each specific questions posed by DOC that form the basis of the review of the fast-track application (Section 2). Responses in Section 2 refer to relevant technical concepts related to underwater acoustics and underwater noise assessment, as well as contextual information regarding the current state of understanding of ambient noise levels and marine mammal presence within the South Taranaki Bight (STB). For the avoidance of doubt, relevant conditions from the application are pasted under specific sub-headings in Appendix A and are referred to directly. This report also includes a bibliography of cited literature.

2. Review of the Fast-Track Application

2.1. Can you review the reports provided by TTR for the Taranaki VTM project in support of their Fast Track proposal (<https://www.fasttrack.govt.nz/projects/taranaki-vtm>) to consider your responses to the following questions in writing your report to us?

To undertake this assessment, JASCO have reviewed the following documents, which were obtained from the Taranaki VTM page of the Fast Track website on 24th July 2025

(<https://www.fasttrack.govt.nz/projects/taranaki-vtm>):

- Taranaki VTM cover letter to the Environmental Protection Authority (EPA)
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0018/4338/Taranaki-VTM-Cover-Letter-to-EPA.pdf
- Taranaki VTM fast track application form
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0017/4346/Taranaki-VTM-project-application-form.pdf
- Taranaki VTM fast track application
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0017/4337/Taranaki-VTM-FTA-Application.pdf
- Attachment 1 - Proposed marine consent conditions
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0013/4261/Attachment-1-Proposed-Marine-Consent-Conditions-FINAL.pdf
- Draft Marine Mammal Management Plan
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0014/4343/Taranaki-VTM-FTA-Application-Appendix-Section-5.pdf
- Evidence on Marine Mammals; evidence from Dr Simon Childerhouse, evidence from Darran Humpheson responding to Dr Simon Childerhouse, and rebuttal evidence from Dr Simon Childerhouse
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0019/4276/Report-4c-Evidence-statement-Childerhouse-May-2023.pdf
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0017/4274/Report-4a-Further-evidence-HUMPHESON-Feb-2025.pdf
 - https://www.fasttrack.govt.nz/_data/assets/pdf_file/0018/4275/Report-4b-Rebuttal-evidence-CHILDERHOUSE-Jan-2024.pdf

2.2. With respect to marine mammals in the area of interest:

- **Does the baseline data that they provide accurately represent the presence and use of marine mammals in the area over which there would be likely impacts from this project?**
- **Are there other sources of information you are aware of that are available and should be considered?**

The extent of the knowledge gaps in New Zealand related to the presence of fauna and the potential effects of underwater noise has long been known (Patiño-Pérez 2015). The Executive Summary of the application implies that only literature up to 2017 has been examined to inform the application. Conversely, the baseline data referenced in the main body of the application, and as reviewed in the evidence provided by Dr Simon Childerhouse in May 2023, accurately represents the current, relatively limited state of understanding of the presence and use of marine mammals in the South Taranaki Bight. We are not aware of any additional substantial sources of information that would add further detail to the baseline data assessment.

The suggestion that recent literature provides '*data on species abundance, distribution, behaviour, and potential impacts*' is a substantial over-statement. Several papers have been published in recent years that provide some novel information about pygmy and Antarctic blue whales in the STB (including Barlow et al. 2018, Barlow et al. 2021, Goetz et al. 2021, Warren et al. 2021, Barlow 2022, Barlow et al. 2022a, Barlow et al. 2022b), however there remains some vital gaps in understanding for these populations such as basic information about where and when breeding and calving occur, the use of foraging areas by individual animals and how this varies temporally and spatially, and other foundational life history information such as day to day behaviour and stressors. These remaining gaps in basic information are notwithstanding of the fact that blue whale understanding is arguably the most improved of any species within the STB; for other marine mammal species found in the region, there is scarcely better understanding in 2025 than there was in 2015.

A species that has been referenced but not considered within the application is the humpback whale. Warren et al. (2020) demonstrated that the STB is an important migratory route for humpback whales and inferred that the central New Zealand region is likely an important cultural location, where humpback whales from different breeding grounds interact and potentially transfer song information that may directly lead to breeding success, or otherwise, when the animals arrive at their breeding grounds in the South Pacific. Cultural transmission such as this is a vital life history aspect for this species and relies on the animals being able to hear each other.

The application states that "*Thanks to the efforts of TTR, the Project area and surrounds are one of the best studied marine environments in New Zealand*". No supporting evidence is provided for this statement, particularly in relation to marine mammals, or comparison to other areas in New Zealand to demonstrate the accuracy of the statement. There have been no dedicated marine mammal surveys undertaken within the project boundary in order to improve the location-specific baseline data related to the project area, apart from 12 aerial surveys conducted between July 2011 to September 2013. Accordingly, the repeated conclusion that the project area is not an important marine mammal area is guided primarily by spatial modelling, which the application itself acknowledges has limitations, such as being informed by "*non-systematic survey data and observer effort bias*". It is expected that spatial models informed by survey results and sightings would predict low abundance of marine mammals in an area where surveys and sightings effort has been low.

A key source of baseline data for the region is the database of sightings and strandings maintained by DOC (Department of Conservation 2025). In July 2025, DOC provided JASCO with all records from the database relevant to the South Taranaki Bight. Database entries for selected species are included as maps in Figures 1, 2 and 3, along with the geo-referenced 120 dB SPL contour provided in Schedule 7 of the proposed marine consent conditions document, which corresponds to the modelled marine mammal behavioural response zone for the IMV (Integrated Mining Vessel) and crawler

activities. Within the database entries, blue whale, Māui dolphin, orca, common dolphin and minke whale have been recorded to occur within, or adjacent to, the modelled 120 dB SPL contour.

The New Zealand Threat Classification System for marine mammals was updated in 2024 (Lundquist et al. 2025), and thirteen of the 57 species of marine mammal considered in the threat classification system received revised threat classifications. While this issue does not materially affect the application or outcomes associated with the proposed conditions, it is important to note that the application is not applying the latest, and therefore best informed, guidance available.

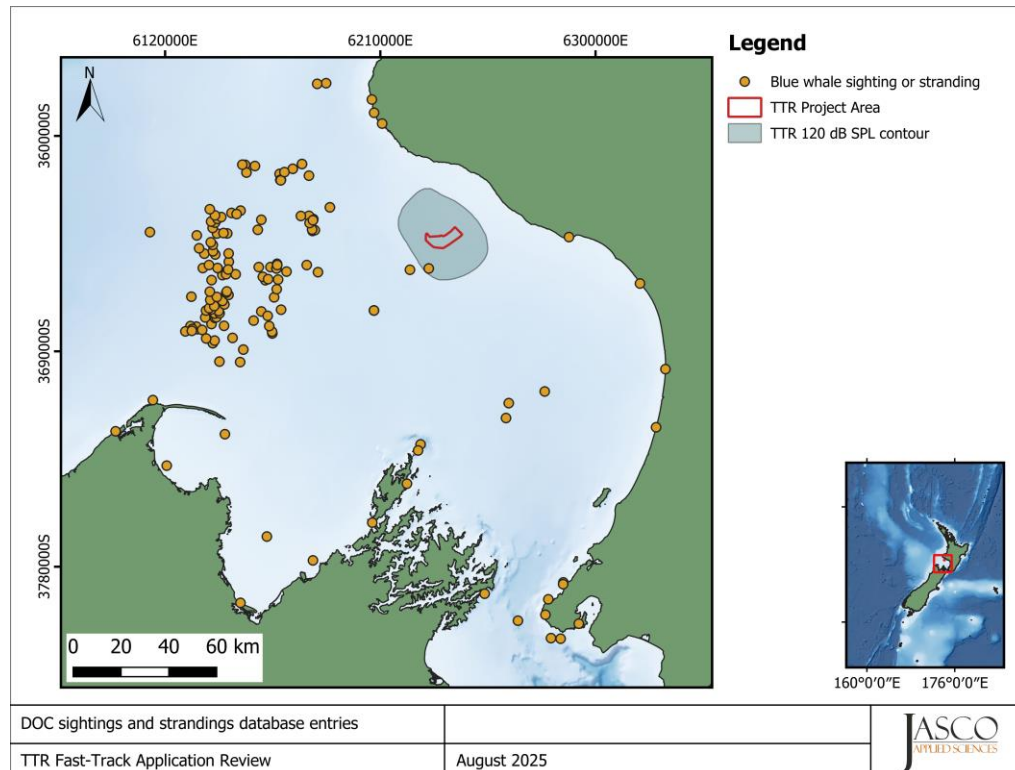


Figure 1. Database entries from the DOC sightings and strandings database for blue whales (not distinguished to sub-species) along with the proposed TTR project area and geo-referenced 120 dB SPL contour provided in Schedule 7 of the proposed marine consent conditions.

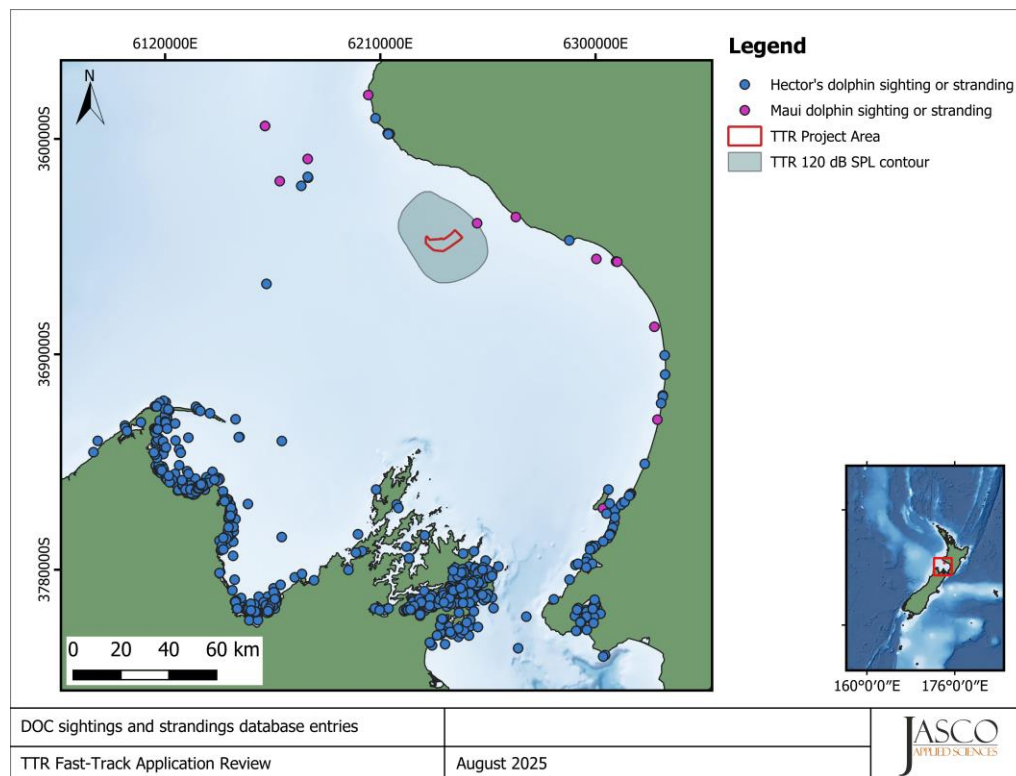


Figure 2. Database entries from the DOC sightings and strandings database for Hector's and Māui dolphins along with the proposed TTR project area and geo-referenced 120 dB SPL contour provided in Schedule 7 of the proposed marine consent conditions.

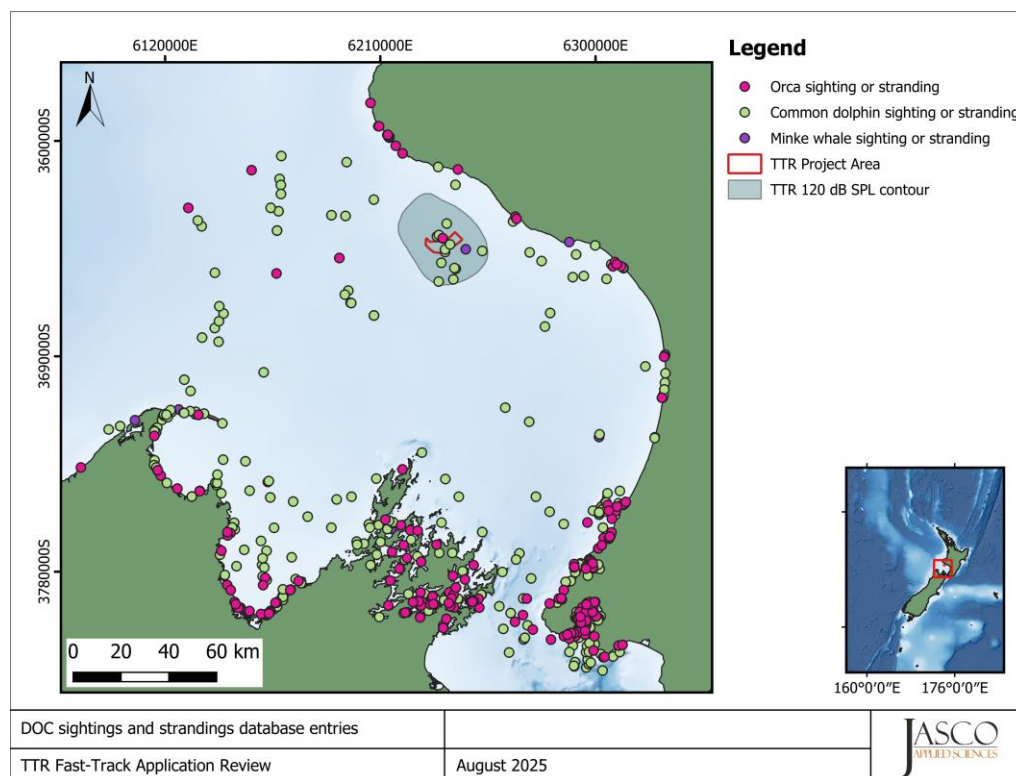


Figure 3. Database entries from the DOC sightings and strandings database for orca, common dolphins and minke whales along with the proposed TTR project area and geo-referenced 120 dB SPL contour provided in Schedule 7 of the proposed marine consent conditions.

2.3. What are the potential impacts on marine mammals from activities of this sort e.g. the effect of noise on feeding, calving, nursing etc?

High noise levels have the potential to negatively affect animals' hearing by causing a shift in hearing threshold (i.e., reducing the hearing sensitivity), with a temporary threshold shift (TTS) referring to a temporary reduction in hearing sensitivity and a permanent threshold shift (PTS) referring to a permanent shift (NMFS, 2024). PTS is a non-recoverable auditory injury. Auditory injury (AUD INJ) can also include damage to tissues in the inner ear that does not result in a permanent threshold shift (NMFS, 2024). TTS and PTS/AUD INJ effects are commonly assessed using sound exposure level (SEL) metrics that consider both the noise level and exposure duration of sound sources.

When an anthropogenic sound is at a perceivable level and it overlaps in time, space, and frequency with critical biological sounds, acoustic masking can occur. Masking means that ecologically relevant sounds, such as communication calls, cannot be distinguished over the interfering sound source. Masking can have direct adverse health effects due to reduced foraging efficiency, missed breeding opportunities, reduced ability to detect predators, and inability to maintain important conspecific communications.

Exposure to sound can also result in behavioural responses. The elicitation of behavioural responses is complex and not solely dependent on the received level. Contextual factors such as previous noise exposure, life stage and behavioural context, as well as proximity and trajectory of the sound source, are important contributing factors (Southall et al. 2021). Behavioural responses can be extreme, such as fleeing or cessation of an important activity (e.g., foraging or breeding) that may have a significant biological consequence. Physiological responses to sound, such as increased stress levels, have also been shown to occur in marine species and a lack of observable behavioural response does not confirm a lack of effect. If an individual has a pressing desire to remain in a location (for example if it is their preferred feeding area, or there is no other suitable habitat to move into), they may persist in an area even if underwater noise levels are high (Gailey et al. 2016, Bedriñana-Romano et al. 2021).

The potential for underwater noise to impact marine fauna is correlated to the type of sound, its frequency range (for certain metrics) and the sensitivity of an individual to those frequencies or sound types. The importance of sound components at given frequencies can be scaled through auditory frequency weighting to account for an animal's sensitivity to those frequencies. Frequency weighting functions have been defined for functional hearing groups of marine mammals (NMFS, 2024). Noise exposure criterion can consist of an auditory weighting function which is specific for the taxonomic group of interest and a noise threshold (i.e., the level at which an effect is expected to occur). Effect zones correspond to the radii of the areas where noise levels are estimated to exceed the noise criteria. Underwater noise exposure criteria are constantly evolving as scientific understanding progresses; criteria for fish and marine invertebrates are rapidly evolving areas of research. Due to the ongoing evolution of scientifically acknowledged noise criteria, the appropriateness of any criteria should be confirmed at the time of undertaking a quantified assessment of effects.

Based on a review of the project description, is it reasonable to assume that impact pathways for marine mammals include:

- Disturbance as a result of underwater noise exposure.
- Temporary and permanent hearing impairment as a result of underwater noise exposure.
- Vessel strike.
- Reduction in ability of echolocating species to forage based on increased turbidity.
- A reduction in, or changes in, the distribution and availability of prey species as a result of changes in environmental quality including increased turbidity, discharge of hypersaline water, disturbance of chemical contaminants in sediments, the use of a low intensity echosounder 24/7 for duration of activity.

Of the above impact pathways, not all have been evaluated within the referral documentation. For example, while it is stated that a large volume of desalinated water will be used to wash the iron ore sands, there is no mention of, nor evaluation of the discharge of brine/hypersaline water from this process. Noting that changes to the physico-chemical properties of the water column can impact on marine biota, this potential impact should be quantified, and the level of dilutions to reach background conditions and range over which that may occur should be modelled. There also does not appear to have been any testing or consideration of contaminant loads within the sediment to be dredged and what impact the dredging may have (e.g. Acid sulphate soils, heavy metals). It is also possible that the project may alter the distribution of some species within the STB. For example, pilot whales preferred prey species is squid which is known to be attracted to sources of artificial light. It is likely the project vessels will create a long-term source of anthropogenic light which may attract squid and result in higher-than-expected numbers of pilot whales foraging within and near the project area. Similarly, Hector's and Maui dolphins typically prefer areas of low water clarity for foraging and thus may be attracted to sediment plumes generated by the project.

A key point is that the underwater noise impact evaluation does not consider all noise sources, both emitted by the vessels themselves, and from all project vessels. Whilst it isn't standard practice to assess general echosounders, other sources such as higher power sonars, positioning systems and acoustic anti-biofouling devices are typically considered – these are particularly relevant to high frequency cetaceans, such as Hector's and Maui dolphins, but also beaked whales (Cholewiak et al. 2017, Varghese et al. 2020, Trickey et al. 2022). The assessment of the combined noise footprints of all project vessels is typically a key part of the impact assessment process, for instance in Australia it is a regular occurrence, for example:

- [Environment Plan for Scarborough Seabed Intervention and Trunkline Installation](#)
- [Environment Plan for Beach Otway Offshore Operations](#)
- [Environment Plan for Gorgon Gas Development Pipeline and Subsea Infrastructure Installation and Pre-Commissioning](#)

From the latter example, one of the modelled scenarios included simultaneous operations of the accommodation vessel with five anchor handling tugs, an offshore construction vessel, two heavy transport vessels and a multi-purpose support vessel, all under dynamic positioning. This is a significantly more complex operation than the TTR one, and is presented to demonstrate what is possible. From the project description it is not clear where all aspects of the operation will take place, vessel proximity, nor whether all project vessels will be operating concurrently. Without this information it is challenging to understand the full scale of potential impacts. The combined acoustic footprint, and therefore area ensonified above effect thresholds, are likely to be greater than what is currently presented.

The approaches for these complicated examples is counter to what is outlined in the TTR Application, where it is stated *'it is unrealistic to define a specific point source for the combined noise sources given all the noise sources are spread over a large area'*.

In summary, while the application has estimated the behavioural effect, TTS and PTS zones associated with the IMV and crawler, the potential effect (and therefore impact zones) for both other vessels and the project holistically have not been considered. Of particular concern is the 80 tonne Anchor Handling Tug (AHT) and the dynamically positioned Floating Storage and Offloading (FSO) vessel, including during offload operations to the bulk Carrier Export Vessel (CEV) that are also likely to be associated with considerable predicted impact ranges for TTS and behavioural response.

The assessment should have considered all the vessels operating cumulatively and concurrently to reflect actual operations *'Additionally, TTR requires that the FSO Vessel travel the shortest possible distance to the CEV for transfer however, this will be at Trans-Tasman Resources Ltd - Taranaki VTM Project 31 least 2km away from the IMV so that the vessels involved in the transfer process do not*

interfere with any operational movements of the IMV or the AHV in the active extraction block.' The frequency of the FSO operations, including transfer to the CEV, are not clearly defined. Ranges to these thresholds as considered for vessels of approximately similar sizes and power operating in isolation for Australian projects (see above Environment Plan examples) support the rationale for their consideration here during the impact assessment process.

Based on the information presented regarding the single vessel and crawler, the project has the potential to result in disturbance to marine mammals as a result of underwater noise emissions and vessel activity out to 1500 m. However, in reality, these behavioural disturbance ranges are likely to extend well beyond the range predicted in the referral documentation and will not be limited to the dredge operations. Behavioural disturbance will also occur in the vicinity of other vessel operations associated with the project. It is also likely that animals remaining within close proximity to the dredging operations (and production/offtake operations) may experience some level of auditory impairment (e.g. TTS), particularly if exposed to high levels of continuous noise. Behavioural disturbances can vary in severity from mild to severe and without a thorough baseline understanding of the potential presence and habitat use of marine mammals in the project area it is difficult to make comment on the likely significance of behavioural disturbance.

There appears to be some confusion about the behavioural response criteria applied. It is introduced as 120 dB Sound Exposure Level (SEL) (and discussed/applied as frequency weighted), however it is also referred to as an SPL, in relation to being the 'national US standard', which is mistakenly referred to as 'being removed as the national US standard', however it is still current, see Section 2.3.1, and is a Sound Pressure Level (SPL) metric. It is challenging to assess how TTR was applying the criteria given the uncertainty around what is being considered. Table 5.13 of the application shows that the SPL level of 120 dB is exceeded beyond 2000 m. Further, Schedule 7 of the Conditions presents a map showing the 120 dB SPL contour appearing to extend up to ~20 km from the project area, and therefore this is the footprint of the behavioural response zone. Without certainty on what the predicted behavioural effect range is, it is difficult to comment on the likely significance of any impacts.

However, some important things to note are:

- The 120 dB SPL behavioural response threshold is based on the median value at which animals exhibit a significant behavioural response. This means some animals may respond at lower levels, and others at higher levels, and the severity of responses will vary between individuals and contexts. Animals undertaking behaviours such as resting and deep foraging are likely to respond at lower levels with a more severe response.
- The biological significance of any response will also vary between contexts. Disturbance of foraging and breeding animals is considered to have the greatest potential for significant impact as these two behavioural states are inherently linked with reproductive success.

The EIA conclusions in the document appear to be largely based on the ranges to effects including behavioural disturbance being small, and the area overlapped by this range not likely to represent important habitat based on few to no marine mammal sightings in the area. However, noting the limitations outlined earlier with regard to limited baseline data and errors and inconsistencies in modelling predictions. Noting that the STB, inclusive of the project area, is likely to support a diversity of marine mammals including blue whales and hectors dolphins, and that the behavioural effects ranges are likely in the order of 10s of kilometres, there exists a credible risk of behavioural disturbance to breeding and foraging blue whales and hectors dolphins.

2.3.1. Noise Effect Criteria

The following thresholds and guidelines which it is recommended that the assessment should apply, based on being the best available science and generally being the internationally accepted guidance for noise exposure criteria, are:

- Frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from NMFS (2024) for the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) in marine mammals for non-impulsive sound sources. As discussed in NMFS (2024) and Accomando et al. (2025) intense noise exposures can cause auditory injury (represented by either AUD INJ or AINJ) without PTS occurring. The terms PTS and auditory injury can be considered to be used interchangeably, however it is acknowledged that auditory injury may occur without PTS.
- Marine mammal behavioural threshold based on the current US National Oceanic and Atmospheric Administration (NOAA 2019) criterion for marine mammals of 120 dB re 1 μ Pa (SPL; L_p) for non-impulsive sound sources.

Both criteria are summarised in Table 1.

Table 1. TTS and PTS/AUD INJ-onset thresholds for marine mammals exposed to non-impulsive noise. SPL value from NOAA (2024) and SEL_{24h} values from NMFS (2024).

Marine mammal hearing group	Behavioural response: SPL (unweighted), dB re 1 μ Pa	TTS onset: SEL_{24h} (weighted), dB re 1 μ Pa ² s	PTS/AUD INJ onset: SEL_{24h} (weighted), dB re 1 μ Pa ² s
Low-frequency cetaceans	120	177	197
High-frequency cetaceans		181	201
Very high-frequency cetaceans		161	181
Phocid pinnipeds		175	195
Otariid pinnipeds		179	199

2.4. From your professional experience can you describe how these potential impacts may affect individuals or populations, including migratory species that are exposed to them?

Repeated or long-term exposure to underwater noise can lead to chronic effects which are likely to be more severe, and less likely to be reversible, than acute effects from single exposures at the same received levels. However, assessing the behavioural and auditory impact of cumulative exposure on marine fauna is complex and currently poorly understood. An ecological assessment can consider impacts on individuals and local, regional or national populations when quantified underwater noise effects are considered in relation to the health, size and distribution of relevant species. A number of frameworks have been developed to consider population consequences, including The Population Consequences of Acoustic Disturbance (PCAD) framework, the subsequent PCoD framework (Population Consequences of Disturbance) and the Risk Assessment Framework (RAF) which effectively integrates risk assessment with a PCAD or PCoD model. The RAF is currently being updated and expanded, with key contributors to the PCoD and effects of sound literature working to provide improved guidance and assist in practical applications. Emerging alternate approaches include those presented in Southall et al. (2023), which presents a 'broadly applicable, transparent, repeatable analytical framework for assessing relative risk of anthropogenic disturbances on marine vertebrates'.

These holistic frameworks rely on detailed secondary data about individual fitness parameters, possible effects, population statistics and cause-effect relationships between parameters. However, in a New Zealand context, there is a lack of information about the ecology, movements, abundance and habitat preferences of these species, which means that it is not possible to confidently predict the effects of any novel anthropogenic activity.

Moreover, multiple sources of sound can occur within an environment from differing sources related to different origins (for example, multiple activities occurring within one industry, or multiple industries undertaking activities concurrently). In such cases, it is an over-simplification to consider individual sound sources in isolation.

Without robust impact predictions it is difficult to make conclusive statements regarding the potential impacts of the project on individuals and populations. However, based on the information provided it is reasonable to assume the following:

- The project is likely to result in behavioural disturbance to individual animals that may be undertaking critical behaviours within the proximity of the project area. This includes disturbance to foraging blue whales and Hector's dolphins. A reduction in foraging effort or success can decrease energetic gain and if severe enough translate to reduced reproductive output for an individual animal. The long-term nature of the project means that many animals may be impacted over many seasons which could result in changes to population recovery level. It also means the project has the potential to result in habitat exclusion should animals choose not to utilise the project area and the broader ensonified area for critical behaviours. It is possible that over time animals may habituate to the noise levels of the project, and the magnitude of behavioural disturbance over time may decline. However, this should not be confused with an absence of potential impacts as chronic noise exposure in marine mammals has been shown to result in increased stress levels, with a negative relationship between cortisol (stress hormone) levels and reproductive fitness in individuals.
- Taken at face value, the project as presented is unlikely to result in population level impacts to blue whales. As the water depths within the project area and predicted ensonified area mean the area is unlikely to be used by blue whales for foraging and any foraging that does occur would be characterised as surface foraging, a state within which blue whales are typically less responsive to underwater noise. The presence of surface foraging behaviours however would put blue whales at

increased risk of vessel strikes and thus control measures to appropriately mitigate this risk would need to be considered. If however, the predicted ensonified area were significantly greater than the predicted 1500 m range presented in the proponent documentation, and if it were to overlap with areas known to support regular foraging behaviour by blue whales, then there would be a real potential for changes in fitness at the population level given the duration of the project.

- Noting the status of the Hector's dolphin population, any potential disturbance to critical behaviours such as foraging, particularly for long term activities should be viewed as having the potential to impact the population. So too should any activities that may impact on the distribution or abundance of their prey items.
- Should the ensonified area overlap with areas within which southern right whale cows and calves and resting, there is the potential for increased disturbance and decreased fitness and survivability of calves. Southern right whales typically use sheltered coastal areas to rest with calves prior to returning to summer foraging areas. Increased noise levels in these areas can result in animals using more energy, increased stress levels and avoidance of habitats. Over multiple seasons, these effects could contribute to a reduction in the recovery rate of the species.
- The potential impacts to other migratory species that may frequent the area is considered to be less significant based on the information provided. The susceptibility of blue and southern right whales and Hector's dolphins is based on their conservation status and likely presence of critical behaviours that may be disrupted by the project.

2.5. From your professional experience can you describe best practice management measures that have been used to mitigate from these potential impacts?

What is considered to be best practice is inherently dependent on environmental and regulatory context. What may be best practice in one situation may not be enough to achieve environmental outcomes in another and so it is most appropriate to look at best practice in terms of the thorough application of EIA approaches and the mitigation hierarchy.

Best practice approaches for underwater noise EIA, mitigation and management, as outlined in Jolliffe et al. (2025) include first identifying the environmental outcome that is to be achieved. This outcome should reflect what is determined to be an acceptable level of impact. The level of acceptable impact will vary between species, environmental contexts and jurisdictions but should be informed by an understanding of species vulnerability and legislative context. In principle, by avoiding higher order impacts such as injury, hearing impairment and mortality, and avoiding disturbance to critical behaviours (e.g. foraging and reproductive behaviours), the potential for significant or unacceptable impacts at the population level would be unlikely.

While behavioural disturbances are considered lower order impacts in many jurisdictions, an increasing body of evidence is demonstrating that the cumulative effect of behavioural disturbance throughout a species range can translate to changes in vital rates including reproductive fitness. The potential significance of impacts at the individual level is exacerbated in species/populations that are threatened and have small population sizes. The understanding of underwater noise impacts to marine species remains incomplete, with the significance of impacts, as well as responsiveness being largely context dependent. Similarly, the efficacy of mitigation and management measures, particularly those that rely on real time detection and management action, is variable depending on context. Owing to these considerable uncertainties, a precautionary approach to the management of underwater noise is always recommended.

Once environmental outcomes for species that may be impacted are defined, the mitigation hierarchy should be applied thoroughly and the resultant outcome after the application of each mitigation/management option compared back to the acceptable level of environmental impact. Where possible, spatial/temporal avoidance of areas where species of concern undertake critical behaviours is always the preferred approach. This should be followed by a reduction in the source level of the noise and the duration of noise exposure.

Adverse effects may be completely or largely mitigated through careful scheduling so that the most impactful works occur when the most vulnerable marine species are least affected. An understanding of the temporal presence of species of concern and critical life history periods will need to be based on robust scientific evidence or baseline studies prior to work commencing. It is possible that the complexity and variability of species and the timing of their key life history periods may make scheduling practically impossible, with prioritisation required. The adverse effects on fauna that cannot be temporally avoided will need to be addressed through mitigation which both reduces sound levels and has operational controls. Standard mitigation measures include 'soft starts', 'ramp ups', and the monitoring and implementation of exclusion zones. It should be noted that while these are standard control measures their implementation may not achieve environmental outcomes. For example, 'ramp ups', while useful for providing animals a warning of increasing sound levels, may still have the effect of exposing animals above effect thresholds and in some contexts an animal moving on in response to a 'soft start' or 'ramp up' would be considered a significant behavioural response (e.g. if the animal was foraging or resting). As noted above, after the adoption of any mitigation/management option the likely environmental outcome should be compared to the defined acceptable level of impact. If the predicted outcome does not meet the defined acceptable level of impact after all mitigation and management options have been adopted then temporal/spatial avoidance should be reconsidered.

To achieve required environmental outcomes, many operators are choosing to design and adopt adaptive management procedures to afford themselves operational flexibility while still working to achieve a level of environmental impact that is acceptable. These adaptive management measures are defined on a noise source- and operation- specific basis. The efficacy of adaptive management measures should be continuously reviewed with contingent management strategies in place should they not perform as expected. Adaptive management options include those that are implemented to mitigate underwater noise effects in-situ and in real-time. Best practice approaches include measures such as: 'pre-start clearance surveys' to ensure marine mammals or other sensitive species are clear of effect zones prior to moving into the area; 'observation' and 'shut down' zones to ensure nearby fauna are not exposed to injurious sound levels; and real time validation measurements to inform exclusion and monitoring zones.

Even with the best of intentions, it may not always be possible to minimise impacts to a level that meets the desired environmental outcome regardless of the technical and management measures applied. This is in part due to the limitations of mitigation methods, but also because some species undertaking some behaviours have a significant level of sensitivity. In these instances, the acceptability of any potential impacts is a regulatory decision to be made by the relevant authority.

For continuous noise producing sources, such as vessels, there are relatively few mitigation options other than the design and control of the vessels. It is not feasible to consider external mitigation, such as bubble curtains, for a moving source, and such a mitigation tool would produce underwater noise and other considerations of its own. Feasible options that do not appear to have been considered include pre-activity clearance surveys to ensure that there are no animals within the project area prior to the vessel moving in. There does not appear to have been much consideration for mitigation approaches to reduce potential impacts from support vessels or export vessels. For example the use of anchoring instead of dynamic position is a possible tool, which might be appropriate for the FSO, which is proposed to be static under DP at all times. Anchoring the AHV when not in use could also help to reduce noise. Adaptive mitigation approaches could also be considered that would see the movements of the AHV and FSO managed to ensure there is a standoff distance of at least 1 km to any observed marine mammals. The implementation of such management would require marine mammal observers to be on all vessels at all times which would be consistent with best practice for operations within areas where threatened species undertake critical behaviours.

2.6. Can you review the noise modelling provided in the reports and consider:

- **Is the approach taken best practice?**

We are assuming the Hegley acoustic report (Microsoft Word - 9101 Iron Sand AEE 2015)(which is attached to the application) has been superseded by the Humpheson acoustic report, however the Humpheson 2017 acoustic modelling report does not seem to be included in the application (Substantive application | Fast-track website) so we aren't able to review the modelling or the methods applied and thus cannot comment. Since the original submissions, literature has been published within measurement data from other vessels and platforms, which may be more accurate representations for the IMV and crawler.

The modelling approach is not considered to be best practice as:

- Only the IMV is considered for the distance to effect thresholds, despite other project vessels being present and in close proximity, therefore the assessment is incomplete.
 - However TTR state that it is
 - The source spectra for these other vessels would need to be sufficiently justified
 - It is best practice to consider the worst-case scenarios for vessel source level and spectra.
- Outdated criteria are applied for TTS and PTS, new criteria has updated weighting functions and thresholds, and could have potentially significantly different results.
- **Do you agree with the comment at page 203 - 204 AEE that notwithstanding the forementioned results, "it is possible for TTS or PTS to potentially occur within 500m of the operation"?**

Yes, we agree that TTS and PTS/AUD INJ have the potential to occur within 500m of the operation, and potentially beyond this range, not only in relation to the IMV and crawler, but also as a result of the other project vessels as well.

- **Are there factors that may influence the noise of the operation that have not been considered?**

Underwater sound that radiates from vessels is produced mainly by propeller and thruster cavitation, with a smaller fraction produced by vibration transmitted through the hull from internal machinery such as engines, gearing, and other mechanical systems. Sound levels tend to be the highest when thrusters are used to position the vessel. A vessel's sound signature depends on the vessel's size, power output, propulsion system and the design characteristics of the given system (e.g., propeller blade number, shape, and size). The sound power from the propellers is proportional to the number of blades, the propeller diameter, and the propeller tip speed. A vessel produces broadband acoustic energy with most of the energy emitted below a few kilohertz. Sound from onboard machinery, particularly sound below 200 Hz, dominates the sound spectrum before cavitation begins—normally around 8–12 knots on many commercial vessels (Spence et al. 2007). At higher speeds and higher propulsion system load, the acoustic output from the cavitation processes on the propeller blades dominates other sources of sound on the vessel such as machinery or hull vibration (Leggat et al. 1981). Noise from dynamic positioning operations is different to that from vessels under transit.

The contributions from the IMV and crawler have been considered, but the Anchor Handling Vessel, and other vessels under dynamic positioning associated with the project may produce louder levels of noise. The IMV is on a dynamic positioning assisted anchor/winch system (Thruster Assisted

Mooring), however the other project vessels, such as the AHV and FSO will be under dynamic positioning a significant amount of time, and will noticeably contribute to the combined sound fields. The assessment of the dynamically positioned vessels should consider the variability in source level and spectra, with the best practice approach typically considering the worst-case scenario.

While vessel noise sources are common in New Zealand waters, generally those vessels are in transit, and the characteristics of the generated noise is different to that from vessels under dynamic positioning. Thrusters have different physical characteristics to the large single propellers on merchant ships, which translates into different acoustic characteristics, and dynamic positioning noise can change suddenly due to instant thrust change requirements based on operational requirements, weather and oceanographic conditions. The design of thrusters also makes them more prone to cavitation at relatively low operational speeds, leading to much higher source levels relative to their thrust (Fischer 2000).

Moreover, a vessel under dynamic positioning remains in one location for an extended period, as opposed to transiting more rapidly through the area. The characteristics of dynamic positioning noise are of great interest to regulators globally (e.g. [Sound Source Characterization of Dynamic Positioning Systems: Field Verification \(NT-25-01\)](#)).

Best practice assessments typically consider all sound sources, including sonar, acoustic positioning systems, vessels and subsea operations (such as the crawler), especially if they are operating concurrently, the application does not do this.

- **Are there additional elements that need to be considered to properly evaluate the noise outputs from the activity?**

The required elements are captured in the answers to the questions above.

Effects of sound and vibration on species other than marine mammals has not been considered within the application, including for fish and seabirds.

2.7. Does the marine mammal management plan as described follow best practice? In your experience, are there gaps that should be addressed?

The marine mammal management plan as described does not follow what is considered to be international best practice. Specifically,

- The use of only one MMO is unlikely to result in effective marine mammal observations as it is not feasible for one MMO to observe 360° around the vessel. Two MMOs is considered best practice, particularly in areas where threatened species are likely to occur.
- The marine mammal management plan states that vessels will stay 300 m from feeding blue whales. While 300 m is appropriate for small tourism vessels, it is not appropriate for large commercial vessels. It is considered that a 1 km exclusion zone around all whales, including blue whales (feeding, foraging or any other behavioural state) would be much more appropriate.
 - Additionally, the management plan does not define what a feeding aggregation of blue whales is. Blue whales typically do not 'aggregate' like humpbacks, and feeding blue whales can be distributed over many kilometres. Therefore this condition should be written to be relevant to individual blue whales.
- A speed limit of 6 knots should be enforced for all project vessels within the project area.
- An observation zone of 3 km for soft starts would be considered best practice. Noting that the project area overlaps with a foraging area for blue whales, it would be most appropriate for the range to behavioural disturbance to be used as the basis for soft start observations and to be cleared prior to operations.
- The marine mammal management zone provides limited consideration of mitigation measures to reduce impacts from support vessels and export vessels. Larger exclusion zones of 1 km and speed limits of 6 knots should also be applied to these vessels.

2.8. Can you review and comment on the conditions proposed for monitoring and mitigating underwater noise impacts?

The responses to the following three questions are detailed in the subsequent sections.

- Is their proposed methodology appropriate, robust, and achievable?
- Will these achieve their proposed objectives?
- Are there available standards or guidelines, including from other jurisdictions that could be considered to inform the appropriateness of conditions?

2.8.1. Standards and Guidelines

- The following international standards provide the terms and definitions that should be employed when discussing underwater acoustics:
 - ISO/IEC 80000 (2009) – *Quantities and Units*
 - ISO 18405 (2017) – *Underwater acoustics - Terminology*
 - BIPM (2019) – *The International System of Units*
- International standards covering methods for measurement of sound radiated by vessels and hydrophone calibration, should be applied:
 - ISO 17208-1 (2016) - *Underwater acoustics – Quantities and procedures for description and measurement of underwater sound from ships – Part 1: Requirements for precision measurements in deep water used for comparison purposes*
 - ISO 17208-2 (2019) - *Underwater acoustics – Quantities and procedures for description and measurement of underwater sound from ships – Part 2: Determination of source levels from deep water measurements*
 - ISO/FDIS 17208-3 ([Under Approval](#)) - Underwater acoustics — Quantities and procedures for description and measurement of underwater sound from ships– Part 3: Requirements for measurements in shallow water (New Zealand Standards has access to this, it can also be accessed online - [ISO/FDIS 17208-3 - 2025-05 - DIN Media](#))
 - Prior to the formal release of this standard, reference should be made to Hannay et al. (2023). This document recommends formal methods that can be adopted directly or used by ship classification societies to increase alignment of their quiet vessel certification/notation approaches. It proposes a consistent base measurement approach and recommends a common metric upon which to assess vessel noise emissions.
 - IEC 60565-1 (2020) - Underwater acoustics - Hydrophones - Calibration of hydrophones - Part 1: Procedures for free-field calibration of hydrophones
 - IEC 60565-2 (2019) - Underwater acoustics - Hydrophones - Calibration of hydrophones - Part 2: Procedures for low frequency pressure calibration
 - Two other ISO standards are in development and should be consulted by project teams once they are released:
 - ISO 7605:2025 (under approval)- Underwater acoustics — Measurement of underwater ambient sound
 - ASA/ANSI S3/SC1.2 – Underwater Passive Acoustic Monitoring for Bioacoustic Applications

The ISO [online browsing platform](#) provides free access to the introductory material and definitions / terminology of each standard and is a highly recommended resource. Several project

terminology documents and best practice guides have been prepared that may also provide useful information for project teams:

- Guidelines and best practice approaches:
 - Publications from the BOEM funded ADEON (Atlantic Deepwater Ecosystem Observatory Network)
 - [Project Dictionary: Terminology Standard.](#)
 - [Underwater Soundscape and Modeling Metadata Standard](#)
 - [Standard procedure for equipment performance, calibration and deployment](#)
- Publications from the European project JOMOPANS (Joint Monitoring Programme for Ambient Noise North Sea):
 - [Standard for Terminology FINAL](#)
 - [Report on Data management workshop](#)
 - [JOMOPANS measurement guidelines](#)
- National Physical Laboratory (UK) Good Practice Guide for [Underwater Noise Measurements](#)
- IQOE – [Inventory of existing standards and guidelines relevant to marine bioacoustics](#)

2.8.2. Methodology robustness

The relevant conditions from the application are pasted under specific sub-headings in Appendix A of this report. The conditions require underwater noise monitoring to be undertaken. No methodology has been stipulated however numerous industry standards exist. Recommendations include:

- Baseline acoustic data should be collected for at least two, and ideally three, years prior to the commencement of an activity in order to quantify variation in levels, similar to what is presented in the Australian [National Guidelines for the Survey of Cetaceans, Marine Turtles and the Dugong](#).
- Acoustic monitoring should cover the footprint of the planned activities at a minimum, with additional moorings enabling the gradient between the disturbed and undisturbed areas to also be assessed. An ambient monitoring program should characterise as many aspects of the marine soundscape as possible, i.e. geophonic (natural, non-biological sounds), biophonic (biological sounds) and anthroponic (human) contributors.
- The underwater noise monitoring required as part of Condition 11 is not standard practice, and contains arbitrary measurement distances, depths and sound levels. These measurement locations are likely achievable, but we do not consider them to be best practice, appropriate or robust. Moreover, the measurements only apply to the IMV and crawler, and are not concerned with other vessels associated with the project that may also be producing high levels of sound as a result of dynamic positioning. The presence of the other vessels will also influence measurements.
 - The characterisation measurements should follow ISO/FDIS 17208-3 / Hannay et al. (2023). These publications define the procedures which should be followed to collect compliant measurements.
 - Measuring under calm conditions is not necessarily proportional to maximum sound production as thrusters (where applicable) will likely be at lower power than they would be in higher sea states.

- The measurement program will need to be conducted over a suitable period of time to capture the variability in noise levels, as exhibited by other offshore platforms and vessels under dynamic positioning (i.e. Austin et al. (2023)).
- The vessel underwater noise monitoring process is not considered to be robust, appropriate, or designed to achieve the goals.

A number of additional issues have been identified in the conditions:

- The conditions appear to be focused on the use of 130 dB SPL within specified frequency bands, (or unweighted 135 dB SPL) as the level which cannot be exceeded at 500 m with 500 m being the range to be monitored by marine fauna observers. It is unclear why 130 dB has been selected noting the industry standard threshold for behavioural response is 120 dB (note: this represents the median level at which marine mammals are expected to respond to continuous noise).
- Condition 17 says that acoustic propagation modelling should take place at commencement of operations – this should be undertaken prior to the commencement of works and should be submitted as part of the approvals process in order for the project to be properly considered. Modelling needs to consider all noise sources, not just the IMV and crawler.
- Condition 10a requires that there be no adverse impact on blue whales or marine mammal species classified as “Nationally Endangered”, “Nationally Critical” or “Nationally Vulnerable”, that utilise the South Taranaki Bight. Based on the information presented, and the proposed management measures, it is not possible to comment on whether this condition is achievable. The judgement as to what constitutes adverse is a regulatory decision and not within the scope of a scientific peer review.
 - The project is likely to result in behavioural disturbance to marine mammals, including blue whales and Hector's dolphins and may result in some level of TTS if animals remain in within the area for an extended period. The range over which these effects may occur should be predicted using robust noise modelling.
 - Without robust baseline information on species occurrence within the project area and noise effect ranges around this area, it is not possible to comment on the likely extent or severity of impacts at a population level.
- As noted above, there are a number of limitations in the conditioned mitigation measures including the use of only one MMO and a 500 m observation range. For operations in sensitive environments a minimum of two MMOs and observation range of 3 km is considered best practice.
- The use of cameras on vessels to monitor for vessel strike will be valuable from a compliance perspective but it is not clear this would perform to reduce the likelihood of vessel strike. To reduce vessel strike risk it would be recommended that one MMO be on duty on each vessel and all vessels adhere to a speed limit of 6 knots.

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Appendix A. Relevant Conditions Within the Fast-Track Application

A.1. Abbreviations

The conditions discussed in the following sections contain a multitude of abbreviations. The following list provides their expanded forms for reference (provided in the order that they appear within the conditions presented below):

AHT = Anchor Handling Tug

CEV = Carrier Export Vessel

IMV = Integrated Mining Vessel

EPA = Environmental Protection Authority

FSO = Floating Storage and Offloading

GPS = Global Positioning System

dB re 1µPa RMS linear = decibel with reference unit of 1 micro Pascal, Root Mean Square

Hz = Hertz

PCEMP = Pre-commencement Environmental Monitoring Plan

SSC = Suspended Sediment Concentration

BEMP = Baseline Environmental Monitoring Plan (draft document, dated August 2016)

TRG = Technical Review Group

EMMP = Environmental Management and Monitoring Plan

OSPM = Operational Sediment Plume Model

ISQG = Interim Sediment Quality Guideline

MMMP = Marine Mammal Management Plan

KRG = Kaitiakitanga Reference Group

A.2. Seabirds

9. The Consent Holder must ensure that:

- a.** There are no adverse effects on seabird species that utilise the South Taranaki Bight that are classified under the New Zealand Threat Classification System as “Threatened” or “At-risk” or “Threatened” in the International Union for the Conservation of Nature “Red List”; and
- b.** For species other than those identified in Condition 9a, adverse effects on seabirds, including but not limited to effects arising from:
 - i.** Lighting (including the Integrated Mining Vessel (“IMV”), Floating Storage and Offloading Vessel);
 - ii.** Spills; and
 - iii.** The effect of sediment in the water column on diving birds that forage visually, are mitigated, and where practicable avoided.

A.3. Marine Mammals

- 10.** Notwithstanding the requirements of Conditions 11, 35, 66 and 88, with respect to marine mammals (excluding seals), the Consent Holder must ensure that:
- a.** There are no adverse effects as a result of the activities authorised by this consent on:
 - i. Blue whales; or
 - ii. Marine mammal species classified under the New Zealand Threat Classification System as “Nationally Endangered”, “Nationally Critical” or “Nationally Vulnerable”, that utilise the South Taranaki Bight.
 - b.** For species other than those identified in Condition 10a, adverse effects on marine mammals, including but not limited to effects arising from:
 - i. Noise;
 - ii. Collision and entanglement;
 - iii. Spills; and
 - iv. Sediment in the water column,are avoided to the greatest extent practicable.
 - c.** At all times during the operational activities authorised by these consents, at least one (1) dedicated and trained marine mammal observer is on-board each of the operational vessels, but not including bulk carriers. While the vessel is in motion, the observer must be in a position where a clear field of vision is provided over the forward section of the vessel and beyond the bow;
 - d.** A video camera is placed in a prominent position on all operational vessels where a clear field of vision is provided over the forward section of the vessel, beyond the bow and to the sides of the bow and is recording at all times while the vessel is in motion. Further to the camera, a monitoring screen must be installed on the bridge of each vessel and the video feed from each of the cameras will be made available to the EPA and/or Department of Conservation staff upon request. The purpose of the cameras is to record passage of the vessels and any contact with marine mammals while in motion;
 - e.** All employees and contractors undertaking airborne, seagoing and watch-keeping duties are informed of their obligations under the Marine Mammals Protection Act 1978 and Marine Mammals Protection Regulations 1992 or any subsequent Regulations;
 - f.** All employees and contractors must record any sightings of marine mammals (except seals) including the date, time and, where possible, GPS position of the vessel. All records must be contained in an Observation Log and be made available to EPA and/or Department of Conservation staff upon request and Annual Report required by Condition 104;
 - g.** Any sightings of Maui or Hector’s dolphins are immediately reported to the Department of Conservation;
 - h.** Masters of all vessels are instructed to reduce speed to a ‘no wake speed’ of no greater than 5 knots within 300 m of any large cetaceans and feeding aggregations of blue whales, and take all necessary steps to avoid contact with the animals and, where practicable, maintaining a distance of at least 300 m from the animal/s;
 - i.** Helicopters servicing the operation (subject to compliance with Safety and Civil Aviation Authority requirements) maintain a minimum altitude of 600 m (2,000 feet) except when landing and taking off;
 - j.** Any marine mammal strikes, entanglements, injuries or deaths are reported to the Department of Conservation and the EPA as soon as practicable, but no later than five (5) working days, following any such event;

k. If a strike, entanglement, injury or death involves Maui or Hector's dolphin, and the carcass is recovered, the Department of Conservation and the EPA must be notified immediately of that recovery. The consent holder must ensure the carcass is returned to shore as soon as practicable, but no later than five (5) working days following such event, for collection by the Department of Conservation subject to the Consent Holder's obligations under the Marine Mammals Protection Act 1978 or any subsequent Regulations; and

l. Any other relevant operational response in relation to marine mammals that has been approved by the EPA is undertaken. For the purpose of this condition, any observer engaged by the Consent Holder must be a trained and/or qualified observer as defined in the 2013 Department of Conservation Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations (or any subsequent updated Code of Conduct).

For the purpose of this condition, the term 'in motion' refers to any period when the Consent Holder's operational vessels are moving under the power of their own engines and travelling at a speed greater than 5 knots. It does not apply to movement of the IMV at those times when it is anchored to the seabed.

For the purpose of this condition, the term 'large cetaceans' refers to any of the following marine mammal species:

- All members of the Mysticeti group (i.e. Baleen whales); and/or
- All members of the Physeteridae group (i.e. Sperm whales); and/or
- All members of the Ziphiidae group (i.e. Beaked whales); and/or
- All members of the Globicephala group (i.e. Pilot whales); and/or
- All members of the Orcinus group (i.e. Killer whales).

A.4. Underwater Noise

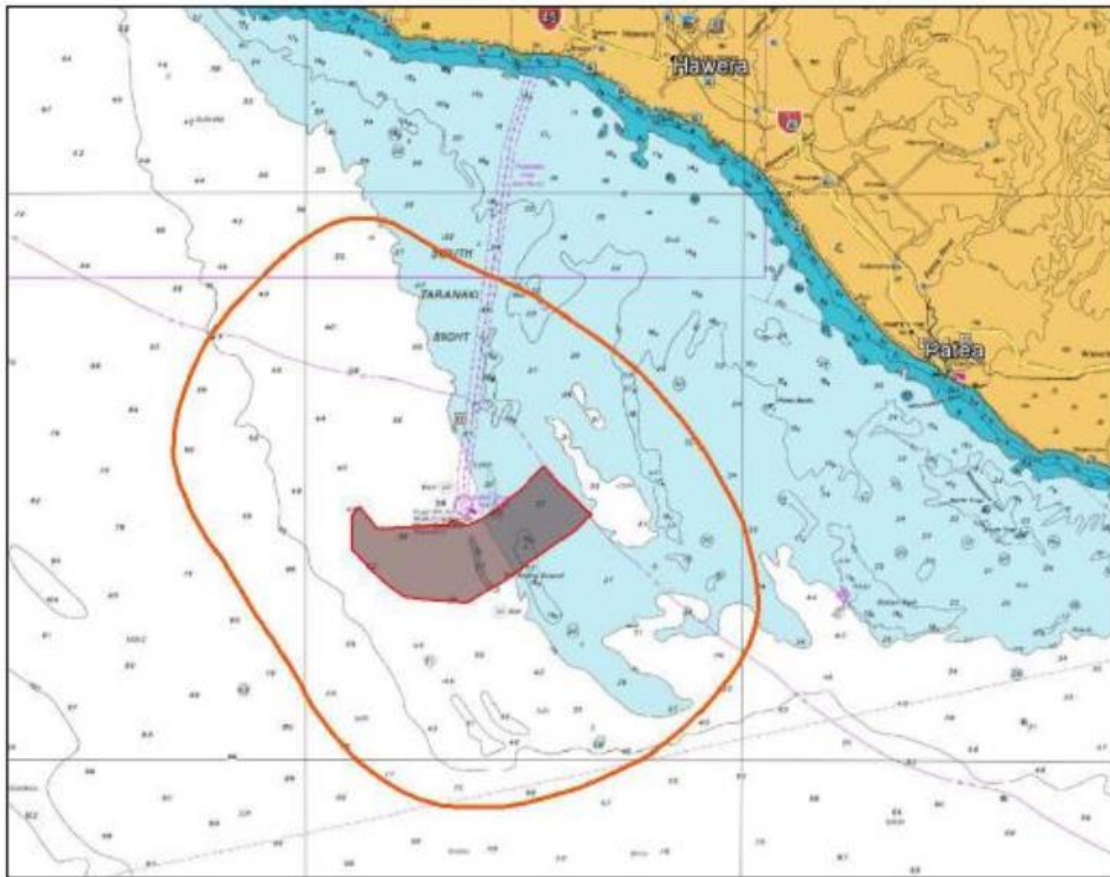
11. At all times during the operation of marine vessels and/or project equipment:

- a.** The combined noise from the IMV and the Seabed Sediment Extraction Device ("Crawler") operating under representative full production conditions must be measured at a nominal depth of ten (10) m below the sea surface and at 300 m, 500 m, 750 m and 1,000 m from the port or starboard side of the IMV;
- b.** The overall combined noise level at 500 metres from the IMV must not exceed 130 dB re 1µPa RMS linear in any of the following frequency ranges: low frequency 10-100 Hz, mid-frequency 100-10,000 Hz, and high frequency >10,000 Hz;
- c.** The overall combined noise level at a nominal depth of ten (10) m below the sea surface and 500 m from the IMV, across all frequencies must not exceed a sound pressure level of 135 dB re 1µPa RMS linear;
- d.** Measurements must be undertaken in calm sea conditions (e.g. Beaufort sea state less than three (3) (beginning of white-capping)), with no precipitation and no external noise sources (e.g. passing ships);
- e.** The monitoring equipment must be calibrated before and after measurements; and
- f.** The combined noise must be monitored:
 - i.** Within twenty (20) working days of seabed material extraction activities reaching no less than 90% of full production but no later than six (6) months following the commencement of the seabed material extraction activities, the Consent Holder must undertake continuous noise measurement for a period of no less than six (6) weeks;
 - ii.** An additional two (2) times in the first twelve (12) months of the commencement of 90% of full production. Each measurement being separated by a period of at least six (6) months;
 - iii.** Annually for the following four (4) years;

iv. Every five (5) years thereafter; and v. At any time reasonably requested by the EPA. Should the operation of the IMV and Crawler be altered in any way which may change the magnitude or character of the underwater noise production, additional noise monitoring must be undertaken within twenty (20) working days of the change to demonstrate compliance with Condition 11.b. has been maintained. <i>Advice note: For the purpose of this condition, the reference to “full production conditions” equates to an operational extraction of 8,000 tonnes per hour as required by Condition 4.a.</i>
12. The Consent Holder must design and construct the crawler and IMV to achieve, at full production, a total combined noise source level (measured in water), of not more than 177 dB re 1µPa RMS linear at one (1) metre.
13. Prior to deployment in New Zealand, the Consent Holder must obtain certification from a suitably qualified and experienced acoustic engineer that the crawler and IMV has been designed to achieve the criterion set out in Condition 12 above, and that the criterion set out in Condition 12 has been demonstrated for full production operation during pre-deployment commissioning. The testing undertaken in accordance with this condition must include both theoretical assessment and noise data collected from field measurements during pre-deployment commissioning.
14. The Consent Holder must not commence extraction activities authorised by these consents until the certification required by Condition 13 has been provided to the EPA.
15. The Consent Holder must undertake noise monitoring in the vicinity of the IMV and crawler once per week during the period referred to in Condition 11.f.i., in order to assess compliance with the criterion set out in Condition 12.
16. Underwater monitoring of the total combined noise from the crawler and IMV must also occur at the same times as monitoring is undertaken under Conditions 11.f.ii to v.
17. At the commencement of the operations authorised by these consents, the Consent Holder must undertake robust underwater propagation modelling using empirical underwater noise data (i.e. as detailed and collected in Condition 11) to estimate the distance of the 120 dB contour from the noise source as identified in Schedule 7.
18. Within twenty (20) working days of any noise monitoring undertaken in accordance with Condition 11 and/or 17, the Consent Holder must provide a detailed report on the monitoring and results to the EPA. As a minimum, this report must include: a. Details of the equipment used, and calibration methods used; and b. A description of the measurement conditions and location; and c. A summary of the noise levels measured, including broadband and one third octave band frequency data and compliance of the operation with respect to the noise standards specified in Condition 11; and / or d. At the commencement of operations, validation of the noise model and confirmation of the extent of the predicted 120 dB contour (as shown by Schedule 7) generated by the IMV and crawler when operating at the centre of the mining area as specified in Condition 17.
Content of Schedule 7:

SCHEDULE 7 – 120 DECIBEL CONTOUR

This map sets the position of the 120 dB contour referred to in Condition 16.



Note 1: This schedule is referred to in conditions 17 and 18.

Note 2: The 120 dB contour is an indicative location based on the combined operation of the IMV and crawler, when operating at the centre of the mining site.

A.5. “Soft Starts”

35. Any start-up of the IMV, Crawler and associated plant, whether related to commencement or re-commencement of operations after a break, of the seabed material extraction activities authorised by these consents must be completed as a “soft start”, whereby equipment is gradually increased in power over at least a twenty (20) minute period.

Soft starts must only commence in daylight hours and when there is at least 500 metres of visibility.

36. Prior to each start-up, the Consent Holder must use suitably trained marine mammal observer(s), in accordance with Condition 88, to monitor the area within a 500 metre radius (mitigation zone) of the IMV for at least 30 minutes prior to start up. There must be no whales or dolphins present within a 500 metre radius (mitigation zone) of the IMV at start up.

If any whales or dolphins are observed in the mitigation zone during pre-start observations, then the start-up must be delayed until the whales or dolphins are seen to leave the mitigation zone or have not been detected within the mitigation zone for a further thirty (30) minutes from the last sighting.

A record of pre-start observations must be kept and made available to the EPA on request and included in the Quarterly Operational Report required by Condition 103 and the Annual Report required by Condition 104.

For the purpose of this condition, any observer engaged by the Consent Holder must be a trained or qualified observer as defined in the 2013 Department of Conservation Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations (or any subsequent updated Code of Conduct).

A.6. Pre-commencement Environmental Monitoring Plan

47. Prior to the commencement of any seabed material extraction activities authorised by these consents, the Consent Holder must undertake a minimum of two (2) years of pre-commencement environmental monitoring in accordance with Conditions 48 – 51 which, as a minimum, includes:

- a.** Suspended sediment concentrations;
- b.** Suspended and seafloor sediment quality;
- c.** Subtidal and intertidal biology;
- d.** Optical water quality;
- e.** Physio-chemical parameters;
- f.** Heavy metals;
- g.** Oceanography;
- h.** Primary production;
- i.** Zooplankton;
- j.** Seafood resources;
- k.** Marine mammals;
- l.** Underwater noise;
- m.** Seabirds;
- n.** Commercial fishing; and
- o.** Recreational fishing.

The Consent Holder must also undertake testing and monitoring of the matters, and for the purposes, set out in Schedule 6.

48. The Consent Holder must prepare, and undertake the pre-commencement environmental monitoring required by Condition 47, in accordance with the procedures and methods, at the locations (including representative points around the Kupe Well Head Platform and along the pipeline and umbilical route), and for the duration and frequency detailed in the certified Pre-commencement Environmental Monitoring Plan ("PCEMP"). The purpose of the PCEMP is to:

- a.** Establish a set of environmental data that identifies natural background levels while considering spatial and temporal variation;
- b.** Confirm the current understanding of the seasonality and natural variability of environmental parameters that will be monitored during seabed material extraction activities;
- c.** Provide data to validate the background data used in the Operational Sediment Plume Model (Condition 52), which predicts the sediment transportation processes in the South Taranaki Bight; and
- d.** Provide data to verify that the 'SSC Limit' values in Schedule 2 are appropriate following the validation of the Operational Sediment Plume Model (Condition 52); and
- e.** Ensure compliance with all regulatory requirements and guidelines; and
- f.** Provide data to establish the proxy relationship between turbidity and SCC at the monitoring sites listed in Schedule 2 and at a control site.

The PCEMP shall also include:

- a.** The roles and responsibilities of parties who are to undertake the precommencement environmental monitoring;
- b.** Objectives for the pre-commencement environmental monitoring associated with the activities authorised by these consents;

- c.** All parameters being monitored, including sampling design, methodology, frequency, duration and monitoring locations;
- d.** Details of data analysis and processing for all parameters being monitored; and
- e.** Report methods for all parameters being monitored.

The PCEMP must be prepared by a suitably qualified and experienced person(s) in and be generally consistent with the draft BEMP dated August 2016.

The PCEMP must be independently peer reviewed by a suitably qualified and experienced person(s) and then provided to the Technical Review Group ("TRG") (Condition 60) for confirmation that the intended monitoring meets the purposes of the PCEMP as set out in this condition.

The PCEMP, together with comments and recommendations of the TRG, including, where necessary, an explanation as to why a TRG recommendation has not been accepted, must be submitted to the EPA for certification that the PCEMP meets the requirements of this condition.

The pre-commencement monitoring required by these consents must be undertaken in accordance with the certified PCEMP.

Advice Note: The PCEMP is a renaming of the draft BEMP (Baseline Environmental Monitoring Plan) referred to in Condition 48.

- 49.** The Consent Holder may amend the PCEMP at any time prior to the commencement of the extraction activities authorised by these consents. Any amendments must be prepared by a suitably qualified and experienced person(s) and then be independently peer reviewed by a suitably qualified of experienced person(s) and then reviewed by the Technical Review Group ("TRG"), unless the EPA confirms that a peer review is not necessary.

Any amendment will only come into effect once it has been certified by the EPA as being consistent with purposes of, and follows the preparation and review processes of, Condition 48, and that the monitoring locations, duration and frequency of monitoring are representative and relevant to each of the environmental components being monitored.

Where certification for an amended PCEMP is not received, the Consent Holder must continue to use the plan which was in place prior to the lodgement of the amended PCEMP.

- 50.** The pre-commencement monitoring required by the PCEMP must be undertaken at all required times except:

- a.** During a mechanical or technical breakdown or malfunction of monitoring equipment; or
- b.** Where monitoring equipment has been damaged or is being replaced; or
- c.** Due to unforeseen circumstances.

If any of the above situations occur, the Consent Holder must notify the EPA as soon as practicable, but no later than twenty four (24) hours of the situation arising and identify:

- a.** What monitoring was affected and how for long; and
- b.** When the monitoring will recommence.

- 51.** Prior to the commencement of seabed material extraction activities authorised by these consents, and following completion of the pre-commencement environmental monitoring required under Conditions 47 and 48, the Consent Holder must review the numerical values of the SSC Limits in Schedule 2 of these consents utilising the methodology specified in Schedule 3. The review of the numerical values must be undertaken by suitably qualified and experienced person(s) and submitted to the TRG for review and comment prior to being submitted to the EPA for certification.

In the event that the numerical values of the SSC Limits as a result of monitoring are different from the numerical values of the SSC Limits in Schedule 2 of these consents, the updated numerical values

will supersede the numerical values of the SSC Limits in Schedule 2 for the purpose of these consents.

Any change to the numerical values in accordance with this condition shall not require a change of consent conditions but are to be identified in the Environmental Monitoring and Management Plan ("EMMP") required under Condition 55.

A.7. Environmental Monitoring Requirements

54. Following the completion of the pre-commencement monitoring required by Conditions 47 and 48 and the review of the SSC Limits required by Condition 51, the Consent Holder must, as a minimum, undertake monitoring of:

- a.** Suspended sediment concentrations;
- b.** Seafloor and suspended sediment quality;
- c.** Subtidal and intertidal biology;
- d.** Optical water quality;
- e.** Physio-chemical parameters;
- f.** Heavy metals;
- g.** Oceanography;
- h.** Primary production;
- i.** Zooplankton;
- j.** Biosecurity;
- k.** Seafood resources;
- l.** Marine mammals;
- m.** Underwater noise;
- n.** Seabirds; and
- o.** Recreational fishing.

The Consent Holder must also undertake testing and monitoring of the matters, and for the purposes, set out in Schedule 6. For the avoidance of doubt, both Schedule 6 and the matters set out above in this condition must be addressed.

Relevant section of Schedule 6:

Marine Mammal Monitoring	
Indicator:	Method:
a. Vessel strike	b. Post mortem
Fur Seals	
Indicator:	Method:
a. Fur seal distribution	b. Counts from IMV and FPSO
Marine Mammal Acoustic Surveys	
Indicator:	Method:
a. Marine mammal distribution	b. Three acoustic loggers to establish benchmark sound levels. Broad spectrum monitoring. Inclusion of bottlenose dolphin.

A.8. Environmental Management and Monitoring Plan

55. The Consent Holder must ensure that the monitoring required by Condition 54 and Schedule 6 is appropriate to ensure that the activities authorised by these consents do not result in any adverse effects that were not anticipated at the time of the granting of these consents. The EMMP must, as a minimum:

- a. Identify the sampling design and methodology for each of the parameters being monitored, including the frequency, duration and monitoring locations;
- b. Describe how the results of the pre-commencement environmental monitoring programme provided for in the PCEMP has been incorporated into the EMMP (Condition 48);
- c. Outline the process for the on-going validation of the OSPM including the calibration and validation of the plume component of the model (Condition 52);
- d. Identify the limits contained in the ISQG-High values (Condition 6);
- e. Specify procedures for comparing the monitoring data against the background data that assist in determining if any activities authorised by the consents have resulted in adverse effects that were not anticipated at the time of the granting, including recovery of the benthic environment, as defined in Condition 7;
- f. Identify the TRG membership, and their evaluation process in accordance with Conditions 60 – 64;
- g. Identify the operational responses to be undertaken if unanticipated adverse effects are identified;
- h. Detail data analysis and processing for all parameters being monitored;
- i. Define the reporting methods and schedule for all parameters being monitored; and
- j. To continue the ongoing calibration of the relationship between SSC and turbidity.

The EMMP must be prepared by a suitably qualified and experienced person(s) and be generally consistent with the draft EMMP dated August 2016. The EMMP must then be independently peer reviewed by a suitably qualified and experienced person(s) and then reviewed by the TRG (Condition 60) to confirm that the intended monitoring meets the purposes of the EMMP as set out in this condition.

The EMMP, together with comments and recommendations of the TRG including, where necessary, an explanation as to why a TRG recommendation has not been accepted, must be submitted to the EPA for certification that the EMMP meets the requirements of this condition.

The environmental monitoring required by these conditions must be undertaken in accordance with the EPA certified EMMP and must commence no later than twenty (20) working days prior to the commencement of the seabed material extraction activities.

56. The Consent Holder may amend the EMMP at any time during the seabed material extraction activities. Any amendments to the EMMP must be prepared by a suitably qualified and experienced person(s) and then independently peer reviewed by a suitably qualified and experienced person(s) and then reviewed by the TRG. Any changes will only come into effect once they have been certified by the EPA, that:

- a.** Such changes are consistent with the requirements of Conditions 54, 55 and Schedule 6; and
- b.** The processes set out in Condition 55 have been followed; and
- c.** The monitoring locations, and the duration and frequency of monitoring, continue to be representative and relevant to each of the environmental components being monitored; and/or
- d.** The change in monitoring location or timing of monitoring is necessary to reflect operational changes, or changes in methodology, due to advances in technology or scientific understanding.

Where certification of the amended EMMP is not received, the Consent Holder must continue to use the plan which was in place prior to the lodgement of the amended plan.

A.9. Marine Mammal Management Plan

66. The Consent Holder must prepare a Marine Mammal Management Plan ("MMMP") following consultation with the Department of Conservation and the KRG (if it has been formed), which must, as a minimum, set out:

- a.** How compliance with Condition 10 will be achieved; and
- b.** Procedures and protocols to minimise the risk of marine mammal entanglement; and
- c.** Set out indicators of adverse effects on marine mammals that utilise the South Taranaki Bight listed in Condition 10.a.; and
- d.** A framework relating to marine mammal operational responses; and
- e.** Integrate any obligations under the Marine Mammals Protection Act 1978 and Marine Mammals Protection Regulations 1992, or any superseding legislation.

The MMMP must be prepared by a suitably qualified and experienced person(s) in general accordance with the draft MMMP dated April 2025 and submitted to the EPA for certification that the requirements of this condition have been met.

The seabed material extraction activities authorised by these consents must not commence until the MMMP has been certified by the EPA.

Any amendments to the MMMP must be submitted to the EPA for certification and may only be implemented following certification from the EPA that the amended MMMP meets the requirements of this condition. Where certification of an amended plan is not received, the Consent Holder must continue to use the plan which was in place prior to the lodgement of the amended plan.

The activities must be undertaken in accordance with the latest certified MMMP, a copy of which must be held on-board each of the Consent Holder's project vessels and at the Consent Holder's head office.