



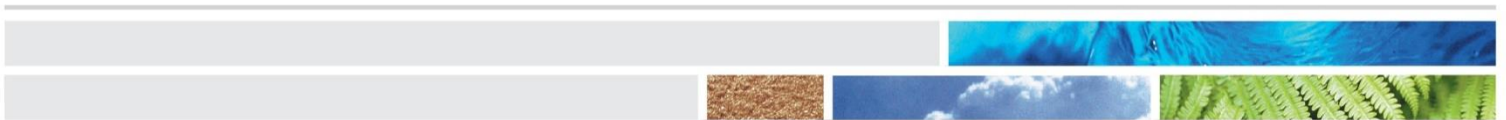
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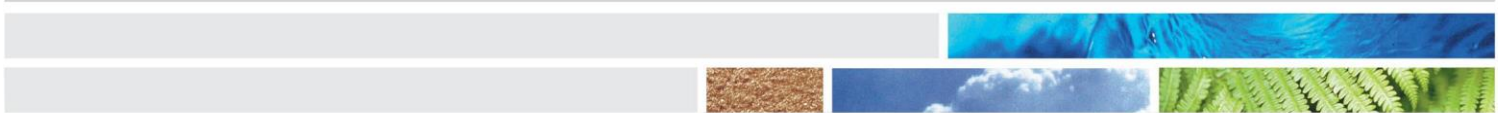
Application Ref: EEZ000011
August 2017

DECISION ON MARINE CONSENTS AND MARINE DISCHARGE CONSENTS APPLICATION

Trans-Tasman Resources Limited

Extracting and processing iron sand within the South Taranaki Bight





MARINE CONSENTS AND MARINE DISCHARGE CONSENTS EEZ000011

Pursuant to section 62(1)(a) and 87F(1) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, the application for marine consents and marine discharge consents by Trans-Tasman Resources Ltd to undertake restricted activities (listed in Appendix 1) is **GRANTED** and the consents are issued subject to conditions (listed in Appendix 2).

These marine consents and marine discharge consents expire 35 years after the date of the granting of the consents.

Dated this 3rd day of August 2017

Alick Shaw
Chair

Dr Kevin Thompson
EPA Board Member

Sharon McGarry
Deputy Chair (dissenting opinion)

Gerry Te Kapa Coates
DMC Member (dissenting opinion)

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Glossary of Abbreviations and Terms

ABS	American Bureau of Shipping
ACE	Annual Catch Entitlement
AHT	Anchor Handling Tug
ANZECC 2000	Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000
Benthic	On the seabed
Bryozoan	Very small filter feeding animals that group together in colonies which look like plants or coral
CEV	Cape-size Export Vessel
CGE	Computable general equilibrium
CMA	Coastal Marine Area
Crown Minerals Act	Crown Minerals Act 1991
Crawler	Subsea sediment extraction device (SSED)
Continental Shelf Act	Continental Shelf Act 1964
Demersal	Near to and significantly affected by the seabed
Discharge of de-ored sediment	The combined discharge of all sediment from the IMV, irrespective of its source, immediately prior to the discharge to the marine environment.
DMC	Decision-making Committee
DOC	Department of Conservation
DPS	Dynamic Positioning System
EEZ Act	Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
EEZ	Exclusive Economic Zone
EEZ Regs 2013	Exclusive Economic Zone and Continental Shelf (Environmental Effects— Permitted Activities) regulations 2013
EEZ Regs 2015	Exclusive Economic Zone and Continental Shelf (Environmental Effects—Discharge and Dumping) Regulations 2015
EMMP	Environmental Monitoring and Management Plan
EPA	Environmental Protection Authority
ESA	Ecologically sensitive area
Euphotic zone	Extends from the surface down to a depth where light intensity falls to one percent of that at the surface, called the euphotic depth. Accordingly, its thickness depends on the extent of light attenuation in the water column.
Fisheries Act	Fisheries Act 1996
The Fisheries Submitters	Fisheries Inshore New Zealand Limited; New Zealand Federation of Commercial fishermen Inc.; Talley's Group Limited; Southern Inshore Fisheries Management Company Limited; Cloudy Bay Clams Limited
FMA	Fisheries Management Area
FSO	Floating storage and offloading vessel
FINZ	Fisheries Inshore NZ
HFO	Heavy Fuel Oil
HNZ	Heritage New Zealand Pouhere Taonga
HSNO Act	Hazardous Substances and New Organisms Act 1996
HSNO Regulations	Hazardous Substances (Emergency Management) Regulations 2001
HRW	H.R. Wallingford Ltd.
IMO	International Maritime Organization
IMO Guidelines	International Maritime Organization 2011 'Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species'
IMV	Integrated mining vessel
IOPPC	International oil pollution prevention certificate
ISQG	Interim sediment quality guidelines
ISR	Iron sands recovery
JORC Code	Joint Ore Reserves Committee: Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, 2012
KRG	Kaitiakitanga Reference Group
Kupe Operator	Operator of the Kupe Petroleum Mining License #38146

Macroalgae	Seaweed
Māori Fisheries Act	Māori Fisheries Act 2004
MARPOL	('Marine Pollution') International Convention for the Prevention of Pollution from Ships
MACA Act	Marine and Coastal Area (Takutai Moana) Act 2011
MBIE	Ministry of Business Innovation and Employment
mg/L	Milligrams per litre
Microalgae	Phytoplankton and MPB
MMR	Marine management regime
MPI	Ministry for Primary Industries
MMMP	Marine mammals monitoring plan
MNZ	Maritime New Zealand
MPB	Microphytobenthos
Maritime Transport Act	The Maritime Transport Act 1994 μ
mol m ² /day	The number of photosynthetically active photons accumulated in a square meter over the course of a day.
μ m	Micron (micrometre) = one thousandth of a millimetre (10 ⁻⁶)
m/s	Metres per second
nm	Nautical Miles
NIWA	National Institute of Water and Atmosphere
Ngā Motu MRS	Ngā Motu Marine Reserve Society
NOAA	National Oceanic and Atmospheric Administration (U.S. Department of Commerce)
OERKL	Origin Energy Resources Kupe Limited
OPRC	International Convention on Oil Pollution Preparedness, Response and Cooperation 1990
OSPM	Operational Sediment Plume Model
Pelagic	Sea that is neither close to the bottom nor near the shore
PCEMP	Pre-commencement Environmental Monitoring Plan (previously called BEMP)
PML	Petroleum Mining Licence
Pore water	Water that occupies the pore spaces between rocks or sediments
PSD	Particle size distribution (of sediment). The relative amounts of particles present according to size
PTS	Permanent threshold shift (permanent reduction in hearing sensitivity)
QMA	Quota management area
QMS	Quota Management System
RMA	Resource Management Act 1991
SEL	Sound exposure level (total noise energy produced from a single noise event)
SPL	Sound pressure level (physical intensity or 'loudness' at a specific point)
SMD	Sediment Model Domain
SOPEP	Shipboard oil pollution emergency plan
SSC	Suspended sediment concentration
STB	South Taranaki Bight
The Act	The Exclusive Economic Zone Act
TRC	Taranaki Regional Council
TRG	Technical Review Group
TTRL	Trans-Tasman Resources Limited
μ g/l	Microgram per litre
μ m	Micron / micrometre: unit of length equivalent to one thousandth of a millimetre (0.001mm)
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
VEC	Valued ecosystem component
Wildlife Act	Wildlife Act 1953
95 th percentile	Internationally, the 95th percentile upper confidence limit (UCL) is the most commonly used method to define an upper limit for background concentrations

PART ONE - RECORD OF DECISION

Summary of Decision

Introduction

1. Trans-Tasman Resources Ltd (TTRL) has applied for marine consents and marine discharge consents for various activities associated with extraction and processing of seabed material containing iron ore. The application area is located in the South Taranaki Bight 22 to 36 kilometres off shore and encompassing approximately 66 square kilometres within the EEZ.
2. TTRL proposes the exaction of up to 50 million tonnes of seabed material per annum and process that on an Integrated Mining Vessel (IMV). Approximately 10% of the material will be processed into iron ore concentrate which is retained for later shipping. The remaining de-ored material will be returned to the seabed by way of a controlled discharge.
3. The application was heard by a Decision-Making Committee (DMC) appointed by the Environmental Protection Authority (EPA). Members of the Committee were Mr Alick Shaw (Chair), Ms Sharon McGarry (Deputy Chair), Dr Kevin Thompson (EPA Board Member) and Mr Gerry Te Kapa Coates.
4. Although some submitters had misgivings about the quality of information, we determined that it was sufficient for our purposes. In our closing Minute we noted that *“The DMC have determined they have received sufficient information to make a decision ...”*¹
5. After hearing and considering all the evidence, submissions, reports and information, members of the DMC did not agree in final deliberations. Mr Shaw and Dr Thompson voted to grant consent and Ms McGarry and Mr Te Kapa Coates voted to refuse consent.
6. The reasons of Ms McGarry and Mr Te Kapa Coates for refusing consent are set out in Part Two of the report of decision.
7. In accordance with the procedures adopted before the hearing began, the decision to grant consent subject to conditions was determined on the casting vote of Mr Shaw as Chair of the DMC².
8. This summary is not an exhaustive description of the effects of the proposed mining operation or of the conditions we have imposed. The reasons for the decision to grant consent are only summarised here and the detail can be found in Chapter 4, Chapter 5, Chapter 6, and Chapter 7 of this record of decision. Unless otherwise stated, every condition we refer to in our report of decision was proffered by TTRL.

The Act

10 Purpose

(1) *The purpose of this Act is—*

¹ Paragraph 2, Minute 46 – Minute of the Decision-making committee, 31 May 2017

² See Appendix 5 for the DMC decision-making procedures

- (a) *to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf; and*
 - (b) *in relation to the exclusive economic zone, the continental shelf, and the waters above the continental shelf beyond the outer limits of the exclusive economic zone, to protect the environment from pollution by regulating or prohibiting the discharge of harmful substances and the dumping or incineration of waste or other matter.*
 - (2) *In this Act, sustainable management means managing the use, development, and protection of natural resources in a way, or at a rate, that enables people to provide for their economic well-being while—*
 - (a) *sustaining the potential of natural resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
 - (b) *safeguarding the life-supporting capacity of the environment; and*
 - (c) *avoiding, remedying, or mitigating any adverse effects of activities on the environment.*
 - (3) *In order to achieve the purpose, decision-makers must—*
 - (a) *take into account decision-making criteria specified in relation to particular decisions; and*
 - (b) *apply the information principles to the development of regulations and the consideration of applications for marine consent.*
- 9. The consents as granted will enable the exercise of a mining licence, which is the “development and use” of the iron sands resource.
- 10. The licence is issued pursuant to the Crown Minerals Act which is administered by the Ministry for Business Innovation and Employment (MBIE).
- 11. A licence to mine these resources is not unqualified and cannot be carried out regardless of impacts and consequences. In this case the activities cannot be carried out unless consent is granted under the Act.
- 12. Section 10 requires that the environment is protected from pollution and dumping of harmful substances and waste such as the residual material that will be returned to the seabed after processing and the extraction of iron ore.
- 13. The use of the resource must be regulated and controlled in such a way that meets the Act’s purpose of sustainable management. We are obliged to identify and to manage effects on the environment to achieve that purpose.

Effects on the Environment

- 14. We have heard evidence and considered various reports and submissions on potential effects of the proposed mining operation on the environment. We have considered the scale, the intensity and the likely duration of these.

15. The impact of most effects will be felt at a localised scale. For example, the mining operation is not assessed as having any significant effects on fish at a population level. Impacts on the number of fish at particular locations within the CMA and the EEZ however will range from no effect to severe.
16. Many submitters identified effects on shellfish as being of particular concern. All the expert evidence we heard and read satisfied us that impacts on kaimoana would be negligible both in respect of specific locations and across the wider STB. We were also satisfied that there would be no effects arising from heavy metal accumulation or toxicity.
17. Potential effects on the environment arise from the discharge to the seabed of residual material. This discharge creates a plume as the suspended material settles onto the seabed. Most of the effects of the plume will be felt within the Coastal Marine Area (CMA) to the South East of the mining site itself.
18. Potential effects of the plume and the deposition of suspended sediment were assessed by the applicant using modelling of the plume itself and modelling the consequent optical impact.
19. We have imposed conditions that will limit the intensity of the plume and its effect on the environment. These conditions are in addition to operational constraints. For example, the Consent Holder will not be able to operate safely in some severe weather and the processing machinery can only handle limited volumes of fine and ultra-fine material. Conditions and operational constraints will limit the scale, intensity and duration of effects of the sediment plume.
20. The mining site itself will suffer direct impacts from the removal and processing of seabed material which will result in a catastrophic destruction of existing benthos on the seabed in the mining site itself. Recovery will take time and the species mix may be different but we accept the evidence that benthos will recolonise the area and it will recover to perform a similar ecological function.
21. Noise generated by the mining operation and the effects of that on marine mammals in particular was another important focus for the hearing. We have imposed threshold limits on the amount of noise that the operation generates and which is experienced in the marine environment. We are confident that the process of defining limits on the generation of noise by the mining machinery and certifying the relevant machinery at the design stage, commissioning stage and prior to deployment will ensure that these thresholds can and will be met.
22. Conditions requiring “soft starts” of machinery will further mitigate the impacts noise on marine mammals that are in the area.
23. The threshold limits express the interim guidelines of The National Oceanic and Atmospheric Administration of the US Department of Commerce (NOAA).
24. These are based on those used to protect marine mammals by regulators in the United States. None of the experts in acoustics on marine mammals identified stricter and relevant threshold limits that were being imposed by other regulators in similar jurisdictions.
25. Most of the effects on the environment will be temporary, albeit of considerable duration. When the extraction of material from the seabed finally comes to an end so will the generation of the plume and most of associated deposition and build up of sediment particles. We acknowledge recovery of

the project site and areas in close proximity to it will recover over varying and longer periods than the rest of the SMD. Noise from the extraction and processing of seabed material will cease and the existing ecology will be largely restored.

Existing Interests

26. We heard evidence and considered various reports and submissions of the effect of the proposed mining operation on existing interests. These included the interests of customary, commercial and recreational Fishers, customary, commercial and recreational harvesters of kaimoana/shellfish, and holders and operators of Petroleum Mining Licences which overlap and adjoin the applicant's project area. This is not an exhaustive list. Greater detail is set out in Chapter 6 of this record of decision. Issues related to the various interests and concerns of iwi are discussed separately.
27. Most of the impacts on existing interests are inextricably associated with effects on the environment. The exception to this related to the OERKL (Origin Energy Resources Kupe NZ Ltd) which holds Petroleum Mining Licences that overlie and are adjacent to the TTRL's interests. The OERKL existing interest was acknowledged by TTRL.
28. Most of the issues identified by OERKL related to marine safety and the physical threat that TTRL's operation might pose to the assets and future operations. Many of the particular concerns expressed related to the other Marine Management regimes but during the course of the hearing OERKL and TTRL agreed a set of conditions that should be imposed. We agreed to that course of action despite a belief that these represented a commercial agreement or private treaty to address matters that in the normal course were subject to other Marine Management regimes and not the EEZ Act.
29. We heard a great deal of evidence and considered many reports regarding the potential impact of the proposed mining operation on parties that fish quota and catch entitlements or fish such quota and entitlement on behalf of others. We found that the mining would have only a very minor impact on fish within the STB as a whole but industry parties expressed concern at the effects around the displacement of fish and the avoidance of the plume by target species. We found that the commercial catch reduction as a consequence will be small; there will be no effect on the abundance or health of the commercial fisheries and no significant effects on property rights or in the capital value of assets such as quota and catch entitlements.
30. Sanford, which owns substantial quota rights in the relevant Fishing Management Areas and fishes additional quota on behalf of others made a submission of conditional support for TTRL's application. Their submissions expressed support for a regime where various interests in the overall resources of the STB could cooperate and co-exist.
31. Sanford also expressed confidence that the operation posed no threat to their considerable interests in aquaculture. Sanford supported industry involvement in ongoing oversight of the operation. In a presentation to the Hearing the company expressed willingness to undertake this role if broader industry representatives were unwilling to do so.

32. The submissions of recreational fishers, divers and others interested in the specific marine environment of the STB and the affected area of the STB were extremely valuable and focussed. Reefs and important marine habitats not described in the application documents were identified, photographed and assessed. Some of the submitters made persuasive presentations on the value of particular fishing and diving spots but were unwilling to share coordinates so they could be mapped. However, they shared sufficient detail that together with other material we have been able to develop a good understanding of the likely impact of the operation on recreational fishing and diving.
33. There will be minor effects on fishing and diving within the relevant areas of the STB as a whole. Other locations including some that are valued by fishers will be subject to greater impacts. These are identified and the intensity of the impacts assessed in Chapter 5-19 of the record of decision.
34. The effects on kaimoana/shellfish are minimal. These filter feeders tolerate high turbidity. The sediment plume will dissipate before it reaches the coast and will be difficult to distinguish from background levels.

Tangata Whenua and Iwi

35. Iwi organisations affected by the proposed mining expressed universal opposition to the proposal. Concerns identified by Iwi included failure by the applicant to consult appropriately with the holders of mana whenua and that the application documentation did not include a Cultural Impact Assessment prepared by Ngāti Ruanui who hold mana whenua. We consider these matters in detail in Chapter 5-21 of our record of decision but none of these are failures in the discharge of statutory obligations.
36. Iwi also identified a failure by the applicant to fully disclose information unless a confidentiality agreement was signed and without adequate time to enable Iwi to properly canvass issues with their people. We refer to this matter in Chapter 1, paragraphs 4 to 5.
37. Submissions and evidence from affected iwi and relevant witnesses traversed concerns set out in the report prepared by the Nga Kaihautū Tikanga Māori (NKTT). The details of the relevant evidence, submissions and reports are set out in Chapter 5-17.3 of the record of decision.
38. We have taken into account the existing Settlement legislation but followed advice from counsel assisting the DMC regarding the status of applications for customary marine title under the Marine and Coastal Area (Takutai Moana) Act. We will not pre-empt the outcome of these applications by treating these as Existing Interests.
39. We were asked to take into account various international treaties and declarations. In general, those to which this country is a signatory are given effect in NZ legislation such as the Treaty of Waitangi Act and the Marine and Coastal Area (Takutai Moana) Act. We note that the potential adverse effects of the mining operation will be felt beyond the mining site located in the EEZ. Much of the impact on existing interests of Māori will fall within the Marine and Coastal Area. Many of those impacts have much in common with consideration of the biological impacts on fish, shellfish and the consequent effects on fishing for example. However, the effects on customary harvest have been

assessed with reference to the rohe of individual iwi rather than over the STB as a whole. Our findings in respect of this are to be found in Chapter 5-17.3.6 of the record of decision.

Adaptive Management

40. Section 63(2) enables the application of an adaptive management approach when setting conditions for a marine consent. Conversely section 87F(4) prohibits the application of conditions that amount to or contribute to an adaptive management approach for marine discharge consents. We invited submissions on this matter and in Chapter 1-2.3 we discuss the submissions and set out our conclusions.
41. In this case the applications for marine consents and marine discharge consents cannot be practically separated and an adaptive management approach is not available to us.

Conditions

42. The conditions we have imposed reflect in large measure those finally proffered by the applicant after substantial comment by experts who appeared before us and reviewed in expert conference by the applicant's and EPA's experts. The DMC spent considerable time and effort reviewing conditions and we are satisfied that they are clearly expressed, practical, necessary and enforceable.

Conclusion

43. Our assessment of the effects of this proposal is that, with the imposition of these conditions granting consent meets the purpose of the Act.
44. Pursuant to section 62(1)(a) and 87F(1) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, the application for marine consents and marine discharge consents by Trans-Tasman Resources Ltd to undertake restricted activities (listed in Appendix 1) is **GRANTED** and the consents are issued subject to conditions (listed in Appendix 2).
45. These marine consents and marine discharge consents expire 35 years after the date of the granting of the consents.
46. The reasons for granting the marine consents and marine discharge consents are set out below in this record of decision in accordance with section 69 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012.

Dated this 3rd day of August 2017



Alick Shaw
Chair



Dr Kevin Thompson
EPA Board Member

Chapter 1. BACKGROUND

This part of our record of decision (Chapter 1-1 to 4) provides a brief introduction to the application made by Trans-Tasman Resources Limited (TTRL). It also introduces our role as the Decision-making Committee (DMC) and sets out some of the procedural history associated with the application and the hearing.

1. The Decision-making Committee

1. The Environmental Protection Authority (EPA) is the consent authority for certain activities that are restricted within New Zealand's exclusive economic zone (EEZ) and in or on the continental shelf. One of the EPA's functions, pursuant to section 13(1) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (the Act), is to decide applications for marine consent.
2. On 30 July 2015, the EPA Board appointed us as a Decision-making Committee (DMC) to exercise powers and functions under the EEZ Act related to the application for marine consent lodged by Trans-Tasman Resources Ltd (TTRL). The EPA Board also delegated all the functions and powers of the EPA related to the processing, hearing and deciding of the application under the Act to the DMC. Members of the Committee were Mr Alick Shaw (Chair), Ms Sharon McGarry (Deputy Chair), Dr Kevin Thompson (EPA Board Member) and Mr Gerry Te Kapa Coates. This is our written record of decision pursuant to Section 69 of the Act.
3. In considering and deciding the application by TTRL for marine consents and marine discharge consents, we have exercised independent judgment within the statutory framework for determining applications under the Act.

2. Introduction

2.1 The Purpose of the Act

4. Under Section 10 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (the Act), the Act's purpose is to promote the sustainable management of natural resources in the exclusive economic zone (EEZ).

"10 Purpose

(1) The purpose of this Act is—

(a) to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf; and

(b) in relation to the exclusive economic zone, the continental shelf, and the waters above the continental shelf beyond the outer limits of the exclusive economic zone, to protect

the environment from pollution by regulating or prohibiting the discharge of harmful substances and the dumping or incineration of waste or other matter.

- (2) *In this Act, sustainable management means managing the use, development, and protection of natural resources in a way, or at a rate, that enables people to provide for their economic well-being while—*
 - (a) *sustaining the potential of natural resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
 - (b) *safeguarding the life-supporting capacity of the environment; and*
 - (c) *avoiding, remedying, or mitigating any adverse effects of activities on the environment.*
- (3) *In order to achieve the purpose, decision-makers must—*
 - (a) *take into account decision-making criteria specified in relation to particular decisions; and*
 - (b) *apply the information principles to the development of regulations and the consideration of applications for marine consent.”*

2.2 Information Principles

1. Section 61 sets out our obligations in respect of requesting and analysing information from the applicant and obtaining advice for marine consents.

“61 Information principles

- (1) *When considering an application for a Marine Consent, the Environmental Protection Authority must—*
 - (a) *make full use of its powers to request information from the applicant, obtain advice, and commission a review or a report; and*
 - (b) *base decisions on the best available information; and*
 - (c) *take into account any uncertainty or inadequacy in the information available.*
- (2) *If, in relation to making a decision under this Act, the information available is uncertain or inadequate, the EPA must favour caution and environmental protection.*
- (3) *If favouring caution and environmental protection means that an activity is likely to be refused, the EPA must first consider whether taking an adaptive management approach would allow the activity to be undertaken.*
- (4) *Subsection (3) does not limit section 63 or 64.*
- (5) *In this section, best available information means the best information that, in the particular circumstances, is available without unreasonable cost, effort, or time.”*

2. Section 87E sets out the corresponding obligations in respect of marine discharge consents.

87E Information principles relating to discharges and dumping

- (1) *When considering an application for a marine dumping consent or a marine discharge consent, the Environmental Protection Authority must—*
- (a) *make full use of its powers to request information from the applicant, obtain advice, and commission a review or a report; and*
 - (b) *base decisions on the best available information; and*
 - (c) *take into account any uncertainty or inadequacy in the information available.*
- (2) *If, in relation to making a decision on the application, the information available is uncertain or inadequate, the EPA must favour caution and environmental protection.*
- (3) *In this section, best available information means the best information that, in the particular circumstances, is available without unreasonable cost, effort, or time.*

3. The Information Principles and “best information” has been a focus for the DMC and submitters from the outset. In closing legal submissions on 25 May counsel for the Fisheries Submitters said “*It is no secret that the Fisheries Submitters have been unhappy with the way these proceedings have unfolded.*”³
4. Prior to the hearing the applicant applied to the EPA under section 158(b) (commercial confidentiality) to restrict access to some information, redacted from the application for consent, to parties who signed a confidentiality agreement with TTRL. The DMC granted TTRL’s application and issued Minute 3 on 14 September saying that the application contained “... *enough information to allow people to understand the nature of the proposed activities and their effect on the environment and existing interests.*”⁴
5. Parties, including Ngāti Ruanui, raised concerns about the confidentiality agreement and the impact that it had on their ability to discuss the proposal with their members. On 8 November 2016 the Environment Court granted an application from Kiwis Against Seabed Mining (KASM) to set aside the DMC’s decision. Judge Dwyer said that “*the crucial nature of the [plume information] in informing the conclusions in the Impact Assessment, when combined with the public’s right to participate effectively in the consent process, outweigh any trade secret or business interest of Trans-Tasman by a considerable margin*”⁵ We address this matter further in paragraph 79.
6. The redaction and then release of this material was also the subject of an application to the DMC to extend the period for submissions and the DMC granted this further extension in Minute 8.

³ Paragraph 2, Closing Legal Submissions for the Fisheries Submitters, 25 May 2017

⁴ Paragraph 7, Minute 3 – Minute and Direction of the Decision-making committee, 14 September 2016

⁵ Paragraph 67, Decision No. [2016] NZEnvC 217, *Kiwis Against Seabed Mining Incorporated v. Environmental Protection Authority and Trans-Tasman Resources Limited (Talley’s Group Limited and Te Rūnanga O Ngāti Ruanui 2274 Interested Parties)*, 8 November 2016

7. Counsel for the Fisheries Submitters summarised their further concerns as:
 - The inadequacy of information provided by TTRL.
 - Attempts to address those inadequacies during the hearing.
 - The applicant's inability to address those inadequacies.
8. Submitters and the DMC identified areas where further information was required. We note that the Act defines information as including analysis. Further reports were commissioned in respect of the sediment plume and propagation of noise in the marine environment and further expert conferencing was convened to contribute to the analysis of that information. This was to ensure we had access to the "best available information" upon which to base our decision.
9. We consider this approach reduced uncertainty and was necessary if the DMC was to discharge its obligations under Sections 61(1) and 87E(1) of the Act.
10. Section 61(2) and 87E(2) require, when making a decision under the Act, that the DMC must favour caution and environmental protection where the available information is uncertain or inadequate.
11. We accept that knowledge of the marine environment is incomplete and we note the comment of Chambers J in the Ngāti Rangī Trust case that "*Decision-making bodies in this area often have to make decisions based on incomplete data.*"⁶.
12. Section 61 does not define best available information as all information. Rather it is "*the best information that in the particular circumstances, is available without unreasonable cost, effort or time.*"⁷
13. Our approach throughout the process has been to reduce uncertainty but also to recognise that the cost of augmenting some of the knowledge of the marine environment by way of survey efforts may not meet the Act's definition of best available information.
14. For example, in respect of potential adverse impacts of marine mammals Professor Slooten told us that a minimum of 3 years' survey effort would be required to establish knowledge about the seasonal patterns of marine mammals. She also said that establishing changes in reproductive rates or feeding efficiency would require a decade of study⁸. Similarly, Mr van Helden drew our attention to deficiencies in scientific understanding of even the full range of marine mammals that might be found in the STB.
15. Although some submitters had misgivings about the quality of information, we determined that it was sufficient for our purposes. In our closing Minute we noted that "*The DMC have determined they have received sufficient information to make a decision ...*"⁹.

⁶ CA518/2007 [2009] NZCA 222, paragraph 62, *Chambers J, Ngāti Rangī Trust, Tamahaki Inc Society and Whanganui River Māori Trust Board v. Genesis Power Limited and Manawatu-Wanganui Regional Council*

⁷ Section 61(5), Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012

⁸ Transcript 21 February 2017, page 530

⁹ Paragraph 2, Minute 46 – Minute of the Decision-making committee, 31 May 2017

16. In any case we have approached this consent application with caution and that has informed establishing conservative thresholds when setting conditions.

2.2.1 Full Use of Powers

17. We are required to make full use of our powers to seek out information, base our decisions on the best available information and consider any uncertainty or inadequacy in the information available. The concept of best available information is defined by the Act. It means the best information that, in the circumstances, is available without unreasonable cost, effort, or time. The application and hearing process is therefore like an inquiry.
18. Our role therefore included reviewing the application documents and public submissions; requiring expert witnesses for relevant parties to confer and defined areas of agreement and disagreement; asking clarification questions of experts and submitters during the hearing; and requiring the applicant or other parties to provide us with additional information.
19. In some cases, the processes described in the preceding paragraph led to parties needing to consider additional information which came to light. We appreciate that this has imposed time and costs on many parties, but it is an inevitable outcome of the process which the Act has established. That said, we always considered whether the information we sought was relevant, reasonably necessary and available without unreasonable cost, effort, or time – an approach made clear in several of the Minutes we issued.
20. Concerns were raised by submitters, particularly the Fisheries Submitters, that the DMC requests for further information “*created the perception that this hearing is being conducted with one outcome in mind; granting consent to TTR.*”¹⁰
21. In addition to the information lodged with the application, the EPA and DMC requested other information from TTRL both before and during the hearing. Those requested covered:
- (a) 8 Sep 2016 (Minute 2): Request to TTRL to comment on how restricting ‘sensitive information’ might work in practice, in relation to a proposed confidentially agreement between TTRL and other parties; in relation to joint witness conferencing; and during the hearing.
- (b) 13 Oct 2016: The EPA requested further information from TTRL related to:
- Discharges of sediment including its off-site dispersion
 - Effects on plankton (primary production), fish and marine mammals.
 - Proposed environmental triggers / limits and the adaptive management approach.
 - Physical seabed and subsoil disturbance effects.
 - Bioaccumulation on benthic ecology.
 - Effects on Māori existing interests.
 - Exclusionary effects in and around the project area and effects of the activity on existing interests.

¹⁰ Memorandum of Counsel for Fisheries Submitters regarding Minute 43 dated 12 May 2017

- Economic benefits to New Zealand.
 - Measures to avoid, remedy or mitigate the adverse effects (conditions).
- (c) 22 February (Minute 29): The DMC requested additional expert conferencing to establish 'worst-case' parameters to apply to a re-run of the sediment plume model.
- (d) 10 Apr 2017 (Minute 41): The DMC requested additional information being:
- An update of the optical modelling report, based on the 'worst-case' sediment modelling which had been provided.
 - Noise modelling, not based on a simple spherical approach.
 - Once the optical remodelling had been provided, further consideration of potential impacts by experts for benthic ecology, primary production, fish, and marine mammals related to:
 - The significance of elevated SSC arising from changes in light received.
 - The significance of elevated SSC related to physical effects such as smothering of filter feeders.
 - Any issues of materiality, in terms of ecological effects, arising from the worst-case sediment plume remodelling.
 - Questions for and direction to TTRL's noise expert related to the requested noise modelling.
 - A list of data to be spatially mapped.
22. The Act's requirement for us to seek out the best available information was, at times, interpreted as us favouring or working too closely with the applicant or as rectifying inadequacies in the application. This is unfounded.
23. We are satisfied we have made full use of our powers to request and access information and consider we have met our responsibility under Sections 61(1)(a) and 87(1)(a) of the EEZ Act.

2.2.2 Best Available Information – s.61(1)

24. We are satisfied that we have been able to make our decision based on the best available information in accordance with Sections 61(1)(b) and 87E(1)(b) of the EEZ Act.
25. However, it is important to note that best available information is not necessarily 'all information'. We have relied on the parties to put the best available information before us and have sought additional advice where necessary. We have exercised our judgment about what information is the best available information for this application, having regard to issues of cost, effort and time.
26. We have had the benefit of:
- (a) The application by TTRL and the Impact Assessment (including supporting technical documents);
 - (b) The completeness and gap analysis referred to in Chapter 1-3.3;
 - (c) Additional information supplied by TTRL at the request of the DMC and EPA (refer to paragraph 26);

- (d) Advice from other agencies with responsibility for other marine management regimes (referred to in Chapter 7-24.11);
 - (e) Submissions from parties with existing interests that may be affected by the application;
 - (f) Submissions from the public and various organisations;
 - (g) Expert evidence, both written and oral, and supplemented by cross-examination and questioning by us;
 - (h) Non-expert evidence and representations in support of submissions;
 - (i) Additional information supplied by TTRL and other parties at our request during the hearing;
 - (j) Legal representations in both opening and closing the hearing on behalf of the applicant;
 - (k) Legal representations on behalf of other parties;
 - (l) Legal advice from EPA in-house counsel supported by Buddle Findlay¹¹;
 - (m) The EPA Key Issues and Conditions reports;
 - (n) Expert advice (Section 44 reviews) sought by the EPA in relation to sediment mobilisation and transport; plankton, fish and marine mammals; benthic ecology; and economics;
 - (o) The NKTT report.
27. The TTRL application was assessed as being complete for the purpose of notification (see Chapter 1-3.3). The advice to us was that a completeness check is administrative in nature and is not a matter for the DMC. It is based only on the information provided with the application, as compared to our decision on the application which is substantive in nature and draws on a much wider base of information¹².
28. As noted in the final bullet point of paragraph 261(d) above, we asked TTRL to provide mapped spatial information to all parties to the hearing. TTRL engaged a third party to do that work. The information was provided as an interactive pdf document. Layers of information in the document could be turned on or off as required, allowing us to visualise spatial relationships between different aspects of the environment and effects of the proposed mining.
29. We appreciate that spatial relationships do not tell the whole story and are no substitute for judgment informed by a closer examination of the underlying information. We also appreciate that the interactive pdf document is not a definitive resource of all possible spatial information. However, we do regard the interactive pdf document as a useful tool.
30. The files used to generate the spatial information were taken mostly from public domains, including from MBIE (NZ Petroleum and Minerals), Department of Conservation, and Ministry for Primary Industries. Other information was generated and provided by TTRL's consultants and presented in

¹¹ Referred to in our record of decision as counsel assisting the DMC

¹² Paragraph 106, Memorandum of Counsel Assisting the Decision-Making Committee – Further Response to Minute 40, 17 May 2017

technical reports accompanying the application or provided in evidence at the hearing, including from submitters.

31. Based on the above, we are satisfied that we have been able to make our decision based on the best available information in accordance with Sections 61(1)(b) and 87E(1)(b) of the EEZ Act.

2.2.3 Certainty and caution – s.61(2)

32. Sections 61(2) and 87E(2) require us firstly to consider whether the information put before us is uncertain or inadequate. If we consider that it is uncertain, then the same section requires us to favour caution and environmental protection in making our decision.
33. In evidence presented for Te Kaahui o Rauru, Ms Iorns and Mr Scott set out their legal opinion regarding the questions of caution and certainty and decision making in terms of Section 61 of the Act¹³. We have assumed this analysis would apply similarly to Section 87E, though that section is not mentioned in their statement. They identified seven key elements they considered need to be worked through in relation to any given set of facts¹⁴. In summary, those elements were:
- (1) The threshold of threat of harm – whether significant adverse effects might result.
 - (2) The level of risk and the certainty about that risk or level of harm that might result.
 - (3) Action must be taken to address the risk and to favour caution where appropriate.
 - (4) That such action must also favour environmental protection.
 - (5) The more uncertain the threat is, the more cautious we must be in our action taken.
 - (6) That adaptive management may be able to be used, but cannot be conflated with precaution.
 - (7) All harm must be minimised as much as possible rather than seeking to identify levels of tolerable insult.
34. On the key point of certainty (point (5) above), Ms Iorns and Mr Scott expanded on this in the following words¹⁵:
- (5) *the more uncertain the threat is, the more cautious we must be in our action taken:*
- (i) *at the strong end of the response spectrum, where the potential harm may be high and/or the lack of knowledge about their nature and potential to manifest is also high, a decision-maker should decline a decision; and*
 - (ii) *at the mid point of the response spectrum, again, on the basis of moderate harm and uncertainty and even high harm and moderate uncertainty, conditions could be imposed that require certain effects to be avoided (and if they cannot be avoided then the activity is not allowed);*
 - (iii) *at the low end of the response spectrum, where the potential harm is low to medium and the associated uncertainty is low but still persistent, conditions to avoid and/or mitigate (if*

¹³ Expert evidence of Catherine Iorns Magallanes and Dale Scott in support of Te Kaahui o Rauru, 24 January 2017

¹⁴ Ibid., evidence of Iorns and Scott, pages 4 - 5

¹⁵ Based on Catherine J Iorns Magallanes and Greg Severinsen, "Diving in the Deep End: Precaution and Seabed Mining in New Zealand's Exclusive Economic Zone" (2015) 13 NZJPIL

avoidance is not possible), and measures capable of overcoming lower levels of uncertainty, such as adaptive management, may be appropriate.

35. Regarding point (7) of the Iorns / Scott framework, we disagree with it being an overridingly determinative factor in our decision making. As noted by Ms Iorns and Mr Scott, the ‘harm minimisation principle’ that they espouse is a “*paradigm shift [that] represents a move away from environmental management practices based regulation following science (i.e. to accurately gauge the health of the environment), to an understanding that effective environmental decision-making, will in appropriate circumstances, require regulators to go beyond available or established scientific knowledge.*”¹⁶ They link the ‘harm minimisation principle’ strongly to the ‘precautionary principle’.
36. TTRL provided us with an extensive set of scientific reports to characterise the environment and the potential effects arising from mining. This is not ‘baseline monitoring’ but it does provide a starting point for the baseline monitoring and subsequent Pre-Commencement Monitoring Plan (PCEMP). The PCEMP must collect two years of data before mining commences. That data, and subsequent monitoring data during the operations, will inform further management plans and operational decisions – as required by the consent conditions – with the purpose of avoiding, remedying or mitigating environmental harm. Independent inputs from the Technical Review Group (TRG) and Kaitiakitanga Review Group (KRG) will contribute to the process. All of these factors contribute to our decision that although there may be uncertainty in some of the current information, caution will be built into the operations moving forward.
37. In deciding to grant consent, we consider that the consent conditions impose the appropriate degree of caution. We agree with the statement of counsel for TTRL, that “*at some point there is a need to make a judgment call based on the information to hand.*”¹⁷ In making that judgment call we have followed Sections 61(2) and 87E(2) of the Act by favouring caution and applying environmental protection to the extent we consider necessary.
38. Our view on this matter accords with case law referred to us by TTRL’s legal counsel. This was a judgment of the High Court on an Environment Court decision in Resource Management Act case. Notwithstanding that this is different legislation, we consider that the principle about making decisions ‘on the information to hand’ is applicable. The Court stated that:

“The Environment Court was bound to evaluate the application in light of the fundamental purpose of the Act, namely the promotion of “the sustainable management of natural and physical resources”: s 5. It had to do that on the basis of the evidence before it, in light of relevant policy statements, plans and proposed plans. If the Court considered it had insufficient material before it to enable a proper evaluation of certain effects, then it would have been appropriate to adjourn the hearing to enable further evidence of a defined character to come before it. Alternatively, it was bound to decide the matter on the basis of what was before it. In that regard, it must be remembered that resource management law is not “black letter” law: there will always be more

¹⁶ Ibid., evidence of Iorns and Scott, page 15

¹⁷ Paragraph 61, Closing Legal Representations on Behalf of Trans-Tasman Resources Limited, 25 May 2017

*evidence that could be called on every application or appeal. Decision-making bodies in this area often have to make decisions based on incomplete data.*¹⁸

39. We adopt this reasoning. There is always more information that could be called for but the EEZ Act does not require us make a decision on a complete and exhaustive set of data. We acknowledge that some of the knowledge about the project and the site may be incomplete. However, the information we have provides a sufficient basis on which to grant consent, while applying caution and environmental protection through conditions.
40. There is no requirement on the DMC to apply a precautionary approach. When faced with uncertainty we are required to favour caution. We have done that. The Consent Holder will not be handed a carte blanche in respect of this mining operation. They will have to conduct the operation in such a way that they avoid adverse effects, remedy adverse effects, or mitigate them. We have imposed conditions which manage the potential for effects on the environment in each of these three ways.
41. Our view in this matter draws on the advice of counsel assisting the DMC advice which was that:
- "We therefore agree with the view expressed by counsel advising the DMC considering Chatham Rock Phosphate Limited's application that "there appears to be no compelling reason to complement section 61(2) with an extraneous precautionary ideal". That is, in our view there is no requirement on the DMC to apply a precautionary approach, in addition to the requirement to favour caution under section 61(2). Nor is it clear to us what distinction there is in practice between the section 61(2) requirement and the precautionary principle or approach as it is generally understood."*¹⁹
42. Section 61(2) requires us to favour environmental protection in addition to caution, if the information we receive is uncertain or inadequate. We have done so.
43. Our record of decision acknowledges that there will be effects related to the mining. The effects will stop when the mining stops, or within a reasonable time period after that point. We acknowledge that the 35-year duration of the consent means that the effects will be long term, but they will not be permanent. Our consideration of this point also acknowledges recovery, and that recovery may not be an exact replication of the environment that existed before the commencement of mining.
44. Some of the information we received does have uncertainties. It is in that context, for the purpose of environmental protection, that we have imposed a suite of conditions to avoid, remedy or mitigate environmental effects.

¹⁸ CA518/2007 [2009] NZCA 222, paragraph 62, Chambers J, *Ngāti Rangī Trust, Tamahaki Inc Society and Whanganui River Māori Trust Board v. Genesis Power Limited and Manawatu-Wanganui Regional Council*

¹⁹ Paragraph 44, Memorandum of Counsel Assisting the Decision-Making Committee – Further Response to Minute 40, 17 May 2017

2.3 Adaptive management – s.61(3)

45. Section 61(3) of the EEZ Act states that, if favouring caution and environmental protection means that an activity is likely to be refused, the EPA must first consider whether taking an adaptive management approach would allow the activity to be undertaken. Section 64(2) defines adaptive management as:

“(2) An adaptive management approach includes—

(a) allowing an activity to commence on a small scale or for a short period so that its effects on the environment and existing interests can be monitored:

(b) any other approach that allows an activity to be undertaken so that its effects can be assessed and the activity discontinued, or continued with or without amendment, on the basis of those effects.”

46. We note that the ability to incorporate an adaptive management approach is limited by Section 87F(4). That is, adaptive management is not available as a tool in relation to marine discharge consents.

47. Section 63(2) sets out the nature of conditions that the EPA can impose on marine consents. This allows, under Section 63(2)(b), the imposition of conditions *“that together amount or contribute to an adaptive management approach”*. However, the EPA does not have the same power with respect marine discharge consents. Section 87F(4) states that:

“If the EPA grants the application, it may issue the consent subject to conditions under section 63, but not under section 63(2)(b).”

48. The application by TTRL requires consent for activities that fall under the marine consent provisions of the Act, and other activities that fall under the marine discharge provisions of the Act. With respect to potential consent conditions, a central question for the DMC has therefore been whether any condition or set of conditions amounts or contributes to an adaptive management approach.

2.3.1 Legal interpretations of adaptive management

49. This is the first notified application for a marine discharge consent since the Act was amended to include Section 87F(4), and no decision of the EPA or a court has expressed a view on its effect. We therefore had no legal precedence to rely on in considering this matter.

50. The issue of adaptive management, and its impact on the ability to set conditions, was recognised at an early stage. Paragraphs 125 and 126 of the Key Issues Report raised the Section 87F(4) issue for us to consider, the applicability of the Augier principle²⁰, and how to identify conditions that together amount or contribute to an adaptive management approach. We referred to this in Minute 17 where we invited legal counsel to address the issues in their opening submissions.

²⁰ The Augier Principle provides that if otherwise ultra vires conditions are volunteered by an applicant, and if that consent is granted with those conditions, they are enforceable.

51. Based on those submissions we concluded that:
1. section 87F(4) prohibits the application of conditions that together amount or contribute to an adaptive management approach; and
 2. the Augier principle is not appropriate to override an express statutory prohibition in this sense.
52. Counsel also generally agreed that separation of the marine consent activities from the marine discharge consent activities in respect of applying conditions would not be practical in this case.
53. However, we considered that a lack of agreement or clarity remained on how to identify conditions that together amount or contribute to an adaptive management approach. For that reason, we issued Minute 28 which invited parties to comment on the distinction – in a legal and/or practical sense – between conditions ‘that together amount or contribute to an adaptive management approach’, and conditions that do not. We clarified our request in Minute 34, noting our intention to question expert witnesses on these matters where relevant.
54. We considered the legal advice from other parties, but rely on that provided to us by counsel assisting the DMC. The conclusions reached by counsel assisting the DMC were²¹:

76. *It is difficult to be definitive about the correct legal test, to be applied by the DMC in this case and by the EPA in future applications, for determining whether possible conditions together amount or contribute to an "adaptive management approach".*
77. *While RMA case law has discussed adaptive management (including its common features) in some detail, the focus of the Courts has been on the permissible limits of adaptive management, rather than the essential elements of such an approach. In our view the decisions are therefore of limited use in interpreting the definition of "adaptive management approach" in the EEZ Act, in the 'section 87F(4)' context.*
78. *That said, in our view a relatively narrow interpretation of "adaptive management approach" is supported by the text of section 64 itself, read in light of the EEZ Act's purpose. Adopting such an approach, "adaptive management approach" would mean:*
- (a) *allowing an activity to commence on a small scale or for a short period, or in stages otherwise contemplated by subsection 64(4), with its effects monitored, and where a possible conditioned outcome is the activity being discontinued on the basis of the observed effects; or*
 - (b) *any other approach reflecting, through conditions, that an appropriate possible response to the activity's effects, following ongoing assessment, is the consented activity being discontinued altogether.*
79. *We acknowledge, however, that a range of interpretations is available, on the words of section 64.*

²¹ Memorandum of Counsel Assisting the Decision-Making Committee – Response to Minute 28, 3 March 2017

55. Crown Law provided an opinion on what kind of conditions constitute adaptive management. Crown Law stated their support for the advice provided by counsel assisting the DMC and said:
- “Under this interpretation, monitoring conditions designed to verify that conditions are met or test the validity of the assumptions made as part of the environmental assessment are not prohibited simply because monitoring may result in an adjustment of activities. However, where the effects of the activity are so uncertain and potentially significant that the conditions of consent need to provide, on the basis of observed effects, for discontinuance of the activity altogether, this will amount to an adaptive management approach for the purpose of s 87F(4) of the Act.”²²*
56. In the opening submissions of counsel for TTRL, the following statements were made:
- “The response and compliance limits are not limits on effects per se but on specific sediment loading percentiles. When percentiles are exceeded, conditions ... are activated.”²³*
- “This enables orthodox monitoring, reporting and auditing conditions to be imposed; and in effect distinguishes those sorts of conditions from an ‘adaptive management approach’.”²⁴*
57. During questioning, counsel for Royal Forest and Bird Protection Society said that monitoring to demonstrate compliance with a quantitative limit set in conditions would not of itself amount to an adaptive management approach.²⁵
58. Counsel for the Fisheries Submitters took a similar position and stated *“I do not consider that monitoring conditions serve the same purpose as adaptive management conditions. Monitoring conditions simply indicate whether an activity complies with conditions of consent imposed to protect the environment. If monitoring conditions indicate the likelihood of non-compliance, the Consent Holder is in breach of the consent and the activity should cease until compliance can be achieved.”²⁶*
59. We acknowledge that counsel for KASM/Greenpeace took a much stricter approach to the ability of conditions to allow for any change or modification in order to comply with limits.
60. Adaptive management within the context of the marine consent is not legally possible. We did not consider it.

2.4 Royalties

61. A number of submitters questioned the royalties that the Crown will receive from the iron sands project. Some believed that the Crown would be receiving an inadequate return, especially in light of the project’s assumed damage to the environment. Other submitters wondered whether all metals potentially recovered by the project would be subject to royalties.

²² Paragraph 7, Memorandum for the Crown Regarding Adaptive Management Conditions — Response to Minute 28, 10 March 2017

²³ Paragraph 233, Opening Legal Representations on Behalf of Trans-Tasman Resources Limited, 15 February 2017

²⁴ Paragraph 238, *ibid.*, TTRL opening legal representations

²⁵ Transcript 16 February 2017, page 110

²⁶ Closing submissions from Counsel for the Fisheries Submitters at para 88

62. We record that these are not matters for the DMC to consider. Royalties are matter for the Crown to determine, through the Ministry of Business Innovation and Employment (MBIE) and the Crown Minerals Act.

3. The Application

3.1 The Applicant

63. TTRL is a New Zealand limited company that was established in 2007 with the objective of developing the potential of the North Island's offshore iron sand deposits. TTRL was described by its chairman Mr Alan Eggers as a majority controlled and managed New Zealand company. The New Zealand Companies Office shows that, as at mid-March 2017, TTRL was approximately 43% owned by Minvest Securities (New Zealand) Limited. Mr Eggers described this as his mining investment entity. The ownership of the company was raised as a matter by some submitters, but this is not a matter which has influenced the decision of the DMC.
64. The applicant holds a Minerals Mining Permit (#55581) issued under sections 25 and 29A of the Crown Minerals Act 1991 for the extraction of iron sands from the STB. The permit was granted for a 20-year term commencing on 2 May 2014. The Minerals Mining Permit (mining permit) requires TTRL to efficiently mine the iron sands, but subject to the need to comply with any other relevant legislation and obtain relevant approvals.
65. The efficient mining of iron sands was described by MBIE as *"efficiently mining the resource for the long-term benefit of New Zealand and New Zealanders means allowing the operators that are in that area to get on and do what they need to do to mine the resource without unnecessary hindrances or extra conditions ... [and] ... being able to give effect to their work programme obligations, which are set out in schedule 3 of their mining permit."*²⁷. MBIE also said that efficient mining was *"... avoiding patchwork type approaches that end up with splitting up a known resource distribution into smaller parcels."*²⁸
66. We note that the existence of a mining permit does not act to predetermine the grant of consent under the EEZ Act. This is an inherent and useful tension between the two Acts (Crown Minerals and EEZ). One allocates rights to efficiently extract mineral resources without needing to consider any environmental questions. The other sustainably²⁹ manages natural resources without needing to consider the fundamental question of whether a mineral should be extracted.

²⁷ Transcript 2 March 2017, page 1025

²⁸ Transcript 2 March 2017, page 1035

²⁹ Section 10(2)(a) of the Act excludes minerals from the requirement to be sustainably managed "to meet the reasonably foreseeable needs of future generations"

3.2 The Application

67. The application is for the undersea mining of iron sands, in waters 20 m to 42 m deep within the South Taranaki Bight (STB), located between 22 km (12 nautical miles) and 36 km off the coast of Patea. It abuts the 22 km boundary between the coastal marine area (CMA) under the Resource Management Act, and the Exclusive Economic Zone under the EEZ Act.
68. The project area in which the mining will take place is defined by the mining permit, and encompasses an area of approximately 65.76 km² within the STB. The associated effects of the mining, principally a sediment plume, will cover a far larger area.
69. The offshore iron sands in the STB are a black iron ore that originated from rocks and ash deposits mainly derived from Mount Taranaki. Iron sand is a general term for sand-sized grains of iron-rich minerals, principally magnetite, titanomagnetite and ilmenite. The offshore iron sands in the STB are the largest such known resource in New Zealand, and cover a much larger area than the area subject to this mining permit and this marine consent application.
70. The application covers all project related operations including; extraction, re-deposition, anchor handling, grade control drilling, and the sediment plume which is a consequence of the works.
71. Some of the activities associated with the project either require approvals solely from other regulatory bodies, or require those approvals in addition to the marine consent. As examples, various approvals will be required from Maritime New Zealand and WorkSafe. The need for any other approval is not relevant to and has not influenced our decision under the EEZ Act. This matter is outlined in more detail by Chapter 2-6.3 below.
72. TTRL lodged its application for marine consent with the EPA on 23 August 2016. In support of its application, TTRL lodged an Impact Assessment, Appendices, and a series of reports commissioned from third parties. The 42 reports are listed in Appendix 3 on page 334. In our record of decision, we sometimes adopt the shorthand of referring to a TTRL report by its number as assigned in Appendix 3.
73. A timeline of the procedural history of the application, hearing, and decision making is set out by Appendix 4 at page 336.

3.3 EPA Completeness Check

74. Section 38 of the Act set out what is required in an application for marine consent. Among other things, the applicant must provide an impact assessment. Section 39 specifies what must be contained in the impact assessment, and states that the information must be in *“such detail as corresponds to the scale and significance of the effects that the activity may have on the environment and existing interests”*.³⁰
75. On receipt of an application for marine consent, the EPA must consider whether it complies with Section 39 of the Act, and may return it to the applicant if the application is deemed to be incomplete. The check was completed in September 2016. As part of the process, the EPA commissioned several external consultants to review technical material related to the environmental effects of the activity. Those consultants raised some issues about aspects of the information. However, the EPA’s memorandum on completeness noted that *“although some gaps in the information may remain, we consider that the information provided regarding the effects of the activity on the environment and existing interests does meet the requirements of making a reasonable effort to identify the effects of the activity”*.³¹
76. The EPA’s memorandum noted several areas where it might be appropriate for the DMC to request further information. The DMC did subsequently issue requests for further information, as set out below in Chapter 1-4.2.

3.4 Submissions

77. TTRL’s application for marine consents and marine discharge consents was publicly notified on 17 September 2016, and hard copies of the application were made available in New Plymouth, Hawera, Patea, Whanganui, and Wellington.
78. The submission period was originally scheduled to close on 14 October 2016. However, at the request of Te Rūnanga o Ngāti Ruanui (supported by other parties), it was extended by the DMC to close on 14 November 2016. The extension was granted because Ngāti Ruanui and other submitters were experiencing difficulty in preparing submissions within the required timeframe. The reasons for the extension are set out in DMC Minute 7.
79. The closing date for submissions was further extended to 12 December 2016, at the request of KASM, Ngāti Ruanui and Talley’s Group Limited, and supported by the Fisheries Submitters. The extension was granted so that all parties could consider information made publicly available on 9 November 2016, as the outcome of an Environment Court decision. The information had previously only been available to parties who entered into a confidentiality agreement with TTRL. The reasons for the extension are set out in DMC Minute 8.

³⁰ Section 39(3)(a) EEZ Act

³¹ Paragraph 61, Memorandum, 6 September 2016, Trans-Tasman Resources Limited’s application for marine consents and marine discharge consents – Assessment against sections 38, 39, and 87B of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012

80. At the close of submissions, the EPA had received 13,733 submissions. A summary and analysis of submissions was prepared for the EPA and completed on 23 February 2017, after the start of the hearing.
81. Of the 13,733 submissions received, 13,477 requested that the application be declined. The positions of the remaining 256 submissions were:
- 115 requested that consent be granted;
 - 32 requested that consent be granted with conditions; and
 - 109 adopted a neutral position.
82. There were 39 withdrawn submissions.

4. The Hearing and Decision Making Process

83. The hearing commenced on 16 February 2017. The Act directs that the hearing should be completed within 40 working days of it commencing, which would have required us to close the hearing by 12 April 2017. However, given the complexity of the evidence and difficulties in scheduling, we extended it to 31 May 2017.
84. As we noted in Minute 38:
- “In accordance with section 160 of the Act, the DMC have taken into account the interests of the parties to the hearing, including the additional time and cost implications discussed further in Minute 37 setting out the timetable for steps required until the close of the hearing. However, the DMC is conscious of its obligation under sections 61 and 87E of the Act to base its decision on the best available information and considers that the extension serves the interests of the community in ensuring that the DMC is able to achieve an adequate assessment of the application.”*
85. We heard evidence and submissions over 22 hearing days between 16 February 2017 and 25 May 2017. The hearing was held in Wellington and New Plymouth. The DMC also undertook a two-day site visit on 10/11 May which traversed a large part of the STB coastline between Hawera and Whanganui. We did not visit the project area, which is over 20 km offshore, although its general location was visible to us from some elevated areas – being marked by the Kupe platform which we could see on the horizon.
86. We heard closing legal submissions on 24-25 May 2017. Following those submissions, the DMC met to determine whether we had sufficient information to make our determination. Having satisfied ourselves that we had the best available information, we formally closed the hearing on 31 May 2017.
87. We appreciate the time and effort taken by parties who participated in this process. We appreciate the expert evidence on the potential effects of the proposed iron sands mining, and the ability to question the experts on their assessments. The opportunity to question government agencies (to

which section 44 requests were made) was valuable in determining the “*nature and effect*” of other marine management regimes in terms of section 59(2)(h) of the EEZ Act.

88. We understand that the consenting process, especially the public hearing, has been time consuming and sometimes costly or challenging for submitters. Their participation was valuable and their observations and evidence was useful.
89. The Act directs that the DMC must issue its decision within 20 working days of the close of the hearing. This timeframe was extended twice in accordance with Section 159 of the Act.

4.1 Consideration of Evidence

90. In some parts of our record of decision we make the distinction between “evidence” from expert witnesses, and presentations from other submitters³². This is not because we automatically place any lesser value on the observations or experience of non-expert submitters. One of the things that distinguishes expert from non-expert opinion is that expert evidence is informed by recognised scientific or technical expertise and experience. The opinions of such experts are required if we are going to have an informed evaluation of the effects of an operation such as seabed mining and the intensity of consequent impacts on the environment.
91. The Code of Conduct requires an expert witness to confirm to the DMC that the topics and opinions addressed in their statement are within their area of expertise, except where they state that they have relied on the evidence of other persons. An expert witness must also confirm that they have not omitted to consider materials or facts known to them that might alter or detract from the opinions they have expressed.
92. TTRL said that persons who were employees of organisations who were parties to the consideration of this application could not demonstrate the level of independence required of people who appear as expert witnesses.
93. We addressed this in our Minute 20, issued 3 February 2017. In that, we took the view that witnesses who are employees of a party to the proceedings may face difficulty in establishing their independence and therefore their ability to participate in expert conferencing. This was not intended as any kind of slight to the expertise or integrity of those witnesses.
94. Our approach on this matter was queried by the Royal Forest and Bird Society, and the Fisheries Submitters, and both parties sought to have experts who were employees of those parties included in conferencing. We considered those submissions and in Minute 24 issued on 24 February, we set aside our earlier decision. We said that our focus had been on the “independence” of witnesses rather than the value of the evidence they might give and the contribution they could make to ensuring the ‘best information’ was available to the DMC.

³² In the context of our decision, a non-expert submitter is not professionally trained or qualified in a discipline relevant to the subject matter. They may however have practical, observational, or cultural experience and opinions of value.

95. A case in point was Dr Helson, on behalf of the Fisheries Submitters, whose status as an independent expert witness had been questioned by TTRL. Dr Helson has relevant academic qualifications and a long career in fisheries research and management. However, he is also the chief executive of Fisheries Inshore New Zealand (FINZ).
96. There was a conflict between Dr Helson's role as chief executive of FINZ and his appearance as an expert witness. It was his independence and not his expertise that was questioned by TTRL. However, we considered that he had an important contribution to make despite his direct accountability to the organisation on whose behalf he appeared. Any concerns that we had about the conflict in roles as a fisheries expert and as CEO of FINZ are matters that could have been addressed in our weighting of the evidence.
97. There was a similar conflict between Mr van Helden's role as "Marine Conservation Advocate" for Forest and Bird and his role as an expert witness in respect of marine mammals. He again was appropriately qualified and it was his independence and not his expertise that was questioned by TTRL. Mr van Helden's input made a significant contribution to our consideration of effects on marine mammals.

4.2 Requests for Information

98. The EPA sought further information from TTRL on 13 October 2016. The matters covered discharge of sediment (including its offsite dispersion); effects on plankton (primary production), fish and mammals; proposed environmental triggers /limits and the adaptive management approach; physical seabed and subsoil disturbance effects; bioaccumulation on benthic ecology; effects on existing Māori interests; exclusionary effects in and around the project area; economic benefits to New Zealand; conditions; hydraulic fluid; and discharges from the hyperbaric filter.
99. During the hearing, the DMC directed further expert conferencing on evidence related to the sediment plume model. As noted in DMC Minute 29, the intention was to consider how worst-case parameters would affect the outputs of the sediment plume model. The experts determine the parameters for consideration as part of expert conferencing.
100. Once the presentation of evidence and representations of other parties had concluded (but prior to closing legal submissions), the DMC was able to identify various questions which needed to be put to the applicant. These were areas concerning matters which had been raised by the applicant or submitters during the hearing, but where further elaboration seemed necessary.
101. In Minute 41 the DMC posed a series of questions to TTRL. The questions to TTRL and the company's responses were made available to other parties for further comment and questioning where necessary.
102. In all cases of seeking further information from parties, the DMC has been mindful of both its obligations under the Act, and the costs (in terms of both time and money) which this might impose.

103. The Fisheries Submitters advised their opposition to further conferencing on the basis that the DMC’s approach was imposing unnecessary costs. We responded in Minute 42, saying:

“These are complex proceedings and it is not unusual in such proceedings for issues to gain a level of materiality needing to be further explored that was not envisaged at the time briefs of evidence are exchanged. ...

There is clearly a point when cost, effort or time to obtain best available information becomes unreasonable. That is a matter to which the DMC must, and does, turn its mind every time it seeks more information, including considering the consequential impact on submitters responding to evidence during the hearing process. ... The costs to other parties arise not from the requests directly but from the consequential process of ensuring all parties have the opportunity to respond to the information – as required to ensure a fair and appropriate process.”

104. Our approach to obtaining the best available information was signalled to all parties from the beginning of the process. Consequently, we allowed all parties significant latitude in the information provided to us during the hearing, whether requested or not. This was on the clearly expressed proviso that there would be the opportunity for that information to be considered and responded to by all parties. A case in point was the evidence of Dr Torres. Her written evidence was dated 23 January and addressed the results of field research on blue whales up to January 2016. In contrast, her oral presentation during the hearing included references to very recent survey work.

4.3 Section 44 advice

105. The EPA commissioned the following reports for us under Section 44 of the EEZ Act:

Table 1: EPA Commissioned Reports for the DMC

From	About	Received
GHD	Sediment mobilisation and transport	6 September 2016
DHI	Effects on plankton, fish and marine mammals	6 September 2016
AECOM	Effects on benthic ecology	6 September 2016
GHD	Economics	5 September 2016
MWH	Key Issues Report	30 September 2016

106. Initial versions these reports were all received in 2015, before the application was formally lodged In August 2016. The reports responded to a pre-application draft provided to the EPA by TTRL. The draft Section 44 reports were then provided to TTRL, allowing it to consider and amend any relevant aspects of its application documents prior to formal lodgement. EPA’s intention in doing so was to help ensure that adequate information was included in the application. After formal lodgement, the EPA experts updated their pre-lodgement reports to take account of any changes in TTRL’s formally lodged documents. The dates given in Table 1 above are for the final reports of the experts.
107. We also requested the following advice under section 44 of the Act:

Table 2: Advice Requested by DMC under Section 44

From	About	Received
Ngā Kaihautū Tikanga Taiao	A Māori perspective on the application	20 February 2017
EPA	Proposed consent conditions	21 February 2017
Taranaki Regional Council	Requesting a copy of the Cawthron Report "Sensitive habitats and threatened species in the Taranaki coastal marine area - database investigation", and for a schedule of permits for any dredging within the council's Coastal Marine Area.	30 January 2017
Department of Conservation (DOC)	The relationship of the Department to the Conservation Boards, as well environmental information.	8 February
Department of Conservation (DOC)	DOC's assessment of the TTRL application.	15 February 2017
Department of Conservation (DOC)	Marine mammal sightings and strandings.	20 March 2017
Horizons Regional Council	Coastal permits for any dredging within the council's Coastal Marine Area.	16 February 2017
Ministry of Business, Innovation and Employment (MBIE)	MBIE's position with respect to the effects arising from the overlap in permit areas held by TTRL and Origin Energy Resources Kupe NZ Ltd.	16 February 2017
Dr Robertson	Fisheries advice and information.	21 and 28 February 2017
Ministry for Primary Industries (MPI)	The impacts on quota owners in Fisheries Management Area 8 (FMA 8).	22 February 2017
WorkSafe New Zealand	WorkSafe New Zealand's responsibilities for managing health and safety matters.	23 February 2017, and 2 May 2017
Maritime New Zealand (MNZ)	MNZ's responsibilities in managing navigational safety and processes or procedures that will be used by MNZ to co-ordinate respective statutory duties with WorkSafe NZ.	13 February 2017, and 1 May 2017
Dr Cresswell	The environmental effects of heavy metals in the extraction and processing of iron sand during operations and the resultant sediment plume.	1 March 2017

108. All the advice provided in response to requests under Section 44 of the Act was made available on the EPA website.

4.4 Key Issues Report

109. The report identifies the "key" issues associated with the project, which the DMC has had regard to as part of its decision making process. The report outlines six main issues:
- The discharges of sediment including its off-site dispersion and the various direct and indirect effects of this sediment;

- The proposed environmental triggers/limits and the adaptive management approach;
- The physical seabed and subsoil disturbance arising from extraction and from structures (anchor placement and removal);
- Effects on Māori existing interests;
- The exclusionary effects in and around the project area; and
- The economic benefits to New Zealand.

110. There are of course other issues associated with the project. Their absence from the Key Issues Report does not mean that we have ignored them. The Report does not provide an assessment of effects, or a conclusion about whether the application should be granted or refused. Its main purpose has been to provide us with a 'roadmap' of major issues and guidance on where to find relevant information on these issues within the application documents. The Report has simply been one of our starting points for consideration, and we have reached our own conclusions on all matters.

4.5 Previous Application

111. In 2014, TTRL was refused consent in relation to an iron sands mining project on the same site. That project had many similarities, but it is not exactly the same as the current application. There was criticism from some submitters that deficiencies in information perceived by submitters, or specifically identified by the DMC in 2014, had not been adequately addressed in the current case.
112. TTRL had its own views about this issue raised by submitters. The closing legal submissions of TTRL said that *"What TTR has done is engage NIWA and a range of other highly experienced experts to undertake relevant scientific studies and reviews. Contrary to the suggestion of opponents this has been a substantial exercise designed to meet issues identified by the first hearing."*³³
113. Given that we have reached a different decision to the DMC on the first application, it is worth setting out the legal advice we received from counsel assisting the DMC in relation to the matter of precedence in general and previous marine consent decisions in particular. That advice was³⁴:

103. *It is important to be mindful that while precedent and case law that has developed under the RMA may be relevant, it cannot automatically be applied in the EEZ context. On the other hand, the principle that "consistency of treatment, in the absence of a reason justifying inconsistency, is generally regarded as an important aspect of good public administration" is equally applicable in relation to decisions made under the Act.*

104. *As a general comment, then, we consider that while the DMC is not bound by previous decisions on legal matters, the DMC should not lightly adopt an inconsistent approach to matters of statutory interpretation to previous DMCs, in order to provide applicants and submitters with a degree of certainty in the sense that like cases should be treated alike except where a change to the law requires a different approach. In relation to matters of*

³³ Paragraph 182, Closing Legal Representations on Behalf of Trans-Tasman Resources Limited, 25 May 2017

³⁴ Memorandum of Counsel Assisting the Decision-Making Committee – Further Response to Minute 40, 17 May 2017

fact, however, it will be for each DMC to form a view as to the appropriate weight to give depending on the evidence before it.

...

107. *On the question as to whether previous decisions on marine consent applications (including any conditions imposed) would have precedent value for the current DMC, we consider it would be open for the DMC to consider such decisions as another relevant matter under section 59(2)(m) provided the previous decisions (including conditions) are put in evidence before it. However, the question as to what degree the findings of the previous DMC are relevant to the decision on the current application will turn on the particular facts. For completeness, as noted above, we do not consider the approach taken in previous decisions to matters of fact or law to be legally binding on the current DMC.*

114. Based on this advice we took care around matters of statutory interpretation. On the matter of the previous decision to refuse consent, we started from a position that the earlier decision to refuse was not legally binding on our own decision.
115. Counsel for the Fisheries submitters agreed with the advice provided by counsel assisting the DMC, that *“the question as to what degree the findings of the previous DMC are relevant to the decision on the current application will turn on the particular facts.”*³⁵ However, counsel did not agree that *“an earlier decision’s precedent value is limited to the extent that a previous decision is in evidence before the DMC.”*³⁶
116. This was a new application being considered by a new DMC. We considered only the evidence and information put before us. We did not evaluate the quality of the evidence put before the other DMC in respect of the earlier application, nor did we critique the decision of that earlier DMC. The two applications are different and we were obliged to deal with the current application as a de novo hearing. We have granted consent based on the evidence put in front of us.

³⁵ Paragraph 76, Closing Legal Submissions for the Fisheries Submitters, 25 May 2017

³⁶ Paragraph 75, *ibid.*, Fisheries closing submissions

Chapter 2. EEZ ACT AND REGULATIONS

This part of our record of decision (Chapter 2-5 to 6) describes the Exclusive Economic Zone Act under which the decision has been made. The Act set out some very specific duties which are outlined below, and are also referred to in other parts of the record of decision. This part of our decision also defines the activities for which consent is required under the Act.

We note that the Act was amended on 1 June 2017 by the Resource Legislation Amendment Act 2017. However, as provided for in clause 1 of Schedule 1 to the Act as amended, this application has been decided under the Act as if it had not been amended.

5. Duties of the EPA and DMC

5.1 Purpose of the Act

117. The DMC is required to give effect to the EEZ Act (the Act). We need to consider whether the application meets the purpose of the Act and the framework for assessing that is set out in Sections 59 and 87D of the Act.
118. New Zealand's Exclusive Economic Zone (EEZ) is the area from 12 to 200 nautical miles (nm) offshore³⁷. Specific types of activity in that area are subject to the EEZ Act and EEZ Regulations³⁸. The Act and Regulations apply to activities (other than fishing) that may have an effect on the management of natural resources, or which may contribute to pollution of the environment. The Act recognises and implements NZ's obligations under various international conventions.
119. This Act and Regulations do not stand alone. There are other marine management regimes including the Fisheries Act, the Marine Mammals Protection Act, the Resource Management Act (which operates between the 12 nautical mile line and the shore), and the Maritime Transport Act. A list of the most relevant applicable legislation is included as Table 4 on page 28. We are obliged when setting conditions to consider whether our decisions may conflict with decisions of other regulators.

5.2 Process

120. The Environmental Protection Authority (EPA) has the responsibility for making decisions on applications for marine consents under the EEZ Act. The EPA will generally appoint a Decision-making Committee (DMC), and the DMC operates under a delegation from the Board of the EPA³⁹.
121. The EPA can request further information before a hearing, or commission various reports on an application. When the EPA is satisfied that the application is complete, it must publicly notify the

³⁷ 22.2 kilometres to 370.4 kilometres

³⁸ Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013; and Exclusive Economic Zone and Continental Shelf (Environmental Effects—Discharge and Dumping) Regulations 2015

³⁹ See Section 16(a) of the EEZ Act

application and call for submissions. The DMC can commission advice prior to and during the hearing.

122. When a hearing is held, the DMC must conduct it in public and without unnecessary formality. We acknowledge that hearings such as this would have felt unfamiliar and potentially daunting to many of the parties who appeared at the hearing. We are grateful to them all for their respectful conduct during the hearing and the contributions that they made to our understanding of the potential impacts of the project.

5.3 Decision Making

123. Sections 59 and 87D set out matters which the DMC must take into account. Underlying our consideration of those matters, Sections 61 and 87E set out the need for the DMC to base its decisions on the best available information. Where information is inadequate or uncertain, the DMC must favour caution and environmental protection. The matters covered by sections 59 to 61 and 87D to 87F of the Act are the basis of our analysis as detailed in Chapter 7-24 of our record of decision.
124. Sections 59(2) and 87D(2) of the Act set out matters we “must take into account”, and section 59(3) states we “must have regard to” any submissions or evidence given to us, any advice or reports we have sought, and any advice from NKTT. We have had regard to these obligations in reaching our decision.
125. The Act establishes no hierarchy in the matters that must be taken into account and those that we must have regard to under section 59 of the Act. We were advised by counsel assisting the DMC that there is no hierarchy in respect of these obligations. The importance of all of the matters listed in all of the subsections depends on the specifics of the proposed project.

6. Activities Subject to EEZ Act Authorisation

6.1 Integration or Splitting of Consents

126. The DMC agreed that separating the marine consents and marine discharge consents aspects was not practicable. The two consents are so interrelated that they must be regarded as an integrated whole. Our position does not ignore the fact that there will be a marine discharge, or that some aspects of the operation clearly fall under the marine consent provisions of the Act. It is simply that the two are inextricably linked.

6.2 Marine Consent and Marine Discharge Consent

127. Details of the activities requiring authorisation under section 20 of the EEZ Act are set out in Table 3 below.

Table 3: Marine Consent and Marine Discharge Consent Requirements

Consent Category	Proposed Activities
Section 20(2)(a) – <i>the construction, placement, alteration, extension, removal, or demolition of a structure on or under the seabed.</i>	<p>The placement, movement and removal of the Integrated Mining Vessel (“IMV”) anchor and the geotechnical support vessel anchor, including the anchor spread, on or under the seabed.</p> <p>The placement, movement and removal of the crawler on or under the seabed.</p> <p>The placement, movement and removal of the grade control drilling equipment on or under the seabed.</p> <p>The placement, movement and retrieval of moored environmental monitoring equipment on or under the seabed.</p>
Section 20(2)(d) – <i>the removal of non-living natural material from the seabed or subsoil.</i>	<p>The removal of sediment from the seabed and subsoil using the crawler and by grade control drilling.</p> <p>The taking of sediment and benthic grab samples from the seabed and subsoil associated with environmental monitoring.</p>
Section 20(2)(e) – <i>the disturbance of the seabed or subsoil in a manner that is likely to have an adverse effect on the seabed or subsoil.</i>	<p>The disturbance of the seabed and subsoil associated with the placement, movement and removal of the IMV anchor and the geotechnical support vessel anchor, including the anchor spread.</p> <p>The disturbance of the seabed and subsoil associated with seabed material extraction via the crawler, through re-deposition of de-ored sediments, and from grade control drilling.</p> <p>The disturbance of the seabed and subsoil associated with the placement, deployment, retrieval and mooring of environmental monitoring equipment.</p> <p>The disturbance of the seabed and subsoil associated with the taking of sediment and benthic samples associated with environmental monitoring.</p>
Section 20(2)(f) – <i>the deposit of any thing or organism in, on, or under the seabed.</i>	<p>The re-deposition of de-ored sediments in, on or under the seabed.</p> <p>The deposition of small amounts of marine organisms and solids in, on or under the seabed arising from vessel maintenance, hull cleaning (biofouling).</p>
Section 20(2)(g) – <i>the destruction, damage, or disturbance of the seabed or subsoil in a manner that is likely to have an adverse effect on marine species or their habitat.</i>	<p>The disturbance and damage of the seabed and subsoil arising from the placement, movement and removal of the IMV anchor, and the geotechnical support vessel anchor on the seabed.</p>

Consent Category	Proposed Activities
	<p>The disturbance and damage of the seabed and subsoil arising from seabed material extraction via the crawler, the redeposition of de-ored sediments, and the grade control drilling.</p> <p>The disturbance and damage of the seabed and subsoil arising from the placement, deployment, retrieval and mooring of environmental monitoring equipment.</p> <p>The disturbance and damage of the seabed and subsoil arising from the taking of sediment and benthic samples associated with environmental monitoring.</p>
<p>Section 20(4)(a) – <i>the construction, mooring or anchoring long-term, placement, alteration, extension, removal, or demolition of a structure or part of a structure.</i></p>	<p>The anchoring of the IMV and the geotechnical support vessel, and the associated placement, movement and removal of the IMV anchor and the geotechnical support vessel anchor in the water column above the seabed.</p> <p>The placement, movement and removal of the crawler in the water column above the seabed.</p> <p>The placement, movement and removal of the grade control drilling equipment in the water column above the seabed.</p> <p>The placement, deployment, retrieval and mooring of environmental monitoring equipment in the water column above the seabed.</p>
<p>Section 20(4)(b) – <i>the causing of vibrations (other than vibrations caused by the normal operation of a ship) in a manner that is likely to have an adverse effect on marine life.</i></p>	<p>Vibration (noise) caused by the IMV and crawler during iron sand extraction activities.</p>
<p>Section 20B – <i>No person may discharge a harmful substance from a structure or from a submarine pipeline into the sea or into or onto the seabed of the exclusive economic zone.</i></p>	<p>The release of seabed material (sediments) arising from the seabed disturbance during grade control drilling activities;</p> <p>The release of disturbed seabed material (sediments) arising from the seabed disturbance during the crawler extraction operations; and</p> <p>The release of disturbed seabed material (sediments) arising from taking of sediment and benthic samples associated with environmental monitoring.</p>
<p>Section 20C – <i>No person may discharge a harmful substance (if the discharge is a mining discharge) from a ship into the sea or into or onto the seabed of the exclusive economic zone or above the continental shelf beyond the outer limits of the exclusive economic zone</i></p>	<p>De-ored sediments and any associated contaminants discharged back to the water column from the IMV.</p>

6.3 Other Activities Associated with the Application

128. There are several activities associated with the application that are not covered by way of a marine consent or marine discharge consent under the EEZ Act, but the effects of which need to be considered as part of the overall assessment of the effects of the restricted activities under section 59(2) of the Act. These ancillary activities include:
- (a) Discharges to air from processing and/or operation of the vessels;
 - (b) Discharge of ballast water;
 - (c) Navigational safety; and
 - (d) Operational safety.
129. Some of the above matters are regulated under other marine management regimes, which are matters we must take into account in accordance with section 59(2)(h) of the EEZ Act. The government agencies operating marine management regimes that are relevant to this application for marine consent are presented in Table 4 below. Some of these regimes were covered by the evidence of Dr Patrick on behalf of TTRL.

Table 4: Relevant Marine Management Regimes

Agency	Legislation	Agency Responsibilities
Ministry of Business, Innovation and Employment	Crown Minerals Act 1991	The New Zealand Petroleum and Minerals branch of MBIE is responsible for managing the prospecting, exploration and mining permit regime.
Department of Conservation	Conservation Act 1987 Wildlife Act 1953 Marine Mammals Protection Act 1978	The Department of Conservation is responsible for protected species and marine mammals. The Department of Conservation also has responsibility for non-mammal species, including seabirds.

Agency	Legislation	Agency Responsibilities
Maritime New Zealand	Maritime Transport Act 1994 International Regulations for Preventing Collisions at Sea 1972	<p>Maritime New Zealand is responsible for ensuring operators have approved plans in place to manage wastes from their activities, as well as Emergency Response Plans if that work causes a leak or spill into the sea. Maritime New Zealand assists the Minister of Transport in setting marine protection rules for managing discharges and oil spills and maritime rules preventing the collision of vessels at sea.</p> <p>Maritime New Zealand requires operators to have an international oil pollution prevention certificate (IOPPC) and a shipboard oil pollution emergency plan (SOPEP), as well as holding certificates of insurance.</p> <p>The Maritime Transport Act gives effect to New Zealand's international obligations, including MARPOL⁴⁰ and OPRC⁴¹.</p>
Ministry for Primary Industries	Biosecurity Act 1993 Fisheries Act 1996	<p>The Ministry for Primary Industries is responsible for managing New Zealand's fisheries within the EEZ and its territorial waters, which includes commercial, recreational and Māori customary fisheries.</p> <p>The Ministry for Primary Industries is also responsible for biosecurity at New Zealand's boundaries and within the EEZ. It administers biofouling and ballast water guidelines for vessels entering New Zealand waters.</p>
WorkSafe New Zealand	Health and Safety at Work Act 2015	WorkSafe New Zealand is responsible for performing functions relating to safety in the workplace.
Environmental Protection Authority	Hazardous Substances and New Organisms Act 1996	The HSNO Act controls the use of chemicals and flammable materials ⁴² . This excludes those used in the motive power of a ship, which are subject to regulation by Maritime NZ.
Regional councils, Ministry for the Environment, Minister of Conservation	Resource Management Act 1991	The Ministry for the Environment provides an overview for documents developed under the Act, including most national policy statements. The Minister of Conservation is responsible for developing the New Zealand Coastal Policy Statement (NZCPS). Regional councils develop regional policy statements (RPS) and regional coastal plans, both of which have relevance to the control of activities within the coastal marine area (CMA), out to the 12 nautical mile limit.

⁴⁰ International Convention for the Prevention of Pollution from Ships 1973/78

⁴¹ International Convention on Oil Pollution Preparedness, Response and Cooperation 1990

⁴² The DMC notes that from 1 December 2017 the relevant controls applying in workplaces will be set under the Health and Safety at Work (Hazardous Substances) Regulations 2017

6.4 Existing Interests

130. Sections 59 and 60 of the Act require the DMC to take into account to the effects of an activity on existing interests, including cumulative effects. Section 4 of the Act defines an existing interest to be: the interest a person has in—
- (a) *any lawfully established existing activity, whether or not authorised by or under any Act or regulations, including rights of access, navigation, and fishing:*
 - (b) *any activity that may be undertaken under the authority of an existing marine consent granted under section 62:*
 - (c) *any activity that may be undertaken under the authority of an existing resource consent granted under the Resource Management Act 1991:*
 - (d) *the settlement of a historical claim under the Treaty of Waitangi Act 1975:*
 - (e) *the settlement of a contemporary claim under the Treaty of Waitangi as provided for in an Act, including the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992:*
 - (f) *a protected customary right or customary marine title recognised under the Marine and Coastal Area (Takutai Moana) Act 2011*
131. We address existing interests in Chapter 5-17, and Chapter 6-22 and 23 of our record of decision.

6.5 Effects of the Activities

132. The following parts of our record of decision summarise our understanding of the key potential effects of the project on the environment and existing interests. The effects are addressed under the following parts of our decision:
- The Project and its Context (Chapter 3 page 33)
 - Environmental Impacts (Chapter 4 page 52)
 - Social and Cultural Impacts (Chapter 5 page 137)
 - Existing Interests (Chapter 6 page 180)
133. In Chapter 7-24 we record our analysis of the effects of the proposal, as required of us by sections 59 to 61 and 87D to 87F of the Act. We have summarised and integrated our findings on individual matters addressed in the preceding parts of our record of decision. We have identified links between different types of effects, and considered matters such as cumulative impacts.
134. Throughout our record of decision, we have applied the definition of “*effect*” in section 6 of the Act. Among other things, this includes any potential cumulative effects and potential effects of low probability but high potential impact.

135. Table 2.2 of TTRL's Report 17 categorises ecological consequence levels in relation to intensity of activity⁴³. We have reproduced that table in full as Table 5. Dr MacDiarmid, TTRL's ecology expert, noted that very similar tables have been used by the Ministry for the Environment, and that almost identical tables are used in Australia⁴⁴. We have used the scale established by the table where relevant when considering the ecological consequences of impacts on habitats.

⁴³ TTRL Report 17: *Assessment of the Scale of Marine Ecological Effects of Seabed Mining in the South Taranaki Bight: Zooplankton, Fish, Kai Moana, Sea Birds, and Marine Mammals*, NIWA, 2015

⁴⁴ Transcript 21 February 2017, page 450/451

Table 5: Consequence Levels for the Intensity of the Activity

Consequence Level	Proportion of Habitat Affected	Population / Community / Habitat Impact	Recovery Period
1 – Negligible	Affecting <1% of area of original habitat area	Interactions may be occurring but unlikely to be ecologically significant (<1% changes in abundance, biomass, or composition) or be detectable at the scale of the population, habitat or community	No recovery time required
2 – Minor	Measurable but localized; affects 1-5% of total habitat area	Possibly detectable with 1-5% change in population size or community composition and no detectable impact on dynamics of specific populations	Rapid recovery would occur if activity stopped – less than 8 weeks
3 – Moderate	Impacts more common; >5-20% of habitat area is affected	Measurable with >5-20% changes to the population, habitat or community components without there being a major change in function	Recovery in >2 months to 1-2 years if activity stopped
4 – Major	Impacts very widespread; >20-60% of habitat is affected/ removed	Populations, habitats or communities substantially altered (>20-50%) and some function or components are missing/ declining/ increasing well outside historical ranges. Some new species appear in the affected environment	Recovery occurs in 2-10 years if activity stopped
5 – Severe	Impact extensive; >60-90% affected	Likely to cause local extinctions of vulnerable species if impact continues, with a >50-90% change to habitat and community structure and function. Different population dynamics now occur with different species or groups now affected	Recovery period 1-2 decades if activity stopped
6 - Catastrophic	Entire habitat in region is in danger of being affected; >90% affected/ removed	Local extinctions of a variety of species are imminent/immediate. Total collapse of habitat, community or ecosystem processes. The abundance, biomass or diversity of most groups is drastically reduced (by 90% or greater) and most original ecological functional groups (primary producers, grazers etc.) have disappeared	Long-term recovery to former levels will be greater than 1-2 decades or never, even if activity stopped

Chapter 3. PROJECT AND CONTEXT

This part of our record of decision (Chapter 3-7 to 9) outlines the project for which TTRL seeks consent. It also describes the context within which the project sits, including the natural (physical) environment and existing interests.

7. Introduction

136. Section 39 of the Act requires an Impact Assessment to describe, among other things, the existing environment. It also requires an Impact Assessment to identify persons whose existing interests are likely to be adversely affected by the activity and identify the effects of the activity on existing interests. The Impact Assessment provided by TTRL was judged complete in these respects (for the purposes of notification), describing the environment in its section 3, and existing interests in its sections 3.11 and 4.15.
137. In addition to the Impact Assessment, submissions from various parties and expert evidence given at the hearing described the application site, the wider area of the South Taranaki Bight (STB), and existing interests potentially affected. Chapter 3-9, and Chapter 6-22 and 23 of our record of decision summarises that information.

8. Exploration and Mining

138. Trans-Tasman Resources Limited proposes to mine seabed material to extract the fraction containing iron ores, and discharge the de-ored material back to the seabed. The 66-km² mining site has been issued a licence by the Ministry of Business Innovation and Employment (MBIE), but also requires consent under the EEZ Act for the activity of mining as well as the discharge.
139. TTRL introduced a team of corporate and expert witnesses to describe the project and its effects. In relation to the operational aspects of the project, as opposed to its environmental effects, we heard evidence from the following persons, each of whom has significant experience working within or advising the mining industry:
 - Mr Eggers is a director and the Executive Chairman of TTRL.
 - Mr S Thompson is the Engineering and Project Director of TTRL.
 - Mr Brown is the General Manager of Exploration for TTRL.
 - Dr Dearnaley is an expert in field and laboratory measurement and numerical modelling of the properties of cohesive material (mud) and the release of fine material from different types of dredging and disposal activity.

8.1 Permit and Licence Areas

140. The management of activities relating to prospecting, exploration and mining of Crown-owned mineral resources within the EEZ is regulated by the Crown Minerals Act. Approvals under that Act are administered by New Zealand Petroleum and Minerals, a branch of the Ministry of Business Innovation and Employment.
141. The TTRL mining project lies within an area of significant interest to the minerals and petroleum industries. This is evidenced by the number and extent of surrounding permits and licences as shown by Figure 1 on page 34.
142. TTRL holds a Minerals Mining Permit (No. 55581) under the Crown Minerals Act, for a term of 20 years which expires 2 May 2034. The boundaries of the 6,575.9-hectare⁴⁵ Permit match the area of the application for marine consent approval. The application for marine discharge consent is also within this area, although a main effect of the discharge (the sediment plume) will extend beyond the mining permit / marine consent area. The irregularly shaped mining permit area is approximately 4 km wide (north to south) and 12 km long (east to west).
143. TTRL also holds a 635-km² Minerals Exploration Permit (No. 54068), which expires 18 December 2017. This Permit area lies immediately northeast of the Mining Permit area, and is within the coastal marine area (CMA) between the EEZ boundary and the coastline. The CMA is subject to management under the Resource Management Act. Adjoining that Exploration Permit area, and surrounding the Mining Permit area, is an 815-km² Minerals Prospecting Licence⁴⁶ (No. 50753), which expires 16 December 2018.

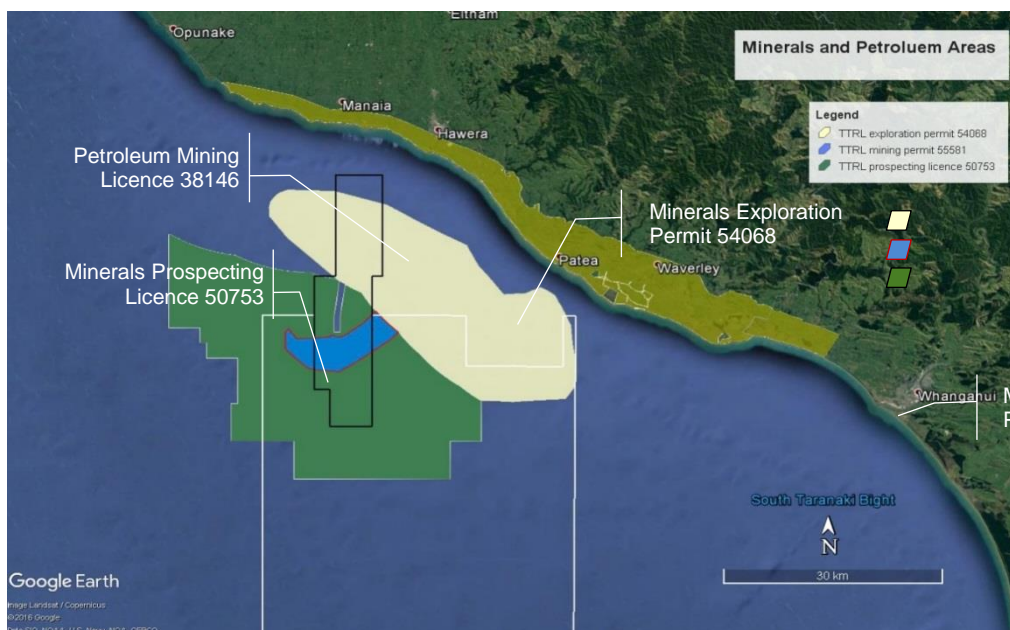


Figure 1: Minerals and Petroleum Areas

Source of shape files: NZ Petroleum and Minerals webmaps
Prepared by DMC

⁴⁵ 65.759 km²

⁴⁶ Continental Shelf Licence

144. Overlying the Mining Permit area is a 256 km² Petroleum Mining Licence (No. 38146), held by Origin Energy Resources (Kupe) Limited. That Licence is due to expire 26 June 2031. Also surrounding the Mining Permit area is Petroleum Exploration Permit 60094, which expires 31 March 2038. There are other nearby petroleum permits and licences which do not directly adjoin the Mining Permit area, and which are not shown by Figure 1. Within PML 38146 sits the Kupe platform, lying approximately 1.2 km north of TTRL's mining permit area (MMP 55581). Within PML 38146 and within MMP 55581, is an abandoned wellhead. The location of the wellhead is shown by Figure 8 on page 195.
145. Onshore, along the southern Taranaki coastline facing the offshore permit and licence areas, is a 402 km² Minerals Prospecting Permit held by a third party – although this expired on 11 June 2017. Within that area there is also a smaller 374 ha Minerals Exploration Permit (for iron sands)⁴⁷ held by the same party, which is due to expire 8 September 2021.

8.2 Description of the Mining Activities

8.2.1 Overview

146. This overview of the mining operation is presented in relatively simplistic terms. However, the DMC has read and understands the full scope of the operation as described in TTRL's assessment of effects, and as elaborated on by evidence presented at the hearing.
147. The purpose of the project is to extract, process and export iron sands from the seabed, offshore in the STB. The mining will take place within a permit area granted under the Crown Minerals Act. Within that permit area, the known and anticipated concentration of recoverable iron sands within the seabed material is around 10%. The depth of the material to be excavated is up to 11 metres, but typically averages about 5 metres. Fine (non-sand) sediments may be present in concentrated lenses, but may otherwise comprise around 1.6% - 2.25% of the excavated material.
148. The iron sands concentration of 10% means that seabed material must be brought to the surface and processed to increase its iron concentration before export. A purpose built seabed crawler will be constructed to excavate up to 8,000 tonnes per hour and send the material to the surface. The crawler sits below and connects directly to a large Integrated Mining Vessel (IMV). The crawler, in concert with the IMV, follows a defined sequence of movements across a mining area of around 900 by 300 metres. The IMV is positioned over the planned mining area and held in place by a four-point mooring system assisted by six on-board thrusters, otherwise referred to as a direct positioning system (DPS). The mooring system is deployed by anchor tugs. The size of the immediate mining area is limited by the anchor spread of the IMV. When the area has been mined, the anchors and crawler must be uplifted and the IMV is then positioned over the next area. The applicant's Impact Assessment indicates that anchor repositioning will take place approximately every 10 days⁴⁸. The IMV is intended to operate in all sea conditions up to a 4 m significant wave height⁴⁹.

⁴⁷ Waipipi Surface iron sands

⁴⁸ Page 24, TTRL Impact Assessment

⁴⁹ Page 14, TTRL Impact Assessment

149. The excavated material is pumped to the IMV where it subject to various processes to increase the concentration to around 56%. Dr Dearnaley, TTRL's sediment plume expert, informed us that the processes include low-intensity magnetic separation or medium-intensity magnetic separation, and a series of mechanical processes. At various stages, fines are released and at the very end, ultra-fine iron sands are collected via magnetic separation.
150. The nature of the processes is not relevant to our consideration, except to the extent that they contribute to the creation and suspension of fine particles after discharge, and generate noise that may adversely affect marine species. We discuss these potential effects later in our record of decision.
151. The 10% fraction of concentrated iron sands is then pumped onwards to a floating storage and off-loading vessel (FSO), via a 70 to 110 metre floating slurry line. The FSO is a holding point for the iron sands until it is transferred to export vessels which will visit the vicinity of the site on a regular basis. The 90% fraction of unwanted material is returned to the seabed via a discharge pipe from the IMV, and is positioned approximately 4 metres above the existing or mined seafloor.
152. It was not made clear to us how often the transfer of processed material between the IMV and FSO will take place. However, we note that the FSO has a 60,000 tonne cargo capacity, and that the rate of mining is 8,000 tonnes per hour, of which 10% is retained onboard the IMV as processed material. This equates to the generation of 800 tonnes of processed material per hour, and over a 24-hour period, will equate to 19,200 tonnes. From those facts, we anticipate that a full load for the FSO will take approximately 3 days to accumulate onboard the IMV.
153. The discharge of unwanted material back to the seafloor will inevitably create a sediment plume (see Chapter 4-10 below). Some of the material will settle out relatively quickly, but some will remain in suspension over many kilometres. Of the material that settles out quickly, most will be deposited in the excavated area. However, at the edge of the excavated area, the discharge will create mounds on the existing seafloor. The application documents state that the mounds will be up to 9 m high and 300 m long. This is because of the fixed position of the discharge pipe relative to the IMV and the excavated area created by the crawler. A corollary of the mounds is a similar sized unfilled region at the end of each excavated area. Mr Todd, on behalf of KASM, sought clarity around mound height. Mr Brown later explained that the 9 m height had been a conservative modelling approach. In reality, the mounds will only be about 5 m high and will deflate to about 4 m high. Regarding mound deflation and pit infilling, Dr MacDonald told us that the timescale for these processes will be very long. Mound deflation will occur over decades, and pit infilling will take centuries.
154. The mining operation includes supporting aspects that also lead to the need for consent. One of these is grade control drilling carried out from a geotechnical support vessel. Grade control drilling is a necessary and ongoing part of the mining process. Although TTRL already has good information about the nature of the iron sands resource, grade control drilling builds that knowledge to a much more detailed level. Working in advance of the mining, the drilling takes samples at approximately 100-metre intervals to provide the information needed for detailed mine planning and iron sands processing. The samples are analysed to understand the depth and grade (iron concentration) of the

resource, the particle size distribution (PSD), and the location of any lenses of fine, non-iron sands material to be avoided by the mining.

155. The other supporting aspect that leads to the need for consent is environmental monitoring. TTRL proposes to undertake a range of monitoring for baseline establishment and understanding subsequent effects. The nature of monitoring will be largely set by conditions to be imposed on the consent. Some, but by no means all, of the monitoring will require consent due to structures on or disturbance of the seabed.
156. Various aspects of the mining operation will produce noise, which we have addressed in Chapter 4-14.4 of our record of decision. Although that section focusses on noise in relation to effects on marine mammals, parts of it (such as the noise modelling process) are applicable to the topic of noise in general.
157. Under the Crown Minerals Act, TTRL has obtained a mining licence for 20 years, which expires in 2034. It is seeking a marine consents and marine discharge consents under the EEZ Act, with a duration of 35 years. We comment further on the duration in Chapter 8-25.6.

8.2.2 Sea Surface Vessels

158. A range of vessels and machinery will be required to recover and process the iron sands from the project area. These include the following:
 - Integrated Mining Vessel (“IMV”);
 - Floating Storage and Offloading vessel (“FSO”);
 - Bulk Cape-sized Export Vessel (“CEV”);
 - Anchor Handling Tug (“AHT”);
 - Refuelling Vessel; and
 - Geotechnical Support Vessel.
159. The IMV is the mid-point of the iron sands mining, processing and shipment system. It sits above and is continuously linked with the crawler which excavates the seabed material. Once processed, iron sands are sent to the FSO via a floating slurry line, and the remaining de-ored sediment is discharged back to the seabed. The IMV is designed to support the uninterrupted recovery and processing of iron sand in sea conditions that have a significant wave height of up to four metres. The IMV’s design has been approved in principle by the American Bureau of Shipping (“ABS”) Classification Society⁵⁰.
160. Associated with these vessels, consent is only required for:
 - Disturbance to the seabed through anchoring of the IMV; and

⁵⁰ ABS is a member of the International Association of Classification Societies (IACS). The IACS contributes to maritime safety and regulation through technical support, compliance verification and research and development. More than 90% of the world’s cargo carrying tonnage is covered by the classification design, construction and through-life compliance with rules and standards set by the twelve Member Societies of IACS. The purpose of a review for “Approval in Principle” is to investigate the feasibility of the conceptual design and identify any major deficiencies that would prove problematic in an ABS review of the design for classification.

- The production of vibrations (noise), other than that caused by the propulsion of a ship. Noise will be caused principally by the crawler, and the iron sands processing and offloading machinery on the IMV and FSO.

161. The export vessels which visit the mining area come from and return to international destinations. As with any ocean-going vessel, they will either take on or discharge seawater as ballast – depending whether they are laden with cargo. No consent is required under the Act for the discharge of ballast or bilge water, although the Biosecurity Act is a relevant marine management regime. We address the matter of biosecurity risks in Chapter 4-16.3.

8.2.3 Seabed mining vehicle

162. Mining of seabed material will be carried out by a large, remote controlled 8-metre high, 420-tonne seabed machine referred to as a “crawler”. Although there will be two crawlers, only one will be used at any one time. They are designed for continuous operation, and fitted with acoustic seabed navigation and a 3D imaging system. They systematically advance along pre-determined lanes using suction to extract seabed material containing the iron sand resource. The suction velocity rapidly decreases as the distance increases from the nozzle. The intake velocity 1 m from the nozzle is calculated to be a maximum of 0.5 m/s.
163. At the start of each mining area, the crawler is lifted off the IMV and lowered into position on the seabed. Once mining in that 900 m by 300 m area is completed, the crawler is lifted back onto the IMV for transport to the next mining area.

8.2.4 Taking and processing of seabed material

164. The seabed material extracted by the crawler will be processed on board the IMV. The proposed iron sand recovery system can extract and process raw material at a design rate of 8,000 tonnes per hour for an average of 6,200 hours per year (out of an available 8,760 hours per annum (i.e. 71% of the time).
165. The IMV is a large vessel, which TTRL will have purpose built for the project. Its intended design characteristics include a length of 345 metres, width of 60 metres, and draught (depth below sea surface) of 12 metres. The IMV is essentially a floating factory for the processing of seabed material and has limited ability to travel under its own power (aside from positioning using its DPS). As noted above, it is connected to the crawler on the seabed, allowing extracted material to be transported upwards to the IMV. It is also connected to the FSO via a floating slurry line, allowing processed material to be offloaded. The IMV is anchored to the seabed, a task which is carried out by the Anchor Handling Tug. Positioning of the IMV is mostly controlled by winches paying in and paying out on the four-point mooring system. The mooring line configuration is regularly adjusted in line length as mining proceeds across the block grid, with anchors reset approximately every 10 days.
166. The mined material, once pumped upwards to the IMV, passes through a series of industrial processes to separate and concentrate the iron ore. These processes are of no relevance to our record of decision except to the extent that they contribute to the generation of noise, and result in

unwanted material being discharged back to the sea floor. We note that the process is based on magnetic and mechanical technologies, with no discharge to the sea from the IMV other than sediment. The FSO will only discharge resalinated water back to the sea. Some trace heavy metals already in the seabed material will comprise part of the discharge. We address that issue in Chapter 4-16.1. All chemicals used in the operation of the reverse osmosis plant will be collected and retained for onshore disposal by approved contractors. We were advised by TTRL that there will be no chemicals or contaminant by-products discharged to the sea arising from the project's processing or water treatment activities.⁵¹

167. To power the industrial processes on board the IMV, it will be equipped with a 60-MW generator burning heavy fuel oil. The FSO will be powered by a 20-MW generator. Powering the IMV, FSO and their processes will release significant amounts of sulphur dioxide (SO₂) into the atmosphere under the current sulphur content in heavy fuel oil. However, from 2020, the internationally agreed sulphur content of heavy fuel oil is anticipated to be significantly less. We address this matter in Chapter 4-16.4 The DMC can take air discharge into account as a potential effect on human health under Section 59(c) of the Act. However, Section 59(5)(b) restricts us from taking into account any effects of discharging greenhouse gases.
168. The IMV is capable of limited independent movement. After mining one of the 900 by 300 metre blocks, it is repositioned with the aid of the AHTs and its own thrusters, and is re-anchored to mine another block.

8.2.5 Re-deposition of de-ored sediment

169. Approximately 90% of the extracted seabed material will be returned to the seafloor. Annually, this is expected to be around 45 million tonnes. Because the seabed will vary in depth, and the IMV will be in motion due to sea conditions, sonar will be used to maintain an intended 4 metre height of discharge above the seabed.
170. The speed at which the material flows back to the seabed will be controlled by other factors such as the slurry input speed, the angle of the discharge pipe, and the density of the material. Density will be controlled by the reintroduction of process water to the discharge pipe. Much of the material will fall directly and quickly to the seafloor. However, the discharge will include some finer sediments and these will create a continuous plume of suspended sediment. We set out the nature of this plume, the related modelling of its extent, and anticipated effects in other parts of our record of decision – primarily in Chapter 4-10 to Chapter 4-13. We consider the sediment plume to be a major environmental effect of the proposed project.
171. When mining each block, the initial discharge of de-ored sediment will be directly to the existing seabed. As the crawler proceeds to create a mined pit lane, the sediment will be discharged into the pit. The fact of discharge to the existing seabed at start of each mining lane is a function of the position of the discharge pipe on the IMV and the relative location of the crawler. At the end of each

⁵¹ Sections 2.3.4, 2.3.6, 4.10.2.1 and 7.5.13.6, TTRL Impact Assessment

mining lane an area of unfilled pit will remain, again being a function of the locations of the discharge pipe and crawler. The mounds on the seabed are expected to be up to 4 to 8 metres high.

8.2.6 Transfer of processed iron sands for shipment

172. On board the IMV, the iron sands which have been separated out from unwanted material need to be transferred to the FSO to await further transfer to export ships. To do so, they are pumped via a floating slurry pipe. To enable ease of pumping, the concentrated iron sands are mixed with seawater which has been desalinated.
173. On reaching the FSO, the iron sand slurry is again de-watered, and the extracted water is resalinated before discharge back to the sea. The FSO is a holding point for the iron sands until an export ship is available for the sand to be offloaded. Until offloading occurs, the FSO can store up to 60,000 tonnes of iron sands. The ship to ship transfer process of iron sands is via a conveyor belt system.

8.3 Exclusion Zone

174. The Impact Assessment notes that there will be an exclusion zone in operation around the mining. The exclusion zone is described by saying that:

“As part of the project, TTR intends to apply to MNZ to establish an exclusion zone (buffer zone) around the IMV and other project related vessels when anchored within the extraction lanes to safeguard other ocean users, members of the public and project vessels from harm. The exclusion zone applied for will extend in a circle with a radius of approximately 1 NM from the IMV to extend beyond the extremities of the anchor pattern and cover the area where support vessels are manoeuvring and/or are constrained in their ability to manoeuvre. It is considered that this measure will further ensure that any effects on marine traffic are avoided.”⁵²

175. The Impact Assessment also says that:

“it is likely that all other vessels will only be excluded from the project’s extraction area (approximately 4 x 4 km) for approximately 10 days at a time. A smaller exclusion area may also be established around vessel transfer areas where they do not occur within the active extraction area. This level of exclusion will continue for the project duration, and the precise location of the exclusion zones will vary as the active extraction area shifts. While there will be a small exclusion area, the rest of the project area will be open to all marine traffic.”⁵³

176. The exclusion zone is not a part of the marine consent under the EEZ Act. However, we have taken its potential effects into account in relevant parts of our record of decision.

⁵² Page 176, TTRL Impact Assessment

⁵³ Page 164, TTRL Impact Assessment

9. Physical Environment

9.1 Setting the Scene

177. The physical environment of the STB is highly dynamic. It sets the scene for activities that occur within it, and the potential effects on life within the environment. Physical factors such as geology, climate, and currents; natural systems such as the distribution of species; and human activities such as fishing all overlap in the setting we refer to as the South Taranaki Bight (STB).
178. The applicant based parts of its assessment of physical effects on an area it called the Sediment Model Domain (SMD). As shown at several places in the application documents⁵⁴, the SMD occupies approximately 13,300 km² of coastal waters.
179. We have adopted the view that the STB includes the following areas: Farewell Spit, Golden Bay, Tasman Bay, the northern end of Cook Strait, and the coastlines of Kāpiti, Horowhenua, Manawatu-Whanganui, and South Taranaki.
180. For the purposes of our decision we have accepted that the SMD lies fully within the STB, even though it extends somewhat beyond Cape Egmont. Our estimate of the wider STB, including the SMD, is approximately 31,300 km². The SMD therefore comprises around 42% of the STB.
181. The Patea Shoals is another area which is a focus of our record of decision, the applicant's reporting, and the concerns of submitters. We address this area in more detail in Chapter 3-9.5.2, but in brief, it is the submerged shelf of relatively shallow water lying offshore of Patea, between about Opunake and Whanganui⁵⁵. For comparative purposes we have divided it into the inner shoals, using the 30 m depth contour, and an outer edge, using the 50 m depth contour. The inner shoals cover around 1,700 km² and the outer shoals a further 1,100 km² (2,800 km² in total).

⁵⁴ Such as page 3, Figure 1 of TTRL Report 20: *Trans-Tasman Resources Ltd Consent Application: Ecological Assessments*, Aquatic Environmental Sciences Ltd., January 2016

⁵⁵ Although it arguably extends further in either direction, we have defined the Patea Shoals as ending directly offshore of these two communities

182. For illustrative and comparative purposes, the boundaries of the SMD (as set by TTRL), and the Inner Patea Shoals and STB (as adopted by the DMC) are shown in Figure 2 below and their areas in Table 6 below. The SMD and the Patea Shoals lie entirely within the STB. Unless otherwise stated, all references in our record of decision are to the Inner Patea Shoals.

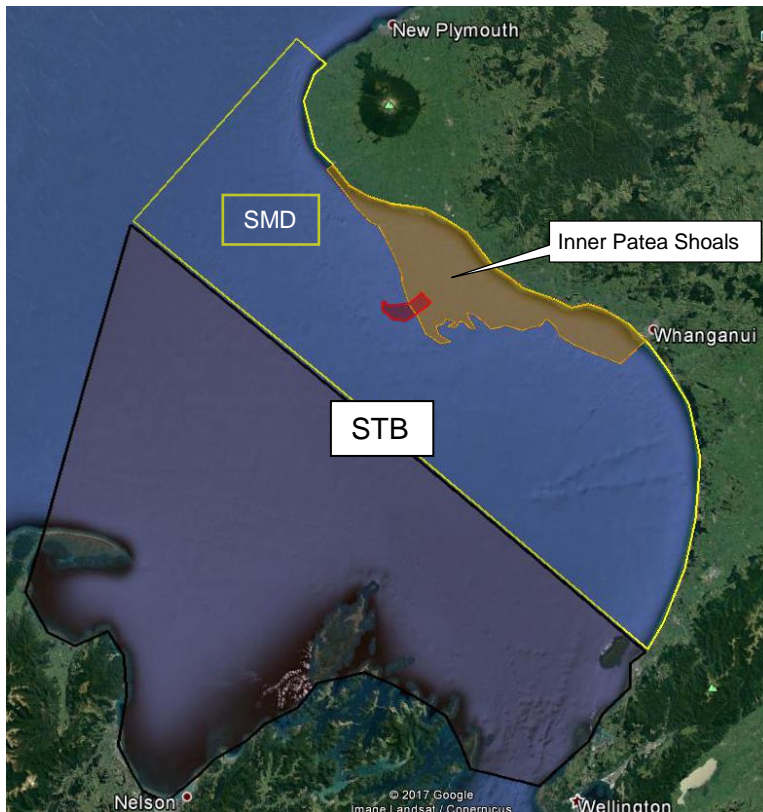


Figure 2: STB, SMD, and Inner Patea Shoals

Prepared by DMC (see paragraphs 178 - 182 for explanation)

183. The relative proportions of each of these areas are shown in Table 6. These are only indicative, and the exact size of any area (other than the mining area) is not fundamental to our decision.

Table 6: Areas of Assessment Compared

Location	Area (km ²)	Coast (km)	STB	SMD	Patea Shoals		TTRL
					outer	inner	
South Taranaki Bight	31,300 km ²	600		x 2.4	x 11.2	x 18.4	x 476
Sediment Model Domain	13,300 km ²	260	42%		x 4.8	x 7.8	x 202
Patea Shoals (inc. outer)	2,800 km ²	115	8.9%	21.1%		x 1.6	x 42.6
Patea Shoals (inner)	1,700 km ²	115	5.4%	12.8%	60.7%		x 25.8
Mining area (TTRL)	65.8 km ²	-	0.21%	0.49%	2.4%	3.9%	

184. The Report notes that the sediment plume modelling has been considered on the basis of three areas: the Greater Cook Strait region, the SMD, and the Patea Shoals⁵⁶. Our approach to the definition of these areas is broadly consistent with that set out in TTRL’s Report 20, but we have also defined the STB.
185. We heard from various experts and submitters who described the physical environment. Among those were:
- Dr Hume, on behalf of TTRL, is marine geologist, coastal geomorphologist and coastal oceanographer.
 - Mr Todd, on behalf of the Fisheries submitters, is a coastal geomorphologist.
 - Dr MacDonald, on behalf of TTRL, is an expert in sediment transport by waves and currents.

9.2 Offshore Geology

186. The project site is around 22 to 36 km offshore⁵⁷ and is part of a relatively shallow undersea shelf that extends out from the coastline. The depth of the shelf below sea level is variable, but its outer edge can be generally said to end in depths of about 30 to 40 metres. The northern and southern ends of the shelf are offshore of the Hawera and Whanganui areas respectively, where it becomes narrower. The greatest widths of the shelf are about 40 km from the shore, and include the vicinity of the project site. In our record of decision we give the shelf the generic name of the Patea Shoals.
187. The Patea Shoals includes some shallower (mostly sand) areas of banks, shoals and ridges. Some of these are named features, such as the North and South Traps, Patea Banks, and Graham Bank – which are typically in water depths of 10 to 20 metres. Some individual features can be more than 20 km long and 5 to 10 m in elevation above the surrounding seabed. The Rolling Ground is another named feature, although it is located at the edge of the shelf.
188. There are also a number of known hard rock reefs. Many of these are at or very close to the shoreline, whereas others are further offshore. The greatest concentration of the further offshore reefs is in the area between The Traps and Whanganui. Submitters identified other rocky reef features such as The Crack which is between about 4.8 km and 7 km from the mining site and The “Project Reef” which is approximately 11 km offshore from Patea. We are aware that many reefs and fishing locations are named by tangata whenua (see Chapter 5-17.3.6), and the customary fisheries analysis⁵⁸.
189. Seabed sediments are variable, but are mostly fine to medium sands. Finer sand tends to occur in the north and west of the STB. There is a greater proportion of coarse sand and gravel / shell to the south and west. The iron sands are primarily derived from volcanic rock that originated from Mount Taranaki. In general terms, the ancient sand deposit is up to 20 m thick at the coast, extending

⁵⁶ Page 20, TTRL Report 20: *Trans-Tasman Resources Ltd Consent Application: Ecological Assessments, Aquatic Environmental Sciences Ltd.*, January 2016

⁵⁷ 12 to 19 nautical miles

⁵⁸ *TTR - Sand Mining – Patea Mātauranga Māori and Customary Fisheries Analysis*, Te Tai Hauāuru Fish Forum, Tanenuiarangi Manawatu Inc., 2016

seaward to the outer edges of the shelf. The depth of sand thins and becomes coarser grained towards the deposit's outer limits. Within the project area there are high iron ore concentrations in these sands, with some samples being greater than 10% iron ore by volume.

190. The presence of contaminants in seabed sediment, which might have the potential to affect organisms if disturbed, has been investigated for TTRL by Auckland University of Technology⁵⁹. Most contaminants were below detection limits (chromium, copper, lead, zinc) but there were elevated levels of cadmium and nickel. Cadmium did not exceed the ANZECC⁶⁰ 99% species protection threshold. Nickel concentrations equalled or exceeded the 99% threshold, but not the 95% level. We address issues related to these contaminants in Chapter 4-16.1 of our record of decision.

9.3 Coastal Processes

191. Dr Hume's evidence is that seabed sand at the mining site is not a significant source for sand on the beaches – especially when compared to sand supplies from cliffs and rivers. Most of the river borne sediment derives from the Patea, Whenuakura, Waitōtara and Whanganui Rivers. He noted that 6 million tonnes / annum comes from rivers and 1.3 million tonnes / annum from cliff erosion.
192. TTRL's Report 1 notes that nearshore and offshore sediment transport is understood in general. Sediment is predominantly pushed by the strong westerly wave climate along the coast from Cape Egmont to the northeast in the direction of New Plymouth, and southeast in the direction of Whanganui. However, the report also notes that there is little information about whether there is sediment input from the offshore region to the littoral zone and the shoreline.⁶¹
193. In Dr Hume's opinion, sand extraction will have no significant effects on sand supply and will not promote beach erosion. In calculating sand supply to the coast, the modelling by Dr Hume did not consider the discharge of sand back to the sea floor from the IMV. However, in his opinion, it makes little difference. Mr Todd accepted that differences between the 2013 and 2015 sediment plume modelling make very little difference in terms of coastal stability.
194. Mr Todd indicated that TTRL's offer to include conditions regarding beach profile monitoring satisfied the concerns that he had about coastal stability. This is provided that monitoring continues for the life of the consent, and for four years afterwards. In contrast, Dr Hume considered there was scope for reviewing the circumstances and ending the monitoring sooner.
195. Regarding waves, Dr Hume stated that there are only small changes in wave conditions close to shore in the most extreme conditions modelled. He qualified the maximum change as 10 cm in wave height, and mostly less than 5 cm. Changes in wave direction will be insignificant when compared to the natural variability.

⁵⁹ TTRL Report 42: *Iron Sand Extraction in South Taranaki Bight: Effects on Trace Metal Contents of Sediment and Seawater*, Auckland University of Technology, September 2013

⁶⁰ Australian and New Zealand Environment and Conservation Council

⁶¹ Page 81, TTRL Report 1: *South Taranaki Bight Factual Baseline Environmental Report*, NIWA, November 2015

196. Dr MacDonald told us that the STB is a high energy wave environment, with the waves generally coming from the south or southwest. Suspended fine material (mud) generally ranges in concentrations from 80 mg/litre⁶² near the seabed and 25 mg/litre near the sea surface. During calm conditions, the level drops to 10 mg/litre. During periods of large waves, suspended sand concentrations (not mud) has a maximum near seabed concentration of 1,900 mg/litre. Field work by Dr MacDonald show that discharge from rivers and wave resuspension are important sources of fine sediments in the nearshore area.⁶³
197. Regarding beach profiles, Dr MacDonald noted that the environment is dynamic, with significant changes occurring on a regular basis.

9.4 Weather and Oceanography

9.4.1 Weather

198. The oceanography and weather at the project site, and the wider STB, are an important part of the project context. Natural variations in the conditions including regular severe weather are factors which we have considered. Submitters told us that weather and ocean conditions significantly limit the frequency with which recreational fishers access the STB.
199. NIWA (Chappell (2014)) undertook an assessment of the region's weather, finding that it is highly exposed to weather systems migrating from the west. It is one of New Zealand's windier regions, but generally sunny with moderate temperatures, and has rainfall evenly distributed throughout the year. The project area, 22 to 36 km offshore, will be very exposed to winds and other weather phenomena. The predominant wind direction is from the west and the southeast. The weather in the STB helps to drive characteristics of the oceanography.

9.4.2 Tidal currents

200. TTRL commissioned an oceanography field programme involving the measurement of currents, waves and sediment transport and assessed oceanographic and shoreline data⁶⁴. Field surveys measured and analysed optical water quality and suspended sediment concentrations near the coastline.
201. Current velocities were measured at five sites across the STB, with recordings taken at various depths through the water column. Report 12 notes that there is an underlying tidal movement from the northwest to the southeast, at average speeds of 0.13 to 0.25 m/sec, which accounts for a significant proportion of the measured currents in the STB. However, the speed and direction can change during strong winds, and speeds of 1 m/sec have been measured. It can either reverse altogether and flow northwest, or the typical northwest to southeast current speed can be enhanced.

⁶² Milligrams per litre

⁶³ Transcript 17 February 2017, page 343

⁶⁴ TTRL Report 12: *South Taranaki Bight Iron Sand Mining: Oceanographic Measurements Data Report*, NIWA, November 2015

Strong winds can influence the current direction for more than 24 hours. The typical current flows, as well as the potential for variability, have important implications for how the sediment plume disperses.⁶⁵

202. Captain Smith agreed that TTRL's information provided good modelling of average flows. However, his personal knowledge is that tidal flows of 1 - 2 knots (0.5 – 1.0 m/second) occur regularly, and in different directions to the average east / south flow. This is consistent with the findings of the NIWA report. Mr Purser of the Patea and Districts Boating Club informed us that the STB can experience very strong currents at times, citing speeds of up to 8 knots (4 metres/second)⁶⁶.
203. An upwelling of waters from the Kahurangi Shoals (the Kahurangi upwelling) and the D'Urville current drive tidal flows in a northeast direction, and then into the STB where it becomes a prevailing current towards the southeast. The upwelling brings nutrients into the STB that feed primary production and subsequently krill. Large and dense aggregations of krill are an important source of food for some cetaceans and seabirds as was noted by several of the expert witnesses (see 10-14 and Chapter 6-22). The direction of the current can be significantly altered by moderate to strong southeast winds, which reverse the drift towards the northwest.

9.4.3 Wave heights

204. The combination of weather and currents contributes to the STB being a high-energy environment with significant wave heights more than 2 metres routinely experienced. Significant wave heights of up to 7.1 m were measured during the seven-month instrument deployment as part of TTRL's studies. Higher waves generally come from either a south, south-southeast, southwest, or west-southwest direction. Wave heights reduce as they move towards the coast or down the coast in a south-southeast direction.
205. Wave heights will affect the operational ability of the IMV and its support vessels. The IMV and its supporting infrastructure have been designed to support the uninterrupted recovery and processing of iron sand in sea conditions that have up to 4 metres significant wave height and will "sit out" major storm events. Some of TTRL's project related vessels may seek shelter in Admiralty Bay in larger storms. Admiralty Bay has been identified by TTRL due to the relatively deep waters and the greatest likelihood of experiencing sheltered sea conditions compared to the STB in the event of a large storm. Admiralty Bay lies approximately 100 km south of the project area.

⁶⁵ Page 94, *ibid.*, TTRL Report 12

⁶⁶ Transcript 7 March 2017, page 1348

9.5 Physical Habitats

206. Habitat identification has been provided through two reports by NIWA. A report prepared by Anderson et al. examined the nearshore environment⁶⁷. The other report, by Beaumont et al. examined locations further offshore⁶⁸. We have described habitats in this section, and distinguished between the nearshore, Patea Shoals and reefs. For our separate discussion around benthic ecosystems and primary production, see Chapter 4-10 below.
207. We requested Taranaki Regional Council to provide us with a copy of a report on sensitive habitats and threatened species in the coastal marine area⁶⁹. The report states that the Patea Shoals area is large, and has a greater proportion of shallow patchy bank/reef high-energy habitat compared to other North Island coastlines⁷⁰. The report also notes that the majority of the Taranaki coastal marine area invertebrate communities, particularly in the further offshore and southern areas, are undescribed – by comparison with other parts of the north and south Taranaki Bights⁷¹.

9.5.1 Nearshore

208. NIWA (Anderson et al. (2015)) undertook an assessment of the benthic habitats, macrobenthos and seabed surface sediments of the nearshore environment. The purpose of this was to characterise nearshore locations which 2012 sediment plume modelling suggested will receive the highest accumulations of sediment on the seabed. Twenty-six nearshore seabed locations between Foxton and Hawera were sampled in early 2013 using underwater video and still images, followed by collecting samples of the seabed surface and its life. A further ten sites were sampled along a transect extending offshore from Whanganui. The seabed life found by that assessment is noted in Chapter 4-10 below.
209. Rocky outcrops made up five of the 36 sites. These outcrops are mostly hard rock and soft to moderately soft mudstone. The remaining sites consist mostly of soft-sediment, and are characterised by fine rippled sands. These environments experience regular sediment disturbances from storm events and river runoff. The mudstone outcrops present in the nearshore area are typically covered in fine silt.

9.5.2 The Patea Shoals

210. We refer to the location of the Patea Shoals earlier in our report. An exact edge to shelf is not necessary to define, but beyond the 30 metre depth, the shelf begins to drop more steeply to greater depths. We have adopted the 30 m contour as indicative of the inner shelf, and the 50 m contour as

⁶⁷ TTRL Report 2: *Benthic Habitats, Macrobenthos and Surficial Sediments of the Nearshore South Taranaki Bight*, NIWA, November 2015

⁶⁸ TTRL Report 3: *Benthic Flora and Fauna of the Patea Shoals Region, South Taranaki Bight*, NIWA, November 2015

⁶⁹ *Sensitive Habitats and Threatened Species in The Taranaki Coastal Marine Area – Database Investigation*, Cawthron Institute, August 2016

⁷⁰ Section 1.3.1, *ibid.*, Cawthron report

⁷¹ Section 3.3.2, *ibid.*, Cawthron report

indicative of shelf's outer extent. The mining site lies within both this inner and outer zone. The 50 m contour is up to 40 km from the shore. Much of the applicant's environmental investigation has covered both the inner and outer shelf areas, although more has been done on the inner shelf.

211. NIWA (Beaumont et al. (2015)) describe the area covered by the sampling project as being within the "Patea Shoals", but also implies that the same area is called The Rolling Ground⁷² and is shown as such on LINZ chart NZ45. The LINZ chart shows that The Rolling Ground is a much more confined location and is very close to or within the mining site. The Optical Water Quality report⁷³ specifies a location for the Rolling Ground which is well removed from the location shown on the LINZ chart. We have chosen to use the term Patea Shoals in our record of decision as a generic term to cover the entire shelf of shallow water between Opunake and Whanganui.
212. For the sake of consistency and clarity we accept that The Rolling Ground is a monitoring site specified in the Optical Water Quality report. However, we acknowledge that this is not fully consistent with the LINZ chart, or fishing industry, or some local usage of the term.
213. Seabed habitats and macrobenthos in the Patea Shoals were visually characterised at 144 locations, most of which appear to be within about 20 km of the boundaries of the proposed mining area. Nineteen of those 144 sites lie within the boundaries of the mining area. Seabed surface sediments and associated infauna were collected from 331 samples at 103 of the sites, while benthic macrofauna and macroflora specimens were collected from 116 of the sites. The seabed life identified by that assessment is noted in Chapter 4-10 below. Some submitters suggested the sampling methodology resulted in a bias towards low diversity habitats as few reefs or higher diversity habitats were sampled. Both Dr MacDiarmid and Dr James disagreed, stating that reefs and reef communities had been identified. Dr Mead acknowledged that the sampling and its intensity was a great improvement from TTRL's previous application, but was still concerned about the number and representativeness of samples.
214. Seven habitat types were identified in Beaumont et al. (2015), with the most common being rippled sand. For example, Graham Bank is a sandy habitat around 16 – 25 km southeast from the mining site. There are also deeper reefs offshore characterised by bivalve / bryozoan rubble and shell debris habitats. Mid and inner shelf habitats appear to be characterised by highly disturbed sediments.
215. Within the boundaries of the mining site, 12 sites were characterised as wormfields and seven sites were characterised as rippled sand. The wormfields occupy the western two thirds of the mining area, and the rippled sand habitat occupies the east.

9.5.3 Further offshore

216. Fifty of the 144 locations sampled by Beaumont et al. lie in deeper waters outside of and generally south of the mining site. There are two habitats, both based on the 'rubble' of dead organisms, that support a diverse and abundant epifaunal community dominated by suspension-feeding taxa. One

⁷² section 2.1, page 13, *ibid.*, TTRL Report 3

⁷³ *Optical Effects of Proposed Iron-Sand Mining in the South Taranaki Bight Region – Worst Case Update*, NIWA, April 2017

habitat type is bivalve (shellfish) rubble at 44 m to 69 m depth which supports early successional stages such as encrusting corraline algae, and small encrusting invertebrates. The other, somewhat deeper (> 60 m), habitat is shell hash and bryozoan rubble which supports later successional stages (certain bryozoans, sponges and higher numbers of motile taxa) and a high abundance of infauna.

9.5.4 Reefs

217. Submitters questioned whether the number and location of reef habitats had been appropriately identified by TTRL. Ms Pratt, a resident of Hawera, was one of those people and in her presentation she provided us with an indication of the location of various reefs. We asked her to provide more detailed documentation about their location. She did so, and it was subsequently incorporated into interactive GIS mapping provided to us by TTRL. Dr MacDiarmid told us that the mining site itself was subject to multi-beam sonar survey and determined that no reefs exist within that area. However, she conceded that only limited multi-beam surveys were undertaken in the broad area between the territorial sea limit (12 nm) and the shore. She stated that bathymetric charts typically don't show offshore reefs and that there may well be reefs that have not been picked up by TTRL's investigations.
218. The Ngā Motu Marine Reserve Society presentation included a slide, taken from the Department of Conservation GIS database, which shows a significant number of small reefs spread throughout the length of the Patea Shoals⁷⁴. These are identified by the slide legend in six categories as sheltered shallow; exposed shallow; high current shallow; high current deep; moderate shallow; and deep reefs. Dr James noted that there could be various small 'reefs', possibly only a few metres across, that come and go as the dynamic environment uncovers them or covers them with sand. He considered that it is the more extensive reef systems we should be concerned with.
219. In Chapter 5-17.3.6 we note that various reefs are mentioned in tangata whenua Deed of Settlement documents, although we do not have information regarding the exact location of all those sites. We are aware of the location of some other reefs through information provided by a report on important kaimoana sites⁷⁵. Based on that report, Manahi reef is the closest location we are aware of to the mining site. It lies about 13 km northeast of the mining site.
220. The Crack was identified by submitters. Ms Hammonds described it as being 4 nautical miles long and 6 km from the edge of the mining area⁷⁶. The Crack (comprising two sites, 5 and 7 km from the site) was later used by TTRL as a reference site in the revision of optical modelling.
221. Mr Boyd, from the South Taranaki Underwater Club, described The "Project Reef"⁷⁷. The "project" was established in response to the first TTRL application and the Club's realisation that there was little knowledge of what lies beneath the waters of the STB, particularly in the area of sediment

⁷⁴ Slide 8, Ngā Motu Marine Reserve Society presentation, 7 March 2017

⁷⁵ Table 2, page 24, *TTR - Sand Mining – Patea Mātauranga Māori and Customary Fisheries Analysis*, Te Tai Hauāuru Fish Forum, Tanenuiarangi Manawatu Inc., 2016

⁷⁶ Transcript 7 March 2017, page 1291

⁷⁷ Note that the name of The Project Reef is unrelated to TTRL's mining project

plume. To address that, the Club chose a reef to study and record the reef community, identify the factors that shape it, and record seasonal trends. The work involves a team of local volunteers (including schools and iwi), working alongside marine scientists, and with the help of experts from NIWA, Te Papa and universities. Mr Boyd told us that The “Project Reef” lies about 11 km from Patea, and pointed out its general location on a map at the hearing. In order to protect the reef, we did not receive any specific location. Dr James for TTRL noted he was aware of the work being conducted for The “Project Reef”.

222. The Ngā Motu MRS submission describes The “Project Reef” as an approximately “100-m-long horseshoe-shaped reef of hard rock and fossilised shells”⁷⁸. Ms Hammonds of the Ngā Motu MRS showed us some pictures of The “Project Reef” and pointed out features such as kelp, ecklonia, and jewel anemones. She said that ecklonia (which is a genus of kelp) requires high water clarity to grow. Dr James told us of a tentative threshold of SSC 20 mg/litre for ecklonia productivity⁷⁹. Ms Pratt noted that the TTRL habitat survey reported only one occurrence of ecklonia, yet that leatherjackets need ecklonia as part of their lifecycle and the significant density of leatherjackets in the STB, suggests there is much more ecklonia than indicated by the survey. Leatherjacket comprises a substantial proportion of the fish caught within the mining site (see paragraph 862).
223. Dr James agreed that it could be useful to add further monitoring sites, such as The Traps. The Traps are a reef habitat lying around 26 – 28 km east of the mining site. They are noted as an outstanding natural feature by the Taranaki Regional Coastal Plan (see Chapter 7-24.11.2 of our report). Dr James noted that the assessment work on SSC time series effects included generic distances of 2 km, 8 km, and 20 km. He said that if a site needs to be characterised in terms of the modelled SSC levels and duration of exposure, then there is the ability to extract time series data.
224. We have reviewed a Taranaki Regional Council report on shoreline reefs, provided to us in evidence⁸⁰. Of the six reefs sites covered by the report, only one (Waihi Reef near Hawera) lies in proximity to the mining site. Manihi Reef⁸¹, near Oanui, is also with the STB but is significantly distant from the site. The other reefs in the report are all north of Cape Egmont. Waihi Reef is noted as the least diverse reef in the study, likely due to the high-energy wave environment, lack of stable habitat, and periodic sand inundation⁸².

9.6 Findings on the Physical Environment

225. Our approach has been to consider matters within the context of the wider STB, the SMD and the Patea Shoals. These different contexts reflect the broader ecosystem scale down to more localised impacts. The mining site is only 0.21% of the STB. The wider Patea Shoals is 8.9% of the STB and the SMD is 42% of the STB. We have defined the wider Patea Shoals by the 50 m depth contour and

⁷⁸ Page 5, Ngā Motu Marine Reserve Society Submission

⁷⁹ Paragraph 9, Expert Supplementary Evidence of Dr Mark James on Behalf of Trans-Tasman Resources Limited, 27 April 2017

⁸⁰ *State of the Environment, Rocky Shore Monitoring Report 2008 – 2015*, Technical Report 2015-56, 2016

⁸¹ Not to be confused with Manahi reef noted in paragraph 219

⁸² page 23, *ibid.*, TRC Technical Report 2015-56

includes the entire mining site. The inner Patea Shoals is defined by the 30 m depth contour and includes the eastern half of the mining site.

226. The seabed sediments of the Patea Shoals are variable, with mostly fine to medium mobile sands and a number of areas of hard substrate and rocky reefs. Some rocky reefs are recorded but other reefs and valued habitats were identified by submitters, notably The Crack and The “Project Reef”.
227. We recognise that the rocky reef habitats are highly diverse and support a wide assemblage of marine life. In comparison, sand habitats support significantly lower levels of biodiversity. We accept the ecological importance of hard substrate and rocky reefs.
228. There are some heavy metal contaminants in the seabed sediments. However, they are generally below detection limits or ANZECC guideline levels for 95% species protection.
229. There is little information on sediment transport from offshore. However, we accept the evidence of Dr Hume that the mining site is not a significant source for sand transport to the beaches and that the application will not increase coastal erosion. However, we have set conditions to require that rates of erosion and accretion are monitored.
230. The Kahurangi upwelling and D’Urville current generally result in a northeast current into the STB which then circulates to the southeast in the vicinity of the Patea Shoals. This predominant current can be reversed near the mining site in strong wind conditions. The current brings nutrients into the STB and the Patea Shoals.
231. In assessing the application we have given careful consideration to the risks posed by the physical environment, especially adverse weather and sea conditions, including strong currents and wave heights of up to 7 metres. We accept that the mining will result in small changes in wave height (5 – 10 cm) and insignificant changes to wave direction close to shore.
232. The nearshore areas of the Patea Shoals experience high levels of SSC due to the wave climate resuspending seabed sediment and from the land, including rivers and coastal erosion. Further offshore, suspended sediment levels are generally low except at seabed level during storm events. Dynamic and variable factors such as wind, waves, sediment runoff from land, and seabed characteristics strongly influence background SSC levels.

Chapter 4. ENVIRONMENTAL IMPACTS

This part of our record of decision (Chapter 4-10 to 16) sets out our understanding of the natural (biological) environment and the impacts that will arise from the project. In doing so we have had regard to broad divisions such as fish, shellfish, and marine mammals – as well as individual components of those divisions where necessary. As an example, we have considered marine mammals in general but have paid particular attention to cetaceans and specific threatened species (such as Māui / Hector’s dolphins). We have also taken account of existing stresses in the environment; we acknowledge those as comprising an existing baseline which cannot be ignored.

10. Sediment Plume and Optical Modelling

233. The sediment plume produced by the project, primarily from discharging de-ored sediment back to the sea floor, is one of the project’s most obvious environmental outcomes. The nature and extent of the plume is regarded by many submitters as having the potential for adverse impacts. According to various witnesses, the potential impacts could include outcomes such as smothering of benthic organisms; avoidance by fish (with consequent impacts on fishing); and avoidance or other behavioural responses by cetaceans (especially threatened species). Two major parameters which relate to the plume’s spread, deposition, and effects are suspended sediment concentration (SSC) and particle size distribution (PSD). Although much of the discussion in our record of decision refers to SSC, we appreciate the relevance of PSD *within* SSC, in terms of the potential environmental effects.
234. We heard evidence from various expert witnesses regarding the sediment plume, its characteristics, and its effects. We also heard from many other submitters whose concerns were focused on the plume as a potential source of adverse effects. The expert witnesses we heard from were:
- Dr Dearnaley, on behalf of TTRL, is an expert in field and laboratory measurement and numerical modelling of the properties of cohesive material (mud) and the release of fine material from different types of dredging and disposal activity.
 - Dr Berthot, on behalf of the EPA, has expertise in hydrodynamic modelling, wave modelling, sediment transport and morphological modelling, and water quality modelling,
 - Dr Petch, on behalf of the EPA, has expertise in auditing approvals document for regulators, especially for dredging and waste disposal projects in marine waters.
 - Mr Jorissen, on behalf of the Fisheries Submitters, is a coastal engineer specialising in coastal processes, numerical modelling of waves, hydrodynamics and sediment transport processes.
 - Dr Barbara is an expert in phytoplankton and bacterial.
 - Dr Longdill, on behalf of the Department of Conservation, is an expert in marine physical processes and their interaction with ecological processes and water quality.
 - Mr Greer, on behalf of KASM/Greenpeace, is a coastal scientist with a background in adaptive systems and statistics.

235. With regard to the appearance by Dr Longdill, the DMC sought advice from the Department of Conservation before the start of the hearing (see Table 2 on page 21). We requested a copy of any report he had provided which led to the Department choosing to not lodge a submission. The Department responded to us that there was no single report, but advice which was set out in emails and other correspondence over a period of time. The Department offered to have Dr Longdill collate the relevant information, which he subsequently did, and we also requested his appearance at the hearing.
236. Our purpose in taking these steps was to understand the basis of Department's decision not to submit on the application. We were advised by the Department that it had reviewed Dr Longdill's advice and was satisfied that TTRL's proposed conditions were appropriate and there would be "no further conservation gains" by submitting.

10.1 Sediment Assessment and Modelling

237. TTRL commissioned technical work by NIWA and HR Wallingford in relation to the sediment plume and modelling. A key work-stream related to how the discharged sediment behaves in the marine environment. HR Wallingford conducted laboratory tests to define the settling speed of the finest sediment particles, and other factors relevant to understanding how the discharged material and sediment plume will behave. NIWA re-ran the sediment plume model which had been developed for TTRL's 2013 application, using the outcomes of the HR Wallingford tests.
238. Dr Dearnaley from HR Wallingford, and Mr Brown from TTRL, described the sources of the seabed material used in laboratory tests that were undertaken to determine the sediment properties. They said that 105 samples were taken from ten locations within the proposed mining area. Mr Jorissen observed that only 70 of those were tested. Dr Longdill considered that using ten sample locations was minimally adequate.
239. Mr Brown told us that three of the ten locations were used to collect bulk samples. These required closely spaced drilling to collect somewhere between 700 kg and 3 tonnes in each case, to provide a suitable volume of material for use in the pilot processing plant. Three sub-samples (not the full bulk samples) were ultimately provided to HR Wallingford for testing the behaviour of fines. Mr Brown made the point that the three sub-samples provided to HR Wallingford were not run of mine⁸³ but comprised fines derived through different methods. One was of fines which had remained in suspension after the bulk sample had been allowed to settle. The other two samples were derived after processing in the pilot plant. He said they incorporated both the fines naturally in the run of mine material and those generated by the processing⁸⁴. Dr Longdill felt that using the pilot plant material was appropriate.

⁸³ Run of mine, in this context, refers to the 'raw' samples from site

⁸⁴ Transcript 17 February 2017, pages 180 - 181

240. Mr Brown explained that chain of custody was an important aspect of sample testing, and that this had been verified as following the JORC code⁸⁵. He explained that the international JORC code is a set of guidelines and procedures for reporting a mineral resource. A miner must prove the chain of custody is appropriate in terms of sample location and methodology, and how the material is handled, transported, prepared and reported⁸⁶.
241. The three samples were used by HR Wallingford to characterise the discharge from the mining operation. Dr Dearnaley emphasised the distinction between outputs from the pilot processing plant, which were tested, and run of mine material, which was not tested. He also noted that the pilot processing outputs are *“not necessarily a complete representation of the full discharge that would ever be released from the IMV.”*⁸⁷
242. Dr Dearnaley stressed that the key question is how the finest fraction of clay particles in the discharge behaves. Mr Jorissen agreed with that view. The fine particles are discharged near the seabed, but as part of a much larger discharge of sand. He said that the sand will settle out rapidly, but the ultra-fine fraction, which settles more slowly, will initially be in a state of near-bed suspension. He noted that the spreading of sediment on the seabed will be unlikely beyond 300 m from the discharge point.
243. The testing undertaken by Dr Dearnaley was aimed at understanding how the fine material will behave. As part of that, the settling behaviours were classified into four different speeds. The two slowest speeds (100th and a 10th of a millimeter a second) are for particles that will become mixed throughout the water column and contribute to the optical effects of the sediment plume. Mr Jorissen noted that particle size distribution is a key factor for understanding settling behaviour. Dr Dearnaley advised us that natural flocculation of the fine particles was an element in the speed of settlement. Mr Jorissen agreed that overall, the settling tests were sound and appropriate, and he accepted that flocculation will occur. Professor Cahoon has told us that the HR Wallingford findings on flocculation may be conservative. He stated that:

*“... some of the biological effects on fine particle removal listed above cannot be tested in a lab setting, e.g., fouling by microbes, adsorption to marine snow or removal by suspension feeders, but certainly occur in nature, so estimates of fine particle loss rates derived from laboratory measurements and used in the sediment transport modelling for TTRL must be considered as conservative, i.e., underestimates, in my opinion.”*⁸⁸

⁸⁵ Joint Ore Reserves Code: Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves

⁸⁶ Transcript 17 February 2017, page 180

⁸⁷ Transcript 17 February 2017, page 263

⁸⁸ Paragraph 14, Expert Evidence of Dr Lawrence Cahoon on Behalf of Trans Tasman Resources Limited, 15 December 2016

244. Ms Cashmore, an environmental advisor acting for Ngāti Ruanui, told us that *“the presence of iron causes sediment to flocculate and settle faster. It is uncertain how much iron is contained in the tested samples. This means the test results presented in the application could have falsely elevated flocculated sediments, thereby increasing the settling velocity and uncertainties.”* We questioned all the relevant experts in relation to this matter and all agreed that any effect of iron on flocculation rates would be minimal.
245. Dr Malpas, a geologist and submitter, questioned the assumptions made about flocculation. She told us that only clay minerals (not sands) will flocculate, and that flocculation was most likely in sheltered estuarine environments rather than the open ocean. She noted that the ultra-fines in the HRW Wallingford analysis were not necessarily clay, and could therefore not be counted on to flocculate.⁸⁹
246. Dr Dearnaley agreed that monitoring of the discharge to validate the assumed particle size distribution is essential. Dr Berthot expressed the same opinion. Mr Greer took this further, saying that conditions should also place an upper limit on the percentage of fines and rate of discharge. In a similar vein, Dr Baxter, on behalf of the EPA, told us it is critical for there to be monitoring to validate actual versus predicted SSC levels. Drs Berthot and Petch questioned the different assumptions around background and mining induced sedimentation rates but noted that doubling the predicted sedimentation rates was unlikely to change the model conclusions⁹⁰.
247. Dr Dearnaley stated that, in his opinion, some of the previous NIWA work was incorrect. However, he noted that the differences between his assessment and that of NIWA, in relation to the proportions of material in the settling classes, do not greatly affect modelled concentrations in the sediment plume. Dr Petch observed that the modelling took an average between the NIWA and HR Wallingford settling speeds, but that the NIWA figures were slightly more conservative. Mr Jorissen preferred the NIWA figures, whereas Dr Longdill accepted the averaging approach. Dr Dearnaley acknowledged the varying opinions expressed by the sediment experts during witness caucusing and estimated that their assumptions could lead to a 25% difference in the effects of the plume⁹¹.
248. Regarding modelling of the plume, Dr Dearnaley advised us that modelling of the plume relied on a set of assumed ‘source terms’. As an example, he said that mining activity was assumed to occur for 80% of the time, but that this was conservative, and the likely operating time was 71%. He noted another aspect of conservatism included assuming that the mined material will comprise 1.6% ultra-fines (a size less than 8 µm) which is muddier than the 0.8% encountered in the samples (see Table 7). In his opinion, this assumption makes an approximately 50% difference to the modelled plume concentrations. Dr Dearnaley further qualified this by noting that Condition 47⁹² from the Impact Assessment set an allowable average upper mining limit of 1.8% ultra-fines. He stated that mine planning will seek to avoid mining ultra-fine material and that the onboard processing will

⁸⁹ Transcript 15 March 2017, pages 1633 to 1636

⁹⁰ Paragraph 24, *Trans-Tasman Resources Ltd Marine Consent Application Review of Sediment Mobilisation and Transport*, GHD, September 2016

⁹¹ Transcript 17 February 2017, page 288

⁹² The reference to a limit of 1.8% is now contained within Condition 4.d of the imposed conditions

continuously monitor PSD in the discharge. Dr Longdill considered that the averaging period should be a week⁹³.

249. Dr Dearnaley told us that fine particles are those with a size of less than 38 microns (μm). The investigations carried out by TTRL have shown that, across the mining licence area they expect, on average, 2% of the mined material to be under 38 μm . On an annual basis, 1 million tonnes of fine material will be removed from and returned to the seabed.

Dr Dearnaley provided us with a table in his evidence, which we repeat as Table 7 that sets out the anticipated makeup of the mined material. The data is based on sampling by TTRL.

Table 7: Sediment Particle Size

Particle size (μm) ⁹⁴	PSD of sediment (cumulative, %)			
	In-situ sediment, to be mined	Coarse sediment discharge	Fine sediment discharge	Combined discharge
< 8 μm	0.8	0.1	15.5	0.3
8–16 μm	1.3	0.2	30.8	1.6
16–38 μm	2.0	0.4	67.4	3.4
38–90 μm	3.0	1.2	86.2	5.0
90–125 μm	5.1	5.0	95.3	9.0
125–150 μm	9.0	10.0	97.8	13.9
150–212 μm	26.9	25.0	100.0	28.3
212–250 μm	40.5	40.9	-	43.5
250–355 μm	69.8	71.8	-	73.0
355–500 μm	86.6	85.6	-	86.2
500–710 μm	93.9	90.5	-	90.9
710–2000 μm	99.1	95.2	-	95.4
> 2000 ⁹⁵ μm	100.0	100.0	-	100.0

251. We also note that TTRL Report 3 characterises sediment in the following way⁹⁶:

Table 8: NIWA Particle Size Characterisation

Particle size	Character
< 2 μm	Clay
2 – 63 μm	Silt
63 – 125 μm	Very fine sand
125 – 250 μm	Fine sand

⁹³ Transcript 17 March 2017, page 1876

⁹⁴ For comparison: 3 – 8 μm = width of a strand of spider silk; 17 to 181 μm = diameter of human hair

⁹⁵ 2,000 μm = 2 mm (millimetres)

⁹⁶ Section 3.3.1, page 63

250 – 500 µm	Medium sand
500 µm – 1.6 mm	Coarse sand
1.6 – 8 mm	Fine gravel / sand
> 8 mm	Medium gravel / sand

252. As we noted earlier, laboratory experiments by HR Wallingford, using samples provided by TTRL, were used to test the settling and resuspension properties of fine particles. The tests showed that the finest particles experience significant natural flocculation, whereby the individual particles combine into larger aggregations. The aggregated particles settle at greater speeds than their individual components. This is a natural physical process which requires no addition of chemicals and operates in either salt or freshwater.
253. We were also informed that the experiments and modelling can show how much of the fine sediment will be trapped in the mining pits. In summary, using the settling speed categories referred to by Dr Dearnaley, there will be:
- 0.01 mm/second: 5% trapped, but then carried out of the pit by currents
 - 0.1 mm/second: 25% to 50% trapped depending on pit width;
 - 1 mm/second: 90% trapped; and
 - 10 mm/second: 100% trapped will be trapped in the pit.
254. Mr Jorissen said that no details had been provided on how the fines content will be monitored and reacted to during processing. Mr Jorissen questioned the adequacy of information available and the assumptions made about variability in the run of mine particle size distribution and how operationally this could be managed. Dr Barbara had similar concerns to Mr Jorissen. Dr Barbara agreed that the percentage of fines can be controlled by appropriate conditions. He also accepted that it would be logical for mining to avoid areas with significant volumes of fines and clay.
255. Dr Dearnaley noted that the width of the mining lane makes a difference. The modelling assumed a 300 m lane width but TTRL are proposing a 900 m lane width. Dr Dearnaley stated that the wider lane will retain more of the fines, although he agreed that the degree of retention will be affected by wave action. In conditions when the waves are more than 4 m he expected the whole seabed to be mobilised, and no discharged material would be retained in the pits. Dr Dearnaley stated that conservative modelling probably over-predicts suspended sediment concentrations in the plume by about 25%⁹⁷.
256. Mr Jorissen noted that the modelling does not address sediment discharge outside the confines of a pit, as is the case at the start of a new mining lane. He said that during those periods, which are of a few weeks duration, a higher release of fines will occur – especially those in the 0.1 mm/second settling speed category and the resulting sediment plume would be larger.

⁹⁷ Transcript 17 February 2017, page 288

257. Dr Berthot and Dr Petch agreed that the modelling provides a good overall representation of the sediment plume and sedimentation. They also noted that:
- “... the worst-case scenario, which would be based on a more energetic wave and current condition on a larger proportion of fines mix or on different mining operations stages, has not been modelled. We would expect that the need to undertake such a scenario would be driven by the assessment of the potential impact at the receptor and the understanding of threshold in terms of suspended sediment concentration and sedimentation.”⁹⁸*
258. Mr Greer held the same opinion as Dr Berthot and Dr Petch, that the wave conditions in the model were not conservative, as the wave size (2 m) and period (7 seconds), cause very little agitation of the seabed⁹⁹. All the experts agreed that in the absence of a sensitivity analysis, modelling a worst case would be of benefit.
259. Dr Berthot stated that if existing modelling indicated an effect on marine or benthic ecology, then that also points to the need for examining a worse-case scenario. However, he sounded a note of caution that a worst case for all parameters may not represent a worse-case scenario for a receptor in a particular location. He said there needs to be further discussion of worst case outputs with other environmental experts.
260. Dr Dearnaley summarised the existing background concentrations in the STB and the modelled spread of the sediment plume by reference to median suspended sediment concentrations. The background concentrations result from the discharge of 20 million tonnes annually put into suspension by waves and currents, and 12 million tonnes discharged by rivers. In contrast, the mining operation will generate 0.7 million tonnes. Mr Greer criticised the use of background levels as a benchmark, noting that much of it is not ‘natural’, but the result of human activity. He said we should view the SSC arising from mining as a cumulative impact on an already affected environment.
261. Dr Dearnaley described median background concentrations seaward of the EEZ boundary as very low – being less than SSC 0.1 mg/litre. Closer to shore, the median background concentrations increase, reaching SSC 10 to 20 mg/litre in shoreline surface waters. Dr James told us that at the seafloor of the inshore area, levels can often approach 100 mg/litre, and around 1,000 mg/litre for short durations close to river mouths.
262. Dr Dearnaley noted that nearshore SSC is influenced by river discharges and wave activity in shallower water and the modelled levels are based on the work by Hadfield and MacDonald¹⁰⁰. He explained that, on a time basis, there is very little variability in SSC in the offshore area. Closer to shore there is variability based on the sediment inputs from rivers and that generated by waves, both of which are weather dependent.

⁹⁸ Transcript 17 February 2017, page 320/321

⁹⁹ Transcript 17 February 2017, pages 330 and 353

¹⁰⁰ *Sediment Plume Modelling Prepared for Trans-Tasman Resources Ltd.*, NIWA, 2015

263. Dr Dearnaley said that, at the plume’s source by the mining site, the median increase of SSC above the background level would be up to about 1 mg/litre. Beyond that, for about 20 – 30 km, the plume will add a median increase of 0.2 – 0.5 mg/litre above background. In the nearshore area, the concentrations will be 0.1 – 0.2 mg/litre above background¹⁰¹. Overall, he described the SSC within about 30 km of the mining site as moderate, but noted that the effects on coastal water are insignificant because the background concentrations are typically elevated.¹⁰²
264. Dr Longdill referred us to Schedule 2 of the consent conditions proposed in the Impact Assessment. At that time, the Consent Holder’s proffered conditions included Schedule 2 which set out SSC response and compliance limits (both at the sea surface and at the sea floor) for seven sites¹⁰³ in the STB. He called this a receptor-based framework, which worked together with several of the proposed conditions. He said the provisions collectively allowed the plume and suspended sediment compliance to be managed. He qualified that by stating the receptor locations should be informed by biologists and ecologists, and that a separate approach might be required when considering mobile fauna. He also noted that rigour around the sediment plume model and its source terms was a key element of the framework. His understanding was that Schedule 2 limits, in conjunction with related consent conditions, set a requirement that no mining derived sediment will impact those sites¹⁰⁴.
265. Dr Baxter said there needed to be clearly defined triggers for management if response limits are exceeded as, *“that would place the onus then on the proponent to manage their operations in a way that their impacts on benthic ecology are no greater than those predicted and assessed.”*¹⁰⁵ He noted that response trigger levels need to be set at a sufficiently conservative level because of time lag effects. Mr Young had a similar concern, citing the physical distance between the monitoring points and the mining area.
266. Dr Dearnaley advised us that the modelling provides a good description of sediment plume effects in mid-field and far-field locations. Defining those terms, he said that near-field is within about 3 km, mid-field is between 3 km and 15 – 20 km, and far-field is beyond 15 – 20 km. However, he stated that the modelling is less useful in near-field locations¹⁰⁶, a point agreed by all experts. Dr Longdill considered the near-field to be closer than 3 km (within 300 – 500 m of the mining), and that mid-field will be 500 m to 3 km. He said that if consent were granted, it should be on the basis that effects within the near-field area would occur. Dr Longdill stated that his confidence in modelled effects is relatively low within 2 km of the mining¹⁰⁷.

¹⁰¹ Transcript 17 February 2017, page 271

¹⁰² Transcript 17 February 2017, page 273

¹⁰³ The Rolling Ground, Graham Bank, Source A to Whanganui 1 km, Source A to Whanganui 20 km, South Traps, North Traps, Tuteremoana

¹⁰⁴ Transcript 17 March 2017, page 1871

¹⁰⁵ Transcript 24 February 2017, page 925

¹⁰⁶ Transcript 17 February 2017, page 293

¹⁰⁷ Transcript 17 March 2017, page 1875

267. The near-field modelling undertaken for TTRL shows that accumulated deposition attributable to the mining will be indistinguishable from the background level beyond 1 to 2 km from the source¹⁰⁸. In evidence, Dr Dearnaley¹⁰⁹ noted that the maximum five-day deposition, within a few kilometers of the mining site, should be scaled upwards by a factor of five. It increases the maximum five day accumulated deposition from 0.6 mm quoted in the application, to a level of 3 mm. Similarly, the 365 day accumulated deposition of 1.1 mm scales upwards to 5.5 mm.
268. Mr Greer said that uncertainty in near-field modelling could not be assumed to abruptly end at the 3 km near-field boundary.
269. Mr Jorissen accepted that the far-field modelling is an appropriate and useful tool. However, he noted that the sediment loads were inputted as a constant and average rate of discharge. His conclusion was therefore that:
- “... the model does not consider temporal variability in the load as a result of variability in the pit material composition, mining operations, mining pit configurations, or environmental conditions. As a result, the loads will be under-estimated during some periods and over-estimated during others.”¹¹⁰*
270. Dr Dearnaley’s opinion is that the mining and sediment discharge will be comparable to a large scale dredging operation and referred to examples where the proportion of fines was significantly higher than in the STB site. Mr Jorissen agreed that it will be similar to large scale dredging, while noting that TTRL’s operation will be more controlled than conventional dredging. He accepted that in some dredging operations, the fines content can be significantly higher than at the TTRL mining site.
271. Dr Barbara observed that dredging projects are typically for a defined and much shorter period than the 35 years sought by TTRL. In the case of port maintenance dredging, it could be ongoing but have intervals where it ceases for some months.
272. TTRL’s application documentation, and the spatial mapping we requested, showed the spatial extent of the sediment plume. Under most metrological and oceanographic conditions, the plume will be largely experienced to the east and southeast of the mining site. The median effect for surface waters, when mining at the eastern end of the site, will be a local increase in SSC. Within an area extending about 7 km north of the mining, and tapering off to around 30 km southeast, the current (background) concentration of 0.5 – 1.0 mg/l SSC will increase to be around 1.0 – 2.0 mg/l SSC. Existing median background concentrations of 2.0 mg/l or more already occur over most of the Patea Shoals.

¹⁰⁸ Section 5.1.4, *Sediment Plume Modelling, Prepared for Trans-Tasman Resources Ltd, NIWA, October 2015*

¹⁰⁹ Paragraph 79, Expert Evidence of Michael Dearnaley on Behalf of Trans-Tasman Resources Limited, 15 December 2016

¹¹⁰ Transcript 24 February 2017, page 909

10.1.1 First expert conferencing

273. Joint expert witness conferencing about the sediment plume was attended by Dr Dearnaley, Dr Berthot, Dr Petch, Mr Greer, Mr Jorissen, and Dr Barbara. The broad issues identified by the experts were:

- Basis for the Run of Mine (ROM) particle size distribution
- Source terms for the plume modelling
- The representation of wave conditions in the near-field modelling
- Differences between the NIWA and HR Wallingford interpretation of the laboratory results for the settling velocity tests and implications for source terms used in the sediment plume modelling
- Temporal variability of the sediment plume and its implications for effects

274. In relation to those issues, the points of agreement and disagreement among the experts are set out as follows:

Disagreement

- Whether the average wave conditions used in the modelling (2 m significant wave height and 7-second period) are representative of the wave climate in the mining area.
- Whether the near-field modelling assumption, that 25% of the slowest 0.1 mm/s fines is retained in the mining pit, is conservative.
- Whether the differences between the NIWA and HR Wallingford interpretation of the laboratory results for the settling velocity tests should be incorporated in the sediment plume modelling.
- Whether the proportional effect of an increase in the source terms would be significant.

Agreement

- If the discharge contains a higher proportion of fine sediment fractions than the ~3.4% adopted in the modelling, the predicted suspended sediment concentration in the plume (SSC) may be increased by a similar ratio, leading to a significant increase in the suspended sediment concentration.
- The return of mining tailings is the main source of release of fine sediments. Other sources are insignificant by comparison.
- The HR Wallingford laboratory tests are comprehensive and sound for informing the settling and resuspension properties of the finest fraction (<38 microns) of the tailings.
- The rate of fine sediments that will be released from the mining site in a passive plume will be affected by variability in wave and current conditions, the mining operations, bed material composition and mining pit operations.
- The temporal variability of fine sediment release has implications for effects of the sediment plume.
- Variability in sediment leaving the mining area could lead to increases in higher order percentiles of SSC.
- Increases in higher order percentiles of SSC will be less evident with distance from the mining area, due to the dominance of storm induced resuspension events.

- Increases in higher order percentiles of SSC may be more evident close to the active mining where higher order SSC percentiles are dominated by the plume derived SSC.
- The sediment plume model simulates the key processes and is an appropriate, useful, tool for assessing the potential effects of sediment being released from the mining site on suspended sediment concentrations in the South Taranaki Bight, away from the mining site.

10.2 Sediment Plume Worst Case Scenarios

275. Having heard evidence from the parties, especially regarding average (representative) versus worst case modelling and lack of sensitivity analysis, we asked the experts to reconvene and focus on a 'worst case scenario'. The conferencing was attended by the same experts and they set the parameters and assumptions for the worst case scenario. These parameters were not established by the applicant.
276. The outcomes of the conferencing defined the parameters and assumptions of a worst case scenario, which were subsequently fed into a remodelling of the sediment plume and into the optical model. The modelled parameters included wave periods and conditions; percentage of fines; ocean current flows; no pit at beginning of a run; and sloping edges of the pit.
277. The worst case scenario is a combination of individual worst case parameters. The parameters from the original model were used, but combined in a way that could lead to the worst sediment discharge from the IMV. The scenario allows the worst case release rates to occur at times of different hydrodynamic conditions. This provides a broad indication of worst case conditions.
278. Discharge rates of the different settling classes (see paragraph 243) were increased by varying amounts, including by up to 130% for the 0.01 mm/second class. On average, across the four settling classes, the worst case discharge rate was increased by 32%. The source terms (fines content and rate of discharge) were modelled as happening over periods of weeks to a month, rather than the hours to days as was adopted for the representative modelling. A significant change in assumptions which is not 'worse' is that operational downtime would be 29%, as opposed to the 20% figure used in the original modelling.
279. During joint witness conferencing, Dr Dearnaley informed the other experts that TTRL would not mine material with an ultra-fines content of 10%. He also said that the highest ultra-fines content that TTRL could operate at for a period of weeks to one month, was 2.25%. TTRL had confirmed that *"the costs and negative implications to equipment ... is both prohibitive and imprudent."*¹¹¹
280. In a later written response to DMC questions Dr Dearnaley stated that:
- "I also note that there are commercial incentives not to continue mining in areas of higher fines content. Such mining would lead to degradation of the quality of the mined product in terms of fines*

¹¹¹ Paragraph 11, Joint Statement of Experts in the Field of Sediment Plume Modelling – Setting Worst Case Parameters, 2 March 2017

*content. Eventually this would significantly reduce the value of the mined product and the reputation of the mine to provide quality mined product.*¹¹²

281. Dr Dearnaley also acknowledged that *“if the mining operation were able to be sustained at the highest release rate continuously ... the results of the plume modelling would be substantially different and the predicted impacts would also increase”*¹¹³. However, Dr Dearnaley considered that this would be an unlikely outcome for three reasons:
- Most fines will be trapped within the mining lanes. It is only at the start of each lane (before a pit is created), that the slow settling fines (0.1 mm/second) will not be trapped.
 - Proposed Condition 4.d.¹¹⁴ does not allow the maximum rate of discharge for fines to continue for an extended period. Averaged over a week, the condition requires that the mined sediment includes less than 1.8% ultra-fines.
 - A high fines content in the mined material would degrade the quality of the processed material, and therefore adversely impact on the reputation of the product.
282. When considering the worst case scenario, none of the experts (Dr Dearnaley excepted) had seen the run of mine source data. For that reason, Mr Jorissen, Mr Greer, and Dr Barbara felt unable to sign off on the 2.25% or 10% figures referred to above. In the Joint Witness Statement dated 2 March 2017, they state that *“the independent experts have not been provided with the complete reports including a full analysis of the sediment samples and cannot verify the validity of the sediment fractions that have been used in the modelling. The experts have had to make assumptions on the PSD and processing rate onboard the IMV ... without being able to review how the values have been derived”*¹¹⁵. We note that the experts were provided with raw data after they had released that Statement.
283. The points of agreement and disagreement arising from the joint witness conferencing on the worst case scenario were:

Agreement

- The worst case scenario should be based on 2.2.5% ultra-fines being encountered in the initial (first 300 m) of a mining lane. The remaining 600 m is modelled at 1.6% ultra-fines.
- On average, each 5 m deep 300 m length of mining lane will take 20 days to complete (14.8 days mining, 5.2 days down time)
- Mound creation, at the start of a mining lane, will occur for 1/9th of the time.
- Retention of fines within the mining pit has been defined in relation to percentage retention of different settling classes of sediment (see table in joint witness statement). The effect of different wave heights has been taken into account.
- The NIWA interpretation of settling classes has been used in preference to the HR Wallingford interpretation (see table in joint witness statement).

¹¹² Dr M Dearnaley, letter to Atkins Holm Majurey, *Reponses to DMC Questions to Applicant*, 28 April 2017

¹¹³ Ibid., letter 28 April 2017

¹¹⁴ The number of the proposed condition remains unchanged in the set of the conditions which we have imposed

¹¹⁵ Paragraph 8, *ibid.* Sediment Plume Joint Witness Statement

- Time varying source terms have been created based on 2.25% and 1.6% ultra-fines and different wave scenarios (see table in joint witness statement).
- Comparisons between the scenario outlined in the Impact Assessment and worst-case scenario have been made to understand the difference in impact.
- Other parameters are kept as used in the original modelling.
- Seabed sediment erosion parameters cannot be established for the worst-case scenario.
- The worst-case scenario should be used to re-run the optical model.
- A condition should be imposed setting an upper limit of 2.25% ultra-fines (<8 µm), averaged over a 1-week period.

Disagreement

- Based on the lack of evidence, it is not possible to accurately define the worst-case parameters for fines discharge (Barbara and Greer).
- Without having been able to see the source data, whether 2.25% ultra-fines content is a worst case scenario that could occur for a period of weeks to one month (Barbara and Greer).
- The effect of high period waves on retention of some fines has not been thoroughly explored (Greer).

10.3 Optical modelling

10.3.1 Base case modelling

284. Optical modelling links sediment plume modelling and some of the consequent effects on ecology. The relevant optical effects are a reduction in light within the water column and to the seabed. Information provided by the optical modelling allows ecologists to calculate potential decreases in primary productivity at specific locations. The reduction in light is also relevant to human recreational use (diving).
285. The original ('base case') modelling was undertaken in 2015. It provided information about three different outcomes. That is: background (no mining); mining at site A (eastern end of the mining site); and mining at site B (western end of the mining site). Two years were simulated to produce outcomes that included natural variability.
286. The results of the base case modelling are shown in the right hand columns of two tables in our report. One is Table 9 on page 72, which shows outcomes in terms of days when there would be more than 1% of the surface light level received at the seabed. The 1% figure is a threshold for primary production, which we discuss in Chapter 4-11.1 of our report. The other table is Table 14 on page 164. It shows changes to the number of high visibility days, which is an indicator of effects on recreational diving.

10.3.2 Worst case modelling

287. As set out in Chapter 4-10.2, during the course of the hearing, the DMC asked TTRL to undertake worst case scenario modelling of the sediment plume. Because the optical model relies on the sediment plume model for its inputs, the next logical step was to then re-run the optical model using the sediment plume worst case parameters.
288. The optical re-modelling therefore relied on the assumptions of the worst case sediment plume modelling which are referred to in paragraph 278. In particular, like the worst case sediment plume modelling, it used a time varying source term that reflects potential variations in fines content and the timing of fines release.
289. The DMC requested that the worst case modelling include eight specific locations. Most of those sites were not included in the original optical modelling. However, modelling using the original parameters was used to back calculate optical effects at those eight sites. This allowed the original and worst case scenarios to be compared.
290. The worst case modelling differed from the original modelling in that it considered two thresholds for primary productivity, being the 1% and 0.1% levels of surface light received at the seabed. Those levels are the equivalent of 0.4 and 0.04 mol m²/day. We refer to those thresholds again in Chapter 4-11.1 of our report. The re-modelling highlights the following findings, including in comparison with the original 2015 modelling:
- The average proportions of the seabed in the SMD with mean light intensity greater than 0.04 and 0.4 mol m²/day was estimated to be 28% (3,775 km²) and 11% (1,478 km²) respectively. These areas are predicted to reduce to about 26% and 9% respectively due to mining.
 - Averaged across the sediment model domain, optical effects relevant to estimating effects on primary productivity were 43.8% greater under the worst case scenario than under the original modelling.
 - At selected sites¹¹⁶, on average, optical effects of mining are 41.0% greater when the worst case conditions apply. These conditions are periodic events and will not occur continuously.
 - Changes in the predicted optical effects between worst case modelling and the earlier modelling varies between the selected sites. For instance, optical effects at The Crack 2 are 29.6% greater under the worst case modelling, whereas changes at The Rolling Grounds are 57.9% greater.
291. Averaged across the SMD, the worst case modelling predicts light reduction at the seabed of 21% to 30%, by comparison with the original modelling of 15% to 23%. At the eight sites which we asked TTRL to consider, the worst case modelling notes that optical effects will on average be 41% greater than in the original modelling. However, light reduction at some of the reference sites will be quite different to that average.

¹¹⁶ The selected sites are those included in Table 9 on page 74

10.3.3 Euphotic zone effects

292. As noted above, the optical modelling included estimating the effect on euphotic zone depth. The effect was variable. The worst case modelling report states that:

“The degree to which euphotic zone depth is reduced depends on how the suspended sediment plume behaves – its movement by the currents, the mixing dispersion) of the material in the water, and the settling of the sediment to the seabed. The movement of the plume is most commonly in an easterly direction from the mining site. Because there is substantial variability in how the suspended sediment plume behaves, both in terms of the direction it moves and how rapidly the sediment disperses or settles, the optical effect reduces with distance away from the mining site.”¹¹⁷

293. Euphotic zone depth under the worst case modelling is predicted to decrease 5% to 43%, by comparison with the original modelling of 3% to 34% (all figures for mine site A). The greatest decreases are at The Crack 1 and 2 sites.

294. The number of days which have more than 1% light at the seabed are predicted to decrease 14% to 83%, by comparison with the original modelling of 8% to 73% (all figures for mine site A). Again, the greatest decreases are at The Crack sites. The decreases in terms of days and relative percentages are shown by Table 9 on page 72.

10.3.4 Visibility effects

295. At the mining site itself, the modelling predicts reductions in midwater visibility between 83% (mine site A) and 66% (mine site B). These figures are an increase on the original modelling, which predicted 77% and 61% respectively.

296. Averaged across the SMD, the worst case modelling predicts that average light in the water column¹¹⁸ will reduce by between 2.4% and 2.9% (mine A compared with mine B). This is an increase by comparison with the original modelling, which predicted 1.6% to 1.9%. These reductions will occur mainly to the east (downcurrent) of the project area, although some current and weather conditions will lead to the effects being experienced in other directions.

297. High visibility days (greater 5 metres) under the worst case modelling are predicted to decrease 3% to 65%, by comparison with the original modelling of 2% to 53% (all figures for mine site A). The greatest decreases are at The Crack 1 and 2 sites. The decreases in terms of days and relative percentages are shown by Table 14 on page 164.

10.4 Findings on the Sediment Plume and Optical Modelling

298. The physical conditions of the STB are variable and turbulent, with consequences for the nearshore and seabed in terms of periodically elevated SSC. There are effects on habitats and their

¹¹⁷ Section 2.2, *Optical Effects of Proposed Iron-Sand Mining in the South Taranaki Bight Region – Worst Case Update*, NIWA, April 2017

¹¹⁸ The entire body of water from sea surface to seabed

inhabitants, and we accept that there is a good level of natural adaptation and resilience to the variability in SSC. Surface waters more than 5 km offshore are generally clearer.

299. The behaviour of the fine / ultra-fine particles in the marine environment is critical to our assessment. We must understand the nature of those particles, where they will be, where they might spread and settle, and what impact they will have on marine ecology. This depends on us having a sufficient degree of confidence in the relevant models.
300. A key issue for us are the samples which were taken and tested to characterise the seabed material. The tested material was either suspended fines from run of mine, or fines that had been processed by the pilot processing plant. It is unclear to us exactly how material for input to the pilot plant was selected, and how the specific outputs from the pilot plant were then selected for testing. We accept Mr Brown's advice that the process satisfied the international JORC code in respect of methodology and chain of custody.
301. We consider that the experts took a reasonable approach by stating that *"the plausible maximum source terms will thus be associated with the highest ultra-fines content [run of mine] that TTR can process on the IMV. TTR have confirmed that the highest ultra-fines content that they could operate at for a period of weeks to one month is 2.25%"*¹¹⁹. Three of the experts (Barbara, Jorissen, and Greer) noted they were unable to sign off on the 2.25% and one month period without having reviewed the source data. The joint witness statement on the worst case scenario recommended a condition to enforce an upper limit of 2.25% ultra-fines.
302. In the event, TTRL proffered a condition that there would be no more than 1.8% fines content, averaged over a week.
303. We consider that conditions we have imposed, being Conditions 4, 5, 6, 51, 52, and 87.f, and the SSC limits in Schedule 2, will act together to keep the size and nature of the sediment plume at or below the modelled levels of impact. In our opinion, these conditions represent a robust approach because they address both output and receiving environment parameters.
304. Regarding the laboratory tests carried out by HR Wallingford, we agree with the experts that those tests are *"comprehensive and sound for informing the settling and resuspension properties of the finest fraction (< 38 µm) of the tailings."*¹²⁰
305. We would have preferred to see sensitivity analyses performed on the various source terms used in the sediment plume modelling. Failing that, we accept that there will be some degree of effect related to each of the terms although we cannot be certain about the exact scale and duration. The original modelling and the worst case modelling have demonstrated that effects do change depending on the variables (source terms) used.
306. We consider it unlikely that all of the worst case parameters that make up the scenario would occur together at one time. In addition, it is unlikely that such a situation would continue for an extended

¹¹⁹ Paragraphs 10 and 11, Joint Statement of Experts in the Field of Sediment Plume Modelling, 16 February 2017

¹²⁰ Paragraph 22, *ibid.*, Sediment Plume Joint Witness Statement

period of time. In those respects, we consider the worst case scenario is an extreme and does not represent a plausible outcome. We prefer the representative modelling, while acknowledging that variations in source terms and other parameters could have significant impacts for short durations.

307. The first Joint Witness Statement of the sediment plume experts agreed that any increase in the percentage of fines will have a proportionate effect on the SSC in the sediment plume¹²¹. We tested the applicability of thresholds with witnesses at the hearing and are satisfied that appropriate measures were used. In relation to conditions, we note that any of the source terms have the potential to be used as an enforceable threshold. However, we do not think that is a necessary addition to the suite of conditions related to the discharge and sediment plume.
308. In these circumstances, we consider that an ‘averaging’ approach is acceptable for indicating the broad effects of the sediment plume over time and in a spatial sense. This finding does not detract from our other findings about specific effects in specific locations. We also have lesser confidence in the modelling as applied to ‘near-field’ areas – being from the point of discharge to within 3 km.
309. We consider that the nature of the receiving environment must also be taken into account. The receiving environment has many characteristics, but the one we concern ourselves with here is the background concentration of suspended sediment (SSC). The modelling of background (existing) SSC shows that, at the sea surface, SSC is typically above 2 mg/l within 8 – 13 km of the shoreline. We have used 2 mg/l in this context, as it is a conservative threshold for fish avoidance provide to us by Dr MacDiarmid.
310. Whether that background is called ‘natural’ or not is not an issue for us in terms of assessing effects. Background suspended sediment exists, it is part of the existing environment, and is also highly variable. There is no steady state against which modelled outputs can be measured. In that respect, we accept the use of time series modelling to understand the variability and duration of impacts over an extended period.
311. The optical modelling relies on the sediment plume modelling and demonstrates several key effects. We consider potential effects on primary production to be the most important of these. We consider that the optical effects will be significant at some sites and deal with this finding in more detail in Chapter 4-11.4 of our report.
312. TTRL’s description and modelling of the physical environment is, in many cases, based on the concept of a sediment model domain (see paragraph 178 and Figure 2). Although this has been useful for some purposes, we note the criticism of Dr Chiffings (see paragraph 335). We have therefore considered environmental information based on the SMD with some caution, which has contributed to our findings to ‘hard code’ caution into the consent conditions.

¹²¹ Paragraph 16, *ibid.*, Sediment Plume Joint Witness Statement

11. Oceanic Productivity

11.1 Primary Productivity

313. We heard evidence from the following experts:

- Professor Cahoon, on behalf of TTRL, is an expert in benthic micro-algal ecology, demersal zooplankton ecology, nutrient fluxes, and benthic primary production.
- Dr James, on behalf of TTRL, is an expert in aquatic ecosystems, plankton and benthic ecology, and food web interactions.
- Dr Chiffings is an expert in biological oceanography, and was engaged by the EPA to advise on plankton, fish and marine mammals.
- Dr Barbara, on behalf of the Fisheries Submitters, is an expert in phytoplankton and bacterial interactions.

11.1.1 The producers

314. A starting point for our consideration of potential effects arising from the project is the generation of biomass within the water column and on the seafloor. The evidence of Professor Cahoon provided us with an overview of the biological communities that contribute to the natural process known as primary productivity – the generation of biomass. Professor Cahoon was an author of TTRL’s Report 16, Effects on Primary Production of Proposed Iron-Sand Mining in the South Taranaki Bight Region (2015).

315. Professor Cahoon’s evidence states that the organisms contributing to primary productivity include:

- Microphytobenthos (MPB): This is a diverse group of mostly mobile organisms which either adhere to or live very near the seabed. The group is distinct from phytoplankton in being specially adapted to a benthic lifestyle. Worldwide, the occurrence of MPB is variable in both space and time.
- Phytoplankton: This diverse group of microscopic organisms are suspended in the water column, and includes both mobile and floating species.
- Macroalgae (seaweeds): Macroalgae are typically attached to hard substrates, although some exhibit a floating lifestyle.

316. Primary production is the base of the oceanic food chain. At and near the seabed, microscopic organisms (MPB) feed on nutrients in water and sediment. Those communities are grazed by larger (but still very small) organisms (phytoplankton), which in turn are food for increasingly larger organisms such as zooplankton which inhabit all levels of the water column. Primary production also includes macroalgae (seaweeds of all sizes) most of which rely on being attached to a hard substrate such as rock, as well as sufficient light and nutrient levels. One of the nutrients available to the benthos is organic carbon arising from the death and decomposition of organisms, including MPB and phytoplankton.

317. Macrobenthic organisms are not primary producers themselves but to some extent rely on primary production. They are visible to the naked eye and include a wide range of species living at the bottom of the water column such as worms, snails, sponges and many other species. Some macrobenthic animals ingest sediment and digest associated bacteria, microalgae and organic matter. Some are filter feeders that feed on suspended algae and detrital particles. Others are carnivores.
318. Primary production occurs at both the seabed (benthic) level, and in the water column above the seabed. All primary production, but especially at the benthic level, is naturally limited by light availability due to depth. Primary production is limited in time and space by varying factors such as nutrient supply, water temperature, and light availability due to suspended sediment. Light availability also changes on a daily and seasonal basis. These factors lead to a high degree of natural variability in productivity. A study of actual phytoplankton production in the STB and adjacent waters found variability of 50% within 2-5 days across the area¹²².
319. Professor Cahoon's evidence informed us that there is some basic knowledge about phytoplankton, but little information about the relationship between phytoplankton and light flux. He said there is no information about MPB, and the existence of MPB in the STB is only inferred from light levels. He also made the point that primary production by phytoplankton and MPB are essentially "uncoupled" in continental shelf ecosystems, as they respond to different limiting factors¹²³.
320. Professor Cahoon said that the organisms that graze on MPB are flexible in their foraging habits because the distribution of MPB naturally varies over space and time. He considered that local MPB production and consumption is therefore pre-adapted to a patchy and disturbed habitat¹²⁴. He noted that MPB is adapted to sediment turnover rates ranging from millimetres to centimetres each day¹²⁵.

11.1.2 Effects of light reduction

321. The euphotic zone depth (the water column depth above which positive net production occurs) is indicative of the potential for primary production and therefore the 'health' of the ecosystem.
322. The 1% primary production threshold is called the euphotic zone depth. We understand that using a 1% threshold is a 'traditional' view of the euphotic zone depth. However, Professor Cahoon stated that various studies, including his own, have shown that productive phytoplankton, microphytobenthos (MPB) and macroalgae can grow naturally at considerably lower light levels. Professor Cahoon considers that those studies reflect a considerable capacity for adaptation to

¹²² Page 12, TTRL Report 16: *Effects on Primary Production of Proposed Iron-sand Mining in the South Taranaki Bight Region*, Dr Lawrence B. Cahoon, October 2015

¹²³ Para 35, Expert Evidence of Dr Lawrence Cahoon on Behalf of Trans-Tasman Resources Limited, 15 December 2016

¹²⁴ Para 37, *ibid.* Evidence of Dr Cahoon

¹²⁵ Para 3, *ibid.*, Evidence of Dr Cahoon

reduced light. He therefore considered effects at the nominal 1% level (0.4 mol m²/day)¹²⁶, and well as a lower euphotic zone limit of 0.04 mol m²/day (0.1% light level).

323. An ability to adapt in this way is one of the underlying assumptions for his opinion that effects on primary production will, on average, be minor.
324. The degree of effect in terms of light reduction is set out in TTRL's Report 16¹²⁷. The Report gives the area available for primary production in the SMD as 3,805 km² (at the 0.1% threshold) and 1,494 km² (at the 1.0% threshold).
325. The Report averages components to provide single indicative figures. Table 3.2 in the Report notes that there will be a 13% to 19% reduction in primary production from microphytobenthos. Changes in primary production due to reductions in light received will largely occur over the eastern Patea Shoals.
326. The effects will be variable, depending on location relative to the mining site and SSC in the sediment plume. The Report calculates that approximately 220 km² of the area that would otherwise be available for primary production at the 1.0% level, will be subject to a 50% reduction in light.
327. At the SMD scale, Professor Cahoon noted that there is considerable variation in the annual average of light received at the seabed. His conclusion is therefore that primary producers are well adapted to that degree of variation, as are species further up the food chain. Dr James told us that changes to euphotic depth at reef sites further 10 – 15 k from the mining site will be within the range of background variability¹²⁸.
328. Professor Cahoon's evidence states that natural variation of the annual-average total light reaching the seabed is between +36% to -32% of the long term mean¹²⁹. Table 9 below, based on information in the updated optical modelling report (including the base case and the worst case), shows relative change in terms of fewer days of > 1% light at individual locations.
329. The following table shows reductions in the proportion and area receiving light below the euphotic thresholds.

¹²⁶ Moles ("mol") of light measures the number of photosynthetically active photons accumulated in a square meter over the course of a day – expressed as mol/m²/day.

¹²⁷ Page 14, *ibid.*, TTRL Report 16

¹²⁸ Transcript 21 February 2017, page 419

¹²⁹ Paragraph 27, Expert Evidence of Dr Lawrence Cahoon on Behalf of Trans-Tasman Resources Limited, 15 December 2016

Table 9: Light Received at Seabed at Selected Sites¹³⁰

>1% light at seabed	Worst case		Base Case	
	Site A	Site B	Site A	Site B
Source A to Whanganui 20 (17.6km N) ¹³¹				
Existing Days	200			
Predicted Days	- 116	- 53	- 86	- 32
Change	- 58%	- 26%	- 43%	- 16%
Graham Bank (17.7km ESE)				
Existing Days	205			
Predicted Days	- 125	- 64	- 95	- 47
Change	- 61%	- 31%	- 46%	- 28%
The Crack 1 (4.8km NE)				
Existing Days	142			
Predicted Days	- 95	- 44	- 87	- 34
Change	- 67%	- 31%	- 61%	- 24%
The Crack 2 (7km E)				
Existing Days	140			
Predicted Days	- 117	- 54	- 102	- 43
Change	- 83%	- 38%	- 73%	- 31%
North Traps (26.2km E)				
Existing Days	141			
Predicted Days	- 45	- 17	- 34	- 11
Change	- 32%	- 12%	- 24%	- 8%
Rolling Grounds (17.5km SE)				
Existing Days	- 1			
Predicted Days	- 4	- 1	- 0.1	- 0.3
Change				
Project Reef (location undefined) ¹³²				
Existing Days	140			
Predicted Days	- 64	- 29	- 50	- 19
Change	- 46%	- 21%	- 35%	- 13%
Source A North 20 (18.5km ESE)				
Existing Days	132			
Predicted Days	- 18	- 7	- 10	- 4
Change	- 14%	- 6%	- 8%	- 3%

Note: Site A and Site B are locations at the eastern and western ends of the mining area respectively, chosen by TTRL as being representative for the purposes of modelling. Being at either end of the mining site, they 'bracket' the range of effects.

330. Professor Cahoon's original opinion about effects on primary production did not change in response to the re-modelling of optical effects under the worst-case scenarios, shown in Table 9. His conclusion remained that effects will be "minor overall, spatially limited in terms of local, more

¹³⁰ Incorporates information from Figures 2.14 to 2.21, and Tables 2.4 to 2.11, and Table 3.2 in *Optical Effects of Proposed Ironsand Mining in the South Taranaki Bight Region - Worst Case Update*, NIWA, April 2017. The "Base Case" is NIWA's 2015 work, the results of which are also set out in the 2017 report.

¹³¹ Distance (and direction) is from the nearest edge of the mining permit area, to the latitude / longitude given for the site in the Optical Effects report

¹³² The "Project Reef" has been described by submitters as 11km 'directly offshore' from Patea and about 'half way to the mining site'. We assume that this places it somewhere between 14km NE and 17km E of the mining site

intense effects, and rapidly mitigated by physical and biological processes typical of continental shelf ecosystems".¹³³

331. Professor Cahoon's conclusions about potential impacts on primary production are based on the sediment plume's dispersal occurring as *"irregular streams and packets, depending on prevailing wind stress"*. He noted that this will lead to variable outcomes away from the mining site, experiencing *"a range from little effect, to substantial effect infrequently, to frequent substantial effect"*¹³⁴. On that basis, his opinions¹³⁵ are that:
- Effects on planktonic production will be minor at the scale of the SMD, and difficult to distinguish from background variability.
 - Effects on macroalgae are likely to be small at the scale of the SMD, with little impact on deep coralline algae, which are well adapted to very low light levels.
 - There will be a reduction in colonisation depth and growth rates of macroalgae at Graham Bank (significant) and The Traps (minor)¹³⁶.
 - Isolated rocky reef outcrops immediately east of the proposed mining site, if they support macroalgae, could be more severely impacted by sediment from Site A.
 - Under the worst-case scenario (revised sediment plume modelling), effects on phytoplankton production will not be significantly different than originally estimated¹³⁷. *"The worst-case scenario would not create conditions at all close to those already occurring at event time scales in this continental shelf ecosystem"*¹³⁸.
332. Professor Cahoon was also of the opinion that local effects on MPB will be substantial, due to frequent reductions of light relative to background levels. The effects will be significant and detectable within 1 to 2 km of the mining site¹³⁹. Those effects will be localised on the eastern side of the Patea Shoals, where MPB is likely to be the dominant benthic primary producer¹⁴⁰. The effect will be greatest in areas of deeper MPB habitat, where a small absolute decrease in light can reduce light below the threshold for MPB growth. The reduction could be up to 45% in carbon flux¹⁴¹.
333. The relevance of a decrease in MPB carbon flux¹⁴² is that it reduces the organic carbon availability to benthic consumers. If the reduction exceeds natural variability, that may have a flow on effect to local

¹³³ Paragraph 15, Expert Supplementary Evidence of Dr Lawrence Cahoon on Behalf of Trans-Tasman Resources Limited, 11 April 2017

¹³⁴ Page 16, TTRL Report 16: *Effects on Primary Production of Proposed Iron-sand Mining in the South Taranaki Bight Region*, Dr Lawrence B. Cahoon, October 2015

¹³⁵ Page 20, *ibid.* TTRL Report 16

¹³⁶ Pages 16 and 20, TTRL Report 16: *Effects on Primary Production of Proposed Iron-sand Mining in the South Taranaki Bight Region*, Dr Lawrence B. Cahoon, October 2015

¹³⁷ Paragraph 11, Expert Supplementary Evidence of Dr Lawrence Cahoon on Behalf of Trans-Tasman Resources Limited, 11 April 2017

¹³⁸ Paragraph 12, *ibid.*, supplementary evidence of Dr Cahoon

¹³⁹ Paragraph 9, *ibid.*, supplementary evidence of Dr Cahoon, and Paragraph 147, Expert Evidence of Mark Richard James on Behalf of Trans-Tasman Resources Limited, 15 December 2016

¹⁴⁰ Page 17, *ibid.* TTRL Report 16

¹⁴¹ Paragraph 33, Expert Evidence of Dr Lawrence Cahoon on Behalf of Trans-Tasman Resources Limited, 15 December 2016

¹⁴² The amount of organic carbon released by decomposition, which is then available for use by other organisms

organisms which feed primarily on MPB. The flow on effect may include the predators of those organisms. TTRL Report 16 states that longer lived benthic organisms may provide a better indicator of variability and trends in benthic carbon flux than direct measurements of MPB¹⁴³. As noted in TTRL's Report 16¹⁴⁴:

“Impacts on higher trophic levels depend on the importance of MPB in this area as a primary food source and the nature of the benthic consumer population. While modelling can provide guidance on the possible scale of impacts, the absence of any validation data on this critical issue cautions careful interpretation”.

334. Dr James drew an overall conclusion in relation to animals which rely on primary productivity. He said that even a 25% reduction in MPB will be immeasurable higher up the food web. He drew that conclusion because of natural variability and wide foraging ranges¹⁴⁵.
335. Dr Chiffings' review was critical of TTRL's overall approach to the impact assessment, stating that it did not meet best practice in three respects, which were:
- Lack a formal process of risk assessment, proposed mitigation, or proposed management of residual risk.
 - The frequent adoption of the sediment-modelling domain as the principal area of consideration in evaluating impact.
 - No specific evaluation, in terms of impact or mitigation, of environmentally sensitive areas (ESAs) or valued ecosystem components (VECs).
336. His major concern related to primary production was the second bullet point, that the SMD does not represent a natural boundary within which assumptions can be made about the overall impacts of the project. He stated that there is a strong likelihood of hydrodynamic gradients, and therefore dispersion boundaries, and that it is normal practice to assess impacts in the context of such boundaries.
337. Taranaki Regional Council's submission provided us with a useful table which indicated the scale of potential effects on water column primary productivity. As shown by the table, the area of greatest effect (20% to 60% decrease) will be confined to a relatively small 1 km² area, only when mining towards the eastern end of the site. We note that the table's total area of 13,366 km² represents the extent of the SMD.

¹⁴³ Page 27, *ibid.* TTRL Report 16

¹⁴⁴ Page 27, *ibid.* TTRL Report 16

¹⁴⁵ Transcript 21 February 2017, page 411

Table 10: Decrease in Primary Production

Decrease in water column Primary Production (%)	Area affected (km ²)	
	Mine A	Mine B
< 1	9,956	10,374
1 - 5	2,705	2,710
5 - 20	704	282
20 - 60	1	0
> 60	0	0
Total	13,366	13,366

Source: Taranaki Regional Council submission (Table 1), original source cited as "Meeting Paper from meeting between TTR and Taranaki Regional Council held on 19 April 2016"

11.2 Secondary Productivity

338. TTRL's Report 19 provides an historical review of zooplankton biomass in the STB and the factors that drive its production and location¹⁴⁶. Dr Chiffings referred to zooplankton as being part of secondary production. Zooplankton floats on currents and its location is therefore influenced by macro and local scale environmental processes which can change seasonally and over shorter time periods. However, as a general observation, the information we have seen indicates that zooplankton location is strongly influenced by the Kahurangi upwelling and the D'Urville current.
339. Studies of zooplankton biomass, such as one in 1980 reviewed by Report 19 and another in 2015 reviewed by Report 9¹⁴⁷, are snapshots of conditions at those times. They both indicated zooplankton biomass of over parts of the Patea Shoals that are some of the highest recorded in New Zealand. The 1980 study showed a concentration over the Graham Bank area, whereas the 2015 study showed peaks over the mining site and towards Whanganui.
340. Species such as krill (a small shrimp) feed on zooplankton. Krill in turn are fed on by baleen whales as well as some species of fish and seabirds.
341. Dr Chiffings told us that both primary and secondary production are highly variable. He made the point that at larger scales, the variability does not matter, as the mining impact will be very small relative to the scale of those processes¹⁴⁸. However, at the fine scale, he said it could be critical in terms of impacts from the mining in the context of annual variations in primary and secondary productivity. He also said that this is probably not an issue when considered over the life of the project, but is relevant in relation to monitoring¹⁴⁹.

¹⁴⁶ TTRL Report 19: *Zooplankton and the Processes Supporting Them in Greater Western Cook Strait*, NIWA, November 2015

¹⁴⁷ TTRL Report 9: *Zooplankton Communities and Surface Water Quality in the South Taranaki Bight*, NIWA, May 2015

¹⁴⁸ Transcript 22 February 2017, pages 577/578

¹⁴⁹ Transcript 22 February 2017, page 578

342. There have been observed aggregations of krill in the central and western parts of the STB. Those locations are some distance from the mining site, to the west and south. Dr Chiffings, in his review prepared for the EPA, stated that the broad conclusion of the NIWA report ecological effects¹⁵⁰ in relation to ecosystem impacts stated that *“the proposed mining activities will have a negligible impact on zooplankton, including krill, populations in the STB”* should be accepted.¹⁵¹
343. Dr Chiffings agreed with Professor Cahoon that it is important to assess effects at an ecosystem scale, but he noted that use of the SMD as an appropriate boundary for the ecosystem had not been justified. With reference to modelled predictions of turbidity he agreed that the STB is an extremely dynamic system and that the averaging of evaluations over a period of a year is reasonable. Despite agreeing with an approach based on averaging over time, Dr Chiffings observed that:

“The issue of local impacts is really very specifically around any particular habitat or any particular type of habitat that’s not generically distributed throughout the entire region, but is specifically in the downstream path of the sediment plume”¹⁵².

11.3 Expert Conferencing

344. Expert conferencing on primary productivity was attended by Professor Cahoon, Dr James, Dr Barbara, and Dr Chiffings. No disagreement was recorded regarding oceanic productivity. The following points of agreement were recorded.

Oceanic Productivity

- The spatial scale of impacts on light flux is of importance to assessment of ecosystem scale responses.
- Optical modelling must be well executed, realistic and robust, to provide scientifically sound assessment of the optical effects of the sediment plume.
- ‘Chlorophyll A’ measurement remains the standard oceanographic method for measuring microalgal biomass.
- Monitoring for phytoplankton biomass and taxonomic composition, and microphytobenthos biomass is a reasonable approach to evaluating ecosystem scale food web effects.
- Evaluation of ecosystem scale effects requires modelling of energy flows across the SMD, rather than just at very local scales.
- Relatively small areas near the mining activity will experience more significant effects on energy flux to the bottom.
- A 25% reduction in light flux to the bottom will not necessarily result in a 25% reduction in ecosystem production, as the system relies heavily on water column as well as benthic production.
- The hydrodynamic, sediment plume, optical, and primary production modelling efforts were sound and yielded high confidence in their accuracy.

¹⁵⁰ TTRL Report 17: *Assessment of the Scale of Marine Ecological Effects of Seabed Mining in the South Taranaki Bight: Zooplankton, Fish, Kai Moana, Sea Birds, and Marine Mammals*, NIWA, September 2015

¹⁵¹ Section 4.3.2, *Lodgement Review of Effects on Plankton, Fish and Marine Mammals*, DHI, September 2016

¹⁵² Transcript 22 February 2017, page 587

- Modelling is a reasonable approach to estimating the variability inherent in this very dynamic continental shelf ecosystem. The proposed monitoring will help validate and confirm the model results are as predicted.

11.4 Findings on Oceanic Productivity

345. Primary productivity is driven by nutrient and light availability. The Patea Shoals is an important site due to its large area of relatively shallow depths (up to 30 m). Shallow water allows light to penetrate to the seabed and drive benthic primary productivity – whether from MPB or macroalgae. We accept that benthic primary productivity is an important component of the overall health of inshore ecosystems, forming the base of the food web in such locations. A reduction in light levels due to SSC is therefore of potential concern. Most of the predicted changes in received light at the reference sites will exceed the natural variability stated by Professor Cahoon.
346. Having reviewed the evidence of all parties, we conclude that effects on primary productivity will be within the interannual range of variability at the scale of the STB. At the scale of the SMD, those effects may be discernible, but will not be significant. However, at a local scale effects on benthic primary productivity may be significant. We acknowledge that the decrease in photosynthesis will not be directly proportional to reductions in light. We also appreciate that primary productivity is complex and depends on several factors such as nutrient availability, photo-adaptation by the primary producers, and grazing by organisms further up the food chain. We acknowledge the complexity of the food web and relationships between different trophic levels.
347. We note that NIWA Report 16 recognises a lack of knowledge regarding overall primary production levels in the STB and the contributions of the components of phytoplankton, macroalgae and MPB. The report notes the importance of MPB to higher trophic levels and that it is thought to be the dominant component of benthic primary production in the Patea Shoals. It also notes the lack of knowledge in the distribution and abundance of primary production across the STB and that there is limited ability to predict effects on MPB due to limited information and understanding of the relationship between photosynthesis and light (P-E curves). We note that the project will lead to average reduction in MPB across the SMD of 13 to 19%, with much higher reductions over the Patea Shoals closer to the mining site.
348. The NIWA report notes the assumption that macroalgae's contribution to primary productivity is small, relative to water column primary production, due to limited areas of hard substrate at the SMD scale. We accept this is likely to have resulted in an underestimation of the contribution of macroalgae given there was no survey of hard substrate undertaken. The EPA's key issues report highlighted the importance of hard substrate and habitat for many organisms, and noted that such areas may be disproportionately important relative to overall productivity, at least locally.

349. We accept that any adverse effects on primary production overall on the SMD are likely to be minor and that an SMD approach to assessment represents likely ecosystem impacts arising from the predicted sediment plume. However, we also agree with Dr Chiffings that the SMD approach is an artificial construct that does not reflect hydrodynamic gradients operating within the STB. We acknowledge that the SMD approach may have led to a discounting in the assessment of ecologically sensitive areas (ESA) or valued ecosystem components (VEC). We have therefore paid attention to localised impacts and the identification of ESA or VEC. These are matters we have given attention to in setting conditions, and in our evaluation of potential effects on social and cultural values, and on recreational use.
350. We accept that the modelling indicates that there will be significant adverse effects within ESA to the east-southeast of the mining site extending to at least Graham Bank. We accept the conclusions of Professor Cahoon that there will be significant effects on macroalgae on at least part of Graham Bank and minor effects on macroalgae at The Traps. We also accept his opinion that there will be significant effects on MPB within 1 to 2 km of the mining site. Overall, we find that the effect on the primary production of the Patea Shoals is likely to be moderate, but will be significant at ESA such as The Crack and The “Project Reef”.
351. If krill were present in the plume we consider that it will be unaffected, as Dr MacDiarmid has told us that sensitivity of zooplankton to SSC is typically 20 mg/litre. This level is much higher than will be produced by the mining operation, other than in a very limited area close to the discharge.
352. Carbon flux, although referred to as a matter for consideration in NIWA Report 16, was not referred to in the joint witness conferencing. No information was provided to us on the importance of localised reductions in primary productivity or carbon flux and potential flow on effects to higher levels of the food web. Dr James considered that even large (25%) changes to MPB will not be discernible as food web effects. We accept this conclusion in the absence of any other information.
353. Suspended sediment will reduce primary production through reductions in light levels. There must be a robust suite of conditions to keep the sediment plume within its anticipated levels. We have therefore imposed conditions which require monitoring to ensure compliance with specific limits. If the limits are exceeded, the mining operation must stop and adjustments made to operational parameters to ensure suspended sediment levels comply. This matter is discussed in more detail in relation to the conditions addressed in Chapter 8.

12. Benthic Ecology

354. The benthos is the community of organisms that live on, in, or near the seabed. This community lives in or near marine sedimentary environments, from tidal pools along the foreshore, out to the depths of the ocean. At its base, the life of the benthos is sustained by primary production from a wide range of microscopic algae and phytoplankton, driven by photosynthesis.
355. The question of relevance to this application is to what extent the mining operation will adversely affect benthic environments and the life they support, and what the related consequences and risks might be.
356. We heard evidence from the following experts:
- Dr James, on behalf of TTRL, is an expert in aquatic ecosystems, plankton and benthic ecology, and food web interactions.
 - Dr MacDiarmid, on behalf of TTRL, is an expert in marine ecology and fisheries, and human impacts on marine ecosystems.
 - Mr Baxter, engaged by the EPA, is an expert in effects on benthic ecology from dredging and spoil disposal operations.
 - Dr Chiffings is an expert in biological oceanography, and was engaged by the EPA to advise on plankton, fish and marine mammals.
 - Dr Barbara, on behalf of the Fisheries Submitters, is an expert in phytoplankton and bacterial interactions.
 - Dr Mead, on behalf of KASM/Greenpeace, is an expert in coastal oceanography, coastal engineering, marine ecology and aquaculture.
357. We also heard from the Ngā Motu Marine Reserve Society. Although they did not present expert evidence, Ms Hammonds and Ms Smith gave observational and well researched evidence informed by their relevant science backgrounds.

12.1 Benthic Ecosystems

358. Some TTRL’s environmental assessment reports describe the benthic ecology of the mining site and the surrounding area as being “depauperate” – meaning that there are relatively few species and/or that their distribution is patchy. Dr Baxter confirmed this possibility when describing seabeds in general. He said that *“you’ll see a pocket of burrows over there, you’ll see a pocket of burrows over there. Ten metres away, there’ll be a few more. There’ll be a ridge and there’ll be a dip and there’s an undulation. It’s a dog’s breakfast down there. The benthic fauna are not evenly distributed in any way and they vary in abundance in scales of metres to tens of metres to hundreds of metres. ... It’s all or nothing. Either the place is a desert and there’s nothing there or there’s a lot there or they’re somewhere in between.”*¹⁵³

¹⁵³ Transcript 24 February 2017, page 933

359. There was criticism from some parties that few of the NIWA sampling sites were in areas potentially impacted by the sediment plume, when mining is towards the eastern end of the site. However, Dr James considered that the sampling was adequate to describe the environments, because they tend to be relatively uniform. He said that a practical approach had to be taken, and that identification to a family level (rather than species) was appropriate and did not make any difference to the overall assessment¹⁵⁴. Dr MacDiarmid noted that:

“this sampling operation which has taken place for this proposal is probably the most intensive sampling programme we have ever had on shallow shelf seas along this stretch of coastline, the whole of the west coast of the North Island”¹⁵⁵.

360. She also agreed that there is the potential for previously undescribed species to exist within the mining site. In explaining that she stated that the shallow shelf areas of the west coast are:

“very poorly sampled, and almost every time we go out and sample in these novel areas, we are picking up new things. So there is a question of under-sampling which gives the appearance of rarity or newness, and that’s just simply a product of a lack of sampling along this west coast generally.”¹⁵⁶

361. Some submitters suggested that the lack of sampling from rocky reefs introduced a bias in the methodology, such that the results show low diversity. Dr James considered that reef habitat and diversity was addressed by the reporting¹⁵⁷, but Dr MacDiarmid noted the multi-beam survey did not cover the entire potential area affected by the sediment plume. She said that this is a “grey area” in terms of formal data to use¹⁵⁸. Dr Mead told us that the interpretation of benthic ecology from multi-beam is still in its infancy¹⁵⁹. Dr MacDiarmid agreed that Graham Bank had not been subject to sampling, although there is one site that was reasonably close¹⁶⁰.

362. Ms Hancock, a marine scientist and submitter, opposed granting consent. She said that a habitat map of the seafloor ecology needs to be done first. It requires sampling for ground-truthing of substrate and benthic communities so that a clear and holistic picture of the seafloor landscape can be obtained¹⁶¹. She said that, at a minimum, the areas of predicted worst SSC levels outside of the mining site should be subject to habitat mapping¹⁶².

¹⁵⁴ Transcript 21 February 2017, pages 410 and 412

¹⁵⁵ Transcript 21 February 2017, page 439

¹⁵⁶ Transcript 21 February 2017, page 439

¹⁵⁷ Transcript 21 February 2017, page 415

¹⁵⁸ Transcript 21 February 2017, page 438

¹⁵⁹ Transcript 23 February 2017, page 817

¹⁶⁰ Transcript 21 February 2017, page 437

¹⁶¹ Transcript 16 March 2017, page 1833

¹⁶² Transcript 16 March 2017, page 1835

12.1.1 Nearshore

363. The rocky outcrops surveyed by NIWA (Anderson et al.) support an abundant and diverse epibenthic assemblage characterised by bryozoans¹⁶³, macroalgae¹⁶⁴ and sponges, as well as more motile species, such as crabs, amphipods¹⁶⁵, starfish, brittle stars, gastropods¹⁶⁶ and polychaete worms¹⁶⁷. Hard rock outcrops accounted for more than 25% of all specimens and 61% of all species collected during the survey.
364. The rippled sands habitat has low and variable numbers of small motile epifauna – mostly hermit crabs, gastropods, and a few suspension-feeding bivalves. These species are subjected to regular sediment disturbances from storm events and river runoff, and are likely to be tolerant to deposition of sediments and disturbance.
365. The undersea mudstone outcrops in the nearshore area are typically covered in fine silt and support low or negligible amounts of epibenthos (less than 2.5% of specimens)¹⁶⁸.

12.1.2 The Patea Shoals

366. Large areas of the Patea Shoals are characterised by “wormfield” habitats. These habitats are dominated by a burrowing tubeworm which lives in the upper sediments. They occur in high but patchy densities, including the western two thirds of the mining area. Dr MacDiarmid told us that the worms are a “*short-lived fast growing highly fecund species which are highly adapted to those very dynamic, frequently disturbed sorts of places*”¹⁶⁹. This was corroborated by Dr Baxter¹⁷⁰.
367. Dr Mead agreed that most of the species in the mining site could be described as early colonisers, but he noted that there are also longer lived species¹⁷¹.
368. The report by NIWA notes that there is nothing to suggest that the habitat or species within the mining area are unique. Dr Barbara, on the other hand, stated that the wormfield habitat was localised, may be unique, and should be investigated further to establish its relationship to demersal fisheries. Dr Mead said that The Rolling Ground might perform a unique ecological function within the wider STB, but Dr Baxter said he was unaware of any information which supports that idea.

¹⁶³ Commonly known as moss animals or sea mats, bryozoans take on a wide variety of forms such as flat encrusting, soft bushy, or erect rigid coral-like colonies. Most marine bryozoans have a partially calcified, hard, body wall. Bryozoans can form extensive thickets and coral-like clumps which are important habitats for other marine invertebrate and fish species.

¹⁶⁴ Large algae, often living attached in dense beds, such as kelp.

¹⁶⁵ Small crustaceans.

¹⁶⁶ Mollusc such as a snail, slug, or whelk.

¹⁶⁷ Sometime called bristle worms, most burrow or build tubes in the sediment.

¹⁶⁸ Page 45, TTRL Impact Assessment

¹⁶⁹ Transcript 21 February 2017, page 440

¹⁷⁰ Transcript 24 February 2017, pages 927/928

¹⁷¹ Transcript 23 February 2017, page 818

369. The NIWA report notes that overall, the inner and mid-shelf habitats support very few visible epifauna. The exception to this is a comparatively diverse epibenthic assemblage on small and scattered inner shelf rocky outcrops.
370. Ms Pratt, Ngā Motu MRS and others drew our attention to photographs and videos of The “Project Reef” and The Crack, which show a high diversity of benthic life in those locations. To demonstrate the emerging state of knowledge about benthic life in the locality, Ms Pratt noted that only one or two sponges were recorded in the OBIS and NIWA databases. She contrasted this with the photographic and video evidence which tell a different story¹⁷².
371. Dr Mead also referred to The Crack, which at its closest is around 5 km from the mining site. Based on video footage, he described it as *“a very interesting and very diverse area with different mixtures of kelps and a lot of three dimensional complexity”*.¹⁷³
372. The report on customary fisheries sites outlines the importance of locations for particular habitats and ecology¹⁷⁴. In summary, the information provided to us shows that the following habitats are in the typical downcurrent direction of the sediment plume:
- Manihi reef (13 km northeast): mussels, paua, kina, crayfish
 - The Traps (26 - 28 km east): snapper, blue cod, crayfish, rig, tarakihi
 - Tahuahua (24 km east southeast and 17 km southeast): a sand gully area and spawning / feeding area; rig, snapper, warehou, kingfish, trevally, gurnard
 - Weira kōwhanga (35 km east): a whale nursery
 - Weira ara (21 km southeast): a whale pathway
 - Tūteremoana reef (50 km east southeast): snapper, gurnard, rig

12.1.3 Further offshore

373. Outside of the mining area, generally to the south, the deeper offshore reefs are dominated by the dog cockle. The deeper reef habitats also support diverse assemblages dominated by sessile suspension-feeding taxa (e.g. bryozoans, sponges, ascidicans, brachiopods and epiphytic bivalves) and some motile taxa such as crabs and gastropods¹⁷⁵.
374. The mid and inner shelf habitats have low abundance and species richness, which is typical of highly disturbed sediments. Deeper offshore benthic habitats support an abundance and diversity of species dominated by suspension feeders. The shallower bivalve rubble habitat is dominated by the large robust dog cockle with live animals at depths of 26 m to 83.5 m. This habitat also supports early successional stages (encrusting corraline algae, small encrusting invertebrates), while the deeper bryozoan rubble habitat supports later successional stages (certain bryozoans, sponges and

¹⁷² Transcript 7 March 2017, page 1228

¹⁷³ Transcript 23 February 2017, page 831

¹⁷⁴ *TTR - Sand Mining – Patea Mātauranga Māori and Customary Fisheries Analysis*, Te Tai Hauāuru Fish Forum, Tanenuiarangi Manawatu Inc., 2016

¹⁷⁵ Page 47, Impact Assessment

higher numbers of motile taxa). Bryozoan rubble habitats also support significantly higher abundances of infauna¹⁷⁶.

12.2 Benthic Ecology Effects

375. Dr Baxter noted that there had not been further benthic sampling between TTRL's two applications, but he considered that new sampling would not have improved the robustness of the impact assessment. In his opinion, the robustness of the impact assessment is linked more strongly to the plume and optical modelling than to the communities themselves.
376. He summarised a range of potential key effects associated with mining which will either kill or adversely affect benthic biota. These include:
- Almost complete biota mortality at the mining site itself;
 - A reduction in primary productivity of benthic flora;
 - Smothering of benthic organisms;
 - Release of toxicants from the mined sediments; and
 - Change in seafloor habitat characteristics in the mining area.
377. Apart from an unplanned release of oils or chemicals from equipment, Dr Baxter considered that all other potential effects will have only minor consequences, and there will be a low risk of significant long term adverse effects. His conclusion was based on the following:
- There are broad areas of similar benthic habitat outside of the zone impacted by the mining operation;
 - The sediment plume will be dynamic, with seabed light levels fluctuating over time as the plume moves; and
 - Species can recolonise the mined area.
378. Regarding recolonisation Dr Baxter noted that:
- “You may get different species initially recolonising. But I couldn't see any reason to suspect that the species that will recolonise won't fulfil the same ecosystem function as those that are there prior to mining”¹⁷⁷.*
379. TTRL's Report 16 states that the potential ecological effects need to consider two factors. They are:
- That mining induced variation in seabed light is likely to be well within natural interannual variability¹⁷⁸; and
 - The fauna of the receiving environment is predominantly “*sparse and depauperate*”, and likely to be adapted to episodic disturbances¹⁷⁹.

¹⁷⁶ Page 48, Impact Assessment

¹⁷⁷ Transcript 24 February 2017, page 921

¹⁷⁸ Page 20, Report 16: *Effects on Primary Production of Proposed Iron-sand Mining in the South Taranaki Bight Region*, Cahoon, October 2015

¹⁷⁹ Page 27, *ibid.*, TTRL Report 16

380. Regarding the second factor, TTRL’s Report 16 draws on Beaumont et al. (2013) to characterise the receiving environment as visually barren sand ripples (medium to coarse sand) with *“low abundances and species richness of both infauna and epifauna organisms”*¹⁸⁰. The area is dominated by suspension feeders, consistent with continual recovery from frequent disturbance, but the Report also notes that occasional rocky outcrops support a more diverse fauna.
381. Dr James told us that when undertaking a risk assessment and considering any individual effect, the DMC should consider its severity, duration, and spatial extent. Dr Baxter agreed that duration of exposure was an important matter that should be recognised in the monitoring programme.
382. Dr James provided us with an overview of effects on benthic ecosystems. He relied in part on the evidence of Drs Dearnaley, Cahoon and MacDiarmid. Dr James acknowledged the ecological importance of habitats within the wider study area, and the mining site. He noted that the mining site itself has relatively low total invertebrate abundance and diversity, and is dominated by tubeworms.
383. Regarding food web effects, he stated that the area covered by mining is negligible compared with the distribution and foraging range of fish, birds and mammals. As an example, Dr James showed us a food web diagram for the Hauraki Gulf. He stated that food webs are very complex and species rely on a wide range of food sources.
384. Dr James commented on recovery of the mining site, stating that recolonisation will involve the tubeworm larvae floating into and settling within the area. Taking a conservative approach, he said this early stage of recovery will take weeks to months. He also told us that larger bivalves may take several years to move into the worked over mining areas. Dr Baxter agreed it takes some time for larger benthic life to re-establish. Dr James dismissed the idea that the mining site will become a dead zone, citing the constant flow of water containing larval groups of all kinds of organisms.
385. Ms Cashmore, an environmental advisor for Ngāti Ruanui, raised a concern about the de-ored sediments discharged to the seabed. She told us that low iron concentrations have been shown to limit primary production rates, biomass accumulation and ecosystem structure in ocean environments and coastal areas. She said that *“if topography and sediment composition are permanently altered and previously stable sediments are not re-established, communities remain at an early developmental stage, and biological recovery can take more than ten years.”*¹⁸¹
386. Dr Mead agreed that most of the species present at the mine site are early colonisers, but said the significance of the change in species mix post-mining was a value judgment¹⁸². Dr Baxter addressed the change in the composition of benthic communities through recolonisation of the mined area. He stated that:

“This may be more strongly influenced by changes in the physical properties of the seafloor (not only particle size distribution, but also the degree of consolidation and cohesiveness of the sediments). While these physical changes may result in a different suite of species initially

¹⁸⁰ Page 27, *ibid.*, TTRL Report 16

¹⁸¹ Transcript 6 March 2017, page 1133

¹⁸² Transcript 23 February 2017, page 818

colonising the mined areas than were present pre-mining, the STB is a highly dynamic environment and it would be expected that, over time, sediments from the areas adjacent to the mined areas would progressively spread across the mined areas. The functionality of the seafloor habitats for benthic communities would therefore return to the pre-mining condition, which would enable the progressive re-establishment of the benthic communities present prior to the commencement of mining.”¹⁸³

387. Dr Mead considered that changes to the mining site will be “*major or catastrophic*”¹⁸⁴. He explained this to mean the potential for local extinctions of benthic infauna or that a species may not recolonise.
388. Ms Anderson, on behalf of the Fisheries Submitters, noted that there needs to be a response if the benthic ecology does not recover. She said “*We’re dealing with a very dynamic environment. Monitoring is fine and post commencement and post completion of the mining operation, continuing to monitor environmental attributes is fine because it builds on scientific information, and that’s fine. But I think I agree with you, it needs to lead to somewhere. And so what’s the response to that monitoring? If, in fact, the environment doesn’t recover, well, then what?*”¹⁸⁵
389. Various statements were made in TTRL reports and evidence about deposition of sediment. The Impact Assessment quantifies it as a 5 day accumulation rate of 0.6 mm and an annual accumulation of 1.1 mm¹⁸⁶. As we noted earlier, Dr Dearnaley considers the rate should be scale up by a factor of five within a few kilometres of the mining¹⁸⁷. Professor Cahoon lists it as an average 0.5 – 1.0 mm per annum¹⁸⁸ and said that the rate would be “*dwarfed by the natural processes*”¹⁸⁹. Dr James stated that expected rates of less than 2 mm/year at the mining site will not impact on recovery or recolonisation.
390. The submission of Taranaki Regional Council drew our attention to reef-dwelling suspension feeding invertebrates, including sponges and bryozoans, being susceptible to smothering from sediments¹⁹⁰. The submission also stated that *Ecklonia radiata* and other large canopy-forming kelp species can be susceptible to the effects of sedimentation, with the early life stages of kelp being particularly sensitive. The submission states that only a light dusting of sediment can substantially reduce the attachment of kelp zygotes¹⁹¹ to hard substrates.
391. Dr James stressed the importance of ecologically meaningful change. In that respect, he called most of the plume, which has a SSC of 0.2 to 0.4 mg/litre, “*very, very low*” in the context of a coastal

¹⁸³ Page 8, *Trans-Tasman Resources Ltd Marine Consent Application Review of Benthic Ecology*, AECOM, September 2016

¹⁸⁴ Transcript 23 February 2017, page 814

¹⁸⁵ Transcript 20 March 2017, page 1989

¹⁸⁶ Section 4.4.2.4, TTRL Impact Assessment

¹⁸⁷ Paragraph 79, Expert Evidence of Michael Dearnaley on Behalf of Trans-Tasman Resources Limited, 15 December 2016

¹⁸⁸ Section 3.2.5, TTRL Report 16: *Effects on Primary Production of Proposed Iron-sand Mining in the South Taranaki Bight Region*, Cahoon, October 2015

¹⁸⁹ Transcript 20 February 2017, page 390

¹⁹⁰ Paragraph 45, Taranaki Regional Council Submission

¹⁹¹ A zygote is a single cell, being the earliest developmental stage of an organism after fertilisation.

environment that can typically experience levels of 10 to 20 mg/litre. He also referred to the expected short periods of peak SSC concentrations at the selected sites. He made the point that change to median SSC levels is important, as well as the duration of that change. By way of example, the model shows an increase of 0.5 mg/litre SSC at Graham Bank. He stated that this level is very low compared with the tolerance levels of marine biota, especially tubeworms. At more than 2 - 3 km from the mining site, Dr James said that effects on benthic biota will be less than minor.

392. Dr James outlined some SSC and related thresholds that have been used in other jurisdictions (Canada and USA)¹⁹², and a range of research on the levels tolerated by various species. One New Zealand example identified that biota on rocky reefs off Coromandel was diverse and abundant with SSC levels up to 7 mg/litre¹⁹³. Dr James observed that there have been few studies on long term exposure to elevated SSC. However, he noted that:

“The peaks in SSC downstream of mining activity will be considerably lower than those reported to cause effects and higher peak levels will only be for up to several days at the most. The levels as a result of ISR [iron sands recovery] will be within the envelope of natural levels downstream and there is no evidence from other studies that the small increases in SSC (up to 1.5 mg/L close to the site and smaller increases moving downstream), even for long periods, will have a detrimental effect on the benthic or water column biota.”¹⁹⁴

393. Dr James stressed that the ecosystem of the Patea Shoals, and inshore, can tolerate much higher rates of SSC than predicted by the modelling – and that those ecological communities are able to adapt. He noted that research has shown 35 mg/litre as a threshold for when more sensitive species might be impacted. He said that inshore species of bivalve, which live in the surf zone, can tolerate at least 300 – 400 mg/litre. In relation to kaimoana species, he noted that the SSC of the sediment plume will be around 0.1 mg/litre in areas where they are gathered, and concluded there will be no risk.
394. Dr Chiffings considered that use of the SMD had led to a level of discounting of the impacts on environmentally sensitive areas (ESAs) and valued ecosystem components (VECs)¹⁹⁵.
395. Dr James drew an overall conclusion about the potential for elevated SSC to have effects on benthic communities. In his opinion, significant direct risks are dependent on duration, SSC levels, and the species. Generalising, he said that risk would arise if SSC was sustained at a seabed median of 5 to 10 mg/litre above background levels for more than 25% of the time. He also said that the absolute SSC (i.e., background plus mining) would need to be at least 25 mg/litre for a sustained period before there are changes in the benthic community¹⁹⁶. Dr Mead considered that risk needs to be

¹⁹² Paragraphs 7 to 11, Expert Supplementary Evidence of Dr Mark James on Behalf of Trans-Tasman Resources Limited, 27 April 2017

¹⁹³ Paragraph 15, *ibid.*, Dr James Supplementary Evidence

¹⁹⁴ Paragraph 20, *ibid.*, Dr James Supplementary Evidence

¹⁹⁵ Section 4.1.1, *Lodgement Review of Effects on Plankton, Fish and Marine Mammals*, DHI, September 2016

¹⁹⁶ Paragraph 27, Expert Supplementary Evidence of Dr Mark James on Behalf of Trans-Tasman Resources Limited, 27 April 2017

considered in terms of the types of organisms and their adaptive capabilities at the site. He stated that organisms present at the seabed mining site are currently not adapted to high sediment load and decreased light penetration.¹⁹⁷

396. Dr Baxter highlighted the need for validation of the sediment plume modelling. He said this will be “of key importance to identifying whether appropriate benthic ecology monitoring sites have been selected.” He considered that if the measured characteristics differ significantly from the modelling, then an assessment will be required of the need for other benthic ecology monitoring sites¹⁹⁸.
397. Dr Baxter noted the need for appropriate response and compliance limits for subtidal and intertidal reef communities (including macroalgae and kaimoana). He said that, “unlike subtidal benthic communities, the intertidal and subtidal reef communities are not widely represented across the STB region and some have been identified as significant kaimoana gathering areas”¹⁹⁹.

12.3 Expert Conferencing

398. Expert conferencing on benthic ecology was attended by Dr James, Dr MacDiarmid, Dr Barbara, Mr Baxter, Dr Phillips, and Dr Mead. The experts disagreed on some points including:
- Whether “recovery” of the mining site could be said to occur if it comprised a species mix different from the original benthic communities.
 - Whether species at the mining site were pre-adapted to periodic disturbance.
 - Whether modelling of the species potentially present was conservative.
 - Whether enough is known about un-surveyed reefs near the mining area.
 - Whether enough is known about food webs.
 - Whether further information should be collected on benthic communities.
 - Whether predictions have been based on best, realistic, or worst case.
399. The experts agreed on all other points, including:
- Nearshore macroalgal communities are sufficiently distant from the mining operation, such that there is a negligible risk.
 - Macroalgae growth on reefs closer than 5 km from the mining area may be inhibited at times but there is negligible risk that they will be destroyed.
 - Food webs are highly complex, and effects on benthic fauna will not necessarily translate into measurable food web effects.
 - Benthic fauna within the mining area are also present outside of the zone of potential impact from the mining project.
 - Sediment impact predictions are sufficiently robust from a benthic ecology perspective.
 - Monitoring is required to verify the modelling of predicted impacts on benthic ecology.

¹⁹⁷ Statement of Evidence by Shaw Trevor Mead on Behalf of Kiwis Against Seabed Mining Incorporated, 23 January 2017

¹⁹⁸ Paragraph 21(b), *Trans-Tasman Resources Ltd Marine Consent Application Review of Benthic Ecology*, AECOM, September 2016

¹⁹⁹ Paragraph 21(d), *ibid.*, AECOM review

- There will be negligible risk of the mining project leading to ecotoxicity effects on, or the extinction of, new species.
- Knowledge of the distribution and biology of the surf clams is sufficient for the purposes of risk assessment.
- Any rare and vulnerable ecosystems and habitats of threatened species identified in the Cawthron report are distant from the mining area.
- Experimental results from Wellington Harbour are not critical to the assessment of potential impacts from the mining project.
- Iron should be included in the suite of metals to be analysed in sediments and water during the mining operation.
- Monitoring of the mining operation will need to include monitoring of benthic communities, regardless of whether or not measured SSC levels exceed criteria levels.
- Ecotoxicity testing should be part of the Pre-Commencement Environmental Monitoring Plan (PCEMP) to establish tolerance levels (to nickel and copper) of larval stages of relevant benthic species.
- There should be monitoring of mined areas in relation to: succession of recolonising species; sediment characteristics correlated with the biological characteristics; verification of model predictions; extent of toxicant and nutrient release; invertebrate and infauna community compositions in relation to water quality protection criteria.

12.4 Findings on Benthic Ecology

400. We have relied on the general description of the mining site and surrounding areas provided by TTRL's Report 20. However, we acknowledge that the mining site's large area, as well as the sampling methodology, means that some generalisations will have been made and the characteristics of some smaller areas may not be apparent. We make the same finding for the wider area of the Patea Shoals.
401. We accept that sandy areas of the seabed can be described as depauperate. However, it would be wrong of us to infer that there is no benthic life of value, or that there are no locations with rich and diverse benthic fauna.
402. We understand and accept that within the mining site, there will effectively be a 100% loss of benthic fauna. Based on the ecological assessment framework used by Dr MacDiarmid (see Table 5), this could be and was described by some people as a "catastrophic" impact. However, the framework also requires consideration of the recovery period. For the catastrophic consequence level, the table assigns a recovery period of one to two decades, or never. The evidence we heard was that most of the benthic fauna within the mining site is short lived and will be re-populated by early colonisers from outside the site within a period of weeks to months and that some species may take several years to recolonise.

403. We accept that advice, and that it is not necessary for the exact habitat or species mix to be replicated for there to be a sustainable ecological recovery. The important point is that a similar species richness and abundance is re-established but not necessarily replicated.
404. Outside the actual mining site, we understand and accept that elevated SSC in the water column and deposition of sediment on the seafloor will have some adverse effects. There may be smothering of some organisms, or effects on their respiration. Light may be reduced to the extent that it affects the production or quality of biomass (we also address this earlier in our findings on oceanic productivity). However, we accept the agreed position of the expert conferencing that macroalgal growth on reefs closer than 5 km from the mining area may be inhibited at times, but there is negligible risk of it being destroyed.
405. Within the near-field, modelling of accumulated deposition needs to be treated with some caution and could be up to five times greater than the predicted level. The maximum predicted rate of accumulation within the near-field area (up to 3 km from the source) is 1.1 mm/year²⁰⁰ and therefore could be up to 5.5 mm/year. The benthic community within 2 to 3 kilometers of the site is likely to be significantly impacted by sediment deposition. Deposition rates and the consequent effects in the mid to far-field will reduce with distance.
406. We consider that the potential for effects associated with a combined change in both deposition and SSC should be closely monitored. This is especially the case for potential effects on ecologically sensitive areas or valued ecosystem components. In this regard, we are concerned for effects at locations demonstrated to have a rich and diverse benthic fauna, such as The Crack and The “Project Reef”.
407. In his closing submissions Mr Holm, on behalf of TTRL, summarised the concerns of various parties around benthic recovery. He said that *“three key issues were: would there be recovery; how long would recovery take; and how would recovery be measured?”*²⁰¹. We agree. Dr Lieffering had earlier expressed some concern about TTRL’s proposed Condition 8, noting that although it specified what comprises ‘recovery’, it did not state what TTRL’s obligations were if recovery has not occurred or is not on track to occur²⁰².
408. In response, TTRL proffered an amended Condition 8 which requires mining to cease until it can be demonstrated that recovery has occurred or is on track to occur²⁰³. Recovery is defined in relation to known pre-mining levels of abundance, biomass, and species richness – but does not require an exact replication of what existed previously. We consider that these elements provide the necessary level of certainty that ecologically sustainable recovery will be achieved. We consider that an urgent operational response is not required.

²⁰⁰ Section 4.4.2.4, TTRL Impact Assessment

²⁰¹ Transcript 25 May 2017, page 3359

²⁰² Transcript 24 May 2017, page 3213/3214

²⁰³ Tabled at hearing 25 May

409. Dr Loeffering advised us that certain elements should be ‘hard coded’ into enforceable consent conditions, rather than being embedded in the various monitoring and management plans. He called this “*the where, the what and when*”²⁰⁴, which includes monitoring locations, parameters or determinants to be monitored, and the frequency and duration of monitoring. He also made specific reference to The Crack and The “Project Reef” as locations which should be included as compliance sites. In answer to questioning, he said that hard coding the various parameters was possible, even in the absence of baseline information yet to be gathered²⁰⁵. We agree with Dr Loeffering on this point.
410. We address the issues raised by Dr Loeffering in our later findings on specific conditions in Chapter 8-25 of the record of decision. In doing so, we draw on aspects highlighted in Mr Govier’s evidence and presentation which set out TTRL’s agreement as to what should be monitored²⁰⁶. All those aspects relate in some way to the health of the benthic environment. They include metals testing in sediment and the water column; the use of biological indicators for metals; ecotoxicology testing using relevant local species; and the appropriate identification of benthic fauna. We also draw on the agreed positions established by expert witness conferencing.
411. We consider that there should be minor changes to Conditions 7 and 8. We address those changes in Chapter 8-25 of our record of decision.

²⁰⁴ Transcript 24 May 2017, page 3214

²⁰⁵ Transcript 24 May 2017, page 3254

²⁰⁶ Expert Evidence of Daniel Govier on Behalf of Trans Tasman Resources Limited, 15 December 2016; Expert Rebuttal Evidence of Daniel Govier on Behalf of Trans Tasman Resources Limited, 10 February 2017; Summary of Evidence (PowerPoint presentation)

13. Fish and Shellfish

412. Commercial fishing is not addressed in this part, but in Chapter 6-22. Iwi interests and customary use are dealt with in Chapter 5-17, and recreational fishing in Chapter 5-19. Our discussions of reef systems and benthic habitats in Chapter 4-9.5 are also relevant.
413. We heard evidence from the following experts:
- Dr MacDiarmid, on behalf of TTRL, who is a marine ecology and fisheries research scientist, employed by NIWA. She was responsible for the NIWA assessment report on fish and fisheries submitted TTRL's application²⁰⁷.
 - Dr James, on behalf of TTRL, is an expert in aquatic ecosystems, plankton and benthic ecology, and food web interactions.
 - Dr Chiffings is an expert in biological oceanography, and was engaged by the EPA to advise on plankton, fish and marine mammals.
 - Dr Barbara, on behalf of the Fisheries Submitters, is an expert in phytoplankton and bacterial interactions.

13.1 Distribution and Abundance

414. The NIWA report reviewed reef fish distribution and abundance. The review was based on earlier estimates from surveys conducted elsewhere, along with a set of environmental and geographical predictors. The potential for rare species was ignored where little or no count data was available. Reef fish species richness was predicted to be greatest along the nearshore reefs, especially between 174° 20' E and 174 ° 40' E²⁰⁸. The assessment only related to rocky reef habitats, whereas some of the species also occur in more open habitats. The report provides maps of the coastal reefs and predicted abundance of some species. This excluded reefs further offshore (such as The Crack and The "Project Reef") which were subsequently identified by submitters at the hearing.
415. Based on modelled predictions by NIWA, demersal and pelagic fish species with distributions in the STB that particularly coincide with the mining site (i.e. those species with an occurrence > 50%) include barracouta, blue cod, carpet shark, eagle rays, john dory, golden mackerel, kahawai, leather jacket, lemon sole, witch, red cod, red gurnard, rig, school shark, snapper, spiny dogfish, tarakihi, trevally, and common warehou.
416. The predicted distribution and abundance relied on observations of fish abundance New Zealand wide, correlated with environmental variables. None of the observations were in South Taranaki. Modelling of reef fish abundance only occurred within grids that contained a known rocky reef. On average, 64% of the variation in reef fish abundance was explained by the models.
417. There is some evidence for spawning activity by 13 demersal or pelagic fish species in the STB while larger juveniles of 24 species also occur. The NIWA report indicates there is good evidence of

²⁰⁷ TTRL Report 10: *South Taranaki Bight Fish and Fisheries*, NIWA, November 2015

²⁰⁸ Approximately between the Manawapou and Waitōtara rivers

breeding within the Patea Shoals by lemon sole, New Zealand sole, rig, sand flounder, yellow-belly flounder, and yellow-eyed mullet. There is probable breeding by golden and blue mackerel.

418. Captain Smith told us that the Patea Shoals area is a “nursery ground” for juvenile fish²⁰⁹, a claim supported by Mr Saunders-Loder. Two of the important customary fishing sites are listed as being spawning grounds²¹⁰.
419. The NIWA report did not specifically cover the significance of fish species for recreation. Various submitters, especially during our hearing days in New Plymouth, referred to a range of species that were regularly caught or targeted. Submitters referred to blue cod, snapper, and crayfish. Graham Bank was noted as a breeding ground for blue cod. The NIWA report notes a ‘possibility’ of breeding by blue cod within the Patea Shoals (as well as john dory, kahawai, kingfish, and sea perch), citing insufficient data for certainty. The report shows modelled distribution and abundance of blue cod (see Figure 3) with the greatest likely concentration on the seaward side of the Shoals and towards Whanganui.

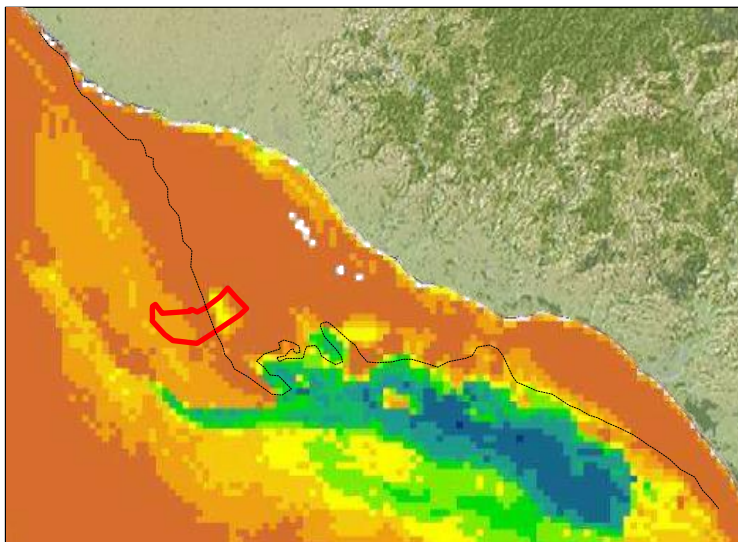


Figure 3: Distribution of Blue Cod

Source: TTRL Report 10: Figure 11-3, Appendix B
30 m contour line (Inner Patea Shoals) added by DMC
Prepared by DMC

420. Dr Chiffings said that there is little information on the abundance, diversity or likely impacts on cephalopods²¹¹. TTRL’s Report 17 notes that octopus should be unaffected by deposition of

²⁰⁹ Evidence of Captain Andrew Smith in Regard to Charts, 10 March 2017 (marked on an accompanying map, but not referred to by the term “Patea Shoals”)

²¹⁰ Table 2, page 24, *TTR - Sand Mining – Patea Mātauranga Māori and Customary Fisheries Analysis*, Te Tai Hauāuru Fish Forum, Tanenuiarangi Manawatu Inc., 2016

²¹¹ Page 13, *Lodgement Review of Effects on Plankton, Fish and Marine Mammals*, DHI, 2016

sediment and largely unaffected by the sediment plume²¹². The joint witness statement agreed that the SSC levels are considerably lower than levels known to cause effects on squid²¹³.

13.2 Effects of the Sediment Plume

421. Dr MacDiarmid provided us with information regarding thresholds at which elevated SSC levels might cause environmentally significant changes²¹⁴. In doing so, she drew the distinction between pelagic and demersal/benthic species.
422. Her evidence reviewed studies of SSC effects on various biota. For fish, she indicated that lethal and non-lethal effects were unlikely unless SSC was high; she provided the example of juvenile snapper in estuaries, where effects were noted at SSC of 37 mg/litre. For shellfish, she provided examples of 80 to 1,000 mg/litre, depending on species. She listed zooplankton sensitivity at 20 mg/litre.
423. Mr Saunders-Loder reported that snapper and trevally disappear from the Patea Shoals area during storm events that cause increased turbidity. He cited these temporary natural events as pointing to the risk of fish avoidance arising from the continuous sediment plume. Dr Barbara noted that many of the fish species present in the STB already forage in areas where SSC levels regularly exceed 10 mg/litre, and are therefore unlikely to be deterred from entering the sediment plume. In fact, he raised the opposite possibility, that organic matter released into the ecosystem (e.g., marine worms crushed by mine processing) could attract fish to the site. This would either be a direct effect (feeding on the organic matter), or through stimulating primary productivity which would have a consequential attraction to fish.
424. Dr MacDiarmid told us that 2 mg/litre is the lowest SSC concentration that some fish start to avoid. Her assessment took that level and applied it across all fish, so is therefore a conservative approach. She said that 3 mg/litre is a conservative effects threshold for all demersal and benthic species of fish and invertebrates. Based on those metrics, her assessment is that effects on all species will be minor to negligible. The effects considered were clogging of respiratory surfaces and feeding structures of marine organisms, avoidance of the discharge area by mobile species, and reduced availability of prey due to either reduced visibility or a reduction in prey numbers or biomass.
425. Based on the modelled extent of the sediment plume at 2 mg/litre and 3 mg/litre, Dr MacDiarmid defined the spatial extent of the potentially affected areas, and compared the worst case with the original modelling. For pelagic species, she considered it was appropriate to use an average of surface and near bottom predicted levels, as shown in Table 11. In all cases, the worst-case magnitude of change is an approximately 30% increase in affected area by comparison with the base case.

²¹² Page 57, TTRL Report 17: *Assessment of the Scale of Marine Ecological Effects of Seabed Mining in the South Taranaki Bight*, NIWA, September 2015

²¹³ Answer to question MJ29, Joint Witness Statement of Experts in the Field of Effects on Fish, 17 February 2017

²¹⁴ Expert Supplementary Evidence of Alison MacDiarmid on Behalf of Trans-Tasman Resources Limited, 1 May 2017

Table 11: Areas Affected by Elevated SSC²¹⁵

	Pelagic			Benthic and Demersal		
	Affected Area (km ²) > SSC 2 mg/litre			Affected Area (km ²) > SSC 3 mg/litre		
	Original	Worst case	Change	Original	Worst case	Change
Surface	45.3 km ²	57.3 km ²	+ 26%	20.5 km ²	28.1 km ²	+ 37%
Near bottom	75.7 km ²	99.8 km ²	+ 32%	47.5 km ²	61.7 km ²	+ 30%
Average	60.5 km ²	78.6 km ²	+ 30%	34.0 km ²	44.9 km ²	+ 32%

426. She said that *“the scale of the mined area and the areas of elevated SSC are small compared to the area used by the populations of these species. Consequently, they are likely to be displaced from, or experience a decrease in prey abundance or availability over a very small part of their distribution.”*²¹⁶
427. She noted that the worst-case assessment does not lift any species into a higher consequence level, and the affected areas remain small (< 1%) compared to the areas occupied by each species²¹⁷.
428. However, she noted that one species may be potentially affected to a moderate extent. This is the eagle ray, which seasonally migrates between inshore and offshore waters. Eagle ray eat mainly shellfish and crustaceans, such as clams and hermit crabs. Dr MacDiarmid noted that although no species studies have been conducted on the eagle ray, she assumed that it had a high tolerance of SSC, greater than the generic 2 to 3 mg/litre she has assumed for other species of fish. She made these assumptions because it is a bottom dwelling species, and seasonally inhabits areas closer to shore which have high SSC.
429. As shown by Figure 4, the highest expected concentration of eagle ray is within and around the mining area. Dr MacDiarmid considered that if eagle ray avoided the mining area, they will move into adjacent areas and still be available as food for orca. However, she considered there will be no real impact on orca, as they generally chase ray when they are in shallower waters. Eagle ray are not a QMS species. On the basis of the ecological assessment framework, Dr MacDiarmid concluded that the effects on fish species and populations will be minor to negligible, other than for eagle ray which she rated as a moderate effect.

²¹⁵ Adapted from Table 1 in Expert Supplementary Evidence of Alison MacDiarmid on Behalf of Trans Tasman Resources Limited, 1 May 2017

²¹⁶ Paragraph 14, *ibid.* Dr MacDiarmid supplementary evidence

²¹⁷ Paragraph 18, *ibid.* Dr MacDiarmid supplementary evidence

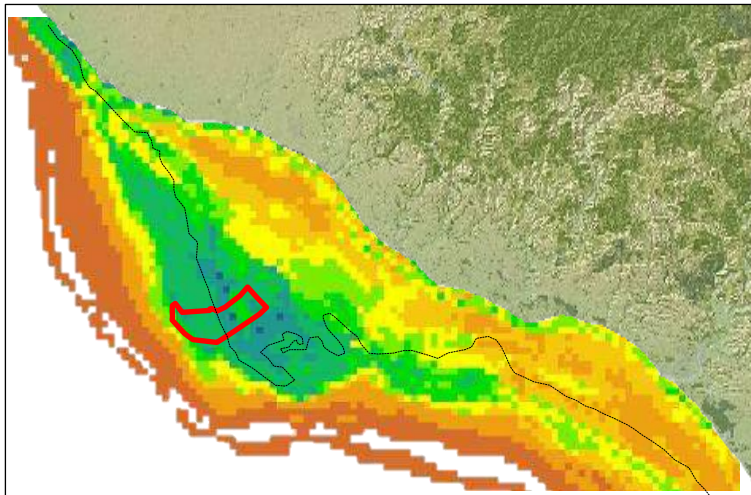


Figure 4: Distribution of Eagle Ray

Source: TTRL Report 10: Figure 11-8, Appendix B
 30 metre depth contour (Inner Patea Shoals) added by DMC
 Prepared by DMC

13.3 Expert Conferencing

430. Expert conferencing was attended by Dr MacDiarmid, Dr Chiffings, Dr Barbara, and Dr James. Points of agreement registered by the experts are as follows:

Disagreement

- There were no areas of recorded disagreement.

Agreement

- The risk posed to fish populations from entrainment in the suction equipment is low, and not practical to monitor.
- There may be local effects of mining noise on fish but population level impacts are unlikely.
- Acclimatisation by fish to underwater noise is likely.
- Actual mining noise should be compared to the known sensitivities of fish occurring in the area (e.g. red gurnard, snapper) to confirm the modelled predictions.
- If there is strong overlap between noise frequencies and fish sensitivities, TTRL should instigate mitigation measures.
- The median area of the plume fish may avoid is between 20 and 80 km² but its size and position will vary. This scale of impact is minor compared to the scale of the fish populations in the STB.
- If plume-modelling predictions prove incorrect and SSC above the fish avoidance thresholds occupies a greater area, then this is unlikely to alter the assessment of impacts on fish populations detailed in Report 17 by MacDiarmid et al. (2015).
- Some species of fish may be attracted to the mining site and others not, but impacts (both positive and negative) are likely to be very local and the overall risk to fish populations minor.

- Predicted mining SSC (95th%iles <2 mg/L) and sedimentation (< 1mm/y), are considerably lower than levels known to cause adverse effects on fish, squid and crustaceans.
- If SSC is higher than predicted, the consent conditions and the EMMP will provide adequate mitigation measures to prevent greater impacts.
- Duration and frequency of elevated SSC contributes to the impact. It is therefore important that frequency and duration at lower levels is not significantly different to that predicted by the 25th and 50th percentiles.
- Tuna are very wide ranging. Seawater temperature is more likely to drive migration routes than the small area impacted by mining induced sediment plumes.

13.4 Findings on Fish and Shellfish

431. Having regard to the opinions of the expert witnesses, we accept that overall effects on fish will be generally no more than minor, other than eagle ray for which the effect will be moderate.
432. We conclude that for fish, because they are mobile, the risk of death due to entrainment by mining operations is negligible. Regarding the Patea Shoals, we consider that there are adequate areas of suitable habitat, for the species reported by TTRL. If fish avoid some areas due to the sediment plume, then there are no apparent physical barriers to them using other locations. Impacts at a population level are therefore unlikely, especially at the STB or SMD level. At the level of the Patea Shoals the effect on fish will be minor.
433. Some localised loss or degradation of habitats will occur. A case in point in the eagle ray, which Dr MacDiarmid told us faces a moderate level of effect. The most suitable habitat for eagle ray, as modelled by NIWA and shown by Figure 4 of our record of decision, is centred within and near the mining area. Based on the ecological assessment framework used by Dr MacDiarmid (see Table 5 on page 32), a moderate effect on eagle ray means that between 5% and 20% of their habitat area will be affected. Moderate, on this scale, also represents a 5% to 20% change in the population, habitat or community components, without there being a major change in function. We are aware that eagle ray is a food source for orca, but we accept Dr MacDiarmid's advice that there will be no real impact on that whale due to the orca only preying on eagle ray in shallower waters.
434. Other species may be subject to a minor effect, meaning a habitat and/or population impact of 1% to 5% using the ecological assessment framework.
435. The modelling of background SSC levels by TTRL indicates there is a substantial difference between 'median' and '99th percentile' conditions. During 99th percentile conditions at the sea floor, much of the area surrounding the mining site experiences levels between 100 and 200 mg/l SSC. While these background levels are well beyond the typical tolerance limits of fish they only occur for short durations (i.e., 1% of the time).
436. By contrast, elevated SSC levels in the sediment plume may have an adverse effect on an ongoing basis, even though the 99th percentile worst case mining induced SSC does not approach the 99th percentile background SSC. We consider that the addition of SSC from the sediment plume will

place stress on natural systems, including fish, and that the effect will be felt most in areas close to the site. We agree with the expert witnesses that frequency and duration are important components of assessing potential and actual effects.

437. Areas affected by the sediment plume are likely to include important locations such as The Crack which is within 5 – 8 km of the mining area, and Graham Bank, which is around 20 km downcurrent of the mine. Based on SSC avoidance thresholds for fish provided to us by Dr MacDiarmid, we consider that the effects may include either temporary or permanent displacement of species. In the worst case modelled by Dr MacDiarmid, an area of approximately 60 km² to 100 km² could be subject to avoidance behaviours by fish, and/or a reduction in their prey. Dr MacDiarmid considered these effects to be “very small” in the context of the overall distribution of species, meaning that less than 1% of their distribution will be affected²¹⁸. The other fish experts agree with her view. Their assessments take a wide view, but we acknowledge the potential for greater effects at the local scale.
438. The experts agreed that there may be local effects of mining noise on fish, but acclimatisation by fish to mining noise is likely, and population level impacts are unlikely. We accept their opinion. Note that we have addressed the topic of mining noise in Chapter 4-14.4 of our record of decision with specific regard to effects on marine mammals.
439. Our conclusions about the nature and scale of effects on fish within the Patea Shoals area also has direct implications for our findings on recreational fishing, which we set out in Chapter 5-19.
440. Regarding surf clams and other shellfish, we conclude that effects related to the deposition of sediment are very unlikely.
441. There are no conditions specific to effects on fish. However, there is a pre-commencement monitoring requirement on the Consent Holder to establish the existing ‘background’ conditions related to commercial and recreational fishing, and “seafood resources” and continue monitoring once mining commences. In addition, the EMMP condition states that the mining activities must not result in adverse effects that were not anticipated when we granted consent. The requirement for the Consent Holder to establish a KRG will provide iwi with the opportunity to influence monitoring, and potential operational responses, to reflect kaitiaki responsibilities.

²¹⁸ Paragraph 72, Expert Evidence of Alison MacDiarmid on Behalf of Trans-Tasman Resources Limited, 15 December 2016

14. Marine Mammals

442. Marine mammals in New Zealand include cetaceans (whales, dolphins and porpoises) as well as pinnipeds (seals and sea lions). They are all given certain protections under the Marine Mammals Protection Act 1978, especially in relation to the effects of commercial fishing. New Zealand is recognised as having a highly diverse cetacean fauna and the STB is no exception.
443. Many submitters and experts expressed concern about the potential for adverse impacts on marine mammals in the STB. This included experts representing TTRL, the EPA, Royal Forest and Bird Society, and KASM / Greenpeace. Many written submissions, and submitters who appeared during the hearing, expressed concern about the impacts on cetaceans. Potential impacts on Māui dolphin (a sub-species of Hector's dolphin) were a focus of those concerns.
444. We heard from several expert witnesses in relation to marine mammals:
- Dr Childerhouse appeared for TTRL. He is a marine scientist with expertise in the ecology and behaviour of marine mammals and the identification and mitigation of impacts of human activities, including noise, on marine mammals.
 - Mr van Helden, appeared for Forest and Bird, and is an expert on whale distribution, anatomy, general biology, and anthropogenic threats; and the conservation status of New Zealand marine mammals in general.
 - Professor Slooten appeared for KASM/Greenpeace and has particular expertise on the biology, behaviour and conservation biology of Hector's and Māui dolphins.
 - Dr Torres appeared for KASM/Greenpeace. She is an expert on whales, and has conducted investigative surveys of blue whales in the STB.
 - Dr Chiffings is an expert in biological oceanography, and was engaged by the EPA to advise on plankton, fish and marine mammals.
445. The DMC acknowledges that it must take into account the importance of protecting rare and vulnerable ecosystems and the habitats of threatened species. The potential for impacts on marine mammals has been a focus of our deliberations, our review of the evidence, and our questioning of expert witnesses.

14.1 Distribution of Species

446. Between July 2011 and September 2013, TTRL conducted an aerial survey covering the mining site and the area inshore. There were 12 flights of four to six hours each, which in total over the survey period comprised 188 transects and occurred in all months except August, November and December. Over the 8,400 km that were flown, the survey only recorded six to eight common dolphin and seven fur seals²¹⁹. Mr van Helden and others were critical of the survey methodology, including aspects such as its timing and the width of the transects. Dr Childerhouse noted that the aerial

²¹⁹ TTRL Report 24: *Cetacean Monitoring Report*, Martin Cawthorn Associates Ltd, November 2015

survey was “basic” but that it should have identified cetaceans with short to medium dive times if they were present in the area. Given the shallow nature of the survey area (20 – 40 metres deep) he thought it unlikely that dive times would be lengthy²²⁰.

447. TTRL’s application included a report on habitat models for three cetacean species. These are Southern right whale, Hector’s dolphin, and orca²²¹. The habitats for these three species have been modelled as they were three species classified as ‘Nationally Endangered’ or ‘Critical’ in 2010. The latest (2013) classification of species (see Table 12) lists Southern right whales as ‘Vulnerable’, although Hector’s dolphin and orca are still listed as ‘Critical’. The reference to Hector’s dolphin in the report refers to Māui dolphin which is a subspecies of Hector’s and has the same habitat requirements. The 2013 classification lists Bryde’s whale as ‘Critical’, and the bottlenose dolphin as ‘Endangered’, but their habitat suitability was not modelled by the report.
448. Dr MacDiarmid acknowledged that the habitat modelling has uncertainties, but that it helped to identify whether these areas are particularly important for at least the three species covered in the report²²². Dr Childerhouse considered that the habitat modelling shows the mining area itself is of no significance to the three species, although areas inshore of there were potentially of higher significance to Hector’s dolphin²²³. Professor Slooten did not directly challenge the habitat modelling, but noted that in general terms there is very poor information about marine mammals in terms of species and their presence²²⁴. Mr van Helden was critical of the habitat modelling because he said it failed to incorporate historical distribution, and was therefore a narrow field of view²²⁵.
449. The modelling suggests that Southern right whale habitat, during winter months, is shallow areas (< 20 m deep) near shore. This supports the ecological need of cows with calves, as the habitat reduces calf energetic demands and injury risk. The predictions are consistent with field surveys that show a preference for calm, shallow habitats that are protected from wind and swell. The Southern right whale population was, in 2010, 3% of its historical level but recovering at a rate of 4.6% per annum²²⁶. In the STB, predicted habitat suitability was generally low, but with slightly higher suitability close to the shoreline. TTRL’s habitat report suggest that this indicates a migration pathway used by Southern right whales while transiting to more suitable wintering grounds to the north or south. Southern right whale cows are known to ‘hug’ shorelines while migrating with calves to avoid predators and habitat model predicts that this occurrence will increase as the population recovers²²⁷. This is consistent with the Department of Conservation sighting records which show inshore sightings occur in mid-winter, whereas sightings offshore in the STB are at other times of the year.

²²⁰ Transcript 21 February 2017 page 499

²²¹ TTRL Report 4: *Habitat Models of Southern Right Whales, Hector’s Dolphin, and Killer Whales in New Zealand*, NIWA November 2015

²²² Transcript 21 February 2017, page 442

²²³ Transcript 21 February 2017, page 489

²²⁴ Transcript 21 February 2017, pages 521 and 528

²²⁵ Transcript 16 March 2017, page 1821

²²⁶ Page 47, *ibid.*, TTRL Report 4

²²⁷ Page 47, *ibid.*, TTRL Report 4

The Department of Conservation strandings database includes one reported stranding of a Southern right whale, north of New Plymouth.

450. The model suggests that habitat for Hector’s dolphin has high concentrations of dissolved organic matter and high primary productivity. This corresponds with field studies which show a preference of the dolphin for areas of turbid water, such as near river mouths. However, the model also suggests preferred habitat as being areas with low levels of suspended matter and primary productivity. The report states this may represent the targeting of different prey species in different water masses. In the STB, predicted habitat suitability is generally low, except along the shoreline. An area of higher suitability occurs between The Traps and the shoreline, especially near the mouths of the Whenuakura and Manawapou rivers. Conversely, a pocket of lower suitability occurs inshore of the Patea Banks, which the report states is likely driven by higher wave heights in that area.
451. The model suggests that habitat for orca is driven by “steep sea surface temperature gradients” which are known to aggregate primary and secondary productivity that attracts fish targeted by the whale. The report shows an area of moderately high temperature gradient passing through the middle of the STB and into Cook Strait, but not including the Patea Shoals²²⁸. Orca habitat use is predicted to be higher in areas with relatively high primary productivity. Based on a combination of the various environmental indicators, overall predicted habitat suitability for orca within the STB ranges from low to moderate. There is higher suitability in a broad location south of the mining area (as close as 8 km southwest), which is known to have increased abundance of prey fish such as kahawai and school shark²²⁹.
452. We also heard traditional knowledge about whales in the presentation of Mr Hawira from Ngā Rauru Kītahi. In his oration (in Te Reo) he said:

“Ko te take tarua, ko te ara tohora. Hoki atu ki te puwaha o Whanganui, Ki Te Paku o Te Rangi. ... Tena te huihuinga o te Kahui Kauika ki Whangaehu, he waiu mo te kuaa tohora. Ka tata mai nga mango. ...Tona whakatauki: Kua e tumutumu te au moana i Tahiti. Kua e tumutumu te ara moana i Taranaki. He arawai tapu na Te Kahui Kauika.”

“Secondly, the migratory pathway of the whales. Returning to the mouth of the Whanganui River to Te Paku o Te Rangi. ... The annual gathering of the mammals at Whangaehu, breast milk for the newborn calves. The sharks draw close. ... The message in essence: do not interfere with the ocean current from Tahiti. Do not intercept the ocean current from Taranaki. It is the sacred ocean path of the whales.”²³⁰

²²⁸ Appendix B, page 58, *ibid.*, TTRL Report 4

²²⁹ section 3.3.1, page 4, *ibid.*, TTRL Report 4

²³⁰ Transcript 6 March 2017, page 1154

453. The Ngā Motu Marine Reserve Society provided us with an online interactive map of the Department of Conservation’s sightings and stranding data. The map shows individually marked sightings, but each marked sighting may represent several animals. The interactive nature of the map allows us to query each sighting and establish the number of animals seen. For example, one single sighting could represent a pod of 10 to 20 dolphins, or just a single animal. The Society’s submission includes a figure, and a table. It also includes a link to “Project Hotspot”, which records orca sightings. Some of these sightings replicate information in the Department of Conservation database. We have taken the Project Hotspot sightings into account in our deliberations.
454. The Department’s sighting and strandings databases are extensive. The information set provided to us includes the STB, but also extends beyond those boundaries. The data covers the area from Awakino (north of New Plymouth), to the eastern shores of Cook Strait, as well as south and west to Farewell Spit and Golden / Tasman bays, and the Marlborough Sounds. A summary of sightings is set out in Table 12. The Department advised treating this information with caution as the database does not provide systematic information on mammal distribution and abundance²³¹. In the same vein, Mr van Helden asked us to consider the databases but also noted that the distribution of sightings effort is patchy and may not present an accurate picture of presence or absence²³². He stated that *“this gives the impression that there are vast areas where whales are not present, however this represents more a lack of survey effort than any real picture of presence or absence”*.²³³
455. Mr van Helden provided us with information about the classification of marine mammals, using the New Zealand classification system which applies to all species (not just marine mammals)²³⁴. The system divides species into various classes, being Threatened, At Risk, Non-Resident Native, and Not Threatened. Sub-classes are as set out below. Species for which there is not enough information to provide a classification are described as Data Deficient (“DD” in Table 12).

<u>Threatened</u>	<u>At Risk</u>	<u>Non-Resident Native</u>
Nationally Critical	Declining	Migrant
Nationally Endangered	Recovering	Vagrant
Nationally Vulnerable	Relict	Coloniser
	Naturally Uncommon	

456. Migrants are those species that predictably and cyclically visit New Zealand but do not breed here. Vagrants are those species found unexpectedly in New Zealand. Their presence is either considered transitory, or they are migratory species with fewer than 15 individuals known or presumed to visit each year.
457. It is important to note that Table 12 cannot be used to draw inferences about total population numbers of any species, at any one time. The column “Total Animals” is the number of animals recorded for the number of sightings listed, but the sightings date range can vary. For instance, sightings of the 14,604 common dolphin recorded in the database were the total over an 18-year

²³¹ Letter to EPA dated 8 February 2017

²³² Paragraph 190, Statement of Evidence by Anton Leo van Helden on Behalf of Royal Forest and Bird Protection Society of New Zealand Incorporated, 24 January 2017

²³³ Paragraph 190, *ibid.*, evidence of Mr van Helden

²³⁴ Conservation status of New Zealand marine mammals, 2013, referenced in van Helden primary evidence

period. There is no way to determine if an individual animal has been recorded more than once. It may have been recorded multiple times in different sightings.

458. The dataset should be treated with caution regarding abundance. For example the Department of Conservation database refers to sightings of rarer species. Māui dolphin are thought to have a current population around 60. The database shows 436 animals recorded over a 45-year period, most of which were close to the coastline between New Plymouth and Awakino (north of New Plymouth).

Table 12: Department of Conservation Marine Mammal Sighting Data

No. Sightings	Total Animals	Species	Date range	NZ Status
Toothed Whales				
30	36	Sperm whale	2001 - 2016	No Threat
1	2	False killer whale	2012	No Threat
62	292	Killer whale	2001 - 2011	Critical
111	466	Orca	2009 - 2016	Critical
2	8	Arnoux's beaked whale	2015	Migrant
1	1	Cuvier's beaked whale	2014	DD
1	5	Shepherd's beaked whale	2014	DD
2	2	Unknown beaked whale	2015	
26	80	Unknown toothed whale	2012 - 2013	
Baleen Whales				
145	336	Blue whale	2002 - 2016	Migrant ²³⁵
1	3	Pygmy blue whale	2013	Migrant
108	162	Southern right whale	1987 - 2016	Vulnerable
3	4	Minke whale	2011 - 2012	No Threat
3	3	Bryde's whale	2014	Critical
1	1	Fin whale	2012	Migrant
136	329	Humpback whale	1970 - 2016	Migrant
2	2	Sei whale	2012 - 2103	Migrant
58	81	Unknown baleen whale	1999 - 2015	
Other Unknown Whales				
66	361	Unknown	2012 - 2105	
25	219	Unknown cetacean	2005 - 2016	
30	36	Unknown large cetacean	2013 - 2015	
30	69	Unknown Whale	2008 - 2016	
Dolphins				
330	14,604	Common dolphin	1999 - 2017	No Threat
21	511	Bottlenose dolphin	2000 - 2016	Endangered
29	2,474	Dusky dolphin	1999 - 2015	No Threat
148	558	Hector's dolphin	1970 - 2016	Endangered
122	436	Māui dolphin ²³⁶	1970 - 2015	Critical
5	26	Risso's dolphin	2013 - 2015	Vagrant

²³⁵ As noted by Mr van Helden, the blue whale is listed by IUCN (International Union for Conservation of Nature) as Critically Endangered

²³⁶ Only two sightings of assumed Maui dolphin have been recorded in the area between the mining and the coast (or within the downcurrent sediment plume area). Both occurred in early 2012, being a pod of four seen on each occasion.

No. Sightings	Total Animals	Species	Date range	NZ Status
15	249	Long finned pilot whale ²³⁷	2011 - 2015	No Threat
1	1	Short finned pilot whale	2015	Migrant
32	514	Unknown pilot whale	2001 - 2016	
27	455	Unknown dolphin	2006 - 2016	
<i>Pinnipeds</i> ²³⁸				
13	13	Leopard seal	2000 - 2016	Vagrant
2	4	Southern elephant seal	2015	Critical
2	2	Unknown pinniped	2008	

Source: Department of Conservation sightings database, wider STB region only

459. Threatened species include orca, Southern right whale, Bryde’s whale, bottlenose dolphin, Hector’s dolphin, Māui dolphin, and southern elephant seal. In addition, the blue whale is classed as a ‘Migrant’ species and its IUCN classification is ‘Critically Endangered’. The Department of Conservation database has no record of southern elephant seal sightings within the area we have defined as the STB. The Department also maintains a strandings database which shows further cetacean species that are not recorded in the sightings database, and we have reviewed that information.
460. Mr van Helden said that we should regard the strandings database as an indicator of the wider range of species that live in the STB. He emphasised that stranding records should not be interpreted as indicating that an animal has accidentally or deliberately come to the STB to die, but that seeking shallow water may in some cases be a survival strategy for that individual. He said stranding data shows that these animals do live in the STB.
461. Almost all the Māui dolphin sightings occur from the New Plymouth area northwards, and almost all the Hector’s dolphin sightings occur from the Manawatu southwards. The indicative distribution of Hector’s / Māui is consistent with what we were told by various experts, but we note that the two species cannot be easily distinguished visually.
462. The evidence of Dr Torres noted that baleen whales, particularly blue whales, are at risk of injury and death from vessel strikes worldwide. She referred us to two studies on that topic. Dror Torres noted that vessel speed or routes to or from the mining site should be regulated to reduce the risk of collision. She advised us that 10 knots²³⁹ or less is generally believed to be a good recommendation to allow whales to detect a vessel approaching and manoeuvre out of the way in time. Dr Childerhouse noted that conditions proposed by TTRL will limit vessel speed and therefore reduce the risk of collision with cetaceans.
463. TTRL’s ecological effects report tells us that common dolphin bycatch is strongly associated with the mackerel fishery off the west coast of North Island. The average rate of death has been estimated at

²³⁷ Pilot “whales” are actually a species of dolphin

²³⁸ Only three sightings of leopard seal are recorded within the area we have defined as the STB. The remaining pinniped sightings in Table 12 occurred outside the STB.

²³⁹ 18 kilometres per hour

2.14 deaths per 100 tows, with 119 common dolphin captures reported on 4,299 observed tows over a 16-year study period. Most captures were of multiple animals with up to nine individuals drowned in a single tow²⁴⁰. In answer to questioning, Dr Helson agreed that on a New Zealand wide basis the adverse effects of fishing on marine mammals probably far outweigh any potential adverse effect of the mining project²⁴¹. Ms Undorf-Lay noted that the effects of the fishing industry, especially trawling, were well researched and understood²⁴².

14.2 Whales

464. Mr van Helden informed us that there are two broad groupings of whales: baleen whales and toothed whales. Baleen whales are filter feeders without teeth. Instead, they have large fringed plates of baleen which act like a sieve to remove their small prey (krill, shrimp, and other small crustaceans, and small fish) from the water. There are nine species of baleen whale in New Zealand, all of which occur in the STB / Cook Strait region. Many baleen whales are large, and among the species are the blue whale, minke whale, and right whale. These generally large animals typically produce sounds at low frequencies.
465. Toothed whales use echolocation to find food, navigate and communicate. There are 34 species in New Zealand, of which 24 are found in the STB / Cook Strait region. Toothed whales are a diverse group which also includes dolphins. Species found in the region include the sperm whales, 12 species of dolphin, and nine species of beaked whale.
466. Mr van Helden and Dr Torres told us that some of the whales are likely to be resident year round – feeding, breeding and nursing. Others like the humpback whale are migratory. Mr van Helden noted that many marine mammals eat fish and squid, so there is often a coincidence between productive fishing areas and the presence of whales. He stated that the STB is a significant location for krill, but also for copepods²⁴³ which are a major food source for the pygmy right whale. He advised us that the pygmy right whale appears in the STB stranding record.
467. Dr Torres also referred to the prevalence of krill in the STB and its importance as a food source for blue whales. She referred to a “unique upwelling” off Kahurangi Point at the northwest end of the South Island, which pushes nutrient-rich waters into the South Taranaki Bight. The nutrients feed krill which aggregates in very dense quantities, and blue whales then eat krill. She noted that fin and sei whales are also probably feeding on the krill. She considered that the sediment plume, through reductions in primary production, will lead to less dense patches of krill. The krill may be less numerous, more difficult to detect, and occur in unusual areas that reduce its availability to whales.

²⁴⁰ Page 90, TTRL Report 17: *Assessment of the Scale of Marine Ecological Effects of Seabed Mining in the South Taranaki Bight: Zooplankton, Fish, Kai Moana, Sea Birds, and Marine Mammals*, September 2015

²⁴¹ Transcript 22 February 2017, page 655

²⁴² Transcript 24 February 2017, page 882

²⁴³ Many species of small crustacean, some visible to the naked eye, which occur in great numbers in the marine environment. Some species are planktonic (drifting in sea waters), some are benthic (living on the ocean floor). They are a major food source for small fish, whales, seabirds, and other crustaceans such as krill.

468. Dr Chiffings acknowledged the importance of the krill and observed that the mine “*sits on the edge of a well-defined stream of nutrients, phytoplankton, zooplankton, including krill, that flows from the top of the South Island into the bight and then around through to Cook Strait*”. He considered that the issue of krill is important to consider in relation to the sediment plume’s potential impacts on blue whale. He noted that questions related to krill had not been resolved in the Joint Witness Conferencing²⁴⁴. His advice about the location of krill is consistent with TTRL’s reporting of zooplankton in the STB. TTRL Report 17 states that krill are most abundant at the ‘downstream’ eastern end of a plume of cold, nutrient rich, upwelled water, extending from the Kahurangi Point-Cape Farewell area north-eastwards into the STB²⁴⁵. Based on that Report, we estimate that the major krill aggregations are 10 km to 50 km from the mining site.
469. Dr Chiffings drew an analogy to fencing off part of a paddock – with the question being, do the animals in the paddock still have enough grazing to sustain them? In this regard, Dr Chiffings considered that noise is the most important ‘fence’ potentially restricting access to food, because it can extend for a considerable distance. We pick up the theme of noise and its effects in Chapter 4-14.4 and 14.5.
470. TTRL’s Report 1 indicates that the STB is biologically productive in terms of mesozooplankton. Biomass estimates are among the highest recorded, when other coastal regions in and around New Zealand are considered. The STB may represent a breeding ground for zooplankton, which in turn promotes aggregations of larger, mobile, predatory species, particularly squid. The mesozooplankton species composition is nearshore and is strongly influenced by the physical oceanography of the region, including both the upwelling events off Cape Farewell and the D’Urville current²⁴⁶.
471. Dr Childerhouse stated that the greater STB area is clearly an important feeding area for blue whales. It is potentially only one of five known feeding areas in the Southern Hemisphere.²⁴⁷ Dr Torres told us that blue whales live all year in the region, and use its waters to feed, breed, and nurse calves. She expressed concern that the mining project will impact blue whales through elevated noise within their frequency range, habitat displacement, vessel impacts, and prey disturbance. She was critical of TTRL’s survey efforts²⁴⁸ which documented no blue whale sightings during aerial surveys near the proposed mining site. Professor Sloten was also critical, expressing an expectation that blue whale, Southern right whale, humpback whale, and pilot whale should have been seen²⁴⁹. Dr Torres and Mr van Helden emphasised that marine mammal sightings are rare

²⁴⁴ Transcript 22 February 2017, pages 586/587 and 589

²⁴⁵ Page 18, TTRL Report 17: *Assessment of the Scale of Marine Ecological Effects of Seabed Mining in the South Taranaki Bight: Zooplankton, Fish, Kai Moana, Sea Birds, and Marine Mammals*, September 2015

²⁴⁶ TTRL Report 1: *South Taranaki Bight Factual Baseline Environmental Report*, NIWA, November 2015

²⁴⁷ Paragraph 66, Expert Evidence of Dr Simon John Childerhouse on Behalf of Trans-Tasman Resources Limited, 15 December 2016

²⁴⁸ Described in TTRL Report 24: *Cetacean Monitoring Report*, Martin Cawthorn Associates Ltd, November 2015

²⁴⁹ Transcript 21 February 2017, page 529

events. Mr van Helden noted that many species are difficult to detect. He said the beaked whales are rarely seen at sea and pygmy sperm whales are rarely detected due to their behaviour²⁵⁰.

472. Dr Torres stated that there have been 387 blue whale sightings reported in New Zealand waters since 1980, with 240 of those being in the STB region. She led surveys during 2013 and 2016 which represent 32 of the 240 sightings, and her survey ranged down as far as Westport. She reported two recent sightings of foraging blue whales within 16 nautical miles²⁵¹ of the mining site. The remainder of the STB blue whale sightings were from observations by the oil and gas industry, and from shipping. Dr Torres also advised us that, based on all available records, 31 blue whale have been sighted within 50 km of the mining site. Although most sightings on record are well west of the mining site, Dr Torres considered that reflected survey efforts and observational bias, which Dr MacDiarmid acknowledged²⁵².
473. Dr Torres described the overall survey effort as “uneven”, making it difficult to draw conclusions about the distribution patterns of blue whales. However, she noted that there is a high degree of certainty around blue whale presence, based on sound recordings. From recent hydrophone records, she stated that blue whale vocalisations have been detected on 89% of days, although the actual location of the whale could be anywhere from very close to up to 40 – 50 km distant.
474. Dr Torres stated that the mining site is on the fringes of preferred blue whale habitat, in terms of depth. She considered 60 to 75 m of water to be shallow for them, and the mining site is 45 m or less depth. This is consistent with the Department of Conservation sightings record, which shows the shallowest blue whale sighting in about 85 m depth of water.
475. The mātauranga Māori and customary fisheries analysis²⁵³ in the appendices to the Impact Assessment identifies two locations relevant to whales within the Patea Shoals. One is Weira Ara, a “whale pathway” in the vicinity of Graham Bank. The other is Weira Kōwhanga, a “whale nursery” approximately 6 km east of South Trap. The report identifies the Waitōtara to Kai Iwi coastline as “*an important whale nursery or feeding area where certain whale species visit at various times of year during their life span.*”²⁵⁴

14.3 Hector / Māui Dolphins

476. Māui dolphins are unique to New Zealand and are a sub-species of the Hector’s dolphin. They are critically endangered. The Māui dolphin is one of the three most threatened small cetaceans in the world. The latest Māui dolphin population estimate reported by the Department of Conservation puts the population at 63 dolphins over the age of one. The sighting locations in Table 12 are restricted to south of Awakino, but the Māui dolphin range extends much further north.

²⁵⁰ Transcript 16 March 2017, page 1789

²⁵¹ 30 km

²⁵² Transcript 21 February 2017, page 442

²⁵³ Table 2, page 24, *TTR - Sand Mining – Patea Mātauranga Māori and Customary Fisheries Analysis*, Te Tai Hauāuru Fish Forum, Tanenuiarangi Manawatu Inc., 2016

²⁵⁴ Page 25, *ibid.*, customary fisheries analysis

477. Professor Slooten informed us that the Māui dolphin is a coastal species, which makes them vulnerable due to the concentration of human activity in those areas. She also noted that, for critically endangered species like the Māui dolphin, even very small effects can be biologically meaningful. She stated that anthropogenic factors including fishing, seismic surveys and marine mining limit population growth and habitat re-colonisation. She considered that such factors are more important in reducing the range of Māui and Hector's dolphins than sharks or other predators. Professor Slooten listed specific TTRL project risks such as collisions with vessels and mining equipment, habitat degradation, and pollution from antifouling agents and oils.
478. The West Coast North Island Marine Mammal Sanctuary, to protect the Māui dolphin, extends from Manganui Bluff in Northland to Oakura just south of New Plymouth. Marine mammals, including Māui dolphin, fur seals, common dolphin, and orca (killer whales) can be found within its boundaries. The southern boundary of the sanctuary is around 90 km north of the mining site. Three types of fishing are most likely to entangle Māui dolphins and have restrictions associated with them. These are set nets, trawls, and drift nets. Set net prohibitions extend past the southern boundary of the marine mammal sanctuary, terminating at Hawera. The outermost set net prohibition²⁵⁵ comes within about 12 km from the northern edge of the mining site (see Figure 7 on page 185).
479. Professor Slooten said that the fishing threat to Māui dolphins still exists, as three to four members of the species are killed per year (New Zealand wide). A sustainable level would be one dolphin every 10 to 23 years. The current population size is 25-30% of its original size. In her opinion, without fisheries related mortality, the population could recover to 50% within 50 years. She told us that New Zealand reported to the International Whaling Commission, that eight Māui dolphin were killed by fishing over the period 2000 – 2012, although she could not tell us the location of those incidents.
480. Professor Slooten considers that any noise pollution, including seismic surveys and mining, risks displacing the Māui dolphin into high risk areas – such as areas where commercial fishing takes place²⁵⁶. She acknowledged that there is already overlap between Māui dolphins and fisheries in the area. She thinks it likely that this overlap, and its attendant risks, will be intensified due to habitat displacement caused by the mining area and its sediment plume.²⁵⁷
481. Sightings of the dolphin appear to be rare in the STB but Ngā Motu MRS advised us of seven sightings, with one occurring about 9 km inshore of the mining area and another about 55 km to the east near Whanganui²⁵⁸. These were 13 km and 5 km offshore respectively. The Department of Conservation database tells us that the first of the sightings is dated 2012, and was a pod of four dolphins. The second of those sightings was also a pod of four, and the two sightings occurred within five weeks of each other. The remaining four sightings are a significant distance to the northwest, mostly near the Māui oil platforms, southwest of Opunake. The furthest offshore was 49 km.

²⁵⁵ Commercial set nets not allowed unless a Ministry for Primary Industries observer is on board

²⁵⁶ Paragraph 14.4, Statement of Evidence by Professor Elisabeth Slooten on Behalf of Kiwis Against Seabed Mining Incorporated, 24 January 2016

²⁵⁷ Paragraph 18.1, *ibid.*, Evidence of Professor Slooten

²⁵⁸ Online interactive map provided by Ngā Motu Marine Reserve Society

Professor Slooten told us that Māui dolphins typically range up to 20 nautical miles offshore²⁵⁹. As noted above in paragraph 461, most of the sightings recorded as Māui dolphin in the database are north of New Plymouth.

²⁵⁹ 37 km

14.4 The Noise Environment

482. The marine mammal experts who we heard, also had observations to make about the effects of noise. The marine mammal experts are not experts in the sense of being acousticians. However, in the earlier stages of the hearing, they expressed some concern about the noise information provided by TTRL, and the approach taken to noise modelling. As we noted earlier, those concerns helped to influence our request to TTRL to provide revised noise modelling.
483. We heard from several witnesses with specific expertise in marine noise. They included:
- Mr Humpheson, an acoustician with experience of marine environments and the management of noise in naval architecture²⁶⁰.
 - Dr Duncan appeared for Forest and Bird. He is an academic researcher and consultant in marine acoustics, with experience in the prediction of underwater sound levels from human activity.
 - Dr Erbe also appeared for Forest and Bird. She is an academic researcher and consultant in marine acoustics.

14.4.1 Ambient Noise Levels

484. Some of the experts were critical about the lack of an estimate of background noise. Dr Chiffings told us that background noise levels are important because of cumulative impacts. Our Minute 41 asked TTRL to consider background noise.
485. Mr Humpheson characterised the ambient noise environment in the STB, an area which he described as “very busy”²⁶¹. To demonstrate his findings, he provided us with various charts. One of these showed a year’s shipping tracks across the Bight. It shows the central and western parts of the STB to be a busy area, with movements into and through it associated with the oil and gas industry, commercial fisheries, and traffic passing through Cook Strait. The plot did not include recreational traffic. Another figure showed noise contours produced by a container ship departing Nelson and travelling towards the West Coast. That figure showed a 120 dB contour extending well out into the STB, and a 115 dB contour reaching almost to the mining site. He also provided us with a plot of hours during which shipping noise has been recorded. The plot is based on recording from a site some 80 km south of the mining site²⁶². We note that in a typical month (September 2016) there appear to have been around 66 hours of recorded shipping sound. Dr Childerhouse provided us with a table of the sound levels produced by generic types of vessel, and well as sound levels for specific named vessels that operate within New Zealand waters²⁶³. Some of these have at source sound levels of over 190 dB.

²⁶⁰ Also known as naval engineering, it is an engineering discipline dealing with the engineering design process, shipbuilding, maintenance, and operation of marine vessels and structures.

²⁶¹ Transcript 22 May 2017, page 3070

²⁶² The specific location of the NIWA Mooring 2 site was not provided to us but, based on distance and direction, we assume it to be near Stephens Island at the head of the Marlborough Sounds

²⁶³ Table 2, Expert Supplementary Evidence of Simon John Childerhouse on Behalf of Trans-Tasman Resources Limited, 2 March 2017

486. Mr Humpheson's report²⁶⁴ stated that he had calculated the ambient STB noise environment based on data which was provided by JASCO was recorded at a NIWA site which is approximately 80 km from the mining site. The background sound level, during lulls in anthropogenic noise, was stated as being 97 dB.
487. Mr Humpheson concluded that beyond 25 km from the mining activity, the mining noise will be less than the background sound level. In answer to questions, he referred to this as a "zone of influence" beyond which the mining noise would be masked by background noise²⁶⁵. He qualified his statements about background and mining induced noise by stating that mining noise may still be audible outside the 25 km zone of influence, but that is dependent on the frequency content of the noise.²⁶⁶

14.4.2 Modelling of Noise

488. Initially, TTRL chose not to call an expert marine acoustician, but relied on the report by Mr Hegley included with the application²⁶⁷. That report relied on sound estimates based on dredging equipment, which the noise report adopted as a maximum source level of 172 dB and ambient noise levels from Lyttelton Harbour.
489. Dr Childerhouse used a spherical spreading model and a source level of 188 dB. In the joint witness statement, Dr Childerhouse agreed that Lyttelton provided an inappropriate comparison for ambient noise levels in the STB. That view was shared by all the other marine mammal experts.
490. Mr van Helden presented us with a detailed critique of different approaches to modelling of sound propagation. He noted for instance that spherical and cylindrical modelling will produce different results. He told us that a spherical model is inappropriate in shallower water as it will be constrained by the depth.
491. Because these and other concerns had been raised about the quality of TTRL's noise assessment, the DMC considered that further information was required. TTRL responding to a request from the DMC, engaged Mr Humpheson. We issued Minute 41 requesting that TTRL answer some specific questions related to noise modelling and the effects on marine mammals²⁶⁸. We requested that TTRL review the noise model used in its application documents, noting our concern that simple spherical spreading of sound was not necessarily appropriate in the marine environment.

²⁶⁴ AECOM report to Dr Childerhouse, 2 May 2017

²⁶⁵ Transcript 22 May 2017, page 3091

²⁶⁶ Transcript 22 May 2017, page 3091; and page 10 of the AECOM report to Dr Childerhouse, 2 May 2017

²⁶⁷ TTRL Report 28: *Offshore Iron Sand Extraction and Processing: Assessment of Noise Effects*, Hegley Acoustic Consultants, November 2015

²⁶⁸ Minute 41, Appendix 3 – Questions for marine acoustic expert

492. TTRL’s response to those questions was provided to the DMC on 2 May 2017 and included modelling of noise contours by Mr Humpheson. The modelling undertaken used software developed by a third party, and is called dBSea. The dBSea software has been subject to validation through field measurements on other projects, where modelling is compared with reality.
493. Mr Humpheson confirmed that the software used takes into the bathymetry (depth contours) of the STB, seabed material, water temperature and salinity, and currents. He told us that dBSea is most appropriate for use in waters less than 80 m depth, with a low frequency sound source, and with uniform seabed material. Mr Humpheson told us that he had assumed a uniform seabed material due to the computational time that would otherwise be involved²⁶⁹.
494. Dr Duncan queried whether Mr Humpheson’s assumption of uniform sandy material to a depth of 15 metres is reasonable, referring to TTRL’s background report on geology which states that the mining site and its surrounds are “gravelly sand”. We note that the report’s statement that the “*sediments are post-glacial marine muds, sands and gravels, and are particularly coarse over the shoals of The Rolling Ground. The overall geometry of this sedimentary cover is not well resolved within the existing data.*”²⁷⁰ In both Mr Humpheson and Dr Duncan’s opinions, reflections from different buried layers could increase the modelled noise by up to 2 dB.
495. Much of the hearing evidence and discussion around the potential for noise to affect marine mammals centred on TTRL’s proposed Condition 11. Later in the hearing, the applicant proffered new conditions 12A, 12B, 12BB, 12BC and 12C to supplement Condition 11. The conditions we have imposed renumber those conditions as 12 to 17 (counting the splitting of one condition). They are:
- Condition 12 (previously 12A) limits the source noise level to 171 dB (IMV and crawler operating at full production).
 - Condition 13 (previously 12B) requires certification that the equipment will meet that source level, prior to deployment in New Zealand.
 - Condition 14 (previously 12BB) states there shall be no extraction until the certification has been received.
 - Condition 15 (previously 12BC) requires weekly noise monitoring in the initial period of operation.
 - Conditions 16 and 17 (previously 12C) relate to underwater monitoring.
496. Condition 11 sets limits in terms of both frequency and sound level at 500 metres from the IMV. The Condition 11 noise limits read:
- “b. The overall combined noise level at 500 m shall 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;*

²⁶⁹ Transcript 22 May 2017, page 3069

²⁷⁰ TTRL Report 11: *Geological Desktop Summary Active Permit Areas 50753 (55581), 54068 and 54272, South Taranaki Bight*, NIWA, November 2015

- 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 shall not exceed a sound pressure level of 135 dB re 1µPa RMS linear;*"

497. An output of Mr Humpheson's modelling is a map of the STB showing noise contours from 120 dB to 90 dB. A 135 dB contour is not shown on the map, so we were unable to judge if the 500 m limit in Condition 11 will be met. Mr Humpheson confirmed that it will. Dr Childerhouse clarified for us that using 135 dB at 500 m, as a proxy for 120 dB at 10 km from the mining site²⁷¹, arose from conferencing between experts at the previous hearing. Regarding measuring at 500 m, his understanding was that measuring it in this way was more practicable.
498. Dr Childerhouse told us that expert conferencing during the previous application had included a review of international literature, including Department of Conservation regulations and the Southall study²⁷², which he considers is the benchmark study for acoustic impacts on marine mammals. The experts also had direct discussions with international experts, including from the USA. He noted that the NOAA interim threshold for behavioural disturbance from continuous noise is 120 dB, and is the same level as described by Southall et al²⁷³.
499. Dr Childerhouse expressed confidence in the proposed condition, telling us that:
- "I genuinely believe it's measurable. I think it's enforceable. And I also think it represents a conservative control on the operation. Mr Humpheson's talked quite extensively about the controls that TTRL are potentially going to have to make to ensure that their noise source is producing 135 decibels at 500 metres. I believe that TTRL have gone into this with open eyes. Advice we've had from Mr Shawn Thompson is that they believe that that is achievable for them."*²⁷⁴
500. There was some lack of clarity during the hearing about what noise sources had been quantified and considered in the noise modelling. However, Mr Humpheson provided a subsequent clarification of the noise sources. He also lists the noise sources in section 3.0 of his report. Mr Humpheson advised us that he had considered cumulative noise effects, from the point of view of what level in the total noise environment will mask any noise from the mining operation²⁷⁵. He also noted that the proposed noise condition does not assess noise on a cumulative (all of environment) basis; it will be solely the noise from the mining itself and the monitoring strategy will need to be designed so that other noise sources were not included²⁷⁶.

²⁷¹ Transcript 22 May 2017, pages 3118 and 3130, and Table 4 in AECOM report to Dr Childerhouse 2 May 2017

²⁷² Southall BL, Bowles AE, Ellison WT, Finneran JJ, Gentry RL, Greene CRJ, Kastak D, Ketten DR, Miller JH, Nachtigall PE, Richardson WJ, Thomas JA, Tyack P (2007) *Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations*. *Aquatic Mammals* 33: 411-522.

²⁷³ Paragraphs 15 to 21, Expert Supplementary Evidence of Simon John Childerhouse on Behalf of Trans-Tasman Resources Limited, 2 March 2017

²⁷⁴ Transcript 22 May 2017, pages 3118/3119

²⁷⁵ Transcript 22 May 2017, page 3091

²⁷⁶ Transcript 22 May 2017, pages 3091/3092

501. Based on noise generated solely by the operation of the IMV and crawler, the noise level will drop to 120 dB at approximately 10 km from the source. We note that the mapped noise contours provided to us by TTRL show only this scenario. Dr Childerhouse appears to have relied on the 120 dB at 10 km outcome in reaching some of his conclusions. It is important to note that in referring to 120 dB at 10 km he was only referring to source noise produced by the IMV and crawler.
502. Mr Humpheson's modelling did consider other noise sources as part of a sensitivity analysis. He stated that if the FSO and thrusters were in use at the same time as the IMV and crawler, the 120 dB level will be experienced at around 23 km from the source²⁷⁷. In answer to questioning, he told us that his calculation of total noise also included the supply vessel and FSO, which will add an additional 7 – 9 dB to the noise source. He qualified that by saying the thrusters are expected to operate for only 4% of the time in response to particular sea conditions. He also noted that they will be used when moving from one mining block to another, but that during those times, the crawler will not be operating as it will have been brought back on board the IMV. The thrusters will be used for about 10% of the time²⁷⁸. As noted in the applicant's Impact Assessment, repositioning of the IMV anchors will occur approximately every 10 days²⁷⁹.
503. Mr Humpheson referred to his experience in naval architecture, including in the defence industry, where design to minimise noise from machinery is important. He is confident that noise from the IMV and crawler can be significantly reduced from the noise generated by the dated De Beers technology operating in Namibia. In his opinion, a reduction of 10 dB can be readily achieved. Greater reductions, up to 20 dB, may be possible but at significantly greater cost²⁸⁰. After suitable design and trials in its country of manufacture, Mr Humpheson expects to achieve less than the 135 dB level, as the design should allow for what he referred to as several decibels of 'headroom'.
504. As shown on the noise contour maps produced by the modelling, the distance of the contours varies from the mining site boundaries. This is partly due to differential spreading of sound in response to the environmental parameters which are inputs to the model. However, some of the variability arises because the model is based on noise produced by mining at a single centrally located site²⁸¹. The noise contours therefore represent an averaged situation.
505. We also record that the 110, 105 and 100 dB contours extend about 40, 90, and 125 km west from the mining site (based on the centralised mining location). These large distances are related to how sound travels through water, which is very different to how it travels through air.
506. It became clear that the two acousticians (Mr Humpheson and Dr Duncan) approached the noise modelling issue from opposite directions. Mr Humpheson explained to us that he used 'back calculation' based on the noise level set in Condition 11. In effect, this means that he imposed a limit of 135 dB at 500 metres, and the model worked back from that point to define the level of the noise

²⁷⁷ Section 4.2, AECOM report to Dr Childerhouse, 2 May 2017

²⁷⁸ Transcript 22 May 2017, page 3100

²⁷⁹ Page 24, TTRL Impact Assessment

²⁸⁰ Transcript 22 May 2017, page 3077

²⁸¹ Section 4.1, AECOM report to Dr Childerhouse, 2 May 2017

source. Using this approach, the model requires the sound at source to be no more than 171 Db, which is the noise level imposed as Condition 12. Mr Humpheson’s assessment of the likely sound output from the proposed equipment is based on measurements from De Beers undersea diamond operation off the African coast. The cited equipment ranges from 171 – 177²⁸² dB, but Mr Humpheson notes that it is old technology which can be improved upon. He therefore concludes that the required level of 171 dB at source can be achieved.

507. Dr Duncan, on the other hand, explained his approach as being based on first defining the likely sound level arising from all the project’s equipment. Based on his expertise related to dredging operations, and his doubts over the De Beers data, he concluded that the totality of sound from the operation will be at least 9 dB higher than the required level of 171 dB. Given those doubts, Dr Duncan recommends that the target levels for noise should be defined statistically, such as a median level, and that verification should be carried out over a long enough period time to include all phases of the mining operation in a variety of weather conditions.

14.5 Effects of Noise

508. Professor Slooten said that the project’s main direct effect on marine mammals will be noise. Professor Dr Torres agreed that noise is the key concern and could be a tipping point for blue whales in terms of stress and consequences.
509. We compared the Department of Conservation’s sightings data²⁸³ with the noise contours set out in Table 13 below. We have also shown the approximate distance of each band from the mining site and included both the 120 dB contour based on IMV/crawler alone, and a 120 dB (23 km) contour based on all noise sources. Note that we have applied the 23 km contour as a set distance from all edges of the mining site, whereas the 120 dB contour is produced by the noise modelling and is a variable distance that responds to factors such as water depth. For that reason, the final column of the table is only broadly indicative of the spatial relationship between cetacean sightings and the likely position of a 120 dB contour which would be produced by modelling.
510. Dr Childerhouse undertook a similar exercise based on the 120 dB IMV/crawler contour, but did not provide information about the species and numbers within the contour bands.

Table 13: Cetaceans and Noise Contours

Species	Mining Site	Noise Contours (dB) and approx. distance				
		MS to 125 (up to 4km)	125 to 120 (4 – 10km)	120 to 115 (10 – 12km) ²⁸⁴	115 to 110 (12 – 30km)	MS to 120 (up to 23 km)
Common dolphin	10	3	38	12	12	51
Minke whale			1			1

²⁸² 177 dB is the highest level, and is associated with the dynamic position system (thrusters) on the IMV

²⁸³ As well as recent blue whale sightings data from Professor Dr Torres, and Project Hotspot orca sightings

²⁸⁴ The 120 and 115 dB contours are a similar distance from the mining site (in a westerly direction) due to local environmental characteristics. In other directions, the 120 to 115 band

		Noise Contours (dB) and approx. distance				
Species	Mining Site	MS to 125 (up to 4km)	125 to 120 (4 – 10km)	120 to 115 (10 – 12km) ²⁸⁴	115 to 110 (12 – 30km)	MS to 120 (up to 23 km)
Hector's/Māui dolphin			4			4
Risso's dolphin				9	5	0
Blue whale					6	4
Dusky dolphin					10	0
Orca			1		13	4
Humpback whale					1	0
Unknown baleen whale					10	2
Unknown large whale					1	0
<i>Date range</i>	<i>2011</i>	<i>2012</i>	<i>2012 - 2015</i>	<i>2011 - 2012</i>	<i>2010 - 2016</i>	<i>2011- 2014</i>

Source: Department of Conservation sightings database, and Torres sightings²⁸⁵, overlaid by TTRL noise contours

511. Dr Childerhouse explained that the 120 dB level is a threshold for behavioural shift in marine mammals, and is an appropriate level for most species. He provided us with a table of sound exposure levels, based on the modelling work undertaken by Mr Humpheson²⁸⁶. This indicates that a marine mammal staying at the 120 dB contour for 24 hours will be subject to an equivalent exposure of 169 dB, which remains below the permanent shift threshold²⁸⁷ of 180 dB for cetaceans and 190 dB for pinnipeds.
512. In his evidence, Mr van Helden's set out criteria which grade response probabilities²⁸⁸. For sensitive species such as migrating baleen whales (which includes southern right and blue whale), beaked whales, and harbour porpoises (a proxy for Hector's / Māui dolphin), the criteria suggest a 50% probability of response at 120 dB. For other marine mammals, there is a 10% response probability at 140 dB. Professor Dr Torres said she did not agree with the 135 dB at 500 m condition, as there are studies which suggest behavioural responses at much lower levels.
513. In very close proximity to the mining site, Dr Childerhouse said that permanent threshold shift (PTS)²⁸⁹ is possible if a marine mammal chose to stay in that location for more than around 3 hours. Behavioural shift is disruption of behavioural patterns, including but not limited to migration, breathing, nursing, breeding, feeding or sheltering. Dr Childerhouse's reliance on 120 dB is based on NOAA²⁹⁰ interim acoustic thresholds.

²⁸⁵ Torres sightings of blue whale may be more than one animal in each instance

²⁸⁶ Table 3, Second Supplementary Evidence of Simon John Childerhouse on Behalf of Trans-Tasman Resources Limited, 1 May 2017

²⁸⁷ Permanent physiological hearing damage to an individual marine mammal

²⁸⁸ Paragraph 144, Statement of Evidence by Anton Leo van Helden, on Behalf of Royal Forest and Bird Society of New Zealand, 24 January 2017

²⁸⁹ Permanent physiological hearing damage

²⁹⁰ National Oceanic and Atmospheric Administration, US Department of Commerce

514. Mr van Helden disagreed with Dr Childerhouse about the use of the NOAA interim guidelines. He informed us that the interim guidelines, which were developed in the late 1990s, have been superseded by draft guidelines which no longer use the 120 dB threshold. Mr van Helden’s opinion is that 120 dB is inadequate for application to behavioural responses²⁹¹, but he also said he was reluctant to speculate on a limit other than 135 dB at 500 m, without the benefit of proper noise modelling. He also noted that decibel levels and behaviour is a scientific point of contention, and there has been much new information since the 120 dB level was established²⁹². Mr van Helden also noted that the NOAA interim guidance should be viewed in the USA statutory context of ‘allowable take’. In effect, the allowable take concept includes death, so knowledge about the species population size and other information is a necessary precursor²⁹³.
515. Mr van Helden’s opinion about the need to more fully understand a species and its behaviour, before drawing any conclusions about the appropriateness of specific noise levels, is consistent with the evidence of Dr Erbe²⁹⁴. In a similar vein, Dr Chiffings said a critical need is to establish whether the area impacted by the mining operation is a preferential feeding area, particularly for blue whales. He agreed with the proposition that the modelled noise contours should be overlaid on blue whale feeding areas.
516. Mr van Helden considered that there is little research into behavioural effects on marine mammals, and referred us to a scientific review of studies²⁹⁵. We note the paper’s conclusion that monitoring and regulation of sub-lethal impacts of noise on cetaceans should not rely entirely on received noise levels thresholds.
517. Dr Childerhouse disagreed with the need for study of behavioural responses. He said that Dr Erbe’s theoretical framework for assessing risks requires accurate estimates of marine mammal densities across the entire South Taranaki Bight/Cook Strait area of approximately 30,000 kilometres. He considered that it unreasonable and prohibitively expensive to require TTRL to obtain that level of data²⁹⁶.
518. Although Dr Childerhouse characterises behavioural change as a relatively minor matter²⁹⁷, Mr van Helden said it is a matter to be treated with great caution because whales are dependent on sound for many activities²⁹⁸. He stated that lack of an observed behavioural response cannot be considered to indicate a lack of impact. In his view, the project’s greatest impact on whales will be from the noise it generates. He distinguished between direct effects – such as impacts on foraging, and long term

²⁹¹ Paragraph 63, Supplementary Statement of Evidence by Anton Leo van Helden on Behalf of Royal Forest and Bird Protection Society of New Zealand Incorporated, 30 March 2017

²⁹² Transcript 16 March 2017, page 1812

²⁹³ Transcript 16 March 2017, page 1820

²⁹⁴ Transcript 22 May 2017, page 3161

²⁹⁵ Gomez et al., 2016, *A Systematic Review on the Behavioural Responses of Wild Marine Mammals to Noise: The Disparity Between Science and Policy*

²⁹⁶ Transcript 22 May 2017, page 3122

²⁹⁷ Paragraph 41, Second Expert Supplementary Statement of Evidence of Simon John Childerhouse on Behalf of Trans-Tasman Resources Limited, 1 May 2017

²⁹⁸ Transcript 16 March 2017, page 1797

effects – such as increased risk of mortality and reduced cognitive function and other stress-related disorders. He said that it is long term effects that may impact species at the population level²⁹⁹.

Professor Dr Torres made a similar point, referring to physiological stress responses to chronically noisy environments which can impact on health by increasing susceptibility to illness. In Mr van Helden's opinion, if the sound levels in proposed Condition 11 are used, then a period of at least six weeks monitoring should be required to ensure that they are being met. Dr Childerhouse agreed with that proposition, and it was subsequently included in a revision of Condition 11.f.

519. Professor Dr Torres explained that animals which avoid noisy environments may lose foraging opportunities. She said this may be a significant impact over the proposed 35 years of mining operations. She also noted that additional noise can have the effect of "acoustic masking", which may cause inefficient or lost communication between individuals. There is rising evidence of physiological impacts of ocean noise on baleen whales.

14.6 Expert Conferencing

520. Expert conferencing was attended by Dr Childerhouse, Professor Slooten, Dr Chiffings, Dr Barbara, Dr MacDiarmid, and Mr van Helden.

Disagreement

- Whether the existing survey and modelling is adequate to describe marine mammal occurrence.
- Whether strandings data can reliably inform cetacean use of the area.
- Whether the sound produced from the mining operation would be comparable to shipping noise.
- The degree to which behavioural disturbance from noise is an issue.
- Whether the sediment plume would impact krill, and blue whale.
- Regarding the density and likely abundance of Māui dolphins in the STB, and whether distribution of the species can be robustly described.
- Whether there is sufficient information to make a science based assessment of the scale of the impact on marine mammals.
- The likely degree of noise impact on marine mammals.
- Whether Condition 11 will be an effective mitigation tool.

Agreement

- There should be pre- and post-mining monitoring on fur seals.
- An impact has to be significant before it will have a negative effect on that species or population.
- Some parts of the STB are an important habitat and foraging area for blue whales. The acceptability of mining impacts will depend on the extent and/or importance of the habitat affected.
- Blue whales and other species may be displaced from important areas, such as those used for feeding or breeding.
- It is unknown whether the sediment plume area is a preferential location for marine mammal foraging.

²⁹⁹ Transcript 16 March 2017, page 1798

- The sediment plume is likely to have ecological impacts, some of which will affect marine mammals.
- Increased vessel speed increases the risk of vessel strike to marine mammals, and vessel strike should be included in the EMMP.
- Ambient ocean noise is highly variable in space and time.
- Background noise should be monitored for at least 1 year before mining starts.
- Noise levels and frequencies from the proposed mining operation need to be defined.
- Increases in sound contribute to behavioural and physical consequences for marine mammals.
- It is not possible to determine the likely impacts of noise on marine mammals, including physical and behavioural effects.
- Some species (e.g. beaked whales, porpoises) have a higher sensitivity to anthropogenic noise than others.
- The proposed number of acoustic recorders inside and outside the PPA is insufficient to provide baseline information.
- Every dead marine mammal should be formally autopsied to provide possible indications of cause of death.
- The STB is an important area linking Māui and Hector's dolphin habitat.
- Any additional impact on Māui dolphins will be unsustainable and therefore should be avoided.
- The potential mining impacts (including noise and sedimentation) will affect a much larger area than the mining area.
- Cumulative impacts on marine mammals (including noise and ship strikes from existing shipping, fishing and other existing impacts) should be taken into account.

14.7 Findings on Marine Mammals

14.7.1 Findings – marine mammals in the STB

521. We accept that a wide range of marine mammals live in and visit the South Taranaki Bight. The STB is an important area in New Zealand for marine mammals and particularly so for some species.
522. Section 59(2)(e) of the Act requires us to consider impacts on the habitats of threatened species. We accept that orca, Southern right whale, Bryde's whale, bottlenose dolphin, Hector's dolphin, Māui dolphin, southern elephant seal, and blue whale are threatened species. We have taken into account the importance of protecting the habitats of these species.
523. The applicant provided us with spatial and descriptive information to map and understand habitat suitability for orca, Southern right whale, and Hector's dolphin³⁰⁰. We received no information regarding the habitats of Bryde's whale, bottlenose dolphin, or southern elephant seal, but we have reviewed the Department of Conservation sightings database. We received additional information regarding blue whale habitat and recent sightings.

³⁰⁰ TTRL Report 4: Habitat Models of Southern Right Whales, Hector's Dolphin, and Killer Whales in New Zealand, November 2015

524. Although we have had regard to the Department of Conservation sightings and strandings databases, we consider them to be indicative only of presence, and not of abundance or distribution. We also agree that the marine mammal aerial survey data provided by TTRL should be treated with caution.
525. Based on the Department of Conservation sightings database, bottlenose dolphin have not been observed in the STB north of a line between Abel Tasman National Park and Kāpiti Island. No bottlenose dolphin strandings have been recorded between Waitarere Beach and Cape Egmont. Based on that, we consider that the mining project poses little risk to the habitat of bottlenose dolphin.
526. Bryde's whale sightings have occurred approximately 45 km northeast of Farewell Spit (70 km southwest of the mining site) and at Pukerua Bay. There are no stranding records for Bryde's whale in the STB. Based on that information, the mining project poses little risk to Bryde's whale.
527. The only sightings of southern elephant seal reported in the Department of Conservation database (which extends beyond the area we have defined as the STB) were at Ngawi in the southern Wairarapa.
528. We accept the information provided by the Ngā Motu mapping that there have been three strandings of Māui dolphins in the STB and that sightings are infrequent³⁰¹.

14.7.2 Findings – marine mammal habitats

529. Blue whale sightings are largely concentrated in a band between points west of Cape Egmont and east from the base of Farewell Spit (30 km to 100 km from the mining site). Blue whale sightings, including those on the Department of Conservation's database and those made by Professor Dr Torres, are all in waters deeper than 60 m, a depth that Professor Dr Torres described to us being shallow for a blue whale. The nearest recorded blue whale sighting is 14 km southwest of the mining site, in water about 85 m deep.
530. Suitable habitat for Southern right whale cows with calves relates to sheltered waters under 20 m in depth, which can extend out to around 15 km offshore in parts of the Patea Shoals. Hector's dolphin habitat is in a somewhat narrower band, being mostly within about 5 km of the shoreline. Suitable habitat for orca is more widespread and fully overlaps the mining project area, although the most suitable habitat is some 8 km southwest of the mining site. Some sightings of orca have occurred out to sea, west of a line running north / south from Cape Egmont. However, most sightings have been close to shore.
531. Southern right whale, blue whale, and Bryde's whale are all baleen whales. They therefore rely on krill as a significant food source, but may also eat small fish. Some evidence was presented to us on the location of krill and other zooplankton, as set out in Chapter 4-11.2 of our record of decision.

³⁰¹ 1963 and 1995 near Whanganui, and 1989 at Opunake – online interactive map provided by Ngā Motu Marine Reserve Society

532. Department of Conservation data shows baleen whale sightings (especially blue whale) are more common in the western part of the STB. We think this also probably indicates the more common location of their food sources – including krill. A notable exception is Southern right whale sightings in near shore locations. This fact reflects their winter migration patterns when mothers and calves stay close to shore and do not feed. Based on depth, the mining site is beyond the eastern edge of the likely blue whale foraging area.

14.7.3 Findings – noise modelling

533. We accept the model used and the general approach adopted by Mr Humpheson. That is, ‘back calculation’ from the limits set by Condition 11 establishes the maximum sound level allowed to be produced at source. Mr Humpheson has told us that the level is 171 dB. Based on his experience of naval architecture and designing for specific acoustic outcomes in marine environments, he believes an engineering solution to keep noise within that limit is possible, while also allowing for some engineering ‘headroom’. He told us that *“I’m reasonably happy within a plus or minus 2 decibels that the noise levels are in the right order.”*³⁰²

534. We have imposed Condition 12 which sets an absolute limit of 171 dB for the source level for the combined operation of the IMV and crawler. The requirement for overseas pre-deployment commissioning and certification, which we have imposed as Condition 13, gives us additional confidence that the mandatory source level will be met before operations can begin.

535. The noise contours provided to us by TTRL show the 120 dB contour extending about 10 km from the mining site. However, we note that there will be times, when the thrusters and FSO are also operating under full power, that there will be more noise generated by the mining operation.

536. The 120 dB contour provided to us is based on noise generated by the IMV and crawler during mining operations, which will occur for around 72% of the time³⁰³, meaning that mining operations will occur for the equivalent of 263 days in a year.

537. The IMV and crawler will generate most of the noise for 90% of that time (i.e., for the equivalent of 237 days a year). However, the remaining 10% of the time (i.e., for the equivalent of 26 days in a year) there will be additional noise generated by the FSO (when under power) and the IMV’s thrusters. The times when all noise sources operate at once will be limited because:

- When the IMV and crawler are mining / processing, the FSO will not be operating;
- The IMV’s thrusters will only be used in adverse sea states or during movement to another mining block (estimated at every 30 days).
- When the IMV is in transit to another mining block, and using its thrusters, the crawler will be brought up on deck and not be operating. The FSO will also not be operating at those times.
- The IMV takes three days to process and temporarily store extracted iron sands onboard, equivalent to the capacity of the FSO. We assume that the FSO is therefore likely to be operating

³⁰² Transcript 2 May 2017, page 3081

³⁰³ Based on 28% downtime for due to inclement weather, vessel operations, plant/equipment maintenance and anchor location noted by Mr. S. Thompson in Transcript 17 February 2017, page 189

/ moving under power every four days, receiving the stored iron sands from the IMV and then moving off site to transfer the material to an export vessel.

538. We were told that altogether, the FSO and the IMV’s thrusters would add to the generation of noise approximately 10% of the time. At those times, the 120 dB contour will extend considerably further than the mapped contour provided by TTRL. Mr Humpheson undertook a sensitivity analysis to determine how much difference the additional noise sources would make. For the purpose of analysis, his report used the assumption that all noise sources would be operating. His report states that this includes *“noise generated by the DPS thrusters and the operation of the FSO under power”*. The assumption used in analysis was that all noise sources would be operating *“simultaneously and constantly”* and therefore represent *“an absolute worst case”*³⁰⁴.
539. Based on those assumptions, his analysis was that there would be 142 dB experienced at 500 metres from the source, which is 7 dB more than when only the IMV and crawler are operating³⁰⁵. The ‘all sources’ noise level would reduce to 120 dB at approximately 23 km from the noise source.
540. In defining the components of the additional noise and period it occurs Mr Humpheson made the following statements in his oral evidence:

*“That 7 - 9 [decibels] includes the dynamic positioning on the IMV. It also includes the supply vessels that would come to the site, it would also include the offloading vessel as well.”*³⁰⁶

*“it’s 4 per cent when there’s sea state, so 4 per cent of an annual period is when DPS would have to be used, and the DPS would also be used on a monthly basis when it repositions from one mining block to another. The only means of propulsion on the vessel are the DPS, it doesn’t have conventional propellers, because it’s only travelling slow speed, it doesn’t have to go from one port to the next. Adding all those in total would come to around 10 per cent of the time that DPS would be used, or thereabouts.”*³⁰⁷

541. There was also the following exchange between Mr Humpheson and commissioner Shaw:

“Humpheson: ... the DPS is only operated when it’s moving from one block to the next and that would be every 30 days that would happen or when the sea state conditions are such that there is a significant swell. That is where the 4 per cent of the time comes in. The DPS was included within the sensitivity test where I consider all sources combined.

Shaw: Was included?

Humpheson: Was included.

Shaw: In all sources combined?

³⁰⁴ Section 4.2 and Table 3, Trans-Tasman Resources – Acoustic Modelling, AECOM, letter report to Dr Childerhouse, 2 May 2017

³⁰⁵ Table 3, *ibid.* acoustic modelling by Mr. Humpheson

³⁰⁶ Transcript 22 May 2017, page 3093

³⁰⁷ Transcript 22 May 2017, page 3100

*Humpheson: Yes.*³⁰⁸

542. Mr Humpheson also gave evidence that beyond 25 km, noise from mining will be below the level of ambient noise (whether anthropogenic or natural), although it may still be audible. Much of the STB appears to be subject to shipping noise levels of 115 dB to 120 dB on a semi-regular basis. The sources of shipping noise include commercial fishing, as well as larger international transport vessels. As with the 23 km extent of the 120 dB sound level, we were not provided with contour modelling to illustrate the 25 km threshold beyond which masking by ambient noise will occur. It is also unclear to us if he included all potential noise sources (not just the IMV and crawler) when calculating the 25 km threshold.

14.7.4 Findings – thresholds of impact

543. It is in this context that we have had to consider the adoption of a 120 dB contour as an enforceable condition and what it will achieve. The 120 dB level, based on NOAA interim guidelines, is the foundation of our decision. NOAA is a notable international agency and has developed the 120 dB guideline for the specific purpose of defining a threshold of effects on marine mammals. We acknowledge that some expert witnesses had concerns about the use of 120 dB as a generic threshold for behavioural impact, and that it does not necessarily represent the same outcomes for different species.
544. However, in the absence of a comprehensive set of well-researched species and habitat specific information, we consider that the NOAA interim 120 dB guidance is the best measure available for us to consider. None of the experts were able to identify an alternative measurable threshold.
545. Mr van Helden and others questioned whether 120 dB is appropriate, but none of them suggested an alternative measurable and enforceable level. Mr van Helden provided us with a set of probabilities for behavioural responses at the 120 dB level (see paragraph 512 of our record of decision). For the most sensitive species, there is a 50% probability of a behavioural response (or a 50% probability of no response at all). This adds to our confidence that 120 dB is a threshold at which behavioural responses may begin to appear. Mr van Helden told us that Hector's dolphin and Southern right whale fall into that class of the most sensitive species. We consider that there is less risk for other cetaceans or pinnipeds that might frequent the location.
546. The potential for noise impacts on marine mammals is a significant concern to us, and TTRL's predicted 120 dB contour is a useful indication of the spatial extent of a threshold for behavioural impact. Accepting that 120 dB provides a relevant and enforceable threshold, we consider that the conditions should include a map showing that noise contour. We have imposed the requirement for map in Condition 17 and added the map as Schedule 7.

³⁰⁸ Transcript 22 May 2017, pages 3105/3106

547. The Condition and the mapped contour address the consistent noise source (the IMV and crawler). However, they provide no basis for assessment or enforcement in relation to the intermittently repeated, additional noise from the FSO, supply vessel, and IMV thrusters, which will occur up to 10% of the time³⁰⁹. The 120 dB contour is based on a single noise source located at the centre of the mining project area³¹⁰. In reality, the location of the noise source will vary over time, being sometimes up to 6 km closer to the shoreline. Variation in these two factors (source location and composition) will greatly influence the extent of noise.
548. The defined 120 dB contour³¹¹ (IMV and crawler alone); an undefined 120 dB contour (all noise sources); and a 25 km radius for ambient noise have jointly influenced our decision. Together, these three factors help to define the likely zone of influence for the purposes of our assessment.
549. We are clear that the potential for adverse behavioural impacts within the zone of influence is different to physiologically damaging impacts such as permanent hearing threshold shift (PTS). We note that PTS (auditory damage) will only be likely for marine mammals that spend 24 hours or more within 500 m of the combined IMV / crawler noise source.

14.7.5 Marine mammal findings – summary

550. In closing, Mr Holm for TTRL referred to an ‘absolutist’ position adopted by some parties, which dismisses the possibility that mining may be able to co-exist with marine mammals. Notable in this regard were Professors Dr Torres and Professor Slooten. Professor Dr Torres expressed the view that animals have an innate right to live in their habitats without disturbance or compromise³¹². Professor Slooten told us she does not accept Condition 11 because it is “arbitrary”³¹³.
551. We have accepted that noise at a certain level will have an impact on marine mammals and the threshold we have adopted is 120 dB. Dr Childerhouse advised us that this is the most conservative underwater noise threshold ever used in New Zealand³¹⁴.
552. We accept that beyond the 120 dB level there is a risk of adverse behavioural impacts on marine mammals which Mr van Helden estimated is possibly as high as 50% for sensitive species. A risk of behavioural impact does not represent a risk of auditory damage.
553. In adopting the 120 dB contour, we have placed considerable weight on the written and oral evidence of Dr Childerhouse and Mr Humpheson. We relied on Dr Childerhouse’s advice about the threshold for impacts on marine mammals, and Mr Humpheson for his advice about the generation and spatial extent of noise. In particular, we have relied on Mr Humpheson’s analysis of the level of additional noise that would be generated, and the period of time that would occur. We have

³⁰⁹ Transcript 22 May 2017, page 3100

³¹⁰ Section 4.1, bullet 2, AECOM report to Dr Childerhouse, 2 May 2017

³¹¹ Which is either a 10 km or 23 km radius, depending on noise sources operating at the time

³¹² Paragraph 58, Statement of Evidence by Dr Leigh Torres on Behalf of Kiwis Against Seabed Mining Incorporated, 23 January 2017

³¹³ Transcript 21 February 2017 page 541

³¹⁴ Transcript 22 May 2017, pages 3118/3119

concluded that it would be for intermittent, short durations, and be the equivalent of approximately 26 days in a year (see paragraph 537 above).

554. Based on that evidence, and through the imposition of conditions, we have established a 120 dB contour. We accept that in practice, it is not a fixed boundary. The position of the contour will move as mining occurs in different part of the site. The contour, shown as Schedule 7 in the conditions, is based on a single indicative location. As such, it is illustrative of the estimated average area from which some sensitive marine mammals may be 'excluded'. The conditions require the modelled contour to be validated at the commencement of mining.
555. Within the Patea Shoals, suitable habitat for Hector's dolphin and Southern right whale³¹⁵ is relatively restricted. The IMV / crawler 'average' 120 dB noise contour will not affect the typical habitat of either animal. However, during periods when the generated by the project is greater, a more extensive 120 dB contour will cover some of their habitat.
556. The greatest risk of effect for Southern right whale will be when the mining operation is at the far eastern end of the mining site. However, when operations are west of the mining site's mid-point, there will be little or no risk of effect.
557. When mining is at the far eastern end of the mining site, and during the limited periods when all noise sources are operating, the area of affected Southern right whale habitat will be around 300 km². That area represents around 43% of the approximately 700 km² of potential Southern right whale habitat across the Patea Shoals.
558. The risk of noise related behavioural impact will be similar for Hector's dolphin. Again, the risk will be greatest when mining is at the far eastern end of the mining site and all noise sources are operating. However, the risk may well be less because the Hector's dolphin typical habitat occupies a narrower coastal strip than Southern right whale.
559. For blue whale, the risk of behavioural impact will be greatest when mining is at the far western end of the mining site and all noise sources are operating (10% of the time). In that circumstance, around 700 km² of the STB within the blue whale's minimum foraging depth will be affected. However, because there is around 20,000 km² of blue whale habitat within the STB³¹⁶, the 700 km² represents only 3.5% of that area.
560. Suitable habitat for orca is widespread, and confined to neither inshore nor offshore. We therefore conclude that there will be no significant effect on orca due to noise.
561. However, there may be a potential effect on orca through destruction or disruption of eagle ray habitat at and near the mining site. A substantial area of eagle ray habitat has been modelled within and around the mining site, including good habitat to the north which is unlikely to be affected by the mining operation. Other good habitat is thought to include much of the mining site itself and an area immediately to the east. Orca appear unlikely to feed directly on eagle ray near the mining site,

³¹⁵ For southern right whale during calving season

³¹⁶ Based on the area deeper than 60 metres

preferring to hunt them during the ray's seasonal movement into shallower waters. A reduction, but not total loss, of eagle ray habitat may have a consequent effect on local seasonal food availability for orca.

562. There have been very few sightings of Bryde's whale, and those are at least 70 km from the mining site. Bryde's whale does not appear in the strandings database for the STB. Given the scarcity of information, the potential for any effects on Bryde's whale has not featured in our decision making.

15. Seabirds

563. TTRL's Report 1³¹⁷ notes that New Zealand supports the most diverse seabird assemblage on earth. However, the STB lacks suitable, predator-free breeding habitat for many species. Although the opportunities for breeding seabirds in the area are relatively limited or relatively high risk, the STB is visited by a diverse range of seabirds that either pass through or forage in the region. However, there have been no systematic and quantitative studies of the at-sea distributions and abundances of seabirds within the area.
564. In the context of that general lack of information, we heard expert evidence from two seabird experts:
- Dr D Thompson, on behalf of TTRL, is an expert in seabird ecology, at sea distributions of seabirds, and seabird-fishery interactions.
 - Professor Cockrem, on behalf of KASM/Greenpeace, is an expert in the responses of birds to changes in their environment, and has particular expertise in relation to penguins.

15.1 Species and Habitats

565. Dr D Thompson described the STB as supporting a relatively modest seabird assemblage, in terms of number of species. However, he also told us that in general terms, the seabird fauna of New Zealand is rich and diverse. Professor Cockrem stated that very large numbers of seabirds use the STB. He also said it is within an Important Bird and Biodiversity Area (IBA) and is therefore an area of international significance. Dr D Thompson told us that IBA areas are an international classification. Given the richness of New Zealand seabird fauna, he said that all or most of New Zealand could be similarly classified³¹⁸. Ms Sitarz from Forest and Bird provided us with a document which shows potential marine IBA areas in New Zealand, based on the seaward extension of land-based colonies³¹⁹. We estimate that about half the New Zealand mainland coastline is identified as being potential IBAs.
566. Dr D Thompson's evidence was based upon reviews of the seabirds that occur within the STB, of the effects of ship lighting on seabirds, squid and fish, and upon an assessment of the scale of ecological effects of seabed mining on seabirds. He informed us that, within the STB, there are four

³¹⁷ TTRL Report 1: *South Taranaki Bight Factual Baseline Environmental Report*, NIWA, November 2015

³¹⁸ Transcript 22 February 2017, page 594

³¹⁹ *Important Areas for New Zealand Seabirds, Sites at Sea Seaward Extensions, Pelagic Areas*, Forest and Bird, June 2014

‘threatened – nationally critical’ species likely to occur. These are three species of albatross and a gull. He also noted that six ‘threatened’ species are likely to occur. These are two species of tern (one of them being ‘nationally endangered’), a gull, a shag, a shearwater, and another albatross – all of which are ‘nationally vulnerable’. In relation to seabirds in general, he drew the distinction between species which are typically found in inshore waters and those which he termed ‘pelagic’, being species which have a wider oceanic range.

567. To the list of species likely in the STB, Dr Cockrem’s evidence added ‘at risk’ birds including the little penguin, two species of mollymawk, two species of shearwater, a tern, the fairy prion, a petrel, and an albatross.
568. The Nga Motu Marine Reserve Society was critical of the source of Dr D Thomson’s information on seabird sightings. They compared the information available on eBird, which Dr Thomson cites as his source, versus Nature Watch in relation to little penguins. The eBird map of little penguin distribution provide to us by Ngā Motu MRS shows almost no presence along the Taranaki coastline, whereas a Nature Watch map shows a far wider distribution of sightings.
569. Dr Cockrem drew our attention to studies on the distances travelled by Little Penguins when. Maximum distances ranged from 22 km to 35 km at two locations. However, Dr Cockrem also told us about the little penguins of Motuara Island at the entrance to Queen Charlotte Sound. Penguins from that site have been satellite tracked, and travel up to 170 km north into the STB – into the area offshore of Hawera and Opunake.
570. The Ngā Motu MRS also expressed concern that the mining will place additional stress on the Motuara colony. In their presentation, Ngā Motu Marine Reserve Society provided us with a map showing penguin satellite tracks, overlaid on a base map from a scientific study of little penguin ranges³²⁰. It shows two focal areas of penguin activity related to foraging from the Motuara colony, one of which lies to the immediate northwest of the mining area. The submission of Taranaki Regional Council also raised the issue of little penguins and referred to the same Motuara tracking study. In addition, the regional council’s submission observed that no seabird monitoring was proposed as part of the BEMP (now called the PCEMP) or EMMP³²¹.
571. Dr Cockrem informed us that little penguins can dive up to 50 metres deep to catch and eat small fish and cephalopods³²², and also eat some krill. We have been told by other parties that the STB hosts significant concentrations of krill that support blue and other species of whale (also see Chapter 4-14.1). Although little penguins primarily feed on fish, Dr Cockrem drew a link between little penguins and krill, highlighting potential risks arising from the sediment plume. He said that if the best krill and an area of high turbidity coincide, the birds may be forced to go elsewhere. If that happened at a particular time in the breeding season there could an impact. However, he also noted that the extent of an adverse effect like that is unpredictable.

³²⁰ *Variability in the Foraging Range of Eudyptula Minor Across Breeding Sites in Central New Zealand*, Poupart et al (2017)

³²¹ Paragraphs 48 – 50, Taranaki Regional Council submission, 11 November 2016

³²² Squid and octopus

572. Dr Cockrem's evidence about the fairy prion highlighted a large colony of 2.8 million birds on Stephens Island, just off the northern tip of D'Urville Island, about 85 km south of the mining area. He also noted the potential for prion 'wrecks' – the death of large numbers at one time from adverse environmental conditions, including food shortages. He considers that the large population of prions on Stephens Island is related to the high densities of krill in the STB. As with penguins, he suggested that any risk to primary production within the STB (see Chapter 4-12.4) represents a risk to a large number of prions.

15.2 Effects on Seabirds

573. Dr D Thompson categorised potential effects on seabirds as including displacement from the mining site (physical exclusion); reduced foraging efficiency (via increased turbidity from the sediment plume); noise; oil pollution; and artificial nocturnal lighting. He considered that displacement will occur from both the mining site and the sediment plume (but only in areas of high turbidity), but that this is of little concern as the seabirds using that area have wide distributions and ranges. Dr Thomson noted that turbidity will, depending on its level, affect those birds that forage in the water column³²³. Dr Cockrem referred to the same issue, stating that the potential was for displacement or reduction of foraging opportunities. He made the point that the risk will vary depending on the time of year, citing breeding and chick rearing seasons as a particular issue³²⁴.
574. Both experts noted the issue of vessel strike, through seabirds being attracted by lighting at night. This was a point of agreement in their joint witness statement. Dr D Thompson noted that the reported incidence of deck strike on fishing vessels was very small compared with the number reported as being killed by the fishing operations themselves (nets, longlines etc.)³²⁵. Dr Cockrem thought there was some potential for mass mortality through deck strike, given the large number of birds in the STB³²⁶.
575. Dr Cockrem told us that, in his opinion, the number one seabird issue related to the mining project is the potential for reductions in foraging opportunities³²⁷. A major focus of his evidence was the potential for impacts on little penguins and fairy prions. He informed us that little penguins were thought to breed on the coast between Hawera and Opunake, which is around 35 – 40 km from the mining site and 'up current' of the sediment plume's typical direction. He considered that little penguins may breed along other parts of the STB coastline but said that there are no sightings to support that assumption. He noted that little penguins generally avoid turbid water.
576. Dr Cockrem considered that consent conditions could not provide adequate safeguards for seabird mortality³²⁸.

³²³ Transcript 22 February 2017, page 601

³²⁴ Transcript 22 February 2017, page 612

³²⁵ Transcript 22 February 2017, pages 605/606

³²⁶ Transcript 22 February 2017, page 629

³²⁷ Transcript 22 February 2017, page 625

³²⁸ Transcript 22 February 2017, pages 635/636

15.3 Expert Conferencing

577. Expert conferencing was attended by Dr Cockrem and Dr D Thompson who identified three major issues:

- The importance of the South Taranaki Bight (STB) for seabirds.
- Increased turbidity and light attenuation resulting from the sediment plume and how these affect seabirds.
- Artificial nocturnal light from mining vessels attracting seabirds and the potential for vessel strike.

Disagreed

- Whether the STB is an important or crucial foraging ground for little penguins from the Marlborough Sounds.
- Whether there will be any effect on foraging by little penguins or other seabirds, related to reductions in light intensity by mining induced turbidity.
- The degree of population level effect on little penguins over the life of the mining.
- Whether there will be any effect on food availability to fairy prions, with a consequent effect on their number.
- Whether two years is a sufficient monitoring period in which to build baseline knowledge about seabirds in the STB.

Agreed

- The STB is within the international Cook Strait Important Bird and Biodiversity Area.
- Ten 'threatened' and 24 'at risk' taxa occur within the STB, year-round or seasonally.
- There are reports of large numbers of seabirds present, for example 100,000 prions.
- There have been no systematic and quantitative surveys of little penguins and other seabirds.
- There has been no systematic coastline survey for the presence of breeding little penguins.
- Observations of penguin tracks on beaches near Hawera and near Opunake are strong evidence that little penguins breed along that coastline.
- Little penguins swim up to 170 km from Motuara Island in the Marlborough Sounds to the STB.
- The project will increase turbidity and reduce light intensity within the water column, and this will affect seabirds.
- Large numbers of seabirds may be present in the STB at night, and that there is potential for significant mortality of seabirds attracted to mining vessel lights.

15.4 Findings on Seabirds

578. The differences in the evidence of Drs Thompson and Cockrem on the scale and consequences was exemplified by the summary in their joint witness statement which said:

“Overall, it was [Dr Cockrem’s] view that mining would have adverse effects on seabirds, including ‘threatened’ and ‘at risk’ taxa. [Dr D Thompson’s] view was that there would be no adverse effects on seabirds.”³²⁹

³²⁹ Joint Statement of Experts in the Field of Effects on Seabirds, 16 February 2017

579. We conclude that there is a lack of detailed knowledge about habitats and behaviour of seabirds in the STB. It is difficult to confidently assess the risks or effects at the scale of the Patea Shoals or the mining site itself.
580. All the seabirds referred to by the experts are wide ranging and at the level of the STB there are likely to be few effects. We do not dismiss the potential for some effects at the local level. The birds are highly mobile and their location in time and space is driven by their habitats, breeding, and foraging, and may conflict with the mining operation.
581. Our evaluation of effects on krill and suspended sediment concentrations enables us to draw some conclusions in respect of effects on seabirds. We have found that effects on krill arising from the sediment plume are unlikely, and concentrations of krill are typically well removed from the mining site (see paragraph 470 above). We conclude there is little risk to foraging by fairy prion.
582. Suspended sediment will increase turbidity in locations near the mining site, and there will be some consequent effects on the behaviour of fish. There is potential for effects on those birds which rely on water clarity to forage. This will be localised and minor, and monitoring of these effects will be required.
583. We accept the inclusion of seabirds in the PCEMP (Condition 48) and the development of a seabird effects mitigation and management plan (Condition 66). We endorse the need for Condition 66.d which addresses the issue of vessel lighting and deck strike. Because the practice of kaitiakitanga extends to seabirds, we have added consultation with the Kaitiakitanga Reference Group to Condition 66.

16. Human and Environmental Health

584. Potential for effects on human and environmental health arise from ecotoxicity from the release of heavy metals, and marine biosecurity related to the discharge of organisms in ballast water. We heard evidence presented by several experts, including:
- Dr Forrest, on behalf of TTRL, is an expert in marine organism biosecurity risks, their transport pathways, and tools and approaches for risk mitigation.
 - Dr James, on behalf of TTRL, is an expert in aquatic ecosystems, and plankton and benthic ecology.
 - Dr Phillips, on behalf of KASM/Greenpeace, is an aquatic ecologist and ecotoxicologist.
 - Dr Cresswell, on behalf of the EPA, is an aquatic ecotoxicologist.
 - Mr Clarke, on behalf of the Fisheries Submitters, is an environmental consultant specialising in risk assessment and air quality assessment.
585. The subjects of ecotoxicity and marine biosecurity featured in large number of submissions.
586. We received advice from counsel assisting the DMC in relation to human health matters. That advice, which was part of a memorandum also covering other topics, is set out below. The memorandum, dated 13 April, was provided to all parties.

15. *In that context, we note that the Act's purpose is quite distinct from that of HSWA. The purpose of HSWA focuses squarely on the health and safety of workers and workplaces,⁵ whereas potential effects on people (other than those with existing interests) are less clearly a focus in marine consent processes under the Act. That is, there are numerous indications in the Act, particularly when contrasted with the Resource Management Act 1991 ("RMA"), that effects on people are less relevant to marine consents than is the case for resource consents. These include narrower definitions in the Act of:*
- (a) "environment", which excludes "amenity values" and "social, economic, aesthetic, and cultural conditions which affect" the other aspects making up the environment (matters included under the corresponding RMA definition), and which does not expressly include "people and communities" when referring to ecosystems and their constituent parts; and*
 - (b) "sustainable management", which does not refer to social and cultural wellbeing.*
16. *We note too, in relation to the DMC's specific reference to conditions relating to health and safety, that the Act appears to distinguish between marine discharges of harmful substances, on the one hand, and activities authorised by a marine consent on the other. That is, there is a difference in wording between:*
- (a) section 59(2)(c) of the Act, which requires the EPA, when considering an application for a marine consent, to take into account "the effects on human health that may arise from effects on the environment"; and*
 - (b) section 87D(2)(a)(ii), which requires the EPA, when considering an application for a marine discharge consent in relation to the discharge of harmful substances, to take into account "the effects on human health of the discharge of harmful substances if consent is granted".⁶*
17. *The difference in wording indicates that Parliament intended:*
- (a) section 59(2)(c) to require the EPA to take into account effects on human health that may arise from effects on the environment, which are derivative effects falling within a narrower category than those contemplated by section 87D; and*
 - (b) section 87D to require consideration of the effects on human health of the discharge of harmful substances if consent is granted, irrespective of whether those effects may arise from effects on the environment.*
18. *In a practical sense, however, it is difficult to conceive of 'direct effects' on human health that do not arise from effects on the environment – that is, effects that are relevant to the broader consideration under section 87D but not under section 59(2)(c).*

⁵ Section 3 of HSWA.

⁶ There is an equivalent obligation in respect of dumping of waste or other matter in section 87D(2)(b)(ii).

16.1 Ecotoxicity

587. The existing heavy metal content in seabed sediments, and the risks that might pose to marine and human health was addressed in the KASM and Greenpeace submissions³³⁰.
588. TTRL's Report 42 provides information about the heavy metal content expected to be released by the grinding process and discharged back into seawater³³¹. In summary, to achieve a concentration below guideline levels for 99% species protection, the degree of dilution required in seawater will be:
- Nickel: 83-fold dilution.
 - Copper: 20 to 160-fold dilution (depending on suspended sediment particle size).
589. Prior to the hearing there was expert conferencing about ecotoxicity. The issue of potential concern was the release of heavy metals including copper and nickel from the mining and processing operations. The overall outcome of the conferencing was that the experts agreed on all points. They found that dilution and mixing will rapidly dilute heavy metal concentrations below trigger levels and there will be no impact on the nearshore environment. The experts agreed that there may be impacts on a small area immediately near the site and for a small distance downcurrent. They concluded that there was a low risk of changes to the background concentrations of nickel and copper. However, they also supported monitoring to confirm that concentrations will not result in increased risk of ecotoxic effects to biota.
590. The experts agreed on the sources of potential risk. Nickel and copper concentrations in sediment increase with depth. Mining could expose biota to higher concentrations than those currently present in surface waters. In addition, the processing of the seabed material will reduce the sediment grain size. Laboratory tests indicate that copper and nickel concentrations are increased with smaller grain size, leading to potential increases in dissolved and small particulate concentrations of those metals.
591. Some submitters criticised the depth of sediments which were sampled. However, the experts agreed that samples were taken from depths which demonstrated the relationship between concentration of contaminants and depth.
592. The Impact Assessment states that the processes for separating and processing the iron ore, use seawater extracted from the immediate area and do not involve the addition of any chemicals or other products. Some chemicals will be used in the operation of the reverse osmosis plant. They will be collected and retained for onshore disposal by approved contractors. No chemicals or contaminant by-products will be discharged to the sea from any processing or water treatment activities related to the project³³².
593. Dr James told us that TTRL will be examining the discharge in relation to a comprehensive suite of metals. In addition to nickel and copper, these will include cadmium, chromium, lead, arsenic and

³³⁰ Submission points 3(F) and 3(J), KASM standard submission. Paragraph 3, Greenpeace standard submission.

³³¹ TTRL Report 42: *Iron Sand Extraction in South Taranaki Bight: Effects on Trace Metal Contents of Sediment and Seawater*, Auckland University of Technology, September 2013

³³² Sections 2.3.4 and 2.3.6, TTRL Impact Assessment

mercury. These are not expected to be an issue. He said that it is important to consider what adheres to sediment particles as well as what is in the water, because shellfish are filter feeders³³³.

Dr Cresswell informed us that the experts agreed that mercury, antimony, arsenic, silver, manganese and selenium should also be assessed. Mr Govier's presentation at the hearing confirmed TTRL's intention to test for a wide range of metals.

594. They agreed that there is adequate information to make an assessment of risks related to the various metals but noted some uncertainties. This included variability of actual environmental conditions that will be encountered on site, and the degree to which the process of crushing and extracting the iron ore may increase copper and nickel concentrations. They therefore supported monitoring to and the imposition of conditions which included:
- Analyses to include metals in the dissolved and suspended particulate fractions, as well as in deposited sediments;
 - Monitoring to include characterisation of the discharge as the ISR every 6 months;
 - Toxicity monitoring using relevant biota during baseline and subsequently if levels exceed the ANZECC guidelines;
 - Biomonitoring for bioaccumulation at key sites every 2 years
 - One-off determination of the sensitivity to copper and nickel of early-stage locally relevant aquatic species during baseline phase.
595. Professor Slooten expressed concern that heavy metals may enter the food chain beginning with benthic communities, with consequent effects on the ecosystem, and eventually higher level predators including marine mammals and seabirds³³⁴.
596. Dr Phillips made a distinction between toxicity and bioaccumulation; she told us that toxicity is a direct effect whereas bioaccumulation is a cumulative effect. She told us that the experts agreed it will be useful to use caged mussels as a monitor for the uptake of metals³³⁵, although this is not specifically referred to in the Joint Witness Statement. Mr Govier's presentation at the hearing regarding the monitoring programme confirms that caged mussels will be used. Dr Phillips highlighted the importance of considering local, rather than national average, data when assessing the risk of consuming wild-caught food³³⁶.
597. Mr Young, on behalf of Ngāti Ruanui, noted that the iwi relies on seafood gathering. They are therefore very exposed to the risk of heavy metal contamination. He said that *"a damaged or un-accessible food resource goes to the heart of cultural impact."*³³⁷

³³³ Transcript 21 February 2017, page 422

³³⁴ Paragraph 17, Statement of Evidence by Professor Elisabeth Slooten on Behalf of Kiwis Against Seabed Mining Incorporated, 24 January 2016

³³⁵ Transcript 2 March 2017, page 1001

³³⁶ Paragraph 82, Statement of Evidence by Ngaire Robyn Phillips on Behalf of Kiwis Against Seabed Mining Incorporated, 22nd January 201, and Transcript 2 March 2017, page 1004

³³⁷ Paragraph 35, Evidence of Graham John Young, 24 January 2017

598. In terms of the overall quality of TTRL’s work on ecotoxicity, Dr Phillips’ opinion was that “*the science is very good*”³³⁸, a point agreed with by Dr Cresswell. Dr Phillips stated that TTRL had followed an international protocol in terms of how to assess the potential toxicity and bioavailability of dredge materials. We accept the evidence of Drs Phillips and Cresswell.

16.2 Expert Conferencing on Ecotoxicity

599. Expert conferencing was attended by Dr James, Dr Phillips, and Dr Cresswell.

Disagreement

- There were no points of disagreement

Agreement

- Dilution and mixing will rapidly dilute concentrations below trigger levels and will not impact on the nearshore environment.
- Concentrations of heavy metals may impact on the small area immediately near the ISR operations and for a small distance downstream.
- The level of metals would be negligible and the effects undetectable by the time the plume reaches the coast.
- Baseline and ongoing monitoring will address any uncertainty related to variation in heavy metals due to depth and location.
- Metals in both pore water³³⁹ and attached to particles should be monitored.
- Monitoring of mercury, antimony, silver, and arsenic should be included in at least the PCEMP.
- Selenium and manganese should be included in the PCEMP for characterisation.
- Sediment samples should be analysed for acid volatile sulphates (AVS).
- Ecotoxicity should be assessed using larval and adult life stages and lethal and sub-lethal endpoints.
- Ecotoxicity tests should be conducted during the baseline period, and during operations if concentrations exceed the ANZECC 95% protection level at sites further than 1 km from the mining and are above background levels.
- Monitoring for bioaccumulation should be performed in-situ using relevant local species and limited to key sites (1 km from the mining and a site at The Traps).
- Analysis using biomarkers representative of sub-lethal effects on shellfish should be undertaken.
- The discharge and the resalinated water should be monitored for key metals.
- One-off chronic ecotoxicity test with locally relevant species at early life stages should be undertaken to determine their sensitivity to dissolved and particulate nickel and copper.

³³⁸ Transcript 2 March 2017, page 1001

³³⁹ Water that occupies the pore spaces between rocks or sediments

16.3 Marine Biosecurity

600. Dr Forrest noted that there is an historic and ongoing risk associated with vessel movements into New Zealand waters. Vessels associated with the mining project pose the same risk to the country via ballast water or biofouling of the vessels' hulls.
601. There will be approximately 30 visits per year by bulk iron sands transport vessels to the mining area. Despite the theoretical risk posed, Dr Forrest said that the actual risk is inherently low. He contrasted the 30 visits per year to the mining site with approximately 6,000 annual port visits to New Zealand by foreign vessels.
602. Dr Forrest informed us that the greatest risk arises when international vessels visit sheltered port-type habitats that have artificial structures on which non-native species may grow. In contrast, he characterised the mining project area as a very physically challenging environment for any species to establish. Dr Forrest told us that the length of typical voyages from foreign ports will minimise the risk of unwanted organisms surviving in ballast water and agreed with Professor Cahoon that the risk of algal blooms in this environment is "*essentially non-existent*."³⁴⁰
603. Dr Forrest advised us that from 2018 New Zealand will operate under a mandatory craft risk management standard which requires all vessels entering our waters to meet strict conditions in terms of hull cleanliness. Current conventions require mid-ocean exchange of ballast water. From September 2017, stricter standards for ballast water treatment on ships will be phased in. In answer to a question from the DMC, Dr Forrest agreed that requiring both management measures (ballast water exchange, and ballast water treatment) will constitute a 'belt and braces' approach, but he questioned whether there will be any real benefit³⁴¹. The Ministry for Primary Industries is responsible for overseeing implementation of the vessel management measures.
604. Dr Forrest told us that TTRL have proposed additional measures to manage the biofouling risk on ships operating between the mainland and the mining area. Proposed consent conditions were developed in discussions with Aquaculture New Zealand and Sanford. These conditions are part of a proposed biosecurity management plan which will implement New Zealand's border standards.
605. Dr Forrest told us that "*the biosecurity risks from TTR are inherently low and/or can be managed to an acceptable level*."³⁴² He thought that conditions requiring a biosecurity management plan will give additional assurance, as it involves both the Ministry for Primary Industries and the aquaculture industry.

³⁴⁰ Transcript 17 February 2017, page 245

³⁴¹ Transcript 17 February 2017, pages 249/250

³⁴² Transcript 17 February 2017, page 245

16.4 Air Discharge

606. Mr S Thompson informed us that the emissions modelling undertaken for TTRL is based on an 80 Megawatt power output. He said that 60 MW is the intended capacity of the IMV, but 80 MW was used to simulate the combined output of the IMV and FSO³⁴³. As a comparison for fuel use, he told us that large cruise ships can use 300 – 900 tonnes of heavy fuel oil (HFO) a day, and that very large cruise ships have a generating capacity of 80 MW – 100 MW³⁴⁴.
607. Mr Clarke for the Fisheries Submitters drew attention to a 2015 TTRL report³⁴⁵ which modelled air discharge from HFO at a maximum 4.5% sulphur content, and noted that this is inconsistent with a statement in the Impact Assessment which refers to 3.5% content. Mr S Thompson told us that the modelling had since been revised, as the internationally approved maximum sulphur content of HFO has been reduced to 3.5%³⁴⁶. Mr Clarke acknowledged TTRL's revised modelling and said it shows there will be a degree of effect close to the area where the vessels are operating³⁴⁷. He concluded that at 3.5%, the impacts are *"much reduced and appropriate"*. However, he noted that there will be some locations out to sea where the National Environmental Standard for ambient air standard was exceeded³⁴⁸.
608. Mr S Thompson told us that the International Maritime Organization (IMO)³⁴⁹ limit for sulphur content in heavy fuel oil will be reducing further, to 0.5%, in 2020³⁵⁰. Mr Clarke cautioned us that if the planned IMO reduction does not occur for some reason, we should consider imposing a condition that achieves the same outcome.³⁵¹

16.5 Oil Spill

609. The evidence of Mr S Thompson, TTRL's Engineering and Project Director, states that the project's refuelling operations will be conducted in accordance with an approved Safety Case. Refuelling will also be compliant with the International Maritime Organisation (IMO) MARPOL regulations, especially chapter 8, ICS/OCIMF "Ship to Ship Transfer Guide (Petroleum) 4th Edition", as well as Maritime New Zealand (MNZ) requirements. The MNZ regulations require every vessel over 400 tonnes (or an oil tanker over 150 tonnes) to carry an approved shipboard oil pollution emergency plan (SOPEP). The SOPEP's purpose is to set out responses to an oil spill³⁵².

³⁴³ Transcript 17 February 2017, page 207

³⁴⁴ Transcript 17 February 2017, page 193

³⁴⁵ TTRL Report 22: *Air Dispersion Modelling Study - Reciprocating Engines*, Tonkin & Taylor, November 2015

³⁴⁶ Transcript 17 February 2017, page 208

³⁴⁷ Transcript 17 March 2017, page 1924

³⁴⁸ Transcript 17 March 2017, page 1923

³⁴⁹ The IMO is a specialised agency of the United Nations, and is the global standard-setting authority for the safety, security and environmental performance of international shipping.

³⁵⁰ Transcript 17 February 2017, page 194

³⁵¹ Transcript 17 March 2017, page 1924

³⁵² Corporate Evidence of Shawn Thompson on Behalf of Trans-Tasman Resources Limited, 16 December 2016

610. TTRL has undertaken oil spill trajectory modelling, the report of which attached to Mr S Thompson’s evidence, and which had also been presented as evidence at the 2014 hearing. The report outlines modelling of a worst case scenario, being a spill uncontrolled for two hours, releasing 100 tonnes of fuel oil into the sea. The predicted time for oil to reach the shoreline is 12.5 to 16.6 hours. The anchor handling tug (AHT) will be equipped, and the crew trained, as first responders to a spill event. However, if any spill exceeded the AHT’s response capability a national response will automatically be triggered³⁵³.
611. Mr S Thompson’s evidence also refers to intended design features, such as DP2 position keeping capability. That capability will enable the vessels to maintain the set distances from each other during the refuelling operation, thereby preventing any hose rupture during the refuelling operation³⁵⁴.
612. Mr Clarke’s evidence also covered oil spill modelling and risks.

16.6 Findings on Human and Environmental Health

613. We find that the risk of adverse effects such as algal blooms and the introduction of invasive species is low. Those risks are managed by international protocols and the relevant New Zealand government agencies and regulators.
614. We accept the recommendations of the experts as set out in paragraphs 594 and 599 above in relation to conditions.
615. We have imposed specific conditions for analysis of dissolved and suspended metals; monitoring of the discharge; toxicity monitoring of biota and bioaccumulation; and baseline assessments of levels of copper and nickel. Those are set out in Schedule 6 of the conditions.
616. We accept the conclusion of the experts that the risk of heavy metals contamination is negligible. We have included Schedule 6 in the suite of conditions which is related to testing for heavy metals to provide assurance that outcomes are consistent with these assessments.
617. We accept that TTRL does not intend to dispose of any chemicals or contaminant by-products to the sea from any processing or water treatment activities related to the project.
618. We accept that TTRL has considered risks associated with oil spills, and that procedures approved under other regulatory regimes will manage that risk.
619. There will be little effect in respect of air discharges from the operation of mining vessels under the current maximum of 3.5% sulphur HFO content. That risk will be further reduced under 0.5% content which is scheduled for introduction in 2020.

³⁵³ Paragraphs 60 – 65, *ibid.*, Evidence of S Thompson

³⁵⁴ Paragraph 60, *ibid.*, Evidence of S Thompson

Chapter 5. SOCIAL AND CULTURAL IMPACTS

This part of our record of decision (Chapter 5-17 to 21) outlines the existing cultural and social environment, and the likely impacts arising from the project. The Act specifically requires us to consider the economic benefit to New Zealand of granting consent, and we have considered that here alongside other impacts on the local community. Two of the most significant types of potential impact are on the interests of tangata whenua, and recreational fishing within the STB.

17. Tangata Whenua Matters

620. We heard from the following witnesses in relation to matters potentially affecting iwi:

- Mr Mikaere, on behalf of TTRL, is a consultant in tangata whenua and cultural issues arising from development applications.
- Ms Ngarewa-Packer, CEO of Te Rūnanga o Ngāti Ruanui Trust.
- Mr Ngarewa, Kaumātua of Pariroa Marae.
- Mr Young, on behalf of Te Rūnanga o Ngāti Ruanui Trust, is an environmental and resource management planner with experience in policy, consenting, and Taranaki's oil and gas industry.
- Ms Cashmore, on behalf of Te Rūnanga o Ngāti Ruanui Trust, is an environmental advisor to the Trust.
- Mr Davies, Chairperson of Te Kaahui o Rauru.
- Ms Iorns, Mr Scott, and Mr Stuart for Te Kaahui o Rauru, are lawyers with a focus on human rights and environmental matters.
- Professor Ruru and Ms Downs, on behalf of Te Kaahui o Rauru, are lawyers with a focus on human rights and environmental matters.
- Dr Erueti, on behalf of Ngā Rauru Kītahi, is a lawyer with a focus on indigenous rights and mining.
- Mr Hamilton, on behalf of Ngā Rauru Kītahi, is a consultant in the links between Te Tiriti, human rights and Ngāa Raurutanga.
- Ms Woods, on behalf of Te Ohu Kai Moana Trustee Limited (Te Ohu), is a resource management professional and a Principal Advisor at Te Ohu.
- Mr Hawira, Te Kaahui o Rauru, and appointed kaitiaki under the Te Awa Tupua Act.
- Ms Broughton, CEO of Te Kaahui o Rauru.

621. Ms Iorns, Mr Scott, Professor Ruru, Ms Downs, and Dr Erueti appeared as expert witnesses for iwi groups. Ms Iorns noted that in her case the *"advice is more akin to legal counsel"*.³⁵⁵

622. We also heard from others who made submissions and gave evidence on behalf of the three iwi which have mana whenua within the area affected or potentially affected by the project.

³⁵⁵ Transcript 6 March 2017, page 1170

17.1 Affected Iwi

623. A significant source of opposition to the proposed iron sands mining came from South Taranaki iwi. The concerns expressed by the iwi relate to their historical and ongoing kaitiakitanga and their customary use of coastal resources.
624. All iwi who claimed mana whenua status, and who were affected by the project, made submissions in opposition to the project. We note in particular submissions from:
- Te Rūnanga o Ngāti Ruanui Trust;
 - Te Kaahui o Rauru;
 - Te Korowai o Ngāruahine Trust;
 - Te Kotahitanga o Te Ātiawa Trust;
 - Te Ngaru Roa ā Māui;
 - Te Whiringa Muka Trust; and
 - Te Ohu Kaimoana representing fisheries interests.
625. The relevant iwi and the coastal frontage of their rohe, as shown by Figure 5 on page 146, are:
- Ngāti Ruanui Between the Whenuakura River (near Patea) and the Waingongoro River (near Hawera)
 - Te Kaahui o Rauru Between the Patea and the Whanganui rivers
 - Ngāruahine Between the Waihi Stream (near Hawera) and the Taungatara Stream (near Opunake).
626. Professor Ruru, on behalf of Ngāa Rauru, told us that the effects of the mining are directly related to the mana moana of Ngāti Ruanui, but that the DMC should consider the cultural values and existing interests of all affected iwi. It is common ground that Ngāti Ruanui hold mana whenua but we acknowledge the values and interests of all affected iwi.

17.2 Legal Framework

627. Section 12 of the Act requires particular actions on the part of the EPA (and this DMC) in relation to Te Tiriti. The wording of the Act on this matter is:

12 Treaty of Waitangi

In order to recognise and respect the Crown's responsibility to give effect to the principles of the Treaty of Waitangi for the purposes of this Act,

- (a) *section 18 (which relates to the function of the Māori Advisory Committee) provides for the Māori Advisory Committee to advise the Environmental Protection Authority so that decisions made under this Act may be informed by a Māori perspective; and*
- (b) *section 32 requires the Minister to establish and use a process that gives iwi adequate time and opportunity to comment on the subject matter of proposed regulations; and*

- (c) sections 33 and 59, respectively, require the Minister and the EPA to take into account the effects of activities on existing interests; and
- (d) section 45 requires the Environmental Protection Authority to notify iwi authorities, customary marine title groups, and protected customary rights groups directly of consent applications that may affect them.

628. In considering these matters and how we have addressed them, we have had regard to specific advice from counsel assisting the DMC. That advice, provided to us (and all parties) on 17 May 2017, is as set out below. We consider this be an important clarification of our role and responsibilities under the Act:

“59. TTRL’s counsel raised this issue at paragraphs 68 to 71 of their opening legal submissions, and noted that section 12 does not impose any express requirement on the DMC to take into account the principles of the Treaty when making decisions on applications.

60. We agree that it is instructive that section 12 sets out specific means by which the Crown’s responsibility to give effect to the principles of the Treaty is achieved, rather than enacting a direct requirement on the EPA or a DMC to take into account the principles of the Treaty in its decisions²⁸. This approach can be contrasted with the means by which the principles of the Treaty are addressed in the RMA.

61. As noted above, this formulation means that it is untenable, in our view, to read in an obligation or power on the EPA to take Treaty principles directly into account in decisions on marine consent applications, such as under the catch-all provision in section 59(2)(m).

62. That said, in our view there remains scope for Treaty principles and the issues that arise in that respect, such as the duty for the Crown to act reasonably, the duty to make decisions informed by Māori perspectives, and the duty of active protection of Māori interests, to influence or ‘colour’ the way in which other provisions are interpreted.

63. The provisions referred to in section 12 encompass both procedural and substantive elements of the marine consenting process; the references are to section 18 (the Māori Advisory Committee – Ngā Kaihautū Tikanga Taiao), section 45 (notification), and section 59 (highlighting the substantive consideration to be given to effects on existing interests). When interpreting these sections in particular, in our view it is appropriate to consider the relevant principles of the Treaty.

64. Procedurally, the EPA must notify iwi authorities, customary marine title groups, and protected customary rights groups directly of consent applications that may affect them to assist their ability to engage in the publicly notified marine consent process.

65. Substantively, any advice provided to the DMC by Ngā Kaihautū Tikanga Taiao is a mandatory consideration to which the DMC must have regard (together with various other mandatory considerations). Further, the concept of existing interests provides a very express means by which recognised Māori interests are to be considered (discussed further below).

In our view it is appropriate to read these obligations in light of the principles of the Treaty. For example, if considering whether an interest asserted by a Māori individual or group is a "lawfully established existing activity", and thus within the definition of "existing activity", it may be appropriate (and consistent with the principles of the Treaty) to apply a broad, inclusive interpretation.

66. *Other cultural considerations may also be relevant to the DMC's decision, as discussed below in the context of its question about claims founded on the Treaty of Waitangi, and the question regarding cultural, spiritual, and metaphysical values.*

67. *Consideration should also be specifically given to effects on Māori, as relevant, when the DMC considers the effects on human health of the discharge of harmful substances under section 87D(2)(a) of the Act²⁹.*

²⁸ *Its formulation is similar to other relatively recent Treaty provisions relating to non-core Crown processes, such as section 4 of the Local Government Act 2002.*

²⁹ *In relation to effects on human health, see also paragraphs 15 to 18 of our memorandum of counsel dated 13 April 2017."*

629. We have adopted this legal advice.

630. As noted under paragraph 627, Section 12 of the Act sets out obligations imposed on the EPA. We are satisfied that the EPA has discharged these obligations, being:

- The provision of a report from the EPA's Māori Advisory Committee (Ngā Kaihautū Tikanga Taiao) which has been provided to us, and which has been taken into consideration (see Chapter 5-17.4);
- The first extension of the submission lodgement time, at the request of Ngāti Ruanui (supported by other parties);
- Recognition of existing interests for the purposes of the Act (see Chapter 5-17.4.12) as well as an underlying consideration of Māori issues throughout our decision making (see Chapter 7-24); and
- The process undertaken by the EPA in relation to notification of iwi.

631. The DMC has considered the submissions from iwi and others, the report from NKTT, and identified the specific impacts which in our view are related to the obligations set out in Section 12 of the Act.

17.3 Major Issues Identified by Iwi

632. The major issues identified by iwi included:

- Te Tiriti;
- TTRL's engagement with iwi;
- The lack of a cultural impact report prepared by tangata whenua;
- Environmental impacts;
- Iwi settlements and the MACA Act;
- Customary uses in the marine environment;
- Iwi commercial interests; and

- Rights of indigenous peoples.

633. Some of these matters relate to existing interests, some to effects on the environment, some to international instruments, and some to other New Zealand statutes.

17.3.1 Te Tiriti

634. Mr Mikaere's evidence states that "*while there is an obligation to take into account existing interests (which would include Ngāti Ruanui interests) there is no specific obligation to take into account the principles of the Treaty (such as active protection of rangatiratanga)*"³⁵⁶.

635. Professor Ruru disagreed with Mr Mikaere and directed our attention to the EPA document "He Whetū Mārama" which sets out a broad framework to guide the EPA in undertaking its statutory obligations to Māori. The framework is guided by four Treaty principles, which He Whetū Mārama states as being:

- Partnership: Requires that the EPA acts reasonably, honourably, and in good faith to ensure the making of informed decisions on matters affecting the interests of Māori.
- Active protection: Requires the EPA to take positive steps to ensure that Māori interests, knowledge, and experience are valued in its decision making and activities.
- Participation: Informs the development of EPA strategy, policy, and process that enables the effective engagement and input of Māori.
- Potential Recognises that EPA decision making and activities have impacts on the direction for future growth and development in a Māori cultural and economic setting.

636. Professor Ruru considered that Section 59(2)(m)³⁵⁷ allows us to tie back to both He Whetū Mārama and the Treaty in our decision making.

17.3.2 TTRL's engagement with iwi

637. The nature of consultation and the current relationship between TTRL and iwi was also the subject of submissions and evidence. We have largely addressed that topic separately, under Chapter 5-21 of our record of decision, which is where we address the corporate evidence of Mr Walden.

638. We note that iwi representatives expressed significant dissatisfaction with TTRL's approach to consultation, regardless of what the company's intention may have been. Although Ngāti Ruanui declined to engage with TTRL on its terms or to prepare a cultural impact report, they did engage with the DMC during the hearing, as did other iwi submitters.

639. TTRL told us it had sought to engage with iwi and acknowledged that the lack of a cultural impact report, prepared by affected iwi, was a significant gap. TTRL made it clear that despite a lack of engagement, it remains willing to form constructive relationships with iwi. We acknowledge that the report by Mr Pōtiki was an attempt to address this gap. While this was helpful, it could not substitute

³⁵⁶ Paragraph 73, Expert Evidence of Buddy Mikaere on Behalf of Trans-Tasman Resources Limited, 17 December 2016

³⁵⁷ "any other matter the EPA considers relevant and reasonably necessary to determine the application"

for the lack of a cultural perspective from Ngāti Ruanui who are acknowledged as the iwi holding mana whenua.

17.3.3 Environmental impacts

640. Mr Young told us that the sediment plume is the *“ultimate environmental issue in terms of the most significant set of impacts.”*³⁵⁸ We understand that the issue for each iwi is that the direct physical effects of the mining will be felt in the CMA of each rohe.
641. Ms Cashmore presented us with detailed evidence covering a wide range of environmental concerns. We have considered some of the matters she raised in other parts of our record of decision.
642. Ms Broughton referred to effects that arose from the onshore Waipipi iron sands mining operation which ran from 1971 to 1987. As part of that activity, the iron sands were mixed into a slurry with water and pumped via pipeline out to cargo vessels. On board, the iron sands were separated from the slurry and the remainder was discharged to the sea. Ms Broughton told us that the discharge choked the reef life and, 45 years later, some people say *“those reefs still haven’t recovered to the state that they were in before the Waipipi Iron Sands began.”*³⁵⁹
643. Ms Broughton noted that the reefs are a feeding ground for snapper, which she called an essential part of her iwi’s diet. She said that *“when you have a healthy reef system there’s an abundance of kai. The mussels, the kina, the crabs, the kōtoretore, sea anemones, the karengo, crayfish. These are all really essential food items to us as Māori, to us as Ngā Rauru.”*³⁶⁰
644. Ms Broughton also referred to Mr Hawira’s presentation with respect to whales (see paragraph 452). She felt that we must exercise kaitiakitanga and be cautious about any new activities in the whales’ environment.
645. Ms Ngarewa-Packer said that *“Our key concern, as we come to the end of this, is that there is too much uncertainty.”*³⁶¹
646. Ms Ngarewa-Packer in closing said *“in our experience conditions in the EEZ are self-monitored. This requires a large degree of trust, discipline and integrity.”* She finished by saying *“Cultural impact is significant on Ngāti Ruanui, as has been shared today, and also as has been covered is [that] economic benefits do outweigh environmental fundamentals. So again we’d really like to emphasise that uncertainty plus insufficient information equals extreme caution.”*

³⁵⁸ Transcript 6 March 2017, page 1129

³⁵⁹ Transcript 6 March 2017, page 1187

³⁶⁰ Transcript 6 March 2017, page 1186

³⁶¹ Transcript 6 March 2017, page 1116

17.3.4 Kaitiakitanga, mauri and other tikanga

647. The legal advice from counsel assisting the DMC touched on how to incorporate Māori cultural perspectives into our decision making. As an example, the advice noted that the lawful exercise of kaitiaki responsibilities might fall within the scope for consideration of effects on the environment or existing interest under Section 59(2)(a) of the Act³⁶².

648. In addition, the advice to us from counsel assisting the DMC was that:³⁶³

"81. We agree that information about Māori interests and values in "existing interests", including cultural, spiritual, and metaphysical values in such interests, is potentially relevant under Section 59(2)(a); to the extent that such information is relevant, it must be taken into account by the DMC, as discussed below.

82. Further, we note that the term "environment" is defined in the Act as "the natural environment, including ecosystems and their constituent parts and all natural resources of New Zealand and its waters". Unlike under the RMA, effects on people and communities, amenity values, and social, economic, aesthetic, and cultural conditions are not effects on matters that make up the "environment" for the purposes of the Act.³¹

83. In our view, however, the DMC should take into account any evidence or information before it about relevant cultural perspectives of effects on the natural environment, alongside scientific or technical information. This would include information about the values that Māori hold in the natural environment, such as values in taonga species or in the mauri of land, water, or other elements of environment."

³¹ See the corresponding definition in section 2 of the RMA

649. We have had regard to that advice in formulating our decision.

650. What we understand to be the view of iwi in general was succinctly expressed by Ms Broughton for Ngā Rauru Kītahi. She told us that *"we submit that seabed mining is an experimental operation and that it will have destructive effects on our marine environment, marine species and people. As kaitiaki we cannot support this activity. It is the absolute antithesis of what we stand for. ... Seabed mining effects are a violation of kaitiakitanga. ... as kaitiaki, we, as Ngā Rauru Kītahi, are defenders of the ecosystems and its constituent parts. We believe that everything has a mauri or a life force and that mauri must be protected."*

³⁶² Paragraph 90, Memorandum of Counsel Assisting the Decision-Making Committee - Further Response to Minute 40, 17 May 2017

³⁶³ Ibid., legal advice from counsel assisting the DMC

17.3.5 Settlement and MACA Acts

651. NKTT asked that we take into account the likelihood that customary marine title and protection mechanisms for customary activities will be processed and granted within the 35-year duration of the mining project consent (see Chapter 5-17.4 below).
652. Settlement legislation is an outcome of processes to settle historical claims, and to recognise and provide redress for past actions of the Crown which have left individual iwi adversely affected in various ways. Each Settlement is subject to its own Deed and Act. The advice we have received from counsel assisting the DMC is that settled claims under Te Tiriti are clearly an existing interest for the purposes of the EEZ Act³⁶⁴.
653. Customary marine title is provided for under the Marine and Customary Area Act (MACA). The MACA repealed the Foreshore and Seabed Act 2004 and restored customary interests extinguished by that Act. The MACA establishes customary interests, and defines protected customary interests and rights
654. The MACA established the concept of customary marine title. A title recognises the relationship of an iwi, hapū or whānau with a part of the common marine and coastal area. Although customary marine title is broadly like a property right, it has particular restrictions and cannot be sold. Free public access, fishing and other recreational activities can continue in customary marine title areas.
655. Mr Young, Ms Ngarewa-Packer, Mr Hamilton, Ms Broughton, Ms Crowley, and Ms Waitai referred to the Ngāti Ruanui, Ngāa Rauru, and Ngāruahine Treaty settlements. Deeds of Settlement have been concluded with the three iwi and accompanied by Treaty of Waitangi Claims Settlement Acts. Settlements have been enacted regarding the Treaty claims of Ngāti Ruanui (2003), Ngā Rauru Kītahi (2005), and Ngāruahine (2016). Each of these Acts requires the settlement to be a consideration in decisions made under the Resource Management Act, but there is no similar requirement for consideration under the EEZ Act³⁶⁵.
656. The Deeds of Settlement under those Acts provide us with some background information about the association of the three iwi with at least the coastal waters immediately adjoining their respective rohe. We acknowledge that this information is not exhaustive, but consider that it is sufficient to help us understand the geographic extent of customary interests.
657. The Ngāti Ruanui Settlement refers to the cultural, spiritual, historical, and traditional association of Ngāti Ruanui with Te Moana Nui a Kupe. The Settlement does not define the seaward extent of the area of interest. The Ngāti Ruanui Settlement refers to specific reefs and fishing grounds which have been a traditional source of food. These areas are named as including Rangatapu, Ohawe Tokotoko, Waihi, Waokena, Tangahoe, Manawapou, Taumaha, Manutahi, Pipiri, Kaikura, Whitikau, Kenepuru, Te Pou a Turi, Rangitawhi, and Whenuakura. We were not presented with evidence about the specific location of these reefs and fishing grounds during the hearing, but note that the Waihi,

³⁶⁴ Paragraph 70, Memorandum of Counsel Assisting the Decision-Making Committee – Further Response to Minute 40, 17 May 2017

³⁶⁵ The three Settlement Acts pre-date the EEZ Act

Waokena, Tangahoe, and Te Pou a Turi, Rangitawhi inshore reefs are mapped by Figure 8 in TTRL's Recreation and Tourism report.

658. The Ngā Rauru Kītahi Settlement also refers to the main food gathering area being between the Waitōtara river mouth and Tuaropaki. Although the Settlement refers to food gathering from the coastal margin, it also refers to the Karewaonui canoe which was used to catch stingray, shark, snapper, and hāpuka about 10 miles (16 km) off the coast.
659. Professor Ruru and Mr Young drew our attention to claims lodged under the Marine and Coastal Area (Takutai Moana) Act 2011 (MACA). Dr Erueti's evidence notes that *"many Taranaki hapū claim rights to the possession of the coastal marine area and rights out to the end of the EEZ based on their continuous connection with their rohe and the exercise of mana whenua and mana moana or tino rangatiratanga over this area"*³⁶⁶.
660. Applications for recognition of customary interests had to be filed by 3 April 2017, and each of the three iwi has done so. Ngāti Ruanui have applied under the MACA for customary title out to the CMA/EEZ boundary – i.e., the 12 nautical mile limit (see Figure 5), which is also a boundary shared with the mining project area. Ms Ngarewa-Packer, on behalf of Ngāti Ruanui, told us that kaitiakitanga and mana do not artificially end at the 12 nautical mile limit. That view is consistent with the example of Ngā Rauru Kītahi, which has a gazetted customary fishing area which extends well past the 12 nm threshold (also see Figure 5).
661. Ngā Rauru Kītahi have also applied under the MACA for customary title, but the claimed area – as shown by the map which accompanied their application – does not fully extend out to the CMA/EEZ boundary. Ngāruahine have applied under the MACA for customary marine title to cover the immediate coastal area which borders their rohe. The Taranaki iwi trust (which includes Ngāruahine), has applied separately for customary marine title, which includes an area defined as being on behalf of Ngāruahine, out to the CMA/EEZ boundary.
662. In Mr Young's opinion, the MACA applications are relevant because of the long term nature of the iron sands mining consent. However, the advice we have received from counsel assisting the DMC is that a contingent or potential interest that an iwi asserts under a MACA customary marine title application is not an existing interest for the purposes of the EEZ Act³⁶⁷.
663. The MACA application areas of all three iwi overlap to a greater or lesser extent.

³⁶⁶ Page 9, Nga Marae o Ngā Rauru Kītahi, Evidence of Andrew Erueti, 23 January 2017

³⁶⁷ Memorandum of Counsel Assisting the Decision-Making Committee – Further Response to Minute 40, 17 May 2017, paragraph 71

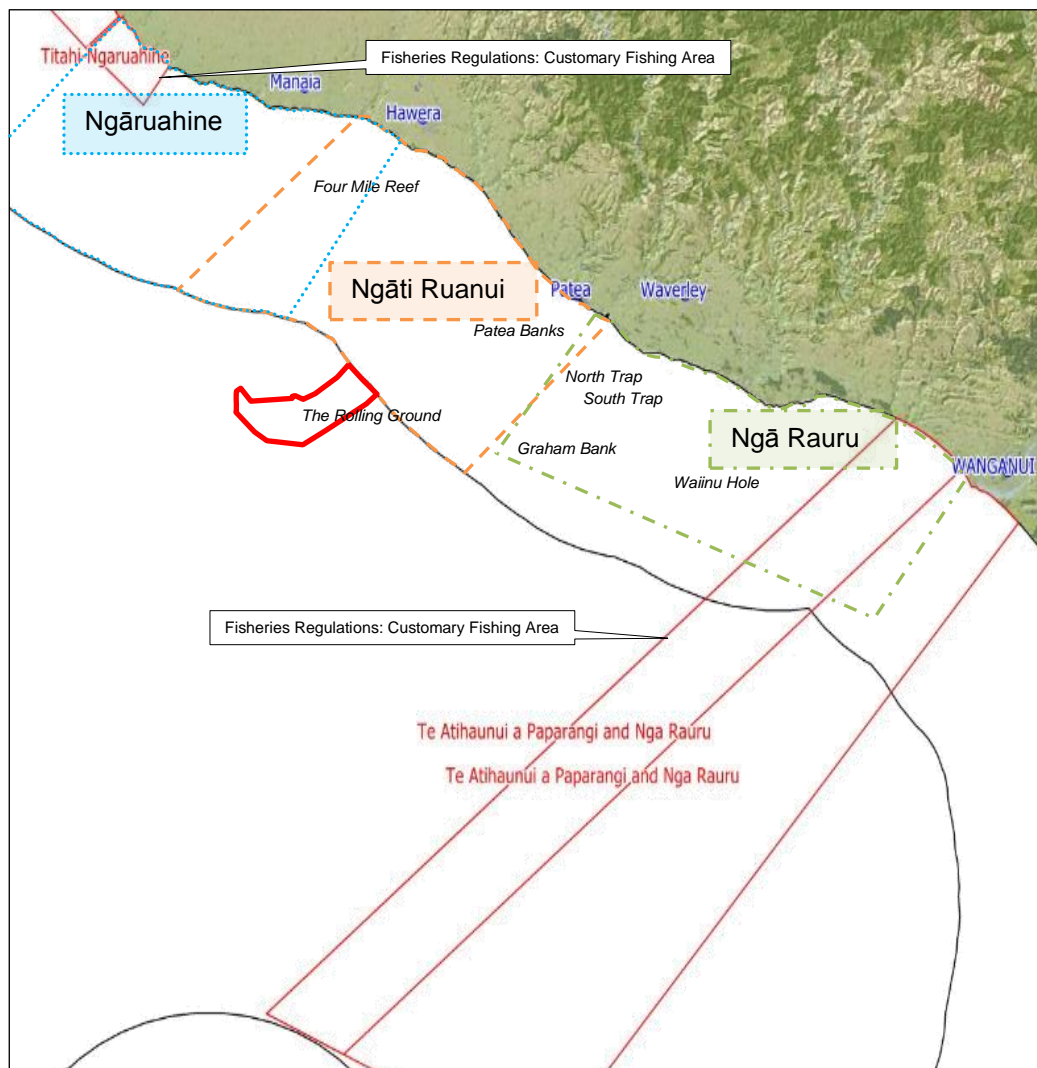


Figure 5: MACA Application Areas, and Regulated Customary Fishing Areas

Source: Customary fisheries areas from TTRL spatial mapping; MACA applications by iwi
Prepared by DMC

17.3.6 Customary use

664. We heard from various submitters, especially during our hearing days in New Plymouth, about fishing and collecting kaimoana in general. We appreciate that for Māori, when seen from a Pākehā perspective, these activities can have both a cultural and a recreation aspect. There is no need for us to distinguish between these two aspects.
665. Mr Ngarewa, a kaumātua, told us that “*Kaikapua, a cousin of mine, a kaumātua, died at the age of 80-plus years 6 years ago, and can recall as a young boy he was used as a bailer. Multiple times he would accompany the skilful fishermen of possibly five men, sometimes they would have up to eight in a crew, and they would row out on the rāoa (rowing-boat) in the Tasman Sea to the designated area proposed by TTR for seabed mining, anchor their boat, their rāoa, throw their fishing lines into the deep sea, and when their rāoa were filled to capacity they would return to shore.*”

666. Mr Young advised us that Ngāti Ruanui was prepared to share information about customary food gathering sites, if requested by the DMC. We made that request at the hearing but did not subsequently receive any information from Ngāti Ruanui.
667. Ms Cashmore pointed out that *“the coastal marine area, which adjoins the site, is considered of regional marine importance because of its distinctive habitat. This area is highly vulnerable to sediment discharge and dispersal.”* She also provided catch data from the Ministry of Primary Industries confirming the presence of both short and longfin eels within the mining site and South Taranaki Bight from 2005 to 2016.³⁶⁸ She said this is contrary to evidence provided by TTRL’s experts.
668. Mr Mikaere attached a submission from Ngāti Ruanui to the EPA as an appendix to his evidence. The submission, written in 2014, was in relation to TTRL’s first application for marine consent. However, Mr Mikaere’s evidence notes that the cultural values expressed in that submission probably remain unchanged³⁶⁹. The Ngāti Ruanui submission refers to kaitiakitanga, puwaitanga, manaakitanga, whakapapa, tikanga, and rangatiratanga. The submission also refers to taonga species under Ngāti Ruanui’s Settlement Act, and is critical of TTRL’s failure to record pipi, kina, kuku and pāua.
669. The NIWA assessment report tells us that information about customary use of marine resources is very limited. The report states that at least forty species of marine invertebrates and fish are subject to customary use in the STB. They are harvested from many locations, ranging from intertidal reefs and deep offshore areas. Methods of collection vary from hand picking or gathering to specialised hook and line and potting techniques. NIWA consider that the customary fisheries having greatest overlap with the mining area are species such as rig and leatherjacket.
670. The mātauranga Māori and customary fisheries analysis³⁷⁰ in the appendices to the Impact Assessment identifies twenty-seven sites of customary importance to Māori for kaimoana. These include the two whale related locations that we referred to in paragraph 475. In addition, there are four onshore fishing camps; two spawning/feeding areas; two river mouth fishing areas; four shellfish gathering areas; two reefs of importance for mussels, paua, kina, and crayfish; with the remaining being areas or reefs important for various species of fish.
671. Many of the sites are at or near the shoreline. The important offshore sites include The Traps (fishing and crayfishing); a spawning ground between Graham Bank and The Traps; another spawning ground offshore of the Patea Shoals – southeast of the mining area; and a reef important for mussels, paua, kina, and crayfish, halfway between the mining site and the Patea River mouth. Based on their locations, the sites subject to the greatest influence from the sediment plume will be:
- Manahi reef: A reef important for mussels, paua, kina, and crayfish, approximately 13 km east-northeast of the mining area; and

³⁶⁸ Transcript 6 March 2017 page 1131

³⁶⁹ Paragraph 19, Expert Evidence of Buddy Mikaere on Behalf of Trans-Tasman Resources Limited 17 December 2016

³⁷⁰ Table 2, page 24, *TTR - Sand Mining – Patea Mātauranga Māori and Customary Fisheries Analysis*, Te Tai Hauāuru Fish Forum, Tanenuiarangi Manawatu Inc., 2016

- Tahuahua: A spawning/feeding area important for Rig, Snapper, Kingfish, Trevally, and Gurnard, approximately 25 km southeast of the mining area.
672. The Social Impact Assessment (SIA) identifies Four Mile Reef (Ohawe) and Waiinu Reef as important kaimoana gathering areas (see Chapter 5-19 below). As noted earlier, the Ngāti Ruanui and Ngā Rauru Settlements are indicative of wide ranging traditional gathering of kaimoana. For Ngā Rauru (and for Ngāruahine), some traditional use is now also regulated via the fisheries regulations.
673. The GIS mapping provided to us by TTRL shows customary fishing areas gazetted under the Fisheries (Kaimoana Customary Fishing) Regulations 1998. Both Ngāruahine and Ngā Rauru have established customary fisheries areas under the regulations. Via the gazetted notices³⁷¹, the iwi have each appointed Tangata Kaitiaki for their rohe moana. The Tangata Kaitiaki may authorise any individual to take fisheries resources managed under the Fisheries Act 1996, for customary food-gathering purposes. No customary food gathering of fisheries resources may take place in the rohe moana without an authorisation from one of the appointed Tangata Kaitiaki. Figure 5 shows the extent of the gazetted customary fishing areas.

17.3.7 Iwi Commercial Interests

674. We heard evidence from Ms Woods for Te Ohu Kai Moana Trustee Limited (Te Ohu). Te Ohu is the corporate trustee of the Te Ohu Kai Moana Trust, established under section 33 of the Māori Fisheries Act 2004 (the Māori Fisheries Act). Te Ohu has an existing interest because it has an interest in the settlement of a historical claim under Te Tiriti, and the settlement of a contemporary claim Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. As mandated by the Māori Fisheries Act, Te Ohu's purpose is to advance the interests of iwi individually and collectively, primarily in the development of fisheries, fishing, and fisheries related activities. Te Ohu is a member of Fisheries Inshore New Zealand (FINZ), which is also a submitter in opposition to TTRL's application.
675. Ms Woods informed us that the Māori Fisheries Act assigned Individual Transferable Quota (ITQ) to all Māori, which is a perpetual property right. In addition to that right, the ITQ assigned to Māori is part of a Te Tiriti settlement. In that respect, Ms Woods stated that the Crown has a duty to protect them. She also noted that the Fisheries Settlement requires the Crown to recognise the use and management practices of Māori in the exercise of non-commercial fishing rights.
676. Ms Wood's evidence includes a map (her Figure 2) which shows that the iwi adjoining the STB have the fisheries assets transferred to them. The assets include both inshore and deepwater fisheries. Fisheries stocks listed in her evidence which STB iwi have an interest in include JMA7 (Jack Mackerel), Hok1 (Hoki), SPO8 (Rig), QMA8 (Surf clams), SNA8/QMA8 (Snapper), and

³⁷¹ Fisheries (Kaimoana Customary Fishing) Notice (No. 2) 2011 (No. F579) [Ngāruahine]; Fisheries (Kaimoana Customary Fishing) Notice (No. 4) 2009 (No. F496) [Ngā Rauru]

LFE23/SFE23 (Long-finned/short-finned eel). These areas cover the mining site and at least part of the area potentially affected by the sediment plume.

677. She also explained the relevance of the customary fisheries regulations which we outline above in paragraph 673.
678. As Ms Woods put it, the interests of iwi are “multi-layered” and overlapping. They encompass commercial offshore and inshore fisheries, as well as currently defined customary use areas (under the Fisheries Regulations) and prospective ones (under the MACA).

17.3.8 Rights of Indigenous Peoples

679. Some submitters queried whether granting consent to the TTRL project will impact on or be in contravention of New Zealand’s international human rights obligations – specifically regarding the impact on iwi. In that regard, we have considered what weight should be given to the United Nations declaration on the rights of indigenous peoples (UNDRIP).
680. UNDRIP covers matters such as the right of indigenous peoples to self-determination, indigenous peoples' right to property, and rights to natural resources. In this regard it has many similarities to Te Tiriti, and other instruments such as MACA and customary areas under the Fisheries Regulations.
681. Counsel assisting the DMC provided us with legal advice on this matter. In summary, the advice is that:
- UNDRIP is not among the list of international obligations in Section 11 of the Act, but that does not preclude the DMC from taking it into account, to the extent that it relates to the marine environment.
 - Caution should be exercised if taking UNDRIP into account, if the Act already gives clear guidance on the matters under consideration.
 - Matters such as the right of indigenous peoples to self-determination, indigenous peoples' right to property, and rights to natural resources must be considered in light of various provisions in the Act, such as those relating to Te Tiriti (section 12 and related provisions) and existing interests.
682. Mr Hamilton referred to UNDRIP and international human rights in his evidence. Setting the scene, he stated that *“the EPA is the Crown and has all the rights and obligations of the Crown. These include the obligations of partnership, protection and participation. These are based on the Treaty being the founding document of our state, belonging to all of us and being a promise of two peoples to take the best possible care of each other.”* He went on to say *“my opinion is that the EPA has a duty to act as a Treaty partner and support Tangata Whenua rights and responsibilities to apply Rangatiratanga, especially as Kaitiaki, to the resources being discussed. Failure to do so will cause a breach of the Crown’s Treaty obligations and international human rights standards.”*³⁷²
683. Mr Hamilton also gave a number of international examples and said *“in summary, the state has an obligation of partnership, the state has an obligation to protect Ngā Raurutanga, which Māori has*

³⁷² Paragraphs 13 and 15, Expert Evidence of Te Huia Bill Hamilton on behalf of Ngā Rauru Kītahi, 23 January 2017

emphasised in this case specifically is about kaitiakitanga, and the third part of it is to enable full participation of the right and responsibility to provide full participation by tangata whenua in decisions that impact on us.”

17.4 NKTT Report

684. The Ngā Kaihautū Tikanga Taiao (NKTT) report was received in January 2017 and it made recommendations that related to the following matters:
1. Cultural Impact Assessment: The need for a cultural impact assessment. Ngā Kaihautū are of the view that the cultural values assessment in the TTRL application is not a cultural impact assessment;
 2. Duration of Consent and Iwi Interests: The ability for effects on iwi existing interests to be managed over the 35 year life of the consent;
 3. Support of Tāngata Whenua for Conditions: Assessing the support of tangata whenua for the iwi related conditions proffered by the applicant, their participation in the proposed Kaitiakitanga Reference Group, and ongoing monitoring, review, and educational processes;
 4. Development of Management Plans: The need for the KRG to contribute to development of the PCEMP, and for tangata whenua to be involved in preparation of the various management plans;
 5. Consent Holder understanding of tangata whenua perspectives: The delivery of educational and/or training activities by tangata whenua to improve TTRL awareness and understanding of tangata whenua perspectives, values, history, interests, tikanga and kawa.
 6. Human Health: Seeking clarity about effects on human health in relation to customary kaimoana gathering;
 7. Biodiversity, Ecosystems, and Habitats: Ensuring suitable protection of the biological diversity and integrity of marine species, ecosystems, and processes [s59(2)(d)], any rare and vulnerable ecosystems, and the habitats of threatened species [s59(2)(e)];
 8. Environmental Protection: The imposition of conditions that require protect the environment;
 9. Triggers, Mitigation, and Recovery: The consideration of Māori perspectives in relation to environmental triggers; the adequacy of mitigation; and long term degradation / recovery;
 10. Settlement Legislation: The need to take into account Claims Settlement legislation relevant to the project area, existing interests, and the impact area of the sediment plume.
 11. Future Customary Title: The need to take into account the implications of customary marine title being granted at some time during the life of the consent;
 12. Cultural Existing Interests: Whether culturally based activities constitute lawfully established existing activities (existing interests), including the existing interests in the CMA;

13. Economic Benefit: Whether the project will demonstrate sustainable economic benefit for tangata whenua, other than employment opportunities.

685. In addition, NKTT recommended that the DMC take into account the key matters identified by Appendix B of the NKTT report. The appendix sets out a range of matters of concern identified by Māori. They are:

- The relationship of Māori to both the environment and area through whakapapa. Whakapapa is what ensures the interconnectedness of all living things and is central to Māori life and the role of kaitiaki.
- The practice of tikanga and kawa, and the application of mātauranga Māori by kaitiaki, ensures the mauri of the ecosystem and environment.
- The rights and interests of Māori, whether as existing interests, activities defined in the EEZ Act, or as lawfully established activities, whether authorised or not.
- The adverse effects from noise and vibration, primarily on marine mammals.
- Impacts from the sediment plume on the environment, with particular reference by some submitters on customary areas/sites of significance.
- The conflict between the Te Tai Hauāuru Fisheries Forum report and the submissions (individual and joint) received from members/representatives on the Forum.
- The role of kaitiaki.
- The principle of protection.
- The lack of a bond mechanism, or insurance cover towards environmental restoration, should something go wrong.
- Inadequate consultation undertaken by TTRL with tangata whenua.
- Lack of transparency and disclosure of information by TTRL.

686. The DMC has noted these recommendations and taken them into account where appropriate. Some of these matters are dealt with in more detail in Chapter 4 of our record of decision, and others such as bonds or insurance, consultation and disclosure have been discussed in other parts of the record of decision.

687. Any conflicting views between Te Tai Hauāuru Fisheries Forum and submitters is not a matter for the DMC to resolve or comment on. We note that all submissions have been taken into account.

17.4.1 Cultural impact assessment

688. NKTT expressed the view that the cultural values assessment in the application is not a cultural impact assessment [emphasis added]. We agree. The applicant told us that efforts at engagement with Ngāti Ruanui had not been successful. They had offered to fund the preparation of a cultural impact assessment but this offer had not led to the preparation of an assessment by Ngāti Ruanui. Mr Young stated that *“Ngati Ruanui had always used a specific approach to validate the environmental data and impact to inform the cultural impact; in basic terms there was not enough*

*environmental information from TTR to undertake this task. It would have been in my belief disingenuous for Ngāti Ruanui to complete a cultural impact statement in these circumstances.”*³⁷³

689. Mr Pōtiki was engaged to prepare the cultural values assessment which was included in the TTRL documentation as an attempt to bridge the gap. Mr Pōtiki was unable to appear at the hearing and Mr Mikaere was engaged by TTRL to review his cultural values assessment and to give evidence at the hearing.

690. We accept that the cultural values assessment was not a substitution for a cultural impact assessment prepared by tangata whenua. It was probably the best that could be done by the applicant in the face of Ngāti Ruanui’s decision not to prepare such an assessment. That decision was a matter for them alone. Mr Mikaere’s view of the situation was that:

*“... when you meet a blank refusal to participate, which includes a refusal to provide a cultural impact assessment even though being invited and knowing that that whole exercise will be properly resourced, it really leaves an applicant in no other position than to seek to prepare their own cultural impact assessment.”*³⁷⁴

691. A cultural impact assessment by tangata whenua is good practice for applications such as this and is highly desirable, but it is not a statutory requirement for applications under the Act. The absence of such an assessment in the documentation accompanying the application is not a fatal flaw.

17.4.2 Duration of consent and iwi interests

692. NKTT and submitters commented on the proposed 35 year life of the consent. We were told that this would be inconsistent with *“the likelihood that customary marine title and protection mechanisms for customary activities will be processed and granted within the 35 year consent period and what, if any, impact this could have on the operation of the consent, should the consent application be granted.”*

693. The recommendation’s reference to marine title is to mechanisms under the Marine and Coastal Area (Takutai Moana) Act 2011 (the MACA Act)³⁷⁵. NKTT questioned whether TTRL had properly considered effects on the existing interests of iwi and whether those effects could be managed over the term of the consent³⁷⁶.

694. We requested advice in respect of future interests to address the matter raised by NKTT. While an interest in a settled claim made under Te Tiriti is clearly an existing interest we were advised that the definition of an existing interest does *“... not include a contingent or potential interest, such as an interest that a person has (or asserts) in an unsettled claim under the Treaty, or an application under MACA that has not yet been determined.”*³⁷⁷

³⁷³ Paragraph 77, Evidence of Graham John Young, 24 January 2017

³⁷⁴ Transcript 30 March 2017, page 775

³⁷⁵ The MACA arose from the repeal of the Foreshore and Seabed Act 2004

³⁷⁶ Ngā Kaihautū Tikanga Taiao Report, recommendation 17

³⁷⁷ Page 18, Memorandum of Counsel Assisting the Decision-Making Committee – Further Response to Minute 40, 17 May 2017

695. Counsel assisting the DMC went on to note that:

“75. Even if an interest relating to an unsettled claim is not an "existing interest" there may yet be scope for the DMC to consider unsettled Treaty claims pursuant to the catch-all provision in section 59(2)(m), which leaves some discretion to the DMC to determine the relevance of certain factors that are not otherwise dealt with in the Act. It may be, for example, that in certain circumstances the effects of a proposal on a person's interest in a future Treaty settlement will be considered under section 59(2)(m) – such as if a future settlement has not been finalised but has progressed far enough through the process that its terms have been agreed in a deed or are otherwise well understood.

76. Such circumstances are likely to be exceptional, however; generally, the DMC should not seek to pre-empt the outcome of Treaty settlement negotiations or to give weight to interests that are not well defined, given that the Act is focussed on existing interests rather than potential ones.”

696. We are satisfied that there are no exceptional circumstances surrounding the applications made by iwi under the MACA. We cannot take future Treaty or MACA Act settlements into account in respect of TTRL’s application, as this would be a preemption of decisions yet to be made. These future possibilities are not existing interests under Section 59(2)(a), and we have decided that they are not exceptional matters we should take into account under Section 59(2)(m).

17.4.3 Support of Tāngata Whenua for conditions

697. We agree that the effectiveness of some proffered conditions will depend on participation by iwi. These conditions relate to monitoring of effects through a Kaitiakitanga Reference Group and a Technical Review Group. This is also true in respect of conditions which may relate to developing economic benefit for tangata whenua.

698. Regarding the relationship between iwi and TTRL, now and into the future, we consider that this is largely dependent on participation by the iwi. We note that TTRL has ‘left the door open’ for iwi to engage. We acknowledge that iwi can decline to take part in activities anticipated by the conditions we have imposed. While we consider that their participation would be highly desirable, we cannot compel them to do so.

17.4.4 Development of management plans

699. We agree with NKTT that the effectiveness of the management plans will be enhanced by the KRG’s input to their development. We cannot require participation in this process by iwi but observe that we support their participation when and if they feel able to do so.

17.4.5 Consent Holder understanding of tangata whenua perspectives

700. We cannot impose a condition which ensures the education and training recommended by NKTT will happen. However, relationships between the Consent Holder and iwi would no doubt be improved with greater understanding of tangata whenua perspectives.

17.4.6 Human health

701. This matter is dealt with in more detail in Chapter 4-16, but we are satisfied that the risk of effects on human health in relation to customary kaimoana gathering is negligible.

17.4.7 Biodiversity, ecosystems, and habitats

702. This matter is dealt with in detail in those parts of our record of decision which address the benthic environment, seabirds, and marine mammals. We consider that managing relevant risks is required and have imposed conditions for that reason. In particular, Condition 8 addresses recovery of the benthic environment.
703. We have disregarded NKTT's recommendation about adaptive management, as this is not available to us (see Chapter 1-2.3).

17.4.8 Environmental protection

704. We have imposed conditions which we consider will avoid, remedy or mitigate adverse effects on the environment.

17.4.9 Triggers, mitigation, and recovery

705. It is highly desirable that Māori values and perspectives are taken into account in setting environmental thresholds. We have taken account of iwi submissions in this matter and have focused particular attention on the impacts of the operation on customary food gathering.
706. Limits on suspended sediment at named locations recognise the value of the Patea Shoals in general, and reef sites in particular, as important to customary food gathering. The Consent Holder will be required by Condition 8 to ensure benthic recovery is achieved.
707. We note that the conditions provide a framework for iwi participation in the KRG and monitoring processes.

17.4.10 Settlement legislation

708. Settlements under Te Tiriti legislation and the MACA are existing interests. We have taken these into account. Many of the potential adverse impacts identified by Māori would accrue within the CMA. Those impacts relevant to existing interests within the CMA have been considered and assessed by the DMC.
709. The impact area of the sediment plume has been a key element of our assessment.

17.4.11 Future customary title

710. We have addressed this matter under Chapter 5-17.4.2 above. We adopt the legal advice provided to us by counsel assisting the DMC, that we cannot take into account potential interests which have not yet been established.

17.4.12 Cultural existing interests

711. The NKTT Report raised the question of what constitutes a “lawfully established existing activity”. The Report drew our attention to sections of the MACA and the RMA which maintain the rights of public use within the coastal marine area and suggested that they provide a basis for further considering what a lawfully established existing activity might be. The NKTT Report expressed the view that tangata whenua collectively have the right to continue to practice their tikanga and other activities on land, in the CMA, and in the EEZ.

712. The most important of these activities relate to customary food gathering, and fisheries. We have also considered the exercise of kaitiakitanga. In our view, this has been provided for through the conditions related to formation and operation of the KRG, and the participation of iwi in ongoing environmental monitoring.

17.4.13 Economic benefit

713. We have considered the potential for economic benefit to tangata whenua, but there is no guarantee that those outcomes will eventuate. Again, a productive working relationship between iwi and TTRL will assist in maximising the potential.

17.5 Findings on Tangata Whenua Matters

714. Although the mining will take place beyond the territorial limit. We acknowledge that iwi view their interests as extending out beyond the horizon. Within that broader area, the effects of the sediment plume and noise will be felt across a wide area, substantially outside the EEZ but within the coastal marine area. There are long established interests within the coastal marine area and current claims by iwi under the Marine and Coastal Area (Takutai Moana) Act.

715. We consider that the EPA satisfied its obligation to notify relevant Māori and iwi groups of applications for marine consents and marine discharge consents.

716. We are obliged by Section 59 of the Act to take into account a wide range of matters in our decision – including environmental impacts which are relevant to both tangata whenua and the wider public. In considering those matters, we have borne in mind the principles of Te Tiriti, including the duty for the Crown to act reasonably, the duty to make decisions informed by Māori perspectives, and the duty of active protection of Māori interests. Customary activities have the status of existing interests under the Act. We find it would be wrong to base our decision solely on UNDRIP as that would duplicate consideration under New Zealand legislation including the EEZ Act, MACA, and Te Tiriti.

717. The term "environment" is defined in the Act as "the natural environment, including ecosystems and their constituent parts and all natural resources ". Effects on people and communities, amenity values, and social, economic, aesthetic, and cultural conditions are not effects on matters that make up the "environment" for the purposes of the Act. This is in contrast to the RMA (which covers the coastal marine area) in which the defined "environment" includes, among other matters, "people and communities" and "social, economic, aesthetic, and cultural conditions". This point was emphasised to us by counsel assisting the DMC (see paragraph 648 above).
718. Under Section 59(2)(m) of the Act, we have considered effects on the coastal marine area and the consequent effects on Māori. Following the advice of counsel³⁷⁸, we have limited our consideration to taking into account the cultural perspective of effects on the natural environment. This includes values held by Māori, such as the taonga nature of some species or in the mauri of land, water, or other elements of environment.
719. We have taken into account the existing Settlement legislation of Ngāti Ruanui, Ngāruahine, and Ngaa Rauru. We have not and cannot take into account the recent applications by those iwi for customary marine title under the MACA. Those applications have not yet been settled, and we cannot pre-judge the outcomes. NKTT asked us to consider the relevance of the marine title applications. However, we considered the advice of counsel assisting the DMC and reached the conclusion that there are no exceptional circumstances that would cause us to give weight to the existence of the MACA applications.
720. Māori interests in general, and Te Tiriti principles in particular, are important and relevant 'other matters' under Section 59(2)(m) of the Act. Our approach in this regard is also consistent with the advice of counsel assisting the DMC; that principles of Te Tiriti should 'colour' our assessment. As an example, we have taken into account the potential physical and biological effects of the sediment plume on kaimoana.
721. On physical and biological questions, our consideration is based on effects. However, we also acknowledge and have had regard to the Māori worldview, including cultural and metaphysical aspects that go beyond western physical science. This includes the focus of iwi on kaitiakitanga, and potential effects on the mauri of any impacted part of the environment. In this regard, we note that there are aspects in common between the three iwi, as well as some differences. Working from north to south, the following paragraphs outline the likely biophysical impact on each rohe.
722. Regarding customary gathering, we considered that it is inappropriate to view the issue from a STB-wide perspective. The rohe of individual iwi are confined to much smaller areas than the STB. The effects on reefs as a focus for food gathering has been part of our consideration.
723. The nearest shoreline in Ngāruahine rohe is north of and over 20 km from the mining site. Even during unusual current and weather conditions, the predicted level of suspended sediment

³⁷⁸ Paragraph 83, Memorandum of Counsel Assisting the Decision-Making Committee - Further Response to Minute 40, 17 May 2017

concentrations will be small increments on background levels inshore and will be less than the levels at which potential adverse effects on marine life might occur.

724. The highest levels of suspended sediment concentration will occur in the coastal marine area offshore from Ngāti Ruanui's whenua. There will be severe effects on seabed life within 2 – 3 km of the project area and moderate effects up to 15 km from the mining activity. Most of these effects will occur within the CMA. There will be adverse effects such as avoidance by fish of those areas. Kaimoana gathering sites on nearshore reefs are likely to be subject to minor impacts given background suspended sediment concentrations nearshore.
725. The Traps, Graham Bank and The "Project Reef" are all within Ngā Rauru's rohe. In relation to Ngā Rauru, there are likely to be adverse effects such as avoidance by fish in areas towards the outer edge of the coastal marine area such as Graham Bank and this area will at times have significant reductions in light, affecting primary production levels. Kaimoana gathering sites on nearshore reefs are likely to be subject to minor or negligible impacts given that background SSC is typically elevated in the nearshore area. Impacts may be moderate towards the western end of the rohe, but minor or negligible elsewhere.
726. Our findings in relation to human and environmental health (see Chapter 4-16) are that effects related to heavy metals are very unlikely, whether by direct impact or via bioaccumulation. The consequent risk to kaimoana is assessed as negligible but we have imposed conditions to monitor and respond to indicators. We consider that the kaimoana monitoring programme (Condition 77) should be imposed because of the importance of this issue to iwi. The monitoring programme will be required to operate, even in the absence of engagement by iwi in the Kaitiakitanga Reference Group.
727. We acknowledge there will be some impact on kaitiakitanga, mauri, or other cultural values. A significant physical area will be affected, either within the mining site itself, or through the effects of elevated SSC in the discharge. Iwi identified other relevant effects such as the impact of noise on marine mammals as being of concern.
728. The concepts of kaitiakitanga and mauri (as well as other cultural values) are of great importance to the iwi within whose rohe the effects of the mining will be felt. We consider that the conditions (especially Conditions 73 - 80) will provide an opportunity for iwi to exercise kaitiakitanga through engaging in monitoring, and other scientific and operational aspects of the project.
729. Condition 80 requires the Consent Holder to continue efforts to engage with and inform iwi. Condition 77 requires the kaimoana monitoring programme to proceed regardless.

18. Social Impact

730. There was a Social Impact Assessment (SIA) prepared for the earlier application, it was updated and included as Report 30 for the current application. It set out impacts on social wellbeing, including economic wellbeing, community uses of the coastal environment (including recreation), and the amenity values associated with the coastal environment. Some of these matters are not specified as matters for assessment by the Act, but where appropriate we have taken them into account.
731. The SIA considered both “local” and “wider” communities – local being coastal communities from Opunake to Whanganui city, and wider being New Plymouth, South Taranaki and Whanganui districts beyond the local area. The SIA noted and assessed eight main coastal communities in the “local area”: Opunake, Manaia, Ohawe, Hawera, Patea, Waverley, Waitōtara and Kai Iwi. During our site visit, we saw the last five of those communities.
732. The SIA noted that:
- New jobs are unlikely to significantly reduce unemployment levels;
 - Positive social effects, in terms of jobs and incomes, will arise – but most of these benefits will be experienced outside the local community (mostly in New Plymouth);
 - High incomes may help to offset existing average low incomes;
 - The proposed operations will have negligible effects (positive or negative) on community facilities, social services and housing;
 - Vessels will have only a minor, if any, effect on the amenity that residents and visitors currently experience onshore;
 - Visual amenity experienced by offshore recreational fishers and divers may be adversely affected to some degree;
 - There may be some adverse social effects on offshore recreational fishing and diving along the coastline from Patea to Whanganui;
 - Effects on surfing are anticipated to be insignificant;
 - There will be negligible effects on the recreational values and associated amenity of the beaches along the South Taranaki / Whanganui coastline; and
 - When viewed from coastal walkways, the sediment plume may have the potential to create some adverse effect on visual amenity.
733. We received submissions from many individual members of the South Taranaki and Whanganui District communities. To the extent that those submissions addressed environmental impacts, we have addressed them in other parts of our record of decision. For some of the submitters, their views about environmental impacts and effects on existing interests are inextricably linked with what we consider to be social impacts. They see the project as an unwelcome impact on their community as a whole. We do not dismiss those views, but the Act does not allow us to take direct account of social wellbeing. However, we can potentially take social impact concerns into account under Section 59(2)(m) of the Act as “other matters”, provided that they relate to effects on the environment or existing interests.

734. The individuals of South Taranaki and Whanganui are also represented by their local bodies. We received submissions from Taranaki Regional Council (TRC) and Whanganui District (WDC). At our request, TRC and Horizons Regional Council (representing Manawatu / Whanganui) also provided us with environmental information, but that was unrelated to issues regarding social impact.
735. TRC stated that it had received community feedback indicating that TTRL had engaged positively and informatively with the public. The Council also gave its opinion that suitable work had been undertaken to identify the positive regional economic benefits. TRC noted its concern about the difficulties that emerged in consultation with iwi. We have addressed all these topics elsewhere in our report. The remainder of the TRC submission concentrated on environmental effects within the coastal marine area, within which it has statutory responsibilities.³⁷⁹
736. Whanganui District Council (WDC) stated that its position on the application was neutral. It acknowledged environmental and tangata whenua concerns from within the community. It also noted community support on the grounds of potential economic growth and job creation.³⁸⁰ Mayor McDouall told us that the application had raised strong feelings, both for and against, among the councillors. He told us that the number for and against was fairly evenly split and “*there’s no middle ground*”³⁸¹.

19. Fishing, Diving and Gathering

19.1 Background Information

737. Submission and presentations made at the hearing demonstrated that fishing, diving, gathering and other uses of coastal waters are popular activities for people living near the STB.
738. We heard from many individuals for whom this is a part of their lives, and from representatives of clubs related to recreational sea fishing, surfcasting, and diving. We heard from the Patea and Districts Boating Club, the Waitotara Patea Surfcasters Club, the New Plymouth Sportfishing and Underwater Club. We also heard from the Raglan Sportfishing Club.
739. During the hearing, TTRL did not present us with any evidence related to recreational fishing but did provide evidence about potential sediment plume avoidance thresholds for fish.
740. To supplement what we learned from submissions and in the hearing, we have considered information contained in the following two reports. Those reports are:
- Report 29 – *Trans-Tasman Resources Ltd, Sea Bed Mining, South Taranaki, Recreation and Tourism Assessment of Effects, Rob Greenaway & Associates, November 2015*
 - Report 30 – *Social Impact Assessment of Trans-Tasman Resources Ltd Iron Sand Mining Project, Corydon Consultants, January 2016*

³⁷⁹ Trans-Tasman Resources Limited: Submission on Application for Marine Consents, Taranaki Regional Council, 1 November 2016

³⁸⁰ Trans-Tasman Resources Limited Iron Sand Extraction and Processing Application, Whanganui District Council, 14 November 2016

³⁸¹ Transcript 16 March 2017, page 1727

741. Through interviews with relevant club and activity representatives (such as fishing clubs), Report 29 summarises the nature of public use in the STB. The summary covers water clarity, diving, fishing, inshore activities (such as surfcasting and shellfish gathering), surfing, spearfishing, and public access along the coastline.
742. The report draws conclusions about effects on recreation and tourism related to turbidity and resuspension of fines. Its main conclusions are that:
- Turbidity effects will be similar to background levels at distances of greater than 10 km from the mining site. Noticeable effects on inshore recreation are therefore unlikely.
 - Turbidity will have little if any effect on recreational fishing in all but the immediate periphery of mining activity (which features very little existing fishing pressure).
 - At the key diving sites of the North and South Traps moderate effects on scenic diving are likely, on the few days when water clarity exceeds 10 m (Secchi disc measurement), and when water clarity is marginal for crayfish harvesting.
 - Resuspension of mined material will have lesser effects than the original mining activity and will occur during weather events when little marine recreation occurs.
 - Changes to wave patterns onshore are likely to be very slight and very unlikely to change surfing amenity or onshore beach replenishment.
 - There are no toxicity effects on marine biota from the activity.

19.2 Activities and Locations

19.2.1 Fishing

743. Report 29 identifies regionally important coastal marine recreation settings as being based at the main public access and activity points of Ohawe Beach, Waihi Beach, the mouths of the Tangahoe and Manawapou Rivers, Patea, Waipipi, Waiinu, Kai Iwi and Castlecliff.
744. Report 30 provides us with a map depicting the importance of locations for recreational fishing, as identified by local fishers themselves in a study by the Department of Conservation³⁸². Based on that study, the most popular area is centred on The Traps and Graham Bank. In addition, Report 29 provides us with a map of recreational boats noted during an aerial survey. All the information is shown together as Figure 6.
745. Ms Pratt presented us with information about recreational fishing locations during the hearing, and TTRL subsequently incorporated that information in its interactive maps. She identified the sites through discussions with 10 fishermen from (we assume) the Hawera / Patea area. They are shown as individual red spots, and cover only the northern part of the map. Most of the red spots are fishing locations, although there are some crayfish diving locations such as The Traps. Fishing effort extends further south than Ms Pratt's information. We noted during our site visit to the Port of

³⁸² Department of Conservation, *Netting Coastal Knowledge: A Report Into What is Known About the South Taranaki-Whanganui Marine Area*, July 2006

Whanganui that up to 120 – 150 leisure boats can operate out of the Port on weekends.

746. Offshore fishing is particularly popular off the coast of Patea. A public boat ramp is located at Patea and the Patea and Districts Boating Club operates from there. We heard evidence from the Club's Secretary Mr Purser that the membership is over 160. The SIA tells us that fishing tournaments can attract 150 boats. Patea Beach recorded the highest average number of people fishing of all the water-based locations surveyed in the Taranaki Region³⁸³.

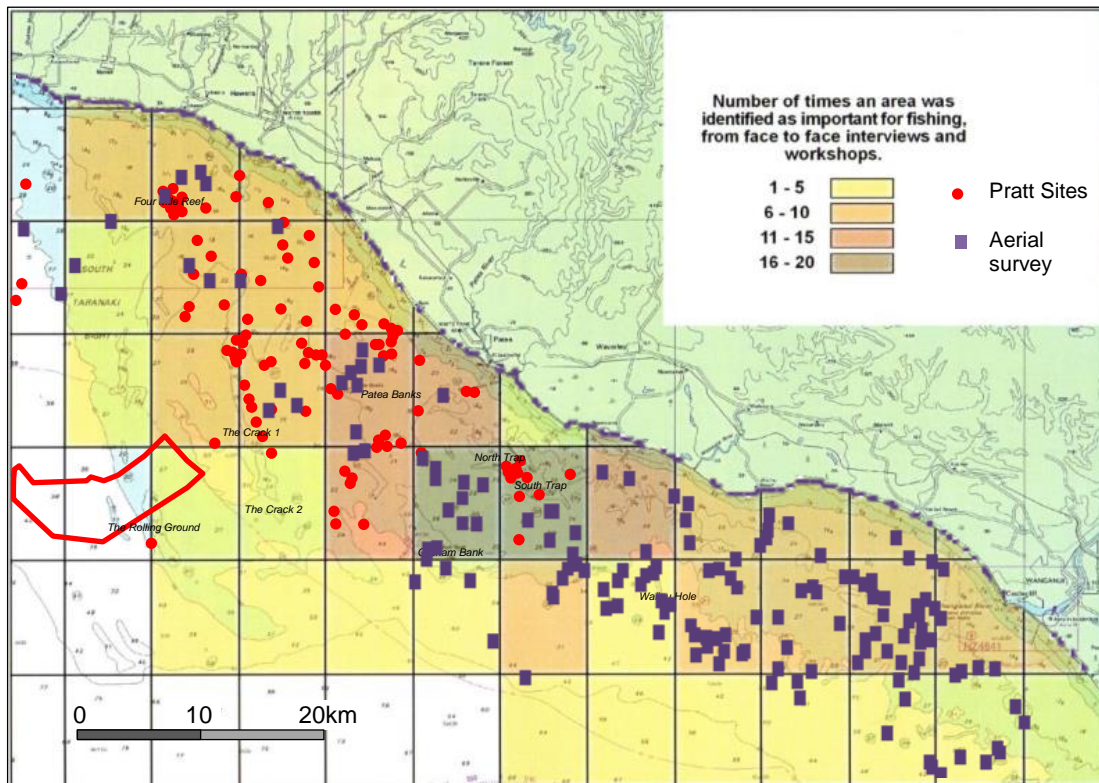


Figure 6: Indicative Recreational Fishing Effort

Source: TTRL Reports 29 and 30; Pratt sites from TTRL spatial mapping
Prepared by DMC

747. The coastal waters off Patea, including The Traps, Graham Bank and Patea Bank, were the most commonly identified areas of importance for fishing identified in research undertaken by the Department of Conservation³⁸⁴. The Waiinu Reef extends from mean high water springs to 3 - 5 kilometres off the coast. Historically, the reef was a major fishing ground for iwi and is still used for gathering kaimoana³⁸⁵.
748. TTRL's Report 30 notes that fishing is popular at Waipipi Dunelands and Waverley Beach, and whitebaiting at Waitōtara Estuary. A boat ramp is located at Waverley Beach. Some of the most

³⁸³ Section 5.6.1, page 44, TTRL Report 30: *Social Impact Assessment of Trans-Tasman Resources Ltd Iron Sand Mining Project*, Corydon Consultants Limited, January 2016

³⁸⁴ Department of Conservation 2006, cited in TTRL Report 30

³⁸⁵ Taranaki Regional Council report, cited in section 4.7.2 of TTRL Report 30

commonly identified areas of importance for fishing identified in research undertaken by the Department of Conservation are located offshore from the Waverley coastline³⁸⁶.

19.2.2 Diving and Gathering

749. Offshore fishing and diving occurs throughout the study area, but particularly at the North and South Traps, the reefs offshore from Opunake, Waipipi and Waiinu beaches, and Four Mile Reef (Ohawe). Rock structures offshore from Waverley are popular diving areas, particularly for rock lobster³⁸⁷.
750. The North and South Traps lie 6 km offshore from Patea. These reefs are the base for much of the recreational diving and fishing off the coast of Patea, and are classified as having high ecological value due to the diverse and abundant marine life, including large seaweed forests. They are identified as a coastal resource of local or regional significance³⁸⁸. Report 29 notes the extent of the fishing and cray-fishing resource up to 20 km offshore, and the scenic dive setting of the North and South Traps. The Traps are the areas most frequently mentioned as important for diving in the Department of Conservation's research³⁸⁹. Fish species regularly seen at the Traps included tarakihi, red moki, cod, snapper, rock lobster, Spanish Lobster, packhorse crayfish, kingfish, blue moki, big eye, leatherjacket and other smaller reef fish.
751. Report 30 identifies Four Mile Reef, 6.5 km offshore from Ohawe Beach, as a traditional fishing reef that is important to local iwi. The reef was noted as important for scuba divers (particularly for crayfish and scallops) and recreational fishers³⁹⁰. Report 29 states that the level of shellfish gathering along the coast is unclear but is a locally important activity.

19.2.3 Surfing

752. Surfing was reviewed as a popular recreation activity by Reports 29 and 30. Report 6 considered effects on the supply of sand to the beaches and effects on wave height and direction. Report 39 also considered effects on the wave and direction, and examined the potential effects on surf breaks.
753. For Report 29, consultation was undertaken with potentially affected parties, including Surfing Taranaki and the Opunake Boardriders Club. Identified issues of concern were changes to coastal wave patterns and sand movement, affecting surfing opportunities. Report 29 identifies the break at Fences, south of Waiinu, as one of the longest right handed breaks in the southern hemisphere. Report 30 states that the three surf breaks at Waiinu Beach make it a popular destination for surf tourists³⁹¹. Other surfing locations referred to by Report 29 include Ohawe and Waihi Beach, Patea, Waipipi, Waiinu, Kai Iwi and Castlecliff. Mr McDonald, a submitter, referred to surf breaks at Patea, Waitōtara, and Whanganui.

³⁸⁶ Section 4.6.3, page 29, TTRL Report 30

³⁸⁷ Section 4.6.3, page 29, TTRL Report 30

³⁸⁸ Taranaki Regional Council, cited in TTRL Report 30

³⁸⁹ Department of Conservation 2006, cited in TTRL Report 30

³⁹⁰ Section 4.3.2, page 23, TTRL Report 30

³⁹¹ Section 4.7.3, page 31, TTRL Report 30

754. Report 6 found that “... it would appear that there is little connection between seabed sediments in the extraction area and the surf zone, and seabed sand in the area of the extraction operations some 22 to 35 km off the coast is not a significant source for sand on the beaches. This suggests that sand extraction will not have significant effects on sand supply to the beaches and will not promote beach erosion.”³⁹² With regard to wave height and direction, the Report found that any variability would be well within the range of natural variability.
755. Report 39 investigated potential effects on wave height and wave direction at ten surfing locations. The locations were Patea River Mouth, Waverley, Waiinu, The Point/Fences, Kai iwi, Longbeach Drive, Rangiora Street, North Mole, Wanganui River Mouth, and South Break. The Report’s conclusions were³⁹³:
- Wave height: Changes at the 10 m contour are less than 0.1 m (0-0.03 m) for waves 3 m high. The impacts on wave heights are considered insignificant with respect to impacts on surfing quality.
 - Wave direction: In most cases, any changes to wave directions are corrected, due to refraction, well before the coast. Impacts on wave directions are therefore considered insignificant with respect to impacts on surfing quality.
 - Locations affected: The insignificant height (0.1 m) and direction (2°) changes outlined above only occur at Waverley. All other locations would experience no change.
756. Report 29 concludes that there is “The potential for only minor, if any, effect on surfing, and inshore recreation which relies on natural beach replenishment processes, due to the very low scale of potential adverse effect (‘insignificant’ changes to wave patterns and only a very weak potential link between the mining setting and inshore sediment levels).”³⁹⁴

19.2.4 Other activities

757. The coast and its high cliffs can be accessed in many individual locations, but continuous walking along the coastline at either beach or cliff top level is not possible.
758. We are unaware of any existing businesses that cater to marine mammal watching.

19.3 Effects and Submissions

759. The submitters we heard from expressed concern about the potential effects of the mining and sediment plume. Many submissions related to the effects on recreational fishing or diving, and some also referred to surfing, coastal walking, and potential tourism ventures.

³⁹² Section 7.4, TTRL Report 6: *Coastal Stability in the South Taranaki Bight - Phase 2, Potential Effects of Offshore Sand Extraction on Physical Drivers and Coastal Stability*, NIWA, November 2015

³⁹³ Section 3.1, 3.2, and 4, TTRL Report 39: *Potential Effects of Trans-Tasman Resources Mining Operations on Surfing Breaks in the Southern Taranaki Bight*, NIWA, November 2015

³⁹⁴ Page 6, TTRL Report 29: *Trans-Tasman Resources Ltd Sea Bed Mining South Taranaki Recreation and Tourism Assessment of Effects*, November 2015

760. Dr Conaghan, a submitter and an expert in sustainable management of tourism destinations, was critical of TTRL Reports 29 and 30, and of the consultation carried out by TTRL. She highlighted the status of State Highway 45 as the “Surf Highway” and told us that South Taranaki and Whanganui have ideal conditions for surf tourism³⁹⁵. She referred to other tourism related aspects such as coastal walkways and Māori culture, and the negative impact which the mining and sediment plume would have.
761. She opposed the mining project because it would negatively impact on the future development of tourism ventures and on New Zealand’s international reputation as a tourism destination.
762. Several submitters referred to their use of the coastline for walking, and expressed concern that the experience would be marred by views of the sediment plume or mining vessels. Some submitters referred to the potential for whale watching, but no one informed us of any current or proposed venture.
763. Report 30 notes that most recreational fishing and diving occurs closer than 10km to shore, and therefore few fishers and divers will experience perceptible visual changes from the sediment plume.
764. The Optical Modelling report characterises high visibility days as those when horizontal visibility exceeds 5 metres (cf. 10 m in the recreation report). In Table 14 below we show the modelling results regarding high visibility at the seabed. The Optical Modelling report acknowledges that high visibility days may indicate recreational amenity value.
765. Dr James said that diving visibility will not be affected beyond about 10 – 15 km from the mining, which he based on his understanding that the sediment plume would add 0.2 – 0.5 mg/l in those locations³⁹⁶. Mr Boyd from the South Taranaki Underwater Club referred to the modelled loss of 26 good visibility days, out of 125 existing, at The Traps. He said that *“For divers who already have limited opportunities due to extreme weather conditions our coast endures, this is devastating.”*³⁹⁷

Table 14: Visibility Effects at the Seabed³⁹⁸

		Worst Case		Base Case	
		Site A	Site B	Site A	Site B
Rolling Grounds (17 km southeast)					
High visibility days	Existing	255			
	Mining	247	223	251	237
	Change in days	- 3 %	- 12 %	- 2 %	- 7 %

³⁹⁵ Transcript 17 February 2017, page 847

³⁹⁶ Transcript 21 February 2017, page 419

³⁹⁷ Transcript 7 March 2017, page 1285

³⁹⁸ Table adapted from Table 2.4 to 2.11, and Table 3-2 in *Optical Effects of Proposed Ironsand Mining in the South Taranaki Bight Region - Worst Case Update*, NIWA, April 2017

The Crack 1 (5 km northeast)					
High visibility days	Existing	211			
	Mining	87	171	109	186
	Change in days	- 59 %	- 19 %	- 48 %	- 12 %
The Crack 2 (8 km east)					
High visibility days	Existing	211			
	Mining	73	166	99	181
	Change in days	- 65 %	- 21 %	- 53 %	- 14 %
Source A to Whanganui 20 km (20 km east-southeast)					
High visibility days	Existing	203			
	Mining	109	168	132	184
	Change in days	- 46 %	- 17 %	- 35 %	- 9 %
Graham Bank (17 km east-southeast)					
High visibility days	Existing	197			
	Mining	102	160	126	173
	Change in days	- 48 %	- 19 %	- 36 %	- 12 %
Project Reef (assumed 17 km east)					
High visibility days	Existing	176			
	Mining	106	155	120	173
	Change in days	- 40 %	- 12 %	- 32 %	- 2 %
North Traps (26 km east)					
High visibility days	Existing	126			
	Mining	91	112	96	119
	Change in days	- 28 %	- 11 %	- 24 %	- 5 %
Source A North 20 km (18 km north)					
High visibility days	Existing	113			
	Mining	99	104	103	103
	Change in days	- 12 %	- 8 %	- 9 %	- 8 %

Source: *Optical Effects of Proposed Ironsand Mining in the South Taranaki Bight Region - Worst Case Update, April 2017, (Tables 2.4 to 2.11)*

Note: *Site A and Site B are locations at the eastern and western ends of the mining area respectively, chosen by TTRL as being representative for the purposes of modelling. Being at either end of the mining site, they 'bracket' the range of effects.*

766. Mr Steele from the New Plymouth Sportfishing and Underwater Club noted that the mining area is not within the club's natural fishing grounds³⁹⁹ and he was not aware of anyone who had fished the mining site itself. He considered that TTRL had not documented sufficient information about species and effects. He noted that the good diversity of fish species in the STB is not typical of some other parts of New Zealand⁴⁰⁰. Mr Steele urged us, if granting consent, to ensure that the effects are defined and measurable⁴⁰¹.

³⁹⁹ Transcript 7 March 2017, page 1343

⁴⁰⁰ Transcript 7 March 2017, page 1347

⁴⁰¹ Transcript 7 March 2017, page 1345

767. Mr Purser and Mr Gane appeared for the Patea and Districts Boating Club. Club members, of which there are around 160, use the STB over 2,000 times per year⁴⁰². Mr Purser noted that fishing in the STB is very good, and that some species are increasing, although blue cod appears to be decreasing. He stated that Graham Bank is a breeding ground for blue cod and is also a location for large snapper as they feed and breed in the sand⁴⁰³. Mr Gane described Graham Bank as “*our most desired area*”⁴⁰⁴. The Club is opposed to the grant of consent as the sediment plume would affect that location and others, including through potential effects on the health of fish – and subsequently humans⁴⁰⁵.
768. Mr and Mrs. Ellet appeared for the Waitotara Patea Surfcasters Club which has 30 members. They noted the Club’s concerns as including the effects of the sediment plume; pollution; safety, mooring and movement of vessels; sand movement; loss of habitat; reduced biodiversity; and general environment harm. They noted that catches from the beaches were generally good, although they had been affected in the past by the Waipipi iron sands operation, and also seemed to be affected by trawling.⁴⁰⁶
769. Mr Boyd identified The “Project Reef”, which we have addressed in Chapter 3-9.5.4 of our report. He was critical of the TTRL’s modelling, and of the proposed monitoring. Regarding monitoring, he said that reefs closer to the mining site should be identified and monitored. He also called for the recreational clubs to be represented on the TRG, as this would bring the benefit of local knowledge⁴⁰⁷.
770. Mr Boyd drew our attention to economic activity in Patea resulting from recreational fishing, through spending on boats, servicing, fuel and food. Mr Purser estimated that as a whole, local boaties spend around \$320,000 - \$340,000 each year in Patea⁴⁰⁸.
771. Mr McCrea, a recreational fisher, told us that there are not many good days when a boat can cross the Patea bar, a situation confirmed by other submitters. He surmised that this limitation helps to protect the fishery. With regard to the ability to catch fish, he said it was a “*rule of thumb that the better the water, the better the fishing*”⁴⁰⁹. Mr Pivac, a recreational fisher, told us that the days available for fishing were governed by both weather and water quality. He said that good weather for fishing occurred around one week per month, but two of those days might be affected by high turbidity.⁴¹⁰
772. Ms Hart, who is Vice-President of the New Zealand Recreational Fishing Council (and from the Raglan Sportfishing Club), told us that only 10% of anglers belong to a club⁴¹¹.

⁴⁰² Based on coastguard notifications

⁴⁰³ Transcript 7 March 2017, pages 1348/49

⁴⁰⁴ Transcript 7 March 2017, page 1349

⁴⁰⁵ Transcript 7 March 2017, page 1350

⁴⁰⁶ Transcript 8 March 2017, pages 1395/96

⁴⁰⁷ Transcript 7 March 2017, page 1285

⁴⁰⁸ Transcript 7 March 2017, page 1351

⁴⁰⁹ Transcript 8 March 2017, page 1436

⁴¹⁰ Transcript 9 March 2017, page 1563

⁴¹¹ Transcript 7 March 2017, page 1312

773. As noted earlier, TTRL proposes to seek an exclusion zone around its operations. Regarding the potential effect on recreational fishing activity, the Impact Assessment notes that *“Any exclusion zone around the project related vessels is unlikely to affect recreational opportunities in the project area. Marico (2015) indicates that the project area is very lightly used by any vessels and, because of the nature of the seabed material, is unlikely to support much marine life which would be of interest to recreational fishers or divers. The site is well removed from recreational boat launching and mooring sites.”*⁴¹²

19.4 Findings on Fishing, Diving and Gathering

774. Recreational fishing and diving effort is concentrated within the inshore area. Little if any recreational fishing occurs beyond the 12 nm limit, and the mining site itself is not a popular site. Submitters at the hearing described how they fish and dive in the STB, and we consider that their experiences are consistent with the information mapped by Figure 6.

775. The STB provides many opportunities for recreation. However, the specific use that individuals make of the environment can be restricted at different times by difficulties in access (due to weather) and variability in factors such as water clarity.

776. The value of any site for diving can be a combination of water depth, ease of access from shore, biodiversity, and visibility, but varies from site to site. The Patea Shoals includes areas of value such as The Traps, The Crack and The “Project Reef”. Their value for diving may be diminished at the times they are subject to the sediment plume. TTRL’s Report 29 adopts 10 metres of horizontal visibility as characterising good conditions for diving, whereas the April 2017 update of the optical modelling uses a figure of 5 metres for “high visibility”.

777. We have used the results of the optical modelling (see Table 14) as the basis of our findings on diving. We consider that the Base Case within that table is more representative of effects than the Worst Case. Under the Base Case, reductions in high visibility days will be major for The Crack and The “Project Reef” (minus 50%⁴¹³ and minus 32% respectively) when mining operations are at the eastern end of the mining site. The reduction at The Crack will be moderate (minus 13%⁴¹⁴) by comparison when operations are at the western end of the mining site. The reduction in high visibility days at The “Project Reef” will be comparatively minor (minus 2%) when mining is at the western end of the mining site. Visibility effects will not be constant over time.

778. The Traps, with 126 existing days of high visibility, is considered a good dive site. When mining is occurring at the western end of the mining site, high visibility at The Crack and The “Project Reef” will exceed that number of days (183⁴¹⁵ days and 173 days respectively). Even when mining occurs at the eastern end, high visibility days at The “Project Reef” (120 days) will only be marginally below the existing number of high visibility days at The Traps (126 days). Our conclusion is that The Crack

⁴¹² Page 176, TTRL Impact Assessment

⁴¹³ The Crack 1 will be minus 48% and The Crack 2 will be minus 53%

⁴¹⁴ The Crack 1 will be minus 12% and The Crack 2 will be minus 14%

⁴¹⁵ The Crack 1 will be 186 days and The Crack 2 will be 181 days

and The “Project Reef” will remain available as dive sites, but be subject to periods of reduced visibility by comparison with their current good levels.

779. As we noted earlier in our findings on human and environmental health (paragraph 616), there is negligible risk of heavy metal contaminant in relation to customary and recreational food gathering. Similarly, we consider that the risks are low for invasive species being introduced, or algal blooms occurring (paragraph 613).
780. Operational noise may also have an effect on fish, but we accept the agreed position of the fish ecology experts that population level impacts are unlikely, and that acclimatisation by fish to underwater noise is likely⁴¹⁶. There may be some avoidance by fish of areas subject to SSC levels higher than the background level.
781. The exclusion zone around the project’s operations will have an impact on the ability to fish in the immediate vicinity of the mining. There is little if any recreational fishing effort that occurs directly within the site, or within 1 nm of it. The exclusion zone will be put in place as a safety measure and, as such, we consider that navigational safety risks to recreational fishing boats will also be minimised.
782. The DMC recognises the importance of fishing, diving and other activities to the local community. Before the hearing, including at the pre-hearing conference between parties, we gave some thought to whether a joint witness forum should be established for this topic. We decided against that option, choosing instead to receive presentations during the hearing by way of submissions and evidence.
783. We would like to pay tribute to the valuable material that was provided by clubs, societies and individuals. Ms Pratt, the Ngā Motu Marine Reserve Society, and sport fishers and divers filled gaps in our understanding of the marine environment of the STB.
784. We would not have known of the existence of rocky reefs such as The Crack and The “Project Reef” if those locations had not been brought to our attention by submitters. We thank these people for their assistance.

20. Economic Matters

20.1 Models and Outcomes

785. Section 59(2)(f) requires us to take into account the "economic benefit to New Zealand of allowing the application". It does not set any threshold level. Economic benefit is not defined by the Act.
786. We heard evidence on behalf of several parties, including from the following economic experts:
- Mr Leung-Wai, on behalf of TTRL, who has experience related to economic impact analyses in the minerals sector including the oil and gas sector in Taranaki.

⁴¹⁶ Points of agreement between the experts, under paragraph 430

- Mr Binney, on behalf of KASM/Greenpeace, who has experience in cost-benefit analysis, cost effectiveness analysis, and economic impact assessments.
- Wenceslaus van Lint, on behalf of the EPA, who has experience in the analysis of investments, cost benefit, and wider economic benefits.

787. The Act does not differentiate between economic benefits at a local, regional, or national level. However, TTRL presented evidence which allows us to consider those respective levels.
788. Mr Leung-Wai explained that in assessing economic impacts he had applied an input-output multiplier analysis approach which he considered is an internationally accepted methodology. He contrasted this with the CGE⁴¹⁷ modelling which was used in the previous TTRL application – but which had only identified benefits at the New Zealand wide level. He noted that CGE models are not available at the local level and are less accurate in smaller study areas. Mr Leung-Wai told us that the experts had agreed an input output model was preferable to a CGE model in this instance.
789. Mr Leung-Wai's analysis assumed recovery over time of the seabed environment, and no ongoing irreversible effects. Mr Binney preferred the use of BCA as it would allow us to consider and build on the biophysical and scientific studies and analyses, to understand the risks and the costs and compare those the benefits of the project. He considered that our role should be to decide whether the project has a net benefit⁴¹⁸. He also noted that the need for a BCA is not negated by the lack of permanent adverse effects of a project.
790. Using the input output model, Mr Leung-Wai had looked at three study areas. These were:
- The district economy (South Taranaki and Whanganui districts);
 - The regional economy (South Taranaki, Whanganui, New Plymouth, and Stratford districts); and
 - The national level.
791. Based on an annual operating budget of \$254 million, and direct employment by TTRL of 261 employees, Mr Leung-Wai calculated the direct spend as:
- District – \$35 million
 - Regional – \$73 million
 - National – \$133 million
 - Offshore – \$14 million
792. He undertook a separate but similar exercise with project employment. The combined spend, GDP, and employment figures are set out in the table below.

⁴¹⁷ Computable general equilibrium

⁴¹⁸ Transcript 23 February 2017, page 737

Table 15: Economic Benefits

	District	Regional	National
TTRL			
Spend	\$34.6 million	\$73.4 million	\$132.7 million
Employment	61	167	230
Direct Benefit			
GDP	\$13.6 million	\$30.4 million	\$59.0 million
Employment	173	367	463
Indirect and Induced			
GDP	\$18.6 million	\$50.6 million	\$159.0 million
Employment	299	705	1,666

793. Mr Leung-Wai stated that there would also be royalties of about \$6.15 million per year, \$310 million in export earnings, and government taxes⁴¹⁹.
794. Mr Leung-Wai emphasised that in his opinion, the monetary benefits set out in Table 15 will accrue annually for each year that the project is in operation. The outputs of the model are a simple calculation of direct outcomes, and do not represent a net benefit. Mr Binney thought that Mr Leung-Wai's analysis may have slightly overstated the indirect benefits. Mr Van Lint thought that values might be overstated by 10% - 15%⁴²⁰. He characterised the national jobs benefit as "minimal" but positive, and the regional benefit as "reasonable"⁴²¹.
795. Mr Leung-Wai reviewed four key questions which had emerged from submissions and during expert conferencing. These were:
1. Does the analysis show the economic benefit to New Zealand of allowing the application?
 2. Is the input-output multiplier analysis the right model to be using to show the economic benefits?
 3. Should operational expenditure and employment be used as inputs and were those inputs applied to the model correctly?
 4. Are the reported benefits likely?
796. In response to the first of these questions Mr Leung-Wai noted that he had assessed economic benefits to New Zealand as required by the Act. He cautioned against 'double counting' through subtracting environmental costs from economic benefits. Mr Binney disagreed. He considered that BCA would provide us with two sets of complementary information (biophysical effects on their own, and biophysical effects after being monetised). This would allow us to value trade-offs using a common metric⁴²².
797. In response to the second question, Mr Leung-Wai was critical of an alternative approach, which is to undertake a Benefit Cost Assessment (BCA). In his opinion, a BCA would lead to the output of a single number that has a high degree of uncertainty, and would be based on a wide range of

⁴¹⁹ Paragraph 99, Expert Evidence of Jason Leung-Wai on Behalf of Trans-Tasman Resources Limited, 15 December 2016

⁴²⁰ Transcript 23 February 2017, page 759

⁴²¹ Transcript 23 February 2017, page 761

⁴²² Transcript 23 February 2017, pages 744/745

assumptions. Although Mr Binney agreed that the input/output model was reasonable to use, he noted that there was no clarity around the multipliers which had been used⁴²³. On the subject of non-market valuation techniques for intangibles, such as environmental costs, Mr Leung-Wai said that although they can provide a different perspective, or an actual number, they would introduce a lot of uncertainty⁴²⁴. Mr Binney acknowledged that it may be difficult to ascribe a value to some environmental factors and very difficult to ascribe values to cultural factors⁴²⁵. Dr Robertson, in commenting on fisheries effects, noted that because of the small scale of effects, it would be unrealistic to attempt an economic analysis⁴²⁶.

798. In response to the third question, Mr Leung-Wai told us that analysing the potential benefits and the negative impact separately, allows each to be considered on its own merits. He said that this economic impact approach clearly identifies potential GDP and employment. In contrast, a BCA approach would provide what he called a *“flawed or contentious”* net benefit cost ratio.
799. Responding to the fourth question, Mr Leung-Wai said that negative impacts are likely to be insignificant, temporary, or negligible. He said that *“the economic benefits lost to areas such as commercial fishing or tourism would be zero to minimal and the net benefit would be the same.”*
800. He also said that only some of those jobs, mostly in the direct area, will be new jobs. Based on discussions with TTRL, he expected that about 80% of jobs will be filled by people from outside the area⁴²⁷. He also agreed that the ability of local people to be directly employed on the project may depend on conscious interventions, such as training, by TTRL⁴²⁸. He noted that in his experience, *“the only way you’re ever going to achieve outcomes ... is to have that partnership. So, all I can say there is that the offer is there and the willingness is there from the one party; the other parties need to get in behind and actually support it.”*⁴²⁹ He also noted that even if locals do not support the project, the jobs will still be filled, those people will spend, and the economy will benefit. He characterised that potential outcome as a lost opportunity (for some), but not a lost economic benefit.
801. He also noted that he had not factored in the training programmes and the geotechnical facility which TTRL had offered by way of the conditions. Mr Leung-Wai said that to do so would make things less clear or reduce the clarity of the numbers, but that they can be considered separately⁴³⁰.
802. We considered the submission of Dr Bumby, a submitter with research experience related to the uses of New Zealand iron sands. Dr Bumby did not appear at the hearing, but he states in his submission that *“... indirect benefits seem probable, although they are unquantifiable at this time. The establishment of TTR’s operation will lead to the formation of a cluster of NZ engineering*

⁴²³ Transcript 23 February 2017, page 742

⁴²⁴ Transcript 23 February 2017, page 724

⁴²⁵ Transcript 23 February 2017, pages 749/750 and 753

⁴²⁶ Paragraph 103, page 22, Expert Evidence of Donald Allan Robertson on Commercial Fisheries Matters as Requested by the EPA for the DMC, 21 February 2017

⁴²⁷ Transcript 23 February 2017, page 723

⁴²⁸ Transcript 23 February 2017, page 719

⁴²⁹ Transcript 23 February 2017, page 719

⁴³⁰ Transcript 23 February 2017, page 732

*companies who will develop unique experience and expertise in the maintenance and operation of advanced robotic sea-bed crawlers. As the international sea-bed mining industry grows these companies will be well-placed to address much larger global markets and grow exports in offshore engineering technologies. A similar pathway has been followed by clusters of engineering firms in Aberdeen and Norway which have developed following the early discovery and exploitation of offshore oil and gas in the 1970's.*⁴³¹

803. We heard from Mr Stevenson-Wallace on behalf of MBIE. He told us that an underlying premise of the Crown Minerals Act is that the Government wants other parties, including private and public companies, to develop Crown owned minerals for the benefit of New Zealand.
804. Mr Stevenson-Wallace told us that part of the Crown's test for a mining permit application includes whether the permit holder can economically deplete the minable mineral resource to the maximum extent practicable, in accordance with good industry practice. Among other matters, if the Ministry grants a permit, it is expressing confidence in economics of the proposed project proposal which stakes up economically, and the financial capability of the permit holder. He said that we can look at the wider project questions, "*confident that the project economics stack up*". He also said the Ministry believes the project supports the Government's broader economic development strategy⁴³².

20.2 Findings on Economic Matters

805. We are required to take into account the economic benefit to New Zealand of allowing the application. We do not think that taking economic benefit into account requires us to consider a benefit cost analysis. Understanding that there is an economic benefit is all that is necessary and is consistent with the purpose of the Act.
806. We have considered the potential environmental, social or cultural 'costs' (or benefits) that might arise from granting the application. We do not consider there is a need to ascribe a monetary value to those things. Indeed, we think that trying to do so would add an unnecessary and questionable layer of complexity.
807. There will be some positive economic impact in South Taranaki and beyond. For instance, the applicant has offered to establish a training facility and heliport in Hawera, and a geotechnical and monitoring facility in Whanganui⁴³³. There may also be positive impacts of the type referred to in the submission of Dr Bumby.
808. Similarly, our assessment has not relied on statements made by various submitters about the potential for adverse impacts on businesses or attractions not yet established. An example of this is whale watching. We have had regard to the advice of counsel for the EPA regarding impacts on such activities. The advice was provided in the context of questions about existing interests, but it also has

⁴³¹ Submission of Christopher Bumby, 14 October 2016

⁴³² Transcript 2 March 2017, page 1031

⁴³³ Paragraph 55, Corporate Evidence of Tokatumoana Kevin Walden on Behalf of Trans-Tasman Resources Limited, 16 December 2016

relevance to economic impacts. In short, if an activity is not yet established, we can only ascribe weight to its potential existence in limited, exceptional circumstances. The advice given to us was⁴³⁴:

“77. In our view a similar analysis applies to this question; paragraph (a) of the definition of "existing interest" requires that the relevant activity be an existing one. If the whale-watching venture has not yet started operating, and no resource consent is held for the activity (such that it would meet paragraph (c) of the definition), it is not an existing interest.

78. Again, there may be some limited scope to consider effects on a potential activity that does not amount to an "existing interest" under section 59(2)(m); the DMC should exercise considerable caution, however, before reaching a conclusion that effects on a potential activity come within that provision or ascribing any weight to that matter.

79. In summary, a potential activity such as a whale-watching venture is not an "existing interest". It may nevertheless be relevant to the DMC's assessment in limited, exceptional circumstances.”

809. We were provided with no evidence during the hearing that such a venture or ventures were imminent. We can therefore place no weight on the possibility of these being established in the future.
810. We have taken into account the nature and effect the provisions of the Crown Minerals Act. MBIE has reviewed the project in the light of that legislation and considers it to be economically feasible, and an activity that will contribute positively to the country's broader economic development strategy (see paragraph 999).
811. We have taken into account the economic benefit of the project which has been described to us.

⁴³⁴ Memorandum of Counsel Assisting the Decision-Making Committee – Further Response to Minute 40, 17 May 2017

21. Consultation

812. As required by Section 39(d) of the Act, TTRL identified existing interests (see Chapter 6-22 and 23 of our report). As required by Section 39(e), consultation with those parties was described in the evidence of Mr Walden.
813. TTRL set out their approach to consultation in the evidence of Mr Walden and Mr Pōtiki, and this was reviewed by Mr Mikaere. We heard corporate evidence about consultation from the following people:
- Mr Walden is TTRL's executive relationship manager, and is an experienced facilitator of community and iwi stakeholder engagement.
 - Mr Mikaere is a consultant specialising in tangata whenua consultation, and cultural issues arising from development applications.
814. Iwi and others said that the consultation was inadequate.

21.1 Consultation Principles

815. There is no statutory obligation for applicants to consult with interested parties or with anyone else. However, consultation is good practice. Consultation must be a genuine effort to exchange information and points of view. It is a process which requires:
- Providing enough information to parties so that they can understand a proposed activity;
 - Discussing the application with them;
 - Receiving any comments that they might have on the proposal and, where appropriate, amending the proposal to be more acceptable to the consulted parties; and
 - Gaining all the necessary information to provide a thorough and complete application.
816. We note three principles identified in various decisions from the courts. We do not intend to repeat all those principles here, but in our opinion they are also relevant to applications under the EEZ Act. However, we do note three concepts that have arisen from court decisions. Those are that:
- Consultation is more about the quality of the information provided, rather than the quantity.
 - Consultation is not a one-sided affair. It requires both parties to act reasonably and in good faith.
 - Consultation is not an obligation in itself.
817. The Act requires applicants to have identified "*persons whose existing interests are likely to be adversely affected by the activity*" and to "*describe any consultation undertaken*" with them. Lack of consultation was commented on by many submitters. This is especially true of iwi submitter Ngāti Ruanui which claims mana whenua over the project area. Whilst there is no statutory obligation to carry out consultation with persons with existing interests it is good practice.

21.2 Outline of TTRL's Consultation

818. The Applicant's Impact Assessment provides a review of the consultation process undertaken by TTRL⁴³⁵. The Impact Assessment states that a key reason for the decline of TTRL's previous application was the DMC's "lack of confidence in the extent to which existing interests were appropriately taken into account".⁴³⁶ The Impact Assessment describes TTRL's response to that issue in the following way:

"Acknowledging the DMC's criticism, TTR re-evaluated their consultation strategy and after extensive review developed a consultation plan that provided for open and inclusive consultation with the existing interest parties, tangata whenua and stakeholders that addressed the identified shortcomings and would improve the overall effectiveness of the consultation process.

*A cornerstone to TTR's consultation strategy was to provide opportunities to one of building genuine relationships through direct engagement, and to this end a dedicated Relationship Manager, based in Taranaki, was employed to engage with affected parties ..."*⁴³⁷

819. Other parts of the Impact Assessment⁴³⁸ set out a summary of the engagement process, which we summarise:

- Facilitation of a stakeholder visit to the De Beers undersea mining operation in South Africa.
- Pre-consultation engagement by initiating contact with all parties identified as stakeholders, and providing them with a project fact sheet. There were over 80 face to face engagements, plus email and phone communications.
- Formal engagement, commencing with provision of a more detailed information package. There were over 40 face to face presentation / feedback sessions.
- Receipt of feedback from stakeholders, with mitigation measures and monitoring / management plans being developed in response.

820. The stakeholder engagement package included a project overview; an animation of the project; a video of the seafloor at the mining site; an explanation of potential effects; a summary of all reports commissioned to quantify effects; an economic analysis; information about cumulative effects; and information about proposed facilities in Hawera and Port Whanganui.

821. Mr Walden informed us that TTR established the role of Executive Relationship Manager. He was appointed as someone based on the ground in Taranaki and tasked with building genuine relationships with all key stakeholders and iwi. His role was to set the strategy and framework for engagement across all sectors⁴³⁹.

⁴³⁵ Section 6, page 220, TTRL Impact Assessment

⁴³⁶ Section 6.2.1, page 220, TTRL Impact Assessment

⁴³⁷ Section 6.2.1, page 220, TTRL Impact Assessment

⁴³⁸ Section 6.2.1, pages 221 – 222, TTRL Impact Assessment

⁴³⁹ Paragraph 3, Corporate Evidence of Tokatumoana Kevin Walden on Behalf of Trans-Tasman Resources Limited, 16 December 2016

822. Mr Walden stated that TTRL formulated a communication plan to outline the company's strategy and framework for iwi and stakeholder engagement. Key values said to underpin the process included⁴⁴⁰:
- (a) Allowing stakeholders to determine how they were engaged;
 - (b) Setting a mutually acceptable timetable for engagement;
 - (c) Honest and open communication in a respectful manner;
 - (d) Fairness in all dealings; and
 - (e) Mutually beneficial and robust, sustainable working relationships.
823. The Applicant's Impact Assessment confirmed this approach by noting that "*TTR allowed for each party to dictate the manner in which they would like the engagement to progress*".⁴⁴¹
824. Appendices to Mr Walden's evidence set out the detail of engagement with parties during the pre-consultation and formal engagement phases and specific detail about engagement with Ngāti Ruanui.
825. Stakeholders were identified as:
- Those with existing interests as defined by the Act;
 - Stakeholders listed by regional and district council databases;
 - Holders of coastal resource consents;
 - Parties to Te Tiriti claims and settlements; and
 - Parties who could provide local knowledge⁴⁴².
826. Many of the parties who were identified as stakeholders made formal submissions on the application.
827. Based on Mr Walden's tables, pre-consultation engagement took place between April and October 2015. Formal engagement took place between October 2015 and March 2016. Much of the engagement with parties is recorded as being kanohi ki kanohi (face to face), although email and phone contact is also noted.

21.3 Consultation with Specific Parties

828. TTRL identified eight iwi groups, which included Ngāti Ruanui, Ngāruahine, Ngā Rauru Kītahi, Taranaki Iwi, Te Ātiawa, Ngāti Mutunga, Ngāti Maru, and Ngāti Tama. Ngāti Ruanui was the key focus of consultation efforts; Mr Walden states that the iwi holds mana whenua over the project area.
829. Mr Walden's evidence details TTRL's efforts at consultation with Ngāti Ruanui. A meeting took place in September 2015, but a follow up meeting initially agreed for October 2015 did not take place. Mr Walden described various attempts at further contact between October 2015 and October 2016, but little progress appears to have been made. TTRL's Chairman had a phone discussion with Ngāti

⁴⁴⁰ Paragraph 13, *ibid.*, evidence of Mr. Walden

⁴⁴¹ Page 221, TTRL Impact Assessment

⁴⁴² Paragraph 14, *ibid.*, evidence of Mr. Walden

Ruanui. The iwi's representatives were invited but chose not to attend the visit to De Beers in South Africa.

830. Mr Mikaere told us that *“the lack of direct consultation and engagement means that getting an understanding of the spiritual, mental, physical and cultural determinants of Ngāti Ruanui is difficult.”*⁴⁴³
831. The evidence of Mr Young for Ngāti Ruanui described what he called *“the fracture of a good sound relationship between Ngāti Ruanui and TTR”*. In his opinion, the provision of a generic information package, rather than something tailored to Ngāti Ruanui, was at the heart of the problem. He also noted that *“part of the request for longer time in dealing with the application proper, I believe, reflects that most stakeholders who became submitters were overwhelmed by the material when it was released by the EPA as an application. This could have been avoided by early release and disclosure of material.”*⁴⁴⁴ The delay in full disclosure of material was related to the confidentiality issue which we noted in Chapter 1, paragraphs 4 to 5. This was the circumstance that surrounded the iwi's request for an extension of the submission period, which we granted.
832. We were told by both Mr Young and Ms Ngarewa-Packer that Ngāti Ruanui have considerable experience in engaging successfully with the petroleum and minerals industry. Ms Ngarewa-Packer told us that, originally, *“Ngāti Ruanui had one strategy when it concerned oil and minerals and it was pretty much a crouch and hold. We were resistant to anything that was extracting and I guess that's a lot to do with our history. We were forced to be landless so we didn't have a particular leaning towards anything that was progressing, that was extracting, that was polluting.”*⁴⁴⁵ However, within the last 5 – 6 years, the iwi chose to confront the fact that Taranaki's largest concentration of oil and minerals permits were within its rohe. She said that the change was sparked by the message from Ngāti Ruanui's kaumātua and people that *“we do want to have economic development in our backyard. But we want to understand that we can live with our conscience that they are going to err on the side of caution as we do environmentally.”*⁴⁴⁶ From that point onwards, the iwi engaged very strongly with oil and minerals consent processes and became experts recognised by the industry. She told us that:

*“So with the largest permits and the most experience, we became recognised experts within the iwi circle. We became recognised experts externally and were invited [to present] at conferences. ... we had a parallel engagement, invited by the Crown, by Nick Smith at the time and then Amy Adams. So our knowledge of this from the inside is very strong. We also became advisors to industry experts that wanted to engage better, that wanted to be able to get some of these activities to fruition.”*⁴⁴⁷

⁴⁴³ Paragraph 71, Expert Evidence of Buddy Mikaere on Behalf of Trans-Tasman Resources Limited, 17 December 2016

⁴⁴⁴ Paragraphs 64 and 70, Evidence of Graham John Young, 24 January 2017

⁴⁴⁵ Transcript 6 March 2017, page 1109

⁴⁴⁶ Transcript 6 March 2017, page 1109

⁴⁴⁷ Transcript, 6 March 2017, pages 1009/1110

833. An outcome of the knowledge developed by Ngāti Ruanui was a document “Best Practice Guidelines for Engagement with Māori” which she told was commissioned by “*government and the industry alike*.”⁴⁴⁸ We note that the document lists various oil and mining industry companies and bodies as having had input to the guidelines.
834. Ms Ngarewa-Packer told us that they “*have supported activity in the EEZ and in fact we have made sure that we have spoken and talked to companies that are working, and they're working well.*”⁴⁴⁹ She pointed out as an example the iwi’s successful engagement with OMV over an application in 2015. She told us that Ngāti Ruanui “*have had to take on an open attitude about how we engage with the sector and that includes mining. And I guess one of the things that we've been really emphatic about is making sure that's reflected in our own cultural impact analysis. It is simply not appropriate for Tahu Pōtiki from Ngāi Tahu or Buddy Mikaere from Tauranga, I think still, to be doing and assuming a role as a cultural person for us.*”⁴⁵⁰
835. Kiwis Against Seabed Mining (KASM) was not identified as a stakeholder. Mr McCabe, on behalf of KASM, stated that the organisation requested a meeting with TTRL in December 2015 but received no response. The organisation also requested a stakeholder engagement pack, which was provided after several months⁴⁵¹. Mr Walden noted to us that, if there was any delay, it was not intentional. Mr S. Thompson, TTRL’s Project Director, in answer to a question about why TTRL did not engage or seek a meeting with KASM, responded:
- “TTR did send Mr McCabe a full set of the stakeholder engagement package to inform him of the project, but I think the nature of KASM's name, any constructive engagement between two parties requires some sort of an acceptance that the other party will be able to at least see the point that you are coming from. We provided the information to KASM and that was the extent of our engagement.”*⁴⁵²
836. Mr Walden noted that, other than KASM’s request for a hui in Raglan, there was no refusal by TTRL to meet with KASM. He said “*our focus was on the South Taranaki Bight*”.⁴⁵³
837. The evidence of Dr Helson, on behalf of the Fisheries Submitters, expressed a similar concern to that of Ngāti Ruanui, citing broad consultation about the project’s nature and scope, but “*no concrete information*” about the potential effects⁴⁵⁴. Mr Piper, on behalf of Cloudy Bay Clams, noted that his company is not a member of FINZ, and had not been consulted by TTRL, despite being a submitter on the previous application⁴⁵⁵.

⁴⁴⁸ Transcript, 6 March 2017, page 1110

⁴⁴⁹ Transcript, 6 March 2017, page 1111

⁴⁵⁰ Transcript, 6 March 2017, page 1115

⁴⁵¹ Transcript 20 March 2017, page 2092

⁴⁵² Transcript 17 February 2017, page 220

⁴⁵³ Transcript 17 February 2017, page 231

⁴⁵⁴ Paragraphs 2(m) and 96, Primary Expert Evidence of Jeremy Graham Helson on Fisheries Management for the Fisheries Submitters, 23rd January 2017

⁴⁵⁵ Transcript 22 February 2017, pages 668 and 679

21.4 Findings on Consultation

838. We consider that consultation in relation to a marine consent application is good practice and highly desirable, and should extend beyond existing interests as defined by the Act. Communities, individual, and organisations expect consultation, and the outcomes of successful consultation assist in better decision making.
839. The engagement by TTRL appears to have focused strongly, if not exclusively, on existing interests. However, as noted above, there was no statutory obligation on TTRL to consult any party, and only an obligation to report consultation with parties representing existing interests. We consider it is difficult to categorise KASM, Greenpeace, or Forest and Bird as existing interests under the Act's definition, but they are interested parties. It may have been helpful if TTRL had chosen to actively engage with those groups. In the case of Cloudy Bay Clams, which has an existing interest as defined by the Act, we consider that TTRL's failure to consult was an oversight.
840. TTRL did make a substantial and organised effort to consult with the parties it had identified as stakeholders, especially in the consultation's initial summary phase. However, while the initial approach provided a broad overview of the project, in some crucial cases it failed to lead into more detailed discussion about the potential effects.
841. Iwi are a case in point where perhaps even the initial summary approach was not appropriately tailored to their needs or expectations. This seems at odds with the key values that TTRL had set itself for the engagement process (see paragraph 822 above), and contributed to the later breakdown in productive communication.
842. That said, any perceived or actual shortfall in consultation has not affected our overall decision on the application. Through the submissions and hearing process, we consider that we are aware the views of potentially affected parties. Our decision does not need to rely on TTRL's reported outcomes of consultation.

Chapter 6. EXISTING INTERESTS

This Part of our record of decision (Chapter 6-22 and 23) deals with the specific question of Existing Interests. Section 59 of the Act requires us to take into account “existing interests” which is a defined term, and which potentially covers a broad range of matters. Section 60 of the Act sets out matters which we must consider in deciding the extent of adverse effects on existing interests.

843. Section 4 of the Act defines the term existing interest. It is the interest a person has in:

- (a) *any lawfully established existing activity, whether or not authorised by or under any Act or regulations, including rights of access, navigation, and fishing;*
- (b) *any activity that may be undertaken under the authority of an existing marine consent granted under section 62;*
- (c) *any activity that may be undertaken under the authority of an existing resource consent granted under the Resource Management Act 1991;*
- (d) *the settlement of a historical claim under the Treaty of Waitangi Act 1975;*
- (e) *the settlement of a contemporary claim under the Treaty of Waitangi as provided for in an Act, including the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992;*
- (f) *a protected customary right or customary marine title recognised under the Marine and Coastal Area (Takutai Moana) Act 2011.*

844. Section 59 of the Act further qualifies this by noting that we must take into account cumulative effects, and effects that occur outside of the Exclusive Economic Zone. We must also consider the effects, on existing interests, of activities undertaken by TTRL as part of this project but which are not regulated by the Act. We consider that this provides us with a broad ability to consider many of the matters raised during the hearing. Section 59 sets these duties out as follows:

- (2) *The EPA must take into account—*
 - (a) *any effects on the environment or existing interests of allowing the activity, including—*
 - (i) *cumulative effects; and*
 - (ii) *effects that may occur in New Zealand or in the waters above or beyond the continental shelf beyond the outer limits of the exclusive economic zone; and*
 - (b) *the effects on the environment or existing interests of other activities undertaken in the area covered by the application or in its vicinity, including—*
 - (i) *the effects of activities that are not regulated under this Act; and*
 - (ii) *effects that may occur in New Zealand or in the waters above or beyond the continental shelf beyond the outer limits of the exclusive economic zone;*

845. In considering the effects of the proposed project on existing interests, Section 60 requires us to have regard to:

- (a) *the area that the activity would have in common with the existing interest; and*
- (b) *the degree to which both the activity and the existing interest must be carried out to the exclusion of other activities; and*
- (c) *whether the existing interest can be exercised only in the area to which the application relates; and*
- (d) *any other relevant matter.*

22. Fisheries

846. Nationally, the New Zealand wild harvest fin fish industry is worth billions of dollars in revenue to the country and supports thousands of jobs. TTRL acknowledged commercial fisheries as an existing interest.
847. National fisheries management is via the Quota Management System (QMS), which splits the country's 636 fish stocks into tradeable quota shares called Individual Transferable Quota (ITQ). For each species in the QMS, a variable number of Quota Management Areas (QMAs) are defined. The Ministry for Primary Industries sets the Total Allowable Commercial Catch (TACC) for individual species. The defined Annual Catch Entitlement (ACE) from one QMA cannot be used to catch that species in any other QMA.
848. There are ten Fisheries Management Areas (FMAs) within the country's EEZ. An FMA may be the same as a QMA. Where the same fish stock extends across one or more FMAs, a QMA may be several FMAs combined. For some species there are only one or two fish stocks covering the whole EEZ, while others have separate fish stocks in most of the QMAs.
849. Māori interests in the fisheries have been defined under the Fisheries Deed of Settlement, implemented through the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992. As an outcome of that Act, the Crown funded 50% Māori ownership of New Zealand's largest fishing company (Sealord), and reserved for Māori a 20% share of the quota for all new species brought into the QMS. We address Māori fisheries interests – which are an existing interest – under Chapter 5-17 of our record of decision. We note that the matters set out below are often inextricably linked with Māori interests through various commercial relationships between iwi and fishing companies.
850. Within the STB there are two FMAs, being FMAs 7 and 8⁴⁵⁶. The boundary between the two FMAs cuts across the STB in a northwest / southeast direction, with FMA 8 lying to the north and FMA 7 to the south. At its closest, the boundary between the two FMAs lies 40 km southwest of the mining area⁴⁵⁷. The mining area is in FMA 8. The FMA 8 area is 53,000 km² in area, covers 540 km of coastline, and extends well beyond the area of the STB. The boundary between the two FMAs is shown in Figure 7 on page 185.

⁴⁵⁶ FMA 7 is the Challenger area, and FMA 8 is the Central (West) area

⁴⁵⁷ It is also 61km due west and 51km due south of the mining area

22.1 Commercial Fisheries

851. We heard from several people regarding matters related to commercial fishing.

- Dr MacDiarmid, on behalf of TTRL, is an expert in marine ecology and fisheries, and human impacts on marine ecosystems.
- Dr Robertson, on behalf of the EPA. Dr Robertson is an expert in marine resource science for sustainability, fisheries science & management, marine ecology, biodiversity, and biosecurity.
- Dr Helson is the Chief Executive of Fisheries Inshore New Zealand Limited (FINZ⁴⁵⁸) and a marine biologist with experience of fisheries management for the Ministry of Primary Industries.
- Captain Smith is the Operations Manager for Talley's Group Ltd., and a deep-sea fishing skipper. He has also worked as an international fisheries consultant.
- Mr Saunders-Loder is the Resource Manager for Talley's Group Limited. He is also President of the New Zealand Federation of Commercial Fishermen (Inc) (the Federation) and Chair of Southern Inshore Fisheries Management Company Limited.
- Ms Undorf-Lay is the Industry Liaison Manager for Sanford Limited. She is also a Resource Management Act expert.
- Ms Anderson, on behalf of the Fisheries Submitters, is a Resource Management Act expert.
- Mr Halley is the Manager of inshore fisheries for Ministry of Primary Industries.

852. We have considered recreational fishing as a separate matter in Chapter 5-19 of our record of decision.

22.1.1 Value of interests and impacts

853. Ms Undorf-Lay informed us that Sanford holds significant quota within FMA 8, and some in FMA 7. She said that the company has a long and well-established presence in the Rolling Grounds, and has fished within the actual area of the mining site⁴⁵⁹. Sanford's interests, in terms of percentage of Total Allowable Commercial Catch (TACC) are:

- | | |
|----------------------------------|--|
| • Snapper (60.8% of SNA 8) | • Red cod (20% of RCO 2) |
| • Trevally (56.7% of TRE 7) | • Rough skate (47.5% of RSK 8) |
| • Tarakihi (35.4% of TAR 8) | • Spiny dogfish (31.6% of SPD 8) |
| • Blue mackerel (21.5% of EMA 7) | • Jack mackerel (37.5% of JMA 7) |
| • Leatherjacket (20.5% of LEA 2) | • A significant interest in skipjack tuna. |

854. Mr Saunders-Loder noted that Talley's Group Limited has a significant existing interest in the STB, amounting to a 2016/2017 value of around \$12 million based on the company's rights to specific fish stocks. He stated that the possible negative economic implications for TGL are much more than 'moderate', both in terms of jack mackerel, migratory stocks (such as tuna), and non-migratory

⁴⁵⁸ FINZ is a national organisation comprising 149 members with significant interests (between 40% and 51% of quota) in 239 fish stocks.

⁴⁵⁹ Paragraphs 11 and 12, Statement of Evidence of Alison Elizabeth Undorf-Lay on Behalf of Sanford Limited

stocks. He provided us with an example of potential costs imposed on fishing operations if the availability of fish was impacted by the mining project.

855. He stated that one tonne of snapper unable to be caught in FMA8 would result in a loss to Talley's of \$60,000. If Talley's was unable to catch any of its snapper in FMA 8 the loss would be \$3 million annually⁴⁶⁰. Similarly, he surmised that an inshore fishing operator could lose \$5,000-\$10,000 per year of snapper revenue that would need to be replaced by other fish stocks in different FMAs. Gaining the right access to those stocks would come at a financial cost, with no guarantee of the actual income or value. Even though fishing operations have a diverse package of fish stocks, Mr Saunders-Loder felt that they run the risk of losing all income if fish are displaced from FMA 8.
856. Dr Robertson considered Mr Saunders-Loder's views about the significance of potential effects on property rights, capital value, and livelihoods of *all* fishermen to be a "*substantial overstatement*".⁴⁶¹
857. In supplementary evidence, Mr Saunders-Loder provided us with a further example of costs that might be imposed on a Patea Shoals inshore fishing operation. For an actual operator based in Nelson, whose fish are normally caught in the Patea Shoals, the trip from Nelson costs \$5,000 - \$7,000 in fuel. He calculated that relocation of effort to other areas (if fish are unavailable due to effects from the mining project), would impose at least a 30% increase in costs.

22.1.2 Characteristics of the industry

858. Based on TTRL's 2013 fisheries report, the STB set net fishery is operated by four vessels out of New Plymouth and two or three from the South Island. Two long-line vessels operate from New Plymouth, and at least one from the South Island. Trawl fishing in the STB is operated by one vessel out of New Plymouth and 10 to 12 out of Nelson. The fisheries report noted only one commercial rock lobster vessel operating in South Taranaki. TTRL's fisheries report concluded that it is unlikely that there will be any wider negative impacts on the commercial fishing industry – in particular, no negative impacts on quota value, downstream businesses, or fish stock sustainability. Dr Robertson agreed with that conclusion.
859. Mr Halley for MPI told us there will be some requirement for individual fishers to adjust their fishing operations, but the Ministry does not anticipate that the project will prevent Annual Catch Entitlement (ACE) being taken from the quota management area as a whole⁴⁶².
860. According to TTRL's fisheries report, the total catch from midwater trawling is about ten times that from bottom trawling. Set netting is the next most common method. Other methods such as longlining and squid jigging have been irregularly reported. Some trolling, rock lobster potting, drop lining, and fish trapping also takes place.

⁴⁶⁰ Capital cost, before lost sales revenue

⁴⁶¹ Paragraph 107, Expert Evidence of Donald Allan Robertson on Commercial Fisheries Matters as Requested by the EPA for the DMC, 21 February 2017

⁴⁶² Transcript 17 March 2017, page 1849

861. A map provided to us by the Ministry for Primary Industries (MPI) shows aggregated catch intensity for the top ten species fished within FMA 8. It also shows a 3-nautical mile (5.6 km) buffer around the boundaries of the mining permit. Within the buffer, including the actual mining area, the catch intensity ranges from medium to high.
862. MPI informed us that, within the 66-km² mining permit area over the last five years, the catch has been 266 tonnes – representing 1.41% of the total catch within the far wider area of FMA 8. The most commonly caught species within the mining area is leatherjacket, being around 10% of the total. MPI noted that if the mining project proceeds, fishing effort from within the exclusion zone will need to shift to other areas but there will be no direct impact on quota shares. Dr Robertson advised us that near the mining area, the commercial species mix and relative abundance changes over time. If the mining is granted consent, he observed that it may be difficult to attribute future changes to either mining or natural variability.
863. MPI also reported that 87% of the fisheries catch in FMA 8 is mid-water trawl, and 8% bottom trawl. Across the whole of FMA 8, jack mackerel is the dominant species taken being about 74% of the catch by tonnage. However, these catch methods and species are for FMA 8 and do not necessarily represent what happens within the mining permit area or within the downstream sediment plume area. Mr Halley told us that bottom trawl for the inshore fleet is a very significant method in FMA8⁴⁶³.
864. Approximately 20 km west and southwest of the mining area, but still within FMA 8, there is a very large area of high catch intensity. We understand the high intensity area mostly represents the jack mackerel fishery. Based on the map, we estimate this concentration of jack mackerel fishing effort to cover about 1,300 km² within FMA 8.
865. Captain Smith provided us with a map of jack mackerel vessel tracks which show jack mackerel effort in both FMA 8 and FMA 7, although it only reflects the movements of one trawler over two years. There are also smaller areas of high aggregate catch intensity (for the top 10 species) which appear to follow the 30 m deep outer edge of the Patea Shoals, between Opunake and Whanganui – passing through the mining permit area – which is consistent with a map provided to us by Captain Smith in supplementary evidence. These various data sources are consistent with an overview map of five years (2007/08 – 2011/12) trawl effort based on recorded tracks, and reported in a paper provided to us by MPI⁴⁶⁴.
866. Of note is that some trawl effort is constrained by the FMA 7/8 boundary and a line further inshore which marks a restriction on vessels over 46 m in length. We have reproduced part of the MPI trawl map with the FMA boundary and various fishing restrictions overlaid.
867. Mr Saunders-Loder considered it highly probable that the Skipjack Tuna schools migrate through the proposed mining site and plume area, but Dr Robertson disagreed with that conclusion. Mr Saunders-Loder disagreed with Dr MacDiarmid's assertion that the diversity of fish species in the

⁴⁶³ Transcript 17 March 2017, page 1848

⁴⁶⁴ Figure 11: Total five year trawl cell-based footprint for 2007–08 to 2011–12 combined, *Benthic Habitat Classes and Trawl Fishing Disturbance in New Zealand Waters Shallower than 250 m*, Ministry for Primary Industries, 2015

STB is broadly similar to assemblages along the whole of the west coast of the North Island. In his view, the migratory stocks of skipjack and albacore tuna greatly vary in terms of volume and location. They cannot be guaranteed to be found in any particular area and could easily take a path through the sediment plume and or mining site. Tuna was also referred to by the New Plymouth Sportfishing and Underwater Club, although they provided no indication of where these fish are seen or caught.

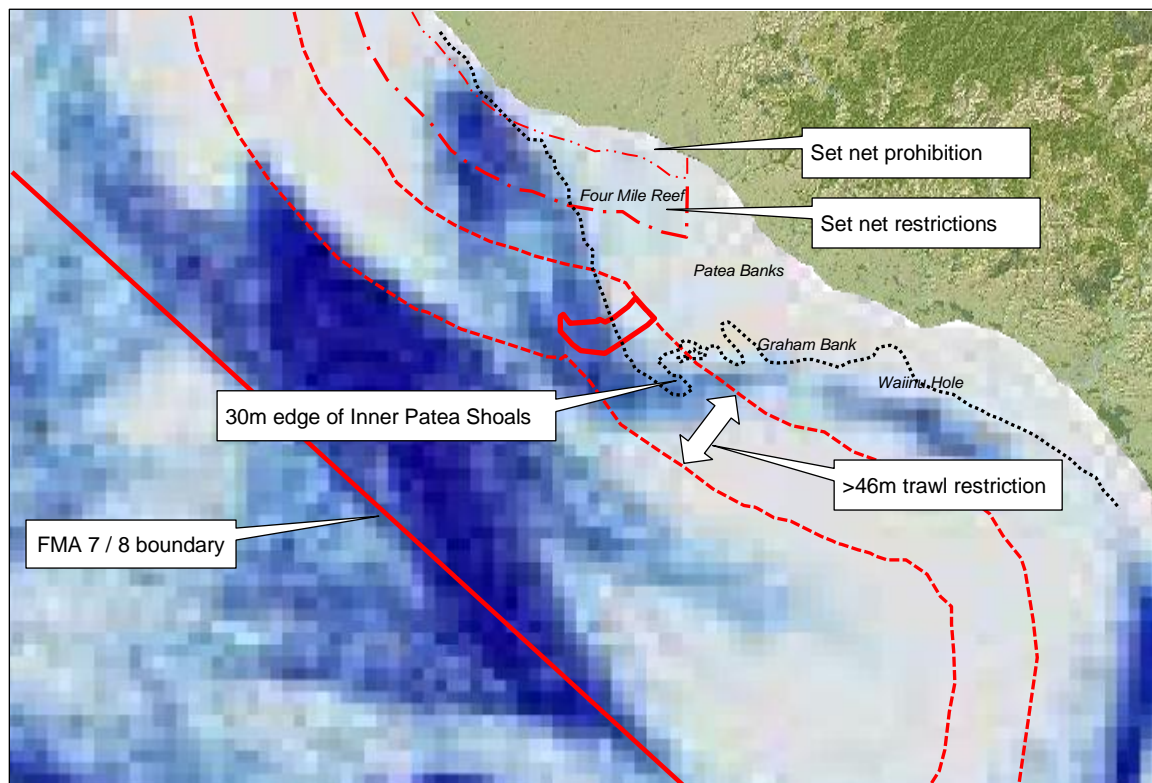


Figure 7: Trawl Effort and Fishing Restrictions

Source: Ministry of Primary Industries s44 response to DMC

30 m contour line (Inner Patea Shoals) added by DMC

Prepared by DMC

Note: Paddle crab, kina, and other set net size restrictions apply elsewhere in FMA 8

22.1.3 Effects on fish distribution

868. The sediment plume will typically extend east-southeast from the mining site. It will mostly be within (but not completely cover) the southern half of the Patea Shoals. Based on the diagrams provided to us by TTRL, we estimate that a surface plume of sediment between 2.1 and 4.6 mg/l SSC up to 35 km long and 10 km wide could extend from the mining site, covering locations such as Graham Bank⁴⁶⁵. However, for the median case (50% of the time), a plume of that intensity will exist only within the immediate vicinity of the site (up to around 1 km).
869. For sediment near the seafloor, we estimate that the 99th percentile plume, between 2.1 and 4.6 mg/l SSC, up to 45 km long and 12 km wide could extend from the mining site. Parts of that plume between 4.6 and 10.0 mg/l could extend up to 8 km from the site. In the median case, the effect of

⁴⁶⁵ 99th percentile case

the seafloor plume will be less. We estimate that the 2.1 to 4.6 mg/l SSC plume could extend to about 3 km from the source.

870. In her evidence, Dr MacDiarmid reported how NIWA had summarised effort, catch, and methods for the period 2006 to 2015 to indicate spatial distribution of the STB fishery. That was then compared to the estimated sediment plume area where SSC will be above 2.0 mg/l for the median and 99th percentile cases (see Chapter 4-13 for more about this threshold).
871. The 2.0 mg/l level was established as the threshold for avoidance by mid-water species, whereas 3.0 mg/l was the threshold for benthic fish species. She noted that the fisheries potentially most affected by elevated SSC are the bottom trawl fisheries for leatherjacket and trevally, and the set-net fisheries for rig, carpet sharks, trevally, school shark, snapper, and spiny dogfish.
872. Figure 5.10(a) in the NIWA Sediment Plume Modelling report (2015), which was also provided to us on TTRL's interactive map set, shows that median background SSC for the Patea Shoals is at least 2.0 mg/l or greater.
873. Dr MacDiarmid noted that, depending on the species referred to above, between 5% and 17% of total catches in the study area occur in the area where SSC exceeds the 2.0 mg/l threshold for fish avoidance in the 99th percentile case. Dr Robertson agreed with her overall conclusion that the effect on commercial fish species will be negligible.
874. Ms Undorf-Lay's evidence is that she had reviewed Dr MacDiarmid's calculations, acknowledged that there will be adverse effects, but that Sanford tolerates them. That was based on the worst-case scenario modelled, and Sanford's understanding that *"the area is not a significant nursery ground or significant contributor to the overall health and abundance of the FMA 8 fishery."*⁴⁶⁶ In reaching her conclusions, she expressed confidence in the opinion of Dr Robertson.
875. Captain. Smith drew on the evidence of Dr Barbara to express concern about how the sediment plume might affect fish distribution patterns. His concern was that organic material released into the plume may attract fish away from their normal areas into the immediate downstream area of the mining, moving inside the 24 nm⁴⁶⁷ zone where larger vessels are restricted from fishing. On the other hand, Captain Smith also expressed concerns about the sediment plume adversely affecting fisheries 55 nm to 124 nm away⁴⁶⁸.
876. Dr Robertson considered that Captain Smith's suggestion of this effect is *"a highly unlikely and unrealistic scenario."*⁴⁶⁹
877. Captain Smith referred to the mining operation's noise and light, and the potential effects on the feeding and movement patterns of mackerel, kahawai and the other fish that they target for food.

⁴⁶⁶ Paragraph 14, Statement of Evidence of Alison Elizabeth Undorf-Lay on Behalf of Sanford Limited, 23 February 2017

⁴⁶⁷ 44.5 km

⁴⁶⁸ 102 km – 230 km

⁴⁶⁹ Paragraph 71, Expert Evidence of Donald Allan Robertson on Commercial Fisheries Matters as Requested by the EPA for the DMC, 21 February 2017

Captain Smith also referred to the potential displacement of krill with consequent effects on the fish which feed on it. He also expressed concern about heavy metals in the sediment plume.

878. Mr Saunders-Loder was concerned about uncertain effects of the sediment plume, especially in relation to potential effects on aquaculture in the top of the South Island (green-lipped mussels and salmon), and wild fisheries that include various finfish, pāua, rock lobster and scallops. His concern was based on an assumed 10%-40% reduction in light penetrating the water column. Mr Saunders-Loder noted that jack mackerel and blue mackerel are highly migratory species and that their migration and spawning patterns may be affected by the increased noise, light, salinity, toxic load, and sediment plume.
879. Ms Undorf-Lay's evidence states that Sanford has a stake in 16 of the 41 greenshell mussel aquaculture farms in Admiralty Bay at the top of the South Island. Sanford also owns the two mussel processing factories which rely on a consistent flow of product from the farms. Sanford's position on the sediment plume is that the risk of adverse effects is highly unlikely. Sanford's concerns are therefore restricted to TTRL's use of Admiralty Bay as a safe haven during adverse weather, and consequent risks posed by refuelling, biofouling, and ballast water. Sanford accepts that these risks will be mitigated through the consent conditions.⁴⁷⁰
880. Captain Smith also expressed concern about changes to the seabed, such as formation of mounds through deposition of sediment, which could present a risk to trawling operations. He saw monitoring buoys as being another potential restriction on the location of trawling.

22.1.4 Regulatory and management issues

881. Dr Helson drew our attention to the Fisheries Act 1996 (the Fisheries Act). Section 10(c) of that Act requires decision makers to be cautious when information is uncertain, unreliable, or inadequate; and to take into account the principle that the biodiversity of the aquatic environment should be maintained. Although our decision is not made under the Fisheries Act, it is a marine management regime to which we have had regard (see Chapter 7-24.11), and the principle of caution is similar to that in the EEZ Act.
882. With regard to effects, Dr Helson stated that:
- “Commercial fishing is an operation that is dependent on adequate biological resources being available (i.e. commercial fish species), but that is not the sole necessary precursor. An analysis of impacts on commercial fisheries needs to consider the economic aspect of the operation and ensure that it can remain economically viable alongside the proposed mining operation.”⁴⁷¹*
883. Dr Helson noted that we should not confuse effects on fish with effects on fisheries; those two things, while related, are only part of the story. At the core of Dr Helson's concern (and that of FINZ and other Fisheries Submitters) is that under the QMS, fishers buy Annual Catch Entitlement (ACE) to

⁴⁷⁰ Paragraphs 16 to 19, *ibid.* Evidence of Ms Undorf-Lay

⁴⁷¹ Paragraph 52, Primary Expert Evidence of Jeremy Graham Helson on Fisheries Management for the Fisheries Submitters, 23 January 2017

reflect the balance of fish species likely to be encountered. If the seabed mining leads to changes in species abundance and location, their catch plans may not reflect what is available in the fishery, which may have a more significant effect on small operators as they are not able to source different combinations of ACE. Fishers may end up having ACE they cannot use, or excess catch for which ACE is not available. Excess ACE held by a fisher is billed by Crown on deemed value. Dr Helson noted that for small-scale operations, especially inshore fishers, this could be critical and represents a risk to commercial viability.

884. Captain Smith noted this is a species related issue. If a quota owner /operator only has snapper quota in FMA 8 and the sediment plume causes the snapper to move to FMA 7, the operator cannot just follow the fish to FMA 7.
885. Mr Saunders-Loder had similar concerns, stating that significant variations in effort and supply caused by the sediment plume will reduce income for both Talley's and the contract fishing operators who supply the company.
886. Dr Robertson, on the other hand, advised us that the *"balancing act (between ITQ/ACE species mix and catch species mix) is an ongoing challenge in the normal course of each years fishing activity."* He stated that *"this is a normal fact of commercial fishing life."*⁴⁷²
887. Mr Halley told us that impacts will result if fishing has to shift from one area to another. He noted that there may be implications for the species that are available to be caught, and the consequent requirement for fishers to cover that new catch with ACE that they may not already own. He said that *"we can't estimate accurately that impact, and it would vary by individual."*⁴⁷³
888. The Impact Assessment notes that there will be an affect arising from the 1 nm dynamic (movable) exclusion / buffer zone established around the project's operations. The Impact Assessment states that *"The proposed buffer zone has the potential to compound the impacts on commercial fishing arising from the existing Maui's Dolphin Threat Management Plan boundaries, and other exclusion zones in the STB associated with oil production (Kupe pipeline and platform exclusion zones). In particular, fishing exclusion associated with the project will potentially further displace, albeit only short-term, set net catch and effort for school shark. ... the overall proportion of school shark taken from the project area is likely to be small."*⁴⁷⁴
889. Ms Anderson was critical about the nature of the baseline data which TTRL had collected. She drew on Mr Clarke's opinions about good practice to say that at least two year's baseline sampling should have been undertaken, fed into an impact assessment, and then used to establish consent conditions and parameters.⁴⁷⁵ However, she also said that *"if you were comfortable that there was limited uncertainty around the baseline information that you have now, and it gave you enough*

⁴⁷² Paragraph 23, Expert Evidence of Donald Allan Robertson on Commercial Fisheries Matters as Requested by the EPA for the DMC, 21 February 2017

⁴⁷³ Transcript 17 March 2017, page 1848

⁴⁷⁴ Page 169, TTRL Impact Assessment

⁴⁷⁵ Transcript 20 March 2017, page 1986

comfort, under the Act, to grant consent, then two years' pre-commencement monitoring, I absolutely support that."⁴⁷⁶

22.1.5 Expert conferencing

890. Expert conferencing was attended by Dr MacDiarmid, Dr Robertson, Dr Helson, Dr Barbara, and Mr Halley. Points of agreement registered by the experts are as follows:

Disagreement

- Whether only assessing the potential effects on fish is sufficient to determine the impact of the proposed mining operations on fisheries in the STB, or whether it should also consider economic, social and legislative influences effects on fishing operations.

Agreement

- Seafloor habitat data and commercial catch data cannot be reliably compared, and would not provide insight into fish displacement.
- The mining site worm species also occurs to the north and northwest, but so far has not been described to the south.
- Any fishery that straddles a QMA boundary is a different fishery from a fisheries management perspective.
- The FMA 7/8 boundary is purely administrative, and in many cases the relevant QMA boundaries may not align with the biological distribution of stocks.
- Legally, QMA7 and QMA8 catch and effort data cannot not be combined for the purposes of evaluating effects in QMA8.
- The NIWA analysis was a good evaluation of the potential biological impacts on commercial fisheries.
- The importance of the boundary between QMAs 7 and 8 varies among species.
- Catch and effort data in QMA7 cannot be combined for the purposes of evaluating effects in QMA8.
- There is no evidence to suggest that surf clam populations will be at risk from suspended sediment.

22.2 Findings on Commercial Fisheries

891. Regarding effects on the abundance and distribution of commercial fish species, we accept the conclusions of Dr Robertson. That is, the commercial catch reduction by spatial exclusion will be small and *"the scale of biological impact on fish and fisheries is likely to be so small, as to render it impossible to determine signal from noise."*⁴⁷⁷

892. Regarding health, we accept the conclusions of the experts in relation to ecotoxicity, that the risk of effects arising from metal contaminants in the sediment plume will be negligible and the effects undetectable (see Chapter 4-16). We also accept the conclusion of Dr Forrest that the biosecurity

⁴⁷⁶ Transcript 20 March 2017, page 1987

⁴⁷⁷ Paragraph 103, page 22, Expert Evidence of Donald Allan Robertson on Commercial Fisheries Matters as Requested by the EPA for the DMC, 21 February 2017

risks from the project's operation are inherently low and/or can be managed to an acceptable level (see Chapter 4-16.3).

893. With respect to the potential effect on commercial fin fish species, we consider that the effects of most potential concern arise in relation to the sediment plume. There is also the issue of fishing effort being excluded from the immediate vicinity of the mining area. In both cases, the potential effect on existing fishing interests is a reduction in commercial opportunity, an increase in costs, or both.
894. We believe that the consultation and information sharing which took place between Sanford and TTRL led to a considered response from Sanford. That company has significant existing interests in the EEZ and CMA, including both fin fishing and aquaculture. As stated by Ms Undorf-Lay "*Sanford has become sufficiently confident with the application to support it being granted subject to conditions.*"⁴⁷⁸ We place some weight on the fact that a holder of significant existing interests has that confidence.
895. We also prefer the views of Dr Robertson who was critical of much of the evidence presented by the Fisheries Submitters. In particular, we accept Dr Robertson's advice that effects on property rights and capital value will not be significant⁴⁷⁹.
896. We accept Dr MacDiarmid's evidence that a conservative threshold for fish avoidance of the plume can be established as 2.0 mg/l for mid-water species, and 3.0 mg/l for benthic species. Having regard to the information provided by TTRL, we consider that the area where SSC exceeds those thresholds for 50% of the time is negligible or minor, depending on whether the surface or seafloor plume is considered. In addition, we note that the greatest effort and catch, as depicted by the MPI information, is offshore of the Patea Shoals, whereas the plume will typically be within the Shoals.
897. There are conflicting claims about whether part of the area affected by the sediment plume has significance in terms of being a nursery area, or whether it is significant contributor to the overall health of the FMA 8 commercial fishery. However, we accept the views of Ms Undorf-Lay and Dr Robertson that it is not significant nursery ground or significant contributor to the overall health and abundance of the FMA 8 fishery.
898. We consider that there will be no effect on the abundance or health of commercial fisheries (including aquaculture), but there may be some minor effect on the distribution of commercial fin fish. To the extent that distribution may be affected, there may also be some degree of economic impact. However, based on MPI figures which quantify the catch within the mining area itself, the displaced economic effort will not be significant in the context of the overall fisheries.
899. Regarding conditions, as already noted in paragraph 441, there is a pre-commencement monitoring requirement on the Consent Holder to establish the existing 'background' conditions related to commercial fishing, and to continue monitoring once mining commences. In addition, the EMMP condition requires that no adverse effects arise that were not anticipated when we granted consent.

⁴⁷⁸ Paragraph 3, Statement of Evidence of Alison Elizabeth Undorf-Lay on Behalf of Sanford Limited, 23 February 2017

⁴⁷⁹ Paragraph 103, page 24, Evidence of Dr Roberston

22.3 Commercial Surf Clam Fisheries

900. We heard from Mr Piper, who is a shareholder and the founder of Cloudy Bay Clams Limited. He has been involved in the New Zealand commercial and aquaculture industry for the past 45 years. Mr Piper told us that the surf clam fishery in Area 8 is significant, both spatially and economically but he was unable to define its extent, except to say that it extends to a depth greater than 10 metres⁴⁸⁰.
901. Cloudy Bay Clams (CBC) holds quota for seven species under the quota management system, with the main four being diamond shell, storm shell, tuatua, and moon shell. The company is the single largest surf clam quota holder in New Zealand by a significant margin – harvesting more than 10,000 tonnes annually. Based in Marlborough, CBC has only recently started its harvesting operations along the STB coastline and now has a boat working out of Whanganui. CBC is working towards completion of a purpose-built vessel for the Area 8 fishery.
902. We note that the benthic ecology expert conferencing reached unanimous agreement about the distribution and the biology of surf clams. They agreed that there was sufficient information to understand the risks and that there was a very low likelihood of clams being exposed to any stresses because of the project operations.
903. However, through direct experience, CBC has become proficient at recognising the signs of distress in shellfish, and mud build up is a significant contributor to stress levels. Mr Piper’s experience of sediment effects on clams arises from seeing material transported down rivers during storms, and consequent increases in the mortality and vulnerability of the shellfish. Mr Piper drew the distinction between mud (very fine particles) and sand (coarser particles). Although the shellfish are resilient and can adapt to some level of deposition (up to 50 mm) his observation is that when mud particles are in suspension, the shellfish filtration mechanisms clog and they can suffocate.
904. Although CBC harvest out to about 10 metres depth (if conditions are calm) Mr Piper told us that the clam fishery extends further out than that point. His concern is that the parent stock in those deeper waters that could potentially be suffocated by the sediment plume particularly when ultra-fine material (mud) is mobilised during heavy weather events and washed onto beaches or into the surf zone.

22.4 Findings on Commercial Surf Clam Fisheries

905. We have considered the matters set out in this part of our record of decision, expert findings, submissions, and other evidence. We have also considered the relationship of this part to other matters in the report, so that an integrated decision can be made. Having done so, we find that:
- The environment in which surf clams are found is typically subject to existing elevated levels of SSC.
 - Surf clams are relatively tolerant of elevated SSC.

⁴⁸⁰ Annexure “C” Responses of Anthony Piper, Memorandum on Behalf of Fisheries Submitters, 21 February 2017

- The sediment plume is unlikely to add significantly to sediment deposition or suspension in the near shore environment inhabited by the clams.

22.5 Recreational Fishing and Customary Activities

906. We deal with customary activities / iwi commercial fishing interests in Chapter 5-17. We also deal with recreational fishing in some detail in Chapter 5-19. We acknowledge that these activities are existing interests for the purposes of our assessment. We have addressed them separately simply because they sit more naturally in the cultural and social effects part of our record of decision.

23. Kupe Platform and Licence Area

907. Kupe Joint Venture Parties New Zealand (Kupe JVP) are the holders of Petroleum Mining Licence 38146 (see Figure 1 on page 34), with Origin Energy (Origin) as the operator. Kupe's petroleum mining licence, which expires in 2031, allows it to exploit the Kupe natural gas field. The production facility comprises an unmanned offshore platform, a 30 km pipeline to shore, and an onshore production station. The unmanned platform, pipeline and umbilicals are located approximately 1.2 km north of the TTRL project area. The capital cost of the Kupe assets and its associated infrastructure was more than \$1.3 billion. Kupe identified themselves as an existing interest, and TTRL acknowledged Kupe JVP as having that status.
908. We note that Todd Exploration Limited holds petroleum exploration permit 60094, which crosses other parts of the TTRL mining permit area – outside of the Kupe permit area. The Todd permit expires in 2028. Todd Exploration Limited did not submit on the TTRL application.
909. We heard evidence from several expert technical witnesses for Origin on behalf of the Kupe JVP.
- Dr Overy is a consultant engineer specialising in jackup, pile and well foundations for the international oil industry.
 - Mr Carra is a consultant engineer specialising in the design, analysis and integrity management of offshore moored floating facilities.
 - Mr Hobbs is General Manager for conventional oil and gas operations in Origin's integrated gas business. He has ultimate accountability for the Kupe asset.
 - Mr Currill is an engineer who has been directly involved in the Kupe development over the life of the project. He has also worked on FSOs.
 - Mr Aylward is a commercial manager for Origin, but has also practiced as a lawyer specialising in energy and resources law.

23.1 Effects and Risks

910. There is a declared circular safety zone of 500 m around the Kupe wellhead platform⁴⁸¹. The pipeline from the platform to the shore begins on the platform's northern side, and has an 800-m wide safety zone along its entire length. These safety zones are marked on LINZ bathymetric charts of the STB with an accompanying note regarding restrictions⁴⁸².
911. The platform is designed to withstand impact by a Kupe supply vessel at low speed. Mr Hobbs told us that the risks of impact are built into the design of a platform before it is constructed. He said that the addition of vessel movements from the nearby mining area will create a new risk profile, and described this as unprecedented within the oil and gas industry. The platform supply vessels are much smaller than the IMV, FSO or export ships that will service the TTRL project and are accounted for in the existing risk profile. Mr Currill told us that a typical supply vessel is 87 m long, which is smaller than the 345 m IMV. Both Mr Currill and Mr Hobbs described as catastrophic the outcome of a collision, if the platform is damaged and oil released from any of its three producing wells.
912. Mr Currill gave his opinion that the most likely cause of impact arising from the mining project is a failure of the IMV or FSO mooring systems, leading to an uncontrolled drift of the ship – an event which is termed “loss of position”. A key issue for Origin is therefore the adequacy of the mooring and vessel thruster systems and how the associated risks can be mitigated. Mr Currill provided us with a map of the mining site and Kupe platform, showing modelled drift times under certain conditions. Based on that model, the drift time until impact could be as little 0.5 hours, although for much of the mining site the drift time would be 1 to 2 hours.
913. Mr Carra told us that he reviewed the technical detail of the proposed mooring systems and procedures, and made several recommendations to Origin. He also considered this risk in relation to interactions within the TTRL fleet, especially regarding the simultaneous operation of the IMV and FSO. He summarised his advice to Origin as being that the company needs to *“seek verifiable assurance that the threats from the TTR vessel loss of position event have been identified by TTR and have been properly mitigated through the preventative controls to eliminate or minimise the threat and through mitigation controls to reduce the likelihood of damage should a loss of position event occur.”*
914. The risk of collision for the Kupe platform is also increased due to the number of vessels providing supplies and other services to the IMV and FSO. Mr Currill told us that these risks can be reduced by a simultaneous operations plan (SIMOPS), which requires agreement by both TTRL and Origin. A

⁴⁸¹ Submarine Cables and Pipelines Protection (Kupe Gas Project) Order 2008

⁴⁸² New Zealand Notice to Mariners No. 240/08:- Safety Zone: The unauthorised entry of any vessel into the 500 metre safety zones around Maui A & B, Kupe and Maari production platforms, the FSO Raroa and the FSO Umuroa is prohibited. Protected Area: All vessels are prohibited from anchoring or fishing within the Protected Area of the gas pipelines to Maui A & B, Kupe and Maari production platforms, the FSO Raroa and the FSO Umuroa. Restricted Area: All New Zealand vessels are prohibited from, and other vessels warned against, anchoring or fishing within the Restricted Area (beyond the Territorial Sea Outer Limit) of gas pipelines. The gas pipelines from Maui A & B and Kupe production platforms contain flammable gas under high pressure; any vessel damaging them would face an immediate fire hazard.

SIMOPS agreement can be independently reached between the two parties. However, Mr Currill said that an ideal outcome would be if the grant of mining consent was conditional on a SIMOPS agreement being in place.

915. Origin also raised concerns about changes to seabed topography, and the potential risks that this might pose to existing and future operations. Three risks are perceived. One relates to the pits and mounds, and the stress the topography will pose for future pipelines on the seabed, especially if the material was unconsolidated and prone to settling. The second risk relates to the effects of mining around a plugged and abandoned well (Kupe South 4) which sits in the middle of the TTRL mining permit area (see Figure 8). The third risk relates to the dangers faced by jack up rigs used for future exploration in the TTRL mining permit area.
916. The Kupe licence area allows the licence owner to drill and extract petroleum products from within the TTRL mining area. Exercising that right would require the use of jackup rigs for exploration wells. Dr Overy introduced us to potential issues associated with jackup drilling rigs, especially in terms of safety of personnel and equipment. Jackup drilling rigs are so named because they are self-elevating with three to eight movable legs that can be extended (“jacked”) above or below the hull. Jackups are towed or moved under self-propulsion to the site with the hull lowered to the water level, and the legs extended above the hull. When the rig reaches the work site, the crew jacks the legs downward through the water and into or onto the sea floor. This anchors the rig and holds the hull well above the waves.
917. Dr Overy told us that the maximum seabed slope for a jackup rig is 4 to 5 degrees, but they can also be affected by buried slopes, such as those which will occur through redistribution of de-ored sediment after processing by the IMV. Buried slopes are the greatest risk if the operator is not aware of them, and instability caused by a buried slope can severely damage a jackup rig. Dr Overy noted that affected ground is capable of remediation before using a jackup rig, but that this comes at a financial cost.
918. Within the area covered by both the Kupe and TTRL areas lies the abandoned Kupe South 4 wellhead. The wellhead lies 2 m below the current seabed and is plugged in six places (at varying depths) with concrete. Origin are concerned that mining near the well might compromise its safety. In Mr Currill’s opinion, the key to safe management is to ensure that there is an exclusion zone or some other control around the wellhead. He advised us that recent (at that time) discussions with TTRL had established that exclusion need not necessarily be a distance. Instead, it could be to ensure that the wellhead and the conductor⁴⁸³ is not exposed by sand extraction to the point that it has a risk of being overloaded.
919. Relevant to both the jackup rig and abandoned wellhead issues, is the assumed stability of the mine tailings. Mr Brown for TTRL told us that the pits will have a slope between 30° and 36°, being the sediment’s natural angle of settlement. Dr Overy disagreed, stating that 15° is maximum stable slope

⁴⁸³ A large diameter pipe that is set into the ground to provide the initial stable structural foundation for a well. The conductor pipe is set in the seabed, and is a key structural foundation for the subsea wellhead.

he has seen in a marine environment. He noted that the only real mitigation for the slope issue was effective record keeping by TTRL of slope and pit locations.

920. Regarding the issue of the competing licence / permit interests, we received advice⁴⁸⁴ from New Zealand Petroleum and Minerals (NZPM)⁴⁸⁵. NZPM is responsible for the issue of licences and permits under the Crown Minerals Act, and therefore issued a mining permit to TTRL in full knowledge of the Kupe licence area and operations.
921. In granting TTRL its mining permit, MBIE imposed a set of conditions – some of which are specifically aimed at avoiding or limiting effects on operation of the Kupe permit. MBIE does not support the imposition of exclusion zones to protect the Kupe operation, considering that to do so “would effectively sterilise portions of the iron sand resource”. MBIE considers that the Crown Minerals Act mining permit conditions are sufficient to protect the Kupe JVP’s interests.

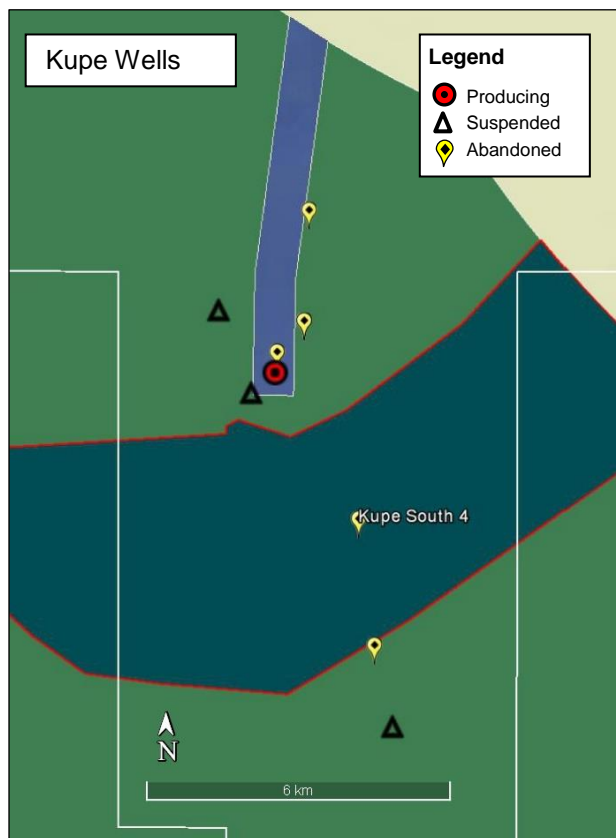


Figure 8: Kupe Field Wells

Source: NZ Petroleum and Minerals webmaps
 See Figure 1 on page 34 for wider area
 Prepared by DMC

922. NZPM considers that where there are conflicting interests MBIE expects both parties to negotiate to resolve any issues and neither party should expect its operations to be given primacy. In the event of

⁴⁸⁴ Ministry of Business, Innovation and Employment’s response to the Decision-Making Committee’s request for advice under Section 44 of the EEZ Act, dated 16 February 2017

⁴⁸⁵ A division of the Ministry of Business, Innovation and Employment (MBIE)

no resolution there is provision under the TTRL's mining permit for arbitration and NZPM also expects the parties to negotiate a "cooperation agreement".

923. Mr Aylward told us that Origin prefer to call the cooperation agreement referred to by MBIE, a risk mitigation agreement. The risk mitigation agreement covers simultaneous operations by the parties, but it is not the simultaneous agreement itself. Instead, the risk mitigation agreement would talk about how it is to be structured and the role that Origin would have in reviewing and endorsing it. On the final day of the hearing, Origin advised us that the two companies had reached agreement in principle on the terms of a risk mitigation agreement.
924. Notwithstanding Origin's general concerns about the proposed iron sands mining operation, Origin and TTRL have agreed a set of conditions between them. In its closing legal submissions, Origin confirmed that the conditions presented to us by Dr Mitchell on the hearing's last day accurately reflect the wording of what has been agreed between the two parties. In legal terms, the agreed conditions are 'Augier' conditions, and we have had to decide whether they are appropriate to impose as part of the grant of consent. We comment further on Augier conditions in Chapter 8-25.3 of our record of decision. If such conditions are not imposed, the alternative is for the issues to be addressed by way of a side agreement between the parties.
925. Origin's original position was that it would prefer TTRL not to be operating within the boundaries of the Kupe licence area. Now that the conditions and in principle risk mitigation have been agreed, Origin advised us that its stance has changed to neutral, but contingent upon the DMC imposing the agreed conditions.

23.2 Findings on Origin / Kupe Existing Interests

926. Origin submitted in opposition, identifying several threats it considered were inherent in a grant of consent. Origin's interests are largely governed by other marine management regimes, and this is true in respect of most issues relevant to the TTRL / Origin relationship. The operations of both parties are subject to licencing under the Crown Minerals Act. MBIE has already imposed conditions on TTRL's licence to avoid or minimise impacts on Origin, and expects both parties to negotiate and agree terms if any areas of conflict remain. We consider that the agreement reached by two parties during this hearing should be seen in that light.
927. Based on the identified issues, and in line with MBIE's expectations, discussions between TTRL and Origin continued up until the conclusion of the hearing. The results of those discussions were detailed in an agreement that set out conditions which would, if imposed by the DMC, lead to Origin taking a neutral stance. While elements of this agreement have the flavour of a private treaty the DMC has decided to impose the agreed conditions.

Having regard to the conditions and the evidence presented during the hearing, we are satisfied that the issues raised by Origin can be managed by the imposition of those conditions.

Chapter 7. INTEGRATED ASSESSMENT

The following part of our record of decision (Chapter 7-24) integrates the various matters covered in evidence and submissions which we set out in previous sections. Our intention in doing so is to achieve the purpose of the Act (Section 10) and more particularly the requirements under Section 10(3), which require us to take into specific decision making criteria and information principles.

24. Section 59 Summary and Analysis

24.1 Introduction

928. We must take into account the decision making criteria and information principles set out in the Act. Specifically, this requires us to follow Sections 59 and 87D – which sets out a decision making framework; Section 60 – which lists matters to be considered in deciding the extent of effects on existing interests; and Sections 61 and 87E and 87F – which establish certain information principles. These matters are set out in Chapter 7-24.3 of our record of decision.
929. We note that pursuant to Section 59(5) of the EEZ Act, we have not given regard to:
- (a) trade competition or the effects of trade competition; or
 - (b) the effects on climate change of discharging greenhouse gases into the air; or
 - (c) any effects on a person's existing interest if the person has given written approval to the proposed activity.

24.2 Key Effects

930. Chapter 3-7 to Chapter 6-23 set out our understanding of the key potential effects of the project on the environment and existing interests based on the Impact Assessment, the EPA Key Issues Report, the report by NKTT, submissions, and expert evidence. It also outlines our individual findings on those potential effects.
931. The physical environment of the STB is challenging, dynamic and complex. It will have a significant influence on how TTRL undertakes its mining operation. It will also have a significant influence on how the project affects the environment, especially the spread and effect of the sediment plume. We consider that TTRL is well aware of the challenges and has incorporated them into its proposed project design.
932. In summary, the key potential effects, aspects of which are interrelated, can be categorised as:
- (a) The sediment plume

The sediment plume will have significant adverse effects on benthic life in the near-field (up to 3 km) through reduction in light affecting primary production, and direct effects such as smothering. The plume may also instigate avoidance behaviour by fish in some locations within

the near to mid-field, adversely affecting existing interests in commercial, recreational, and customary fishing. The effects of the sediment plume will largely be felt outside of the EEZ.

(b) Marine mammals

Marine mammals may be affected by the sediment plume, but greater potential impacts will arise from noise produced by the mining vessels. Noise at a level likely to cause behavioural impacts will extend for some considerable distance in all directions. The effects will be felt within both the EEZ and the CMA.

(c) Human impacts

The natural resources of the STB are already used for commercial gain, personal enjoyment, and customary practices. The ocean's role as a source of food for many people is a significant characteristic. To the extent that these existing roles and values are disrupted by the mining project, there will be adverse effects on people and communities. The effects will largely be felt outside of the EEZ, although potential effects on Origin's Kupe operations are within the EEZ.

933. In our opinion, a key underlying consideration is the spatial and temporal distribution of effects. All of the effects will be in some sense 'temporary', albeit that many may last for the duration of the mining operation or longer. There will be no constant level of effect in most locations. The sediment plume will vary in terms of its location and the level of SSC. As described by Professor Cahoon, the sediment plume will exist as "*irregular streams and packets*" of elevated SSC which he said would cause "*a range from little effect, to substantial effect infrequently, to frequent substantial effect*" (see paragraph 331). An important question for the DMC has been how significant those varying effects will be in terms of specific locations, and their relevance at different spatial scales of assessment.

24.3 Section 59(2)(a) – Effects

934. Section 59(2)(a) of the Act requires us to take into account the adverse effects of allowing the activity on the environment and/or existing interests. This includes cumulative effects, and effects that extend beyond the boundaries of the EEZ.
935. This section of the Act is highly relevant to our assessment of the effects, especially in respect of the sediment plume. The plume will extend into the coastal marine area (CMA) which is subject to the Resource Management Act. In considering "effects" we have applied the definition in section 6 of the Act and considered potential effects of low probability but high potential impact.
936. The existing interests identified in Chapter 6-22 and 23 of our record of decision include commercial fishing and Origin's Kupe operations. Chapter 5-17 identifies the existing interests of tangata whenua, and Chapter 5-18 describes other existing interests such as recreational fishing, diving, and surfing. Our principal findings on these matters are set out below.

Tangata whenua

937. The mining will take place beyond the territorial limit, but iwi see their interests as extending beyond territorial waters. The effects of the sediment plume and noise will be felt over a wide area. This includes the project site, which is in the EEZ, but also substantially within the CMA inshore of the EEZ. There are long established interests within the CMA and current claims by iwi under the Marine and Coastal Area (Takutai Moana) Act.
938. The nearest shoreline in Ngāruahine rohe is north of and over 20 km from the mining site. Even during unusual current and weather conditions, the predicted level of suspended sediment concentrations will be small increments on background levels inshore and will be less than the levels at which potential adverse effects on marine life might occur.
939. The highest levels of suspended sediment concentration will occur in the CMA offshore from Ngāti Ruanui's whenua. There will be severe effects on seabed life within 2 – 3 km of the project area and moderate effects up to 15 km from the mining activity. Most of these effects will occur within the CMA. There will be adverse effects such as avoidance by fish of those areas. Kaimoana gathering sites on nearshore reefs are likely to be subject to minor impacts given background suspended sediment concentrations nearshore.
940. The Traps, Graham Bank and The "Project Reef" are all within Ngāa Rauru's rohe. In relation to Ngāa Rauru, there are likely to be adverse effects such as avoidance by fish in areas towards the outer edge of the CMA such as Graham Bank and this area will at times have significant reductions in light, affecting primary production levels. Kaimoana gathering sites on nearshore reefs are likely to be subject to minor or negligible impacts given that background SSC is typically elevated in the nearshore area. Impacts may be moderate towards the western end of the rohe, but minor or negligible elsewhere.
941. Our findings in relation to human and environmental health are that effects related to heavy metals are very unlikely, whether by direct impact or via bioaccumulation. The consequent risk to kaimoana is assessed as negligible but we have imposed conditions to monitor and respond to indicators. We consider that the kaimoana monitoring programme (Condition 77) should be imposed because of the importance of this issue to iwi. The monitoring programme will be required to operate, even in the absence of engagement by iwi in the Kaitiakitanga Reference Group.
942. We acknowledge there will be some impact on kaitiakitanga, mauri, or other cultural values. A significant physical area will be affected, either within the mining site itself, or through the effects of elevated SSC in the discharge. Iwi identified other relevant effects such as the impact of noise on marine mammals as being of concern.

Fish and Fisheries

943. We accept Dr MacDiarmid's evidence that a conservative threshold for fish avoidance of the plume can be established as 2.0 mg/l for mid-water species, and 3.0 mg/l for benthic species. Having regard to the information provided by TTRL, we consider that the area where SSC exceeds those

thresholds for 50% of the time is negligible or minor, depending on whether the surface or seafloor plume is considered.

944. We accept the views of Ms Undorf-Lay and Dr Robertson that the area affected by the sediment plume is not a significant nursery ground or significant contributor to the overall health and abundance of the FMA 8 fishery.
945. Surf clams are relatively tolerant of elevated SSC. The sediment plume is unlikely to add significantly to sediment deposition or suspension in the near shore environment inhabited by the clams.
946. We accept the conclusions of Dr Robertson. That is, the commercial catch reduction by spatial exclusion will be small and *“the scale of biological impact on fish and fisheries is likely to be so small, as to render it impossible to determine signal from noise.”*
947. We consider that there will be no effect on the abundance or health of commercial fisheries (including aquaculture), but there may be some minor effect on the distribution of commercial fin fish. To the extent that distribution may be affected, there may also be some degree of economic impact. However, based on MPI figures which quantify the catch within the mining area itself, the displaced economic effort will not be significant in the context of the overall fisheries.

Origin / Kupe

948. Origin submitted in opposition, identifying several threats it considered were inherent in a grant of consent. Origin's interests are largely governed by other marine management regimes, and this is true in respect of most issues relevant to the TTRL / Origin relationship. The operations of both parties are subject to licencing under the Crown Minerals Act. MBIE has already imposed conditions on TTRL's licence to avoid or minimise impacts on Origin, and expects both parties to negotiate and agree terms if any areas of conflict remain. We consider that the agreement reached by two parties during this hearing should be seen in that light.
949. Based on the identified issues, and in line with MBIE's expectations, discussions between TTRL and Origin continued up until the conclusion of the hearing. The results of those discussions were detailed in an agreement that set out conditions which would, if imposed by the DMC, lead to Origin taking neutral stance. While elements of this agreement have the flavour of a private treaty the DMC has decided to impose the agreed conditions.
950. Having regard to the conditions and the evidence presented during the hearing, we are satisfied that the issues raised by Origin can be managed by the imposition of those conditions.

Other existing interests

951. The value of any site for diving can be a combination of water depth, ease of access from shore, biodiversity, and visibility, but varies from site to site. The Patea Shoals includes areas of value such as The Traps, The Crack and The "Project Reef". Their value for diving may be diminished at the times they are subject to the sediment plume.

952. Reductions in high visibility days will be major for The Crack when mining operations are at the eastern end of the mining site or moderate when it is at the western end. The reduction in high visibility days at The “Project Reef” will be major when mining is at the eastern end, and minor when it is at the western end. Visibility effects will not be constant over time. The Crack and The “Project Reef” will remain available as dive sites, but be subject to periods of reduced visibility by comparison with their current good levels.
953. There is negligible risk of heavy metal contaminant in relation to customary and recreational food gathering. Similarly, we consider that the risks are low for invasive species being introduced, or algal blooms occurring.
954. Operational noise may also have an effect on fish, but we accept the agreed position of the fish ecology experts that population level impacts are unlikely, and that acclimatisation by fish to underwater noise is likely⁴⁸⁶. There may be some avoidance by fish of areas subject to SSC levels higher than the background level.

24.4 Section 59(2)(a)(i) – Cumulative Impacts

955. The main potential for cumulative effects arises in relation to suspended sediment. Regardless of the existing sources, mobilisation of sediment is an ongoing process. The oceanographic and climate regimes in the STB lead to an almost continuous suspension and re-suspension.
956. Within this context we accept that the sediment plume will be a cumulative addition to the existing background level. At some times, and in some locations, this will cause adverse effects.
957. Although the sediment plume will be the main contributor to cumulative impacts, we considered the potential for that type of effect to occur in relation to all other aspects of the proposal.

24.5 Section 59(2)(b) – Other Activities

958. Section 59(2)(b) requires us to take into account other activities occurring near the application site, including those not regulated under the Act, and the likely effects that they also have on the environment and existing interests. In some respects, this might be considered analogous to the ‘existing environment’ or ‘baseline’ concepts sometimes referred to under the RMA.
959. Our principal findings on this matter are that:
- Activities on land contribute to elevated background levels of SSC, and this is an environmental issue unlikely to be resolved in the near future;
 - The commercial fishing industry, especially bottom trawling, may have some effect on benthic disturbance, but the effect is not on the same scale as the mining operation or its associated sediment plume;
 - Oil and gas exploration (seismic testing), and the movement of shipping generally, pose a widespread risk of disturbance to marine mammals through noise.

⁴⁸⁶ Points of agreement between the experts, under paragraph 430

24.6 Section 59(2)(c) – Human Health

960. Under Section 59(2)(c), we must take into account the effects on human health which may arise from effects on the environment. This section of the Act therefore allows us to consider matters such as toxicants entering the food chain. We covered this issue in Chapter 4-16 of our report, but it also has relevance to customary food gathering by iwi and recreational fishing. Our principal findings on this matter are set out below.
961. In relation to marine discharges under Section 87D(2)(a) we considered human health effects. As advised by counsel assisting the DMC (see paragraph 586 of record of decision), we have considered effects on human health of the discharge of harmful substances if consent is granted, irrespective of whether those effects may arise from effects on the environment.
962. We find that the risk of adverse effects such as algal blooms and the introduction of invasive species is low. Those risks are managed by international protocols and the relevant New Zealand government agencies and regulators.
963. The risk of heavy metals contaminating seafood is negligible. We have included Schedule 6 in the suite of conditions which is related to testing for heavy metals to provide assurance that the outcomes are consistent with this assessment.
964. We accept that TTRL has considered risks associated with oil spills, and that procedures approved under other regulatory regimes will manage that risk.
965. There will be little effect in respect of air discharges from the operation of mining vessels under the current maximum of 3.5% sulphur HFO content. That risk will be further reduced under 0.5% content which is scheduled for introduction in 2020.

24.7 Section 59(2)(d) – Biodiversity

966. Section 59(2)(d) requires us to take into account the need to protect biological diversity and integrity. We have considered the potential for effects on individual species, as well as ecosystems either or in part, or as a whole. We have covered those matters in Chapter 4-10 to 13. We have paid particular attention to the habitats of threatened species.
967. Our principal findings on biodiversity are set out below.

Oceanic productivity

968. We conclude that effects on primary productivity will be within the interannual range of variability at the scale of the STB. At the scale of the SMD, those effects may be discernible, but will not be significant. However, at a local scale effects on benthic primary productivity may be significant. The project will lead to average reduction in microphytobenthos across the SMD of 13% to 19%, with much higher reductions over the Patea Shoals closer to the mining site.
969. We accept that any adverse effects on primary production overall on the SMD are likely to be minor.

970. There will be significant adverse effects on environmentally sensitive areas to the east-southeast of the mining site. We agree that there will be significant effects on macroalgae on at least part of Graham Bank and minor effects on macroalgae at The Traps. There will also be significant effects on microphytobenthos within 1 to 2 km of the mining site. Overall, we find that the effect on the primary production of the Patea Shoals is likely to be moderate, but will be significant at environmentally sensitive areas such as The Crack and The "Project Reef". However, we note that not all primary production is dependent on the availability of light.
971. We believe that the sediment plume will have no effect on krill.

Benthic fauna

972. Within the mining site, there will effectively be a 100% loss of benthic fauna. The evidence we heard was that most of the benthic fauna within the mining site is short lived and will be re-populated by early colonisers from outside the site within a period of weeks to months and that some species may take several years to recolonise. We accept that there will be some effects on environmental sensitive areas or value ecosystem components.
973. We recognise that the rocky reef habitats are highly diverse and support a wide assemblage of marine life. In comparison, sand habitats support significantly lower levels of biodiversity.
974. The benthic community within 2 to 3 kilometers of the site will be significantly impacted by sediment deposition. Deposition rates and the consequent effects in the mid to far-field will reduce with distance.
975. We find that there may be smothering of some organisms, or effects on their respiration. Light may be reduced to the extent that it affects the production or quality of biomass. We accept that macroalgal growth on reefs closer than 5 km from the mining area may be inhibited at times, but there is negligible risk of it being destroyed.

Fish

976. We accept that overall effects on fish will be generally no more than minor, other than eagle ray for which the effect will be moderate. We conclude that for fish, because they are mobile, the risk of death due to entrainment by mining operations is negligible.
977. A moderate effect on eagle ray means that between 5% and 20% of their habitat area will be affected. We are aware that eagle ray is a food source for orca, but we accept Dr MacDiarmid's advice that there will be no real impact on that whale.
978. Other species may be subject to a minor effect, meaning a habitat and/or population impact of 1% to 5% using the ecological assessment framework.
979. We consider that the addition of SSC from the sediment plume will place stress on natural systems, including fish, and that the effect will be felt most in areas close to the site.
980. Areas affected by the sediment plume are likely to include important locations such as The Crack which is within 5 – 8 km of the mining area, and Graham Bank, which is around 20 km downcurrent

of the mine. Based on SSC avoidance thresholds for fish provided to us by Dr MacDiarmid, we consider that the effects may include either temporary or permanent displacement of species.

981. There may be local effects of mining noise on fish, but acclimatisation by fish to mining noise is likely, and population level impacts are unlikely.

24.8 Section 59(2)(e) – Effects on Species

982. Section 59(2)(e) builds on the matters under 59(2)(d) by requiring us to specifically consider rare and vulnerable species, and the habitats of threatened species. These two sections are therefore relevant to our consideration of potential effects on species such as whales and dolphins, but also seabirds. In Chapter 4-14 and 15 we address matters related to the various species, but especially those classified by the Department of Conservation as threatened.

Seabirds and their habitats

983. All the seabirds referred to by the experts are wide ranging and at the level of the STB there are likely to be few effects. We do not dismiss the potential for some effects at the local level. The birds are highly mobile and their location in time and space is driven by their habitats, breeding, and foraging, and may conflict with the mining operation.
984. Effects on krill are unlikely, and concentrations of krill are typically well removed from the mining site. We conclude there is little risk to foraging by fairy prion. Suspended sediment will increase turbidity in locations near the mining site, and there will be some consequent effects on the behaviour of fish. There is potential for effects on those birds which rely on water clarity to forage. This will be localised and minor, and monitoring of these effects will be required.

Marine mammals and their habitats

985. We have accepted that noise at a certain level will have an impact on marine mammals and the threshold we have adopted is 120 dB. Dr Childerhouse advised us that this is the most conservative underwater noise threshold ever used in New Zealand⁴⁸⁷.
986. We accept that beyond the 120 dB level there is a risk of adverse behavioural impacts on marine mammals which Mr van Helden estimated is possibly as high as 50% for sensitive species. A risk of behavioural impact does not represent a risk of auditory damage.
987. Within the Patea Shoals, suitable habitat for Hector's dolphin and Southern right whale⁴⁸⁸ is relatively restricted. The IMV / crawler 'average' 120 dB noise contour will not affect the typical habitat of either animal. However, during periods when the noise generated by the project is greater, a more extensive 120 dB contour will cover some of their habitat.

⁴⁸⁷ Transcript 22 May 2017, pages 3118/3119

⁴⁸⁸ For southern right whale during calving season

988. The greatest risk of effect for Southern right whale will be when the mining operation is at the far eastern end of the mining site. However, when operations are west of the mining site's mid-point, there will be little or no risk of effect.
989. When mining is at the far eastern end of the mining site, and during the limited periods when all noise sources are operating, the area of affected Southern right whale habitat will be around 300 km². That area represents around 43% of the approximately 700 km² of potential Southern right whale habitat across the Patea Shoals.
990. The risk of noise related behavioural impact will be similar for Hector's dolphin. Again, the risk will be greatest when mining is at the far eastern end of the mining site and all noise sources are operating. However, the risk may well be less because the Hector's dolphin typical habitat occupies a narrower coastal strip than Southern right whale.
991. For blue whale, the risk of behavioural impact will be greatest when mining is at the far western end of the mining site and all noise sources are operating (10% of the time). In that circumstance, around 700 km² of the STB within the blue whale's minimum foraging depth will be affected. However, because there is around 20,000 km² of blue whale habitat within the STB⁴⁸⁹, the 700 km² represents only 3.5% of that area.
992. Suitable habitat for orca is widespread, and confined to neither inshore nor offshore. We therefore conclude that there will be no significant effect on orca due to noise.
993. However, there may be a potential effect on orca through destruction or disruption of eagle ray habitat at and near the mining site. A substantial area of eagle ray habitat has been modelled within and around the mining site, including good habitat to the north which is unlikely to be affected by the mining operation. Other good habitat is thought to include much of the mining site itself and an area immediately to the east. Orca appear unlikely to feed directly on eagle ray near the mining site, preferring to hunt them during the ray's seasonal movement into shallower waters. A reduction, but not total loss, of eagle ray habitat may have a consequent effect on local seasonal food availability for orca.
994. There have been very few sightings of Bryde's whale, and those are at least 70 km from the mining site. Bryde's whale does not appear in the strandings database for the STB. Given the scarcity of information, the potential for any effects on Bryde's whale has not featured in our decision making.

24.9 Section 59(2)(f) – Economic Benefit

995. Economic benefit to New Zealand is the focus of Section 59(2)(f). In considering benefits, we think that any economic dis-benefits must also be taken into account – such as impacts on existing interests (which we are required to consider under Section 59(2)(a)). We address economic matters in Chapter 5-20 of our report, and existing interest in Chapter 6-22 and 23. Although we recognise environmental 'costs' in other parts of our record of decision, we have not attempted to ascribe them

⁴⁸⁹ Based on the area deeper than 60 metres

a dollar value as they are best considered in qualitative terms. Our principal findings on this matter are set out below.

996. We are required to take into account the economic benefit to New Zealand of allowing the application. We do not think that taking economic benefit into account requires us to consider a benefit cost analysis. Understanding that there is an economic benefit is all that is necessary and is consistent with the purpose of the Act. There will be an annual direct benefit of \$59 million in terms of GDP, or \$159 million if indirect and induced effects are taken into account. There will also be royalties of about \$6.15 million per year, \$310 million in export earnings, and government taxes.
997. There will be some positive economic impact in South Taranaki and beyond.
998. We have taken no account of the potential for adverse effects on businesses or attractions which have not yet been established, such as whale watching.
999. We have taken into account the views of MBIE that it considers the project to be economically feasible, and an activity that will contribute positively to the country's broader economic development strategy.

24.10 Section 59(2)(g) – Natural Resources

1000. Section 59(2)(g) requires us to take into account the efficient use and development of natural resources. Natural resources include the iron sands resource itself; the Origin Kupe petroleum permit area; and commercial, recreational and customary fisheries resources. We have taken into account these matters in Chapter 5-17, and Chapter 6-22 and 23 of our report.

24.11 Section 59(2)(h) – Marine Management Regimes

1001. Section 59(2)(h) requires us to take into account the nature and effect of other marine management regimes. The marine management regimes of most relevance to our assessment are the Resource Management Act, Crown Minerals Act, Maritime Transport Act, and the Health and Safety at Work Act. Our principal findings on this matter are set out below.
1002. Marine management regimes (MMRs) are defined (listed) by Section 7 of the Act. Table 4 on page 28 of our record of decision sets out MMRs potentially relevant to this application. We received information from various parties and heard evidence from several experts in relation to other MMRs.
1003. We have taken other marine management regimes into account when considering activities relevant to this application. The evidence and reports that we received satisfies us that we are aware of the relevant issues. We have imposed conditions only where necessary and we are satisfied there will be no conflict with these other regimes.

24.11.1 Overview

1004. Section 59(2)(h) of the Act requires us to take into account the nature and effect of other marine management regimes (MMRs). However, the Act gives us little guidance about considering the

nature and effect of the other MMRs. The relevance of those regimes and the weight we have given them has therefore been based on the circumstances of this case, rather than any specific statutory direction. As with any other requirement under Section 59(2) we have evaluated the relevance of the regimes and determined what weight to give them in reaching our decision.

1005. We considered how any of the MMRs regulate effects arising from the mining project, and whether conditions we impose might be an unnecessary duplication of requirements. We also gave thought to how MMRs regulate existing interests (such as fisheries) and whether that is relevant to the management of effects and the imposition of consent conditions on the mining project.

1006. Section 7 of the Act defines what a marine management regime is. Agencies and MMRs of relevance to this application are:

(a) New Zealand Petroleum and Minerals⁴⁹⁰ – responsible for managing the prospecting, exploration and mining permit regime under the Crown Minerals Act. This is relevant to the operations of TTRL and the existing interests of Origin Energy, as their permit areas overlap. We received advice from MBIE under Section 44 of the Act, and the Ministry appeared at the hearing.

In Chapter 6-23, we considered the Crown Minerals Act in relation to the effects on the operation of the Origin / Kupe licence.

(b) The Department of Conservation – responsible for marine mammals and protected species including under the Marine Mammals Protection Act. This is relevant, given the presence of various species of cetacean and other marine mammals. Similarly, the Wildlife Act applies to the protection of seabirds. The Department provided Section 44 advice, and Dr Longdill gave evidence at the hearing regarding DOC's position on the sediment plume.

In Chapter 4-14, we considered the potential effects on marine mammals.

(c) The Ministry for Primary Industries – responsible for managing fisheries within the EEZ and territorial waters and biosecurity at New Zealand's boundaries. This is relevant due to the existing interests of commercial fishing in the South Taranaki Bight. The Ministry is also responsible for the Biosecurity Act, which is relevant to the risk of marine pest organisms being introduced from outside New Zealand, through discharge of ballast water or biofouling of hulls. We received fisheries advice from MPI under Section 44 of the Act, and representatives of the Ministry also gave evidence at the hearing.

In Chapter 4-16, we considered matters related to biosecurity. Matters related to commercial fisheries are considered in Chapter 6-22.

(d) Maritime New Zealand – responsible for maritime safety associated with shipping, maritime rules for discharges, and oil spills. This is relevant due to the presence of various surface vessels associated with the project. We received advice from MNZ under Section 44 of the Act and representatives of the organisation appeared at the hearing.

⁴⁹⁰ A branch of the Ministry of Business Innovation and Employment (MBIE)

In Chapter 4-16 we consider the risk of oil spills. Shipping safety is a feature of the conditions we have imposed with respect to the joint presence of vessels servicing the OERKL and TTRL projects. We are aware of and have taken into account the relationship between MNZ and WorkSafe New Zealand regulations. We consider those matters in Chapter 6-23.

- (e) WorkSafe New Zealand – responsible for administering legislation to provide a safe workplace, which is relevant to operation of vessels such as the IMV, and other aspects of the project. We received advice from WorkSafe New Zealand under Section 44 of the Act and the organisation appeared at the hearing.

As noted above, the relationship between WorkSafe and MNZ regulations was addressed as an issue during the hearing and we consider those matters in Chapter 6-23.

- (f) Regional Councils – responsible for environmental management within the CMA (CMA) from the shore out to the 12 nautical mile limit. We received information from TRC and Horizons Regional Council under Section 44 of the Act. We outline matters of relevance below in Chapter 7-24.11.2.

24.11.2 Resource Management Act

1007. The Resource Management Act (RMA) is a marine management regime recognised by the EEZ Act. The New Zealand Coastal Policy Statement (NZCPS), regional policy statements, and regional coastal plans are instruments developed under the RMA.
1008. The RMA applies to activities carried out within New Zealand's land area, but also within what that Act calls the coastal marine area (CMA). The CMA extends from the shoreline out to 12 nautical miles offshore. It therefore butts up against the boundary of the Exclusive Economic Zone, which begins at 12 nautical miles offshore. Regional policy statements, regional coastal plans, and the NZCPS are not directly applicable within the EEZ. However, we have had regard to the fact that many of the effects will be experienced within the CMA where those documents are relevant, which is consistent with our duty under Section 59(2)(h).
1009. Certain activities within the CMA are subject to the regional coastal plan (every region must have one) and may require resource consent to be obtained from the relevant regional council. Regional policy statements and the NZPS are overlying policy documents that are relevant to the interpretation of resource consents sought within the CMA and the immediate area of land adjoining the coast (collectively the 'coastal environment'). Activities and effects associated with the project are not prohibited by the NZCPS or the planning documents of the two regional councils.
1010. We have assessed effects within the CMA in the same way as if the consent were applied for in that area.
1011. Counsel assisting the DMC provided us with advice about the interrelationship between marine consenting under the EEZ Act and matters controlled by the RMA. That advice was:

17. *As discussed above, section 59(2)(h) requires the DMC to take into account the nature and effect of any "regulations, rules, and policies" made under the RMA.⁶*
18. *In our view such "regulations, rules, and policies" include planning instruments prepared by local authorities under the RMA, as well as policy direction provided by central government such as through the New Zealand Coastal Policy Statement 2010 ("NZCPS").⁷ The nature and effect of the NZCPS and other planning instruments must therefore be taken into account by the DMC, notwithstanding that those documents do not apply within the area regulated by the Act.*
19. *That said, as discussed above, the Act gives little guidance on how the DMC should take into account the nature and effect of MMRs, including RMA instruments. The relevance of those instruments and the weight to be given to them are matters to be determined by the DMC, in the circumstances of the matter before it.*
20. *The DMC considering the earlier marine consent application by Trans-Tasman Resources Limited ("TTRL") sought advice on a different issue, namely the relevance of the NZCPS to activities within the EEZ.⁸ The advice concluded that the NZCPS does not apply within the EEZ because "the coastal environment of New Zealand", to which the NZCPS applies, excludes "any area beyond the territorial sea".⁹ The advice also noted that the NZCPS might be relevant "to the assessment of marine consent activities under the EEZ Act (...) as information about the policy framework applying within proximate parts of the CMA". We agree, for the reasons discussed above.*

⁶ Section 7(2)(l).

⁷ The NZCPS is an instrument "to state policies in order to achieve the purpose of the [RMA] in relation to the coastal environment of New Zealand"; section 56 of the RMA; page 5 of the NZCPS 2010.

⁸ Memorandum of counsel in response to questions from the decision-making committee, 1 April 2014, page 17.

⁹ At 18.

1012. We agree with that advice, in relation to the non-applicability of the NZCPS within the EEZ. However, we have had regard to the fact that many of the effects will be experienced within the CMA where the NZCPS is relevant, which is consistent with our duty under Section 59(2)(h).
1013. TRC and Horizons Regional Council (Horizons) are interested parties, as the effects of the sediment plume are felt within their coastal marine areas. The boundary between the two councils is about 3 km east of Waiinu Beach, with the boundary also extending offshore to the 12 nm limit. The boundary is therefore almost 50 km from the closest point of the mining site.
1014. The Horizon's submission drew our attention to a range of potentially applicable provisions from the council's 'One Plan', a document which combines the regional policy statement and regional plan provisions. It highlighted Objectives 8.2 and 8.3 relating to activities in the CMA and water quality, Policies 8.4 and 8.6 which cover the same issue, and tables related to seawater management zones and water quality targets.

1015. With respect to those targets, the ones of relevance are the allowable percentage of toxicants, and measures related to visual clarity. Toxicants must not exceed the ANZECC guideline level for protection of 99% of species. Given the agreed position of the ecotoxicology experts about levels of potential toxicants (see paragraph 589), we consider that the Horizon's target will be met. Regarding visual clarity, the Horizon's target is a no more than 20% reduction. We have reviewed TTRL's mapping of predicted changes in midwater horizontal visibility and the euphotic zone. Although the precise quantum of change is not clear to us, it seems possible that there will be a more than 20% reduction in visibility in some parts of the CMA subject to the One Plan. If consent had been required for the discharge under the rules of the One Plan, it seems likely it would be classified as a discretionary activity.
1016. The TRC submission accepted the outcome of the first TTRL hearing decision, that the activity required consent from the EPA, not from TRC⁴⁹¹. Despite that acceptance, the TRC submission still provided us with a useful outline of the TRC regional policy framework applicable under the RMA⁴⁹². Potentially relevant provisions covered a range of issues including recognition of tangata whenua relationships to resources, water quality, biodiversity, and outstanding natural features. Regarding the latter, the TRC submission alerted us to the coastal plan status of The Traps as an outstanding natural feature. The Traps are the only offshore ONF in South Taranaki. If consent had been required for the discharge under the TRC regional coastal plan, it seems likely that it would be classified as a discretionary activity. Consideration of an application would however need to consider Policy 4.1 of the coastal plan which is: "*The following areas are areas of outstanding coastal value [which includes The Traps] and shall be managed in a way that gives priority to avoiding adverse effects on the outstanding coastal values of each area.*" As a matter of national importance (under Section 6 of the RMA), the consent authority would need to recognise and provide for the protection of The Traps when determining a consent application.
1017. A CMA is also subject to the regional policy statement of the region it falls within. The Horizon's One Plan integrates its RPS, whereas the TRC RPS is a separate document. Regional policy statements set the policy framework for the regional coastal plan. In addition, the regional policy statement itself is subject to the New Zealand Coastal Policy Statement (NZCPS).
1018. The Ngā Motu MRS submission drew our attention to the provisions of the NZCPS, observing that it requires avoidance of adverse effects on:
- Areas with outstanding natural character; and
 - Threatened species (with the submitter making specific mention of orca and threatened / at risk seabirds).
1019. We have had regard to the NZCPS, but provisions (or parts of provisions) of potential relevance include the following:
- Objective 1 – Ecosystems

⁴⁹¹ Paragraph 14, Taranaki Regional Council submission, 11 November 2016

⁴⁹² Paragraphs 19 and 20, *ibid.*, TRC submission

- Objective 2 – Natural character
- Objective 3 – Treaty of Waitangi
- Objective 4 – Recreation opportunities
- Objective 6 – Enabling development
- Policy 2 – Treaty of Waitangi
- Policy 3 – Precautionary approach
- Policy 4 – Integration across administrative boundaries
- Policy 6 – Extraction of minerals
- Policy 11 – Biodiversity
- Policy 12 – Harmful aquatic organisms
- Policy 13 – Preservation of natural character
- Policy 14 – Restoration of natural character
- Policy 15 – Natural features and landscapes
- Policy 18 – Public open space
- Policy 22 – Sedimentation
- Policy 23 – Discharge of contaminants

1020. The submission of TRC touched on the question of monitoring costs. TRC contended that if consent was granted, it should be involved in the monitoring programme because effects will be felt within the Taranaki CMA. TRC noted that it is responsible for environmental monitoring within the CMA, and responding to potential ratepayer complaints associated with the effects of the project will therefore impose costs. TRC stated that its iron sands project monitoring costs should be recoverable from the Consent Holder on a user pays basis.⁴⁹³

24.11.3 Summary of Marine Management Regimes

1021. Many of the effects associated with the project will be experienced in environments outside of the EEZ. The coastal marine area (CMA) is subject to the RMA. Various provisions of documents developed under the RMA are relevant to understanding the importance of the CMA and the environmental aspirations which bordering communities have for CMA waters. We have taken those matters into account in our deliberations. We have not ignored effects simply because they are outside the area covered by the EEZ.
1022. Our review of the NZCPS found that many of its potentially relevant provisions have parallels in the EEZ. For instance, the NZCPS has provisions related to indigenous ecosystems / biodiversity; and Section 59(2)(d) of the EEZ requires us to take into account the importance of protecting the biological diversity and integrity of marine species, ecosystems, and processes. Similarly, taking into account Te Tiriti is required under both documents. Importantly, we note that the NZCPS establishes discretionary activities as the highest consent status under regional coastal plans.
1023. The NZCPS is a national policy document, and therefore differs from the EEZ Act in the detail of direction that it provides. That detail provided us with a useful framework that gave additional context

⁴⁹³ Paragraphs 61 and 67, Taranaki Regional Council submission

to our deliberations. That said, we have not regarded the NZCPS as in any way a replacement for the EEZ Act. We are clear that our duty and powers lie only under the Act, and there is no relevant topic covered by the NZPS which is also not able to be considered in some way under the EEZ Act. We were mindful of avoiding duplication related to the Act's requirement for caution, as opposed to the NZCPS direction on the 'precautionary principle'. See paragraph 41 for legal advice we received on the precautionary principle.

1024. The TRC submission sought that the council should be involved in the monitoring programme. We have imposed Condition 61 which allows for TRC to be a member of the Technical Review Group, which may amount to the same outcome. The costs of TRC involvement in the TRG will be funded by TTRL (Condition 64). TRC also foresaw costs arising from its own monitoring in response to public complaints. Mr McLay, on behalf of TRC, suggested that TTRL should offer to pay for such costs by way of an Augier type condition⁴⁹⁴. Such a condition was not offered by TTRL.

24.12 Section 59(2)(i) – Best Practice

1025. Section 59(2)(i) requires us to take into account industry or activity best practice. This is a new industry, and there are no directly comparable operations. However, we have had regard to practices for relevant activities which are carried out as parts of other industries, and to practices associated with the management of effects arising from resource extraction.

1026. Our principal findings on this matter are:

- The proposed design and certification process for the IMV and crawler will be undertaken using internationally recognised expertise.
- The noise limits imposed on the operation will require the consideration of noise minimisation in the design of the IMV, crawler, and other equipment.
- Verification of the achievement of the noise limits at source is required before the equipment is mobilised.
- The combined imposition of discharge controls and receiving environment limits is a well-recognised resource management approach to minimising adverse effects.
- The use of a Technical Review Group, with representation by independent parties, and the inclusion of a Kaitiakitanga Reference Group represent best practice oversight of technical and cultural matters.

24.13 Section 59(2)(j) – Conditions

1027. We have considered whether conditions can avoid, remedy or mitigate the adverse effects of the activities. We considered the evidence about effects, and the conditions proffered by TTRL to address those effects. In some instances, we considered that conditions should be amended or

⁴⁹⁴ Transcript 7 March 2017, page 142

strengthened, and we have done that with the intent of addressing specific effects or achieving desired outcomes.

1028. We believe that the conditions imposed will avoid, remedy or mitigate effects to the extent required to achieve the Act's purpose. Appendix 2 sets out the conditions.

24.14 Section 59(2)(k) – Regulations

1029. Section 59(2)(k) of the EEZ Act requires us to take into account relevant regulations. Regulations are defined in Section 4 of the Act to mean regulations made under the EEZ Act. We have therefore taken into account the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013. These regulations state which activities are permitted activities for the purpose of the EEZ Act and the conditions for undertaking those activities without a marine consent.
1030. We also took into account the Exclusive Economic Zone and Continental Shelf (Environmental Effects - Discharge and Dumping) Regulations 2015, particularly Regulation 10 which defines the discharge of sediment associated with the iron sands mining project as a discretionary activity.

24.15 Section 59(2)(l) – Other Law

1031. Section 59(2)(l) requires us to take account of any other applicable law. We have considered other marine management regimes as required by Section 59(2)(h).
1032. We have considered the need to avoid duplicating regulations and conditions that will be imposed by regulators under other marine management regimes. In respect of the issues raised by OERKL, there may be some duplication arising from the conditions imposed, but we are satisfied that there is no conflict.
1033. We have addressed the Marine and Coastal Area (Takutai Moana) Act 2011 in Chapter 5-17.3.5. It is relevant in a similar way to the RMA. That is, the marine and coastal area subject to the MACA directly abuts the EEZ and the project site. As shown by Figure 5, the interests of Ngāruahine, Ngāti Ruanui, and Ngā Rauru Kītahi – as represented by MACA claims – will be potentially affected by the presence and extent of the sediment plume.
1034. The MACA claims of the three iwi are recent and have not yet been resolved. Despite that fact, we recognise that the claims exist and have taken that into account in our decision.
1035. We were informed by submitters about the Te Awa Tupua (Whanganui River Claims Settlement) Act 2017 (the River Act). The Whanganui River is the longest navigable river in New Zealand, originating at Mount Tongariro and ending in the Tasman Sea. The river has a long history of providing physical and spiritual support to Whanganui iwi and their hapū. Several iwi have interests in the Whanganui River and its tributaries. The River Act lists these iwi as including, among others, Ngā Rauru Kītahi and Ngāti Ruanui, both of which submitted on the application by TTRL.

1036. The River Act establishes the river as its own legal personality, recognising all its physical and metaphysical elements. The River Act lists other Acts under which decision makers must have particular regard to the legal status of the river. The Exclusive Economic Zone Act is not one of those listed.
1037. We acknowledge the significance of the river, and of the River Act, but note that there will be no direct effect on the river in relation to the sediment plume.

24.16 Section 59(2)(m) – Any Other Matter

1038. Section 59(m) is commonly called a catch-all provision. It provides the potential for us to consider anything that we consider relevant and which is not otherwise covered by the other matters referenced in Section 59.
1039. The advice of counsel assisting the DMC was that Section 59(2)(m) does not provide us with unlimited scope. The advice was that we cannot expand on (or take a different approach to) a specific requirement that Parliament has chosen to confine or regulate in a particular way. We have therefore considered Section 59(2)(m) in the context of the specific matters required to be taken into account by Section 59(2), and related matters which have a bearing on our decision. Importantly, we have been careful to consider whether a matter has been expressly addressed by another section of the Act – before it could be capable of consideration under Section 59(2)(m).
1040. We considered the extent to which international provisions⁴⁹⁵ are relevant to the mining project, including various treaties, declarations and conventions. For instance, we reviewed the extent to which MARPOL, UNDRIP, and the regulatory role of the International Maritime Organization are relevant. Section 11 of the EEZ Act states:
- “This Act continues or enables the implementation of New Zealand’s obligations under various international conventions relating to the marine environment, including—*
- (a) *the United Nations Convention on the Law of the Sea 1982:*
- (b) *the Convention on Biological Diversity 1992.”*
1041. As set out in Section 11 of the Act, New Zealand’s major international obligations are implicit in the EEZ Act. We have addressed the United Nations declaration on the rights of indigenous peoples (UNDRIP) in Chapter 5-17.3.8 of our record of decision.
1042. We considered whether the concept of an existing environmental or activities ‘baselines’ are relevant. We decided they were not. We considered whether precedent had any value in our deliberations. We determined that there was little of relevance in prior experience or case law to draw on for this application.

⁴⁹⁵ Provisions which are not ‘law’ in the sense envisaged by Section 59(2)(l) of the Act.

24.17 Section 59(3) – Submissions and Evidence

1043. Section 59(3) of the EEZ Act requires us to have regard to submissions and evidence; advice, reports and information; and advice from NKTT.
1044. In meeting that requirement, we had formal regard to all the written and oral evidence and representations made at the hearing, including legal representations made by all parties. We also sought advice from counsel assisting the DMC, and from experts through the Section 44 process.
1045. Although this record of decision does not specifically acknowledge every single submission, submitter, or point made during the hearing, all the matters put before us have been considered.

Chapter 8. CONDITIONS AND MONITORING

25. Conditions – General Findings

1046. Section 59(2)(j) of the EEZ Act requires us to take into account *“the extent to which imposing conditions under section 63 might avoid, remedy, or mitigate the adverse effects of the activity”*. We have wide discretion in terms of imposing conditions on this application for marine consent. In exercising that discretion, we have carefully considered the outcomes of expert conferencing, the conditions proffered by TTRL in its closing legal submissions, input by EPA advisors, and the views of other parties.
1047. During the hearing (and in Minutes 40 and 45), we noted that our efforts to obtain information about conditions or other measures which might avoid, remedy, or mitigate adverse effects in no way indicated that we had reached a conclusion in favour of the project. Our actions in relation to possible conditions reflected our obligations under the Act to comply with the information principles. This required us to obtain the best available information about mitigation measures and possible conditions so that we could consider them in our decision making. We regard this as standard practice in consenting processes under the EEZ Act (and under the Resource Management Act 1991).
1048. Although many experts and submitters contributed to our thinking about conditions, we specifically acknowledge the following two people whose specific role was to consider these matters. They were:
- Dr Loeffering, a consultant advising the EPA, has a doctorate in earth sciences, and is a resource management planner and accredited hearings commissioner. He prepared a report for the EPA analysing the conditions proffered by TRL
 - Dr Mitchell, a consultant advising TTRL, has a doctorate in water resources engineering, and is a resource management planner and accredited hearings commissioner.
1049. Unless otherwise stated, every condition we refer to in our record of decision was proffered by TTRL. Unless otherwise stated, the condition numbering in our record of decision is the final numbering used in Appendix 2.

25.1 EPA Conditions Report

1050. The EPA Analysis of Conditions Report (17 May 2017) prepared by Dr Loeffering reviewed the conditions as they stood at that time. The report was issued prior to the final conferencing between the planners representing the EPA and TTRL. The purpose of the review was not related to whether consent should be granted or refused. Its purpose was to advise the DMC on matters related to the clarity and applicability of conditions.
1051. The report provided commentary and wide range of recommend wording changes to the conditions. It also proposed several new conditions, being:

- Condition 66A (now 70) – requiring TTRL to prepare an operational Safety Case in consultation with WorkSafe New Zealand.
- Condition 75A (now 80) – requiring TTRL to continue to inform and seek to engage with relevant iwi entities.
- Condition 104 – the inclusion of a Bond to ensure that an event such as restoration occurs, not as a penalty for non-compliance with any other condition. Our eventual decision has been to not use a bond, and that condition has therefore been struck out.
- Condition 105 (now 109) – requiring TTRL to engage a regular independent audit of compliance with consent conditions. We note that this does not replace the EPA’s compliance monitoring and/or enforcement functions.

1052. The report also advised us that:

- Some of the conditions result in the EPA fulfilling the role of an arbitrator and such conditions and should not be imposed in that form.
- If any condition refers to a ‘significant’ change, the characteristics that comprise significance need to be clearly specified.
- Monitoring locations, frequency and duration of monitoring, and what is to be monitored (i.e. where, what, and when) should be ‘hard coded’ into the conditions rather than embedded in management plans.
- Any future proposal to amend the locations, frequency, and duration of monitoring should be a transparent process, and is therefore better dealt with via a formal application under section 87 of the Act (as opposed to a condition simply requiring EPA approval).
- Management or monitoring plans should be ‘certified’ rather than ‘approved’, because conditions should not be subject to secondary (or third party) approvals.
- Any plans prepared under other Marine Management Regimes (MMRs) or in consultation with other parties or agencies should not be certified by the EPA.
- Any plans prepared under other MMRs or in consultation with other parties or agencies should be independently reviewed by a suitably qualified and experienced person and then submitted to the EPA for compliance monitoring.
- The only plans which the EPA should certify are the Pre-commencement Environmental Monitoring Plan (PCEMP), Environmental Monitoring and Management Plan (EMMP), Post-extraction Monitoring Plan (PEMP), and the Operational Sediment Plume Model (OSPM).
- Conditions, where relevant, should include both discharge limits and receiving environment limits, and both must be certain and enforceable.
The Crack or ‘The “Project Reef”’ may need to be included in the conditions as additional compliance sites.
- The various volunteered ‘Augier’ conditions may be better accommodated by way of side agreements rather than being imposed as consent conditions.
- Consistent terminology for the mined material should be used throughout the conditions. ‘Seabed material’ and ‘de-ored sediment’ are the recommend terms.
- Consistent terminology about timeframes should be used.

1053. We have had regard to that advice in reaching our conclusions about any amendments necessary to the conditions, as set out in Chapter 8-26 below.

25.2 Operational Response Conditions

1054. There will be a range of circumstances in which the Consent Holder will need to put day to day operations on hold for a period of time. As noted by TTRL, the company's expectation is for operations to occur for only 72% of the time – for a variety of reasons not related to consent compliance.

1055. We are conscious of our obligation not to impose conditions that contribute to an adaptive management approach. The condition proffered by the applicant dealing with benthic recovery required them to cease operations until recovery is back on track. Dr Lieffering said that *"I think it's an environmental bottom line. It's a compliance matter. It's not an adaptive management, as I understand it."*⁴⁹⁶

1056. We agree with Dr Lieffering that this condition is unlikely to lead to a permanent cessation in the mining activity. The non-compliance will only be apparent after a long period of time and we think it requires a broader range of responses rather than immediate and short term operational responses such as stopping the crawler. We have amended the condition to reflect that distinction (see Condition 8). We consider this provides an appropriate process to demonstrate and achieve compliance.

1057. On the other hand, we think that the limits set out in Conditions 4.c, 4.d. and 5 are more amenable to rapid operational adjustments. This could include responses such as limiting operations in particular sea conditions or, if necessary, the removal of the crawler to another part of the mining site where there are smaller proportions of fine and ultra-fine material. This approach may require putting day to day operations on hold for a period of time. However, we consider that it is extremely unlikely to require permanent cessation of the mining.

25.3 Augier Conditions

1058. Augier conditions are a well-known aspect of case law under the RMA. Even though that Act does not apply in the EEZ, we consider that Augier is a valid legal approach in specific circumstances. An Augier condition is one volunteered by an applicant that might otherwise be ultra vires⁴⁹⁷ for the consent authority to impose, and is relied on by the consent authority and others when granting consent.

1059. The High Court⁴⁹⁸ held that four elements comprise an Augier condition:

- a clear and unequivocal undertaking to the consent authority and/or the other parties;
- receipt of the grant of resource consent in reliance on that undertaking;

⁴⁹⁶ Transcript 24 May 2017, page 3221

⁴⁹⁷ Beyond one's legal power or authority

⁴⁹⁸ *Frasers Papamoa Limited v Tauranga City Council* (CIV 2008-470-465)

- the imposition of a condition on the resource consent which broadly encompassed the undertaking; and
- detriment to the consent authority or other parties if the undertaking is not complied with.

1060. Conditions offered by TTRL, for example, those offered to address the concerns of OERKL, are Augier conditions. Other examples are the inclusion of Kaitiakitanga Reference Group (Condition 72) and community funding (Condition 83). In the High Court's language, they are an 'undertaking'. We have had to consider whether those conditions offer clarity; adequately encompass the undertaking; and whether the EPA or any other party would suffer if the conditions were not imposed.

25.4 Management Plans and Monitoring

1061. We heard evidence from many parties about TTRL's proposed regime of monitoring and management plans. This included evidence from Mr Govier, TTRL's monitoring expert, Mr Clarke for the Fisheries Submitters, and other technical / scientific experts.
1062. Condition 48 requires the Consent Holder to undertake two years of monitoring before the extraction of seabed material commences. Monitoring must be in accordance with a Pre-Commencement Environmental Monitoring Plan (PCEMP), which was initially called a Baseline Monitoring Plan (BEMP).
1063. Condition 48 and Schedule 6 set out the matters that must be addressed by the PCEMP, and the plan is subject to review by the Technical Review Group. As a final step, the PCEMP must be submitted to the EPA for certification. Although the Consent Holder can apply to amend provisions in the PCEMP, it must continue to operate under a certified version until new certification is forthcoming from the EPA.
1064. Following the two year monitoring required under the PCEMP, the Consent Holder can commence extraction of seabed material. However, extraction cannot commence until the SSC limits set by Schedule 2 have been reviewed, adjusted if necessary to reflect actual (rather than modelled) conditions, and then passed through the same TRG / EPA review and certification processes.
1065. The DMC considers that the two year monitoring period will provide sufficient information as a precursor to commencing extraction of seabed material. Some parties were critical of the monitoring taking place after the issue of consents, and/or that the two year period was too short. We consider that the period is adequate, especially in light of the background information already gathered by TTRL.
1066. After the initial two year monitoring period, the Consent Holder is required to continue monitoring for the life the consent, under an Environmental Management and Monitoring Plan (EMMP) developed for that purpose (Conditions 54 and 55). The matters to be covered by the plan follow on from the PCEMP. The processes for its development, review and certification are the same. No extraction of seabed material can take place until the EMMP has been certified by the EPA.
1067. There are other issue specific plans that must also be developed, being:

- Condition 57: Post Extraction Benthic Recovery Monitoring (PEMP).
- Condition 66: Seabirds Effects Mitigation and Monitoring Plan (SEMMP).
- Condition 67: Marine Mammal Management Plan (MMMP).
- Condition 68: Collision Contingency Management Plan (CCMP).
- Condition 69: Simultaneous Operations Plan (SIMOPP).
- Condition 70: Biosecurity Management Plan (BMP).
- Condition 77: Kaimoana Monitoring Programme.

1068. The DMC accepts that the framework and processes around these plans is appropriate for understanding the environment, monitoring effects, and addressing issues if they arise.

1069. Mr Clarke stated that *"If consent is granted on the basis of the proposed conditions, notwithstanding the absence of adequate baseline information, TTR needs to address what actions would be taken if the BEMP [now called the PCEMP] sampling identifies other sensitive areas or more endangered species in the mining area and area of influence from the mining activities. I would recommend that the consent conditions require a series of reviews by the EPA, of the BEMP data to ensure transparency of results and findings of the BEMP programme and how any issues not previously identified are to be addressed."*⁴⁹⁹

1070. We consider that the concerns identified by Mr Clarke are appropriately covered by the interrelated responsibilities of the Technical Review Group, Kaitiakitanga Reference Group, and EPA. In particular:

- Condition 61.b. requires the TRG to determine whether monitoring shows any unanticipated adverse effects.
- Condition 61.c. requires the TRG to make recommendations about the need to monitor any new parameter.
- Condition 61.f. requires the TRG to recommend that the EPA review consent conditions to deal with adverse effects that can be addressed as the project progresses.
- Conditions 66 and 67 require the seabird and marine mammal plans to be developed in consultation with the KRG.
- Condition 73.d. allows the KRG to evaluate monitoring data and advise the Consent Holder on monitoring or operational responses to address effects on cultural values.
- Condition 106 allows the EPA to review conditions related to discharge limits, environmental limits, or operational controls.
- All environmental monitoring and management plans must be certified by the EPA.

⁴⁹⁹ Paragraph (H), Primary Expert Evidence of Bruce Paterson Clarke on Environmental Risk for Fisheries Submitters, 23 January 2017

25.5 Bond / Insurance

1071. Section 63(2)(a)(i) of the Act expressly empowers the DMC to impose a condition on a marine consent requiring the Consent Holder to "provide a bond for the performance of any 1 or more conditions of the consent". Section 65 of the EEZ Act provides additional details regarding bond conditions. Various submitters considered that we should impose a bond.

1072. To date, no marine consents granted under the Act have had a bond condition imposed. We sought advice from counsel assisting the DMC on bonds⁵⁰⁰. Excerpts of that advice are:

33. *The key requirement for a bond-related condition is that it must relate to – and in effect secure – the performance of one or more other conditions of consent.*

...

37. *In the RMA context, judicial discussion has tended to focus on the amount of the bond, which is an evidential matter for the decision-maker to decide in the circumstances of each case. The main driver in ascribing a bond value is the likely cost of the consent authority (or a third party) complying with the bonded condition, in the event that the consent holder fails to do so, plus a contingency.²⁹*

38. *... the amount of the bond (or at least an initial amount) is commonly specified in the conditions. Another option is not to stipulate an initial bond amount, but rather require a process of the consent holder, typically, developing a cost estimate based on a risk assessment and then agreeing the bond amount with the consent authority (or through arbitration, if no agreement is reached).*

39. *In most cases provision is made for the bond amount to be reviewed on a regular basis and adjusted in certain circumstances.*

²⁹ *The Planning Tribunal in Bletchley Developments Ltd v Palmerston North City Council W58/92 (at 10) suggested that an appropriate level of bond be based on estimated costs plus a factor of 25%.*

1073. In addition, Dr Lieferring advised us that "If a consent holder is for some reason unable to ensure compliance with a bond requirement, such as the liquidation of a consent holder company, then a financial bond is available for the EPA to use to undertake those specific works. The value of the bond specified in the condition should be based on the estimated cost of the works subject to the bond. Bonds should not be used as a penalty for non-compliance. The purpose of a bond is to ensure that an event such as restoration occurs, not to solve compliance issues."⁵⁰¹

1074. Having regard to the circumstances of the application, and taking into account the legal and technical advice that we received, we concluded that the bond is not necessary in addition to the \$500 million insurance offered by TTRL (Condition 107).

⁵⁰⁰ Memorandum of Counsel Assisting the Decision-making Committee – Response to Minute 40, 13 April 2017

⁵⁰¹ Paragraph 116, EPA Conditions Report

25.6 Duration – Consistency with Mining Permit

1075. Section 73 of the EEZ Act sets out matters relevant to determining the duration of the marine consent. It states:

- “(1) The duration of a marine consent is—*
- (a) 35 years after the date of the granting of the consent; or*
 - (b) a period less than 35 years that is specified in the consent.*
- (2) When determining the duration of the consent, the Environmental Protection Authority must—*
- (a) comply with sections 59 and 61; and*
 - (b) take into account the duration sought by the applicant; and*
 - (c) take into account the duration of any other legislative authorisations granted or required for the activity that is the subject of the application for consent.”*

1076. Section 87H sets out the duration of marine discharge consents. It states:

- “(1) The duration of a marine discharge consent or a marine dumping consent is the term specified in the consent.*
- (2) However, the duration must not be more than 35 years.*
- (3) If no duration is specified in a consent, its duration is 5 years.*
- (4) When determining the duration of a consent, the Environmental Protection Authority must comply with sections 73(2)(b) and (c), 87D, and 87E.”*

1077. Pursuant to section 73(2)(b) in determining the duration of the marine consent, we have taken into account the 35 year duration sought by TTRL.

1078. Section 73(2)(c) and 87H(4)) require us, when determining the duration of marine consents and marine discharge consents, to take into account the duration of any other legislative authorisations granted or required for the activity.

1079. Section 59(2)(h) requires us to take into account the nature and effect of any other marine management regime, which in this case includes the Crown Minerals Act. In that respect, we consider that the existence of a Crown Minerals Act mining permit is relevant, as is its duration. The mining permit was issued for a 20 year term and expires in 2034.

1080. Mr Stevenson-Wallace, representing MBIE, informed us that the Crown Minerals Act allows for an extension of mining permits. He said that the Crown’s preference was for the marine consent to extend beyond the expiry of the Crown Minerals Act permit, to provide an opportunity for that extension.⁵⁰²

⁵⁰² Transcript 2 March 2017, page 1038

1081. In closing, TTRL's legal counsel stated that *"In terms of the renewal process for mining permits, section 36 of the Crown Minerals Act 1991 makes it clear that extensions are dealt with as straightforward renewals rather than a more involved re-consenting process. In particular, an extension can be granted (at the request of the permit holder or on the Minister's own motion) where the Minister is satisfied that an extension is required to enable the economic depletion of the resource. There is no public consenting process to be stepped through."*⁵⁰³
1082. Having regard to the matters outlined above, we consider that there is no need to limit the duration of the EEZ consents to align with the current term of the mining permit. The Consent Holder can use the process of mining permit extension under the Crown Minerals Act as and when required.

26. Conditions – Specific Findings

1083. TTRL proffered an extensive suite of conditions in its Impact Assessment. Conditions were the subject of evidence and questioning during the hearing, and were also subject to conferencing between the planning experts. In this part of our record of decision we address conditions which have not been proffered by TTRL. We also address amendments to some of the conditions that were proffered.
1084. There are many aspects which remain unchanged from the notified version. We have also made a number of changes to enhance clarity. We do not comment on the unchanged aspects or the minor amendments.
1085. The starting point for our final consideration of the conditions was the version tabled on 25 May 2017, the last day of the hearing. That version had been subject to discussion between Dr Mitchell for TTRL and Dr Loeffering on behalf of the EPA. It was a 'red line' version which showed recent changes, and it also set out remaining areas of disagreement between those two experts.
1086. One aspect of Dr Loeffering's advice was that certain aspects of the project which had been discussed during evidence should be 'hard coded' as conditions. Matters recommended for hard coding included:
- Monitoring locations;
 - Parameters to be monitored or analysed; and
 - Frequency/duration of monitoring.
1087. Hard coding was recommended within conditions related to Pre-Commencement Environmental Monitoring, Operational Environmental Monitoring, and Post-Extraction Benthic Recovery Monitoring. Some of the change we have made to conditions relate to the concept of hard coding.
1088. Having regard to all the information we were made aware of throughout the course of the hearing, and considering the advice of the conditions experts, we have made the following changes to the 25

⁵⁰³ Paragraph 53, Closing Legal Representations On Behalf Of Trans-Tasman Resources Limited, 25 May 2017

May version of consent conditions. The full set of conditions we have imposed is attached to our record of decision as Appendix 2.

26.1.1 Condition 5 (Sediments)

1089. Condition 6 (now Condition 5), as proffered by TTRL, was set out in three main parts (sub-clauses a, b, and c). The sub-clauses are preceded by the statement *“the activities authorised by these consents shall not result in”* the limits set by each of the sub-clauses. The DMC has decided that for clarity, there should be an explicit requirement to cease mining activity if the limits set by Condition 5 are not met. To that end, we have imposed a final paragraph in the condition which requires ‘extraction activities to cease’. This matter has been outlined above in paragraph 1057.
1090. Sub-clause (c), as proffered by the applicant, required that there should be “no significant change” in the 25th, 50th, 80th or 95th percentile SSC at specified monitoring sites. Towards the close of the hearing, Dr Mitchell sought to modify that wording by defining “significant change” as 10%. We accept TTRL’s view that a “significant change” in SSC should be defined by the condition but for clarity we have amended the wording used to refer to “measured actual SSC and modelled background statistical metric”.
1091. Sub-clause (c) as noted above will allow some flexibility around the difference between actual SSC and values established by the model. We accept that this is an appropriate approach for the 25th, 50th and 80th percentile values. However, we consider that the modelled 95th percentile value should be a fixed limit, unless changed through the process established under Condition 51 and Schedule 3. We have therefore deleted reference to the 95th percentile from sub-clause (c) and added it to sub-clause (a). By being in sub-clause (a), it is clear that the 95th percentile is fixed unless changed through the required process.
1092. Sub-clause (c) referred to “seven” monitoring sites. Based on the evidence we heard about The Crack and The “Project Reef”, we have decided to add them as sites subject to SSC monitoring. As a result, the sub-clause now refers to “ten” sites, and the sites have been listed in Schedule 2 of the conditions. A consequence of the amendment is that SSC values for the 25th, 50th, 80th and 95th percentiles will need to be set. In Schedule 2 we state this will be a responsibility of the Technical Review Group.

26.1.2 Condition 6 (Sediments)

1093. This condition also referred to the “seven” monitoring sites. We have amended it to “ten”.

26.1.3 Condition 7 (Benthic Ecology)

1094. TTRL proffered a revised Condition 8 (now Condition 7) to respond to concerns raised by various parties during the hearing. The revision was to establish enforceable limits to change in benthic fauna. We have simplified the wording for clarity, removing the words “and any wider environmental changes not related to mining activities”. We consider that ‘wider environmental changes’ was a not

a readily measurable factor and its inclusion was not necessary for achieving the purpose of the condition.

1095. We have also redefined the operational response required if benthic recovery is not on track to occur, as discussed in paragraphs 1055 and 1056.

26.1.4 Condition 9 (Seabirds)

1096. We have reworded aspects of this condition for greater clarity about the mitigation of effects on seabirds arising from lighting.

26.1.5 Conditions 17 and 18 (Underwater Noise)

1097. We have imposed new Condition 17 which makes explicit reference to the mapped 120 dB contour which we have added as Schedule 7. The condition requires underwater monitoring at and beyond the contour to ensure that the noise level is not exceeded, but only in respect of noise generated by the IMV and crawler when operating at the centre of the mining site.
1098. Condition 17 works in conjunction with an amendment we have made to Condition 18. New sub-clause (d) of Condition 18 requires validation of the noise model at the commencement of operations. It does this by ensuring that the extent of the predicted 120 dB contour generated by the IMV and crawler matches the mapped contour we were provided by TTRL.
1099. These changes are based on the noise modelling evidence we received from Mr Humpheson, and Dr Childerhouse's evidence that 120 dB is a threshold for behavioural disturbance in sensitive marine mammals, as we discussed in paragraph 512.

26.1.6 Condition 27 (Vessel and Operational Management)

1100. For clarity we have added a reference to the height of mounds left at the starting point of each mining lane. TTRL confirmed during the hearing that the mounds will be no higher than 4 metres above the level of the original seabed. Our change makes that outcome an explicit requirement.

26.1.7 Condition 37 (Soft Starts)

1101. This condition requires that prior to each startup of the mining operation, trained marine mammal observers are required to ensure that no animals are within a 500 metres radius. The condition as proffered by TTRL only referred to whales and dolphins. We have amended it to also include seals and sea lions.

26.1.8 Conditions 41 and 42 (Other Discharges from Operational Vessels)

1102. We have clarified Condition 41 so that it matches assurances provided by TTRL in its application. As proffered, the condition was excluded from applying to *"biodegradable hydraulic fluid / oils from the Crawler"*. The effect of our amendment is that the Consent Holder must ensure any such oil or fluid is

not 'ecotoxic', as the exact composition of the 'biodegradable' hydraulic fluids / oils has not yet been notified to the EPA and demonstrated as 'safe'.

1103. In Condition 42 we have added a reference to the need to comply with the current International Maritime Organization limit for sulphur content in heavy fuel oil. The intent of the change is that sulphur content is limited to 3.5% at the date consent is granted, but it must comply with the IMO limit of 0.5% anticipated to be in force in 2020.

26.1.9 Conditions 48, 53, 54 and 55 (Monitoring Plans)

1104. Among other matters, Condition 48 outlines matters that will be monitored under the PCEMP. To the proffered list of matters we have added Oceanography, Primary Production, and Zooplankton. Based on the evidence we heard, these are important factors in understanding the nature of the environment and potential effects. We have also added a reference to the need to undertake monitoring of matters referred to in Schedule 6.
1105. For Condition 53 we have added the same requirement to monitor Oceanography, Primary Production, and Zooplankton, and the same reference to undertaking the monitoring set out in Schedule 6.
1106. In Condition 48 we have added a requirement to establish the proxy relationship between turbidity and SSC at the Schedule 2 monitoring sites. We have also added a requirement for amendments to the PCEMP to be reviewed by the Technical Review Group (in addition to an independent third party). For consistency, these same two requirements have been added to Conditions 54 and 55, in relation to the Environmental Management and Monitoring Plan.

26.1.10 Conditions 66 and 67 (Seabird and Marine Mammal Plans)

1107. We have added a requirement to both of these conditions, that consultation must occur with the Kaitiakitanga Reference Group in preparing each plan, if the KRG has been formed. Our reason for doing so is to assist in giving effect to kaitiakitanga.
1108. In addition, we have specified that extraction of seabed material cannot commence until the marine mammal plan has been certified by the EPA.

26.1.11 Schedule 2 (Suspended Sediment Concentration Limits)

1109. Schedule 2 operates in conjunction with various conditions that refer to the SSC limits. The Schedule proffered by TTRL only included 95th percentile limits.
1110. The changes we have made to Schedule 2 are a consequence of the changes agreed by TTRL with respect to Condition 5. Specifically, we have included 25th, 50th and 80th percentiles in the Schedule. Although TTRL provided information about 80th percentile values (which we have included in the amended Schedule), there was no comparable information about the 25th and 50th percentile values. In our amendment we have therefore noted that those percentile values are to be established by the Technical Review Group.

1111. The original Schedule referred to the seven SSC monitoring sites. As noted under our changes to Condition 5 we have imposed three additional sites, and have therefore amended the Schedule to refer to ten sites.

26.1.12 Schedule 4 (Benthic Ecology Monitoring Sites)

1112. A list of benthic ecology monitoring sites was originally included in Condition 8 (now Condition 7). We have moved them to new Schedule 4.

26.1.13 Schedule 6 (Monitoring of Indicators)

1113. This Schedule is part of our decision to 'hard code' undertakings that were provided by TTRL during the hearing. The Schedule specifies a set of environmental indicators, and outlines methods and locations related to testing / monitoring. The indicators and methods are derived from the evidence of Mr Govier, TTRL's environmental monitoring expert.

26.1.14 Schedule 7 (120 dB contour)

1114. This Schedule is a map of the 120 dB contour provided to us by Mr Humpheson as an output of the modelling presented in evidence. It is based on the maximum 171 dB generated by the IMV and crawler when operating from an indicative location in the centre of the mining site. The map is referred to by Condition 17.

PART TWO - ALTERNATIVE VIEW

1. Executive Summary

1.1 Introduction

1. We have worked collaboratively on the agreed factual narrative in the decision report, but have some major differences in our interpretation of the evidence over matters of uncertainty and what in our view are significant risks. Overall, we have determined on the basis of the evidence before us, that the marine consent and marine discharge consents sought by Trans-Tasman Resource Limited (TTRL) should be refused.
2. The key difference that we have reached is our view that overall the localised adverse environmental effects on the Patea Shoals and tangata whenua existing interests are unacceptable, and are not avoided, remedied or mitigated by the conditions imposed. We also have concerns regarding uncertainty and the adequacy of environmental protection within the coastal marine area (CMA).

1.2 Impacts on the CMA

3. The lack of adequate baseline information results in an inability to both adequately describe the potentially affected environment and to assess the sensitivity of the receiving environment. It also follows that the formulation of robust consent conditions setting appropriate standards and limits that are linked to environmental protection is not possible. We consider that granting consent to the application before the collection of sufficient baseline data on the existing environment is unwise and untenable, and inconsistent with recognised best practice for environmental impact assessment.
4. TTRL has approached the impact assessment from a 'global' ecosystem perspective, averaging effects across the entire sediment model domain (SMD) and over the wider South Taranaki Bight (STB). This has obscured the significance of the impact of the sediment plume on the Patea Shoals and discounted specific sites of important ecological and cultural value. We disagree with such a minimising approach.
5. We consider the area of the Patea Shoals that will be impacted by the sediment plume contains ecologically sensitive areas (ESAs) and valued ecosystem components (VECs) that should be protected. The Patea Shoals is a unique shallow geological feature on the west coast of the North Island that contributes significantly to benthic primary production in the STB, which supports aggregations of zooplankton that are among the highest recorded in NZ. The wider STB is recognised as important habitat for threatened species of marine mammals and seabirds. We are not satisfied that the potential of the natural resources of the Patea Shoals and the CMA will be protected and sustained to meet the foreseeable needs of this generation or future generations.

6. The proximity of the sediment discharge to the CMA, the predominant currents and the continuous nature of the activity for up to 35 years – extending over two generations – will result in significant adverse effects on the life supporting capacity of the Patea Shoals.
7. The New Zealand Coastal Policy Statement (NZCPS) is a national policy statement under the Resource Management Act 1991 (RMA). To take into account the nature and effect of the RMA and the NZCPS we are required to be satisfied that the proposal will not have significant adverse effects on important ecological values and would not result in deterioration or degradation of the CMA. The applicant's evidence clearly demonstrates there will be significant adverse effects on ecologically sensitive sites, such as The Crack and The "Project Reef", and the Patea Shoals on an ongoing and long-term basis. The timeframe for recovery of such complex and diverse offshore marine habitats that are adapted to relatively low levels of suspended sediment concentrations for short durations, is largely unknown.

1.3 Engagement with Tangata Whenua

8. We view the lack of engagement between TTRL and tangata whenua as a serious deficiency. The application does not adequately recognise the role of tangata whenua as kaitiaki and undermines their relationship with their rohe. This relationship is not limited to kai moana sites within the nearshore environment. The message of local iwi and majority of the wider community was consistent and clear – the social and economic benefits of the proposal are small and the environmental effects and risks to marine life are unacceptable.
9. The conditions of consent do not avoid, remedy or mitigate direct or indirect adverse effects on the coastal marine area that tangata whenua have statutory acknowledgement over. A large proportion of their rohe will be significantly impacted by the sediment plume on an ongoing basis for the duration of the mining. This will significantly impact the ability of tangata whenua to exercise kaitiakitanga over their rohe and marine resources, and will in their view adversely affect the mauri of the marine environment.

1.4 Uncertainty and Inadequate Information

10. Section 61(1)(c) of the EEZ Act requires us to take into account any uncertainty or inadequacy in the information available, and if the information available is uncertain or inadequate, the DMC must favour caution and environmental protection.
11. Uncertainty is the potential for unpredictable or uncontrollable outcomes from a course of action. Risk is the consequences of actions taken despite uncertainty or inadequate knowledge. In the case of this application, even with the best available information, there is a lack of knowledge due to uncertainty inherent in the modelling approaches undertaken and inadequate baseline data.
12. TTRL focussed its impact assessment on the results of modelling to predict the scale, intensity and extent of the sediment plume based on assumptions about environmental conditions, design and operational limits, and economic imperatives. The results of this modelling are entirely dependent on

certain key inputs such as the discharge parameters and meteorological ocean data. No sensitivity analysis was undertaken to demonstrate the relative effect or importance of the various source terms or met-ocean inputs. Wave and currents are modelled based on averages.

13. The accuracy of the optical model is dependent on the accuracy of the sediment plume modelling and estimations of background suspended sediment concentrations.
14. Primary production in the STB is unknown and is extrapolated based on data from elsewhere. Impacts on primary production are based on the results of the optical modelling, which is linked to information from standard algorithms that do not perform well in optically complex water such as the STB. Benthic primary production is estimated based on a limited number of identified nearshore reefs.
15. Significant localised reductions in benthic primary production are predicted to occur over the Patea Shoals where the area of seabed receiving more than 1% of light is limited to only 1,494 km² of the wider 13,300 km² SMD. Averaging reductions over the entire SMD and STB obscures the severe reductions in light penetration over the most productive offshore areas of the Patea Shoals with generally good water clarity.
16. The abundance and distribution of reef fish has been estimated from modelling DOC fish survey data from outside the STB and linking this with a limited number of identified nearshore reefs in the STB.
17. Important reef habitat and rocky substrate in the sediment plume 'zone of influence' that supports highly diverse and abundance marine life, such as The Crack and The "Project Reef" have not been surveyed by TTRL to record ecological values present. Sensitive and threatened habitats in the Patea Shoals have not been adequately surveyed and sites such as Graham Bank, which have been identified as "likely to be outstanding" have also not been surveyed by TTRL.
18. Habitat modelling for the Southern right whale, Hector's dolphin and orca is based on little data, and is subject to high levels of uncertainty. The sightings and stranding data shows that the STB as a whole is an important habitat for a diverse range marine mammals and seabirds.
19. Overall, TTRL's impact assessment relies heavily on modelling based on inputs from modelling and very little actual data. This results in high levels of compounding uncertainty.
20. Compounding uncertainty is largely due to the lack of good baseline information and the complexity of the marine environment. We acknowledge that the accuracy of the sediment modelling can only be verified when mining activities commence, but many of the other areas of uncertainty reflect TTRL's approach to collecting baseline information after consent is granted, rather than before.

1.5 Conditions

21. We consider that the conditions imposed are inadequate to control the effects of the mining activity given the lack of information presented to us about existing environmental baseline conditions, the potential adverse cumulative effects over time, and the fact that the proposed monitoring often has significant time delays before a major reaction such as ceasing extraction activities can occur.

22. In our view, the formulation of appropriate compliance standards and receiving water limits linked to environmental protection is simply not possible in the absence of sufficient baseline data.
23. A survey of the sensitive habitats and ecological values present within the sediment plume zone of influence is critical to understanding the sensitivity of the offshore receiving environment, where SSC levels are generally very low. Protection of these offshore species must be linked to actual studies on their tolerance to increased SSC and duration of exposure.
24. Noise limits to protect threatened marine mammals must be based on consideration of received levels, characterisation of the noise, the magnitude of change and the duration of exposure in order to enable assessment of the probability and severity of any behavioural response. Such behavioural response would be difficult to detect, but could be significant at a population level.
25. Overall, the conditions imposed do not adequately avoid, remedy or mitigate adverse effects on the environment or tangata whenua existing interests.

1.6 Conclusions

26. The strength and depth of people's attachment and love for the coastal marine area and all the marine life it supports was demonstrated consistently throughout the hearing. The concerns are based on TTRL's evidence which demonstrates the mining activity will have long term, ongoing, significant localised adverse effects on the Patea Shoals and the CMA up to 20 km from the mining discharge. The vast majority of submitters (13,477 out of 13,733) find these environmental effects to be unacceptable and sought that the applications be refused on this basis. We agree.
27. Tangata whenua will be particularly affected by adverse effects on their existing customary rights. Māori have statutory acknowledgement over the coastal marine area that will be directly and indirectly affected by the sediment plume. This will significantly impact the ability of tangata whenua to exercise kaitiakitanga over their rohe and marine resources and will in their view adversely affect the mauri of the marine environment. We accept that fish may avoid the sediment plume and move elsewhere. However, Ngāti Ruanui and Ngā Rauru Kītahi cannot move their rohe.
28. Overall, TTRL's approach to impact assessment relies heavily on modelling based on inputs from other modelling, and this results in compounding levels of uncertainty in the applicant's impact assessment. This level of uncertainty is largely due to the lack of good baseline information and the complexity of the marine environment. The environment impact assessment is inconsistent with recognised best practice. Many of the gaps in baseline information could have been addressed without unreasonable time and cost.

29. We have determined on the basis of the evidence before us, that the purpose of the EEZ Act is achieved by refusing the marine consent and marine discharge consents sought by TTRL.

Dated this 3rd day of August



Sharon McGarry
Deputy Chair



Gerry Te Kapa Coates
DMC Member

2. Alternative View

2.1 Preamble

30. This document sets out the reasons of Ms Sharon McGarry (Deputy Chair, DMC) and Mr Gerry Te Kapa Coates (Member, DMC) for this Alternative View to the decision to grant marine consents to Trans-Tasman Resources Limited (TTRL). We have all worked collaboratively within the DMC to agree on the report of the decision (as contained in Part One) on the basis of the evidence before us. While we generally agree with the factual narrative, it inevitably reflects the view of the majority and we accept this. We have some differences in its interpretation leading to the findings reached in relation to effects on primary production, marine mammals and tangata whenua interests. The major differences are in our interpretation of the evidence over matters of uncertainty and what in our view remain significant risks. The key difference is that we have reached the view that overall the localised adverse environmental effects on the Patea Shoals are unacceptable and the proposed conditions do not provide sufficient avoidance or mitigation of these adverse effects. We also have concerns regarding uncertainty and the adequacy of the baseline information, but accept that even with more information and thus more certainty, the localised adverse effects (as described by TTRL) on the coastal marine area (CMA) are, in our view, unacceptable and are contrary to New Zealand's aspirations for protection of our marine environment.
31. Where we have identified uncertainty and inadequate information, we are required under sections 61 and 87E of the EEZ Act to favour caution and environmental protection. We consider there are compounding levels of uncertainty in the information provided that could result in significantly greater adverse effects than predicted. The lack of adequate baseline information results in an inability to adequately describe the potentially affected environment and to assess the sensitivity of the receiving environment. The formulation of robust consent conditions that are linked to environmental protection is not possible without adequate baseline information on the ecological values present in the receiving environment, thresholds for protection and an assessment of effects of the activity.
32. TTRL has focussed its application on describing the nature and extent of the potential effects of the activity. It has approached the impact assessment from a 'global' wide ecosystem perspective. Effects have generally been averaged across the sediment model domain (SMD) and considered over the wider South Taranaki Bight (STB) scale. The conclusions reached are generally that any effects on ecological values are minor at an ecosystem or population level, and that any area adversely affected in terms of ecological values is only a small percentage of the STB. The application relies on the premise that any significant adverse effects are localised and that the ecological values affected are not unique. However, we consider the area of the Patea Shoals to the east and southeast of the mining site that will predominantly be impacted by the sediment plume does contain ecologically sensitive areas (ESAs) and valued ecosystem components (VECs) that are worthy of protection. Offshore rocky reef habitats such as The Crack and The "Project Reef" are acknowledged to be relatively rare in the STB and support a large number of species that live permanently in one location, in close association with each other.

33. We are not satisfied that the life-supporting capacity of the Patea Shoals would be safeguarded and that the adverse effects of the proposed mining project can be sufficiently avoided, remedied or mitigated. We also consider that the conditions imposed are inadequate to control the mining operation given the lack of information presented to us about existing environmental baseline conditions and the potential for adverse cumulative effects to arise over time. The monitoring proposed often has significant time delays before a major reaction such as ceasing extraction activities becomes an outcome. We consider that granting consent to the application before the collection of sufficient baseline data on the existing environment, is in our view unwise and untenable, and is contrary to recognised best practice for environmental impact assessment. Recasting this process as a Pre-Commencement Environmental Monitoring Plan (PCEMP), rather than the original Baseline Environmental Management Plan (BEMP), begs the question as to whether there is sufficient information to enable consent to be granted.
34. We have not viewed the lack of engagement with tangata whenua as a fatal flaw in the application, but rather have focussed our consideration on what tangata whenua have said to us in evidence and during the hearings. Their message was consistent and clear – the social and economic benefits of the proposal are small and the environmental effects and risks are potentially large and unacceptable, particularly given the long-term nature of the activity and its proximity to the coastal marine area and to the rohe of mana whenua. This view was also consistent with the majority of submitters.
35. Overall, we have determined on the basis of the evidence before us, that the marine consent and marine discharge consents sought by TTRL should be refused for the following reasons:
- (a) The application is contrary to the purposes of the EEZ Act and the Resource Management Act, and the objectives and policies of the New Zealand Coastal Policy Statement.
 - (b) The duration of the activity, location of the mining site, and the sediment plume produced and its proximity to the coastal marine area will result in significant adverse localised effects on the ecological values of the Patea Shoals and existing tangata whenua interests in the coastal marine area.
 - (c) In the light of uncertainty and inadequate information, we are required to favour caution and environmental protection.
 - (d) The conditions of consent imposed do not sufficiently avoid, remedy or mitigate adverse effects of the application on ecological values and existing interests.
36. We discuss each of these points below.

2.2 EEZ Act

37. Section 10 of the EEZ Act states:

(1) *The purpose of this Act is—*

- (a) *to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf; and*
- (b) *in relation to the exclusive economic zone, the continental shelf, and the waters above the continental shelf beyond the outer limits of the exclusive economic zone, to protect the environment from pollution by regulating or prohibiting the discharge of harmful substances and the dumping or incineration of waste or other matter.*

(2) *In this Act, sustainable management means managing the use, development, and protection of natural resources in a way, or at a rate, that enables people to provide for their economic well-being while—*

- (a) *sustaining the potential of natural resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
- (b) *safeguarding the life-supporting capacity of the environment; and*
- (c) *avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

(3) *In order to achieve the purpose, decision-makers must—*

- (a) *take into account decision-making criteria specified in relation to particular decisions; and*
- (b) *apply the information principles to the development of regulations and the consideration of applications for marine consent.*

38. On the basis of the evidence before us, we are not satisfied that the potential of the natural resources of the Patea Shoals and the CMA will be sustained to meet the foreseeable needs of this generation or future generations. The proximity of the sediment discharge to the CMA, the predominant currents and the continuous nature of the activity for up to 35 years will result in significant adverse effects on the life supporting capacity of the Patea Shoals.
39. The evidence before us indicates that ecologically significant sites such as The Crack and The “Project Reef” will be severely impacted by sediment deposition and light reductions. Benthic primary production will be significantly reduced over large areas of the Patea Shoals.
40. TTRL has focussed its assessment on describing the scale and intensity of the sediment plume and arguing that these adverse effects are ‘acceptable’ when considered in the context of the wider STB. In our view, the adverse effects of the sediment discharge could be significantly avoided or mitigated by re-considering the location of the discharge and its proximity to ecologically and culturally sensitive areas. This is clearly demonstrated by the evidence, which shows that the scale and intensity of adverse effects on the Patea Shoals and the CMA are significantly greater when mining at the eastern end of the mining site (‘Site A’) than the western end (‘Site B’). Overall, identified adverse effects are not sufficiently avoided, remedied or mitigated by the conditions imposed.
41. For these reasons, we find the proposal is contrary to the purpose of the EEZ Act.

2.3 RMA and NZCPS

42. We are required to take into account the nature and effect of other Marine Management Regimes (MMRs). This is to ensure that consistency and coordination with other regimes is achieved and to address any cross-boundary issues. The mining site is on the boundary of the CMA where activities are regulated under the Resource Management Act 1991 (RMA). While we acknowledge the proposed activities will occur within the EEZ and authorisation for any activities is pursuant to the EEZ Act, the evidence shows that the most significant effects from the sediment plume will predominantly affect the CMA.
43. We note that when activities that occur on land (outside of the CMA), but potentially affect the CMA, it is appropriate to consider the objectives and policies of the New Zealand Coastal Policy Statement (NZCPS) and any regional coastal plan, even if the activity itself occurs outside of the CMA. In our view, given the proximity of the activity to the CMA and fact that the effects of the sediment plume predominantly occur in the CMA, the objectives and policies of the NZCPS should be given significant weight. We accept this would not be appropriate if the effects of the activity were removed from the CMA or did not predominantly occur in the CMA.
44. The purpose of the RMA is to promote the sustainable management of natural and physical resources. The RMA prohibits any discharge that will cause any of the effects set out in section 107, including any conspicuous colour change or any significant adverse effects on aquatic life, after reasonable mixing. The concept of 'a zone of reasonable mixing' was not explored during the hearing. However, evidence presented indicates that significant adverse effects on aquatic life would occur within 3-5 km of the discharge. It was acknowledged that there would be significant impacts on macroalgae at Graham Bank (16-25 km from the mining site).
45. We consider the restrictions of section 107 of the RMA are effectively environmental bottom lines which must not be crossed by allowing activities with such environmental effects to occur in the CMA. If evidence showed that significant adverse effects on aquatic life would occur as far away as 16-25 km from the point of discharge, the consent application would have to be refused. We acknowledge these environmental bottom lines do not apply to activities occurring within the EEZ. However, section 107 sets clear environmental protection thresholds of discharge effects that are unacceptable in the CMA. We consider significant weight must be given to such prohibitions where discharge activities occur in close proximity to the CMA and the effects predominantly occur in the CMA. In our view, this ensures consistent sustainable management of the both CMA and EEZ.
46. The NZCPS is a national policy statement under the RMA. The purpose of the NZCPS is to state policies in order to achieve the purpose of the Act in relation to the coastal environment of New Zealand. The NZCPS has been formulated with consultation and public participation, and reflects the aspirations of New Zealanders for the coastal environment. While we accept we are not exercising functions and powers under the RMA, we consider the objectives and policies give clear guidance as to what activities and effects are acceptable in the CMA.
47. The NZCPS identifies a number of key issues relevant to this application including:

- The ability to manage activities in the coastal environment is hindered by lack of understanding about some coastal processes and the effects of activities on them;
- Continuing decline in species habitats and ecosystems in the coastal environment under pressure from subdivision and use, vegetation clearance, loss of intertidal areas, plant and animal pests, poor water quality, and sedimentation in estuaries and the coastal marine area;
- Poor and declining coastal water quality in many areas as a consequence of point and diffuse source contamination, including stormwater and wastewater;
- Adverse effects of poor water quality on aquatic life and opportunities for aquaculture, mahinga kai gathering and recreational use such as swimming and kayaking; and
- Continuing coastal erosion and other natural hazards that will be exacerbated by climate change and which will increasingly threaten existing infrastructure, public access and other coastal values as well as private property.
- The unnaturally high background levels of suspended sediment concentrations (SSC) from land use is recognised as a key issue, as is ongoing degradation of the CMA from sedimentation. Climate change is recognised as an increasing threat to coastal values that must also be taken into account when considering use and development.

48. These key issues are addressed by the NZCPS through the following objectives and policies:

Objective 1

To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by:

- *maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature;*
- *protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and*
- *maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.*

Objective 3

To take account of the principles of the Treaty of Waitangi, recognise the role of tangata whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment by:

- *recognising the ongoing and enduring relationship of tangata whenua over their lands, rohe and resources;*
- *promoting meaningful relationships and interactions between tangata whenua and persons exercising functions and powers under the Act; incorporating mātauranga Māori into sustainable management practices; and*

- *recognising and protecting characteristics of the coastal environment that are of special value to tangata whenua.*

Objective 7

To ensure that management of the coastal environment recognises and provides for New Zealand's international obligations regarding the coastal environment, including the coastal marine area.

Policy 2

The Treaty of Waitangi, tangata whenua and Māori heritage

In taking account of the principles of the Treaty of Waitangi (Te Tiriti o Waitangi), and kaitiakitanga, in relation to the coastal environment:

- (a) recognise that tangata whenua have traditional and continuing cultural relationships with areas of the coastal environment, including places where they have lived and fished for generations;*
- (b) involve iwi authorities or hapū on behalf of tangata whenua in the preparation of regional policy statements, and plans, by undertaking effective consultation with tangata whenua; with such consultation to be early, meaningful, and as far as practicable in accordance with tikanga Māori;*
- (c) with the consent of tangata whenua and as far as practicable in accordance with tikanga Māori, incorporate mātauranga Māori in regional policy statements, in plans, and in the consideration of applications for resource consents, notices of requirement for designation and private plan changes;*
- (d) provide opportunities in appropriate circumstances for Māori involvement in decision making, for example when a consent application or notice of requirement is dealing with cultural localities or issues of cultural significance, and Māori experts, including pūkenga, may have knowledge not otherwise available;*
- (e) take into account any relevant iwi resource management plan and any other relevant planning document recognised by the appropriate iwi authority or hapū and lodged with the council, to the extent that its content has a bearing on resource management issues in the region or district; and*
 - (i) where appropriate incorporate references to, or material from, iwi resource management plans in regional policy statements and in plans; and*
 - (ii) consider providing practical assistance to iwi or hapū who have indicated a wish to develop iwi resource management plans;*
- (f) provide for opportunities for tangata whenua to exercise kaitiakitanga over waters, forests, lands, and fisheries in the coastal environment through such measures as:*

- (i) *bringing cultural understanding to monitoring of natural resources;*
 - (ii) *providing appropriate methods for the management, maintenance and protection of the taonga of tangata whenua;*
 - (iii) *having regard to regulations, rules or bylaws relating to ensuring sustainability of fisheries resources such as taiāpure, mahinga mātaītai or other non-commercial Māori customary fishing; and*
- (g) *in consultation and collaboration with tangata whenua, working as far as practicable in accordance with tikanga Māori, and recognising that tangata whenua have the right to choose not to identify places or values of historic, cultural or spiritual significance or special value:*
- (i) *recognise the importance of Māori cultural and heritage values through such methods as historic heritage, landscape and cultural impact assessments; and*
 - (ii) *provide for the identification, assessment, protection and management of areas or sites of significance or special value to Māori, including by historic analysis and archaeological survey and the development of methods such as alert layers and predictive methodologies for identifying areas of high potential for undiscovered Māori heritage, for example coastal pā or fishing villages.*

Policy 3

Precautionary approach

- (1) *Adopt a precautionary approach towards proposed activities whose effects on the coastal environment are uncertain, unknown, or little understood, but potentially significantly adverse.*

Policy 11

Indigenous biological diversity (biodiversity)

To protect indigenous biological diversity in the coastal environment:

- (a) *avoid adverse effects of activities on:*
- (i) *indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists;*
 - (ii) *taxa that are listed by the International Union for Conservation of Nature and Natural Resources as threatened;*
 - (iii) *indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare;*
 - (iv) *habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare;*

- (v) *areas containing nationally significant examples of indigenous community types; and*
- (vi) *areas set aside for full or partial protection of indigenous biological diversity under other legislation; and*
- (b) *avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on:*
 - (i) *areas of predominantly indigenous vegetation in the coastal environment;*
 - (ii) *habitats in the coastal environment that are important during the vulnerable life stages of indigenous species;*
 - (iii) *indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh;*
 - (iv) *habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes;*
 - (v) *habitats, including areas and routes, important to migratory species; and*
 - (vi) *ecological corridors, and areas important for linking or maintaining biological values identified under this policy.*

Policy 21

Enhancement of water quality

Where the quality of water in the coastal environment has deteriorated so that it is having a significant adverse effect on ecosystems, natural habitats, or water based recreational activities, or is restricting existing uses, such as aquaculture, shellfish gathering, and cultural activities, give priority to improving that quality by:

- (a) *identifying such areas of coastal water and water bodies and including them in plans;*
- (b) *including provisions in plans to address improving water quality in the areas identified above;*
- (c) *where practicable, restoring water quality to at least a state that can support such activities and ecosystems and natural habitats;*
- (d) *requiring that stock are excluded from the coastal marine area, adjoining intertidal areas and other water bodies and riparian margins in the coastal environment, within a prescribed time frame; and*
- (e) *engaging with tangata whenua to identify areas of coastal waters where they have particular interest, for example in cultural sites, wāhi tapu, other taonga, and values such as mauri, and remedying, or, where remediation is not practicable, mitigating adverse effects on these areas and values.*

Policy 22

Sedimentation

- (1) *Assess and monitor sedimentation levels and impacts on the coastal environment.*
- (2) *Require that subdivision, use, or development will not result in a significant increase in sedimentation in the coastal marine area, or other coastal water.*
- (3) *Control the impacts of vegetation removal on sedimentation including the impacts of harvesting plantation forestry.*
- (4) *Reduce sediment loadings in runoff and in stormwater systems through controls on land use activities.*

Policy 23

Discharge of contaminants

- (1) *In managing discharges to water in the coastal environment, have particular regard to:*
 - (a) *the sensitivity of the receiving environment;*
 - (b) *the nature of the contaminants to be discharged, the particular concentration of contaminants needed to achieve the required water quality in the receiving environment, and the risks if that concentration of contaminants is exceeded; and*
 - (c) *the capacity of the receiving environment to assimilate the contaminants; and:*
 - (d) *avoid significant adverse effects on ecosystems and habitats after reasonable mixing;*
 - (e) *use the smallest mixing zone necessary to achieve the required water quality in the receiving environment; and*
 - (f) *minimise adverse effects on the life-supporting capacity of water within a mixing zone.*

49. It is clear that the nature and effect of these objectives and policies is to protect significant ecological values and biological diversity, maintain and enhance water quality, recognise the role of tangata whenua as kaitiaki and their relationship with their rohe, and recognise and provide for New Zealand's international obligations regarding the coastal environment.

50. We agree with the view of Ms Sitarz¹ that to take into account the nature and effect of the RMA and the NZCPS would require us to be satisfied that the proposal will not have significant adverse effects on important ecological values and would not result in deterioration or degradation of the CMA. We consider the evidence clearly demonstrates there will be significant adverse effects on ecologically sensitive sites and the Patea Shoals, and will further degrade water quality in the CMA on an ongoing and long-term basis. To allow this level of adverse impact on ecological values in the CMA could be viewed as undermining the nature and effect of the RMA.

¹ Statement of Evidence by Ms Natasha Sitarz, pg. 14, para 69

51. TTRL has focussed on high background SSC levels in the nearshore coastal environment and that the sediment discharges will not measurably increase these levels. However, the offshore coastal environment (more than 5 km offshore) has generally very low background SSC levels and will therefore experience very large changes in the intensity, frequency and duration of suspended sediment. In our view, this will significantly degrade offshore water quality and impact ecological values between the mining site and nearshore coastal environment.
52. The application does not adequately recognise the role of tangata whenua as kaitiaki and minimises their relationship with their rohe. TTRL has concluded that any adverse effects on tangata whenua will be minor based on the assumption that most kai moana is harvested from the nearshore environment. This ignores the evidence from tangata whenua that they have a long term and enduring relationship with important sites in the offshore coastal environment and across the Patea Shoals.
53. The importance of taking into account the views of tangata whenua was emphasised by Dr Erueti on behalf of Ngā Rauru Kītahi when he stated –
- “The way I see international human rights, including the declaration, is that they can be called upon in looking at particular issues such the requirements of consultation and engagement. I think it is important to read the provisions in the EEZ Act with regard to these international obligations, which include the right to free prior and informed consent, which include the right to self-determination, in the same way legislation is typically interpreted with reference to the obligations under the Treaty of Waitangi.”²*
54. We agree. We consider it is also important to read the provisions of the EEZ Act with the provisions of the RMA, in circumstance such as this, where the activities are on the boundary of the CMA and the adverse effects will predominantly occur on values within the CMA.
55. We also consider it is important to recognise and provide for our international obligations in relation to the protection of ecological and cultural values.
56. On the basis of the evidence before us, we find that the application is contrary to the nature and effect of the Resource Management Act 1991 and the objectives and policies of the New Zealand Coastal Policy Statement 2010.

2.4 Duration of the Activity

57. The term of consent is 35 years – potentially a relatively long term operation, extending over two generations. The activity will occur continuously (with some operational down time) until the iron resource is exhausted from the application site. The sediment plume will impact the Patea Shoals and the CMA on a relatively continuous basis during that time.

² Transcript, 6 March 2017, pg. 1165

58. The closing representation³ from counsel for TTRL said that “submitters questioned whether a term of 35 years for the marine and discharge consents was appropriate when the mining permit only had a 20-year term.” He made it clear that extensions of term for mining permits can be granted “on the Minister’s own motion or where the Minister is satisfied that an extension is required to enable the economic depletion of the resource ... there is no public consenting process to be stepped through.” From this it is clear that this application will be for the full 35-year term, unless the resource is exhausted before then.
59. The key areas of risk arising from the long-term nature of the consent duration arise from the following:
- Ongoing effects on tangata whenua existing interests;
 - Compounding uncertainty of the impact assessment;
 - Significant localised reductions in benthic primary productivity over the Patea Shoals;
 - Significant reductions in water clarity and significant changes in the euphotic zone over the Patea Shoals adversely affecting offshore ecological values, and recreational and customary fishing areas;
 - Elevated noise levels above behavioural response thresholds for marine mammals within at least a 23 km distance from the mining activity;
 - Inadequate baseline information;
 - Sensitivity of the receiving environment; and
 - Cumulative effects of any adverse effects over 35 years.

2.5 Tangata Whenua Issues

60. Tangata whenua issues have been covered in some detail in Section 17 of the consent decision. We generally accept this account. Māori have statutory acknowledgement over the coastal marine area that will be directly and indirectly affected by the sediment plume. We consider a large proportion of Ngāti Ruanui’s rohe will be significantly impacted by the sediment plume on an ongoing basis for the duration of the mining. This will significantly impact the ability of tangata whenua to exercise kaitiakitanga over their rohe and marine resources, and will in their view, adversely affect the mauri of the marine environment. We accept that fish may avoid the sediment plume and move elsewhere. However, Ngāti Ruanui and Ngā Rauru Kītahi cannot move their rohe.
61. Concerns by tangata whenua were encapsulated in the traditional customary evidence given in Te Reo by Mr Hawira, representing Te Kaahui o Rauru, which stated -

“Tōna whakatauki – The message in essence:

Me kaua e tumutumu te mauri kei ngā tauranga matua,

– Desist from impacting upon the life force inherent in our ancestral fishing grounds.

³ Closing legal representations on behalf of Trans-Tasman Resources Limited, pg. 10, para 52

Ka noho mōrehu kore kai, kore kōrero aku uki.

– Lest the future generations become refugee survivors, without sustenance, without substance.”⁴

62. We cannot simply ignore the concerns of tangata whenua because there was a failure to engage in consultation. While counsel for TTRL suggested this was *“a scenario where engagement is deliberately withheld as a tactic to undermine a consent application”⁵*, we accept that tangata whenua have a right not to engage with TTRL and to present their view independently through the hearing process.
63. We consider the failure to engage with Māori appears to have stemmed from TTRL’s desire at the outset of the process to limit access to information deemed ‘commercially sensitive’ and their focus on a pre-determined outcome. Both these actions are contrary to recognised best practice for open consultation to occur. Evidence of best practice was demonstrated by the guidance document produced by Ngāti Ruanui on best practice consultation⁶ that was given to the DMC at the hearing, along with their tribal history.
64. Ms Broughton referred to the Waipipi onshore iron sands mining operation which ended 30 years ago, and told us the slurry discharge from offshore loading had choked the reef life and that *“those reefs still haven’t recovered to the state that they were in before the Waipipi Iron Sands began.”⁷*
65. The Ngā Kaihautū Tikanga Taiao (NKTT) report is provided so that *“decisions made under this Act may be informed by a Māori ‘perspective’ and whose advice the ‘EPA must have regard to.”* One of the main points they made was *“to encourage the DMC to ensure suitable protection of the biological diversity and integrity of marine species, ecosystems, and processes [s59(2)(d)], any rare and vulnerable ecosystems, and the habitats of threatened species [s59(2)(e)].”* We have taken account of this advice in forming our Alternative View.

2.6 Section 60 of the EEZ Act

66. Section 60 of the EEZ Act requires us to consider the effects of the application on existing interests including the *“area that the activity would have in common”*, and *“the degree to which both the activity and the existing interest must be carried out to the exclusion of other activities”* and *“whether the existing interest can be exercised only in the area to which the application relates.”*
67. We think that there is considerable overlap between the area in which tangata whenua exercise their customary activities and that is affected by the discharge of sediment from TTRL’s mining activities. The terms *“in common”* and *“area to which the application relates”* are significant in this regard.
68. We find there will be an adverse effect on the existing interests of tangata whenua from the sediment plume.

⁴ Evidence presented on Hearing Day 6 March 2017 from Mr Turama Hawira, representing Te Kaahui o Rauru page 11

⁵ Closing legal representations on behalf of Trans-Tasman Resources Limited, pg.14, para 46

⁶ Best Practice Guidelines for Engagement With Maori, Ngāti Ruanui, 2014

⁷ Transcript 6 March 2017, page 1187

2.7 Section 61 of the EEZ Act

69. Section 61(1)(c) and section 87E of the EEZ Act require us to take into account any uncertainty or inadequate information, and if the information available is uncertain or inadequate, the DMC must favour caution and environmental protection.
70. Uncertainty is the potential for unpredictable or uncontrollable outcomes from a course of action. Risk is the consequences of actions taken despite uncertainty or inadequate knowledge. In the case of this application, even with the best available information when considering the granting of a consent there is still a lack of knowledge due to uncertainty or inadequate data.
71. The following sections of our report outlines some of the key areas of uncertainty in the available information.

2.7.1 Modelling accuracy

72. TTRL focussed its impact assessment on the results of modelling in order to predict the scale, intensity and extent of the sediment plume. This modelling is based on assumptions about environmental conditions, design and operational limits, and economic imperatives. This approach has enabled us to define a probable 'zone of influence'. The results of the sediment plume modelling are entirely dependent on the following key inputs:
 - rate of discharge (volume and mass);
 - method of discharge (i.e. one discharge stream for all material discharged);
 - location of the discharge point (4 m above the seabed, into a pit or onto the seafloor, and the width of the pit);
 - Particle Size Distribution (PSD) of the run of mine material;
 - percentage of ultra-fines (less than 8 microns);
 - behaviour of ultra-fines (potential rate of flocculation, settling velocity and threshold for resuspension); and
 - meteorological data (met-ocean conditions).
73. The accuracy of the sediment plume modelling is highly dependent on the assumed PSD of the discharge, which is in turn dependent on the PSD of the run of mine sediment samples, the design and limitations of the processing plant, and TTRL's ability to avoid mining lenses of fine material. The re-modelling of 'a worst case scenario' demonstrated how sensitive the results of the sediment plume modelling are to these inputs and the significant factor of change that can result. However, no sensitivity analysis was undertaken to demonstrate the relative effect or importance of the various source terms and inputs outlined above.
74. We were told that the results of the HR Wallingford work were based on the material discharged from the pilot plant after processing three bulk 'run of mine' samples. Confidence in this work relies on the representativeness of those samples, the chain of custody of those samples and the robustness of the laboratory tests undertaken. While we accept the modelling undertaken has used the best available information, we consider the methodology, limited number of samples, and lack of detail or

evidence regarding the pilot plant and chain of custody of those samples, results in a high level of uncertainty.

75. We are particularly concerned as to where the ultra-fines will ultimately be advected to and/or deposited. NIWA Report 1 stated that there is little information on whether there is sediment input from offshore to the littoral zone and that inputted sediments would be distributed alongshore or offshore, but are eventually transported beyond the STB. The NIWA reports suggested sediment will be flushed out of the STB over a period of weeks to a few months. We wonder where the unstable fine sediments will ultimately end up or whether they will continue to be re-suspended? This uncertainty concerns us.
76. The accuracy of the predicted zone of influence of the discharge is highly dependent on the accuracy of the met-ocean data used and the location of the discharge point. We note that NZ lacks a long term systematic wave measurement program and that the wave climate characterisation relies strongly on model studies⁸. NIWA Report 1 stated "*The STB continental shelf is complex due to shoals, namely Patea and Graham Banks and The Rolling Grounds*". We consider there are high levels of uncertainty with the met-ocean data underpinning the sediment modelling and note that wave direction, height and period are critical inputs in determining the direction and extent of the sediment plume.
77. The outputs of the sediment modelling provide predictions of the magnitude of increases in SSC within the water column (increases in near surface and near bottom concentrations) and increases in sediment deposition rates (spatially and temporally) as a result of the mining. The magnitude of these changes depends on comparison with background SSC. We note that background SSC has been measured at 10 sites. The results show background SSC levels are highest at nearshore sites, which are influenced by river inputs during significant rainfall events, and that at offshore sites (near the mining site) background SSC levels are generally very low. These results have been used to model background SSC levels at the proposed monitoring sites. However, there is still uncertainty in the background SSC levels at these sites, particularly in the offshore environment. In addition, Mr Greer considered there was 'reasonable uncertainty' associated with estimated sediment inputs from rivers by Hadfield and MacDonald (2015)⁹ which was based on extrapolating non-linear relationships between SSC and flow from limited sampling and flow gaugings for some rivers¹⁰.
78. The accuracy and reliability of the predicted optical effects are dependent on the accuracy and performance of the sediment model. The NIWA optical model (OPSM) uses the results of the sediment plume modelling to predict the effects on the optical properties of the water column, which can affect visual feeders and light attenuation for primary producers within the water column and on the seabed. The overall impact of optical effects was initially assessed over the whole sediment model domain (SMD) and at two selected sites (Graham Bank and The Traps). The results gave a

⁸ NIWA Report 1, pg. 62

⁹ NIWA Sediment Plume Modelling Report

¹⁰ Transcript, 20 February 2017, pg. 354

'global' picture of the impacts, but did not address specific areas of concern within the predicted zone of influence of the sediment plume.

79. NIWA's prediction of the impacts on primary production was assessed over a one-year period, using an empirical approach to estimate the reduction in primary production averaged over the SMD area. Primary production in the STB is unknown and was extrapolated based on data from elsewhere.
80. The optical model used two mean light intensity limits (0.04 and 0.4 mol/m²/d) to estimate the average proportions of the seabed over the SMD that benthic primary production could occur without mining derived sediments. These were estimated to be 29% (3,805 km²) of the SMD at the lower threshold of 0.1% of light at the seabed; and 11% (1,494 km²) of the SMD at the higher threshold 1.0% of light at the seabed. This shows that most of the SMD (i.e. 71%) does not support benthic primary production. Only 1,494 km² of the 13,300-km² SMD has mean light intensities widely recognised as supporting benthic primary production; whereas 3,805 km² is, according to Professor Cahoon, recognised by some people as potentially supporting benthic primary production. In other words, it is recognised that benthic primary production is likely to occur over 1,494 km² of the SMD, but it may occur over 3,305 km². There is a high level of uncertainty regarding benthic primary production at the lower light intensity threshold and the larger area of the SMD.

2.7.2 Averaging effects over the SMD

81. We know that the areas of seabed that are important for benthic primary productions are predominantly in the Patea Shoals area and not over the wider SMD. The average reductions over the SMD are considered in the Pinkerton and Gall Report (2015) 'NIWA Report' – *"This reduction reflects the fact that for much of the time the plume of fine sediment passes over relatively shallow sea floor which would otherwise be relatively well lit. Most of the SMD is deep and/or overlain by turbid water, [and] receives little seabed light and would be little affected by the mining."* (pg.72). This demonstrates how averaging the predicted reductions in benthic primary production over the SMD obscures the significant localised reductions over the Patea Shoals, where benthic primary production is primarily located.
82. In relation to the two selected sites the NIWA Report states -
- "The "Traps" site (174.524° E, 39.853° S) is included because it is used for recreational sub-aqua diving and includes areas with hard substrate and macroalgae. At the Traps, mining is predicted to:*
- (a) Reduce the median underwater visibility by 14% (mine A) and by 4% (mine B).*
 - (b) Reduce the number of "good visibility days" at the Traps by about 25 days (mine A) and 8 days (mine B) out of a total of 126 good visibility days/year.*
 - (c) Reduce the euphotic zone depth by 11% (mine A) and by 3% (mine B).*
 - (d) Reduce the number of days that more than 1% of incident light reaches the seabed by 32 days (mine A) and 11 days (mine B) out of a total of 138 days/year.*

Graham Bank (174.4192°E, -39.8919° S) is included because it is also used as for recreational sub-aqua diving and may include areas with hard substrate and macroalgae. At Graham Bank, mining is predicted to:

- (a) **Reduce the median underwater visibility by 37% (mine A) and by 16% (mine B).**
- (b) **Reduce the number of “good visibility days” at Graham Bank by about 69 days (mine A) and 23 days (mine B) out of a total of 206 good visibility days/year.**
- (c) Reduce euphotic zone depth by 24% (mine A) and by 12% (mine B).
- (d) Reduce the number of days that more than 1% of incident light reaches the seabed by 94 days (mine A) and 45 days (mine B) out of a total of 216 days/year.” (our emphasis in bold)

83. This demonstrates there will be measurable optical changes and significant reductions to the euphotic zone more than 20-30 km from the mine discharge. Significant reductions in the euphotic zone of up to 24% at Graham Bank (16-25 km away) cannot be dismissed as minor changes or within the range of background variability, as claimed by Dr James¹¹, without consideration of what species are present and their tolerance levels for SSC increases. We consider it is not only the range of background variability that is important, but the frequency and duration of the optical changes at these sites.
84. The results estimate the number of days that light is reduced, but information is not presented to enable an analysis of whether there is a pattern to these days or over how many days these reductions are contiguous. Without knowing the frequency or duration of the reductions or the species present it is simply not possible to adequately assess the ecological consequences of these reductions.
85. No evidence was presented as to what the ecological impacts of these changes would be at the specific sites. NIWA Report 16 stated that there would be significant impacts on macroalgae at Graham Bank, but it would be unlikely that macroalgae would be completely eliminated; and that there would be minor effects on macroalgae at The Traps (pg. 16).
86. There has been no site-specific investigation of the benthos present at Graham Bank and no information on the effect of euphotic changes on sessile benthic fauna. Dr James referred to a few studies on a limited number of intertidal and subtidal species and short-term exposure to elevated levels of SSC. However, his focus was on species found in the nearshore environment, which experience regular exposure to high SSC levels¹². There was no information presented regarding thresholds, frequency or durations for benthic species in offshore in environments with generally very low levels of SSC. Dr Longdill confirmed that he was unaware of any such relevant studies in the NZ context¹³. We conclude that any mid to far field effects on benthic flora and fauna are highly uncertain

¹¹ Transcript, 17 February 2017, pg. 419

¹² Transcript, 21 February 2017, pg. 417

¹³ Transcript, 17 March 2017, pg. 1877

and that the information on the ecological value of these sites is inadequate to assess the ecological significance of the predicted light reductions.

87. Our concerns regarding significant to moderate adverse effects on benthic primary production in the Patea Shoals are confirmed in the following conclusion in Report 16:

“In some situations, e.g., a possible reduction in colonisation depth and growth rates at the Traps, more locally significant impacts may occur. Isolated rocky reef outcrops immediately east of the proposed mining site, which rise to 17 m below chart datum, potentially support macroalgae, and during mining operations at Site A these could be more severely impacted. Effects on MPB are predicted to be more substantial, but are expected to be focussed on the eastern side of the Patea Banks (Figure 1-2), where frequent, substantial reductions of irradiance relative to background can be expected.”

88. The optical model was re-run on the basis of ‘a worst case scenario’ and we requested more information on other closer ecologically sensitive areas (The Crack and The “Project Reef”), which are east of the mining site. These showed results for both the original optical model and a worst-case scenario at the additional sites. Under the original modelling the result showed:

- **Reductions in the euphotic zone at the ‘The Crack 1’ of 30% (Site A) and 10% (Site B), ‘The Crack 2’ of 34% (Site A) and 14% (Site B) and The “Project Reef” of 20% (Site A) and 7% (Site B);**
- **Reductions in the median underwater visibility at ‘The Crack 1’ by 47% (Site A) and 17% (Site B), ‘The Crack 2’ by 47% (Site A) and 21% (Site B), and The “Project Reef” by 25% (Site A) and 11% (Site B);**
- **Reductions in the number of ‘good visibility days’ at ‘The Crack 1’ by 98 days (Site A) and 25 days (Site B), ‘The Crack 2’ by 107 days (Site A) and 27 days (Site B), and The “Project Reef” by 52 days (Site A) and 14 days (Site B) out of a total of 206 days per year; and**
- **Reductions in the number of days that more than 1% of incident light reaches the seabed at ‘The Crack 1’ by 89 days (Site A) and 34 days (Site B), ‘The Crack 2’ by 102 days (Site A) and 43 days (Site B), and The “Project Reef” by 50 days (Site A) and 19 days (Site B) out of a total of 216 per year. (our emphasis in bold)**

89. Under the remodelled ‘a worst case scenario’ the results showed:

- **Reductions in the euphotic zone at the ‘The Crack 1’ of 37% (Site A) and 15% (Site B), ‘The Crack 2’ and 43% (Site A) and 19% (Site B) and The “Project Reef” of 27% (Site A) and 10% (Site B);**
- **Reductions in the median underwater visibility at ‘The Crack 1’ by 55% (Site A) and 24% (Site B), ‘The Crack 2’ by 57% (Site A) and 27% (Site B), and The “Project Reef” by 34% (Site A) and 15% (Site B);**
- **Reductions in the number of ‘good visibility days’ at ‘The Crack 1’ by 121 days (Site A) and 37 days (Site B), ‘The Crack 2’ by 133 days (Site A) to 41 days (Site B), and The “Project Reef” by 70 days (Site A) and 23 days (Site B) out of a total of 206 days per year; and**

- Reductions in the number of days that more than 1% of incident light reaches the seabed at 'The Crack 1' by 95 days (Site A) and 44 days (Site B), 'The Crack 2' by 117 days (Site A) and 54 days (Site B), and The "Project Reef" by 64 days (Site A) and 29 days (Site B) out of a total of 216 day per year. (our emphasis in bold)

90. These results show that reductions in water clarity and light penetration are significant (particularly when mining occurs at 'Site A') even under the base case scenario. The ecological values at these sites have not been assessed and the consequences of these changes have not been adequately addressed by TTRL.
91. The results show that good visibility days for recreational diving at these three sites will be significantly reduced by mining activity, particularly when mining at 'Site A'. In our view, this is a significant impact on recreational diving at these closer sites. Arguing that there are only limited opportunities to dive these sites and few people who do so, is circumspect at best. The 'worst case scenario' results are alarming.
92. The NIWA report notes that the complex optical conditions in the STB make quantification of Chlorophyll-a from ocean colour satellite data difficult. It states that coloured dissolved organic matter (CDOM) or Chlorophyll-a can be confused with sediment and vice versa, which may lead to overestimation of Chlorophyll-a concentrations. This has implications for the assumptions made as to the proportion of water column primary production and benthic primary production in the STB. What we do know is that macroalgae primary production is likely to have been underestimated due to assuming small areas of hard substrate in the SMD; and that MPB is the dominant source of primary production in the Patea Shoals. We also know that higher trophic levels depend on MPB as a primary food source.
93. The ability to quantitatively predict effects on MPB is acknowledged to be limited due to the absence of useful information on primary producer dynamics and photosynthesis rates (P) – light effluence (P-E curves). It is acknowledged there is no information available on the distribution of MPB in the STB. Professor Cahoon's conclusions rely on averaging primary production reductions over the SMD and including areas receiving the lower threshold of 0.1% of light penetration in the area potentially capable of primary production, in addition to areas receiving the recognised higher threshold 1% of light penetration. This significantly reduces the magnitude of the percentage loss of the extremely limited areas of seabed receiving more than 1% of light penetration (as outlined above in relation to the optical model). In our view, this distorts the severe impacts on benthic productivity in the most productive areas of the Patea Shoals. Professor Cahoon referred to this as the *"sweet spot – the intermediate depths, 20, 30, 40 m – where the water clarity is enough. There's advection to supply nutrients to some degree and where you don't have the background turbidity limiting light flux to the bottom."*¹⁴

¹⁴ Transcript, 20 February 2017, pg.382

2.7.3 Reef Fish

94. It is acknowledged that inshore fishery values are directly linked to reefs and hard substrate. The abundance and distribution of reef fish has been estimated from modelling DOC fish survey data from outside STB and linking this with identified reefs in the STB. However, for the purposes of modelling, identified reefs were limited to those shown on charts, TRC reports and DOC reports. TTRL has not undertaken any surveys to map unidentified reef habitat in the area of the Patea Shoals impacted by the sediment plume. There is therefore a high level of uncertainty in the abundance and distribution of reef fish over the offshore area of the Patea Shoals.
95. We know that the physical disturbance of the mining site over the 'life' of the project (excluding the sediment plume) is approximately 3.5% of the STB which falls between 20-40 m depth and that many reef and demersal fish are restricted to this depth range. The area adversely affected by the sediment plume is in addition to the mining area and represents a much larger area percentage of the STB in this limited depth range. NIWA Report 16 stated that the most chronic effects of declining water quality are expected to occur slightly south of east over the 20-30 m depth zone on the southern slope of Patea Bank, including over Graham Bank (pg.18). The quality of important reef habitat and hard substrate in this zone of influence will be degraded and sessile benthos will be smothered.
96. The application has little information on sedimentation deposition rates in the near to mid field, but acknowledges there will be smothering of sessile benthos within 2-5 km of the discharge of sediment. Averaging sedimentation rates across the SMD, (0.5-1.0 mm per year) again obscures the more localised rates of up to 5.5 mm per year within 2-3 km of the sediment discharge. On the basis of the information presented, it is difficult to determine sedimentation rates at sites such as The Crack and The "Project Reef".

2.7.4 Benthic ecology

97. We do not accept the adverse effects from the sediment plume on the ecologically sensitive areas of benthic ecology can be considered to be temporary and reversible. Recovery of ecological and cultural values of the Patea Shoal within 15 km of the mining site, after years of regular increases in sedimentation, is extremely uncertain.
98. TTRL's evidence is focused on the mine site where soft sediment habitats are dominated by early colonisers. It is agreed that these relatively simple communities are likely to recover over relatively short timeframes (months to years) after extraction ceases.
99. However, recovery of more complex reef habitat and hard rocky outcrops in the sediment plume zone of influence is more uncertain. These habitats accounted for 68% of species diversity found during sampling (despite rocky habitats representing only 5 of 36 of the benthic samples taken by TTRL).¹⁵ We were told that these communities would take significantly longer to recover after mining

¹⁵ TTRL's NIWA Report 2, pg.21

ceases. We are conscious this recovery would depend on hard substrate not being permanently buried and recruitment of later successional species from unaffected areas.

2.7.5 Conclusions

100. TTRL's impact assessment relies heavily on optical modelling outputs, which are based on sediment modelling outputs, which are in turn based on wave and current modelling. Impacts on primary production are based on the results of the optical modelling, which is linked to information from standard algorithms that do not perform well in optically complex water such as the STB. Reef fish abundance and distribution is based on modelling abundance data from outside the STB and linking this with limited identified nearshore reef areas. Compounding uncertainty is largely due to the lack of good baseline information and the complexity of the marine environment. We acknowledge that the accuracy of the sediment modelling can only be verified when mining activities commence, but many of the other areas of uncertainty reflect TTRL's approach to collecting baseline information after consent is granted, rather than before. This is discussed further below.

2.8 Inadequate Information

101. The independent review by Dr Chiffings discussed TTRL's risk based approach to Environmental Impact Assessment (EIA). The report noted that EIA conventionally follows the following steps:
- “Step 1: Determine the state of the existing environment in terms of spatial and temporal gradients and boundaries of ecosystems or biotopes, physical processes and social landscapes.*
 - Step 2: Within the existing environment, Identify Environmentally Sensitive Areas (ESAs) or Environmentally Sensitive Receptors (ESRs – species, other non-spatially dependent elements) and/or those components of the environment that are valued by society (VECs) and what their relevant sensitivities or tolerances to change are.*
 - Step 3: Determine the likely pressure or perturbations of the proposed project on the environment in terms of mechanisms, the magnitude, spatial extent, duration and frequency.*
 - Step 4: Assess the impacts in terms of likelihood and severity, including recoverability and the influence of other existing or planned perturbations (within the timeframe of the project).*
 - Step 5: Evaluate possible mitigation measures, including cessation or abandonment.*
 - Step 6: Determine and evaluate residual impacts.”¹⁶*
102. We consider TTRL has focussed its assessments on steps (3) and (4) and has largely ignored steps (1), (2), (5) and (6). Steps (1), (2) and (6) require the collection of sufficient baseline information.
103. Dr Chiffings considered that the overall approach taken by TTRL differed from what is considered best practice in the following respects:

¹⁶ Lodgement Review of Effects on Plankton, Fish and Marine Mammals, DHI, September 2016, pg.5-6

- “One is that [the] general approach is not expressed in terms of a formal process of risk assessment, proposed mitigation and proposed management of residual risk as described by MacDiarmid et al. (2012) and Clark et al. (2014), and as prescribed by the EPA for this review.
- The second is the frequent adoption of the sediment modelling domain (SMD) as the principal area of consideration in evaluating impact.
- The third is that nominated environmentally areas ESAs or those components of the environment that are values by society (VECs) are not specifically evaluated in terms of impacts and proposed mitigations, should such be needed.”¹⁷

104. These three areas of concerns are fundamental to our overall finding that the consents sought should be refused.

105. In reaching our findings, we have read the outcomes of joint witness statements in conjunction with each expert’s primary evidence. We have not relied on statements such as ‘no points of difference’ without further consideration of key concerns, such as the assessment approach to averaging effects across the SMD taken by TTRL, were raised in evidence. We are conscious that the scope of the joint witness conferencing was narrow and that not all matters raised in each party’s written evidence were discussed in conferencing.

106. A critical example of this approach was in relation to point (2) above made by Dr Chiffings, where he stated the following in his report:

*“The IA assessment is, in many respects, based on the application of a one-direction nested hydrodynamic (HD) model that drives a turbidity model for a part of the South Taranaki Bight (STB) that includes the TTR proposed lease (Figure 2). The model boundary is linear and defines an area referred to in the report as the sediment modelling domain (SMD). This, in itself, is not an issue and very much standard practise. It should be recognised though that **the SMD is an artificial construct to establish boundary conditions for numerical model purposes**. Such a boundary is normally defined well away from the specific areas of interest within the model domain so boundary effects do not interfere with the subsequent analysis. (our emphasis in bold)*

*Consideration of Figure 3 shows that there is a strong likelihood of hydrodynamic gradients, and therefore dispersion boundaries, within the SMD. This is reflected in the modelling results of projected plume dispersion and transport. **It would be normal practise to assess the extent of impacts within the context of such boundaries and gradients and not across the entire model domain.***

Given this, it is not made clear in the IA why the SMD can be used to also represent a natural boundary condition within the STB reflecting a discrete geographic domain within which to make assumptions about overall impacts from the proposed project. This needs to be addressed as a

¹⁷ Ibid, pg.6

preface to the assessment of impacts and would normally be derived / proposed at the terms of reference stage on preparing for an IA.

The predilection to use the SMD as an assessment framework has also led to a level of discounting in the assessment of ESAs or VECs in terms of impacts and proposed mitigations within the evaluation process. It is best practise to clearly identify these elements as a second step process and to specifically assess impacts on these areas so it is clear in the assessment what the specific impacts might be and how they might be mitigated.

*In summary, **if it is accepted** that it is reasonable to average impacts across the entire SMD, and not take into account smaller spatial and temporal domains, nor specific ESA within the model domain, then the analysis and conclusions provided throughout the IA are considered as suitably assessed. For this to be acceptable though, we think it is necessary for the case to be made within the IA and presented as a preface to any impact assessment.*

DHI believes in projects such as this one, where there is a wide set of concerns and stakeholders, clarity is essential about what is impacted and the nature of the impacts, so that all stakeholders are aware as to what is at risk. If there are ESAs/VECs within the SMD then these need to be explicitly addressed or the argument made as to why/how they are not important. (our emphasis in bold)

107. We do not accept the approach to average the effects over the SMD can be used to assess effects on the Patea Shoals and find that TTRL has not adequately identified ESAs or VECs. This is discussed further below.
108. The extract above also confirms that the approach taken by TTRL is not in line with recognised best practice for environmental impact assessment.
109. Dr Chiffings suggested how TTRL could have addressed uncertainty associated with the assessment approach stating:

“Correspondingly, a dynamic coupling of the HD, turbidity, light field and phytoplankton responses would allow a level of refinement of the prevailing understanding of the likely impacts of the sediment plumes on the PP of the downstream areas of the STB. This is particularly relevant if the focus of the modelling is not to produce an absolute estimation of phytoplankton production but rather test the influence of changes in turbidity (nee [sic] light) on extant populations in a relative way. Thereby, defining acceptable impact.

If the same approach was taken for the PP assessments as that of MacDiarmid and Ballara (2016) for fish, the level of confidence in the overall conclusions would increase considerably. Moreover, DHI believes this can be done at minimal expense and without the need to collect new data.”¹⁸

110. The need for this level of assessment was dismissed by Professor Cahoon and he maintained an ecosystem scale assessment was appropriate for assessing reductions in primary production. However, we remain concerned that the approach taken hides the very high reductions in primary

¹⁸ Ibid, pg.24

production over the Patea Shoals down current of the mining site, despite acknowledging that this area of the STB is important for MPB and macroalgae.

111. The approach to averaging across the SMD and lack of identification of ESAs and VECs were key concerns for many submitters. In the end, the DMC had to rely on submitters to identify ESAs and VECs within the potentially affected area of the sediment plume, such as The Crack and The "Project Reef". Even identified areas such as Graham Bank were not physically assessed by TTRL, despite being identified in Cawthron Report No.2877¹⁹ as having ecological values that were "*likely to be outstanding*". We repeat, without identification of species present at these sites, it is not possible to adequately assess the adequacy of any ecological protection provided by the SSC limits proffered.
112. The averaging of reductions in primary production across the SMD has flowed on to the assessment of effects on zooplankton and higher trophic levels. We consider using an artificial construct such as the SMD ignores the strong likelihood hydrodynamic gradients in the STB and obscures localised effects over the Patea Shoals.

2.9 Favouring Caution and Environmental Protection

113. The evidence of Ms Iorns and Mr Scott noted that it is widely recognised that the marine environment requires a stronger precautionary approach than other settings "*due to the fact that less is known about the receiving environment itself, with more reliance for predictions of future effects in scientific modelling that is necessarily complete.*"²⁰ They considered the information presented may represent the best scientific knowledge available today, but that it is incomplete and uncertain. We agree.
114. Ms Iorns and Mr Scott²¹ set out the key elements to work through in applying section 61 of the EEZ Act below:

- (1) *The threshold of threat of harm – whether significant adverse effects might result;*
- (2) *The level of risk and the certainty about that risk or level of harm that might result: some evidence is needed of a risk, mere speculation is not enough, but an amount significantly lower than the level of a legal burden of proof; these levels will likely be lower – i.e. more cautious - for the kinds of activities being considered in the marine environment under the EEZ Act;*
- (3) *That at the appropriate levels of harm and risk (i.e. appropriate for the situation and activities in question), action must be taken to address the risk and to favour caution;*
- (4) *That such action must also favour environmental protection;*
- (5) *The more uncertain the threat is, the more cautious we must be in our action taken:*

¹⁹ Sensitive Habitats and Threatened Species in the Taranaki Coastal Marine Area (TCMA) – Database Investigation, August 2016

²⁰ Expert Evidence of Catherine Iorns and Dale Scott (24 January 2017), pg. 4

²¹ Ibid., pg. 65, para 5

- (i) at the strong end of the response spectrum, where the potential harm may be high and/or the lack of knowledge about their nature and potential to manifest is also high, a decision-maker should decline a decision; and*
- (ii) at the mid point of the response spectrum, again, on the basis of moderate harm and uncertainty and even high harm and moderate uncertainty, conditions could be imposed that require certain effects to be avoided (and if they cannot be avoided then the activity is not allowed);*
- (iii) at the low end of the response spectrum, where the potential harm is low to medium and the associated uncertainty is low but still persistent, conditions to avoid and/or mitigate (if avoidance is not possible), and measures capable of overcoming lower levels of uncertainty, such as adaptive management, may be appropriate.*

(6) That adaptive management may be able to be used, as per s.61(3); it may enable real data to be gathered (as opposed to relying on models) but cannot be conflated with precaution under s.61(2);”

115. We have worked our way through these key elements in making our decision. We consider the evidence shows significant localised adverse effects on the Patea Shoals and the CMA, and the potential for significant adverse cumulative effects over time. We accept that an adaptive management approach is prohibited in relation to this application. This leads us to favour a course of action under 5 (i) above which would lead to a decision to refuse consent.

2.10 Sensitivity of the Receiving Environment

116. The sensitivity of the receiving environment depends on the nature of the discharge, the existing state of the environment (including existing impacts), and ecological and cultural values present. Good baseline information enables determination of the sensitivity of the receiving environment. In the absence of the good baseline information, we must draw on the evidence to consider the sensitivity of the receiving environment.
117. It is accepted by all parties that the adverse effects of the sediment plume will predominantly occur in the coastal marine area immediately east and southeast of the application site over the Patea Shoals between Patea and Whanganui. Except in periods of strong south west winds or calm weather conditions, the plume will impact much of the same area for much of the time. The location of the mining site and its proximity to the coastal marine area result will result in adverse effects on ecologically significant areas down current of the sediment plume extending as far as 20-30 km from the site towards Patea and Whanganui.

2.10.1 Background SSC

118. The evidence shows that background SSC levels are high in the nearshore environment (within 5 km of the shoreline) and that fluctuations correlate with sediment inputs from river during rain events and re-suspension during inclement weather. Marine life in this intertidal and subtidal zone frequently

experiences high levels of SSC for short durations and can tolerate a wide range of fluctuations in SSC. There is limited information available regarding SSC tolerance levels and exposure durations for some species in the NZ context.

119. In contrast, background levels of SSC in the offshore coastal environment (more than 5 km offshore) are generally very low (near zero), except during short periods when small increases in SSC occur at seabed level from re-suspension of seabed sediment. Marine life in this offshore zone is less tolerant to high SSC levels. There is no information on SSC tolerance levels and exposure durations for species found in these offshore environments in the NZ context.

2.10.2 Primary production

120. The Patea Shoals is a unique shallow geological feature on the west coast of the North Island that contributes significantly to benthic primary production in the STB. Primary production in the STB is among the highest recorded in NZ. This in turn supports higher trophic levels and a significant number of marine mammals.
121. Although there is very limited data on primary production, it is accepted that the zooplankton biomasses in the STB are among the highest ever recorded compared with other NZ coastal regions. There is some information about species composition and biomasses of meso-zooplankton in the upper water column, but little stratified sampling through the entire water column. Timing of sampling and varying methodologies used limit the overall conclusions that can be made and seasonal patterns are unknown. Information about macro-zooplankton in Cook Strait suggests biomasses of *Nyctiphanes australis* (krill) are elevated in the STB in comparison with Cook Strait.²² However, there is little information on macro-zooplankton. NIWA Report 1 states "*The STB may represent a breeding ground for zooplankton, which in turn promotes aggregations of larger, mobile, predatory species, particularly squid.*" (pg.108). The Report indicates aggregations of zooplankton in the centre of the STB, in close proximity to the mining site.

2.10.3 Marine mammals

122. The habitat modelling undertaken for the Southern right whale, Hector's dolphin and orca were generated using presence only sightings data combined with bathymetry (except for orca), dissolved organic matter, winter surface sea temperature, sea surface temperature gradients, suspended particulate matter, primary production, tidal currents and 95th percentile wave heights. There is no seasonality, just a yearly average. The sightings data is subject to observational bias which impacts on the accuracy and predictions capability. Report 4 stated that spatial bias was detected in the Hector's dolphin and orca incidental sightings and that the modelling sought to compensate for this bias. Overall, we consider there is a significant level of uncertainty in habitat modelling and it is acknowledged it is based on very little information. Report 4²³ stated:

²² NIWA Report 1, pg.105

²³ NIWA Report 4, pg. 46

“While these models are a first of their kind for these species in New Zealand and offer a robust step-forward in our understanding of their distribution and habitat use patterns, the spatial predictions should not be considered absolute, but rather as mathematical approximations based on the best available data and methods. Unfortunately, independent datasets are not available to validate the model predictions.”

123. We have placed little weight on the habitat modelling, and the sightings and strandings data, and have not drawn conclusions on the likely risks to threatened marine mammal based on uncertain assumptions about abundance and distribution. We have not focussed on whether the mining site is part of a defined habitat for each particular species, when no such reliable information is available.
124. Mr van Helden stated in his oral evidence about the distribution of sightings saying the effort is patchy and *“gives the impression that there are vast areas where whales are not present, however this represents more a lack of survey effort than any real picture of presence or absence”*. We agree. We accept that the sighting and strandings data indicates that the STB as a whole is an important habitat for threatened species, and that these species are not limited to particular areas.
125. We are particularly concerned about uncertain impacts on orca given there is very little information on their abundance and distribution, and the fact that moderate effects on eagle ray are predicted. It is unknown how this effect on an orca prey species may impact orca over time. We are also concerned that reductions in krill, linked to localised reductions in primary production, may adversely impact the fitness of blue whales. Dr Chiffings noted his concern that *“there is clearly one part of the SMD that is strongly influenced by the currents from the south which is where the nutrients, phytoplankton and krill come from, and there’s one part which is not”*²⁴. We do not accept the finding in the decision granting consent that krill aggregations are removed from the mining site. Again, there is a high level of uncertainty given the ‘models based on models’ approach and lack of baseline data.
126. Noise impacts on marine mammals is a key concern for us. We consider the information available is extremely uncertain and inadequate. The modelling undertaken by Dr Childerhouse has been shown to be inaccurate by the significantly different results of the later work by Mr Humpheson. The 1994 De Beers report has also been shown to be inaccurate and of extremely limited value.
127. We have no information on background noise levels at the application site and are forced to rely on a site some 80 km away as a proxy. It would not have been difficult or expensive to have undertaken ambient noise measurements, but TTRL chose not to address this gap. Without knowing background noise levels at the mining site, it is not possible to accurately assess the sensitivity of the receiving environment or the significance of any magnitude of change to that environment, let alone predict any likely impacts on marine mammals. We discuss our concerns further below in relation to the noise conditions.
128. We note that several species that periodically inhabit the STB are classified as ‘critically endangered’, ‘endangered’ and ‘vulnerable’. These include Hector’s and Māui dolphin, orca, blue

²⁴ Transcript, 22 February 2017, pg.586

whale, Bryde's whale and the Southern right whale. There is no reliable evidence on population numbers and residence times for marine mammals in the STB. We accept that evidence of sightings and strandings is only proof of presence but not of population or distribution, and that lack of data is not a proof of absence.

129. It is clear that the STB is an important feeding ground for baleen whales and other species dependent on zooplankton. Dr Childerhouse confirmed that the STB is one of only five important feeding areas in the Southern Hemisphere. On the basis of the evidence presented, we consider the STB is an important foraging ground for threatened species such as blue whales and orca, an important migratory pathway for Southern right whale and a corridor linking Hector's and Maui dolphin populations.
130. Dr Chiffings noted that there was little information on cephalopods (squid species) and that large aggregations are thought to occur in the STB in association with the Kahurangi upwelling. He highlighted that no specific account had been given on the abundance, diversity or likely impact on this group of animals and that they are prey for fish and marine mammals. This lack of knowledge and uncertainty concerns us given the range of marine mammals frequenting the area.

2.10.4 Other threatened species

131. Cawthron Report No. 2877²⁵, a desktop investigation commissioned by TRC assessing outstanding and sensitive substrates/benthic habitats and threatened taxa in the Taranaki CMA, found that sensitive marine habitats and threatened taxa were likely to exist, but that further physical investigation would be required to confirm the records, densities and spatial extents. It noted that Beaumont et al. (2009) found the STB to be important habitat for polychaete diversity, with four threatened species per cell; and that Beaumont et al. (2013) suggested that the STB was more diverse than previously suggested. The report stated that wormfield habitats in the Patea Shoals (mid shelf to the north) were undescribed (pg. 16); macroalgae species collected in the vicinity of the Patea Shoals (notably inner shelf, mid-shelf north and mid-shelf south, and offshore locations) occur at levels consistent with the EEZ sensitive habitat criteria (pg.18); and that lack of sponge taxa is likely related to a deficit of sampling/monitoring that is appropriate for detecting sponges. It noted that NIWA work had tentatively identified a dozen different sponges on a small patch reef 11 km offshore from Patea and it was possible that sponge gardens occur within the CMA at volumes and surface areas that meet the EEZ sensitive habitat criteria (pg.19). We consider this indicates that the area of Patea Shoals impacted by the sediment plume is likely to contain unidentified sensitive habitats. The photographic evidence of Nga Motu Marine Reserve Society of The "Project Reef" is consistent with this information and shows complex assemblages of sponges.
132. There has not been any systematic survey of sea birds in the STB. There is very limited information on habitats or foraging behaviour. It was agreed that a number of threatened species occur within

²⁵ Sensitive Habitats and Threatened Species in the Taranaki Coastal Marine Area (TCMA) – Database Investigation, August 2016

the STB, year round or seasonally. There was disagreement between the experts on the importance of the STB as habitat for threatened species. The STB is within the Cook Strait Important Bird and Biodiversity Area²⁶. Nga Motu Marine Reserve Society provided information to show that little penguins forage over long distances over the entire STB, including the mining site and sediment plume area.

133. The longfin eel is prevalent in the STB according to catch data provided by MPI. This eel, which is found only in New Zealand, is classified by the Department of Conservation as 'At Risk- Declining'. No information was included in TTRL's impact assessment on potential effects on the longfin eel.

2.10.5 Conclusions

134. The Patea Shoals are important ecologically, culturally and recreationally. The area of the Patea Shoals adversely affected by the sediment plume is important to benthic primary production, which supports a high abundance and diversity of zooplankton, which in turn supports higher trophic levels, such as seabirds and marine mammals. The abundance and diversity of marine life in the STB is linked to the Kahurangi upwelling and high levels of primary and secondary production. The STB is of national and international significance to baleen whales in the Southern Hemisphere and a number of threatened sea birds. Marine mammal habitat modelling is based on very limited data and modelled met-ocean conditions. Overall, this approach results in compounding levels of uncertainty in TTRL's impact assessment.
135. The Patea Shoals is a unique shallow geological feature on the west coast of the North Island, which supports a diverse assemblage of marine life. The sediment plume will adversely impact ecologically sensitive areas that currently experience relatively low background levels of SSC. There are a number of ecologically significant areas within 20 km of the mining discharge. There is likely to be unidentified sensitive habitats within the sediment plume zone of influence.
136. For these reasons, we consider the Patea Shoals and the coastal marine area to be moderately sensitive to adverse effects from the sediment plume.

2.11 Granting Consent Before Collecting Baseline Information

137. The granting of consent before the collection of sufficient baseline data on the existing environment is available, is in our view unwise and untenable. It is difficult to accept some of the conclusions reached by TTRL's experts in the absence of baseline information to identify ecological values and to adequately understand seasonality and natural variations, particularly in the complex marine environment.
138. There are significant gaps in the existing baseline information that could have been filled by TTRL, without unreasonable time or expense. Some key examples of this are:
- Background SSC levels at monitoring sites;

²⁶ Important Areas for New Zealand Seabirds, Sites at Sea, Seaward extensions, pelagic areas. Forest and Bird, June 2014

- Habitat survey/swathe mapping of the sediment plume zone of influence;
 - Benthic surveys of offshore reefs and sensitive areas within the sediment plume zone of influence;
 - Measuring ambient noise levels at the mining site to characterise the existing noise environment;
 - Measurements of source noise levels of crawlers;
 - Acoustic surveys using autonomous sea loggers to understand marine mammal distribution and density in the STB (particularly blue whales and Hector's dolphin); and
 - Sampling of zooplankton to understand distribution and seasonality/natural variation.
139. The consent has been granted on the basis of implementation of the draft Pre-Commencement Environmental Management Plan (PCEMP). Mr Govier stated that *"The BEMP has been developed to ensure that there is sufficient environmental baseline information on which any subsequent actions to avoid, manage or mitigate adverse environmental effects from iron sand extraction can be founded"*²⁷. In our view, this confirms that without sufficient baseline information, it is not possible to impose appropriate conditions to avoid, remedy and mitigate adverse effects. It is also not possible to set appropriate standards and limits. This is why the conditions imposed are inadequate to avoid and mitigate adverse effects and the level of protection provided is extremely uncertain.
140. This lack of baseline information was a key concern of the expert planners who gave evidence on behalf of submitters.
141. Mr Clarke noted that the baseline data must be adequate enough to enable changes in the receiving environment (i.e. uncertain impacts) to be monitored and appropriate environmental triggers to be established. He considered TTRL had not addressed what actions would be taken if the baseline information collected identified other sensitive areas or more endangered species in the mining site or of the sediment zone of influence.²⁸
142. Ms Anderson considered there was not sufficient baseline information against which to measure changes in the environment and that without this information no meaningful triggers can be established.²⁹
143. Ms Sitarz concluded there was not sufficient baseline information to set certain and robust conditions which would ensure adverse effects from the proposal would be avoided, remedied or mitigated. She considered this lack of information could not be addressed without the ability to consider an adaptive management approach.³⁰
144. We agree with expert opinions of Mr Clarke, Ms Anderson, Ms Sitarz and Mr Young that good baseline information is fundamental in conducting an impact assessment and is a key cornerstone in determining whether or not the impacts of a proposed development are acceptable. We agree it is also fundamental to addressing the potential impacts of a proposal where the information concerning the potential impacts is uncertain or may change over time. The applicant's approach to collecting

²⁷ Statement of Evidence, pg. 7, para 26

²⁸ Statement of Evidence by Mr. Bruce Clarke, pg.16, para 30

²⁹ Statement of Evidence by Ms Helen Anderson, pg.28, para 90

³⁰ Statement of Evidence by Ms Natasha Sitarz, pg. 29, para 142

baseline information after consent is granted **is not in line** with recognised best practice for environmental impact assessment, as outlined above in Dr Chiffing's report.

2.12 Marine Consent and Marine Discharge Consent Conditions

145. The collection of baseline information enables assessment of the sensitivity of the receiving environment, assessment of environmental impacts, and formulation of appropriate standards and limits to protect the environment and existing interests. Without sufficient baseline data it is impossible to adequately assess the potential effects of application because the validity of the modelling cannot be checked and the inputs cannot be ground truthed. This is why TTRL's approach is unacceptable and extremely environmentally risky.
146. Without good baseline information, we cannot assess the suitability of the proposed monitoring locations or the ecological protection provided by the standards and limits proposed. It is not acceptable to leave determination of monitoring locations and frequency of monitoring to TTRL. However, there is too much uncertainty to set these before the baseline monitoring is undertaken, as monitoring sites locations may not be appropriate and monitoring frequency may not be statistically robust. In our view, this is a critical issue that could not be addressed on the basis of the information provided.

2.12.1 Suspended sediment concentration limits

147. TTRL's approach has been that all adverse effects of the sediment plume can be addressed by ensuring that SSC levels are no more than predicted by the OSPM. Emphasis is on validating the modelling and ensuring any actual effects are within the SSC levels predicted by the model.
148. TTRL has chosen not to provide the baseline data and has instead focussed its assessment on refining the sediment modelling and the optical modelling. The assessment relies on the predictions of the models and the premise that any adverse effects can be limited to within the scope of the predicted effects by the imposition of discharge limits and receiving water limits at selected receptor sites. This is the approach taken in the proffered conditions and accepted by the decision to grant consent.
149. However, we consider this approach fundamentally flawed because:
- (a) The receiving water limits or acceptable threshold changes should be linked to ecological protection and not validation of the model;
 - (b) The selected receptor (monitoring) sites should be based on identified ESAs and VECs within the potential zone of influence; and
 - (c) The predicted changes should indicate compliance with the receiving limits imposed.
150. The receiving water limits or an acceptable threshold of change proposed at the selected monitoring sites is based on an absolute limit of SSC levels of no more than the 95th percentile level of background SSC (as set out in Schedule 2, or as amended based on two years of baseline

monitoring before mining commences) to address intensity (Condition 5.a.). In addition, the activities shall not result in *“Any significant change of the 25th, 50th and 80th percentiles Suspended Sediment Concentration (“SSC”) at any of the ten monitoring sites identified in Schedule 2 when the difference between the **actual measured SSC and modelled background statistical metric**, as predicted by the validated OSPM, and as determined over any twelve (12) month period, is not more than 10%”*. (our emphasis in bold)

151. This means that post mining the ‘actual measured SSC’ (i.e. actual measures background plus mining) must be within a 10% difference of the ‘modelled background statistic’. We have no evidence to support the ecological basis for a 10% difference as a significant threshold or what the implications might be if the statistical bell curve moves up to 10% from the existing bell curve. This lack of link between the statistical approach taken by TTRL and the level of ecological protection provided was raised by Dr Lieffering and remained unanswered in evidence.
152. We note that Dr Longdill’s understanding of the receptor-based framework as set, out in Schedule 2, was that *“there was to be zero impact from mining activity in terms of suspended sediment at these locations”*³¹. He considered any concerns regarding the sediment modelling were ultimately addressed by the presumption that there would effectively be no change at these monitoring sites. This is not what the modelling shows, particularly at offshore sites within 20 km of the point of discharge with generally very low background levels of SSC.
153. In considering the evidence presented, it is clear that the sediment plume modelling predicts changes at the selected monitoring sites that are greater than a 10% difference between **modelled background SSC and modelled background plus mining SSC** (our emphasis in bold). This difference is evident at the monitoring sites originally proposed by TTRL, but is even more pronounced at the closer sites added by the DMC in the decision to grant consent. In some cases, changes show 150% increases.
154. The decision to grant consent has accepted the statistical approach taken to setting SSC limits, without linking any threshold of significant change to any level of ecological protection. We were provided with no information as to the species likely to be present at Graham Banks or the Rolling Grounds, and no studies indicating SSC thresholds or durations for these species. The evidence of Dr James addressed ecological thresholds in a very general sense with sparse information on SSC thresholds and durations of exposure for some individual intertidal and subtidal species found in nearshore habitats, but not species found offshore where background SSC levels are generally very low.
155. We are concerned that the condition refers to the optical model (OSPM) when it would be appropriate for the compliance limit to be set by the **actual measured background SSC levels** (as measured over two years) and that any **actual measured SSC level at each monitoring site** (after mining commences) must be no more than the measured 95th percentile; and that there is no significant change between the pre-mining background 25th, 50th, and 80th percentile SSC level and

³¹ Transcript 17 March 2017, pg. 1874

post-mining percentiles. This would be consistent with the expectations of Dr Longdill for no impact at these monitoring sites. In our view, the limits in Schedule 2 should be **set once only** through the collection of SSC baseline data at each monitoring site before mining commences and should not rely on modelling or validation of the OSPM. (our emphasis in bold)

156. We acknowledge that collection of background SSC data will allow for validation of the OSPM. However, we consider this should have been done before consent is granted to give greater confidence in the accuracy of the predictions. In granting consent prior to validating the model, the decision to grant consent has already accepted the accuracy of the model. The value of the OSPM from this point, is as an operational tool for TTRL to predict sediment effects and effectively manage compliance. We do not see the OSPM as having an ongoing role in setting the receiving water limits, as its value was as a tool for predicting and assessing effects to determine whether these were acceptable or not.
157. It is clear that the selected monitoring sites are not based on an assessment of ESAs and VECs in the potential zone of influence, but rather sites that are more remote from the mining site or within 5 km of the coast. In the decision, the DMC has determined to address this gap by adding closer receptor sites such as The Crack and The "Project Reef". However, the evidence suggests the receiving water limits imposed will not be achievable at these closer sites. In light of this evidence, we consider the addition of such monitoring sites would potentially clearly frustrate or nullify the exercise of consent.
158. We were told that the appropriateness of the monitoring must be assessed by biologists and ecologists. However, this cannot occur in anything more than a general sense without adequate survey and documentation of the ecological values currently existing at those sites. Ecologically sensitive sites such as The Crack and The "Project Reef" were not even identified by TTRL, and ecological values remain undocumented. As discussed above, even sites such as Graham Bank, which were identified by TTRL, were not surveyed to assess ecological values present. We cannot adequately assess the adverse effects of increased SSC or deposition on these sites if we do not know what ecological values are present.

2.12.2 Primary production

159. The monitoring proposed by TTRL will only be able to potentially detect impacts at higher trophic levels and not on primary production. There is no direct measurement of primary production proposed in addition to using a modelling approach and only sampling phytoplankton biomass, abundance and composition monitoring. This will not be meaningful or useful given it is only a very small part of the primary production in the STB. There are also no thresholds proposed for any acceptable level of change in phytoplankton biomass, abundance and composition. It appears to be for monitoring for information purposes only.

2.12.3 Threatened species

160. Conditions requiring 'no population level' effects for threatened species of seabirds and marine mammals have been imposed. These conditions are meaningless in the absence of information on existing population levels and any requirement for systematic monitoring. Such conditions, at best, require TTRL to record deaths or injury, but there are no thresholds imposed and there is no ability to establish cause-effect links.

2.12.4 Noise effects

161. Conditions 11 – 18 relate to noise effects. Condition 11 limits noise levels to 135 decibels at 500 m from the source, as a proxy for a received level (RL) of sound of 120 decibels at 10 km. We were told that the RL limit of 120 decibels is a generic threshold for a 50% probability of a behavioural response in marine mammals from the National Oceanic and Atmospheric Administration (NOAA) interim guidelines and Southall et al. (2007) study. The consent decision accepts that the imposition of this generic RL of 120 decibels will provide adequate protection for marine mammals from adverse effects. We disagree for the following reasons.
162. Mr van Helden told us that current scientific knowledge had moved on from setting generic RL thresholds for the level of sound intensity and that the acoustic characteristics of the sound source, marine mammals hearing sensitivity, and context of exposure must be considered to predict the probability and severity of behavioural response. He provided us with a copy of the Gomez et al (2016)³² study which reviewed literature (370 papers) to summarise the critical and complex role of context of exposure, in addition to received level, when assessing the probability and severity of behavioural response in wild marine mammals. The analysis emphasised that behavioural responses were best explained by the interaction between source type (continuous, sonar, or seismic/explosion) and functional hearing group (as a proxy for hearing capabilities). The results of the study showed that the RL of sound did not explain the severity of the behavioural responses in toothed or baleen whales.
163. Dr Chiffings considered the noise limit of 135 decibels at 500 m should be lower to be in line with the NOAA interim guidelines and that this limit should be reviewed in light of other publications that had appeared since the 120 decibel RL was set.³³ Similar concerns were voiced by Dr Torres and Professor Slooten.
164. We consider there is very limited information on which to base any conclusions on the level of environmental protection provided by the noise limit imposed, except for the assertion that it is based on the NOAA interim guidance, which is acknowledged to provide different levels of protection for different species. This does not give us confidence that threatened marine mammal species will be adequately protected.

³² Gomez et al. (2016) 'A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy'

³³ Transcript, 22 February 2017, pg.

165. The current noise environment at the mining site has not been measured and the characteristics of the noise sources (particularly the combined noise sources) is not understood. The characteristics of the mining sound source is not known. Source levels have been assumed based on dredging operations and the De Beers noise measurements were shown to be of limited value given they are more than 20 years old and were conducted in questionable circumstances. The 'back calculation' method of assessment used by Mr Humpheson does not account for specific acoustic characteristics of the sound and relies on the IMV and crawler meeting a source level of 171 decibels. Duration of exposure was not considered in assessing the probability or severity of behavioural impacts. There is little information on the functional hearing of each marine mammal species present in the STB or likely behavioural responses.
166. Overall, there is a high level of uncertainty over the actual area of the STB that will be exposed to a RL of sound up to 120 decibels. This is clearly demonstrated in the significant difference in Mr Childerhouse's initial predictions of an approximately 2 km distance of the 120-decibel contour and the revised assessment by Mr Humpheson of a 10 km distance of the 120-decibel contour.
167. Furthermore, Condition 12 applies to the operational noise from the IMV and crawler only. We consider this is a flawed approach. In our view, the conditions **must apply to and limit all operational noise from mining activities**, including the FSO, the bulk carriers and any support vessels, and the use of any thrusters (our emphasis in bold). The evidence shows that the FSO and any vessel using thrusters to hold a position will significantly added to overall noise emissions. The decision dismisses these other noise sources by accepting that the IMV will only use thrusters approximately 10% of the time. However, the bulk carrier and FSO will be in operation every 2-3 days (depending on extraction rates) and will therefore add to noise emissions of the IMV and crawler on a frequent and regular basis.
168. Consideration of all mining activity noise sources requires us to assess noise impacts over a distance of at least 23 km from the noise source, which equates to an area of approximately 2,600 km². This is approximately 8% of the STB and a large proportion of the Patea Shoals, extending from the mining site to the shoreline. Combined operating noise effects will occur for significant durations (far in excess of 10% of the time as assumed in the decision) and on a regular basis.
169. We consider the decision to grant consent has not sufficiently recognised the potential severity of behavioural responses and has instead focussed on permanent threshold shifts (PTT) and physiological impacts. We consider that behavioural responses can include severe and unknown impacts, including reduced foraging, reproduction and survival. Such impacts will be difficult to detect given our current level of knowledge.
170. In our view, the long term and continuous nature of the mining operation will result in noise impacts over a large area of the STB for a very long time. A large area of the Patea Shoals used by the Southern right whale for calving will be within the 23 km radius of combined operating noise exceeding 120 decibels. The 23 km 120-decibel contour will reach the shoreline and the migratory corridor for Hector's dolphins and Southern right whale will be affected with noise levels exceeding the behavioural response threshold. The high suitability habitat for orca to the west of the mining site

is also affected by the 23-km 120-decibel contour. In our view, these adverse effects on the habitats of threatened species are likely to be significant and are therefore unacceptable. Given the uncertain and inadequate information, we are required to favour caution and to protect such habitats from degradation. The noise conditions imposed will not achieve this.

2.12.5 Tangata whenua and conditions

171. We also wish to comment on the effectiveness and adequacy of conditions under the heading 'Relationship with Tangata Whenua' (Conditions 72 - 80). We note that these conditions have been proffered on an Augier basis – that is a condition offered that is *ultra vires*, but is enforceable by agreement. The principal means of recognising and providing for the relationship of tangata whenua – “including but not limited to Ngāti Ruanui and Ngā Rauru Kītahi and Ngāruahine” – with the STB is through the:
- Establishment and maintenance of a Kaitiakitanga Reference Group (KRG) (Condition 73)
 - Provisions for involvement of the KRG in the Technical Review Group (TRG) (Condition 61) and the Kaimoana Monitoring Programme (Condition 77)
172. An associated 'Advice Note' to Condition 73 records the Consent Holder's “*commitment to implementing this condition in good faith and to using the services of an independent mediator, as necessary, in doing so.*”
173. It states that the purpose of the KRG is to:
- Recognise the kaitiakitanga of tangata whenua and their relationship with the STB;
 - Review and advise on the suitability of the Kaimoana Monitoring Programme (Condition 77);
 - Provide for the on-going involvement of tangata whenua in monitoring the effects of mining activities;
 - Provide for kaitiaki responsibilities and values to be reflected in the monitoring of the seabed material extraction area and the surrounding marine environment; and
 - Be responsible for receiving requests for and facilitating any cultural ceremonies by tangata whenua.
174. The condition stated that the Consent Holder shall appoint one member of the KRG, facilitate and fund the administration of formal meetings and take minutes, and shall meet the actual and reasonable costs incurred for providing the services required of it. For the avoidance of doubt, Condition 79 says the Consent Holder “*shall still comply with Conditions 77 and 78 in the event the KRG has not been established.*”
175. The Kaimoana Monitoring Programme is for monitoring species important to customary needs, including from customary fishing grounds around the mining site. It states that the Consent Holder “*shall use its best endeavours to engage tangata whenua representatives including mana whenua iwi and from Te Tai Hauāuru Fishing Forum to undertake the monitoring*”. An attached 'Advice Note' states – “*The Consent Holder is encouraged to use this opportunity to investigate the involvement of*

relevant iwi entities as kaitiaki, in environmental practices and the development of environmental indicators using both mātauranga Māori and western science.”

176. Given the history of engagement during the application phase, we consider there may be issues in establishing trust with mana whenua iwi and establishing the KRG. We consider mediation provisions would be essential to ensure that all parties’ requirements and any relevant costs involved in participation are met.
177. Overall, we consider these conditions do not avoid, remedy or mitigate potential adverse effects on the existing interests of tangata whenua. They merely enable tangata whenua to participate in monitoring effects. Again, this is about monitoring for information purposes, not for effectively addressing potential adverse effects. There are no limits or thresholds proposed for acceptable changes to intertidal communities (macroalgae and kaimoana). There is likely to be a lag time in any detection of statistically significant changes and it will not be possible to establish cause-effect links in light of the sedimentation inputs from land source.

2.12.6 Conclusions

178. The outputs of the sediment plume modelling show that the mining at ‘Site A’ has a significantly greater impact on the ecological and cultural values of the Patea Shoals and coastal marine area than mining at ‘Site B’. In our view, this clearly demonstrates how adverse effects of the sediment plume could be significantly avoided or mitigated by both the location of the discharge and its proximity to the coastal marine area.
179. Without adequate baseline information, it is not possible to identify further avoidance or mitigation levels or to set appropriate standards and limits that are directly linked to environmental protection.
180. Overall, we agree with Mr Young that the *“conditions create an illusion of safety and environmental protection in that they are based on the concept that the effects are minor”*.³⁴
181. Environmental monitoring is to ensure that any adverse effects are within the nature and scope of those anticipated or predicted by the environmental impact assessment and that no unanticipated or unforeseen adverse effects occur. However, when consent conditions are drafted on the basis of uncertain or inadequate information it is highly likely that the standards and limits will either not be able to be met by the Consent Holder or insufficient to ensure adequate environmental protection.
182. Monitoring may indicate when compliance limits are exceeded, but once mining commences it will be very difficult to draw any cause – effect links. This was confirmed by Mr Govier when he stated –
- “It is important to note that monitoring results will not necessarily allow a cause and effect relationship to be determined due to the very large degree of natural variability that exists for many environmental parameters being measured.”*³⁵

³⁴ Statement of Evidence Mr. Graham Young, pg.15, para 89

³⁵ Statement of Evidence, pg.12, para 42

183. We are conscious that not only is there a large degree of natural variability, but that factors such as climate change will further impede any hope of determining cause-effect links over such a long time period. We also acknowledge that the marine ecosystems are extremely complex and significant time lags may occur between an adverse effect occurring and detection of an effect on a particular species level or between different trophic levels. We consider such risks would be significantly reduced if potentially affected ecological values were adequately identified and seasonality and natural variation was better understood before consent is granted.

2.13 Cumulative Effects

184. Given the long-term duration and continuous nature of the activity, we consider there is very real potential for unforeseen cumulative effects over time and in combination with other effects, such as commercial fishing and marine traffic. Twenty years or thirty-five years is a very long time for continuous effects from the sediment plume and noise. The sediment will move around depending on the weather and currents, but it will predominantly impact much of the same area of the Patea Shoals and the CMA, intermittently and for long periods for up to 35 years. Studies relating to dredging impacts are hardly comparable given the scale, intensity and continuous long-term nature of the activity.
185. There is limited ability to assess cumulative impacts on marine food webs. The time lag between establishing any statistically significant changes in the environmental and detecting any higher trophic levels effects may be too late for some threatened and sensitive species in the STB. It will be very difficult, if not impossible to establish any cause-effect links.
186. Many submitters emphasised that the marine environment is already suffering degradation from anthropogenic activities and that this proposal will only increase this habitat degradation. We agree.
187. Noise in the marine environment of the STB is increasing over time due to marine traffic, seismic and sonar surveys, oil and gas exploration. Impacts on marine mammals are unknown, but this proposal will undoubtedly increase noise levels. Mining activities will result in significant increases in noise levels on a nearly continuous basis for a long duration, in a part of the STB that is not currently impacted by large number of commercial marine vessels.
188. Overall, we consider that there is a moderate risk of significant cumulative impacts on primary production and marine mammals in the STB.

2.14 Overall Conclusions

189. The Patea Shoals and the coastal marine area are highly valued by the nearby communities for their cultural values, ecological values, recreational values and intrinsic value. The strength and depth of people's attachment and love for the coastal marine area and all the creatures it supports was demonstrated throughout the hearing. Their concerns cannot be discounted as merely emotional responses and misconceived perceptions of risk. The concerns are based on TTRL's evidence which demonstrates the mining activity will have long term, ongoing, significant localised adverse effects on

the Patea Shoals and the CMA. The vast majority of submitters (13,477 out of 13,733) find these environmental effects to be unacceptable and sought that the applications be refused.

190. In his closing legal representations, counsel for TTRL quoted Sir Peter Gluckman, the Prime Minister's Chief Science adviser as saying – "*When it comes to environmental or public health risks, minority voices claiming that a particular risk is high often get disproportional attention compared with a scientific majority that sees the risk as much lower*"³⁶, referring here to the fluoride in drinking water debate. However, in this case there is a not 'minority of voices', but rather a majority of voices, and the experts have not provided a significant or independent 'scientific majority' in many areas to refute the majority opinion. There is no basis to ignore or dismiss the views of submitters or to prefer the evidence of TTRL's particular scientific experts given the uncertainty and inadequacy of the information before us.
191. In taking into account section 59 and section 87D of the EEZ Act, we find that refusing the marine and marine discharge consents sought by TTRL would:
- (a) Recognise the importance of protecting biological diversity and the integrity of marine species, ecosystems and processes of the Patea Shoals;
 - (b) Recognise the importance of protecting rare and vulnerable ecosystems and the habitats of threatened species of marine mammals and sea birds found in the STB;
 - (c) Recognise the nature and effect of the RMA and the objective and policies of the NZCPS; and
 - (d) Recognise best practice for environmental impact assessment.
192. Granting the marine and marine discharge consents does not sufficiently take into account the section 59 requirements to:
- (a) Avoid, remedy and mitigate adverse effects on the ecological and cultural values of the Patea Shoals and the coastal marine area; and
 - (b) Avoid, remedy or mitigate adverse effects on tangata whenua's existing interests;
193. In accordance with section 60, we consider a decision to refuse the consents sought would recognise the extent of the overlap between of the sediment plume zone of influence and the areas of statutory acknowledgement, and the fact that the area to which tangata whenua existing interests applies cannot be moved elsewhere.
194. In accordance with section 61 and section 87E, where the available information is shown to be uncertain or inadequate, we must favour caution and environmental protection.
195. For the above reasons, we consider the purpose of the EEZ Act is achieved by refusing the marine and marine discharge consents sought by TTRL.

³⁶ Closing legal representations on behalf of Trans-Tasman Resources Limited, pg.16, Para 60

APPENDICES

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Appendix 1. Authorised Restricted Activities

The marine consents and marine discharge consents authorise the following restricted activities, subject to conditions listed in Appendix 2.

Section 20(2) (a) – the construction, placement, alteration, extension, removal, or demolition of a structure on or under the seabed.

- 1) The placement, movement and removal of the Integrated Mining Vessel (“IMV”) anchor and the geotechnical support vessel anchor, including the anchor spread, on or under the seabed.
- 2) The placement, movement and removal of the crawler on or under the seabed.
- 3) The placement, movement and removal of the grade control drilling equipment on or under the seabed.
- 4) The placement, movement and retrieval of moored environmental monitoring equipment on or under the seabed.

Section 20(2)(d) – the removal of non-living natural material from the seabed or subsoil

- 1) The removal of sediment from the seabed and subsoil using the crawler and by grade control drilling.
- 2) The taking of sediment and benthic grab samples from the seabed and subsoil associated with environmental monitoring.

Section 20(2)(e) – the disturbance of the seabed or subsoil in a manner that is likely to have an adverse effect on the seabed or subsoil

- 1) The disturbance of the seabed and subsoil associated with the placement, movement and removal of the IMV anchor and the geotechnical support vessel anchor, including the anchor spread.
- 2) The disturbance of the seabed and subsoil associated with seabed material extraction via the crawler, through re-deposition of de-ored sediments, and from grade control drilling.
- 3) The disturbance of the seabed and subsoil associated with the placement, deployment, retrieval and mooring of environmental monitoring equipment.
- 4) The disturbance of the seabed and subsoil associated with the taking of sediment and benthic samples associated with environmental monitoring.

Section 20(2)(f) – the deposit of any thing or organism in, on, or under the seabed.

- 1) The re-deposition of de-ored sediments in, on or under the seabed.
- 2) The deposition of small amounts of marine organisms and solids in, on or under the seabed as a result of vessel maintenance, hull cleaning (biofouling).

Section 20(2)(g) – the destruction, damage, or disturbance of the seabed or subsoil in a manner that is likely to have an adverse effect on marine species or their habitat.

- 1) The disturbance and damage of the seabed and subsoil as a result of the placement, movement and removal of the IMV anchor, and the geotechnical support vessel anchor on the seabed.
- 2) The disturbance and damage of the seabed and subsoil as a result of seabed material extraction via the crawler, the redeposition of de-ored sediments, and the grade control drilling.

- 3) The disturbance and damage of the seabed and subsoil as a result of the placement, deployment, retrieval and mooring of environmental monitoring equipment.
- 4) The disturbance and damage of the seabed and subsoil as a result of the taking of sediment and benthic samples associated with environmental monitoring.

Section 20(4)(a) – the construction, mooring or anchoring long-term, placement, alteration, extension, removal, or demolition of a structure or part of a structure.

- 1) The anchoring of the IMV and the geotechnical support vessel, and the associated placement, movement and removal of the IMV anchor and the geotechnical support vessel anchor in the water column above the seabed.
- 2) The placement, movement and removal of the crawler in the water column above the seabed.
- 3) The placement, movement and removal of the grade control drilling equipment in the water column above the seabed.
- 4) The placement, deployment, retrieval and mooring of environmental monitoring equipment in the water column above the seabed.

Section 20(4)(b) – the causing of vibrations (other than vibrations caused by the normal operation of a ship) in a manner that is likely to have an adverse effect on marine life.

- 1) Vibration (noise) caused by the IMV and crawler during iron sand extraction activities.

Section 20B – No person may discharge a harmful substance from a structure or from a submarine pipeline into the sea or into or onto the seabed of the exclusive economic zone

- 1) The release of seabed material (sediments) arising from the seabed disturbance during grade control drilling activities;
- 2) The release of disturbed seabed material (sediments) arising from the seabed disturbance during the crawler extraction operations; and
- 3) The release of disturbed seabed material (sediments) arising from taking of sediment and benthic samples associated with environmental monitoring.

Section 20C – No person may discharge a harmful substance (if the discharge is a mining discharge) from a ship into the sea or into or onto the seabed of the exclusive economic zone or above the continental shelf beyond the outer limits of the exclusive economic zone

- 1) De-ored sediments and any associated contaminants discharged back to the water column from the IMV.

Appendix 2. Marine Consent Conditions

The marine consents and marine discharge consents are granted subject to the following conditions, which have been imposed under sections 63 and 87F(4) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012:

Note: Working days are as defined in section 4 of the EEZ Act.

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Glossary of Terms and Abbreviations in Conditions

ABS	American Bureau of Shipping
ANZECC 2000	Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000
Benthic	On the seabed
Crawler	Subsea sediment extraction device (SSED)
Discharge of de-ored sediment	The combined discharge of all sediment from the IMV, irrespective of its source, immediately prior to the discharge to the marine environment.
DPS	Dynamic Positioning System
EEZ Act	Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
EEZ	Exclusive Economic Zone
EMMP	Environmental Monitoring and Management Plan
EPA	Environmental Protection Authority
HNZ	Heritage New Zealand Pouhere Taonga
IMO	International Maritime Organization
IMO Guidelines	International Marine Organization 2011 'Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species'
IMV	Integrated mining vessel
ISQG	Interim sediment quality guidelines
JORC Code	Joint Ore Reserves Committee: Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, 2012
KRG	Kaitiakitanga Reference Group
Kupe Operator	Operator of the Kupe Petroleum Mining License #38146
mg/L	Milligrams per litre
MMMP	Marine mammals monitoring plan
MNZ	Maritime New Zealand
Maritime Transport Act	The Maritime Transport Act 1994
NIWA	National Institute of Water and Atmosphere
OSPM	Operational Sediment Plume Model
PCEMP	Pre-commencement Environmental Monitoring Plan (previously called BEMP)
Pore water	Water that occupies the pore spaces between rocks or sediments
PSD	Particle size distribution (of sediment). The relative amounts of particles present according to size
SSC	Suspended sediment concentration
TRG	Technical Review Group
95 th percentile	Internationally, the 95th percentile upper confidence limit (UCL) is the most commonly used method to define an upper limit for background concentrations

GENERAL CONDITIONS

1. Pursuant to section 85 of the EEZ Act, these consents shall lapse ten (10) years after the date of their commencement unless the consents are given effect to prior to that date.
2. Subject to compliance with these consent conditions, the activities authorised by these consents shall be undertaken in general accordance with the application and supporting documents submitted as part of the application lodged on 23 August 2016. Where information contained in the application documents is contrary to the conditions of these consents the conditions will prevail.

Advice note: For the purpose of these consents, the term 'pit' refers to the pit that remains following the extraction of seabed materials by the Crawler.

DISCHARGE LIMITS

3. The Consent Holder shall not extract more than 12.5 million tonnes of seabed material during any three (3) month period, and 50 million tonnes of seabed material during any twelve (12) month period for the term of these consents.

The Consent Holder shall continuously record the mass of seabed material extracted and report on this as part of the Quarterly Operational Report required by Condition 103.

4. The following limits shall apply:
 - a. The rate of extraction of seabed material, averaged over any monthly period, shall not exceed 8,000 tonnes per hour ("t/hr"); and
 - b. The rate of discharge of de-ored sediment onto the seabed, averaged over any monthly period, shall not exceed 7,190 t/hr; and
 - c. The rate of discharge of de-ored sediment having a size of <38 microns (" μm ") shall not exceed:
 - i. 130 cubic metres per hour (" m^3/hr "), averaged over any 48 hour period; and
 - ii. 83 m^3/hr , averaged over any seven (7) day period; and
 - iii. 66 m^3/hr , averaged over any three (3) month period.
 - d. Averaged over any one (1) week period, the extraction of seabed material having a size of <8 μm , shall not exceed 1.8% of the total seabed material extracted.

For the purpose of (c) of this condition, the average value shall be derived from the use of continuous flow measurement and the analysis of one daily composite sample comprised of not less than the 12 individual samples collected during each 24 hour period at a point immediately prior to discharge to the marine environment.

For the purpose of (d) of this condition, the average value shall be derived from the analysis of a minimum of 20 representative samples of the excavated seabed material.

The Consent Holder shall record Particle Size Distribution, and the rate and volume/mass of the discharge of de-ored sediment continuously. The Consent Holder shall advise the EPA of any

exceedances of the discharge limits specified in clauses (b), (c) and (d) within 24 hours of any exceedance.

The information collected in accordance with this condition shall be reported on as part of the Quarterly Operational Report required by Condition 103.

ENVIRONMENTAL LIMITS

Sediments

5. The activities authorised by these consents shall not result in:
 - a. An exceedance of a 95th percentile Suspended Sediment Concentration Limit ("SSC Limit") specified in Schedule 2; or
 - b. An exceedance of any modified numerical values of an SSC Limit determined in accordance with Condition 51 (in which case a. above will no longer apply); or
 - c. Any significant change of the 25th, 50th, or 80th percentile Suspended Sediment Concentrations ("SSC") at any of the ten monitoring sites identified in Schedule 2 when the difference between the measured actual SSC and modelled background statistical metric, as predicted by the validated OSPM, and as determined over any twelve (12) month period, is more than 10%.

In the event that monitoring shows that limits in Condition 5.a. or 5.b. are exceeded, or the significance of change under Condition 5.c. exceeds 10%, then extraction activities shall cease until the Consent Holder can demonstrate compliance with those conditions, to the satisfaction of the EPA.

6. The activities authorised by these consents shall not result in an exceedance of any Interim Sediment Quality Guideline-High ("ISQG-High") value in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 ("ANZECC 2000"), or any subsequent versions thereof, at any of the ten monitoring sites identified in Schedule 2.

For the purpose of these consents, any reference herein to either ISQG-High is deemed to be a reference to the ISQG-High values for metals, metalloids, organometallic and organic compounds provided in the ANZECC 2000, or any subsequent versions thereof. The metals subject to this condition are those specified in Schedule 6.

Benthic Ecology

7. The activities authorised by these consents shall not, result in a:
 - a. more than a 5% reduction in overall abundance of macro fauna and flora; and
 - b. more than a 5% reduction in the average number of macro-faunal and floral taxa present; and
 - c. more than a 5% reduction in total macro-faunal and floral biomass;

at the monitoring sites listed in Schedule 4 when compared against the pre-commencement monitoring data as determined in accordance with Condition 48, but taking into account natural variation.

For the purpose of this condition, “a 5% reduction” at any specified location, shall be determined by comparing the mean values of all replicate samples collected at that location at the particular time.

Benthic Recovery

8. No later than five (5) years following the completion of all seabed material extraction within two (2) km of the location where extraction has first occurred, the Consent Holder shall be required to demonstrate that recovery of the macroinfauna benthic community at that location has occurred, provided that the annual monitoring results for that area (Condition 54) indicate that that such recovery is on track to be achieved.

For the purpose of this condition, “recovery of the macroinfauna benthic community” will have occurred when the macroinfauna communities at a specified location are within 15% of the average pre-mining total abundance, biomass and species richness, but taking into account natural variation.

In the event that annual monitoring shows that recovery is not on track to be achieved, then the Consent Holder shall, in the next quarterly report, provide information to the EPA that:

- a. highlights the results of monitoring at the location that show that recovery is not on track to be achieved; and
- b. includes analysis by a duly qualified benthic ecology expert of:
 - i. possible reasons why recovery is not on track to be achieved; and
 - ii. potential measures to enhance recovery; and
- d. explains how the Consent Holder will comply with the obligation to demonstrate that recovery of the macroinfauna benthic community has occurred no later than 5 years following completion of all seabed material extraction within two (2) km of the location where extraction first occurred.

Seabirds

9. At all times during the term of these consents, the Consent Holder shall comply with the following:
- a. There shall be no adverse effects at a population level of seabird species that utilise the South Taranaki Bight that are classified under the New Zealand Threat Classification System as “Nationally Endangered”, “Nationally Critical” or “Nationally Vulnerable” or classified as “Endangered” or “Vulnerable” in the International Union for the Conservation of Nature “Red List”; and
 - b. 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
- shall be mitigated, and where practicable avoided

Marine Mammals

10. Notwithstanding the requirements of Conditions 11, 37, 67 and 88, with respect to marine mammals (excluding seals), the Consent Holder shall ensure that:

- a. There are no adverse effects at a population level 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”; or
 - iii. Marine mammal species classified as “Endangered” or “Vulnerable” in the International Union for the Conservation of Nature “Red List”;

that utilise the South Taranaki Bight.

- b. 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 exercise of these consents, at least one (1) designated 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 shall 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 shall be installed on the bridge of each vessel and the video feed from each of the cameras will be made available on the Consent Holder’s website or such other website as may be established from time to time (Condition 81). 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 record any sightings of whales or dolphins including the date, time and, where possible, GPS position of the vessel;
- 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 safe maximum within 500 m of any large cetaceans and feeding aggregations of blue whales, and take all necessary steps to avoid contact

with the animals by detouring around and, where practicable, maintaining a distance of at least 500 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, the carcass is recovered, the Department of Conservation and the EPA are notified immediately of that recovery and 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;
- l. Records are kept of all sightings of marine mammals (except seals). All records shall 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; and
- m. 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 shall be a 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, but 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:

- n. All members of the Mysticeti group (i.e. Baleen whales); and/or
- o. All members of the Physeteriodea group (i.e. Sperm whales); and/or
- p. All members of the Ziphiodea group (i.e. Beaked whales); and/or
- q. All members of the Globicephala group (i.e. Pilot whales); and/or
- r. All members of the Orcinus group (i.e. Killer whales).

Underwater Noise

11. At all times during the operation of marine vessels and/or project equipment, the Consent Holder shall comply with the following requirements in relation to underwater noise:
 - a. The combined noise from the IMV and the Seabed Sediment Extraction Device (“Crawler”) operating under representative full production conditions shall 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 m shall 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 shall not exceed a sound pressure level of 135 dB re 1µPa RMS linear;
 - d. Measurements shall be undertaken in calm sea conditions (e.g. Beaufort sea state less than 3 (beginning of white-capping)), with no precipitation and no external noise sources (e.g. passing ships);
 - e. The monitoring equipment shall be calibrated before and after measurements; and
 - f. The combined noise shall be monitored:
 - i. Within twenty (20) working days of seabed material extraction activities authorised by these consents 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 shall undertake continuous noise measurement for a period of no less than six (6) weeks;
 - ii. An additional two 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.
 - vi. 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, the noise shall be monitored within twenty (20) working days of the change to demonstrate compliance with Condition 11.b. has been maintained.

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.

12. The Consent Holder shall design and construct the crawler and IMV to achieve a total combined noise source level (measured in water), when operating at full production, of not more than 171 dB re 1µPa RMS linear at one (1) metre.

13. Prior to deployment in New Zealand, the Consent Holder shall 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 shall include both theoretical assessment and noise data collected from field measurements during pre-deployment commissioning.
14. For the avoidance of doubt, the Consent Holder shall not commence extraction activities until the certification required by Condition 13 has been received by the Consent Holder and provided to the EPA.
15. The Consent Holder shall 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 shall also occur at the same times as monitoring is undertaken under Conditions 11.f.ii to v.
17. Underwater monitoring at and beyond the 120 dB contour identified in Schedule 7 shall occur to ensure that a sound pressure level of 120 dB re 1 μ Pa is validated.
18. Within twenty (20) working days of any noise monitoring undertaken in accordance with Condition 11, the Consent Holder shall provide a detailed report on the monitoring and results to the EPA. As a minimum, this report shall include:
 - a. Details of the equipment used and calibration methods used;
 - b. A description of the measurement conditions and location;
 - 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
 - d. At the commencement of operations, validation of the noise model and 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.
19. Notwithstanding Conditions 3 - 18 above, the Consent Holder shall 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 Consent Holder shall advise the EPA of any such adverse effects that are identified.

Archaeological Remains (Shipwrecks)

20. If any of the following:
 - a. Steel;
 - b. Brass;

- c. Other metals in solid state;
- d. Manufactured or worked timbers; or
- e. Other material not naturally found in the seabed material extraction area,

are discovered during seabed material extraction activities authorised by these consents that are of potential historical or cultural importance, the Consent Holder shall immediately stop extraction activities within the discovery area.

21. The Consent Holder shall record all discoveries made under Condition 20 and as a minimum record:
- a. GPS location and depth of the find;
 - b. Photos of the find; and
 - c. A detailed description of the find.

This record shall be provided to an appropriately qualified and experienced archaeologist for interpretation and identification, and provided to the EPA and Heritage New Zealand Pouhere Taonga (“HNZ”) upon completion.

22. Further to the requirements of Condition 21, the Consent Holder shall notify the EPA within five (5) working days of any discoveries made in accordance with Condition 20.

Additionally, the Consent Holder shall consult with HNZ and the iwi representatives referred to in Condition 72 to confirm the origin and any other relevant information to the discovery including, as a minimum:

- a. What it is that has been discovered; and
- b. What the age of the discovery is.

23. If the discoveries under Condition 20 are found to be a legally protected archaeological site (origins pre-dating 1900), the Consent Holder shall obtain the relevant Archaeological Authority from HNZ prior to any seabed material extraction activities recommencing within the discovery area.

24. The Consent Holder shall not recommence seabed material extraction activities authorised by these consents in the discovery area until HNZ has confirmed the discovery does not qualify as a legally protected archaeological site (pre-1900 shipwreck) as described under the Heritage New Zealand Pouhere Taonga Act 2014 or the relevant Archaeological Authority has been obtained in accordance with Condition 23.

The Consent Holder shall inform the EPA of the outcome of any engagement with HNZ as soon as practicable, but no later than (5) working days) following the completion of any engagement process.

OPERATIONAL CONTROLS

Vessel and Operational Management

25. The Consent Holder shall ensure that when extracting seabed material using the Crawler, the cut depths shall not be deeper than eleven (11) m below the pre-mined seabed level and that only one (1) Crawler is in use, or in place, on the seabed at any time.

The Consent Holder shall continuously record the cut depth of the Crawler and report on this as part of the Quarterly Operational Report required by Condition 103.

26. The IMV shall be anchored to the seabed at all times when the Crawler is operating.

Upon each resetting of any anchor, the Consent Holder shall undertake a 'proof-load test' for the anchor and keep a record of each test. In addition to recording the proof-loading tests, each test shall be witnessed by the relevant Class society or Marine Warranty Surveyor. The record of all tests undertaken shall be made available to the EPA upon request following a review by a suitably qualified expert.

In situations where the mooring or thruster assistance of the IMV is in a degraded capability situation and is deemed unsafe by the Captain of the IMV, all Floating Storage and Off-loading transshipment operations shall cease immediately and the IMV shall be removed to a safe location until the capability situation is, in the opinion of the Captain of the IMV, deemed operationally safe.

For the purpose of this condition, "safe location" is defined as "safe for the Consent Holder's personnel and assets, the Kupe assets, and shipping".

27. The discharge of all de-ored sediment from the IMV, shall take place by means of a dedicated pipe which discharges at a nominal distance of four (4) m above the seabed.

The height and GPS position of any mounds created on the seabed during the deposition of de-ored sediments shall be recorded and reported on in the Quarterly Operational Report required by Condition 103. Re-deposition mound heights shall be recorded with accuracy for both height and location of +/- one (1) m.

All mounds remaining at the beginning of each lane shall be no higher than 4 metres above the level of the original seabed.

For the purpose of this condition, the 'seabed' refers to the area immediately below the point of discharge, whether that be the natural seabed or the base of the mining pit.

28. The direct deposition of de-ored sediment onto the seabed shall not occur within 300 m of the seaward boundary of the Coastal Marine Area.

29. All pits remaining at the end of each mining lane shall be no deeper than ten (10) m maximum depth and five (5) m average depth below the pre-mined seabed level.

The average and maximum depth and GPS position of any unfilled pits remaining after completion of a mining lane shall be recorded and reported in the Quarterly Operational Report required by Condition 103.

30. The Consent Holder shall ensure that:
 - a. Pits created by the removal of seabed material, other than those at the end of each mining lane, are backfilled using de-ored sediments; and
 - b. Other than at the commencement of each mining lane, all de-ored sediment is backfilled into the mining lanes.

Effects on Existing Interests

31. At all times during the term of these consents, the Consent Holder shall, to the greatest extent practicable, mitigate and where practicable avoid, any adverse effects on the environment or on existing interests (including infrastructure and operations of licences) as a result of mooring failure or loss of position.
32. At all times during the term of these consents, the Consent Holder shall:
 - a. Mitigate, and where practicable avoid, adverse biosecurity effects resulting from activities being undertaken by the IMV, Floating Storage and Offloading Vessel and other support vessels; and
 - b. Ensure that there are effective procedures in place to manage biosecurity risk from overseas and domestic vessels.
33. The Consent Holder shall manage all activities associated with the seabed material extraction operations, including the project vessels and their operation, to ensure that the activities authorised by these consents do not result in any adverse effects on the Operator of the Kupe Petroleum Mining License #38146 (“the Kupe Operator”) Kupe assets and Infrastructure.

Spill Prevention

34. At all times during the term of these consents, the Consent Holder shall undertake all necessary measures to ensure that there are no discharges or spills of oils or fuels from any of the operational vessels into any environment.
35. Notwithstanding Condition 34, in the event that there is a discharge or spill of oil or fuels, the Consent Holder shall implement all necessary operational responses, including the measures set out in oil spill contingency plans required under Parts 130A and 131 of the Marine Protection Rules, to ensure that any adverse effects associated with such event/s are remedied or mitigated.

As soon as practicable following any spill or discharge of oil or fuels, the Consent Holder shall notify the EPA of any such event. Notification shall include a description of the event, its location and the Consent Holder’s response.

Advice Note: Parts 130A and 130 of the Marine Protection Rules require oil spill contingency plans to be approved by MNZ for ships and installations.

“Soft Starts”

36. The Consent Holder shall ensure that any start-up, whether related to commencement or re-commencement after a break, of the seabed material extraction activities authorised by these consents shall be completed as a “soft start” whereby equipment shall be gradually increased in power over a minimum of twenty (20) minutes. For clarity, a “soft start” includes noise from the IMV, Crawler and any associated plant.

Soft starts may only commence in daylight hours and during good sighting conditions (visibility to at least 500 m).

37. Prior to each start-up, the Consent Holder shall use suitably trained marine mammal observer(s), in accordance with Condition 88, to conduct pre-start observations over a 500 m radius (mitigation zone) surrounding the IMV for at least thirty (30) minutes to ensure no whales, dolphins, seals or sea lions are present within the mitigation zone.

If any whales, dolphins, seals or sea lions are observed in the mitigation zone during pre-start observations, then the soft start shall be delayed until the marine mammals 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 shall 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 shall be a 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).

Mooring of the Integrated Mining Vessel

38. All mooring lines and associated anchors for the IMV shall be located within the area bounded by the co-ordinates set out below and within the boundary shown in Schedule 5:

Longitude	Latitude
174 02 25.991 E	39 50 31.772 S
174 02 50.521 E	39 50 36.773 S
174 03 01.220 E	39 50 44.081 S
174 03 37.595 E	39 51 19.249 S
174 06 08.626 E	39 51 11.999 S
174 06 34.844 E	39 51 10.325 S
174 07 03.608 E	39 51 26.161 S
174 07 29.690 E	39 51 19.249 S
174 07 34.410 E	39 51 10.688 S

Longitude	Latitude
174 07 48.173 E	39 51 00.184 S
174 09 17.294 E	39 50 08.963 S
174 01 54.984 E	39 50 44.354 S
174 01 38.867 E	39 51 00.295 S
174 01 29.982 E	39 51 19.120 S
174 01 27.257 E	39 52 37.056 S
174 01 38.838 E	39 53 00.222 S
174 02 21.106 E	39 53 34.505 S
174 02 21.106 E	39 53 34.505 S
174 03 20.239 E	39 54 15.826 S
174 03 24.102 E	39 54 18.205 S
174 04 08.746 E	39 54 42.628 S
174 04 27.660 E	39 54 48.330 S
174 05 33.180 E	39 54 54.950 S
174 07 17.836 E	39 55 01.477 S
174 07 43.140 E	39 54 56.884 S
174 09 26.539 E	39 54 08.428 S
174 12 40.756 E	39 52 22.433 S
174 12 45.767 E	39 52 19.229 S
174 13 29.914 E	39 51 45.857 S
174 10 22.771 E	39 49 12.680 S

39. If any equipment or machinery greater than one (1) m x one (1) m in size is lost overboard from any project or operational vessel, the Consent Holder shall collect it from the seafloor as soon as practicable but no later than five (5) working days from the time it was lost overboard.

Where it is not practicable to recover the item, the Consent Holder shall provide a description of the item (including dimensions) and record the location and depth that the item was lost overboard. This information shall be provided to the EPA, Land Information New Zealand, and the Harbour Master (if within the twelve (12) nautical mile limit) and placed on the Consent Holder’s website (Condition 81) within twenty four (24) hours of the item going overboard.

40. Notwithstanding the requirements of Condition 39 the Consent Holder shall ensure that any equipment or structures involved with the extraction operations are removed from the seabed, no later than twenty (20) working days following the completion of all seabed material extraction activities authorised by these consents.

Advice Note: Conditions 39 and 40 do not remove any obligation of the Consent Holder to comply with Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act.

Other Discharges from Operational Vessels

41. The Consent Holder shall not dispose of, or discharge, any harmful substances at sea.

All hazardous and/or oily waste shall be stored on board each project vessel for transport in suitable containers or packaging to a shore side reception facility that is authorised to accept such material. The Consent Holder shall keep a record of all such material and the reception facility/facilities and make this information available to the EPA upon request.

For the purpose of this condition, 'harmful substances' do not include any 'mining discharges' from the seabed material extraction activities authorised by these consents as defined by section 4 of the EEZ Act.

42. All fuel used in the operational vessels shall have a sulphur content compliant with the current International Maritime Organization limit, or no greater than 3.5% (w/w) by weight, whichever is the lesser.

A record of all fuel used in, and the sulphur content of, any of the project vessels shall be kept and provided as part of the Annual Report required under Condition 104 and shall be made available to the EPA upon request.

Biosecurity Management

43. All operational vessels carrying ballast water that travel to and from overseas ports, including bulk carriers, shall be required to have a shipboard ballast water treatment system as part of their charter agreements with the Consent Holder. The ballast water treatment system shall be in the Ministry for Primary Industry List of Approved Ballast Water Treatment Systems, or be an equivalent system approved by the International Maritime Organization.

Any vessel that does not comply with the above requirements shall not be used for any part of the activities authorised by these consents, unless the vessel's Master can demonstrate that the vessel complies with additional ballast water management options listed in the Ministry for Primary Industries' Import Health Standard: Ballast Water from All Countries, 16 December 2015, or any replacement rule or standard, including the Maritime New Zealand ("MNZ") Marine Protection Rules (Part 300: Ballast Water Management).

The Consent Holder shall keep a record of the approved ballast water management for each vessel and shall provide this information to the EPA upon request.

44. The Consent Holder shall ensure that:
- a. All long term stay overseas vessels that are to be located in the project area, including but not limited to the IMV and Crawler; and
 - b. All vessels servicing the seabed material extraction operation that regularly travel to and from overseas ports, including bulk carriers,

meet the 'Clean Hull' for 'long-stay vessels' requirement specified in the Ministry for Primary Industries Craft Risk Management Standard: Biofouling on Vessels Arriving to New Zealand, 15 May 2014 ("the CRMS"), or any subsequent version thereof. For vessels identified in Clause a. above, special measures

to minimise biofouling risk shall be included in the Biosecurity Management Plan (“BMP”) developed under Condition 70.

Any vessel that does not comply with the above requirements shall not be used for any part of the seabed material extraction activities authorised by these consents.

45. Within twenty (20) working days of each anniversary of the commencement of these consents, the Consent Holder shall provide a copy of the ‘Biofouling Record Book’ (Condition 70.b.iv) to a nominated representative of the Aquaculture Industry, as appointed by Aquaculture New Zealand.

The Consent Holder shall provide a copy of the Biofouling Record Book to the EPA upon request.

46. Vessels associated with operations authorised by these consents shall only enter and anchor in Admiralty Bay for the purpose of seeking shelter in adverse weather or vessel safety requirements, and under no circumstances shall any operational or maintenance activities, including the discharge of ballast water, be undertaken at this location unless:
- a. An emergency situation arises and, in the opinion of the vessel’s Master, there is no practicable alternative; and
 - b. MNZ, the Marlborough District Council, Aquaculture New Zealand and a nominated representative of Ngāti Koata are notified as soon as practicable, but no later than five (5) working days, following the occurrence of any such emergency event.

The Consent Holder shall keep a record of all notifications required by this condition and shall provide this information to the EPA upon request.

The Consent Holder does not need to comply with this condition in the event that the Director of MNZ directs a vessel to enter Admiralty Bay as a safe anchorage in accordance with the Maritime Transport Act 1994.

47. Prior to any vessels associated with operations authorised by these consents entering and anchoring in Admiralty Bay in accordance with Condition 46, the Consent Holder shall notify Ngāti Koata as soon as reasonably practicable, but no later than five (5) working days, and, to the extent practicable:
- a. Provide the opportunity for a nominated representative from Ngāti Koata to have input in the anchoring location within the bay; and
 - b. Provide the opportunity for a nominated Ngāti Koata iwi observer to monitor the presence of marine mammals.

The Consent Holder shall keep a record of all notifications required by this condition and shall provide this information to the EPA upon request.

PRE-COMMENCEMENT MONITORING

Pre-commencement Environmental Monitoring Plan

48. Prior to the commencement of any seabed material extraction activities authorised by these consents, the Consent Holder shall ensure that a minimum of two (2) years of environmental monitoring has been undertaken and shall, as a minimum, include monitoring of:

- Suspended sediment concentrations as measured from two weekly grab samples and as calculated from continuous turbidity measurements;
- Sediment quality;
- Subtidal and intertidal biology;
- Optical water quality;
- Physio-chemical parameters;
- Heavy metals;
- Oceanography;
- Primary production;
- Zooplankton;
- Seafood resources;
- Marine mammals;
- Underwater noise;
- Seabirds;
- Commercial fishing;
- Beach profiles; and
- Recreational fishing.

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

The Consent Holder shall prepare, and undertake pre-commencement environmental monitoring, 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 which is to:

- a. Establish a set of environmental data that identifies natural background levels while taking into account 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 authorised by these consents;
- 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 pre-commencement 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 shall be prepared by a suitably qualified and experienced person(s) in general accordance with the draft BEMP dated August 2016. The PCEMP shall then be independently peer reviewed by a suitably qualified and experienced person(s) and then reviewed by the Technical Review Group (“TRG”) (Condition 61) to confirm 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, shall be submitted to the EPA for certification that the PCEMP meets the requirements of this condition.

If within thirty (30) working days the EPA has not certified the PCEMP, or advised the Consent Holder that it has not yet been certified, the PCEMP will be deemed to have been so certified.

The pre-commencement monitoring required by these consents shall 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. Any amendments shall be prepared by a suitably qualified and experienced person(s), and shall 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 changes will only come into effect once they have been certified by the EPA that such amendment is 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.

If within twenty (20) working days the EPA has not certified the amended PCEMP, or advised the Consent Holder that it has not yet been certified, the amended PCEMP will be deemed to have been so certified

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

Minor amendments that take into account unforeseen circumstances, or that address circumstances that require immediate action on site do not need to be submitted in advance of the work being undertaken, provided the effects of such amendments are no greater than those provided for under the consents. The Consent Holder should submit any such amendments as soon as practicable but no later than five (5) working days after the minor amendments are made.

50. For the purpose of all monitoring in accordance with the conditions of these consents, the Consent Holder shall undertake monitoring 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 shall as soon as practicable, but no later than twenty four (24) hours following, notify the EPA of any such occurrence identifying:

- (a) What monitoring was affected and for how 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 Condition 48, the Consent Holder shall determine updated 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 updated 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, then the updated numerical

values shall 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.

OPERATIONAL SEDIMENT PLUME MODEL

52. At all times during the term of these consents, the Consent Holder shall maintain an Operational Sediment Plume Model (“OSPM”), in order to ensure that activities authorised by these consents comply with the conditions of these consents and to provide an effective mechanism to assist in:
- a. Predicting background and extraction derived Suspended Sediment Concentrations to inform the management of the seabed material extraction activities authorised by these consents;
 - b. Distinguishing operationally derived contributions to Suspended Sediment Concentrations from background processes; and
 - c. Forecasting, as accurately as practicable, sediment plume dynamics including but not limited to:
 - d. Intensity; and
 - e. Geographic spread.

The OSPM shall be run in real time forecast mode using up to date Met Ocean three (3), five (5), seven (7) or ten (10) day forecasts to inform the day to day mine operations and ensure that compliance with the SSC Limits specified in Condition 5 is maintained.

The OSPM shall be developed and maintained by a suitably qualified and experienced person(s).

The OSPM shall be updated and independently peer reviewed by a suitably qualified and experienced person at the following intervals:

- (a) Once at the conclusion of the PCEMP period prior to any seabed material extraction activities authorised by these consents; and
- (b) During seabed material extraction activities authorised by these consents, immediately following each calibration and validation exercise at the frequencies defined in Condition 53.

The scope of the OSPM independent review shall include the model, its calibration, validation, availability and applicability of data and the use of the OSPM in management of the seabed material extraction activities authorised by these consents. The predictive fine sediment identification methods and sampling density (Condition 87) shall be included within the review scope.

An OSPM report shall be prepared that summarises the establishment, calibration, validation, operation and updating of the OSPM. The OSPM report, including that updated OSPM, shall, together with the independent peer review, be provided to the TRG for review prior to lodgement with the EPA.

The OSPM report, including the updated OSPM, the comments and recommendations of the peer reviewer and the TRG, and explanations as to why any recommendation has not been accepted shall be provided to the EPA certification, that the updated OPSM satisfies the requirements of this Condition 52.

If within thirty (30) working days the EPA has not certified the updated OSPM, or advised the Consent Holder that it has not yet been certified, the updated OSPM will be deemed to have been so certified.

No seabed material extraction shall commence until the EPA has certified the updated OSPM required following the pre-commencement environmental monitoring period.

The Consent Holder shall at all times operate an EPA certified OSPM. If certification of an updated OSPM is not received, the Consent Holder shall continue to use the certified OSPM that was in use prior to lodgement of the updated OSPM.

53. The Consent Holder shall calibrate and validate the OPSM at least:

- a. Every six (6) months during the PCEMP and for the first three (3) years of seabed material extraction activities authorised by these consents; and
- b. Every twenty-four (24) months thereafter,

utilising the sediment data from the PCEMP (Condition 48), the Operational Assessment Report (Condition 87) and the on-going monitoring information collected in accordance with Conditions 54.

The calibration and validation exercise shall review the modelled and measured sediment plume properties. The Consent Holder shall review whether the benthic ecology and SSC monitoring sites are appropriately located to detect any adverse effect of SSC and report the outcome of that review to the TRG under Condition 61.b. Any change to the location of benthic ecology or SSC monitoring sites shall be by way of a change of conditions.

ENVIRONMENTAL MONITORING REQUIREMENTS

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

- Suspended Sediment Concentrations, as measured from two weekly grab samples and as calculated from continuous turbidity measurements;
- Sediment quality;
- Subtidal and intertidal biology;
- Optical water quality;
- Physio-chemical parameters;
- Heavy metals;

- Oceanography;
- Primary production;
- Zooplankton;
- Biosecurity;
- Seafood resources;
- Marine mammals;
- Underwater noise;
- Beach profiles; and
- Recreational fishing.

The Consent Holder shall 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 shall be addressed.

The Consent Holder shall prepare, and undertake environmental monitoring in accordance with the procedures and methods, at the locations, and for the duration and frequency detailed in the certified EMMP required by Condition 55.

Environmental Management and Monitoring Plan

55. The Consent Holder shall ensure that 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 shall, 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 8;
- f. Identify the TRG membership, and their evaluation process in accordance with Conditions 61 - 65;
- 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 shall be prepared by a suitably qualified and experienced person(s) in general accordance with the draft EMMP dated August 2016. The EMMP shall then be independently peer reviewed by a suitably qualified and experienced person(s) and then reviewed by the TRG (Condition 61) 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, shall be submitted to the EPA for certification that the EMMP meets the requirements of this condition.

The environmental monitoring required by these consents shall be undertaken in accordance with the certified EMMP and shall commence no later than one (1) month prior to the commencement of the seabed material extraction activities authorised by these consents.

If within thirty (30) working days the EPA has not certified the EMMP, or advised the Consent Holder that it has not yet been certified, it will be deemed to have been so certified.

No seabed material extraction shall commence until the EMMP has been certified by the EPA.

The environmental monitoring required by these conditions shall be undertaken in accordance with the EPA certified EMMP and shall commence at least twenty (20) working days prior to the commencement of the seabed material extraction activities authorised by these consents.

56. The Consent Holder may amend the EMMP at any time. Any amendments to the EMMP shall 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.

If within twenty (20) working days the EPA has not certified the amended EMMP, or advised the Consent Holder that it has not yet been certified, the amended EMMP will be deemed to have been so certified.

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

Minor amendments that take into account unforeseen circumstances on site, or that address circumstances that require immediate action do not need to be submitted in advance of the work being

undertaken, provided any effects of such amendments are no greater than those provided for under these consents. The Consent Holder should submit any such amendments made under this condition as soon as practicable, but no later than five (5) working days after the minor amendments are made.

Post-Extraction Benthic Recovery Monitoring

57. Following the completion of the seabed material extraction activities authorised by these consents, the Consent Holder shall undertake five (5) years of post-extraction monitoring of the biological environment, including heavy metal concentrations, within the consent area and its surrounds, the purpose of which is to assess whether recovery of the benthic environment, as defined in Condition 8, has been achieved.

At least three (3) months prior to the completion of the seabed material extraction activities authorised by these consents, the Consent Holder shall provide to the EPA for certification, a Post- extraction Monitoring Plan (“PEMP”) which shall, as a minimum, include:

- a. The roles and responsibilities of parties who are to undertake each aspect of the environmental monitoring;
- b. Objectives for the post-extraction monitoring of the activities authorised by these consents;
- c. Description of the TRG, their role and their evaluation process in accordance with Conditions 61 - 65;
- d. Identification of the sampling design and methodology for each of the parameters being monitored, including the frequency, duration and monitoring locations as set out in Schedule 6;
- e. Procedures for comparing the monitoring data against the background data that will assist in determining if the biological environment within the extraction area is recovering following the completion of the extraction activities;
- f. Details of data analysis and processing for all parameters being monitored; and
- g. Reporting methods for all parameters being monitored.

The PEMP shall be prepared by a suitably qualified and experienced person(s) and shall then be peer reviewed by the TRG (Condition 61) to confirm that the PEMP meets the purposes of the PEMP, as set out in this condition.

If within thirty (30) working days the EPA has not certified the PEMP, or advised the Consent Holder that it has not yet been certified, it will be deemed to have been so certified.

The post-extraction monitoring shall be undertaken in accordance with the certified PEMP.

58. Within twenty (20) working days of each anniversary of the commencement of the post-extraction monitoring programme, the Consent Holder shall, following consultation with the TRG, prepare and lodge with the EPA, an Annual Post-extraction Monitoring Report that includes as a minimum:
- a. The monitoring undertaken in the previous twelve (12) month period;
 - b. The monitoring to be undertaken in the next twelve (12) month period;

- c. Data collected from the monitoring undertaken and a comparison against all relevant environmental limits specified in the conditions of these consents;
 - d. Any remediation undertaken and the results of any such remediation;
 - e. A summary of any commentary or recommendations from the TRG and, where necessary, an explanation as to why any TRG recommendation has not been accepted; and
 - f. A summary report of the findings of the monitoring undertaken with conclusions drawn as to the recovery and overall biological health of the extraction area.
59. Within three (3) months of the completion of the post-extraction monitoring programme, the Consent Holder shall, following consultation with the TRG, prepare and lodge with the EPA, a Final Post-extraction Monitoring Report that includes as a minimum:
- a. A summary of all of the monitoring undertaken in the previous four (4) year period;
 - b. A summary report of the findings of the monitoring undertaken, including a comparison against all the relevant environmental limits specified in the conditions of these consents, and conclusions drawn as to the recovery and overall biological health of the seabed material extraction area; and
 - c. Identification of any commentary or recommendations from the TRG and, where necessary, an explanation as to why any TRG recommendation has not been accepted.

Laboratory Accreditation

60. All laboratory based analyses undertaken in conjunction with the requirements of these consents shall be performed by an IANZ accredited laboratory or, where applicable, any other accredited laboratory.

TECHNICAL REVIEW GROUP

61. At least six (6) months prior to the commencement of the PCEMP required by Condition 48, the Consent Holder shall provide for the formation of a TRG, the role of which is to provide technical advice to the Consent Holder, including but not limited to the following:
- a. Prior to their lodgement with the EPA, review and advise on the appropriateness of the monitoring provided for in the PCEMP and EMMP (Conditions 48 and 55), and any review of the PCEMP and EMMP (Conditions 49 and 56);
 - b. Compare the monitoring data against the pre-commencement data in order to assist in determining if any activities authorised by these consents have resulted in adverse effects on the marine environment that were not anticipated at the time of the granting;
 - c. Consider and make recommendations on the need for any new parameter to be monitored in accordance with Conditions 54 and 55;
 - d. Community knowledge and “mātauranga māori” issues when reviewing the monitoring data;
 - e. The environmental management component of the seabed material extraction activities authorised by these consents, by an annual data review whereby each year’s monitoring results will be tabulated, reviewed, and compared against the previous monitoring data collected; and

- f. Make recommendations to the Consent Holder that it recommends to the EPA that a review of the consent conditions in accordance with Condition 106 of these consents be instigated for the purpose of dealing with any adverse effects on the environment which may arise from the exercise of these consents and which it is appropriate to deal with at a later stage.

The Consent Holder shall invite the following parties to nominate one suitably qualified and experienced representative to be involved in the TRG:

- g. The Consent Holder;
- h. Taranaki Regional Council;
- i. Fisheries Inshore New Zealand;
- j. The Kaitiakitanga Reference Group (Condition 73);
- k. Te Tai Hauāuru Regional Fishing Forum;
- l. The Department of Conservation; and
- m. The Kupe Operator.

Each representative shall have specialist expertise in one or more of the key environmental, ecosystem, mātauranga māori (Māori traditional knowledge) and engineering components being monitored.

In the event that a Kaitiakitanga Reference Group, as specified in Condition 73, is not formed the Consent Holder is not required to extend an invitation to any alternative party. (refer to the Advice Note below)

In the event that Fisheries Inshore New Zealand do not accept the invitation to nominate a representative, the Consent Holder shall invite Sanford Limited to do so.

At any time during the term of these consents, any party who appoints a representative to the TRG may change that representative on the basis that any new representative also has the relevant qualifications and experience.

At any time during the term of these consents, including if any party is not able, for whatever reason, to provide a representative to the TRG, the TRG may recommend to the Consent Holder that other suitably qualified and experienced specialists be seconded, or technical studies be commissioned for the proper exercise of the TRG functions. The decision on whether to act on such a recommendation will rest with the Consent Holder after consultation with the EPA, however the Consent Holder shall ensure that the TRG always has a membership which includes specialist expertise in all of these specified fields.

Advice Note: The Consent Holder is still required to comply with Condition 80.

- 62. The Consent Holder shall maintain the TRG for the duration of these consents, and beyond as necessary, to provide for the review and commentary on any post-extraction monitoring undertaken in accordance with these consents.

63. The Consent Holder shall convene meetings of the TRG:
- a. Annually, following the completion of each year of monitoring, during the pre-commencement environmental monitoring period;
 - b. Then, for the first five (5) years following the commencement of the seabed material extraction activities authorised by these consents, on a quarterly basis (during the months of January, April, July and October of each year) with one meeting to occur following completion of each annual monitoring period;
 - c. Then annually, following completion of each annual monitoring period, for the duration of these consents;
 - d. Then annually, following the completion of each annual post-extraction monitoring period; and
 - e. At any other time requested by the Consent Holder.

For the purpose of this condition, the 'annual monitoring period' is the twelve (12) month period commencing in the month in which the pre-commencement environmental monitoring or the operational environmental monitoring commenced. Further, the 'annual post-extraction monitoring period' is the twelve (12) month period commencing in the month following the month that the seabed material extraction activities authorised by these consents ceased.

64. The Consent Holder shall fund the administration of each meeting of the TRG and shall meet all actual and reasonable costs incurred by any other specialists seconded to the TRG, as provided for in Condition 61.
65. Minutes of each of the TRG meetings, including the identification of any disagreements between the TRG members and any recommendations provided by the TRG to the Consent Holder, shall be taken and forwarded to its members, the Consent Holder, the Kaitiakitanga Reference Group, and the EPA, and provided on the Consent Holder's website (Condition 81), within ten (10) working days of any meeting being held.

Minutes of each meeting shall also be summarised in the Annual Report required by Condition 104.

MANAGEMENT PLANS

Seabird Effects Mitigation and Management Plan

66. The Consent Holder shall prepare a Seabird Effects Mitigation and Management Plan ("SEMMP") that has been prepared following consultation with the Department of Conservation and the KRG (if it has been formed), which shall, as a minimum:
- a. Set out how compliance with Condition 9 will be achieved;
 - b. Set out indicators of adverse effects at a population level of seabird species that utilise the South Taranaki Bight due to mortality or injury of seabirds of the species classified under the New Zealand Conservation Status as "Nationally Endangered", "Nationally Critical" or "Nationally

Vulnerable” or classified “Endangered” or “Vulnerable” in the International Union for the Conservation of Nature “Red List”;

- c. Identify responses / actions to be undertaken by the Consent Holder if the indicators in (b) are reached; and
- d. Outline any monitoring requirements for bird strike due to vessel lighting and, where necessary, provide for procedures to alter vessel lighting and vessel operations to reduce the incidence of bird strike.

The SEMMP shall be prepared by a suitably qualified and experienced person(s) in general accordance with the draft SEMMP dated August 2016, and submitted to the EPA for certification that the requirements of this condition have been met.

No seabed material extraction shall commence until the SEMMP has been certified by the EPA.

The Consent Holder may amend the SEMMP at any time provided such amendments have been prepared in consultation with the Department of Conservation, such amendments are consistent with the purpose of this condition.

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

The activities authorised by these consents shall be undertaken in accordance with the latest certified SEMMP.

A copy of the certified SEMMP, or any subsequently certified amendment, shall be held on-board each of the Consent Holder’s project vessels and at the Consent Holder’s head office.

Marine Mammal Management Plan

67. The Consent Holder shall prepare a Marine Mammal Management Plan (“MMMP”) following consultation with the Department of Conservation and the KRG (if it has been formed), which shall, as a minimum, set out:
 - a. How compliance with Condition 10 will be achieved; and
 - b. Procedures and protocols to minimise the risk of whale and dolphin entanglement; and
 - c. Set out indicators of adverse effects at a population level of marine mammals that utilise the South Taranaki Bight listed in Condition 10.a.; and
 - d. A training framework relating to marine mammal operational responses; and

Integrate any obligations under the Marine Mammals Protection Act 1978 and Marine Mammals Protection Regulations 1992, or any superseding legislation.

The MMMP shall be prepared by a suitably qualified and experienced person(s) in general accordance with the draft MMMP dated August 2016, and submitted to the EPA for certification that the requirements of this condition have been met.

No seabed material extraction shall commence until the MMMP has been certified by the EPA.

Any amendments to the MMMP shall be submitted to the EPA for certification, and shall only be implemented following confirmation 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 shall continue to use the plan which was in place prior to the lodgement of the amended plan.

The activities authorised by these consents shall be undertaken in accordance with the latest certified MMMP. A copy of the latest MMMP shall be held on-board each of the Consent Holder's project vessels and at the Consent Holder's held office.

Collision (Loss of Position) Contingency Management Plan

68. The Consent Holder shall prepare a Collision (Loss of Position) Contingency Management Plan ("CCMP") following consultation with the Kupe Operator.

The purpose of the CCMP is to demonstrate how the objectives set out below will be achieved and to outline the specific operating procedures to be implemented during the seabed material extraction operations. The CCMP shall, as a minimum, identify the following:

- a. How compliance with Conditions 31 and 33 will be achieved;
- b. The processes, methods, procedures and responses to be implemented after any unplanned / emergency event that potentially results in mooring failure or loss of position;
- c. The measures which will be taken to avoid, remedy or mitigate any adverse environmental effects or effects on existing interests such as the infrastructure and operations of the licensee of Petroleum Mining License #38146;
- d. How the IMV will be operated to 'sit out' severe environmental conditions such that the risk of collision between the Consent Holder's assets and the Kupe assets is as low as reasonably practicable;
- e. The emergency procedures to be implemented in the event of a mooring failure / loss of station-keeping by the IMV;
- f. The protective measures / procedures proposed should any aspect of the thruster system, and its associated systems, be rendered out of service by accident or planned maintenance, such that they are immediately available in the event of a mooring leg failure;
- g. The procedure for ensuring that, when the IMV is operating in any position where a station keeping failure may result in a potential collision of the IMV or its dragged mooring system with the Kupe assets, the thruster system be fully operational and active to enable immediate control of the IMV in the event of an incident. This shall include having such power generation capacity on line at these times;

- h. The procedures for the recovery and setting of the IMV anchors such that the required anchor holding capacity is achieved including an operability assessment assessing the likelihood that an anchor handling operation cannot be completed due to a fast rising storm;
- i. The measures to address the reduced station keeping integrity of the mooring whilst recovering, running and re-setting anchors;
- j. The planned inspection regime for the safety critical TAM systems including the discard criteria for the mooring wires;
- k. The detailed emergency response procedure (including communication requirements and notification periods) addressing incidents such as mooring leg failure, loss of heading control, thruster drive off, and disablement of thruster system. The response must address the risk of collision between the Consent Holder's assets and the Kupe assets to ensure the risk is 'As Low As Reasonably Practicable';
- l. The procedure for recovering and resetting of the mooring line and anchor buffer zone with regard to the requirements for the Anchor Handling Tug to recover and set anchors; and
- m. The joint operating procedures for the trans-shipment of ore between the IMV and the Floating Storage and Off-loading Vessel.

All operational procedures shall be developed to reflect the safe operating requirements outlined in the final version of the CCMP with clear descriptions on when each procedure is applicable (i.e. normal operations, or under emergency trigger conditions).

The CCMP shall be prepared by a suitably qualified and experienced person(s) and submitted to the EPA for certification that the requirements of this condition have been met.

Prior to being finalised, the CCMP shall be independently reviewed by a suitably qualified and internationally recognised person or body. The review shall confirm that the CCMP is fit for purpose and demonstrates that the objectives above will be achieved, including sufficient detail as to the operating procedures required to achieve them. The recommendations of the review shall be incorporated into the final version of the CCMP.

No seabed material extraction shall commence until the CCMP has been certified by the EPA.

The Consent Holder may amend the CCMP at any time during the term of these consents following consultation with the Kupe Operator. At the Kupe Operator's request, the proposed amendments to the CCMP shall be subject to a further independent peer review. The Consent Holder shall consult with the Kupe Operator on the recommendations of that peer review prior to them being incorporated into the final amendments to the CCMP that are lodged with the EPA.

Any changes to the CCMP will only come into effect once consultation with the Kupe Operator has occurred and any such amendment is consistent with the purpose of these conditions. A copy of the CCMP shall be held on all operational vessels and at the Consent Holder's head office and shall be provided to the EPA and the Kupe Operator upon request.

The reviewer shall be mutually agreed between the Consent Holder and the Kupe Operator. In the event that the Consent Holder and the Kupe Operator cannot reach agreement, each party shall recommend one suitably qualified independent reviewer to the Chief Executive of the EPA who will decide on the reviewer to be appointed from the two recommendations. The costs of the review will be met by the Consent Holder.

Simultaneous Operations Plan

69. The Consent Holder shall prepare a Simultaneous Operations Plan (“SIMOPP”) in accordance with the requirements of IMCA M 203 Guidance on Simultaneous Operations (SIMOPS) following consultation with the Kupe Operator.

The purpose of the SIMOPP is to:

- a. Define the procedures to be followed when two or more vessels are operating in the same general area and in close proximity to each other;
- b. Outline the consultation framework under which the Kupe Operator may provide input into the Consent Holder’s design and execution of the mining operations;
- c. Identify how the Consent Holder will operate within the guidelines as specified in IMCA M 203, Guidelines on Simultaneous Operations; and
- d. Identify how the operations of both the Consent Holder and the Kupe Operator within the area of Petroleum Mining Licence #38146 will be conducted for the duration of the seabed material extraction operations.

The SIMOPP shall, as a minimum, set out:

- (a) How mining operations will be managed in the event that a ‘Jack-up Drill Rig’ is being moved into position or temporarily moored adjacent to the Kupe platform prior to spudding in or jacking down of a rig;
- (b) How the Consent Holder shall confer with the Kupe Operator regarding the sequence of blocks of areas to be mined to ensure that any proposed pipeline corridor or location for a ‘Jack -up Drill Rig’ has time to consolidate, based on the geotechnical data relevant to that block.
- (c) How the Consent Holder shall confer with the Kupe Operator with regards to the planning of maintenance activities undertaken by the Kupe Operator on the Kupe assets.

Prior to being finalised, the SIMOPP shall be independently reviewed by a suitably qualified and internationally recognised person or body. The review shall confirm that the SIMOPP is fit for purpose, and identifies how the Consent Holder will operate within the guidelines as specified in IMCA M 203, Guidelines on Simultaneous Operations. The recommendations of that review shall be incorporated into the SIMOPP.

The SIMOPP shall be finalised and provided to the EPA and the Kupe Operator at least three (3) months prior to the commencement of any seabed material extraction activities authorised by these consents.

The SIMOPP may be amended at any time during the term of these consents following consultation with the Kupe Operator. At the Kupe Operator's request, proposed amendments to the SIMOPP shall be subject to a further independent peer review. The recommendations of that review shall be incorporated into the SIMOPP.

The Consent Holder shall ensure that the EPA has a copy of the most update version of the SIMOPP at all times, and shall provide a copy to the Kupe Operator upon request.

The reviewer shall be mutually agreed between the Consent Holder and the Kupe Operator. In the event that the Consent Holder and the Kupe Operator cannot reach agreement, each party shall recommend one suitably qualified independent reviewer to the Chief Executive of the EPA who will decide on the reviewer to be appointed from the two recommendations.

Biosecurity Management Plan

70. The Consent Holder shall, following consultation with the Ministry for Primary Industries and a nominated representative from Aquaculture New Zealand, prepare, a Biosecurity Management Plan ("BMP") which shall, as a minimum, contain or require the following:
- a. For overseas vessels, describe the 'acceptable measures' for biofouling management that will be implemented to meet the 'Clean Hull' requirement of the CRMS, or demonstrate an equivalent level of risk;
 - b. For all vessels, both overseas and domestic, prepare a vessel-specific 'Biofouling Management Plan', in accordance with the International Marine Organization 2011 'Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species' ("the IMO Guidelines"), or any subsequent version thereof. The Biofouling Management Plan shall include or require the following:
 - i. Details of the anti-fouling systems and operational practices or treatments to be used, including those for niche areas (e.g. 'sea chests');
 - ii. Identification of hull locations susceptible to biofouling, and a schedule of planned inspections, repairs, maintenance and renewal of anti-fouling systems;
 - iii. Details of the recommended operating conditions suitable for the chosen anti-fouling systems and operational practices;
 - iv. Other relevant details as described in Appendices 1 and 2 of the IMO Guidelines, including maintenance of a 'Biofouling Record Book', which records details of all inspections and biofouling management measures undertaken on the vessel;
 - c. For overseas vessels that are to be permanently located in the vicinity of the project area, the BMP shall consider additional special measures that can be implemented to minimise biosecurity risk. These could include, but are not limited to, any of the following:

- i. Using new-build vessels that have appropriate anti-fouling systems;
- ii. Minimising the time vessels spend idle in water before departure from the overseas source port, in order to minimise the risk of colonisation by biofouling organisms;
- iii. Ensuring appropriate measures are in place for sources of risk in addition to biofouling, such as cleaning and removal of sediment; and
- iv. Acquiring vessels from regions that are not 'climatically matched' to the project area, in order to further mitigate any residual risk.

The BMP shall be prepared by a suitably qualified and experienced person(s) and submitted to the EPA for that the requirements of this condition have been met.

No seabed material extraction shall commence until the BMP has been certified by the EPA.

The Consent Holder may amend the BMP at any time provided such amendments have been prepared in consultation with the Ministry for Primary Industries and a nominated representative from Aquaculture New Zealand, and the changes are consistent with the purposes of this condition.

The BMP shall be updated as necessary to reflect the most up-to-date marine standards and guidelines, and any amendments to the BMP shall be submitted to the EPA for certification, and shall only be implemented following confirmation from the EPA that the amended BMP meets the requirements of this condition. Where certification for an amended plan is not received, the Consent Holder shall continue to use the plan which was in place prior to the lodgement of the amended plan.

The activities authorised by these consents shall be undertaken in accordance with the latest BMP. A copy of the latest BMP shall be held on-board each of the Consent Holder's project vessels and at the Consent Holder's head office.

Safety Case

71. The Consent Holder shall, following consultation with WorkSafe New Zealand, prepare a Safety Case which shall, as a minimum identify:
 - a. What the major hazards are associated with the activities authorised by these consents, from a safety and environmental perspective; and
 - b. What control measures are necessary to prevent harm arising from these hazards; and
 - c. The standards that such control measures would need to meet.

The Safety Case shall include the matters set out in Appendix 1 and Appendix 2 attached to WorkSafe New Zealand's letter to the EPA dated 2 May 2017 presented during the hearing process.

The Safety Case shall be prepared by a suitably qualified and experienced person(s). The Safety Case shall then be independently peer reviewed by a suitably qualified and experienced person(s) to ensure that the requirements of this condition have been met before it is submitted to the EPA.

No seabed material extraction shall commence until the independently reviewed Safety Case has been submitted to the EPA.

The Consent Holder may amend the Safety Case at any time provided such amendments have been prepared in consultation with WorkSafe New Zealand, and any changes are consistent with purposes of this condition.

The activities authorised by these consents shall be undertaken in accordance with the latest Safety Case and a copy of the latest Safety Case shall be held on-board each of the Consent Holder's project vessels and at the Consent Holder's head office, and provided to the EPA upon request.

RELATIONSHIP WITH TANGATA WHENUA

Advice Note: To the extent that any of conditions 72 – 85 are ultra vires, they have been proffered by the Consent Holder on an Augier basis.

Advice Note: Notwithstanding Conditions 72 and 79, the Consent Holder acknowledges the relationship of tangata whenua, including but not limited to Ngāti Ruanui, Ngā Rauru and Ngāruahine, with the South Taranaki Bight, and undertakes to use its best endeavours to facilitate engagement with tangata whenua during the term of these consents.

72. The relationship of tangata whenua, including but not limited to Ngāti Ruanui, Ngā Rauru Kītahi and Ngāruahine, with the South Taranaki Bight shall be recognised and provided for by the Consent Holder through:
- a. Provision for the establishment and maintenance of a Kaitiakitanga Reference Group (Condition 73);
 - b. Provisions for involvement of the Kaitiakitanga Reference Group, in accordance with their defined role, in:
 - i. The TRG (Condition 61); and
 - ii. The Kaimoana Monitoring Programme (Condition 77).
73. Within twenty (20) working days of the commencement of these consents, the Consent Holder shall provide to tangata whenua, including but not limited to Ngāti Ruanui, Ngā Rauru Kītahi and Ngāruahine, a written offer to establish and maintain a Kaitiakitanga Reference Group, the purpose of which is to:
- a. Recognise the kaitiakitanga of tangata whenua, including but not limited to Ngāti Ruanui, Ngā Rauru Kītahi and Ngāruahine, and their relationship with the South Taranaki Bight;
 - b. Review and advise the Consent Holder on the suitability of the Kaimoana Monitoring Programme (Condition 77);
 - c. Provide for the on-going involvement of tangata whenua, who have a relationship with the South Taranaki Bight as kaitiaki, in monitoring the effects of the activities authorised by these consents, including a process for considering any future change to the membership of the Kaitiakitanga Reference Group;
 - d. Provide for kaitiaki responsibilities and values to be reflected in the monitoring of the seabed material extraction area and of the surrounding marine environment undertaken under these consents, including:

- i. To advise the Consent Holder on monitoring for changes to risk, or threat to, the cultural values of the South Taranaki Bight;
- ii. To evaluate the data obtained from physical monitoring insofar as it relates to the cultural values of the South Taranaki Bight and the effects on those values from the seabed material extraction and, in the event that changes to effects are identified, advise the Consent Holder on possible monitoring or operational responses;
- iii. To advise the Consent Holder on the appropriateness of any operational responses as they relate to cultural values, proposed by others;
- iv. To provide a means of liaison between tangata whenua, including but not limited to Ngāti Ruanui, Ngā Rauru Kītahi and Ngāruahine, and the Consent Holder through providing a forum for discussion about the implementation of these consents; and

Be responsible for receiving requests for, and facilitating the provision of, any cultural ceremonies by tangata whenua, including but not limited to Ngāti Ruanui, Ngā Rauru Kītahi, Ngāruahine, and other tangata whenua groups who have a relationship with the South Taranaki Bight.

Advice note: The Consent Holder records its commitment to implementing this condition in good faith and to using the services of an independent mediator, as necessary, in doing so.

74. Once the Kaitiakitanga Reference Group is formed, the Consent Holder shall provide details of its membership, and any subsequent changes, to the EPA.
75. The Consent Holder shall:
 - a. Be entitled to appoint one member of the Kaitiakitanga Reference Group.
 - b. Facilitate and fund the administration of each formal meeting of the Kaitiakitanga Reference Group. The first Kaitiakitanga Reference Group meeting shall convene within three (3) months of the formation of the Kaitiakitanga Reference Group. As a minimum, meetings shall be held at a sufficient frequency to ensure that the obligations of the Kaitiakitanga Reference Group are met, but in any event, shall not be less than one time per year.
 - c. Take minutes of the Kaitiakitanga Reference Group meetings, which shall be forwarded to members and the EPA, within twenty (20) working days of each meeting being held.
 - d. Give members at least twenty (20) working days' notice of the date, time and location of the next Kaitiakitanga Reference Group meeting.
 - e. Ensure that, where appropriate, the agreed outcomes from the Kaitiakitanga Reference Group meetings are available to other tangata whenua groups and the wider public.
76. The Consent Holder shall meet the actual and reasonable costs incurred by the Kaitiakitanga Reference Group for providing the services required of it by these consents, subject to normal business practice of invoicing and accounting.
77. At least (20) working days prior to the commencement of any seabed material extraction activities authorised by these consents, the Consent Holder shall prepare, and implement, a Kaimoana

Monitoring Programme following consultation with the Kaitiakitanga Reference Group if this group has been established.

The objective of the Kaimoana Monitoring Programme is to provide for the monitoring of species important to customary needs, including from customary fishing grounds around the site, of Māori who have a relationship to the site and shall identify as a minimum:

- a. The roles and responsibilities of parties who are to conduct the kaimoana monitoring;
- b. The methodology to be employed in the kaimoana monitoring, including to minimise the risks to health and safety, and the environment;
- c. The kaimoana indicators to be monitored and any thresholds for desired actions that may arise from monitoring as a result of effects from the activities authorised by these consents;
- d. Any components of the EMMP that provide information on the kaimoana values and indicators;
and
- e. A reporting mechanism for results of the kaimoana monitoring to the Consent Holder, who shall provide them to the EPA.

The Kaimoana Monitoring Programme may be amended at any time during the term of these consents. Any proposed changes to the Kaimoana Monitoring Programme shall be prepared by the Consent Holder following consultation with the Kaitiakitanga Reference Group if this group has been established.

The Consent Holder shall ensure that the EPA has a copy of the most update version of the Kaimoana Monitoring Programme at all times.

78. The Consent Holder shall use its best endeavours to engage tangata whenua representatives, including but not limited to Ngāti Ruanui, Ngā Rauru Kītahi, Ngāruahine and Te Tai Hauāuru Regional Fishing Forum representatives, to undertake the monitoring identified in the Kaimoana Monitoring Programme (Condition 77).

The Consent Holder shall meet the actual and reasonable costs of implementing the Kaimoana Monitoring Programme subject to the receipt of itemised invoices.

Advice Note: The Consent Holder records its willingness to work collaboratively with tangata whenua, including Ngāti Ruanui, Ngā Rauru Kītahi and Ngāruahine, and to assist them financially in undertaking environmental initiatives or other initiatives that advance their cultural well-being.

79. In the event that a Kaitiakitanga Reference Group has not been established twelve (12) months following the date of the offer made by the Consent Holder required by Condition 73, and the Consent Holder has demonstrated, to the satisfaction of the EPA, that it has acted in good faith, the Consent Holder shall have no further obligation under Conditions 73 - 76.

For the avoidance of doubt, The Consent Holder shall still comply with Conditions 77 and 78 in the event that the Kaitiakitanga Reference Group has not been established.

80. In addition to Condition 79, in the event that that a Kaitiakitanga Reference Group has not been established twelve (12) months following the date of the offer made by the Consent Holder required by Condition 73, the Consent Holder shall, at least once every twelve (12) months, inform and seek to engage with relevant iwi entities on the general scope of the planned activities authorised by these consents. The Consent Holder shall keep a record of how it has complied with this condition and make this information available to the EPA upon request.

Advice Note: The Consent Holder should seek advice from the EPA as to who the relevant iwi entities are. The Consent Holder is also encouraged to use this opportunity to investigate the involvement of the relevant iwi entities, as kaitiaki, in environmental management practices and the development of environmental indicators using both mātauranga Māori and western science.

COMMUNITY RELATIONSHIPS

81. The Consent Holder shall provide the public with up to date information on the seabed material extraction activities authorised by these consents and environmental monitoring, including the pre-commencement environmental monitoring, undertaken in accordance with the conditions of these consents.

The information shall be made available through a website maintained by the Consent Holder for the duration of these consents.

The Consent Holder shall advise the EPA of the website address within five (5) working days of it going live.

82. For the duration of these consents, the Consent Holder shall provide for and facilitate community meetings to keep the public informed of the seabed material extraction activities authorised by these consents and any recent monitoring results and/or actions, or other matters that may be of interest to the public.

The community meetings shall be held six (6) monthly (during the months of February and July of each year) for the first five (5) years of the seabed material extraction activities authorised by these consents and annually at all other times.

At least twenty (20) working days prior to the date of any community meeting, notice shall be placed on the Consent Holder's website (Condition 81) and by way of advertisements in the regional newspapers, including the Taranaki Daily News, the South Taranaki Star and the Wanganui Chronicle, and on local radio stations. Notice shall include the date, time and location of the meeting and contact details of the meeting facilitator.

The Consent Holder shall keep a record of the details of each community meeting, including details of the notification mechanisms used for each meeting. A copy of these records shall be provided to the EPA upon request.

83. Following the commencement of seabed material extraction activities, the Consent Holder shall provide an annual fund of \$50,000 per year to be administered by the South Taranaki District Council in collaboration with the Consent Holder. The annual fund shall be inflation adjusted.

The purpose of the fund is to assist in the establishment of projects for the benefit of the South Taranaki community, in particular for the social and economic wellbeing of the community.

The Consent Holder shall keep records of the annual contributions and provide a copy of these to the EPA upon request.

84. Within twelve (12) months of the commencement of the construction of the IMV associated with the activities authorised by these consents, the Consent Holder shall establish and maintain a training facility located in the township of Hawera.

The purpose of the training facility is to provide technical and marine skills based training to prospective trainee process operators and maintenance support staff from the South Taranaki communities who then can be employed by the Consent Holder as part of the seabed material extraction activities authorised by these consents.

In establishing the training facility, the Consent Holder shall consult with the Hawera business community, local iwi, South Taranaki District Council and Accredited Education providers to ensure that the purpose of the training facility is being met.

The Consent Holder shall keep records of the consultation required by this condition and provide a copy of these to the EPA upon request.

Advice note: The Consent Holder has confirmed that it will, where practicable, offer training positions to members of local iwi and the community.

85. Prior to the commencement of any seabed material extraction activities authorised by these consents, the Consent Holder shall establish and maintain a geotechnical and environmental monitoring base located in the port of Whanganui.

The purpose of the base is to support the seabed material extraction activities authorised by these consents by providing, as a minimum:

- a. A permanent berthing site for a vessel;
- b. A secure laydown area;
- c. A storage area and warehouse;
- d. An operation and maintenance workshop;
- e. Administration offices; and
- f. Scientific Laboratory.

The Consent Holder shall provide written confirmation to the EPA that the base has been established.

Advice note: The Consent Holder is committed to employing suitably qualified and experienced local residents at the base.

Advice note: The Consent Holder is committed to acquiring any additional consents required to enable the construction and operation of the Support Base. Construction of the base and associated berthing site will occur subject to any such consents being granted

FISHING INDUSTRY RELATIONSHIP

86. The Consent Holder shall provide for six (6) monthly meetings between itself and representatives of the commercial fishing industry including any representatives nominated by Fisheries Inshore New Zealand. The purpose of the meetings shall be to enable parties to share relevant information and to establish a coordinated approach between the seabed material extraction activities authorised by these consents and commercial fishing activities, including communications protocols.

The first meeting shall occur no later than six (6) months prior to the commencement of the seabed material extraction activities authorised by these consents.

The Consent Holder shall:

- a. Facilitate and fund the administration of each formal meeting; and
- b. Take minutes of each meeting, which shall be forwarded to attendees, within twenty (20) working days of each meeting being held. The minutes shall be included in the Annual Report required by Condition 104.

OPERATIONAL DOCUMENTATION

Operational Assessment Report

87. No less than three (3) months prior to the commencement of any seabed material extraction activities authorised by these consents, and every twelve (12) months thereafter the Consent Holder shall prepare, and provide to the EPA, an Operational Assessment Report which shall include but not be limited to:
- a. An outline of the area where removal of seabed material, targeting the extractable resource of titanomagnetite seabed material, will take place during the next twelve (12) month period, and the timing thereof;
 - b. Bathymetry of the seabed in the area where removal of seabed material is planned;
 - c. Bathymetry of the pits and mounds created during the extraction and deposition of sediments;
 - d. Extraction plan schedules;
 - e. Identification of the occurrence of fine sediments (<8 µm) in the area subject to extraction via grade control drilling conducted in accordance with the requirements for a 'Measured Mineral Resource' by "The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, 2012 or subsequent editions (the "JORC" code). The Operational Assessment Report is to demonstrate how compliance with Condition 4 has been achieved; and
 - f. Procedures for avoiding identified fine sediments to the extent necessary to meet the requirements of Conditions 4, 5 and 7.

Where extraction activities within the following twelve (12)-month period will occur within the area of Petroleum Mining Licence #38146, the Consent Holder shall also provide the Kupe Operator with a copy of the Operational Assessment Report at the same time the report is provided to the EPA.

Training of Personnel

88. Pursuant to section 25(1)(b)(i) of the EEZ Act, the Consent Holder shall ensure that all personnel on-board project related vessels receive the appropriate training prior to taking part in any duties related to any activities authorised by these consents.

Training shall be appropriate to ensure compliance with the conditions of these consents is achieved, including but not limited to training on:

- a. The Consent Holder's obligations under these consent conditions, including any obligations under the EMMP and associated management plans;
- b. Their responsibilities under any condition, the EMMP or management plan and how to meet those responsibilities; and
- c. Their obligations under the Marine Mammals Protection Act 1978 and Marine Mammals Protection Regulations 1992, or any superseding legislation.

A record of all training carried out in accordance with this condition shall be maintained by the Consent Holder and made available to the EPA upon request.

Complaints Register

89. The Consent Holder shall maintain a permanent register of any complaints received by any person or company about activities authorised by these consents.

The register shall include:

- a. The contact details of the complainant, including the name and address of the complainant;
- b. The nature of the complaint, and the time which it was received;
- c. The location, date and time of the complaint and of the event associated with the complaint;
- d. The cause or likely cause of the event and any factors, such as weather conditions (including wind direction and approximate wind speed, the real-time New Zealand Met Service forecast for the seabed material extraction area and any forecast warning for the area and the presence of precipitation, fog or any other weather related impact on visibility), that may have influenced its severity;
- e. The outcome of any investigation into the complaint, including the nature and timing of any measures implemented by the Consent Holder to remedy or mitigate any adverse effects, if associated with the event;
- f. Details of any steps taken to prevent the reoccurrence of similar events; and g. Any other relevant information.

This register shall be held in the form of a Complaints Log at the Consent Holder's head office and should be made available to the EPA upon request.

The Log shall be updated within forty eight (48) hours following the receipt of any new complaint and should also be included as part of the Quarterly Operational Report required by Condition 103.

MARINE SAFETY MATTERS

90. The Consent Holder shall ensure that the design and construction of the IMV complies with 'best practice' international marine standards and, as a minimum, shall include:
- a. A thruster assisted mooring system that meets the requirements of America Bureau of Shipping ("ABS") ⚡TAM-R notation with the system built, installed and commissioned to the satisfaction of ABS Survey;
 - b. A thruster system, including power, distribution, control and position reference systems that meet the redundancy requirement of ABS DPS-2 with the system built, installed and commissioned to the satisfaction of ABS Survey. Additionally, a Failure Modes, Effects, and Criticality Analysis ("FMECA") of the system shall be completed as an extension of the FMEA process required by class for achieving many of the special or optional Classification notations ACC, ACCU and DPS-2. (Ref: ABS GUIDANCE NOTES ON FAILURE MODE AND EFFECTS ANALYSIS (FMEA) FOR CLASSIFICATION. 2015);
 - c. Compliance with the ABS notation for Station Keeping Performance ("SKP") for the specified limiting environmental conditions in the South Taranaki Bight;
 - d. A mooring system that complies with the design requirements for a permanent mooring system as specified in API 2SK, and that clearly defines the system's mode of operation, including its normal operating condition limits and performance in severe environmental conditions (including its proposed return period); and
 - e. Incorporation of an operational vessel motion monitoring and forecasting software system.

The Consent Holder shall provide documentation to the EPA which confirms that the IMV complies with all the requirements of this condition.

91. Prior to the IMV being used in the seabed material extraction operations, the IMV's mooring design shall be independently reviewed, in a technical capacity, by a suitably qualified and internationally recognised person or body. The review shall confirm that the IMV mooring is fit for purpose and complies with 'best practice' international marine standards and the standards specified in Condition 90 above. The review shall also:
- a. Confirm that approval from ABS for the IMV mooring concept has been provided;
 - b. Consider the final mooring and thruster design assessment and confirm it is appropriate for the intended operational purposes (including in relation to proximity to the first de-ored sediment mound);

- c. Confirm that the thruster capacity is adequate to maintain the IMV position/heading in the event of a mooring failure;
- d. Confirm that the operational (limit) environmental conditions specified for the IMV are appropriate for / consistent with the mooring system design.
- e. Confirm that the location and design of the fairleads on the IMV are capable of accommodating the large changes expected in departure angle without the mooring rope clashing with deck structures or the articulation limits of the fairleads; and
- f. Confirm the operation of the TAM system and the segregation of thruster power supply, control and distribution from that required for mining operations is fit for purpose.

The recommendations of the review shall be incorporated into the final design of the IMV mooring system.

The Consent Holder shall provide documentation to the EPA which confirms that the IMV's mooring design complies with the requirements of this condition.

The independent reviewer shall be mutually agreed between the Consent Holder and the Kupe Operator. In the event that the Consent Holder and the Kupe Operator cannot reach agreement, each party shall recommend one a suitably qualified independent reviewer to the Chief Executive of the EPA who will decide on the reviewer to be appointed from the two recommendations. The costs of the review will be met by the Consent Holder.

92. Annually, on the anniversary of the commencement of the seabed material extraction operations, or where notice is received from the Kupe Operator providing confirmation of a commitment to deploy a 'Jack-up Drill Rig' within the Project Area identified in Schedule 1, the Consent Holder shall prepare a Geotechnical Report for the previous twelve (12) months seabed material extraction activities authorised by these consents for the identified location (where confirmation of a commitment to deploy has been received in accordance with this condition).

Each Geotechnical Report shall report on the geotechnical properties of the backfilled mining lanes and include, as a minimum, the following information:

- a. A detailed explanation of the geotechnical investigations undertaken, including the location of the investigations and the methodology undertaken, for the previous 12 month period;
- b. All of the data / results from the geotechnical investigations including but not limited to:
 - i. Particle / grain size distribution;
 - ii. In-situ bulk density; and
 - iii. Cone penetrometer or shear strength value.
- c. A summary of the findings from the geotechnical investigations and the properties of the seabed investigated.

The Consent Holder shall provide each Geotechnical Report to the Kupe Operator within three (3) months of the completion of the annual geotechnical investigations or within six (6) months of the receipt

by the Consent Holder of notice from the Kupe Operator providing the confirmation above. The Geotechnical Report shall be made available to the EPA upon request.

93. Annually, and within twenty (20) working days after each anniversary of the commencement of the seabed material extraction operations, the Consent Holder shall undertake an assessment of the impact of de-ored sediment discharges on the cathodic protection systems associated with the Integrated Mining Vessel's safety critical systems.

The Consent Holder shall provide a copy of its assessment report to the Kupe Operator within twenty (20) working days of the completion of the assessment outlined above and will make the report available to the EPA upon request.

94. Following the completion of the pre-commencement environmental monitoring required by Condition 48, the Consent Holder shall commission an assessment of the visibility limits at the Kupe Platform and at the inshore border of the Project Area identified in Schedule 1.

The results of this assessment shall be provided to the Kupe Operator within twenty (20) working days of its completion and make the assessment available to the EPA upon request.

95. The Consent Holder shall install and have operational, a Barge Management System for all of its vessels operating within the area of Petroleum Mining Licence #38146.

A display from the Barge Management System shall be made available to the Kupe Operator's control room for the Kupe assets at all times.

96. The Consent Holder shall ensure that no iron ore transhipments take place when any aspect of the thruster or mooring system of the IMV or the Floating Storage and Off-loading vessel is inoperative due to maintenance or failure.

97. The Consent Holder shall ensure that activities within the 'Kupe Platform Safety Zone' do not occur without prior approval in accordance with the requirements of the SIMOPP (Condition 69). Approval under this condition is not required during an emergency situation.

The Consent Holder shall keep records of any related correspondence with the Kupe Operator and these records shall be made available to the EPA upon request.

98. The Consent Holder shall undertake bathymetric surveys annually around the boundaries of the Kupe Operator's exclusion zones (existing or future), and representative points around the Kupe Well Head Platform and along the pipeline and umbilical route, to determine any migration of the mound and pit bathymetry. Access by the Consent Holder to representative points around the Kupe Well Head Platform and pipeline and umbilical route will be agreed with the Kupe Operator in advance in accordance with the SIMOPP (Condition 69).

The Consent Holder shall supply results of these surveys to the Kupe Operator within twenty (20) days of their completion and provide the results to the EPA upon request.

99. The Consent Holder shall ensure that the Kupe Operator retains all rights to explore and develop assets within the Petroleum Mining Licence area #38146 to the extent provided for in that permit where it overlaps with the Project Area identified in Schedule 1.
100. The Consent Holder shall ensure that all operations proposed by the Kupe Operator within the area of Petroleum Mining Licence #38416 have precedence over the Consent Holder's operations provided that the Kupe Operator gives at least twelve (12) months' notice its intentions to undertake such operations and provides specific details not less than six (6) months prior to the scheduled commencement of such operations.
101. For the duration of this consent, the Consent Holder shall maintain a 500 m protection zone around all wellheads (except Kupe South 4 wellhead where the size of the protection zone will be sufficient to ensure that the Consent Holder's activities do not result in the well-casing being exposed at any time), and a 1.5 km protection zone around the Kupe Well Head Platform.

For the purpose of this condition, the “protection zone” is an exclusion zone where the Consent Holder’s vessels shall not operate and no mining activities will occur, without the prior approval of the Kupe Operator.

Advice note: The Kupe South 4 wellhead refers to the abandoned wellhead located within the Consent Holder’s Mineral Mining Permit area.

102. Notwithstanding any of the requirements of the conditions above, the Consent Holder shall manage all activities associated with the seabed material extraction operations, including the project vessels and their operation, to ensure that the activities authorised by these consents do not result in any adverse effects on the Kupe assets.

REPORTING REQUIREMENTS

Quarterly Operational Report

103. Following the commencement of seabed material extraction, the Consent Holder shall prepare a Quarterly Operational Report summarising the seabed material extraction activities authorised by these consents undertaken for the previous quarter (three (3) months). The Quarterly Operational Report shall, as a minimum, include the following operational information:
 - a. GPS positions of anchor placements on the seabed and coordinates illustrated on a map with the seabed material extraction area clearly marked;
 - b. GPS positions of the Crawler placement and tracks during seabed material extraction activities authorised by these consents and coordinates illustrated on a map with the extraction area clearly marked;
 - c. Any bathymetry measurements of the seabed measured in the reporting period for the area where removal of seabed material has taken place. (Note: Bathymetry will be assessed on a six (6) monthly basis);

- d. Quantity and rate of seabed material excavated and quantity and rate of de-ored sediment discharged including the PSD data recorded to assess compliance with Condition 4;
- e. Maximum and average depth of seabed material extracted by the Crawler throughout each mining lane (from bathymetry);
- f. Average and maximum depth, and GPS position of any unfilled pits remaining after completion of a mining lane (from bathymetry);
- g. Average and maximum height, and GPS position of any mounds created during the deposition of de-ored sediment (from bathymetry);
- h. Location and height above the seabed of discharge pipe whilst discharging de-ored sediments;
- i. Details of any complaints received, including the Complaints Log; and
- j. Details of any investigations, including recommendations, undertaken by the Consent Holder, the TRG or the Kaitiakitanga Reference Group including a summary of any commentary or recommendations from the TRG and, where necessary, an explanation as to why any TRG recommendation has not been accepted;
- k. Actual 25, 50, 80 and 95th percentile SSC values during the preceding three (3) month period, including a comparison with the “naturally occurring” values predicted by the validated OSPM;
- l. A record of pre-start observations as required by Condition 37; and m. Any other components required by the conditions of these consents.

The Consent Holder shall provide the Quarterly Operational Report to the EPA and the Kupe Operator within two (2) months of each quarter ending (being 31 March, 30 June, 30 September and 31 December) during the seabed material extraction activities authorised by these consents.

Annual Report

104. The Consent Holder shall prepare an Annual Report for the previous twelve (12) month period from the commencement of seabed material extraction activities authorised under these consents. Subsequently, an Annual Report shall be prepared for each twelve (12) month period following the anniversary of commencement of the seabed material extraction activities.

Each Annual Report shall, as a minimum, include the following information:

- a. A critical evaluation of all monitoring data collected prior to the reporting date, including, but not limited to:
 - i. The information contained in earlier Annual Reports; and
 - ii. Identifying any trends in the monitoring and any emerging issues of actual or potential concern.
- b. An Extraction Schedule detailing:
 - i. The areas in which extraction and deposition is proposed to occur over the next twelve (12) month period;
 - ii. The timing of proposed extraction and deposition activities in areas identified in Condition 104.a.i.;

- iii. The volume, mass, and rate of seabed material extracted and de-ored sediments deposited during the previous twelve (12) month period;
 - iv. GPS locations or chart references detailing the location of extraction and deposition in the previous twelve (12) month period;
 - v. Depths of extraction that are scheduled to occur; and
 - vi. All updates of the extraction schedule that were notified to the EPA..
- c. A summary report on all monitoring undertaken in the previous twelve (12) months in accordance with the EMMP required under Condition 55, including identification of any trends in results;
 - d. Details of monitoring proposed for the next twelve (12) months in accordance with the EMMP required under Condition 55 including the rationale for this, including by reference to clause a above;
 - e. Details of any exceedances of the limits as identified in Conditions 4, 5, 6, or 7, as well as any management / mitigation action(s) implemented in response to any exceedance including details of any investigations;
 - f. A record of all fuel used, and the sulphur content of the fuel, for each project related vessel as required under Condition 42;
 - g. A record of pre-start observations as required by Condition 37;
 - h. Details of the TRG review of the annual monitoring data and the EMMP, along with recommendations for any actions or changes to the EMMP or the seabed material extraction activities, and how these were provided for as well as any reasoning as to why recommendations were not accepted; and
 - i. Any other component required by the conditions of these consents.
 - j. The Consent Holder shall provide the Annual Report to the EPA and the Kupe Operator within three (3) months of the completion of each twelve (12) month monitoring period.
105. The Consent Holder shall inform the EPA of any modified operational extraction and deposition areas or periods which differ from those identified in the “the next twelve (12) month” period of any Annual Report required by Condition 104.

Where any such changes are in the Petroleum Mining Licence area #38146, or the project area immediately adjacent to the Kupe assets, the Consent Holder shall also inform the Kupe Operator of any modified operational extraction and deposition areas or periods which differ from those identified.

The EPA, and where necessary the Kupe Operator, shall be informed of any such changes no later than thirty (30) working days prior to commencement of works in the modified areas, or as otherwise agreed in the SIMOPP.

REVIEW CONDITION

- 106. Within twenty (20) working days of the receipt of either the Quarterly Report or Annual Report, or within twenty (20) working days of the EPA receiving the recommendation from either the Consent Holder or from the TRG, including any recommendations from the TRG not accepted or implemented

by the Consent Holder, the EPA may serve notice on the Consent Holder, in accordance with sections 76 and 77 of the EEZ Act, of its intention to review the conditions of these consents for the purpose of:

- a. Adding, amending or cancelling any discharge limits, environmental limits, or operational controls (Conditions 4 - 47); and/or
- b. Including any new discharge limits, environmental limits, or operational controls; and/or
- c. Dealing with any adverse effects on the environment that may arise from the exercise of the consents and which it is appropriate to deal with after the consent(s) have been granted; and/or
- d. Reviewing monitoring or reporting required by any condition(s) of these consents.

RISK MANAGEMENT

107. The Consent Holder shall, while giving effect to these consents, maintain public liability insurance for a sum not less than NZ\$500,000,000 (2016 dollar value) for any one claim or series of claims arising from giving effect to these consents to cover costs of environmental restoration and damage to the assets of existing interests (including any environmental restoration as a result of damage to those assets), required as a result of an unplanned event occurring during the exercise of these consents.
108. The Consent Holder shall submit a certificate demonstrating that it holds the insurance required by Condition 107 prior to giving effect to these consents and an updated certificate annually by 1 July of each year for the term of these consents to the EPA.

COST RECOVERY

Advice Note: To the extent that condition 109 is ultra vires, it has been proffered by the applicant on an Augier basis.

109. The Consent Holder shall meet the actual and reasonable costs incurred by the EPA when obtaining external advice it considers necessary to:
 - a. Exercise its certification functions as required by these conditions; and
 - b. Audit compliance with the conditions of consent, including, but not limited to, assessing the Annual Report required by Condition 104.

Advice Note: Where a condition requires the Consent Holder to submit a plan or document to the EPA "for certification" the EPA may, if it considers it necessary, seek the advice of a suitably qualified and experienced external expert(s) before it certifies the plan/document. In addition, the EPA may request further information/clarification from the Consent Holder after it submits the plan/document. In such cases the EPA will advise the Consent Holder that it has not yet certified the plan/document and the clause in the respective condition which states that the plan is "deemed to be certified" after a specified time period will not apply. For clarity, certification includes the exercise of the responsibilities assigned to the CEO of the EPA by any condition.

SCHEDULE 1 – Grid References Of The Project Area

Point	Longitude	Latitude
1	174° 10' 51" E	39° 49' 39" S
2	174° 13' 03" E	39° 51' 21" S
3	174° 12' 16" E	39° 51' 56" S
4	174° 09' 02" E	39° 53' 42" S
5	174° 07' 21" E	39° 54' 29" S
6	174° 05' 37" E	39° 54' 23" S
7	174° 04' 33" E	39° 54' 16" S
8	174° 03' 49" E	39° 53' 52" S
9	174° 02' 52" E	39° 53' 12" S
10	174° 02' 09" E	39° 52' 38" S
11	174° 02' 12" E	39° 51' 20" S
12	174° 02' 28" E	39° 51' 04" S
13	174° 03' 18" E	39° 51' 53" S
14	174° 06' 30" E	39° 51' 43" S
15	174° 06' 30" E	39° 51' 39" S
16	174° 06' 40" E	39° 51' 34" S
17	174° 07' 23" E	39° 51' 45" S
18	174° 08' 10" E	39° 51' 28" S
19	174° 09' 46" E	39° 50' 33" S

Datum: NZGD2000

Note 1: This schedule is referred to in conditions 93, 94 and 99.

SCHEDULE 2 – Suspended Sediment Concentration (SSC) Limits

South Taranaki Bight Sites	Background Percentiles (SSC mg/L)							
	Surface				Bottom			
	25 th	50 th	80 th	95 th	25 th	50 th	80 th	95 th
Rolling Grounds (WGS 1984: 39 57 22.58780 S, 174 22 29.90885 E)	TRG	TRG	0.3	1.1	TRG	TRG	3.5	15.3
Graham Bank (WGS 1984: 39 53 16.22020 S, 174 24 40.68384 E)	TRG	TRG	1.7	4.5	TRG	TRG	32.8	84
Source A to Whanganui 1 km (WGS 1984: 39 51 22.41692 S, 174 13 46.13207 E)	TRG	TRG	1.1	2.7	TRG	TRG	16.9	44.2
Source A to Whanganui 20 km (WGS 1984: 39 53 14.34932 S, 174 27 08.62846 E)	TRG	TRG	2.3	5.9	TRG	TRG	29	76.6
South Traps (WGS 1984: 39 51 53.21010 S, 174 32 48.75387 E)	TRG	TRG	6.3	11.1	TRG	TRG	37.7	97.4
North Traps (WGS 1984: 39 51 02.22374 S, 174 31 10.63364 E)	TRG	TRG	7.2	12.4	TRG	TRG	46.5	115
Tūteremoana (WGS 1984: 39 55 00.03802 S, 174 47 41.29085 E)	TRG	TRG	8.5	13.6	TRG	TRG	23.7	62.5
The Crack 1 (WGS 1984: 39 49 12.00 S, 174 15 00.00 E) provisional	TRG	TRG	TRG	TRG	TRG	TRG	TRG	TRG
The Crack 2 (WGS 1984: 39 51 00.00 S, 174 18 00.00 E) provisional	TRG	TRG	TRG	TRG	TRG	TRG	TRG	TRG
The “Project Reef” (location to be set by TRG)	TRG	TRG	TRG	TRG	TRG	TRG	TRG	TRG

Note 1: This schedule is referred to in conditions 5, 6, 48, 51 and Schedule 3.

Note 2: The source of the numerical values of the levels of “naturally occurring” 80th and 95th percentile background limits contained in this table are as set out in Daniel Govier’s evidence (Appendix 10) 16 December 2016, and have been derived from the sediment plume modelling (“no mining” scenario) which was informed by measurements of background sediment concentrations and other oceanographic parameters addressed by NIWA, as set out in the NIWA Oceanographic Measurements Report, the Nearshore Measurements Report, and the Remote Sensing Report.

For the purposes of operational management, the SSC Limits contained in this table are to be considered as inclusive of both natural and mining derived suspended sediment concentrations. All percentile values marked “TRG” are to be derived by the Technical Review Group. The SSC limits and location coordinates for The Crack 1 and 2, and The “Project Reef” are also to be derived by the TRG.

Note 3: Turbidity may be used as a proxy for suspended sediment concentrations when assessing against the limits in this table.

Note 4: The numerical values of this table that represent a percentile limit at a location may be amended by way of the process set out in Condition 51 but any change to the percentiles themselves (for instance amending 95th percentile to 90th) can only be changed by way of Condition 106 or in accordance with the EEZ Act.

Note 5: The 95th percentile is a fixed limit and is subject to Condition 5.a., unless subject to Condition 5.b. after the value has been modified under Condition 51. The 25th, 50th and 80th percentiles are subject to Condition 5.c. which allows variation of up to 10%.

**SCHEDULE 3 – Methodology For Reviewing The Suspended Sediment Concentration
'Compliance Limit' Numerical Values In SCHEDULE 2**

The suspended sediment concentrations collected as part of the Pre-commencement Environmental Monitoring Programme (PCEMP) will be used to calibrate and validate the Operational Sediment Plume Model and provide data to verify the SSC Limit numerical values set in Schedule 2. As per Condition 53, calibration and validation of the Operational Sediment Plume Model will occur every six (6) months during the PCEMP and for the first three years of seabed material extraction activities, and then every 24 months thereafter with independent peer review as per Condition 52.

Validation will occur by statistically comparing the modelled and actual measured values to provide a measure of the Operational Sediment Plume Model accuracy. The aim of the validation process is to assess whether the actual measurements differ from the predicted values and if so by what margin, and over how much of the period that was being reviewed (i.e. the percentage of time the values differ and the range, median, mean, etc. of this difference). A range of statistical techniques (within suitable statistical programmes) can be employed to assess any differences, including, but not limited to, scatterplots of predicted vs actual concentrations (and examining the adjusted R² value), residual plots (observed – predicted values) and calculating the root mean squared error (or standard error of the regression).

If the actual measured suspended sediment concentration values do not fall within 10% of the modelled values listed in Schedule 2 for 95% of time within each six (6) month review period, the model will be revised using the actual data to update the compliance limit values. Long term time series data are preferable for comparison with the Schedule 2 statistical limits. Therefore, as the measured data accumulates over the PCEMP period comparisons are to make use of as much of the aggregated time-series data as possible.

As per Condition 51, in the event that the updated numerical values of the SSC Limits are different from the numerical values of the SSC Limits in Schedule 2, then the updated numerical values of the SSC Limits shall supersede the numerical values of the SSC Limits in Schedule 2. Any updated numerical values of the SSC Limits shall represent “background” conditions and not be influenced by any actual or model simulated seabed material extraction activity.

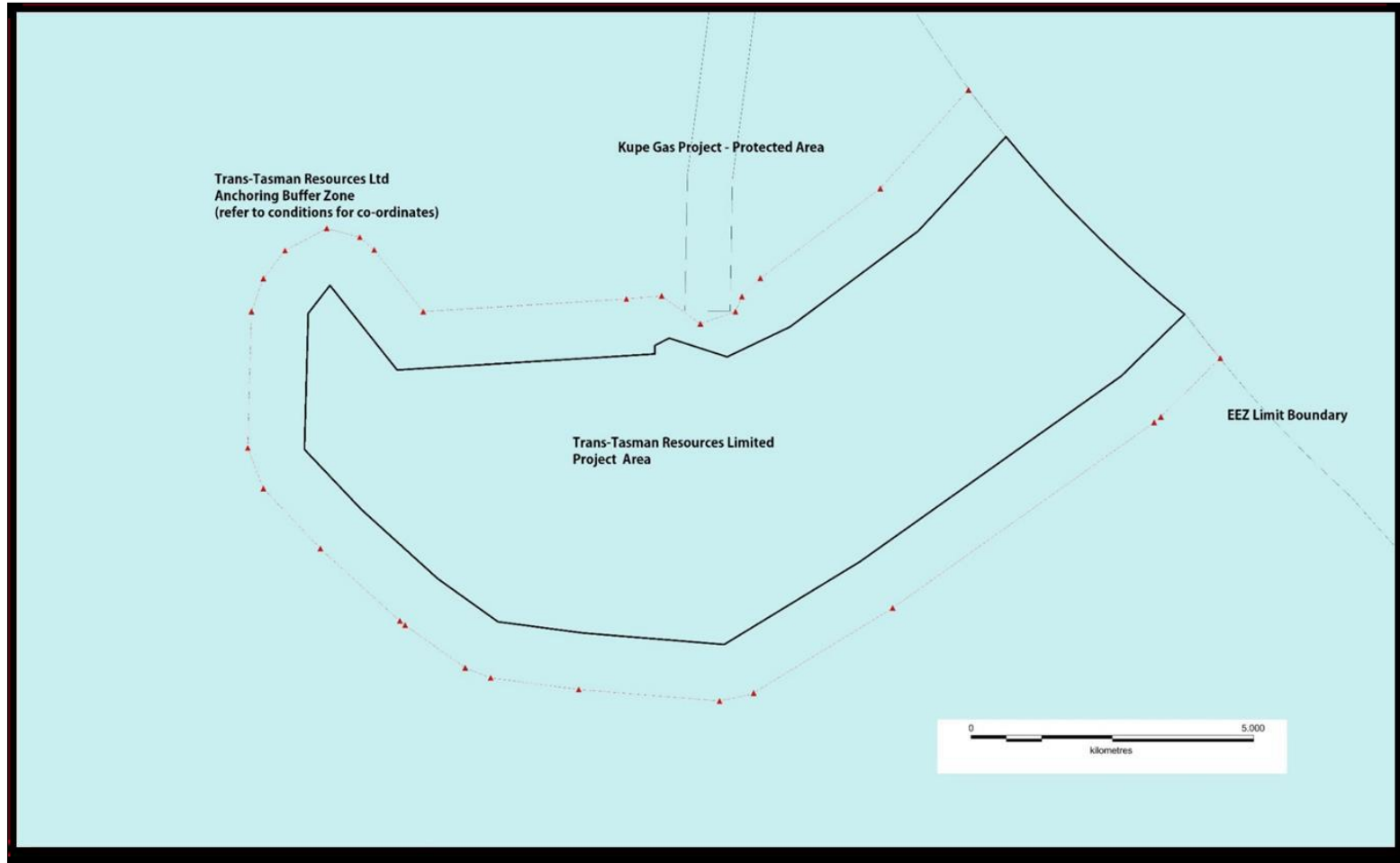
Note 1: This schedule is referred to in condition 51.

SCHEDULE 4 – Benthic Ecology Monitoring Sites

- (a) Rolling Grounds (WGS 1984: 39 57 22.58780 S, 174 22 29.90885 E)
- (b) Graham Bank (WGS 1984: 39 53 16.22020 S, 174 24 40.68384 E)
- (c) Source A to Whanganui 1 km (WGS 1984: 39 51 22.41692 S, 174 13 46.13207 E)
- (d) Source A to Whanganui 20 km (WGS 1984: 39 53 14.34932 S, 174 27 08.62846 E)
- (e) South Traps (WGS 1984: 39 51 53.21010 S, 174 32 48.75387 E)
- (f) North Traps (WGS 1984: 39 51 02.22374 S, 174 31 10.63364 E)
- (g) Tūteremoana (WGS 1984: 39 55 00.03802 S, 174 47 41.29085 E)

Note 1: This schedule is referred to in condition 7.

SCHEDULE 5 – Plan Of Consented Integrated Mining Vessel Mooring Area Boundary



Note 1: This schedule is referred to in condition 38.

SCHEDULE 6 – Monitoring Of Indicators

Schedule 6– Monitoring Of Indicators	
Indicator	Methods and Locations
Metals Testing	
To be undertaken on:	Testing for:
a. Sediments	e. Cadmium
b. Water column (plume)	f. Copper
c. Biological indicators	g. Nickel
d. Tailings slurry	h. Mercury
	i. Lead
	j. Chromium
	k. Zinc
	l. Tributyltin
	m. Arsenic
	n. Antimony
	o. Manganese
	p. Selenium
	q. Iron
	r. Silver
Biological Indicators for Metals	
Indicator:	Locations:
a. Green lipped mussels	b. Source A to Whanganui 1km, The Traps
Ecotoxicology	
Indicator:	Method:
a. Relevant local species (larval and adult stages) to assess lethal and sub-lethal end points	b. Species exposed to dilute-acid extracted metals derived from elutriate tests of the fine fraction of the de-ored sediment, as would be released in the plume
Chronic Ecotoxicity	
Indicator:	Method:
a. Relevant local species to address potential long terms effects on sensitive life stages	b. Testing of sensitivity to dissolved and particulate nickel and copper
Benthic Fauna	
Indicator:	Method:
a. All benthic fauna	b. Identified to lowest practicable taxonomic level (genus or species)

Schedule 6– Monitoring Of Indicators	
Indicator	Methods and Locations
<i>Acid Volatile Sulphides</i>	
Indicator:	Method:
a. Bioavailability potential for organisms inhabiting the seabed	b. Sampled from tailings slurry
<i>Metals in Pore Water</i>	
Indicator:	Method:
a. Metals in pore water	b. Analysis as required
<i>Beach Profiles</i>	
Indicator:	Locations:
a. Rates of erosion / accretion and associated changes in beach volume	b. Ohawe, Hawera, Manawapou, Patea, Waverley, Waiinu, Ototoka, Kai Iwi
<i>Marine Mammal Monitoring</i>	
Indicator:	Method:
a. Vessel strike	b. Post mortem
<i>Fur Seals</i>	
Indicator:	Method:
a. Fur seal distribution	b. Counts from IMV and FPSO
<i>Marine Mammal Acoustic Surveys</i>	
Indicator:	Method:
a. Marine mammal distribution	b. Three acoustic loggers to establish benchmark sound levels. Broad spectrum monitoring. Inclusion of bottlenose dolphin.
<i>Resalinated Water</i>	
Indicator:	Method:
a. Metals in water	b. Six monthly sampling

Schedule 6– Monitoring Of Indicators	
Indicator	Methods and Locations
<i>Origin Kupe Assets</i>	
Indicator:	Locations and Method:
<ul style="list-style-type: none"> a. Migration of mounds and pits 	<ul style="list-style-type: none"> b. Bathymetric surveys, including around the WHP, pipeline, and umbilical route
<i>Biosecurity Monitoring Plan</i>	
Indicator:	Location and Method:
<ul style="list-style-type: none"> a. Algal blooms and marine pests 	<ul style="list-style-type: none"> b. Surveillance in and surrounding project area. Primary productivity and subtidal benthos monitoring programmes.
<i>Operational Monitoring</i>	
Indicator:	Location and Method:
<ul style="list-style-type: none"> a. Near-field effects and recovery 	<ul style="list-style-type: none"> b. Six stations within operational area c. Nine stations placed along first strip of mined seabed and monitored for term of consent d. Fifteen stations monitored quarterly, in triplicate

Note 1: This schedule is referred to in conditions 6, 54, 55, 56 and 57.

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.

END OF MARINE CONSENT DOCUMENT

Appendix 3. Application Reports

The following reports are those lodged with the application. The report numbers are those assigned by the EPA and used on the EPA website.

- Report 1 South Taranaki Bight (STB) Baseline Environmental
 - *STB Baseline Environmental Appendix 1*
 - *NIWA STB Baseline Environmental Appendix 2*
 - *NIWA STB Baseline Environmental Appendix 3*
 - *NIWA STB Baseline Environmental Appendix 4*
- Report 2 Benthic Habitats, Macrobenthos and Surficial Sediments of the Nearshore South Taranaki Bight
- Report 3 Benthic Flora and Fauna of the Patea Shoals Region, South Taranaki Bight
- Report 4 Habitat Models of Southern Right Whales, Hector's Dolphin, and Killer Whales in New Zealand
- Report 5 Coastal Stability in the South Taranaki Bight – Phase 1
- Report 6 Coastal Stability in the South Taranaki Bight – Phase 2
- Report 7 Effects of Ships Light on Fish, Squid and Seabirds
- Report 8 Seabirds of the South Taranaki Bight
- Report 9 Zooplankton Communities and Surface Water Quality in the South Taranaki Bight
- Report 10 NIWA South Taranaki Bight Fish and Fisheries
 - *NIWA Fish and Fisheries Appendix A*
 - *NIWA Fish and Fisheries Appendix B*
 - *NIWA Fish and Fisheries Appendix C*
- Report 11 Geological Desktop Summary
 - *NIWA Geological Desktop Summary Appendix A*
 - *NIWA Geological Desktop Summary Appendix B*
 - *NIWA Geological Desktop Summary Appendix C*
 - *NIWA Geological Desktop Summary Appendix D*
 - *NIWA Geological Desktop Summary Appendix E*
 - *NIWA Geological Desktop Summary Appendix F*
- Report 12 South Taranaki Bight Iron Sand Mining: Oceanographic Measurements
- Report 13 Nearshore Optical Water Quality in the South Taranaki Bight
- Report 14 South Taranaki Bight Iron Sand Mining: Shoreline Monitoring Data Report
- Report 15 South Taranaki Bight Iron Sand Mining Nearshore Wave Modelling
- Report 16 Effects on Primary Production of proposed Iron Sand Mining in the South Taranaki Bight
- Report 17 Assessment of the Scale of Marine Ecological Effects
- Report 18 South Taranaki Bight Commercial Fisheries
- Report 19 Zooplankton and the Processes supporting them in Greater Western Cook Strait
- Report 20 Aquatic Environmental Sciences - Trans-Tasman Resources Ltd Consent Application: Ecological Assessments

- [Report 21](#) Tonkin & Taylor Ltd – Air Dispersion Modelling Studies on Gas turbine discharges
- [Report 22](#) Tonkin & Taylor Ltd – Air Dispersion Modelling Studies on Reciprocating engine discharges
- [Report 23](#) Clough and Associates Ltd – Trans-Tasman Resources South Taranaki Bight Offshore Iron Sand Project: Archaeological Assessment
- [Report 24](#) Martin Cawthorn Associates Ltd – Cetacean Monitoring Report
- [Report 25](#) Fathom – Assessment of Potential Impacts on Commercial Fishing
- [Report 26](#) R N Barlow and Associates Limited – Maritime and Navigational Impacts of the Project
- [Report 27](#) Marico Marine – South Taranaki Bight Marine Traffic Study
- [Report 28](#) Hegley Acoustic Consultants – Assessment of Noise Effects
- [Report 29](#) Rob Greenaway & Associates – Recreation and Tourism Assessment of Effects
- [Report 30](#) Corydon Consultants Ltd – Social Impact Assessment
- [Report 31](#) Boffa Seascape Natural Character Assessment
 - *Boffa Miskell – Visual Effects Report and Graphic Supplement*
- [Report 32](#) OCEL Consultants – Implications of Loose Tailings Seabed Material on Future Jack-Up Deployment
- [Report 33](#) MetOcean Solutions Ltd – Oil Spill Trajectory Modelling
- [Report 34](#) Te Taihauauru Iwi Forum Fisheries Plan 2012 – 2017
- [Report 35](#) Richardson. K, 'A perspective of marine mining within De Beers', The Journal of The South African Institute of Mining and Metallurgy, Volume 107
- [Report 36](#) Findlay. K, P. The Impact of Diamond Mining Noise on Marine Mammal Fauna off Southern Namibia, June 1996
- [Report 37](#) Institute for Maritime Technology – Environmental Impact Study: Underwater Radiated Noise, 1994
- [Report 38](#) Institute for Maritime Technology – Environmental Impact Study: Underwater Radiated Noise II, 1995
- [Report 39](#) eCoast Potential Effects of Trans-Tasman Resources Mining Operations on Surfing Breaks in Southern Taranaki Bight
- [Report 40](#) Martin Jenkins Ltd - Economic Impact Analysis of the Offshore Iron Sands Project
- [Report 41](#) Tahu Pōtiki - Cultural Values Assessment and Analysis
- [Report 42](#) Auckland University of Technology – Iron Sand extraction in the South Taranaki Bight: effects on trace metal contents of sediment and seawater

Appendix 4. Procedural History

Timeline for Application

30 Jul 2015	EPA appointed DMC including delegating decision-making powers to it
22 Sep 2015 ⁵⁴⁰	EPA commissioned AECOM to review effects on benthic ecology, and DHI to review effects on plankton, fish and marine mammals
23 Sep 2015 ⁵⁴⁰	EPA commissioned GHD to review economic effects, and sediment mobilisation and transport
23 Aug 2016	Application for marine consent lodged with the EPA by TTRL
1 Sep 2016	AECOM review of effects on benthic ecology received
5 Sep 2016	GHD review of economic effects received
6 Sep 2016	GHD review of sediment mobilisation and transport received
6 Sep 2016	DHI review of effects on plankton, fish and marine mammals received
6 Sep 2016	EPA completeness of application check completed
14 Sep 2016	DMC issued Minute 3 with the direction restricting access to confidential information under section 158 of the Act
16 Sep 2016	EPA decision on cross boundary activities issued
17 Sep 2016	Public notification of application
17 Sep 2016	EPA served copies of the TTRL application on persons required by section 45(1) of the EEZ Act
30 Sep 2016	EPA Key Issues Report issued
13 Oct 2016	EPA requested further information from TTRL
13 Oct 2016	Extension to the submission period to 14 Nov 2016
31 Oct 2016	TTRL response to EPA request for further information received
8 Nov 2016	Environment Court cancelled direction of DMC restricting access to confidential information under section 158 of the Act
9 Nov 2016	All redacted information made publicly available
10 Nov 2016	Extension of submission period to 12 Dec 2016
12 Dec 2016	Submissions period closed
13 Jan 2017	Ngā Kaihautū Tikanga Taiao (NKTT) report received
25 Jan 2017	DMC requested advice from Ministry for Primary Industries, Horizons Regional Council, Taranaki Regional Council, and Maritime New Zealand

⁵⁴⁰ These experts were commissioned to prepare reports during the pre lodgement period that analyse the draft application documents. These reports were provided to TTRL to assist it in finalising its application documents prior to formal lodgement. After the formal lodgement, the EPA experts updated their pre-lodgement reports to take account of any changes to TTRL's formally lodged application documents.

26 Jan 2017	DMC requested advice from Ministry of Business Innovation and Employment (MBIE), WorkSafe, and Department of Conservation (DOC)
30 Jan 2017	Taranaki Regional Council response to DMC request for advice received
31 Jan 2017	DMC requested advice from Dr Cresswell
8 Feb 2017	DOC response to DMC request for advice received
8 Feb 2017	DMC requested advice from Dr Robertson
10 Feb 2017	DMC second requests for advice from DOC and MPI
13 Feb 2017	Maritime NZ response to DMC request for advice received
15 Feb 2017	DOC response to second DMC request for advice received
16 Feb 2017	MBIE and Horizons Regional Council responses to DMC requests for advice received
20 Feb 2017	Supplementary advice from NKTT
21 Feb 2017	Dr Robertson response to DMC request for advice received (and addendum on 28 Feb)
22 Feb 2017	EPA Conditions Report issued
22 Feb 2017	MPI response to DMC requests for advice received
23 Feb 2017	WorkSafe response to DMC request for advice received
16 – 24 Feb 2017 and 2 – 3 Mar	First stage of hearing in Wellington
1 March 2017	Dr Cresswell response to DMC request for advice received
6 – 9 Mar 2017	Second stage of hearing: New Plymouth
9 Mar 2017	DMC third request for advice from DOC
15 – 21 Mar 2017	Second stage of hearing in Wellington
20 Mar 2017	DOC response to third DMC request for advice received
10 Apr 2017	DMC additional information request to TTRL (Minute 41)
1 May 2017	Maritime NZ response to DMC questions during the hearing received
2 May 2017	WorkSafe response to DMC questions during the hearing received
2 May 2017	TTRL responses to additional information sought by DMC in Minute 41 received
22 – 25 May 2017	Third stage of hearing: Wellington
31 May 2017	Closure of hearing
15 June 2017	Extension of decision date to 17 July
3 August 2017	Decision date

Minutes issued by the Decision-making Committee

Minute 1	8 Sep 2016	Hearing locations
Minute 2	8 Sep 2016	Request to TTRL for further information
Minute 3	14 Sep 2016	Decision on sensitive information
Minute 4	28 Sep 2016	Follow up to Minute 3
Minute 5	7 Oct 2016	Request for extension to submission period
Minute 6	7 Oct 2016	Association with potential witnesses
Minute 7	13 Oct 2016	Extension of the submission period to 14 Nov 2016
Minute 8	10 Nov 2017	Extension of submission period to 12 Dec 2016
Minute 9	1 Dec 2016	Timetable and process
Minute 10	1 Dec 2016	Procedural
Minute 11	15 Dec 2016	Timetable and process
Minute 12	22 Dec 2016	Hearing locations
Minute 13	10 Jan 2017	Hearing date and procedures
Minute 14	20 Jan 2017	Follow up to Minute 12
Minute 15	24 Jan 2017	Late filing of evidence
Minute 16	3 Feb 2016	Pre-hearing conference
Minute 17	3 Feb 2017	Adaptive management
Minute 18	3 Feb 2017	Late filing of evidence
Minute 19	3 Feb 2017	Rebuttal evidence and cross examination
Minute 20	3 Feb 2017	Expert conferencing
Minute 21	7 Feb 2017	Questions from parties
Minute 22	9 Feb 2017	Hearing locations
Minute 23	9 Feb 2017	Translation and speaking requests
Minute 24	10 Feb 2017	Expert conferencing
Minute 25	15 Feb 2017	Media requests
Minute 26	15 Feb 2016	Video conferencing
Minute 27	17 Feb 2017	Expert conferencing
Minute 28	21 Feb 2017	Adaptive management
Minute 29	22 Feb 2017	Expert conferencing on sediment plume
Minute 30	3 Mar 2017	Questions from parties
Minute 31	3 Mar 2017	Analysis of submissions
Minute 32	8 Mar 2017	Response to Fisheries Submitters

Minute 33	13 Mar 2017	Marine mammal experts
Minute 34	13 Mar 2017	Adaptive management
Minute 35	15 Mar 2017	Timetable
Minute 36	22 Mar 2017	Expert conferencing on sediment plume
Minute 37	22 Mar 2017	Timetable
Minute 38	22 Mar 2017	Extension of the hearing to 31 May 2017
Minute 39	24 Mar 2017	Sites of significance
Minute 40	4 Apr 2017	EPA legal advice sought
Minute 41	10 Apr 2017	Request for information
Minute 42	21 Apr 2017	Parties concerns about Minute 41
Minute 43	9 May 2017	Timetabling and other directions
Minute 44	16 May 2017	Record of DMC's site visit
Minute 45	18 May 2017	Timeframes and further evidence from parties
Minute 46	31 May 2017	DMC formally closes hearing
Minute 47	15 June 2017	Extension of time to deliver decision to EPA to 27 July 2017
Minute 48	26 July 2017	Extension of time to deliver decision to EPA to 3 August 2017

Appendix 5. Decision-making Committee Procedures

Purpose

1. On 30 July 2015, the Environmental Protection Authority ("EPA") Board appointed a Decision-making Committee (DMC) under clause 14 of Schedule 5 of the Crown Entities Act 2004 to decide on a marine consent application in accordance with the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012. The EPA also appointed a chairperson of this DMC ("the Chairperson").
2. This document sets out the arrangements for operation of this DMC, which are designed to reflect the principles of good governance, including being participatory, consensus oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive and follow the rule of law. These procedures are based on those set for the EPA Board by Schedule 5 of the Crown Entities Act 2004, with appropriate amendments.
3. These procedures govern any decisions made by this DMC relating to the EPA's statutory functions.
4. A copy of the delegation of statutory powers and functions from the EPA Board to this DMC has been provided to each Member. An updated copy is attached at Appendix 1. The delegation of statutory powers and functions was updated to reflect the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Discharge and Dumping Regulations 2015 (DD Regs) which came into force on 31 October 2015 and to remove the reference to the '*Decision Making Committee 2015*'.

Chairperson

5. A Chairperson of the DMC has been appointed by the EPA Board. The Chairperson is Alick Shaw.

Acting chairperson

6. The Chairperson must appoint a member of the DMC as Acting Chairperson if the Chairperson is not available for any meeting.
7. If there is no Chairperson or Acting Chairperson for any meeting, the DMC must appoint an Acting Chair person.
8. The Acting Chairperson has and may exercise all of the functions and powers of the Chairperson in relation to a matter.

Meetings

Committee meetings (other than hearings)

9. A quorum for a DMC meeting will be more than half the membership (i.e. three members).

However it is expected that all members will be present at all meetings.

10. The DMC will set their own meeting schedule. In addition any member may request a meeting by advising the Chairperson.
11. The DMC may hold meetings by teleconference or by video conference.
12. The DMC meetings (other than hearings or other public forums as decided by the DMC from time to time) will not be open to the public or media.

Voting at meetings

13. As far as possible, decision making will be by consensus. All members of the DMC have a vote. Where there is no clear majority the Chairperson has the casting vote.
14. A member present at a meeting of the DMC is presumed to have agreed to, and to have voted in favour of, a decision of the DMC unless he or she expressly dissents from or votes against the decision at the meeting.
15. Where a decision is made by a majority, with dissent from one or more members present, the reasons for their dissent may be included in the written record of that decision.

Meeting notes

16. Meeting notes will be kept by the EPA for all meetings (including teleconferences and video conferences).

Meeting notes will be circulated with papers for the next available meeting. The notes will record:

- a. the time and place of the meeting, and those present;
 - b. the reports and other documents referred to or tabled at the meeting;
 - c. any conflicts of interest that are declared at the meeting;
 - d. identification of the key matters discussed;
 - e. action points; and
 - f. all decisions of the DMC.
17. The meeting notes will not provide a comprehensive record of the various contributions to discussions at the meeting.

Decisions out of meeting

18. A decision signed or assented to in writing (whether sent by post, delivery, or electronic communication) by all available members is as valid and effectual as if it had been decided at a meeting of the DMC duly called and constituted. ("Available" in this context means a member who

is not excluded from voting or taking part in a decision under s 66 of the Crown Entities Act 2004 by virtue of being interested in a matter)

19. The decision may consist of several documents containing the same decision; each signed or assented to in writing by one or more members.

Support to the DMC

20. The DMC will be supported by the EPA staff. Communications to the DMC from external parties will be via the EPA staff. The EPA staff will provide administration support and processing systems.
21. At the request of the DMC, the EPA staff will arrange work or the provision of information for the DMC. EPA staff will provide secretarial services to the DMC (such as preparation of agendas and meeting notes, and meeting arrangements) and will provide or procure any services the DMC requires using the EPA supply panel.
22. The DMC's media releases, other media dealings, and public notifications will be managed by the EPA, in consultation with the DMC.

Public dealings

23. The DMC will act collegially. Members should avoid engagement with interested parties or the media without a mandate from the DMC, especially about anything that may be construed as expressing an opinion on, or receiving representations on, issues the DMC will be considering. The Chairperson will be the spokesperson for the DMC, unless the Chairperson or the DMC delegates that responsibility in any instance.

Statutory Delegations

24. The EPA Board consented to the DMC delegating all the functions and powers delegated to that DMC to one or more members of that DMC (except the power to decide the application). The DMC may therefore delegate functions to be carried out on its behalf. Any such delegations will be recorded in writing. These functions may include deciding to waive or extend statutory timeframes, make an order protecting sensitive information or give directions at or before a hearing. An updated copy of the Record of Appointment and Delegation and a list of key delegation powers is attached at Appendix 1.

Tasks that may be performed by the Chairperson

25. The following tasks do not involve the exercise of statutory functions, and can be exercised by the Chairperson on the DMC's behalf without the need for a formal delegation:
 - a. Approving a brief for any reports the DMC may want to commission.
 - b. Approving media releases.
 - c. Signing of minutes and directions issued by the DMC.

Conflicts of Interest

26. If any member has a conflict of interest in respect of any matter being considered by the DMC at any meeting, that member should disclose details of the interest in the interests register and to the Chairperson in accordance with s 64 of the Crown Entities Act 2004.

Consequences of being interested in a matter (s 66 of the Crown Entities Act)

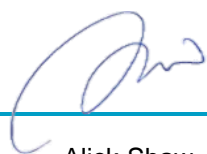
27. A member who is interested in a matter relating to a statutory entity:
- a. must not vote or take part in any discussion or decision of the DMC relating to the matter, or otherwise participate in any activity of the DMC that relates to the matter; and
 - b. must not sign any document relating to the entry into a transaction or the initiation of the matter; and
 - c. is to be disregarded for the purpose of forming a quorum for that part of a meeting of the DMC during which a discussion or decision relating to the matter occurs or is made.

Permission to act despite being interested (s 68 of the Crown Entities Act)

28. The Chairperson may, by prior written notice to the DMC, permit one or more members, or members with a specified class of interest, to do anything otherwise prohibited by s 66, if the Chairperson is satisfied that it is in the public interest to do so.
29. The permission may state conditions that the member must comply with.
30. If there is neither a Chairperson nor an Acting Chairperson, or if both the Chairperson and the Acting Chairperson are unavailable or interested, then the DMC may give the permission.
31. The permission may be amended or revoked in the same way as it may be given.
32. The DMC must disclose an interest to which permission relates, to the EPA, together with a statement of who gave the permission and any conditions or amendments to, or revocation of, the permission.

Approval

33. DMC procedures were approved by the DMC on 6 September 2016.



Alick Shaw
Chair TTRL Decision-making Committee

Appendix 6. List of People Who Appeared at the Hearing

Day 1— 16 February 2017

Westpac Stadium, Wellington

Mr Mike Holm, on behalf of TTRL – opening representation

Mr Duncan Currie, representing KASM and Greenpeace – opening representation

Mr Robert Makgill, representing the Fisheries Submitters – opening representation

Mr Peter Anderson, representing Royal Forest and Bird Protection Society – opening representation

Ms Bronwyn Carruthers, representing Origin Energy Resources Kupe NZ Ltd – opening representation

Day 2 — 17 February 2017

Westpac Stadium, Wellington

Mr Mike Holm, representing TTRL – responses to questions asked on Day 1

Mr Alan Eggers, representing TTRL – corporate evidence

Mr Matthew Brown, representing TTRL – evidence on geotechnical investigations

Mr Shawn Thompson, representing TTRL – evidence on operational description and project description

Mr Tokatumoana Walden, representing TTRL – evidence on stakeholder engagement

Mr Mike Patrick, representing TTRL – evidence on overview of other legislation regulation

Mr Barrie Forrest, representing TTRL – evidence on biosecurity

Day 3 — 20 February 2017

Westpac Stadium, Wellington

Mr Michael Dearnaley, representing TTRL – evidence on sediment plume model

Dr Alexis Berthot, representing the EPA – evidence on sediment mobilisation and transport

Dr David Petch, representing the EPA – evidence on sediment mobilisation and transport

Mr Iain MacDonald, representing TTRL – evidence on existing environment

Mr Dougal Greer, representing KASM and Greenpeace – evidence on sediment and plume modelling

Mr Lawrence Cahoon, representing TTRL – evidence on primary productivity and optical effects

Day 4 —21 February 2017

Westpac Stadium, Wellington

Dr Mark James, representing TTRL – evidence on overall ecological effects, primary production, effects on fish, ecotoxicity

Dr Alison MacDiarmid, representing TTRL – evidence on marine effects and benthic ecology, commercial fisheries, effects on fish, marine mammals

Dr Greg Barbara, representing the Fisheries Submitters – evidence on marine ecology, sediment plume modelling, primary production, marine mammals, effects on fish

Dr Simon Childerhouse, representing TTRL – evidence on marine mammals

Dr Elisabeth Slooten, representing KASM and Greenpeace – evidence on marine mammals

Dr Leigh Torres, representing KASM and Greenpeace – evidence on marine mammals

Day 5 — 22 February 2017

Westpac Stadium, Wellington

Dr Tony Chiffings, representing the EPA - evidence on plankton, fish and marine mammals

Dr David Thompson, representing TTRL – evidence on seabirds

Dr John Cockrem, representing KASM and Greenpeace – evidence on penguins

Dr Jeremy Helson, representing Fisheries Inshore NZ – evidence on fisheries

Mr Anthony Piper, representing Cloudy Bay Clams group – evidence on fisheries

Mr Doug Saunders-Loder, representing the NZ Federation of Commercial Fishermen Inc – evidence on fisheries

Day 6 — 23 February 2017

Westpac Stadium, Wellington

Mr Jason Leung-Wai, representing TTRL – evidence on economics

Mr Jim Binney, representing KASM and Greenpeace – evidence on economic impacts

Mr Wenceslaus van Lint, representing the EPA – evidence on economics

Mr Buddy Mikaere, representing TTRL – evidence on cultural impact assessment

Mr Derek Todd, representing Fisheries submitters – evidence on coastal hazards

Mr Terry Hume, representing TTRL – evidence on coastal stability

Dr Shaw Mead, representing KASM and Greenpeace – ecological effects and benthic ecology

Mr Matthew Brown, representing TTRL – overview of offshore mining operations

Day 7 — 24 February 2017

Westpac Stadium, Wellington

Dr Aine Conaghan - representation

Mr Murray McCurdy - representation

Ms Alison Undorf-lay, representing Sanford Limited – evidence on fishing

Mr Joshua Barclay, representing the NZ Sport Fishing Council - representation

Mr Martin De Jong and Ms Julianne Hickey, representing Caritas Aotearoa NZ - representation

Mr Michael Lawry, representing the Sea Shepherd NZ - representation

Mr Joris Jorissen, representing the Fisheries Submitters – evidence on laboratory testing and plume modelling

Mr Ian Baxter, representing the EPA – evidence on benthic ecology

Day 8 — 2 March 2017

Westpac Stadium, Wellington

Dr Don Robertson, representing the EPA – evidence on effects on fishing

Mr Andrew Smith, representing APS Fishing Consultancy Ltd and Talley's Group Ltd – evidence on fisheries

Dr Ngaire Phillips, representing KASM and Greenpeace – evidence on eco-toxicity

Mr James Pope, representing CRL Energy Ltd - representation

Mr Trevor Dine - representation

Mr Marcos Peleneur, Mr Tim Jeanneau, Mr David Jeaffreson, Mr James Stevenson-Wallace and Mr Joshua O'Rourke, representing (Ministry of Business, Innovation and Employment) MBIE - representation

Dr Heidi Douglass - representation

Day 9 — 3 March 2017

Westpac Stadium, Wellington

Dr Simon Childerhouse, representing TTRL – evidence on marine mammals

Dr Alison MacDiarmid, representing TTRL – evidence on marine effects and benthic ecology, commercial fisheries, effects on fish, marine mammals

Mr Greg Rzesniowiecki - representation

Mr Sam Nobs - representation

Day 10 — 6 March 2017

The Devon Hotel, New Plymouth

Haimona Maruera, representing Te Runanga o Ngāti Ruanui Trust – opening representation

Ms Debbie Ngarewa-Packer, representing Te Runanga o Ngāti Ruanui Trust – opening representation

Mr Graham Young, representing Te Runanga o Ngāti Ruanui Trust - evidence

Ms Maria Cashmore, representing Te Runanga o Ngāti Ruanui Trust - evidence

Mr Hemi Ngarewa - representation

Mr Martin Davies, representing Te Kaahui o Rauru – opening representation

Mr Turama Hawira, representing Te Kaahui o Rauru - evidence

Mr Te Te Huia Bill Hamilton, representing Te Kaahui o Rauru - evidence

Mr Andrew Erueti, representing Te Kaahui o Rauru - evidence

Ms Jacinta Ruru, representing Te Kaahui o Rauru - evidence

Ms Catherine Irons, representing Te Kaahui o Rauru – evidence

Mr Thomas Stuart, representing Te Kaahui o Rauru – closing statement

Ms Anne Marie Broughton, representing Te Kaahui o Rauru – closing statement

Day 11 — 7 March 2017

The Devon Hotel, New Plymouth

Dr Will Edwards, representing Te Korowai O Ngāruahine Trust - representation

Ms Cassandra Crowley, representing Te Korowai O Ngāruahine Trust - representation

Ms Karen Pratt - representation

Mr Fred McLay, representing the Taranaki Regional Council - representation

Mr Harry Duynhoven - representation

Ms Catherine Cheung - representation
Ms Nicole Patrick - representation
Dr Lyndon De Vantier, representing Climate Justice Taranaki - representation
Mr Roger Malthus - representation
Mr Bruce Boyd - representation
Ms Barbara Hammonds and Elise Smith, representing Nga Motu Marine Reserve Society - representation
Mr Malibu Hamilton, representing Te Ngaru Roa ā Maui - representation
Mr John Milnes - representation
Mrs Sheryl Hart, representing Raglan Sportfishing Club - representation
Ms Alessandra Keighley - representation
Ms Raukura Waitai - representation
Ms Tanea Tangaroa - representation
Mr Mita Davies - representation
Ms Rochelle Bullock, representing Reina Benett, Te Kopere O Raehina Rongoā - representation
Ms Harmony-Charm Carkeek-Edwardson - representation
Mr Ian Steele, representing New Plymouth Sportfishing and Underwater Club - representation
Mr Andrew Purser and Ted Gane, representing Patea and Districts Boating Club - representation
Ms Vera Van Der Voorden - representation
Ms Heather Cunningham - representation
Ms June Penn - representation

Day 12 — 8 March 2017

The Devon Hotel, New Plymouth

Ms Anne Marie Broughton, Dr Christine Cheyne, Vicky Dombroski, and Dr Robert Shaw, representing Taranaki/Whanganui Conservation Board - representation
Ms Jacq Dwyer, representing Patea Historical Society- representation
Ms Glenys Ellett and Graham Ellet, representing Waitotara Patea Surfcasters Club - representation
Ms Lyn Pearson, representing Sustainable Wanganui - representation
Mr James Croker -representation
Mr John Hubbard - representation
Mr Lincoln and Deanne McCrea - representation
Mr Ian Poff - representation
Mr Ron Hepworth- representation
Mr Mark Donald - representation
Ms Michaela Stoneman - representation
Ms Hinemaria Ward-Holmes and Heather Cunningham - representation
Ms Paulina Sadowska and June Penn - representation
Ms Joanne Lynne Massey - representation
Ms Lisa Schill - representation
Mr Sebastian Mueller - representation

Mr Chris Wilkes - representation
Ms Denise Lockett - representation

Day 13 — 9 March 2017

The Devon Hotel, New Plymouth

Mr Paul Williams - representation
Dr Lyndon Devantier - representation
Ms Jacqueline Cran - representation
Mr Danielle Hart - representation
Ms June Penn, representing Ra Puriri - representation
Mr Neil Jennings -representation
Ms Emily Bailey - representation
Mr Urs Signer -representation
Ms Cally Brown - representation
Mr Vic Albon - representation
Mr George Johnston -representation
Dr Tom Cresswell, representing the EPA – evidence on eco-toxicity
Mr Steve Pivac -representation

Day 14 — 15 March 2017

Westpac Stadium, Wellington

Mr Paul Vorwerk, Mr Nigel Clifford and Mr Kenneth Crawford, representing Maritime New Zealand
Mr Wayne Vernon and Mr Mark Pizey, representing WorkSafe
Mr Richard Leckinger - representation
Ms Stine Tang Sorensen - representation
Mr Andrew Mepham - representation
Mr Dani Lebo - representation
Ms Franca Morani - representation
Mr Roderick Young - representation
Mr Jim Mikozi - representation
Dr Jacqui Malpas, representing Geodiversity Ltd - representation
Ms Beth Pearsall - representation
Mr David March - representation
Dr Stuart Bramhall - representation
Ms Annette Mitchell - representation
Mr Andrew Bonner - representation
Mr Ash Howell - representation
Dr Athol Steward - representation
Mr Oliver Hoffmann - representation

Day 15 — 16 March 2017

Westpac Stadium, Wellington

Dr Robert Overy, representing Origin Energy Resources Kupe NZ Ltd – evidence on geotechnical impacts of the application on OERKL's current and future operations

Mr Joseph Hassell - representation

Ms Mareta Marsters-Grubner- representation

Ms Marianne Archibald - representation

Mayor Hamish McDouall, representing the Whanganui District Council - representation

Mr Owen Hobbs, representing Origin Energy Resources Kupe NZ Ltd – overview evidence

Mr Iain Currill, representing Origin Energy Resources Kupe NZ Ltd – evidence on current operations and future expansion

Mr Chris Carra, representing Origin Energy Resources Kupe NZ Ltd – evidence on impacts on the TTRL application on OERKL's current and future operations

Mr Martin Aylward, representing Origin Energy Resources Kupe NZ Ltd – evidence on OERKL's operations

Mr Anton van Helden, representing the Royal Forest and Bird Protection Society – evidence on marine mammals including whales

Ms Nicole Hancock - representation

Day 16 — 17 March 2017

Westpac Stadium, Wellington

Mr Steve Halley, representing the Ministry for Primary Industries

Dr Peter Longdill, representing the Department of Conservation

Ms Anne MacLennan - representation

Ms Kirsty Woods, representing Te Ohu Kaimoana

Mr Daniel Govier, representing TTRL – evidence on monitoring effects and management plans

Mr Bruce Clarke, representing the Fisheries Submitters – evidence on environmental risks

Dr Phillip Mitchell, representing TTRL – evidence on planning and conditions

Dr Robert Lieffering, representing EPA – evidence on planning and conditions

Mr Duncan Currie, representing KASM and Greenpeace – legal submission

Mr Peter Anderson, representing the Royal Forest and Bird Society - legal submission

Day 17 — 20 March 2017

Westpac Stadium, Wellington

Ms Helen Anderson, representing the Fisheries Submitters – evidence on planning and conditions

Ms Lynne Wilkins - representation

Ms Natasha Sitarz, representing Royal Forest and Bird Society – evidence on planning and conditions

Dr Phillip Mitchell, representing TTRL – evidence on planning and conditions

Mr Gerrard Albert and Ms Jenny Tamakehu, representing Te Whiringa Muka Trust, Whanganui Iwi Fisheries Ltd and Nga Tangata Tiaki o Whanganui - representation

Mr David Randal, representing EPA – legal submission

Ms Catherine Iorns, representing Te Kaahui o Rauru - evidence

Mr Nicholai Anderson, representing the Ministry of Business, Innovation and Employment (MBIE) – legal submission

Mr Mike Holm, representing TTRL - legal submission

Mr Phil McCabe, representing Kiwis Against Seabed Mining - representation

Day 18 — 21 March 2017

Westpac Stadium, Wellington

Ms Mandy Leathers - representation

Mr Tony Oosten - representation

Ms Kelly Murphy - representation

Mr Xavier Meade- representation

Mr John Lawson - representation

Ms Stephanie Philp - representation

Ms Cynthia Douds - representation

Ms Marie Moodie - representation

Dr Leigh Torres, representing KASM and Greenpeace – evidence on marine mammals

Day 19 – 22 May 2017

Cliftons Conference Centre, Wellington

Mr Darran Humpheson - representing TTRL – evidence on marine acoustics

Dr Simon Childerhouse - representing TTRL – evidence on marine mammals

Dr Alec Duncan - representing Royal Forest and Bird Protection Society – evidence on sound propagation modelling and sound source levels

Dr Christine Erbe - representing Royal Forest and Bird Protection Society – evidence

Day 20 — 23 May 2017

Cliftons Conference Centre, Wellington

Mr Anton van Helden, representing Royal Forest and Bird Protection Society – evidence on marine mammals

Matthew Brown, representing TTRL – spatial mapping display

Day 21 — 24 May 2017

Cliftons Conference Centre, Wellington

Dr Robert Lieffering, representing the EPA – evidence on planning and conditions

Dr Phil Mitchell, representing TTRL – evidence on planning and conditions

Ms Bronwyn Carruthers, representing Origin Energy Resources (Kupe) – closing statement

Day 22 — 25 May 2017

Cliftons Conference Centre, Wellington

Ms Ruby Haazen and Mr Duncan Currie, representing KASM and Greenpeace – closing statement

Mr Peter Anderson, representing Royal Forest and Bird Protection Society – closing statement

Mr Robert Makgill and Mr Peter Dawson, representing the Fisheries Submitters – closing statement

Mr Mike Holm, representing TTRL – closing statement