SOUTH TARANAKI BIGHT OFFSHORE IRON SAND EXTRACTION AND PROCESSING PROJECT

IMPACT ASSESSMENT

August 2016

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GLOSSARY OF TERMS

ABS	American Bureau of Shipping
AES	Aquatic Environmental Sciences
AIS	Automatic Identification Systems
AHT	Anchor Handling Tug
AUT	Auckland University of Technology
BEMP	Baseline Environmental Monitoring Plan
Biosecurity Act	Biosecurity Act 1993
BMP	Biosecurity Management Plan
BWM-CON	International Convention for Control and Management of Ships' Ballast Water and Sediments
BWT	Ballast Water Treatment
CDOM	Coloured dissolved oxygen matter
CELR	Catch, Effort, Landing Record
CEV	Cape-size Export Vessel
CMA	Coastal Marine Area
CRMS	Craft Risk Management Standard
Crown Minerals Act	Crown Minerals Act 1991
crawler	Subsea sediment extraction devices
Continental Shelf Act	Continental Shelf Act 1964
CSL	CSL Group
CVA	Cultural Values Assessment
DMC	Decision Making Committee
DOC	Department of Conservation
DPS	Dynamic Positioning System
eCoast	eCoast Marine Consulting and Research
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
EMS	Environmental Management Strategy
EPA	Environmental Protection Authority
Fisheries Act	Fisheries Act 1996
FMA	Fisheries Management Area
Forum Report	TTR – Sand Mining – Patea Matauranga Maori and Customary Fisheries Analysis Te Tai Hauauru Fish Forum Report, Tanenuiarangi Manawatu Inc. 2016
HSW Act	Health and Safety at Work Act 2015
Heritage Act	Heritage New Zealand Pouhere Taonga Act 2014
Heritage New Zealand	Heritage New Zealand Pouhere Taonga
IMV	Integrated Mining Vessel
FSO vessel	Floating Storage and Offloading Vessel
GDP	Gross domestic product
HFO	Heavy Fuel Oil
HMO	Harmful Marine Organism
HSNO Act	Hazardous Substances and New Organisms Act 1996

HRW	H.R. Wallingford Ltd.
IA	Impact Assessment
ICP	Iwi Consultation Plan
IMO	International Maritime Organisation
I-O	Input Output
kg/s/m	kilograms per second per metre
Kupe JVP	Kupe Joint Venture Parties New Zealand
LIMS	Low Intensity Magnetic Separator
Maori Fisheries Act	Maori Fisheries Act 2004
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA Act	Marine and Coastal Area (Takutai Moana) Act 2011
MfE AAQS	Ministry for the Environment Ambient Air Quality Standards
mg/L	milligrams per litre
MPI	Ministry for Primary Industries
MIMS	Medium Intensity Magnetic Separator
MNZ	Maritime New Zealand
MPB	Microphytobenthos
Maritime Transport Act	The Maritime Transport Act 1994
m/s	Metres per second
M2	The twice-daily lunar (average) tidal cycle
NESAQ	National Environmental Standards for Air Quality
NIMS	Non-Indigenous Marine Species
NM	Nautical Miles
NTMC	North and Trew Marine Consultancy
NIWA	National Institute of Water and Atmosphere
NZD	New Zealand Dollars
OCEL	OCEL Consultants NZ Limited
Origin Energy	Origin Energy Resources (Kupe) Limited
OSPM	Operational Sediment Plume Model
PML	Petroleum Mining Licence
project	TTR Iron Sand Extraction and Processing Project
proposed consent conditions	Proposed Marine Consent Conditions – Trans Tasman Resources South Taranaki Bight Iron Sand Project – August 2016
RMA	Resource Management Act 1991
RO	Reverse Osmosis
SKM	Sinclair Knight Merz
SMD	Sediment Model Domain
SOLAS	International Convention for the Safety of Life at Sea, 1974
STB	South Taranaki Bight
Submarine Cable Act	Submarine Cables and Pipelines Protection Act 1996
The Iwi Fisheries	Te Taihauāuru Iwi Fisheries Forum
The Forum Fisheries Plan	Te Tai Hauauru Fisheries Plan (2012 – 2017)
TSHD	Trailer Suction Hopper Dredger
TRG	Technical Reference Group
TTR	Trans-Tasman Resources Limited
T&T	Tonkin and Taylor Limited
µg/l	Microgram per litre
µm	Micron: unit of length equivalent to one thousandth of a millimetre
Wildlife Act	Wildlife Act 1953

1 INTRODUCTION

1.1 Background

This Impact Assessment ("**IA**") has been prepared in support of marine consent and marine discharge consent applications in accordance with the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 ("**EEZ Act**") by Trans-Tasman Resources Limited ("**TTR**") to enable all necessary activities associated with the recovery of iron sand deposits from the Exclusive Economic Zone ("**EEZ**"). The recovery of iron sands is to occur within an area of 65.76 km^2 within the South Taranaki Bight ("**STB**").

These applications follow a previous application by TTR for the recovery of iron ore deposits in the same location in 2013. That application was refused by a Decision-Making Committee ("**DMC**") appointed by the Environmental Protection Authority ("**EPA**"). The DMC considered the previous application was not sufficiently robust in respect of a number of matters.

As a consequence, TTR has undertaken a comprehensive work programme to update and refine the physical models that support the effects assessments in order to address the areas of perceived uncertainty and, therefore, the concerns of the previous DMC. TTR has also undertaken a wide range of additional scientific studies. The new work has focused on obtaining a comprehensive understanding of sediment plume source, sediment characteristics and dispersion, optical properties, primary production and ecological resources. The results of this work are incorporated into the revised assessments which form the basis of this IA.

In some instances, TTR also sought both national and international peer reviews of the scope and results assessments it had commissioned in order to ensure that these were robust.

When considering the existing and new technical information, and the assessments that have been commissioned by TTR, it is considered that any perceived short-comings in the previous application have been suitably addressed and that the assessments contain the best available information to enable the consideration of the marine consent and marine discharge consent applications for the project by the EPA.

1.2 Trans-Tasman Resources Limited

TTR 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. TTR is committed to the recovery of offshore iron ore deposits because it is a proven, environmentally sound and economically viable approach to mineral extraction. Furthermore, the recovery of offshore iron ore deposits is able to be undertaken without the detrimental effects on communities and the environment that are often associated with traditional land-based mining operations.

TTR shares the values of New Zealanders and the communities that it is operating in. TTR provides for these through a commitment to protecting the environment and a commitment to the following values:

- Sustainability;
- Environmental responsibility;

- Transparency;
- Integrity;
- Mutually respectful and beneficial relationships;
- Performance; and
- Accountability.

TTR's proposed operation is consistent with a 'best practicable option' approach to mineral extraction and recovery. Through extensive investment in environmental, social, scientific and engineering research and development, TTR is confident that the recovery of iron sand from the STB meets the requirements of the EEZ Act.

TTR is also committed to working with local communities and tangata whenua to achieve sustainable and enduring economic benefits for the Taranaki Region and New Zealand.

1.3 Project Background and Rationale

1.3.1 Project Background

TTR currently 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 (refer to Appendix 1.1). The permit is subject to specific conditions and does not of itself authorise TTR to commence iron sand recovery activities within the defined permit area. A key requirement of the permit's conditions is that:

> *"2 In carrying out activities under this permit, the permit holder must:*
>
> *…*
>
> *(b) obtain any consents and approvals required under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, and any other applicable acts; and*
>
> *…"*

TTR has invested more than NZD$60 million since 2007 into research on the development of a world-leading approach to low-impact, environmentally responsible seabed mineral recovery. This application is the culmination of the research undertaken by TTR.

The project area encompasses approximately 65.76 km^2 located between 22 and 36 kilometres ("**km**")[1] off the coastline of South Taranaki (refer to Figure 1.1 below). TTR proposes to extract up to 50 million tonnes of seabed material per year, targeting the recovery of iron sand deposits. Of the extracted material, approximately 10% by volume, will be processed into iron ore concentrate for export. The remaining de-ored sediments will be re-deposited on the seabed within the previously excavated area via a controlled discharge system.

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[1] This equates to between 12 and 19 nautical miles ("**NM**").

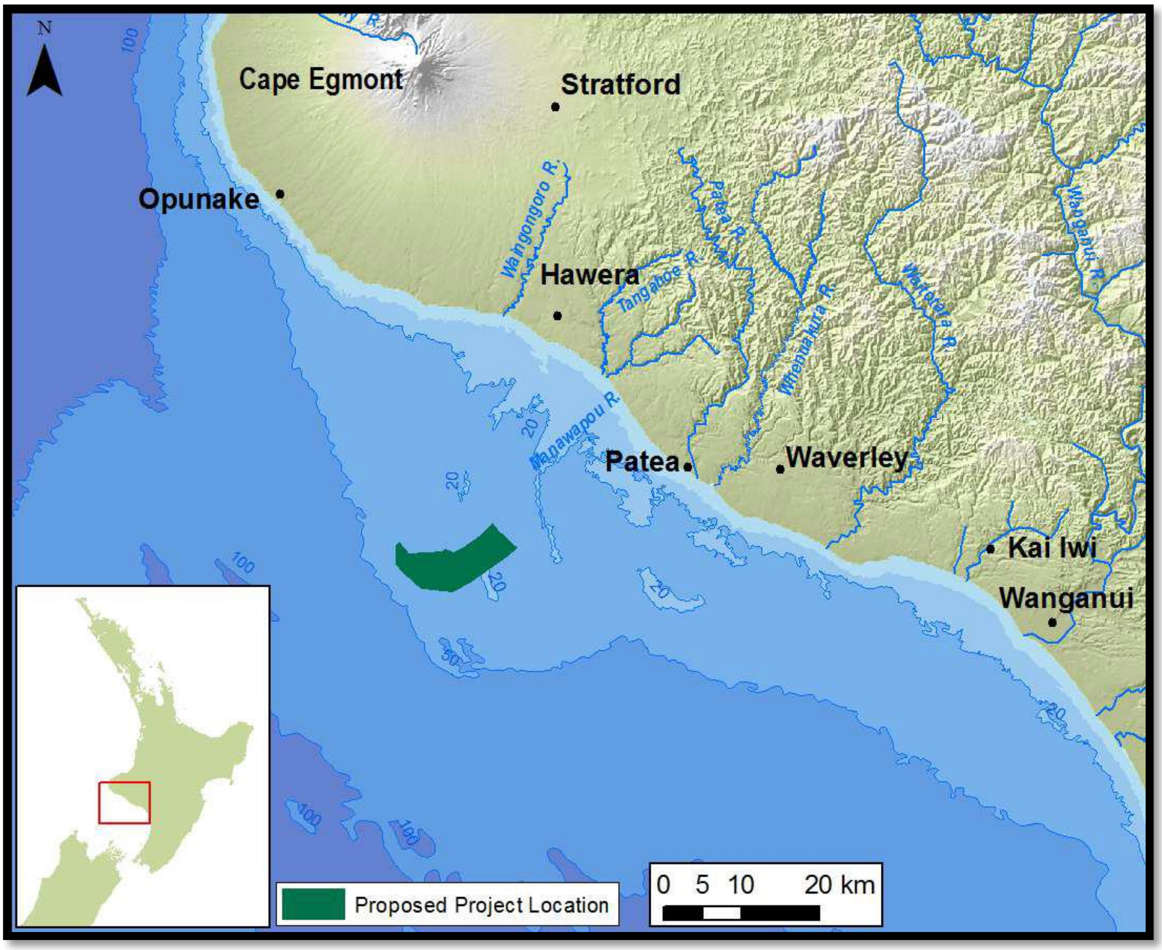

Figure 1.1: Trans-Tasman Resources Application Area.

1.3.2 Project Rationale

The offshore iron ore has the potential to become a valuable and strategic source of export revenue for New Zealand because of the projected long-term international demand and the low operating cost model. New Zealand has a freight advantage over other iron ore suppliers, such as those in West Africa and Brazil, as it is geographically well placed to service China's demand for iron ore (which continues to make up more than half of the global demand for iron ore).

The Prime Minister's Speech from the Throne in October 2014[2] noted *"the Government believes that balanced and sensible management of our natural resources can meet environmental responsibilities while creating economic opportunities".*

The Government's Business Growth Agenda 2015 also sets out the following high-level goal for natural resources: *"the quality of our natural resource base improves over time, while sustaining the growth needed from key sectors to meet our 40 percent exports to GDP target".*

This project has been designed with an environmental and socio-economic focus, and when fully operational is expected to increase New Zealand's Gross Domestic Product ("**GDP**") by approximately NZD$159 million and increase national employment

2 https://www.beehive.govt.nz/speech/speech-throne-2

numbers by approximately 1,666, through direct, indirect and induced jobs. As such, the project will contribute to the Government's goals in the Business Growth Agenda.

Approximately half of the operational costs associated with the project will be spent in the Taranaki and Manawatu - Whanganui Regions. The Economic Impact Analysis undertaken by Martin Jenkins (Jenkins (2015))[3] estimates that, for these regions combined, the project will raise the GDP by NZD$50 million and create approximately 705 direct, indirect and induced jobs.

Manning the project will require over 200 skilled workers, including offshore for vessel operations as well as staff for onshore activities and facilities. TTR is also committed to focusing on sourcing services, supplies and people from the local community where possible, and is aiming for 80% of staff to be based within, or near, the Taranaki and Whanganui Regions. TTR is already in discussions with the local community in relation to engineering and maintenance services related to the project.

The iron ore exports will add to New Zealand's export earnings. Based on the recent historically low price of iron ore of US$40/tonne, TTR's operation would earn approximately NZD$312 million annually. To put that in context, it would be in the top 20 of New Zealand exports by itself. When combined with "Iron, Steel and Articles of Iron and Steel", the added contribution of nearly 50% to the category would raise it into the top 10 (refer Table 1.1 below).

Table 1.1: New Zealand Exports (Year to June 2015).

Export category	$m
Dairy	12,036
Meat	6,376
Wood	4,596
Wine	1,424
Seafood	1,407
Machinery and Mechanical Appliances	1,353
Oil	1,215
Kiwifruit	1,182
Aluminium	1,070
Electrical Machinery and Equipment	808
Wool	805
Precious Stones, Metals and Jewellery	688
Iron, Steel and Articles of Iron and Steel	638
Apples	562
Plastic Materials and Articles of Plastic	452
Vegetables	395
Live Animals	370
Iron Ore[4]	**312**
Carpets and Other Textile Floor Coverings	128
Fabrics, Textiles and Apparel	125
Printed Books, Newspapers etc.	53

Additional economic benefits that will also occur as a result of the project (e.g. taxes and royalties, inward capital investment, employer funded employee benefits such as health insurance and superannuation, and any profits and cash retained within New Zealand) have not been included in this assessment.

[3] *Economic Impact Analysis of Trans-Tasman Resources Offshore Iron Sands Project*, 30 October 2015, Martin Jenkins (Jenkins 2015).

[4] Based on a spot price of US$40/tonne for iron ore.

1.4 EEZ Consent Requirements

In order to authorise the project's activities, TTR requires marine consents under section 20 of the EZZ Act and also a marine discharge consent under the Exclusive Economic Zone and Continental Shelf (Environmental Effects – Discharge and Dumping) Regulations 2015 ("**EEZ Regs 2015**").

The individual activities requiring consent and the provisions under the relevant section of the EZZ Act and the relevant regulation in the EEZ Regs 2015 are identified in the sub-sections below.

1.4.1 Marine Consent Requirements

Section 20 of the EEZ Act restricts certain activities, other than those which relate to discharges or dumping, from being undertaken in the EEZ or in, or on, the continental shelf unless they are a permitted activity or authorised by a marine consent in accordance with the Act.

The activities associated with the recovery of iron ore deposits and related environmental monitoring activities requiring marine consent in accordance with section 20 of the EEZ Act are detailed in Table 1.2 below.

Table 1.2: Marine Consent Requirements.

Section of the EEZ Act	Activity for which Marine Consent Required	Project Element
s20(2)(a)	The construction, placement, alteration, extension, removal, or demolition of a structure on or under the seabed.	• 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. • The placement, movement and removal of the crawler on or under the seabed. • The placement, movement and removal of the grade control drilling equipment on or under the seabed. • The placement, movement and retrieval of moored environmental monitoring equipment on or under the seabed.
s20(2)(d)	The removal of non-living natural material from seabed or subsoil.	• The removal of sediment from the seabed and subsoil using the crawler and by grade control drilling. • The taking of sediment and benthic grab samples from the seabed and subsoil associated

Section of the EEZ Act	Activity for which Marine Consent Required	Project Element
		with environmental monitoring.
s20(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.	• 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. • 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. • The disturbance of the seabed and subsoil associated with the placement, deployment, retrieval and mooring of environmental monitoring equipment. • The disturbance of the seabed and subsoil associated with the taking of sediment and benthic samples associated with environmental monitoring.
s20(2)(f)	The deposit of any thing or organism in, on, or under the seabed.	• The re-deposition of de-ored sediments in, on or under the seabed. • 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).
s20(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.	• 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. • The disturbance and damage of the seabed and subsoil as a result of seabed material extraction via the crawler, the re-deposition of de-ored sediments, and the grade control drilling. • The disturbance and damage of the seabed and subsoil as a result of the placement, deployment, retrieval and mooring of environmental

Section of the EEZ Act	Activity for which Marine Consent Required	Project Element
		monitoring equipment. • The disturbance and damage of the seabed and subsoil as a result of the taking of sediment and benthic samples associated with environmental monitoring.
s20(4)(a)	The construction, mooring or anchoring long-term, placement, alteration, extension, removal, or demolition of a structure, part of a structure, or a ship used in connection with a structure.	• 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. • The placement, movement and removal of the crawler in the water column above the seabed. • The placement, movement and removal of the grade control drilling equipment in the water column above the seabed. • The placement, deployment, retrieval and mooring of environmental monitoring equipment in the water column above the seabed.
s20(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.	• Vibration (noise) caused by the IMV and crawler during iron sand extraction activities.

1.4.2 Marine Discharge Consent Requirements

Further to the requirements of section 20 of the EEZ Act, the mining discharges associated with the project also require consent to authorise the discharge activities.

Section 4(1) of the EEZ Act defines ‘mining discharges’ as:

> *“…in relation to a harmful substance, means a discharge made as an integral part of, or as a direct result of, a mining activity”*

Further, section 4(1) also identifies a ‘harmful substance’ as:

> *“…any substance specified as a harmful substance by regulations made under this Act”*

With regard to ‘regulations made by this Act’, the regulation of activities associated with the discharge and dumping in the EEZ and beyond were formally transferred from the Maritime Transport Act 1994 (“**Maritime Transport Act**”) to the EEZ Act on 31 October 2015. The transfer of control resulted in the creation of the EEZ Regs 2015.

Regulation 4(d) of the EEZ Regs 2015 identifies that *'sediments from mining activities other than petroleum extraction'* is a *'harmful substance'.*

Based on the description of the project in Section 2 of this IA, the project has the potential to generate the following 'mining discharges' from an 'integral part of' the project being:

- The release of seabed material (sediments) as a result of the seabed disturbance during grade control drilling activities;
- The release of disturbed seabed material (sediments) as a result of the seabed disturbance during the crawler extraction operations;
- De-ored sediments and any associated contaminants discharged back to the water column from the IMV; and
- The release of seabed material (sediments) as a result of taking of sediment and benthic samples associated with environmental monitoring.

Subpart 2 of the EEZ Act, which includes section 20B and 20C, contains provisions on the restriction on mining discharges from ships / structures. As the discharge activities meet the definition of *'mining discharges'* and subsequently *'harmful substances'*, sections 20B and 20C of the EZZ Act apply and require that a 'mining discharge' may occur if the activity is permitted or authorised by a consent.

As the 'mining discharge' activities are not permitted under the EEZ Act or the EEZ Regs 2015, a consent is required.

With regard to the consents required, Part 3, Subpart 2 (marine discharge consents and marine dumping consents), section 87A(1) of the EEZ Act states that:

> *"(1) This subpart applies in relation to an activity described in subpart 2 of Part 2."*

As the mining discharges are identified as 'an activity described in subpart 2 of Part 2', a marine discharge consent is required for these activities, therefore the EEZ Regs 2015 apply to the activities.

Therefore, the marine discharge consent requirements for the project are documented in Table 1.3 below.

Table 1.3: Marine Discharge Consent Requirements.

Relevant Regulation from the EEZ Regs 2015	Activity for which Marine Discharge Consent Required	Project Element
Regulations 10 – ***non-notified***	The discharge of sediments, other than a discharge that is permitted by regulation 7, 8, or 9 or prohibited by regulation 11, is classified as a discretionary activity under the EEZ Act	• The release of seabed material (sediments) as a result of the seabed disturbance during grade control drilling activities; • The release of disturbed seabed material

Relevant Regulation from the EEZ Regs 2015	Activity for which Marine Discharge Consent Required	Project Element
		(sediments) as a result of the seabed disturbance during the crawler extraction operations; and • De-ored sediments and any associated contaminants discharged back to the water column from the IMV. • The release of disturbed seabed material (sediments) as a result of taking of sediment and benthic samples associated with environmental monitoring.

TTR has identified that there may also be some very low level residual contaminant discharges, in the form of biodegradable hydraulic fluid (Hytec Bio 46 or a similar product (refer to Appendix 1.2 (Material Safety Data Sheet)) from the crawler and other operational equipment, during the recovery of the iron sands.

When considering the discharge of this material, as the biodegradable fluid is a vegetable oil based product with no ecotoxic characteristics that does not contain any petroleum based product, it does not meet the definition of 'oil' under section 3 the EEZ Regs 2015 as it is not petroleum (a); and vegetable oils are specifically excluded from the Appendix of Part 120 of the Maritime Protection Rules (b). Section 3 of the EZZ Regs 2015 defines 'oil' as:

> *"(a) means petroleum in any form, including crude oil, fuel oil, sludge, oil refuse, and refined products (other than petrochemicals subject to the provisions of Part 140 of the Marine Protection Rules); and*
>
> *(b) includes any substance declared to be oil in the Appendix to Part 120 of the Marine Protection Rules and any oily mixture."*

Nor does it meet the definition of a 'harmful substance' under the EEZ Regs 2015 as it is not ecotoxic (section 4a), it is not an oil (section 4b), it is not garbage (section 4c), and it is not a sediment from mining activities (section 4d). As such, the activity does not fall for consideration under the EEZ Regs 2015, require a marine discharge consent or a marine consent under the EEZ Act.

On this basis, any discharges of residual biodegradable hydraulic fluids from the crawler or other operational equipment is considered to be an 'activity that is not regulated under the EEZ Act' and has been identified for consideration under section 59(2)(b)(i) of the EEZ Act as described in Section 1.4.4 below.

1.4.3 Activity Status

When considering discretionary activities under the EEZ Act, section 36 of the EEZ Act states:

> *'(1) An activity is a discretionary activity if regulations—*
>
> *(a) describe the activity as discretionary; or*
> *(b) allow the activity with a marine consent; or*
> *(c) do not classify the activity as permitted, discretionary, or prohibited.*
>
> *(2) A person must have a marine consent before undertaking a discretionary activity.'*

The activities identified in Tables 1.2 and 1.3 above are considered discretionary activities in accordance with section 36(1)(c) of the EEZ Act because neither the EEZ Act or the EEZ Regs 2015 classify the activities as being either permitted or prohibited activities.

Section 36(2) identifies that a person must have marine consent before undertaking any discretionary activity in the EEZ. As such, TTR is seeking all necessary marine consents and marine discharge consents for the activities associated with the recovery of iron sands from the EEZ.

1.4.4 Activities not Regulated by the EEZ Act

In addition to the above, there are activities to be conducted as part of the project area that are covered by other regulatory regimes or consent processes. Although these activities are not included in this application for the marine consents and marine discharge consents, they are described in this IA as they are relevant to understanding this application and assessing the measures required by other regimes that may have the effect of avoiding, remedying and mitigating the adverse effects of the project. In addition, section 59(2)(b)(i) of the EEZ Act requires the decision-maker to take into consideration 'the effects of activities that are not regulated under this Act'.

For the purpose of this application, the activities that are not considered under the EEZ Act, or regulated by any of the EEZ Regulations, are identified below:

- Ship to ship ore transfer;
- Ship to ship fuel transfer;
- Taking of seawater associated with the iron sand extraction activity;
- Discharge of de-salinated and / or re-salinated water following the processing of the seabed material;
- Discharge of residual biodegradable hydraulic fluids from the crawler and other operational equipment;
- Discharges to air and effects on air quality;
- Navigational safety and vessel movement;
- Taking of seawater for the purposes of environmental monitoring;

- Unplanned oil / fuel spills;
- Vessel lighting;
- Recreation and tourism activities;
- Economics and social impacts;
- Antifouling and biosecurity activities; and
- Health and safety.

TTR note that while the effects of these activities are required to be considered under section 59 of the EEZ Act, an assessment of these effects is not required to form part of any Impact Assessment for a Marine Consent and / or Marine Discharge Consent application. However, in order to ensure that a comprehensive approach has been undertaken when considering the project, an assessment of the effects related to the abovementioned activities has been included in the assessments in Section 4 of this IA.

1.5 Report Structure

All matters required to be addressed under the EEZ Act are contained in this IA, which is set out in eight sections as follows:

Section 1 This introduction.

Section 2 Describes all components of the project in detail.

Section 3 Describes the existing environment and identifies existing interests within the project area and the surrounding environment.

Section 4 Provides an assessment of the actual and potential environmental effects of the project, including cumulative effects and the effects of other activities undertaken in the project area. This section also describes the measures that TTR intends to take to avoid, remedy or mitigate potential effects on the environment.

Section 5 Summarises the monitoring and management framework to be implemented by TTR as part of the project. Further, this section also describes the monitoring and management measures that TTR intends to take to avoid, remedy or mitigate potential effects on the environment, including a set of the proposed consent conditions for the project.

Section 6 Describes the consultation undertaken by TTR with stakeholders and persons with existing interests, and outlines the ongoing consultation that will occur following lodgement of the marine consent and marine discharge consent applications.

Section 7 Sets out the statutory framework against which the marine consent and marine discharge consent applications have been made and assesses the project in relation to the provisions of the EEZ Act and other relevant legislation and marine management regimes.

Section 8 Provides a concluding statement to this IA.

2 THE PROPOSAL

2.1 Project Area

The project area in which the iron sand recovery activities will take place encompasses an area of approximately 65.76 km^2 within the STB (refer to Figure 1.1). The project area is located between 22 and 36 km off the coast in the EEZ (i.e. outside of the 12 NM limit) and in waters that are between 20 and 42 m deep. The project area has been defined to provide sufficient space for all project related operations including; extraction, re-deposition, anchor handling and grade control drilling.

TTR has identified a minable resource of titanomagnetite iron sand within the project area, which has been delineated and sampled from 121 drill holes. The exploratory drilling has identified the project area as having one of the highest iron ore grades within the STB.

2.2 Iron Sand Resource

Iron sand is a general term for sand-sized grains of iron-rich minerals, principally magnetite (Fe_3O_4), titanomagnetite (Fe_2TiO_3) and ilmenite ($FeTiO_3$). The offshore iron sands in the STB are considered to be the largest known resource of metalliferous ore in New Zealand. Onshore, New Zealand's iron sands occur extensively in coastal dune areas, and within the adjacent continental shelf, along the west coast of the North Island. They have been successfully mined onshore for over 35 years at various locations; including Waipipi, Taharoa and Waikato North.

The offshore iron sands in the STB are a black, heavy, magnetic iron ore that originated as crystals in volcanic rocks and ash deposits mainly derived from Mount Taranaki. Over thousands of years the rock and ash has been washed down and eroded by rivers, transported along the coast by shallow-marine longshore currents, and subsequently concentrated offshore by wave and wind action into remnant beaches and dune lag deposits - such as those found within the project area.

Through aeromagnetic surveys, 2D seismic investigations, and shallow and deep sampling campaigns, TTR has identified areas of higher grade iron sand within the project area. The extent of the extractable resource is up to 11 m below the existing seabed level. TTR has also undertaken resource estimation of the iron sand using exploration and resource estimation software, which models the occurrence of the mineral resource (from drill samples), estimates tonnage and grades (i.e. percentage of iron sand), and design optimisation and scheduling. This has allowed TTR to report mineral resource estimates that are prepared and classified in accordance with the Australasian Code for the Reporting of Identified Mineral Resources and Ore Reserves (JORC (2012))[5], which provides strict standards for public reporting.

2.3 Project Overview

2.3.1 Introduction

This section of the IA provides an overview of the various components of the project, including details of the vessel and machinery requirements, extraction methodology, processing methodology and resourcing requirements.

5 Australasian Code for Reporting of Exploration Results, Minerals Resources and Ore Reserves, 2012. *"The JORC Code – 2012 Edition"* http://www.jorc.org/docs/jorc_code2012.pdf

2.3.2 Vessel and Machinery Requirements

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 Off-loading vessel ("**FSO vessel**");
- Bulk Cape-sized Export Vessel ("**CEV**");
- Anchor Handling Tug ("**AHT**");
- Refuelling vessel; and
- Geotechnical support vessel.

The functions of the required vessels are summarised in the sections below.

2.3.2.1 Integrated Mining Vessel

The IMV is the central vessel for the recovery and processing of iron sands from the project area. 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 a four metre significant wave height (Hs)[6] and will be able to 'sit out' major storm events. The proposed iron sand recovery system is capable of extracting and processing 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).

The IMV will have the following characteristics:

- Overall length: 345 m;
- Length between perpendiculars: 330 m;
- Design draught: 12 m;
- Breadth moulded: 60 m; and
- Depth: 26.25 m.

A schematic of the layout on board the IMV is provided in Figure 2.1 below.

[6] Significant Wave Height is the average of the highest one-third (33%) of waves (measured from trough to crest) that occur in a given period.

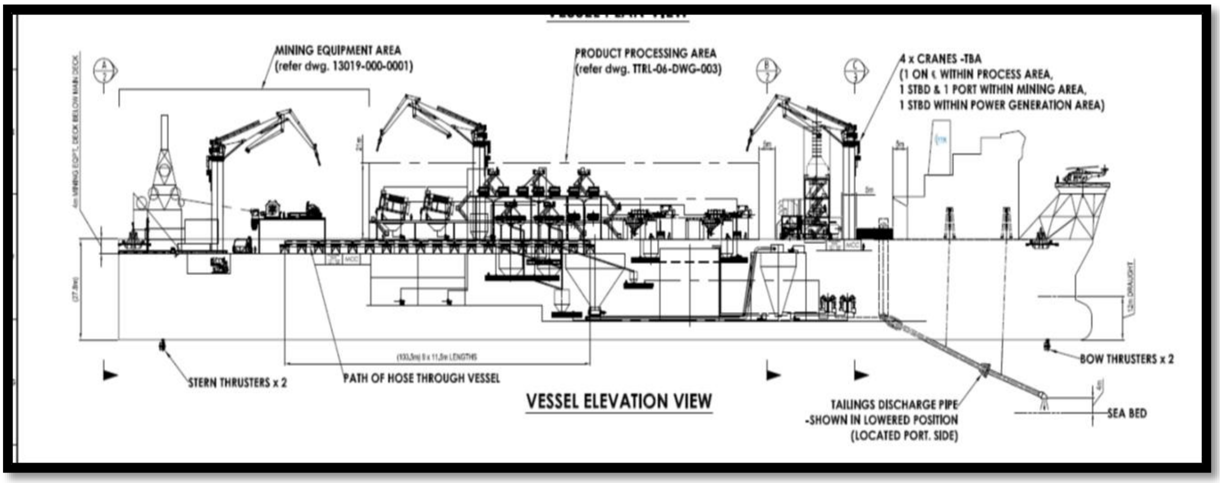

Figure 2.1: Schematic IMV Layout.

The IMV's design has been approved in principle by the American Bureau of Shipping ("**ABS**") Classification Society, a IACS certified Classification Society, with the class notation: **✠ A1, Restricted Service, ✠ AMS, SPS, UWILD, CPS, SH-DLA, SFA (number of years), Circle P, Circle E, Helidk, CRC, TAM, ✠ ACCU,** with the description "Mining vessel" at the specific site, South Taranaki Bight, New Zealand.[7]

The IMV will be fitted with a four point, thruster-assisted, winch mooring system which will allow the vessel to be continually positioned on a pre-determined extraction and associated de-ored sediments deposition pattern. The position keeping capabilities of the vessel consists of six thrusters (three at the bow and three at the stern). The ABS class notations referring to the specific automatic position and heading control for the IMV are the Thruster Assisted Mooring ("**TAM"**) and Automatic Centralised Control Unmanned Systems (**"ACCU")**, which are discussed as follows:

- Thruster Assisted Mooring (TAM): is an automatic position controlled system that is capable of automatically maintaining the position and heading of the vessel under specified maximum environmental conditions, having an independent centralised manual position control with automatic heading control; and

- Automatic Centralised Control Unmanned (ACCU): this notation is assigned to a vessel having the means to control and monitor the propulsion machinery from the navigation bridge and from a centralised control and monitoring station installed within, or adjacent to, the propulsion machinery space.

The IMV shall also be designed to comply with all the relevant international codes, standards and guidelines required for operations within New Zealand and international waters, including:

- International Maritime Organisation ("**IMO**") International Convention for the Safety of Life at Sea, 1974 ("**SOLAS**"), Consolidated Edition 2004 with latest amendments;

7 ABS Notations and Symbols – 29 January 2015

- IMO International Convention for the Prevention of Pollution from Ships ("**MARPOL**") with latest amendments;
- IMO NOx regulations (MARPOL - Annex VI);
- IMO International Convention on Load Line 1966, including Protocol of 1988;
- IMO International Convention on Preventing Collisions at Sea 1972, including amendments of 1981 and 1987;
- IMO International Convention of Tonnage Measurement of Ships 1969;
- Radio Rules of the International Telecommunication Convention, 1976 and 1979;
- Global Maritime Distress and Safety requirements for sea areas A1+A2+A3;
- International Labour Conference Marine Labour Convention 2006; and
- International State and Port Security.

The flag state for the IMV will be New Zealand and as such it will comply with all New Zealand's applicable flag state rules and regulations.

The accommodation on board the IMV will cater for a complement of 140 persons and provide all the necessary amenities for the crew to be self-sustained on the vessel. Any waste, including sewage and garbage, generated onboard will be collected and transferred onshore for disposal by approved operators.

A central power generation module on the IMV will supply power to all aspects of the vessel, including the crawlers, launch and recovery system, vessel positioning systems (thrusters and anchor cable winches), iron ore processing plant, desalination plant and the accommodation block. The power generation module will comprise multiple medium speed reciprocating engines, which have been selected to match the IMV's electricity load profiles under varying operating scenarios (including start up, shut down and vessel only loads).

The proposed medium speed reciprocating engines will be run using Heavy Fuel Oil ("**HFO**") with a maximum sulphur content of 3.5%, but will also be able to operate on diesel, typically prior to shut down to flush the fuel lines of HFO. The engines will operate to International Maritime Organisation ("**IMO**") Tier II emission levels, with no exhaust gas treatment systems.

Transferring the iron ore from the IMV to the FSO vessel requires desalinated water that will also 'wash' the chlorides from the iron ore concentrate to achieve a target chloride content of less than 350 parts per million ("**ppm**"). The required desalinated water will be produced through a modular reverse osmosis system whereby seawater is pumped from the IMV's sea chests through a process that involves screening, heating, straining and filtration. The modular nature of the desalination plant will allow for individual elements to be taken out of service for repair / regeneration without impacting on the rest of the plant operation.

With regard to maintenance of the IMV, as indicated by the IMV's ABS UWILD notation, the vessel will be subject to regular on-board and maintenance. Routine scheduled maintenance activities will be carefully planned considering both weather and sea conditions especially with any subsea related activities i.e. hull, thrusters, sea chests etc. As the IMV is required to stay on station throughout the life of the project, TTR will employ management systems to enable maintenance to be managed at realistic levels without taking undue health and safety, environmental risks or production risks. Maintenance of the IMV's certification will be subject to satisfactory in-service inspection by ABS surveyors as required for classification.

With regard to hull cleaning, the IMV's hull will be protected against marine growth with a long service anti fouling coating in addition to a cathodic protection system. The IMV's hull will not require an annual inspection or cleaning, which will involve the in water inspection and cleaning of the sea chests and thrusters, but this will be part of the programmed maintenance of the vessel and will be typically be done every 3-5 years.

All of the maintenance and, if required, hull cleaning will be done on station within the project area.

2.3.2.2 Sediment Extraction System

Crawlers

The sediment extraction system consists of two remote controlled subsea crawlers, a launch and recovery system, a four-point wire rope mooring system and the controlled tailings depositional system. The subsea crawler is shown in Figure 2.2 below.

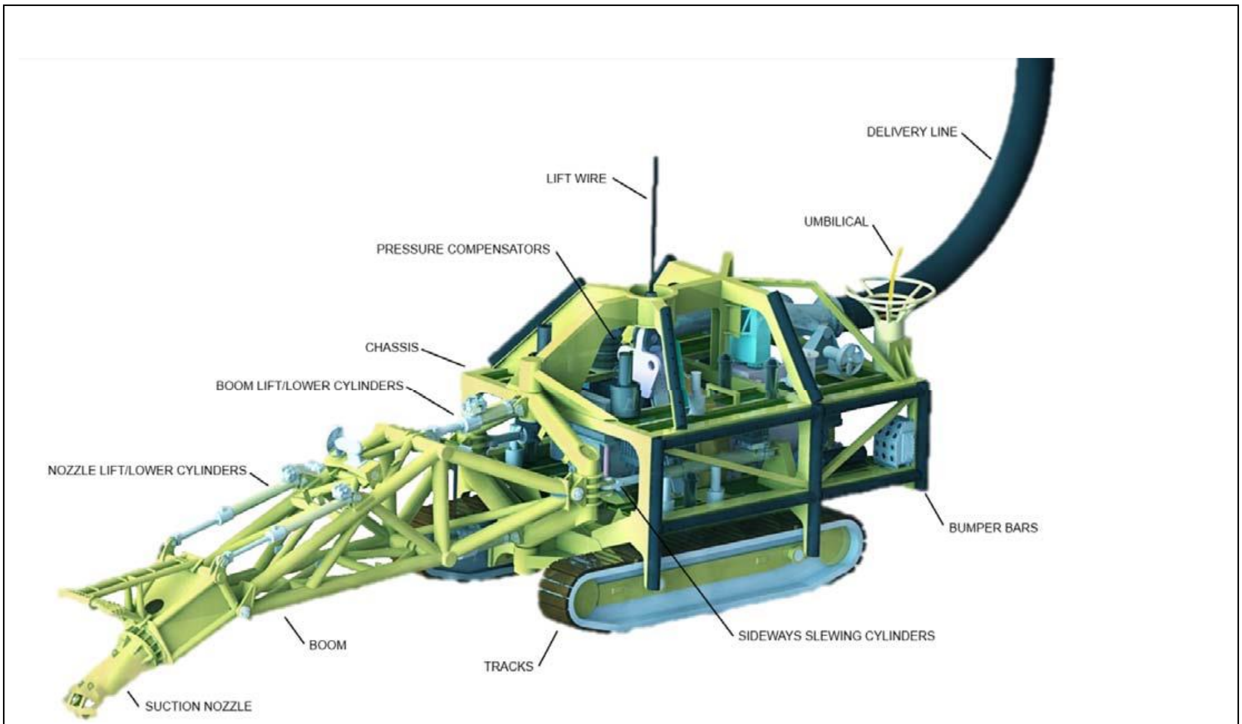

Figure 2.2: Example of the Crawler Configuration.

The crawlers have been designed for continuous operation, with only one of the two crawlers in operation at any time, while the other undergoes on-board maintenance.

Each crawler weighs approximately 420 tonnes with a depth rating of 70 m. The crawlers will be fitted with acoustic seabed navigation and a 3D imaging system, and will systematically advance along pre-determined 'lanes' extracting seabed material containing the iron sand resource. The suction velocities directly at the nozzle entry of a crawler will typically be 1.5 – 2 metres per second ("**m/s**"), with the velocity degrading rapidly 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.

All hydraulic and lubricating fluid for the crawlers will be of a biodegradable type (TOTAL BIOHYDRAN TMP Hydraulic Oil or a similar product) and the systems designed to minimise the risk of hydraulic fluid leaks.

The launch and recovery system will be used to lift the crawler off the IMV and lower it into position on the seabed during the launch phase, as well as retrieving the crawler onto the IMV following the completion of extraction works.

The deposition pipe for de-ored sediments will be located near the bow of the IMV. The pipe's exit end is designed to be lifted and lowered so as to ensure that the sediment is released at a nominal depth of approximately 4 m above the seabed.

2.3.2.3 Floating Storage and Offloading Vessel

TTR has commissioned the CSL Group ("**CSL**") to provide the iron sand transhipment system that consists of a modified self-unloading FSO vessel with a cargo capacity of 60,000 tonnes. The FSO vessel will be designed to be a Dynamic Positioning 2 (DP-2)[8] vessel.

The modified loading system aboard the FSO vessel requires the installation of a pressurised dewatering plant. Extracted iron ore material will be slurried with desalinated water from the IMV and pumped via floating hoses to the FSO vessel.

Once fully loaded, the FSO vessel will sail to a pre-determined area, the transfer site for will be chosen by the Master of the FSO vessel in conjunction with the Master of the CEV (Bulk Cape-sized Export Vessel) as described in Section 2.3.7.1, identified for transfer of the extracted iron ore concentrate onto the CEV. The dewatered iron ore concentrate is then loaded with a mechanical deck conveying system. The 'dry' cargo transfer system is a proven system widely used across CSL's global fleet of vessels.

The general arrangement of the FSO vessel is provided in Figure 2.3 below.

8 A Dynamic Positioning notation refers to station keeping capability, reliability and redundancy. For a vessel with the notation **DP-2**, a loss of position may not occur in the event of a single fault in any active component or system.

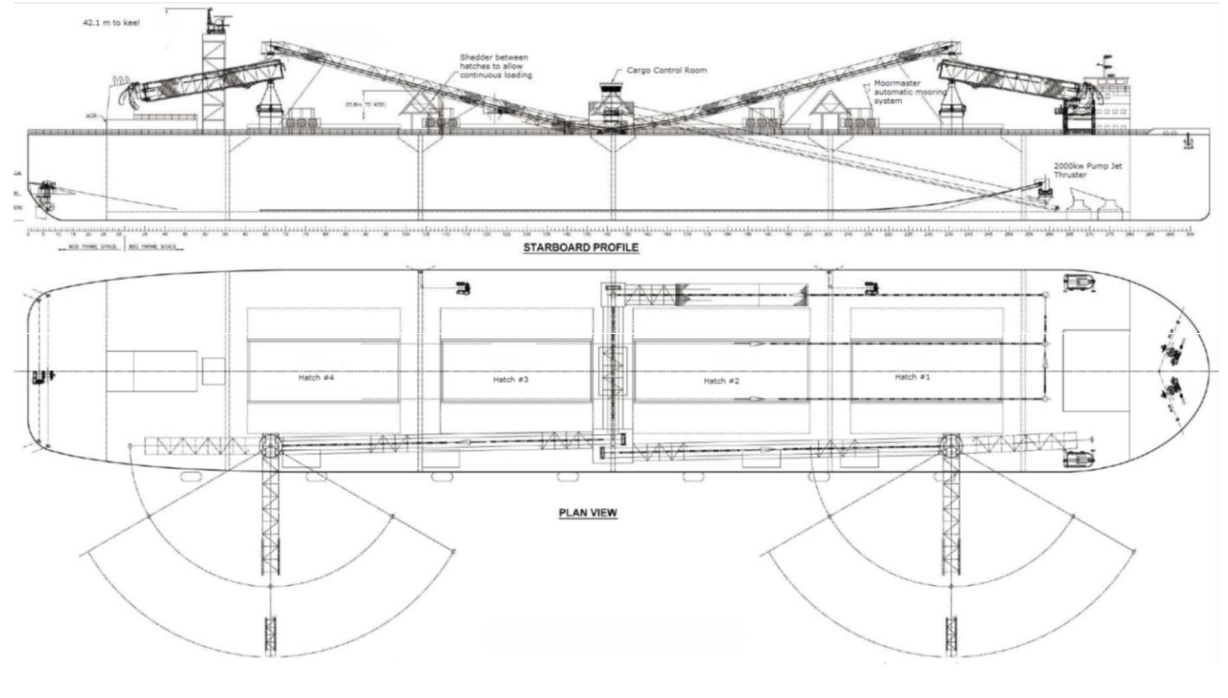

Figure 2.3: FSO vessel 60,000 Self-unloading Transhipment Shuttle Vessel – General Arrangement.

2.3.2.4 Bulk Carrier Export Vessels

CEVs are commonly defined as cape-size bulk carrier export vessels of approximately 180,000 tonne (dead weight) capacity used for international transhipment of iron ore.

The final processed iron ore concentrate will be transferred dry to the CEV from the FSO vessel for export to the international markets.

2.3.2.5 Anchor Handling Tug

The project includes provision for a full-time 80 tonne bollard pull AHT to assist with the relocation and placement of the anchors and mooring lines for the IMV. The AHT will also assist with:

- Provisioning of the project's operational vessels;
- Assist with the connection of floating hoses for transfers from the IMV to the FSO vessel;
- Provide refuelling assistance; and
- Be equipped to assist in case of a fuel spillage event or a fire.

As with the IMV and FSO vessel, any waste generated onboard the AHT will be collected and transferred onshore for disposal by approved operators.

2.3.2.6 Geotechnical Support Vessel

The geotechnical support vessel will be a multipurpose vessel that will be capable of undertaking grade control drilling as well as providing support for environmental monitoring activities within the STB, while based at Whanganui Port.

The geotechnical support vessel will be able to use TTR's shallow drill rig, which is controlled remotely from the vessel using an electric and hydraulic system. The TTR drill rig is approximately 2.5 tonnes and is 11.4 m in height with the base of 2.4 m by 2.4 m, which is the area that is placed on the seabed (see Figure 2.4 below).

Figure 2.4: The drill rig that will be used in grade control drilling.

The geotechnical support vessel (as shown in Figure 2.5 below) is a multi-purpose vessel that will:

- Have an approximate a 25m survey length;
- Have the ability to navigate the Whanganui bar and use Whanganui Port facilities;
- Be classified to operate within 200 miles of the coast;
- Have a clear deck space of 10.5 m by 7 m;
- Have a deck mounted centre line winch (SWL 5T), capable of lowering and raising the 2500kg drill rig;
- Have a two-point anchor system (one bow and one stern), capable of holding the vessel in position with a maximum deviation of 10 m;

- The anchor spread is typically 150m (depending of metocean conditions) from the vessel with the anchors located by buoys;
- The anchors are typically 2 x 145kg SARCA (S/H/H/P) galvanised anchors with two x 50m 2" chains on each anchor. Mooring line is a 18mm wire rope; and
- Have accommodation for 5 people plus the crew.

Figure 2.5: The Island Leader II. Used by TTR for offshore drilling in the South Taranaki Bight. Note the structure at the aft of the vessel is the launch and recovery system from which the grade control drill rig will be launched and recovered from.

2.3.3 Extraction Methodology

Iron sand extraction and processing operations on the IMV are planned to be undertaken continuously over 24 hours per day.

By way of overview, the proposed extraction methodology comprises of two phases:

Phase 1: Grade control drilling and planning; and

Phase 2: Channel extraction of subsea sediments for processing and iron ore recovery**.**

2.3.3.1 Phase 1: Grade Control Drilling

Phase 1 involves grade control drilling to be undertaken by the geotechnical support vessel in advance of any extraction operations.

Grade control drilling involves closely spaced seabed sampling to further define the extent of the extraction area as well as providing further information of the sediment characteristics within this area, prior to any extraction activity. The drilling will use the TTR patented reverse circulation drilling rig, currently used for exploration drilling, which is designed to take representative samples of seabed material at 1 m vertical intervals to a maximum depth of 11 m below the seabed.

Grade control drilling will be undertaken on average to a 100 m spacing within a defined grid pattern, or on an as required basis. The area of seabed affected by each grade control drilling sample will require removing no more than approximately 0.086 m^3 per sample. The drilling rig footprint will occupy around 4 m^2 and leave no visible signs of having been on the seabed once it is removed.

Prior to the launching of the drill rig, the geotechnical support vessel sets anchors on station at predetermined co-ordinates. Once the forward anchor is set the vessel moves back on the anchor to the determined distance and then sets the stern anchor. With the two anchors in place the vessel then advances forward on the forward line with the stern anchor keeping the vessel in line. The entire length paid out is subject to operating depth but typically comprised of approximately 150m in length total, with the operations conducted at mid-point (75m). The mooring would typically be in the water at each site for less than 40mins.

The geotechnical support vessel uses a centre line winch to lower the drill rig to the seabed as well as recover onto the support vessel via a launch and recovery system, which is placed at the stern of the vessel. The launch and recovery system is to assist the recovery of the rig back onto the vessel. There are no loose (or floating) cables or pipelines associated with the drill rig as it is deployed on the seabed undertaking drilling activities.

A hydraulic system is used to control the drilling rate of the drill sampling rod and again to pull the drill string from the hole. The whole process is monitored by two cameras stationed on the rig. As this rig is diverless it can be deployed in water depths of up to 70m. This is a single pass drilling system, with the sampling rod only going through the sediment once, with the maximum penetration depth of up to 11m below the seafloor.

The grade control drilling rig is not a conventional offshore drilling rig, such as that used in petroleum drilling, in that the drill head is not mechanical and does not use drilling fluid to assist drilling recovery of samples. Because the drilling rig only uses air and water the noise generated by the drilling rig is minimal and is considered to be similar to that of background marine vessel noise as described in section 4.9.2.2 of this IA.

2.3.3.2 Phase 2: Extraction of Subsea Sediments

Targeted seabed material, consisting mainly of sediments, will be extracted in a single pass from the seabed and delivered to the IMV using the crawler. Upon completion of the processing (i.e. removal of the magnetic fraction (ore)), the de-ored sediment will be re-deposited into the recently excavated areas, with the exception of the initial excavation lane pass which will be deposited onto existing seabed.

<u>Subsea Sediment Extraction</u>

The crawler’s sediment extraction process will use seawater jets to mobilise the free flowing sediment in front and adjacent to the crawler’s extraction nozzle. This has been shown to create a free flowing slurry that is easily drawn into the crawler’s nozzle and then pumped to the IMV at an average rate of 8,000 tonnes/hour. This extraction system enables TTR to extract the full depth of targeted sediment in a single pass. The depth of each pass is pre-determined by the extraction plan, confirmed during the preceding grade control drilling phase. TTR’s exploration surveys have confirmed that the maximum depth will be no more than 11 m below the surrounding seabed, and on average 5m below the surrounding seabed.

Each detailed extraction area or block is sized at approximately 300 m x 300 m. The IMV, and crawler, will typically work six of these extraction areas or blocks before having to re-position the anchors and move over to the next planned extraction area. At the end of each planned extraction pass, which will typically be 900 m, the crawler will turn 180° and continue adjacent to the previous pass.

Figure 2.6 below illustrates the subsea sediment extraction process outlined above.

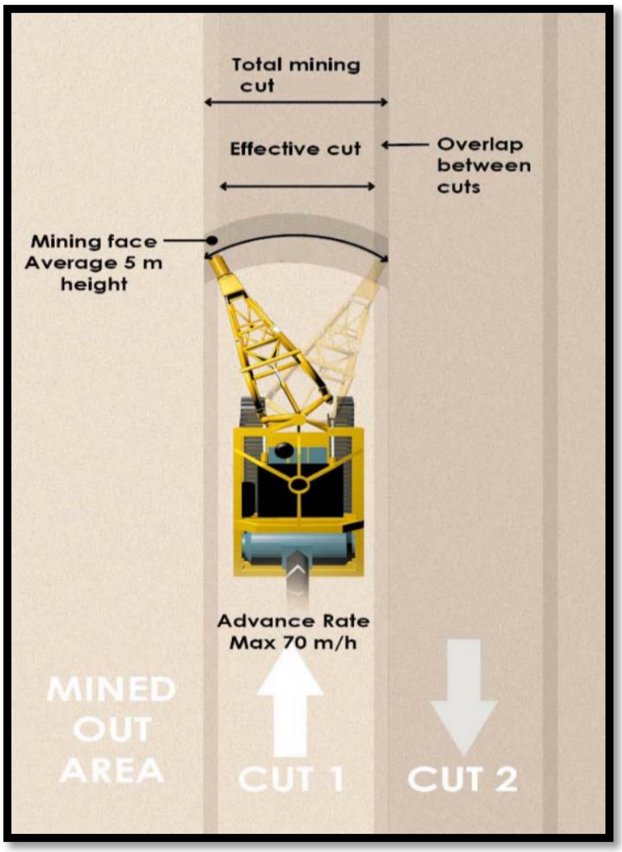

Figure 2.6: General Sediment Extraction Methodology.

<u>Crawler Positioning in Relation to the IMV</u>

Following the anchors being set and the crawler positioned on the seabed, the IMV will use an on-board winching system using the anchor lines to continuously re-locate itself relative to the crawler location on the seabed; which will be working in a pre-determined sequence.

The IMV mooring system has been designed in compliance with the TAM notation from Class[9]. The mooring system will consist of 4 mooring winches complete with wire rope and anchors, assisted by 6 thrusters. If the environmental loads become too large due to a change in sea state or direction of the environmental loads, the thrusters automatically assist by reducing the loads on the mooring wires and maintaining the position of the vessel. The vessel mooring system shall be designed in compliance with the following:

9 ABS Classification Society, a International Association of Classification Societies (IACS) certified body.

- ABS – "Rules for Building and Classing Floating Production Installations, 2014"; and

- API - "Recommended Practice for Design and Analysis of Station keeping Systems for Floating structures, October 2005"

The winching system will enable the IMV to safely and efficiently move over a planned grid in water depths between 20 and 50 m. The IMV will follow the crawler which moves at an average speed of 70 m/hour, depending on the depth of the sediment cut. It is expected that anchor re-positioning will occur approximately every 10 days.

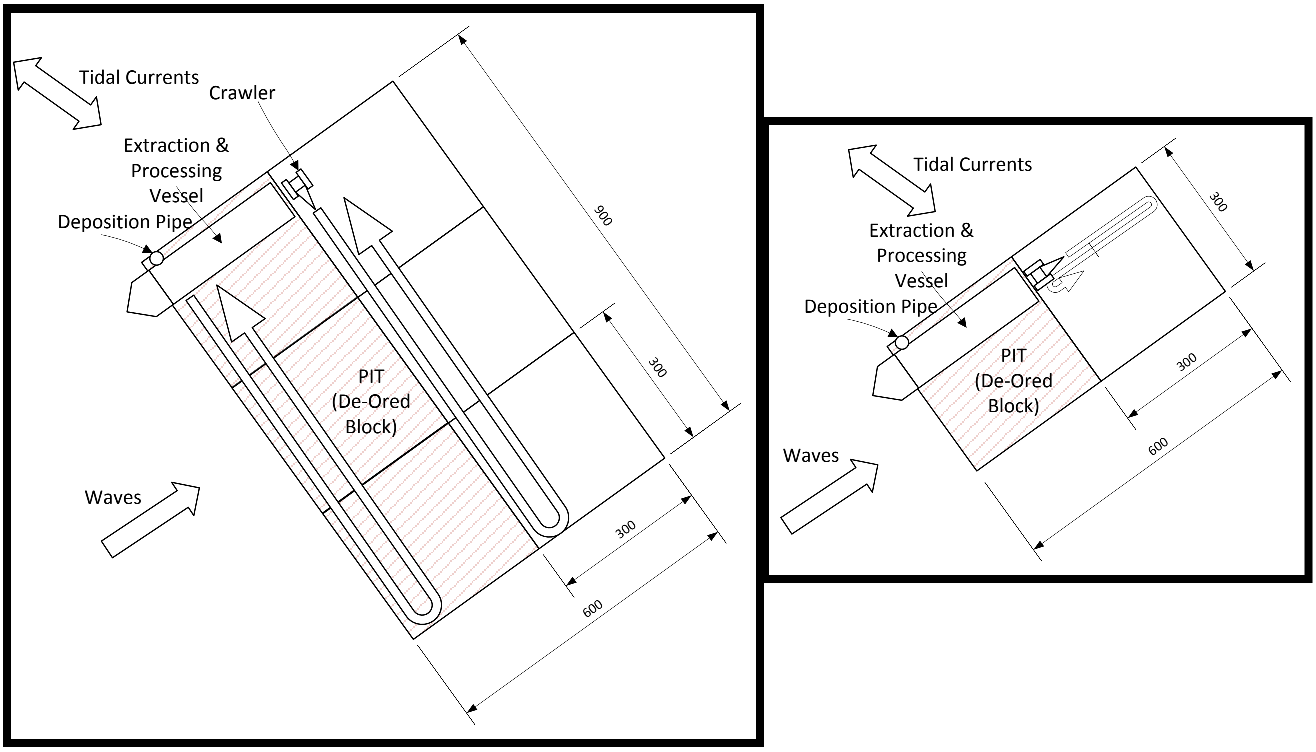

Figure 2.7: Sequence of Typical Extraction Operations.

2.3.4 Processing Methodology

The project will involve the extraction of up to 50 million tonnes of seabed material per year. Around 10% of the extracted material will be processed into iron ore concentrate for export (i.e. up to 5 million tonnes on a rolling 12-month average), with the remaining material (approximately 45 million tonnes) being returned to the area on the seabed, from whence it was extracted, as de-ored sediment via a controlled tailings deposition pipe located near the bow of the IMV.

Processing on the IMV will involve the separation of the iron ore from the seabed material using magnetic separators. To enable the separation and processing of the iron ore concentrate, the process uses seawater extracted from the immediate area and does not involve the addition of any chemicals or other products. The aim of the processing operation is to produce a vanadium bearing titanomagnetite concentrate with a 55 – 57% iron content.

The process steps are summarised as follows:

- Screening: The process uses a vibrating screen effectively removing any +3.5 mm sized material;
- Medium Intensity Magnetic Separation ("**MIMS**"): This is the first stage of magnetic separation and removes the bulk of the non-magnetic sediment from the screened material;
- Classification: This step classifies the material on size and sends the larger particles to a grinding circuit;
- Comminution[10]: This process consists of a vertimill that gently mills the material until it reaches a specific size. The vertimill has been chosen as it employs a low intensity milling action that produces a very low fraction of mill related fines;
- Low Intensity Magnetic Separation ("LIMS"): This is the final magnetic separation of particles that have been through the comminution circuit; and
- Dewatering: The product is dewatered before being stored aboard the IMV for transfer at a later time to the FSO vessel.

2.3.5 Re-deposition of de-ored Sediments

As mentioned above, following the processing of the seabed material to extract the iron ore, approximately 45 million tonnes (on a rolling 12-month average) of de-ored sediments will be returned to the seabed in the general vicinity of where it was extracted within the project area.

The re-deposition will occur via a deposition pipe located on the IMV. The re-deposition process is shown in Figure 2.8 below.

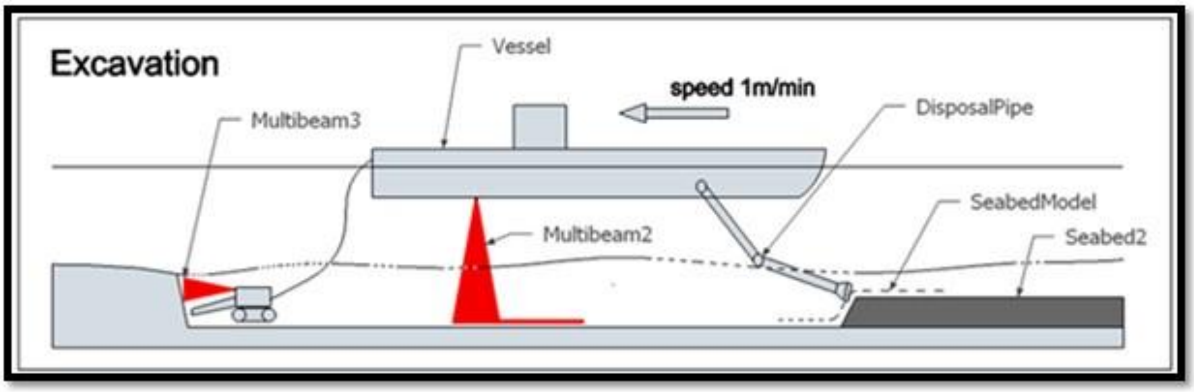

Figure 2.8: Sequence of Extraction Operation.

The key performance parameter for the de-ored sediment deposition is the ability to maintain a constant height of the deposition pipe discharge point above the sea bed. Due to the variation of the water depth, seabed height and the vessel motion it will be required for the installation to constantly change length. Height of deposition pipe outlet above the seabed will be controlled using sonar. The IMV will employ a dedicated low intensity sonar unit to

10 **Comminution** is the reduction of solid materials from one average particle size to a smaller average particle size, by crushing, grinding, cutting, vibrating, or other processes.

profile the sea bottom below the deposition pipe to enable the location of the discharge to be as close to the sea bottom as possible.

System parameters required to ensure consistent slurry flow are:

- Being able to control the slurry feed and pipe angle, both of these parameters will change the flow speed; and

- Being able to re-introduce process water, extracted by the hydro-cyclone, to the de-ored sediment at critical points so the density can be controlled.

The hydro-cyclone is a generic liquid / solid separator unit located on the IMV used to remove a specified fraction of the water contained within the slurry. In the deposition operations it is used to indicate a process step, whereby TTR will be able to control the characteristics of the de-ored sediment slurry at certain points of the deposition operation to assist the slurry in flowing. The removed water will be reintroduced to the slurry before the de-ored sediment slurry is released from the deposition pipe.

2.3.6 Transfer from IMV to FSO Vessel

The FSO vessel will connect to the IMV via a floating slurry line between 70 and 110 m in length that provides for the transfer of the iron ore concentrate. The transfer operations will be undertaken in accordance with industry best practice methods which are consistent with the method outlined below and discussed in Section 7.5.10.

The IMV transfer process relies on desalinated seawater as a transport medium. De-watered iron ore concentrate on the IMV will be transferred periodically from the storage hoppers onto a conveyor belt, then into a mixing tank, where it will be blended with desalinated water to form a transportable slurry.

Ten proprietary reverse osmosis units will be used on the IMV to generate sufficient desalinated water for transferring the iron ore concentrate to the FSO vessel. A peak daily production of 30,000 m^3 of desalinated seawater will be required, and a total annual requirement of approximately 5,000,000 tonnes.

All chemicals used in the operation of the reverse osmosis plant will be collected and retained for onshore disposal by approved contractors. There will be no chemicals or contaminant by-products discharged to the sea as a result of any processing or water treatment activities related to the project.

As a final process, the iron ore concentrate having been rinsed with the desalinated water, will be de-watered to a final moisture content of less than 10% using hyperbaric disc filtration on-board the FSO vessel using similar equipment as shown in Figure 2.9 below.

Figure 2.9: Example of the Hyperbaric Pressure Filter

The clean resalinated water from the filter system, will be discharged via an outfall pipe located 1 m below the surface near the bow of the FSO vessel.

Once the iron ore concentrate transfer operation is complete, the vessels will be disconnected and the floating slurry lines relocated back onto the IMV.

2.3.7 Export to World Markets

2.3.7.1 Transferral to Bulk Carrier Export Vessel

The final iron ore concentrate will be transferred from the FSO vessel to the CEV and exported to world markets.

The transfer site for loading the CEV will be chosen by the Master of the FSO vessel in conjunction with the Master of the CEV. The transfer site will be contingent on weather conditions at the time and the short range forecast. Additionally, TTR requires that the FSO Vessel travel the shortest possible distance to the CEV for transfer however, this will be at least 2 km away from the IMV so that the vessels involved in the transfer process do not to interfere with any operational movements of the IMV or the AHT in the active extraction block.

Subject to maritime safety requirements identified in Section 7.5.10, the transfer of iron ore concentrate is expected to take place in the STB in a location in the south west of the project area. During extreme adverse weather conditions all iron ore transfer will be suspended.

2.3.7.2 Transfer Procedure

TTR will nominate its proposed transfer site to Maritime New Zealand ("**MNZ**") through the Master of the FSO vessel and will occur in accordance with best practice methods which are described in Section 2.3.6.

Transhipping of iron ore from the FSO vessel to the CEV uses proven methods used in many locations around the world and will involve dedicated belt conveyors installed below the FSO vessel holds, allowing a gravity transfer onto an inclining tunnel belt used to elevate the cargo to the main deck of the CEV. The iron ore will then be deposited onto two separate incline conveyors, each feeding a 'ship-loader' located fore and aft on the FSO vessel. The ship-loaders can slew, luff and telescope and are capable of loading and trimming CEV up to 57 m across.

No additional mechanical trimming will be required and there will be no discharge associated with the transfer operation.

2.3.8 Personnel

The project will require the personnel for both offshore and onshore operations. The majority of the personnel requirements relate to the manning of the offshore vessels, with an estimated 200 personnel required to provide sufficient cover for the operation of the IMV, FSO vessel and the AHT.

A further estimated 50 full-time employees will be required to manage the onshore aspects of the project, including administrative, engineering and environmental staff.

2.3.9 Ports and Harbour Usage

The project is likely to use a number of different ports to support the project related vessels depending on the services required and the method of delivering them. The ports of Whanganui, New Plymouth and Nelson are the closest to the project area in that order and each will be necessary to provide the project support in different ways according to their capabilities over the duration of the requested consent term.

2.4 Fuel Storage, Use and Handling

HFO is the preferred fuel option for the project as it is the standard grade fuel for ocean going vessels. There may also be some requirements for the use of diesel on board the IMV, primarily to flush the fuel system on the engines prior to shut down, to run the generators when in port, and for the emergency generator.

The IMV and FSO vessels will have capacity for 35,000 tonnes and 20,000 tonnes of HFO respectively, and under normal operations will consume up to 7,500 and 1,500 tonnes per month.

Refuelling of the IMV and FSO vessel will occur via standard ship-to-ship transfer, which will be consistent with industry best practice currently being applied in the STB by the existing oil and gas operators.

Storage and handling of fuel on the vessels will be managed to comply with the requirements of the Hazardous Substances and New Organisms Act 1996 ("**HSNO Act**"). Fuel transfer operations at sea also require approval from MNZ and require notification at the commencement and completion of each transfer. This will be completed by the Master of the vessel providing the HFO. Due to the offshore nature of the project, fuel transfer will typically occur in the project area located within the EEZ. However, if fuel transfer takes place within a harbour or port area, any required fuel transfer permit from the relevant Harbour / Port Authority, typically being the Harbour Master or regional council delegated authority, will be obtained.

2.5 Biosecurity Matters

2.5.1 General

'Biosecurity' refers to the protection of native or indigenous biological resources from non-native, invasive species. In the context of this project, marine biosecurity refers to the prevention, detection and management of Non-Indigenous Marine Species ("**NIMS**") that may be harboured on or within project-associated vessels. These include the IMV, FSO vessel, refuelling vessels, AHT and CEV.

Potential marine biosecurity issues for the project are associated with the use and management of ballast waters and also vessel bio-fouling activities.

Together with specific proposed conditions, TTR will prepare and implement a project-specific Biosecurity Management Plan which will include reference to the relevant vectors of NIMS into and around New Zealand and provide mechanisms for the detection, mitigation and response to biosecurity threats for all project activities. These vectors and activities are discussed in Section 4.15.2 of this IA.

2.6 Maritime Management and Safety

Each aspect of the project has been designed to follow 'best practice' maritime management and safety measures to ensure the vessels completing and supporting the iron sand recovery operations are compliant with all IMO and MNZ rules as they relate to vessel movement, collision protection and safety of life at sea. These rules are detailed further in Section 7.5.13.11 of this IA, including but not limited to matters relating to:

- Vessel manoeuvrability;
- Requirements of Automatic Identification Systems ("**AIS**") transmitter/receivers;
- Navigation safety buffer zones;
- Lighting requirements on vessels;
- Towing requirements;
- Refuelling requirements; and
- Safety of life at sea requirements.

2.7 Consideration of Alternatives

2.7.1 Introduction

Section 39(g) of the EEZ Act states that the IA must ‘specify any possible alternative locations for, or methods for undertaking, the activity that may avoid, remedy, or mitigate any adverse effects’.

TTR has evaluated a wide range of alternative project components many of which have been selected or discarded on the basis of avoiding or mitigating adverse environmental effects.

2.7.2 Scale of Project

The scale of TTR’s original project concept envisaged extraction of 100 million tonnes per year of sediment. TTR’s pre-project evaluation determined that extraction of half that amount would deliver a commercially viable project, with an associated markedly reduced environmental footprint, equal with a 50% reduction in annual extraction rates.

Although the entire permitted area encompasses 65.76 km^2, TTR will only extract sediment from an average area of approximately 5 km^2 per annum. As per the proposed conditions, TTR will be required to submit both quarterly and annual reports in addition to an annual technical review of its operations and monitoring results.

2.7.3 Location

There is no existing alternative to sediment processing and re-deposition at sea.

The transfer of 50 million tonnes of sediment for processing to land (including washing and de-watering) would require significant environmental, financial, and time associated costs. Sediment re-deposition on land would be prohibitively expensive, not only from the perspective of operational costs, but also in respect of the area of land that would need to be purchased for disposal of de-ored sediments. Additionally, the environmental consequences of permanent un-filled pits on the seabed following extraction would be potentially significant as the permanent removal of sediments may result in adverse effects at an ecological and coastal processes level.

The activity for which consent is being sought involves the extraction and processing of iron sands at sea, with the residual material being returned to the environment as rapidly as possible, near to the source of where it was extracted. This is considered to be the most environmentally appropriate approach while also being economically efficient.

TTR’s initial concept involved extraction occurring within the 12 NM limit, as close as 11 km from the STB coastline, in addition to the project area under this application. However, initial sediment plume modelling indicated that potential environmental effects would be greater with a nearshore operation than those which may arise from the proposed project. Accordingly, and following stakeholder consultation, TTR modified its project and moved all operations to beyond the 12 NM limit until the predicted negligible effects of the proposed operation can be demonstrated.

2.7.4 Extraction Methodology

TTR considered a wide range of alternative extraction methodologies before opting for the crawler as the preferred option. Consideration was given to airlift dredging, use of a Plain Suction Dredger, and use of a Trailer Suction Hopper Dredger ("**TSHD**").

TTR's initial preference was for the TSHD methodology considering its widely used operational performance, delivery and reliability of the dredge cycle. However, in the final internal evaluation process it was found that while the TSHD was easily scalable, the TSHD system:

- Required multiple extraction passes thus delaying the recovery period of any affected seabed;

- Would have made disposal of de-ored sediment into previously mined areas more problematic; and

- Had the potential to generate large plumes of suspended sediments.

When considering the available alternatives, the crawler, using its distinctive "focused" "single-pass" extraction process, the relatively immediate re-deposition of de-ored sediment into recently extracted areas and the deposition of de-ored material near the seabed, provided a more environmentally sustainable and acceptable extraction method.

Operational logistics between the two systems were also different, with the TSHD system needing the processing plant to be located on another separate vessel, whereas, a crawler could be incorporated into the processing vessel, thereby greatly enhancing project efficiency.

From an operational and environmental outcome perspective, the crawler has been deemed to be the better alternative for the extraction of iron sands from the seabed.

2.7.5 De-ored Sediment Disposal

TTR considered a range of options for disposal of the de-ored sediments. TTR's objective was that the redeposition would occur back into previously extracted areas as close to the location of the extraction as possible.

With the TSHD system, which involved relatively uncontrolled discharges of sediments, an initial deposition area was required to allow the dredges to continue to work in areas not influenced by previously deposited de-ored sediments. Under the TSHD concept, a separate initial de-ored sand disposal area was identified to the south of the extraction area in deeper water.

TTR commissioned the National Institute of Water and Atmosphere ("**NIWA**") to investigate the marine biota at this proposed location and found that this area supported a diverse assemblage of deeper water species, and therefore the initial deposition area was re-located to shallower water.

With adoption of the crawler method it became possible to consider re-deposition of de-ored sediment in the immediate vicinity of the extraction area. This had the environmental benefit of minimising the operational footprint and providing a substratum for more immediate re-colonisation following the extraction activities.

Further, the use of the preferred crawler and re-deposition method enables de-ored sediments to be discharged at a nominal distance of 4 m above the seabed, as opposed to surface discharges, this reduces the potential for sediment transport from the discharge location as the sediments are able to settle out of the water column faster due to the depth.

2.7.6 Freshwater Source

TTR evaluated a wide range of options for sourcing the required five million tonnes of freshwater per year needed for the processing. Options assessed included groundwater from beneath Golden Bay, surface water from various rivers in Taranaki, and around Whanganui and Marlborough, and securing treated wastewater from the Whanganui Wastewater Treatment Plant.

The treated wastewater source was originally the preferred option and would have involved the construction of a dedicated storage lagoon or deployment of a dedicated freshwater storage vessel, along with installation of an offshore mooring for the vessel. The treated sewage option would have effectively utilised the entire Whanganui wastewater discharge stream.

TTR invested significant resources into addressing technical, environmental and economic factors associated with this option, but detailed evaluation indicated that on balance it would not be economic and would pose significant environmental risks, and on this basis the use of reverse osmosis technology on the IMV was considered better suited to the project.

Use of reverse osmosis eliminates any adverse effects associated with removal of freshwater from groundwater, rivers and streams; and eliminates any potential risks associated with collection and transport of treated wastewater. It is also more economically viable from a project operational sense.

2.7.7 Summary

No alternative locations have been considered for the project as the initial project feasibility study and investigations identified that the project area within the STB as one with sufficient grade of iron ore such that the project is viable in a commercial sense and hence TTR obtained a Minerals Mining Permit over the area.

No alternative methods have been considered further as the proposed method of extraction, processing and discharges are considered to be appropriate and result in adverse effects that can effectively be avoided, remedied or mitigated.

However, a number of operational variables have been considered to ensure that the environmental effects of the project are minimised. This has resulted in a considerable refinement of the way in which the project will be delivered, and a consequent further reduction in its environmental footprint.

3 EXISTING ENVIRONMENT

3.1 Introduction

This section of the IA provides a summary of the existing physical, social and environmental values of the project area and those parts of the STB in its general vicinity. It also, in accordance with section 39(1)(d) of the EEZ Act, includes an overview of those persons and parties who have an existing interest in the STB which may be potentially affected by the project.

The summary of the existing environment in this section has been informed by a number of technical assessments commissioned by TTR and provides the context against which the actual and potential effects of the project (including potential cumulative effects) have been assessed.

Whereas the STB is defined as the large bay to the south and west of the coastline of Taranaki, extending down to Farewell Spit and the western entrance to Cook Strait, for the purpose of this section it means that portion of the South Taranaki marine environment in the general vicinity of the project, as shown on Figure 3.1.

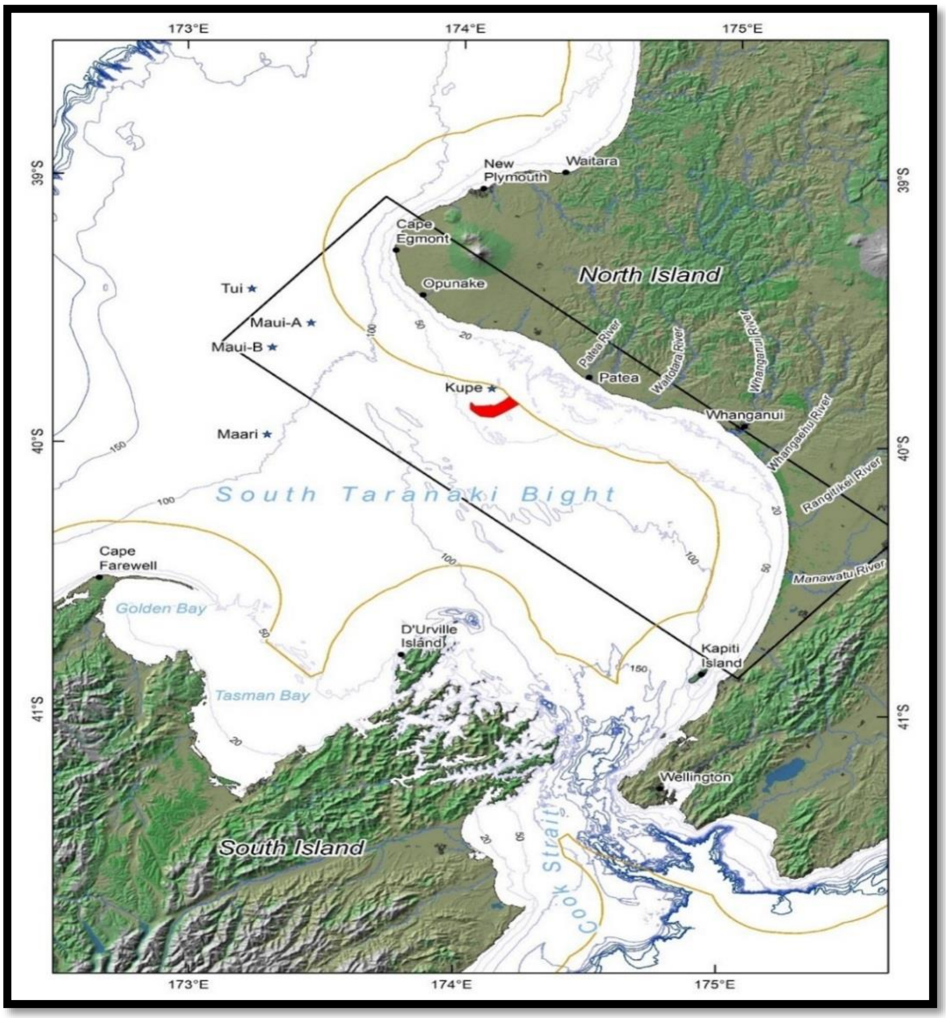

Figure 3.1: The South Taranaki Bight (STB) showing the Sediment Model Domain (SMD) (oblique black rectangle). The approximate project area is shown in red and the 12 NM boundary of the Territorial Sea is shown in yellow.

3.2 Social Setting

3.2.1 Existing Communities

Corydon Consultants was commissioned by TTR to undertake a social impact assessment for the project, which included an outline of the existing social environment (Austin et al. (2016)).[11]

The area with regard to the project is defined at two scales in recognition that the potential project effects could occur across a wide geographic area, with different communities and groups potentially affected in different ways:

- The 'local area' covers the coastal communities from Opunake to Whanganui city. It is the area with the closest association to the project; and
- The 'wider area' covers the districts of New Plymouth, South Taranaki and Whanganui, which is the area most likely to experience employment-related effects.

Appendix 3.1 to this IA sets out further information on the existing social environment for the local communities and Appendix 3.2 to this IA sets out further information on the existing social environment for the wider communities.

The social setting with regard to the local and wider communities of interest to the project is further summarised in the sections below.

3.2.1.1 Profiles

The local communities of interest to the project differ from New Zealand as a whole, with the main differences as being:

- All communities had a declining residential population between 1996 and 2006 in comparison to population growth across New Zealand as a whole. Some communities have had a significant decline in population (e.g. Waitotara, Patea, Manaia, Opunake and Waverley);
- The communities are generally not as ethnically diverse as New Zealand as a whole. All communities have a significantly greater percentage of the population with Maori ethnicity;
- The age profile of all communities indicates that there are fewer residents in the early and mid-stages of their careers (15-44 years of age) and more residents of retirement age (65 years and older);
- There are significantly lower household incomes in Patea, Waverley, Opunake and Manaia than New Zealand as a whole;
- With the exception of Hawera, there is a significantly higher percentage of residents earning an income from some form of benefit (e.g. unemployment, sickness, domestic purposes or invalids benefit); and

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11 Austin, K., Buchan, D., 2016 *"Social Impact Assessment of Trans-Tasman Resource Ltd Iron Sand Mining Project"* January 2016. 59 pp.

- The manufacturing sector is the largest employer in each community, and the percentage of the workforce in this sector is significantly greater than for New Zealand as a whole.

The wider communities of interest to the project also differs from New Zealand as a whole. The main differences are described below:

- Recent trends show only a small increase in population percentage (less than 2%) or a decline, which contrasts to the overall increase of 11.3% across New Zealand;
- At the time of the 2006 Census, all three districts had lower median household incomes in comparison to New Zealand as a whole ($51,400). Whanganui District had the lowest median household income ($36,100), followed by New Plymouth ($44,700) and South Taranaki ($45,400); and
- (2013 Census, all three districts had lower median household incomes in comparison to New Zealand as a whole ($63,800). Whanganui District had the lowest median household income ($43,800), followed by New Plymouth ($59,800) and South Taranaki ($56,300)); and
- Regarding employment, the main differences to New Zealand were the significantly higher proportion of those employed in mining in New Plymouth, health and community services in Whanganui, and agriculture, forestry, fisheries, and manufacturing in South Taranaki.

3.3 Physical Environment

3.3.1 Geological Setting

TTR commissioned a desktop assessment of the geological conditions of the project area and the STB by NIWA (Orpin (2015)).[12] Orpin (2015) provides a detailed geological summary of the STB and identifies it as a shore-connected Holocene sand prism that is up to 20 m thick at the coast, and extends seaward to approximately 22 – 29 km offshore. At the seaward limit the sand prism thins to a transgressive erosional surface, delineated by coarse-grained lag deposits. The project area borders these two environments within the sand prism.

Beyond the project area the continental shelf area is typically covered by between 1 – 3 m of muddy sediment (at water depths of 50 – 100 m), which becomes the dominant seabed and sub-seafloor material in water depths greater than 100 m.

Orpin (2015) identifies that, based on their mineral assemblages, the coastal iron sands along the west coast of the North Island are primarily derived from Taranaki volcano andesites. Orpin (2015) also completed x-ray fluorescence of 151 sediment samples from across the STB to confirm iron ore concentrations. The results of the samples from around the project area showed high iron ore concentrations, with several samples returning values of greater than 10% volume in the sample.

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12 Orpin A.R., 2013. *"Geological Desktop Summary – Active Permit areas 50753 (55581), 54068 and 54272, South Taranaki Bight – Prepared for Trans-Tasman Resources Limited"* Unpublished NIWA Client Report WLG2013-44, August 2013, 42pp + 6 appendixes Updated November 2015.

3.3.2 Climate

TTR commissioned an assessment of the climate and weather of the Taranaki Region by NIWA (Chappell (2014)).[13] This assessment notes that the climate of the Taranaki Region, and by extension the STB, is largely determined by its position in relation to the large scale weather patterns that affect New Zealand. In this regard, the region is exposed to weather systems migrating in an easterly direction across the Tasman Sea and the predominant westerly airstream makes it one of the windiest regions in New Zealand.

The Taranaki Region is generally sunny, with a good supply of evenly distributed rainfall throughout the year and moderate temperatures.

As the project will be located 22 to 36 km offshore it will be highly exposed to winds. The Maui A platform, which is located 70 km northwest of the project area, has had a weather station installed since the 1970s and this has provided a large dataset of weather patterns for the STB. Table 3.1 below shows the monthly variation in wind speed at Maui A. Chappell (2014) considers that a similar pattern can be expected within the project area due to the proximity to the Maui A platform and the lack of any land mass or other factors that may influence the passage of wind in the area.

Table 3.1: Mean Monthly and Annual Wind Speed (kph) for Maui A Platform.[14]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maui A Platform	33.3	34.5	37.4	39.4	39.6	39.5	37.8	37.3	43.3	38.8	35.8	34.1	37.6

Other climatic features of the STB and the Taranaki Region identified in Chappell (2014) include the following:

- Sea surface temperature: averages 14 – 15 ºC throughout the year;
- Air temperature: summer 15 – 22 ºC, winter 8 – 12 ºC;
- Rainfall: 140 days of rain per year, 1,100 – 1,200 mm/year as measured at Hawera;
- Sunshine hours: 2,025 – 2,050 hours per year, as measured at Hawera; and
- Frosts: ground frosts occur 8.5 days/year and air frost occur 1.3 days/year, as measured at the New Plymouth Automated Weather Station.

Fog, thunder and hail are likely to be experienced within the project area. Data from seven onshore weather stations in the Taranaki Region illustrates that fog occurs approximately 15 days / year, thunder occurs approximately seven days / year, and hail occurs approximately five days / year. It should, however, be noted that the occurrences of these phenomena within the project area is likely to differ from occurrences on land.

[13] Chappell, P.R., 2014. *"The Climate and Weather of Taranaki"* NIWA Science and Technology Series Number 64. ISSN 1173-0382, 40 pp. 2014.

[14] From all available data in 2014.

3.3.3 Oceanography

TTR commissioned an oceanography field programme involving the measurement of currents, waves and sediment transport in the STB. NIWA has prepared an assessment of oceanographic measurements data (MacDonald et al. (2015a),[15] as well as a shoreline monitoring data (MacDonald et al. (2015b))[16] as a result of this field programme.

Subsequent to this programme, TTR commissioned NIWA to undertake further field surveys measuring background optical water quality and suspended sediment concentrations within 2.5 km of the coastline of the STB. An assessment of nearshore optical water quality was produced as a result of these surveys (MacDonald et al. (2015c).[17]

The various assessments by NIWA are summarised below.

3.3.3.1 Oceanographic Measurements

Currents and Tides

Current velocities were measured at five sites across the STB, with recordings taken at various depths through the water column. These results provided a velocity profile over the entire water column. These current velocities show the prevailing patterns of water movement in the STB.

Tidal currents account for a significant proportion of the measured currents in the project area and the STB, covering depths from the 50 m contour to the coast, with the proportion explained by the tidal constituents ranging from 40% to 78%. Between 40 – 80% of the variability in currents was explained by tidal currents occurring on the twice-daily lunar tidal cycle. Peak and ebb current speeds of an averaged twice-daily lunar tidal cycle ranged between 0.13 – 0.25 m/s, with higher and lower speeds occurring on spring and neap tides respectively. The orientation of the tidal flow is in a southeast - northeast direction (i.e. parallel to the coast), which has important implications for sediment plume dispersion.

Current direction and strength can also be substantially affected by wind conditions at the surface. Current speeds of approximately 1 m/s were measured in the upper water column on a number of occasions as a result of high wind speeds. The predominant wind direction recorded was from the west and southeast, with strong winds producing currents in a constant direction for more than 24 hours.

Under calm conditions there is a prevailing current towards the southeast as a result of the influence of the D'Urville Current, which flows past Farewell Spit and into the STB and then towards the southeast. This current drift direction is significantly altered by moderate to strong southeast winds, which reversed the drift towards the northwest.

Wave Environment

The coastal environment out to a water depth of 50 m is a high-energy environment with significant wave heights in excess of 2 m routinely experienced. Significant wave heights of up to 7.1 m were measured during the seven-month instrument deployment as part of the

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15 MacDonald, I., Budd, R., Bremner, D., Edhouse, S. 2012. *" South Taranaki Bight Iron Sand Mining: Oceanographic measurements data report"* NIWA Client Report No: HAM2012-147, Updated November 2015.

16 MacDonald, I., Ovenden, R., Hume, T. 2012 *"South Taranaki Bight Iron Sand Mining: Shoreline Monitoring Data Report"* NIWA Client Report No: HAM2012-085, June 2012. Updated November 2015.

17 MacDonald, I., Gall, M., Bremner, D. 2013. *"Nearshore Optical Water Quality in the South Taranaki Bight"* NIWA Client Report No: HAM2013-040, Updated November 2015.

oceanographic studies carried out for TTR. The higher waves recorded generally came from either a south - south-southeast or southwest - west-southwest direction, with a reduction in wave heights as they move towards the coast or down the coast in a south-southeast direction.

<u>Suspended Sediment Concentrations</u>

Measurements taken around the project area and across the Patea Shoals as part of the oceanographic studies by MacDonald et al. (2015a) recorded typical maximum concentrations of suspended fine sediment concentrations of up to 25 milligrams per litre ("**mg/L**"), with higher peaks inshore after significant rainfall or following significant wave activity.

Offshore near-surface suspended fine sediment concentrations were typically less than 10 mg/L. Near the seabed suspended fine sediment concentrations were typically less than 10 mg/L, but were recorded up to 80 mg/L. The highest concentrations were not always associated with rainfall events or wave activity, but could also be a result of advection up current of the area.

Inshore suspended fine sediment concentrations of up to 1,900 mg/L were recorded close to the seabed, mostly associated with high wave activity. It is estimated that sediment transport along this coast is up to 2.1 cubic metres ("$\mathbf{m^3}$") per meter width of seabed during large storm events.

The data demonstrated that periods of increased suspended sediment concentrations coincided with large wave events. During calm periods no suspended sand sediment concentrations were recorded.

Records showed that the largest instantaneous sediment flux, of 0.13 kilograms per second per metre ("**kg/s/m**"), occurred during the highest current speeds at a monitoring site approximately 15 km from shore - between the shoreline and boundary of the project area. During this time the maximum sediment flux within the project area was 0.0519 kg/s/m at the shoreward limit and 0.0002 kg/s/m at the seaward limit of the project area.

3.3.3.2 Nearshore Optical Water Quality

To establish the existing nearshore optical water quality, NIWA completed two boat surveys and collected water samples from 11 nearshore sites across the project area. Further, a six-week deployment of instruments on nearshore moorings in approximately 10 m of water was undertaken to assess temporal variability and establish relationships of optical properties.

Measurements from the boat surveys showed that suspended sediment concentrations and optical variables vary significantly over distance from the shoreline. Suspended sediment concentrations and diffuse light attenuation are greatest closest to shore, and visual clarity increases rapidly with depth and distance offshore.

Data showed there is also a reduction in suspended sediment concentrations and a subsequent increase in visual clarity in the south-southeast direction of the STB. Further, both coloured dissolved oxygen matter and chlorophyll *a* concentrations decreased with depth and distance offshore.

Suspended sediment concentrations also increased as result of increased river flows (and related sediment load inputs), with high suspended sediment concentrations resulting in reduced visual clarity. The data also showed that few nearshore increases in suspended sediment concentrations occurred during periods of high wind speeds and low river discharges, when typically wave stirring entrains seafloor sediment into the water column and affects visual clarity.

The EPA commissioned Sinclair Knight Merz ("**SKM**") to review the background data from NIWA as part of the consideration of the previous marine consent application by TTR (Huber (2104)).[18] SKM identified that the assessments by NIWA were generally comprehensive owing to the extensive field investigation that had been undertaken.

Further, the experts who took part in the joint expert conferencing as part of the hearing process for the previous marine consent application by TTR agreed that the oceanographic measurements taken were fit for purpose and of an international standard.[19] There were no areas of disagreement and no areas of uncertainty were identified beyond normal measurement error and natural variation.

3.3.4 Sediment Movement

An assessment of the nearshore and offshore sediment movement process occurring in the STB was undertaken by NIWA (Hume et al. (2015)).[20] Hume et al. (2015) identified that the coastline along the STB is exposed, highly energetic and has been subjected to continual tectonic uplift and erosion over the past 15,000 years. This has produced almost continuous near-vertical, 30 – 50 m tall cliffs along the shoreline. These cliffs are subject to high levels of wind and wave erosion that has left behind a hard shore platform covered by sandy beaches.

Erosion of the sea cliffs and deposition of sediment on the beaches ensures that a continual supply of fresh sediment is transported along the shoreline of the STB, predominantly by wave processes and in a south east direction. Beaches along the coastline of the STB are primarily erosional with a few sections varying between erosional and accretionary, with no set pattern of erosion and accretion along the coast.

South of the Whangaehu River the beaches transition to being primarily accretionary. Appendix 3.3 to this IA shows how sediment movement in the STB is roughly related to mean wave height and whether the coastline is erosional, accretionary, stable or variable.

Hume et al. (2015) identifies that the coastal sediment budget in the STB is largely made up of inputs from longshore transport into the area, onshore transport, river transport and sea cliff erosion. Sediment is lost through longshore transport out of the area, wind transport away from the beach, offshore transport, and solution and abrasion.

The longshore sediment transport is considered large and in the order of 20 million cubic metres ("**m^3/yr**") per year in the northwest at Ohawe. This reduces south eastward along the coastline to approximately 2 million m^3/yr at Kai Iwi.

3.3.4.1 Shoreline Monitoring

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18 Huber, M., Yestes, M., Taylor, G., 2014. *"Assessment Of Effects On The Physical Environment From The Trans Tasman Resources Marine Consent Application: Oceanographic And Coastal Processes"* SKM review for EPA. February 2014. 24 pp.

19 Environmental Protection Authority, Joint statement of experts in the field of effects on bathymetry and oceanographic processes. Dated 20 March 2014

20 Hume, T., Gorman, R., Green, M., MacDonald, I., 2013. *"Coastal stability in the South Taranaki Bight - Phase 2 - Potential effects of offshore sand extraction on physical drivers and coastal stability"* NIWA Client Report No: HAM2013-082. October 2013. 135 pp. Updated November 2015.

An 11-month beach monitoring programme along the South Taranaki coastline was undertaken by MacDonald et al. (2015b) to provide background data from which rates of change along the shore could be established.

A network of 32 beach profiles at eight sites was established to monitor the shoreline stability along the STB from Kai Iwi to Ohawe. The sites were selected as lying landward of the project area, away from rivers and headlands which may influence beach processes locally, and where there was public access to the beach.

MacDonald et al. (2015b) identifies that the beach profiles show that the shoreline along the South Taranaki coastline is very dynamic, with large changes in the beach profiles occurring at nearly all of the 32 profiling sites. At six sites there was little accommodation space for beach sand, which appears to form a veneer only several metres thick over the rocky shore platform left by the retreating cliff line. Very high tides and waves reach right to the top of the beach and the toe of the cliffs, thus there is no space for sand dunes to build out of the reach of waves.

Given the limited storage, MacDonald et al. (2015b) considers that a large fraction of the entire beach volume is being washed offshore and onshore on a regular basis.

3.3.4.2 River Inputs

Rivers along the South Taranaki coastline deliver sediment derived from the erosion of sedimentary and volcanic rocks in their catchments. These sediment inputs are visible as nearshore plumes of muddy water, some of which can extend several kilometres offshore and along the coast after flood events.

Estimates of the suspended sediment yield from the major rivers along the South Taranaki coastline are provided in Table 3.2 below. The most sediment derives from the Patea, Whenuakura, Waitotara and Whanganui Rivers. The total annual yield from the various rivers is approximately 2,930,600 m^3/year (or 5,861,200 tonnes/year).

Hume et al. (2015) notes that when looking at the sediment yields of the rivers, it is difficult to accurately determine what proportion of the input from each of these rivers is beach grade material.

Table 3.2: Suspended Sediment Inputs from Rivers into the STB.

River	Catchment Area (km^2)	Mean Flow (m/s)	Sediment Yield	
			tonnes/year	m^3/year
Waiaua	46.4	3.6	4,900	2,450
Kaupokonui Stream	146.3	8.6	9,700	4,850
Waingongoro	233.1	7.8	9,100	4,550
Tangahoe	285.1	4.2	43,900	21,950
Manawapou	120.9	1.9	15,000	7,500
Patea	1,048.5	30.4	310,600	155,300
Whenuakura	465.3	9.9	275,900	137,950
Waiotara	1162.0	23.3	475,400	237,700
Kai Iwi Stream	191.0	1.8	16,900	8,450
Whanganui	7,113.8	229.0	4,699,800	2,349,900

3.3.4.3 Existing Surface Suspended Sediment Concentrations

As part of the sediment plume modelling for the project, NIWA completed remote sensing to evaluate the background suspended sediment concentrations in the STB. The STB environment can be split into three sections with 5^{th}, 50^{th} (median) and 90^{th} percentiles modelled. Table 3.3 below identifies the modelled and remote sensed suspended sediment concentrations at three different locations within the STB.

Table 3.3: Comparison of modelled and remote sensed suspended sediment concentrations within the STB.

Suspended Sediments Concentration (percentile)	Near coast between Hawera and Whanganui	At the shoreward side of the project area	Beyond the 12 NM territorial limit (near the bottom of the figures)
5^{th}	• Modelled - 2 mg/L; • Remote-sensed ~ 2 mg/L (but highly variable)	• Modelled = 0.01 mg/L; • Remote-sensed ~ 0.1 mg/L	• Modelled < 0.001 mg/L; • Remote-sensed ~ 0.1 mg/L
50^{th} (medium)	• Modelled = 10 – 15 mg/L; • Remote-sensed = 10 – 20 mg/L	• Modelled = 0.3 – 0.4 mg/L; • Remote-sensed = 0.5 mg/L	• Modelled ~ 0.001 mg/L; • Remote-sensed = 0.2 – 0.5 mg/L
90^{th}	• Modelled = 40 – 60 mg/L (100 mg/L at Whanganui River mouth); • Remote-sensed = 40 – 60 mg/L.	• Modelled = 3 mg/L; • Remote-sensed ~ 3 mg/L	• Modelled ~ 0.01 mg/L; • Remote-sensed ~ 1 mg/L

The purpose of this exercise was two-fold:

- To establish the existing suspended sediment concentrations in, and around, the project area; and
- To confirm the agreement between the modelled and measured data.

The remote sensing data used for comparison with the modelled existing sediment environment is discussed further in Section 4.4 of this IA below.

3.3.5 Seabed Morphology and Sediments

The assessment of sediment transport by Hume et al. (2015) contains an outline of the seabed morphology and sediments within the STB. It notes that the inner continental shelf, out to 50 m depth, is approximately 30 km wide off Hawera, widening to approximately 40 km off Patea, and then narrows immediately south to widths of approximately 20 km wide at Whanganui.

The topography of the shelf off Patea and Waitotara is characterised by banks, shoals and ridges. These features are generally large in size with some individual features offshore from Patea being more than 20 km long and 5 to 10 m in elevation. These features are typically aligned with the dominant north-west to south-east current direction in the STB.

Bedforms in the STB generally consist of two basic types:

- Bedforms in the nearshore zone which are mainly erosional; and
- Bedforms located offshore zone which are depositional.

Erosional bedforms typically occur in water depths less than 30 m and comprise elements such as rock outcrops and ancient buried river valleys from differential weathering of the underlying Plio-Pleistocene mudstone. In contrast, at water depths greater than 30 m storm-generated depositional bedforms occur, including dunes and ridges, sand ribbons, symmetrical mega-ripples and sand waves.

The largest sediment body bedforms in the STB are situated immediately southeast of the mouth of the Whanganui River. These deposits are typically 4 – 12 m high, several hundred metres wide, several kilometres long, and aligned sub-parallel to the coastline. Their surface is composed of iron sand and volcanic pebbles, interpreted to be sourced from Mount Taranaki. These sand ridges are located on a relatively flat area of the seafloor of the STB.

Within the intervening troughs is a complex array of smaller active bedforms, including sand ribbons, ripples, symmetrical mega-ripples and sand waves. These bedforms persist to water depths greater than approximately 50 m and have presumably been formed by strong oscillatory currents approaching 1 m/s that occur during the passage of large storms.

Seabed sediments vary from fine sands to gravelly fine sands, although sediments are mostly fine to medium sands with a general trend of more fine sand to the north and west of the STB, and a greater proportion of coarse sand and gravel / shell to the south and west, as shown in Figure 3.2 below.

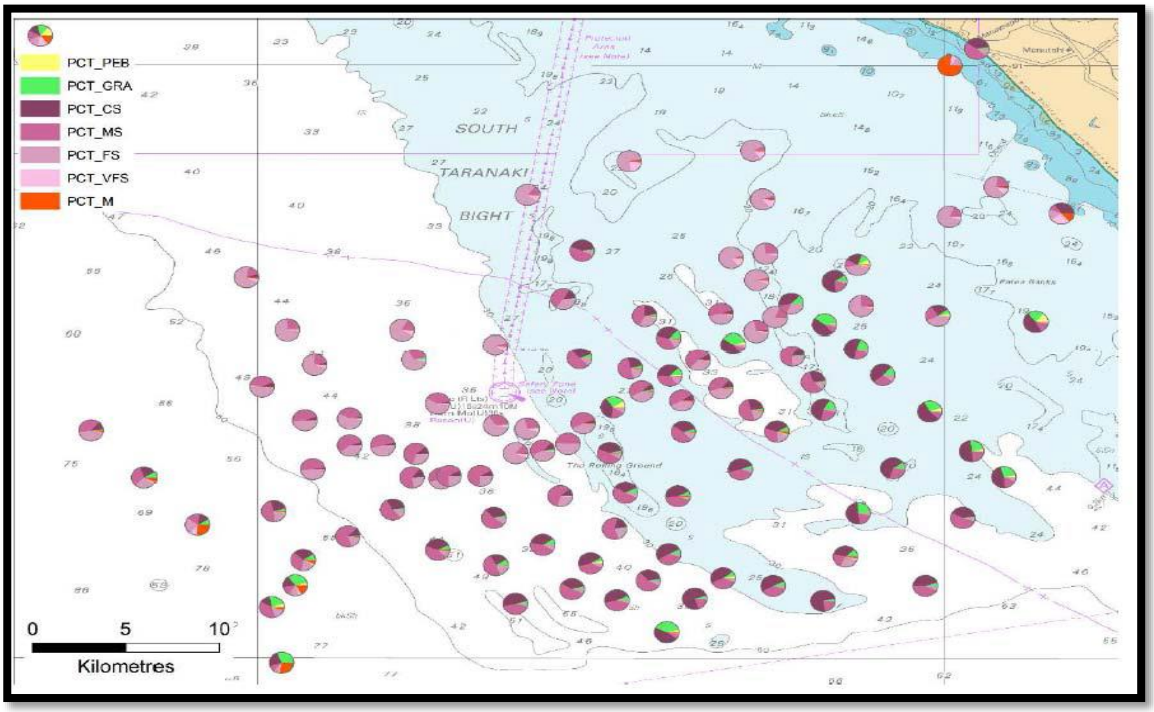

Figure 3.2: Grain size of the sediments in the STB. Note: data shown as percentages in different size classes. PCT_PEB: pebbles, PCT_GRA: gravel, PCT_CS: coarse sand (500 µm – 1.6 mm), PCT_MS: medium sand (250 µm – 500 µm), PCT_FS: fine sand (125 µm – 250 µm), PCT_VFS: very fine sand (63 µm – 125 µm), PCT_M: mud (<63 µm).

3.3.6 Seabed Sediments Chemistry

TTR commissioned Auckland University of Technology to assess the potential for the project to displace, modify and suspend anoxic sediment, and make sediment bound contaminants available to biota (AUT (2013)).[21] To understand these potential effects, AUT (2013) investigated the following:

- Selected physical properties of the target sediment;
- The sediment content of acid volatile sulfides and simultaneously extracted trace metals; and
- The concentrations of trace metals in suspensions of sediment in seawater.

This was determined through the collection of one sediment core and 20 L of seawater at five sites within the project area in June 2012, and sediment slurry and 20 L of seawater at two further sites in February 2013. AUT (2013) found that, as expected for high-energy offshore environments, the low organic matter content (less than 1% dry weight) of the medium sand in the project area explained the low sediment content of acid volatile sulfides. There was no evidence for an increase with depth below the seafloor in sediment organic matter and acid volatile sulfides contents.

The concentrations of dilute-acid soluble cadmium, copper, lead and zinc in deep sediment were of the same order of magnitude as their maximum concentrations in surface sediment. For cadmium, copper and zinc, there was no evidence for consistent trend of increasing concentrations with increasing sediment depth below the seafloor. The sediment concentrations of lead decreased with depth below the seafloor at three of five sites.

The concentrations of dilute-acid soluble chromium and nickel in deep sediment were often one order of magnitude higher than their maximum concentrations in surface sediment. Furthermore, at four of five sites, chromium and nickel concentrations increased with increasing depth below the seafloor. Additional analyses of sediment slurry collected to a maximum depth below the seafloor of 18 m, however, did not reveal evidence for such trend. No consistent increase with depth in the concentrations of dissolved nickel in the slurry was found. The concentrations of chromium in the slurry were below the detection limit.

For all metals except nickel, the concentration in seawater suspensions of deep sediment (elutriate) were either below detection limit (chromium, copper, lead, zinc) or, if a metal was detected (cadmium), the concentration did not exceed the Australian and New Zealand Environment and Conservation Council ("**ANZECC**") and Agriculture and Resources Management Council of Australia and New Zealand ("**ARMCANZ**") guidelines for the protection of 99% of species. The detection limit of copper was below the guidelines for the protection of 95% of species.

The concentrations of nickel in the seawater suspensions of deep sediments (all five sites) and surface sediment (three of five sites) were equal or larger than the ANZECC & ARMCANZ guideline concentrations for the protection of 99% of species. However, the nickel concentration never exceeded the guideline concentrations for the protection of 95% of species.

[21] Vopel K, Robertson J and Wilson P.S. (2013) *"Iron sand extraction in South Taranaki Bight: effects on seawater trace metal concentrations"* AUT Client report: TTRL 20138 October 2013

3.4 Benthic Ecosystems

3.4.1 Nearshore Epibenthos / Shallow Infauna

An assessment of the benthic habitats, macrobenthos and surficial sediments of the nearshore environment was undertaken by NIWA (Anderson et al. (2015)).[22]

Sampling of 36 seabed sites was undertaken between February to March 2013 using underwater video and still images, followed by the collection of representative grab samples and benthic dredge collections for sediment and microbenthic surficial samples. The location of the sampling sites along the South Taranaki coastline are shown in Figure 3.3 below.

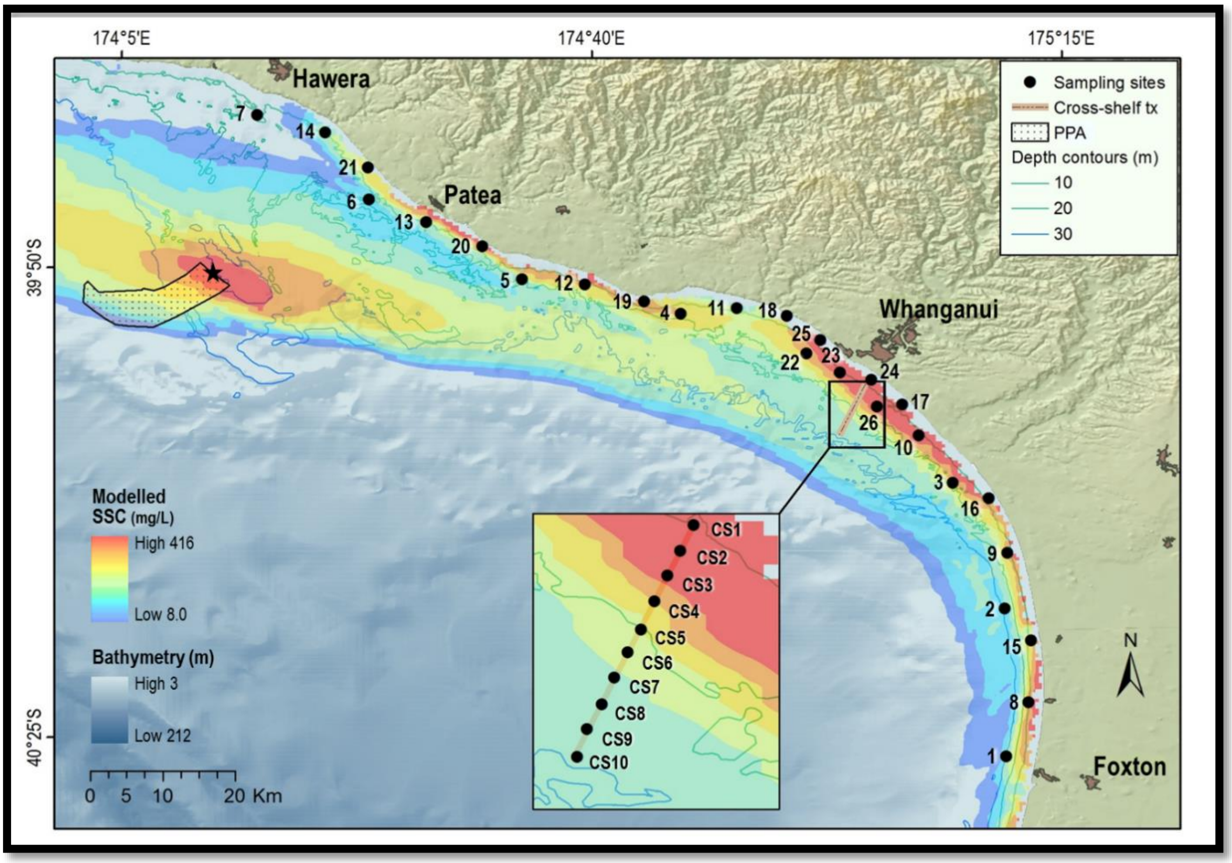

Figure 3.3: Location of sampling sites relative to the predicted bottom suspended sediment concentrations (SSC) of extraction-derived sediment within the STB. SSC values represent 95th percentile for releases from the dredging source (black star = Source B in NIWA, 2012) within the proposed project area (PPA). Sites 1-26 = nearshore sites (main figure), Sites CS1-CS10 = cross-shelf transect sites (insert).

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22 Anderson. T.J., MacDiarmid, A., Stewart, R., 2013. *"Benthic habitats, macrobenthos and surficial sediments of the nearshore South Taranaki Bight"* NIWA Client Report No: NEL2013-012. June 2013. 44 pp. Updated November 2015.

Rocky outcrops made up five of the 36 sites and generally consisted of hard rock and soft to moderately soft mudstone. These outcrops supported more abundant and diverse epibenthic assemblages characterised by bryozoans, macroalgae and sponges, as well as more motile species, such as crabs, amphipods, starfish, brittle stars, gastropods and polychaete worms.

Hard rock outcrops accounted for more than 25% of all specimens and 61% of all species collected during the survey. Mudstone outcrops supported low or negligible amounts of epibenthos (less than 2.5% of specimens).

The remaining sites consisted primarily of soft-sediment structures, which are characterised by fine rippled sands with low and variable numbers of small motile epifauna – mostly hermit crabs, gastropods, and a few suspension-feeding bivalves. These species are presently subjected to regular sediment disturbances from storm events and river runoff, and are likely to be tolerant to deposition of sediments and constant disturbance.

The mudstone outcrops present in the nearshore area are typically covered in fine silt with few epibenthic organisms present. The typical seabed strata of the sites are shown in Figure 3.4 below.

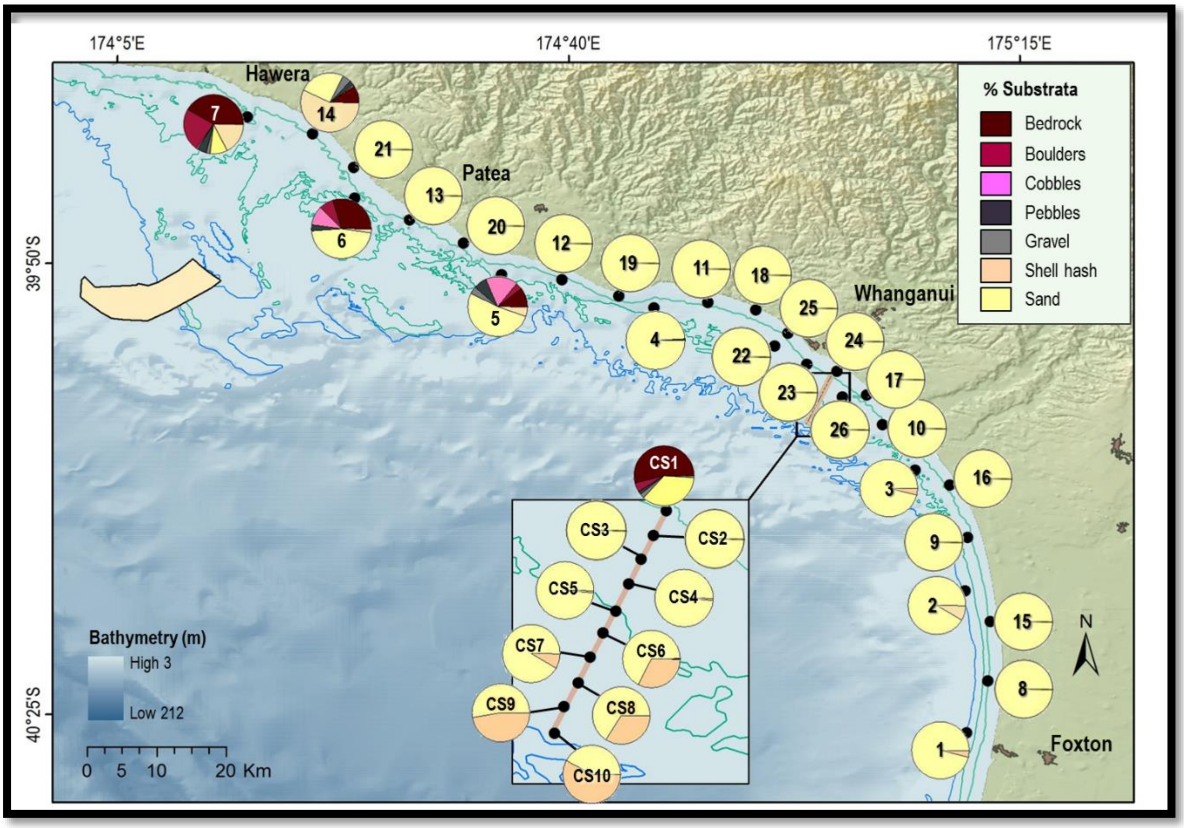

Figure 3.4: Seabed substratum types at nearshore (1-26) and cross-shelf transect (CS1-CS10) sites within the STB. Figure captions are provided in See Figure 3.3.

Other habitats and organisms present include macroalgal and suspension-feeding species associated with hard rock outcrops, primarily being diverse bryozoan and sponge dominated assemblages.

3.4.2 Offshore Benthic Ecology

The Patea Shoals is an area of seabed located between 25 and 40 km off the coast of Taranaki in water depths of between 25 and 45 m which includes the project area, as generally shown in Figure 3.5. NIWA conducted a survey on the benthic fauna in this area in 2013 (Beaumont et al. (2015)).[23]

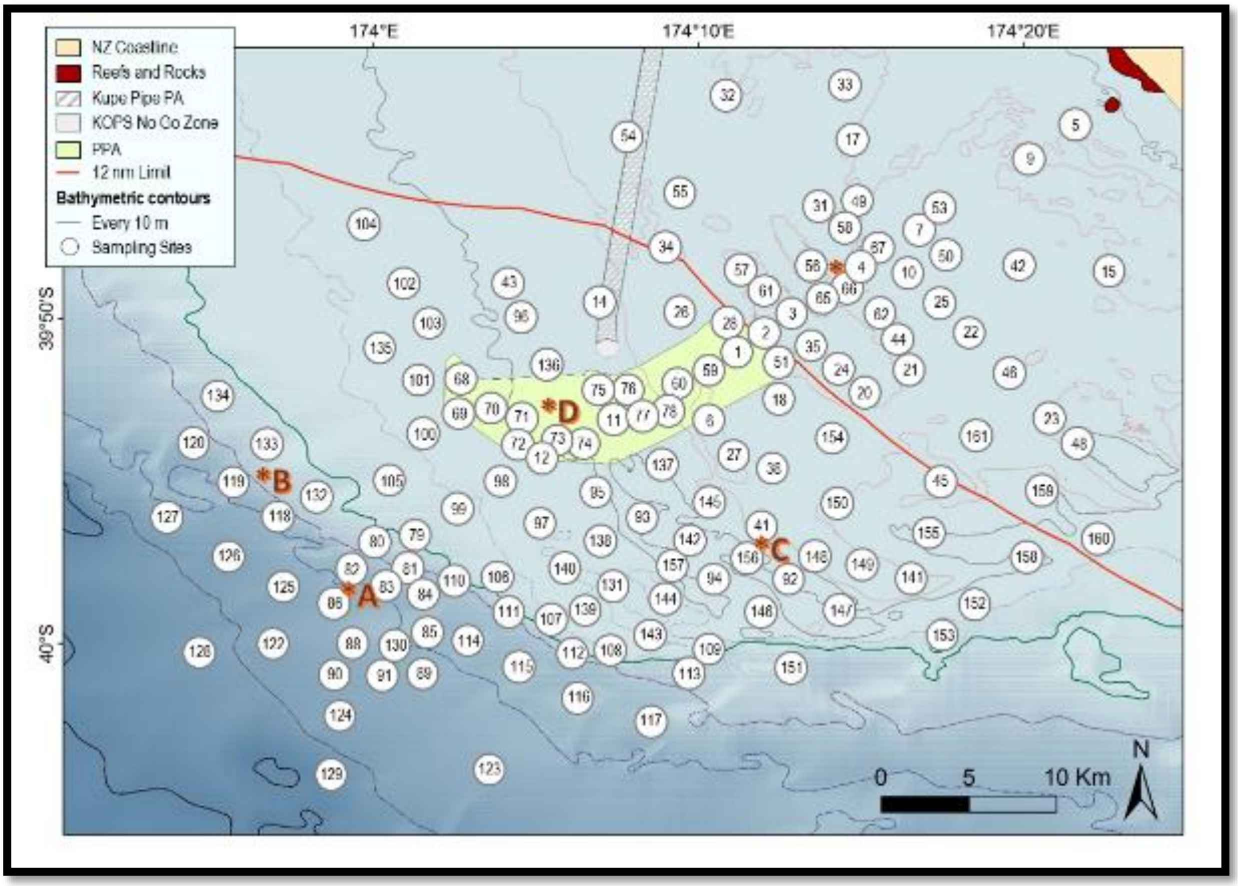

Figure 3.5: Location of sampling sites across Patea Shoals within the STB. PPA= Proposed Extraction Area; Kupe Pipe PA = Kupe Pipe protected area; KOPS no go zone = Kupe Oil Platform Safety no go zone. Depth contours are in 10 m intervals. *A-*C indicate TTR's preliminary deposition-assessment areas, *D indicates TTR's proposed extraction/deposition area/PPA. '*' depicts the inner shelf area prior to contraction of the PPA area.

Seabed habitats and macrobenthos were visually characterised at 144 sites using underwater video footage and still photographs. Surficial sediments and associated infauna were collected from 331 samples at 103 sites, while benthic macrofauna and macroflora specimens were collected from 116 sites using a benthic dredge. Figure 3.6 identifies the seabed habitat sites in and around the project area. It identifies that the sites typically consist of sand waves and worm communities (i.e. wormfields).

Seven habitat types were identified in Beaumont et al. (2015), with the most common being rippled sand. Large parts of the seabed were characterised by wormfields which were

23 Beaumont, J., Anderson, T.J., MacDiarmid, A.B., 2013. "B*enthic flora and fauna of the Patea Shoals Region, South Taranaki Bight*" NIWA Client Report No: WLG2012-55. October 2013. 183 pp. Updated November 2015.

dominated by *Euchone sp A,* with some very dense patches in the central and mid-shelf zone. Generally inner and mid-shelf habitats supported few visible epifauna apart from small scattered rocky outcrops on the inner shelf which had diverse epibenthic assemblages.

Deeper reefs offshore were characterised by two habitat types:

- The bivalve rubble habitats dominated by the large robust dog cockle (*Tucetona laticostata*), with live animals at depths of between 26 and 83.5 m and shell debris at depths of between 44 and 69 m; and

- The bryozoan rubble habitat at depths of greater than 60 m forming a habitat with generic shell debris.

These habitats support diverse assemblages dominated by sessile suspension-feeding taxa (e.g. bryozoans, sponges, ascidicans, brachiopods and epiphytic bivalves) and a number of motile taxa such as crabs and gastropods.

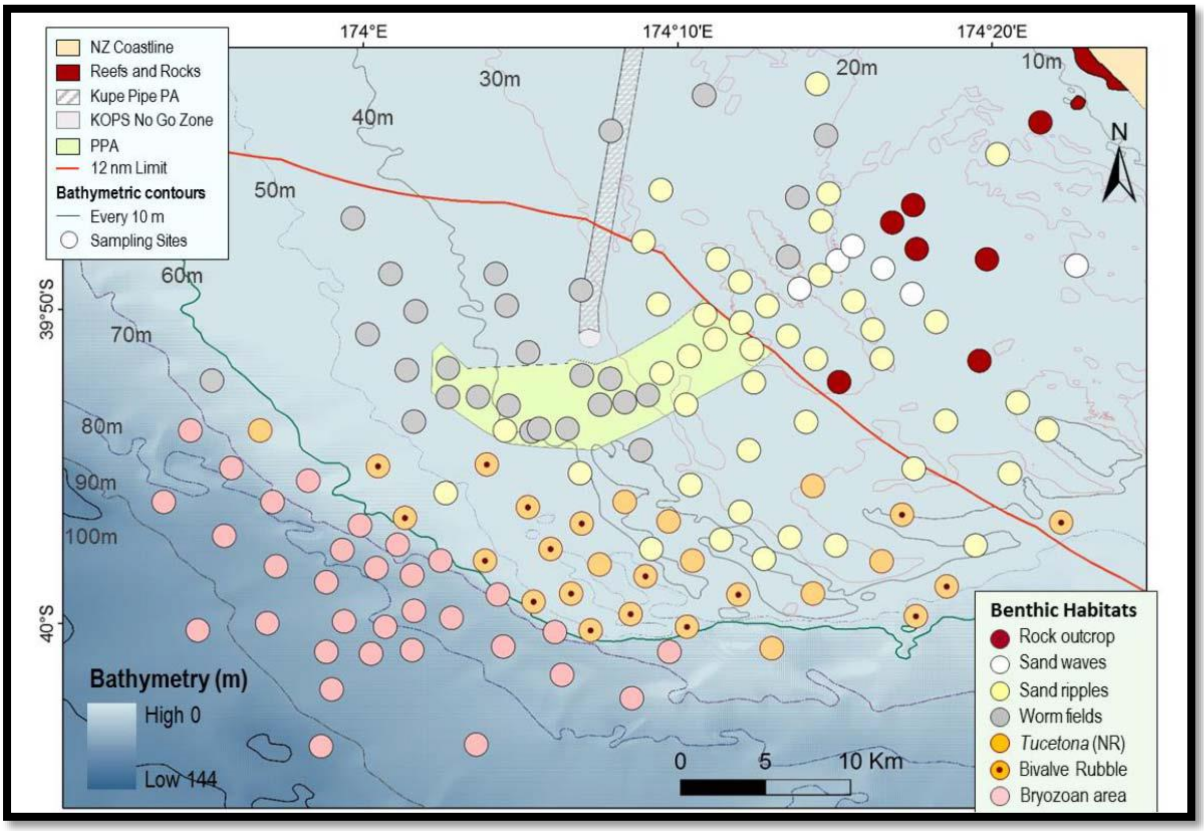

Figure 3.6: Seabed habitat types observed at each site within the Patea Shoals area of the STB.

Sediment and infauna sampling found that the mid and inner shelf habitats were characterised by low abundance and species richness, typical of highly disturbed sediments and the region in general. Beaumont et al. (2015) identifies that there is no evidence that the project area is unique with respect to benthic epifauna or infauna.

In contrast, the deeper offshore benthic habitat supports a diverse and abundant epifaunal community associated with shell hash and bryozoan rubble and is dominated by suspension-feeding taxa. The shallower bivalve rubble habitat supports early successional stages (encrusting corraline algae, small encrusting invertebrates), while the deeper bryozoan rubble habitat supports later successional stages (certain bryozoans, sponges and higher numbers of motile taxa). Bryozoan rubble habitats also supported significantly higher abundances of infauna.

Microphytobenthos (or small algae found on the seabed) are usually found on sandy sediments and where there is sufficient daily light reaching the seabed. Although there are no direct measurements of microphytobenthos from the Patea Shoals, Beaumont et al. (2015) considers they are likely to occur there as they are found in similar environments in other parts of the world and seabed images have shown sediment-water interface features, such as colour, which is consistent with their presence.

3.5 Primary Productivity

3.5.1 Phytoplankton

TTR commissioned NIWA to undertake a baseline assessment of the STB (Ching et al. (2015)).[24] It identifies that the STB is a dynamic region with plankton communities and primary production influenced by local drivers such as light, nutrient availability and grazing. Plankton communities are also influenced by advective processes such as upwelling from the Kahurangi Shoals and the rivers that discharge into the STB. It is important to note that Ching et al. (2015) concludes that nutrients are the main limitation on primary production rather than light availability based on observed nutrient levels, phytoplankton biomass and primary production.

Ching et al. (2015) used locally-tuned algorithms and 10 years of satellite observations (2002 – 2012) to assess mean conditions and characterise water constituents such as chlorophyll *a* concentrations, which provide a proxy for phytoplankton biomass. Based on the satellite data and some ground-truthing, Ching et al. (2015) found that elevated levels of chlorophyll *a* could be attributed to two processes - nutrient input from rivers and advected material from further afield.

Long-term median chlorophyll *a* levels were highest close to the coast (5 microgram per litre ("**µg/l**")) as a result of river runoff, and decreased to an annual median of 0.2 µg/l offshore (greater than 10 km from the shoreline). Intermittent blooms occur offshore, but can be spatially large and cover much of the STB. It is thought that some of these larger blooms result from dynamic processes associated with the upwelling off the Kahurangi Shoals and possibly, at times, the Cook Strait. In some cases these blooms can exceed 4 µg/l.

Ching et al. (2015) also reported a seasonal component to satellite derived chlorophyll *a* concentrations, with spring peaks at most sites in the STB. However, there was evidence of winter peaks also occurring inshore and at the deeper sites to the north.

Median chlorophyll *a* concentrations are relatively high across the northern and eastern parts of the STB throughout the year, with an overall range of between 0.02 – 32 µg/l (median 0.57 µg/l). This compares to values less than 0.1 µg/l for clear blue waters. More recent surveys by NIWA have added to the database on phytoplankton and found chlorophyll *a* concentrations greater than 1 µg/l immediately to the east of the project area, which is an indication of localised algal blooms.

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24 Ching, N., MacDiarmid, A., Anderson, O., Beaumont, J., Gorman, R., Hancock, N., Julian, K., Schwarz, J., Stevens, C., Sturman, J., Thompson, D., Torres, L., 2011. *"South Taranaki Bight Factual Baseline Environmental Report"* NIWA Client Report: WLG2011-43. September, 2011. 189 pp. Updated November 2015.

Further, phytoplankton blooms appear to peak in spring time from an offshore origin 80 km west of the project area and is transported by advection through the STB and into the Cook Strait.

No significant long term trends in the chlorophyll *a* concentrations were observed.

3.5.2 Zooplankton

Zooplankton are microscopic animals which float around in the currents, mostly in surface waters. They range in size from small single celled protozoa to copepods and larval crabs, molluscs and fish as well as the large euphausiids or krill. They play a critical role in marine food webs and are the link between primary producers, fish and marine mammals.

As identified in MacDiarmid et al. (2015a),[25] baseline environmental survey of studies of zooplankton where undertaken during the 1970s and 1980s, with additional studies completed in 2015. This information concluded that the zooplankton ecology of the STB was largely influenced by upwelling events off the Kahurangi Shoal and Cape Farewell.

Bradford-Grieve et al. (2015) [26] undertook an assessment of zooplankton for the project and concluded that zooplankton species in the STB are typical of those found in coastal waters around New Zealand. The STB is also considered to be very productive. In this regard, biomass estimates are among the highest recorded when considered against other coastal regions around New Zealand.

Bradford-Grieve et al. (2015) identifies that the Greater Western Cook Strait Region (including the STB, Tasman and Golden Bays, and bounded by the Cook Strait Narrows) is impacted by several large-scale, highly variable, physical phenomena that structure the distribution and biomass of zooplankton. These large-scale physical processes include the Kahurangi upwelling plume, tidal mixing, river plumes and surf beach processes. Of these, the Kahurangi upwelling plume is the best understood in terms of plant nutrient renewal, which impacts primary production and dynamics, and its downstream impact on the zooplankton.

With respect to the STB, it is influenced by the D'Urville Current and the Kahurangi upwelling which bring in colder, nutrient rich waters. The nutrients drive primary production as the water is advected around the top of the western side of the South Island and into the STB. As upwelled water is advected into the STB, carbon production was found to exceed utilisation by larger zooplankton, potentially providing a net carbon source. However, much of this is likely to be utilised by smaller micro-zooplankton. These upwelling events are also thought to be important for the squid aggregations which occur in the lower reaches of the STB.

The zooplankton populations of coastal waters in the STB, when not dominated by the zooplankton species *salps*, are likely to be dominated numerically by the copepod *Oithona similis*, and moderately large numbers of *Acartia ensifera*, *Clausocalanus jobei*, *Paracalanus c.f. indicus* and copepod *nauplii*. The findings concluded that omnivorous copepods dominate (66%), with 34% herbivores and 0.1% carnivores. No information is available on

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[25] MacDiarmid, A.; Thompson, D.; Grieve, J. 2015a. *"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 Client Report: WLG2015-13. Report prepared for Trans-Tasman Resources Ltd. September 2015.

[26] Bradford-Grieve, J., Stevens, C., 2013 *"Zooplankton and the processes supporting them in Greater Western Cook Strait"* NIWA Client Report No: WLG2013-9. April 2013. 22 pp. Updated November 2015.

zooplankton assemblages in very shallow nearshore waters (mean depth of 8 m)) where orbital velocities are very high.

While acknowledging the assessment in Bradford-Grieve (2015) represents a snap shot in time, the following findings were identified:

- There was no obvious spatial pattern in zooplankton biomass distribution when comparing inshore to offshore distribution, but highest biomasses were found to occur over the Patea Shoals and east towards Whanganui;

- Copepods dominated most sites sampled with salps and juvenile euphausiids dominating the sites with the highest biomass. Most of the copepods were omnivores and dominated by *Oithona* and *Paracalanus*; and

- The community was typical of nearshore waters and, as would be expected, was dominated by neritic or coastal species.

3.5.3 Polychaete Worm Communities

Beaumont et al. (2015) identifies that of the annelid worms, polychaetes were the most abundant (97% of annelid worms, 90% of all worms) with a total of 4,190 polychaete worms from 87 species / groups collected from the surface sediments within a study area that included the project area and the Patea Shoals.

Most seaworms are poorly known in New Zealand and not identified at species level. Figure 3.7 below sets out the polychaete abundance within the top five centimetres of the seabed in, and around, the project area.

Polychaete abundance was highest inside, and to the north of, the project area - including sites along the Kupe wellhead pipeline. In contrast, the rippled sediments in the southern mid-shelf supports much lower abundances of worm. Species richness, however, was more evenly distributed across the STB.

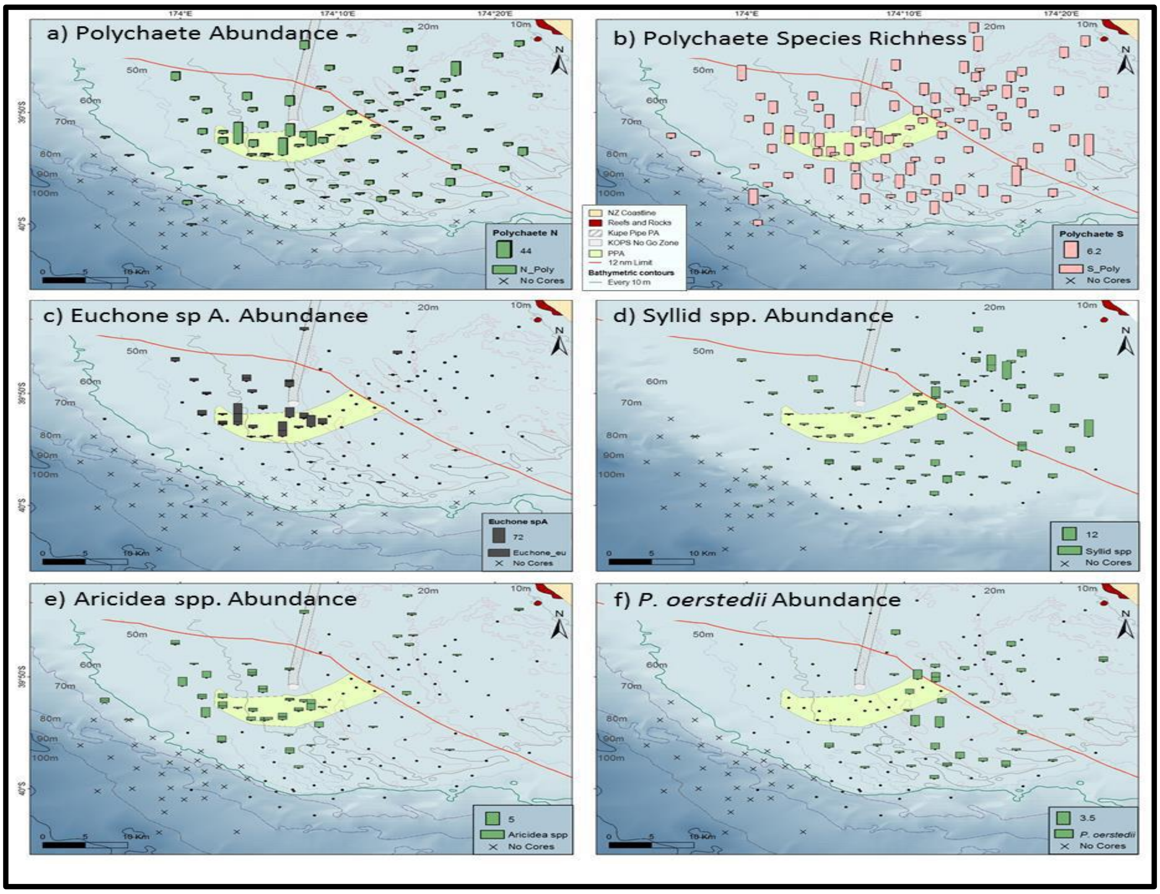

Figure 3.7: Spatial distribution of polychaete worms/site for top 0-5 cm section of sediment. Notes: a) The green bars represent the mean number of individuals (N) collected; b) The light brown bars represent the mean number of species/OTU's (S) collected. c-f) Mean numbers p/site of: c) Euchone sp A; d) Syllid spp; e) Aricidae spp; and f) Pisione oerstedii, per site. Relative scale bars are provided in the legend of each graph.

3.6 Fish Species

The following section contains a summary of the distribution and movement of fish species as they relate to the project area. This information is based on an assessment of the fishery in the STB that was undertaken by NIWA in 2013, and updated in 2015 (MacDiarmid et al. (2015b)).[27]

3.6.1 Oceanic Fish

3.6.1.1 Introduction

A wide range of species have predicted distributions in the STB. The species present within the project area include barracoota, blue cod, carpet shark, eagle rays, John Dory, golden mackerel, kahawai, leatherjacket, lemon sole, red cod, red gurnard, rig, school shark, snapper, spiny dogfish, terakihi, trevally, common warehou and witch. None of these species are recognised or listed as being endangered or threatened.

27 MacDiarmid, A., Anderson, O., Sturman, J., 2013. *"South Taranaki Bight Fish and Fisheries"* NIWA Client Report No: WLG2012-13. October 2013. 70 pp. Updated November 2015.

3.6.1.2 Reef Fish

The distribution of reef fish in the STB was predicted based on models developed from comprehensive dive surveys and habitat information. MacDiarmid et al. (2015b) considers that the STB has a moderately diverse reef fish fauna with 38 species likely to be found (compared with 72 species modelled around New Zealand by Smith (2008)).[28]

None of the modelled species are nationally threatened however, two species, being black angelfish and common roughy, are rare in the STB. They occur in low abundance on just a few coastal reefs and six other species have restricted distributions occurring at less than 50% of the reef sites in the STB.

All other 29 species are predicted to be much more widespread and either occur in low abundance throughout the STB (14 species), are moderately common over the entire area (13 species), or are abundant widely distributed species (two species).

3.6.1.3 Demersal and Pelagic Fish

Demersal (bottom dwelling) and pelagic (open water and in the water column) fish species occur throughout the STB, supporting commercial, recreational and customary fisheries.

MacDiarmid et al. (2015b) provides a description of the distribution of these species based on models developed from trawl surveys throughout New Zealand, statistical relationships with habitat, as well as from a literature review for all species. Depth, temperature and salinity have been found to be the main predictors of demersal species abundance.

MacDiarmid et al. (2015b) identifies 51 species of demersal fish occurring in the STB. The richness of this assemblage was similar to that recorded off the west coasts of both the North and South Islands, but was slightly lower than in depths less than 50 m off Patea and slightly higher compared with inshore to the southeast of the STB (i.e. Kapiti to Whanganui). Overall, the species richness is moderate on a New Zealand wide basis.

A few species are very widespread and abundant, but most species are common only within a restricted depth range. MacDiarmid et al. (2015b) also reported earlier work that found evidence of spawning activity by 13 demersal and pelagic fish species in the STB, along with juveniles of 24 species. However, the surveys were based on areas with water depths greater than 20 m.

Species with their main distribution along the coastline of the STB, that coincide with the project area and the surrounding environment, include anchovy, blue cod, eagle rays, red gurnard, golden mackerel, leatherjacket, lemon sole, snapper, rig and trevally.

3.6.1.4 Spawning and Juvenile Fish – General

MacDiarmid et al. (2015b) identifies that there is evidence of spawning, pupping or egg-laying along the ocean shelf in the southwest of the North Island by lemon sole, New Zealand sole, rig, sand flounder, yellow-belly flounder and yellow-eyed mullet, and possible breeding of blue cod, John Dory, kahawai, kingfish and sea perch.

Other reports reviewed by MacDiarmid et al. (2015b) show low abundances of juveniles of the following species were present within the STB: arrow squid, barracoota, blue warehou,

[28] Smith, A.N.H. (2008). "Predicting the distribution and relative abundance of fishes on shallow subtidal reefs around New Zealand". NIWA Client Report WLG2008-9, 175 pp.

giant stargazer, jack mackerel, John Dory, kahawai, kingfish, red gurnard, rig, sea perch, school shark, snapper, spiny dogfish, terakihi and trevally.

Juveniles of eight other species are listed but no abundance estimate is provided because of insufficient data. These species included blue cod, grey mullet, horse mackerel, New Zealand sole, red cod, silver warehou, yellowbelly flounder and yelloweyed mullet.

3.6.1.5 Crayfish

Crayfish are the largest and most abundant invertebrate predator on rocky coastal reefs throughout New Zealand.

Crayfish occur predominantly on rocky reefs from the shallow subtidal to depths of 50 m, but in some areas they are found as deep as 250 m. Crayfish are mobile for a number of reasons including moulting, reproduction and feeding. The distance travelled depends on the crayfish's maturity and typically ranges from a few metres to multiple kilometres. It has been identified that crayfish have a 'home reef' that they will return to throughout their lifetime.

Immediately after mating and malting in winter and summer respectively, crayfish migrate offshore across sand flats to feed off shellfish, and egg-brooding female make for offshore aggregations in areas of high water current in spring during larval hatching. Although the exact migration areas for crayfish are unknown, due to the distance offshore and lack of suitable habitat, it is not considered likely that crayfish would be present within the project area. However, they will be present within the rocky areas of the coastline as this is their preferred habitats outside of their mitigation areas.

3.6.2 Freshwater Migratory (Diadromous) Fish

New Zealand has 35 species of freshwater fish, most of which are endemic and almost half are diadromous – meaning that they spend part of their lifecycle at sea.

Depending on the species, the part of their lifecycle spent in a marine environment may be eggs and larvae, juveniles or adults. Important customary fisheries exist for a number of diadromous fish including lampreys, short and long fined eels and whitebait (galaxids).

Information relevant to the species found in the project area and the STB is set below.

3.6.2.1 Lampreys – Piharau

New Zealand has one species of lamprey, which is widely distributed and is likely to be found within the project area.

Spawning occurs in freshwater where larvae spend approximately four years as filter feeders before metamorphosing and migrating to the marine environment. Lamprey typically spends three - four years of its lifecycle in the ocean where it feeds by attaching itself to other animals and feeding by rasping holes in their flesh. They then return to freshwaters and spend 16 months reaching sexual maturity before spawning and dying.

3.6.2.2 Freshwater Eels – Tuna

New Zealand has two species of eel; shortfin and longfin. The shortfin eel occurs throughout the South Pacific, while the longfin eel is endemic to New Zealand.

Adult eels are thought to breed in the deep ocean trenches to the northeast of New Zealand, although the migration routes are not entirely understood. Transparent leaf-like larvae drift on ocean currents for over a year before reaching the coastline of New Zealand and entering the freshwater environment in the more familiar eel shape.

Eels spend many years in streams, rivers and lakes (approximately 14 and 25 years for male and female shortfins respectively, and 25 and 40+ years for male and female longfins) before migrating downstream to make their way their tropical spawning sites.

While specific information on the presence of eels within the STB and the project area is unknown, it is considered that any presence of eels would be short-term in nature as they migrate towards their spawning sites in the South Pacific.

3.6.2.3 Whitebait – Inanga

Whitebait or inanga is a general term applied to juvenile galaxids of five different species; *Galaxias argentenus, G. brevipinnis, G. fasciatus, G. maculatus, and G. postvectis.* All five species occur in the Taranaki Region and have a similar life cycle.

Newly hatched larvae are swept down rivers and out to sea, where they spend their first six months feeding and growing. Where they live during this phase is unknown. Juvenile galaxids re-enter streams and rivers in spring, migrating back to their upstream environments.

However, due to the distances offshore, it is not considered likely that whitebait will be located within the project area.

3.7 Marine Mammals

Ching et al. (2015) includes a review of whale and dolphin populations in the STB using cetacean sighting data from the Department of Conservation ("**DOC**") and a dataset of incidental sightings by transit cargo ships in the STB provided in a cetacean monitoring report by Martin Cawthorn Associates on behalf of TTR (Cawthorn (2015)).[29] This observation data noted in Ching et al. (2015) is only presence data (not presence / absence data) and because a species is not present does not necessarily mean that it does not frequent these waters.

In summary, Ching et al. (2015) identifies there has been relatively few cetacean sightings along the north and southern Taranaki Bight but the endangered or critically endangered Maui's dolphin, killer whale and southern right whale have been sighted within the Taranaki Bight. The full table of data is included in Table 3.4 below.

[29] Martin Cawthorn Associates Ltd, 2013. *"Cetacean Monitoring Report"* Document No: TTR071013. October 2013. 35pp. Updated November 2015.

Table 3.4: Cetacean sightings in the STB by season from DOC and Cawthorn datasets.

Species	Threat Classification	Spring	Autumn	Summer	Winter	Unknown	Total
Blue whale (*Balaenoptera*	Migrant			1		1	2
Bottlenose dolphin (*Tursiops truncatus*)	Range restricted			1			1
Common dolphin (*Delphinus* spp.)	Not threatened	2	2	5	5	1	15
Dusky dolphin (*Lagenorhynchus obscurus*)	Not threatened	1	3				4
False killer whale (*Pseudorca crassidens*)	Not threatened			1			1
Fin whale (*Balaenoptera physalus*)	Migrant			1			1
Humpback whale (*Megaptera novaeangliae*)	Migrant	3		2	10		15
Killer whale (*Orcinus orca*)	Nationally critical			3		3	6
Maui's dolphin *Cephalorhynchus hectori maui*)	Nationally critical			2			2
Pilot whale (*Globicephala* spp.)	Not threatened	5	1	6			12
Sei whale (*Balaenoptera borealis*)	Migrant			1			1
Southern right whale (*Eubalaena australis*)	Nationally endangered	1			1		2
Sperm whale (*Physeter macrocephalus*)	Migrant			2			2
Total		**12**	**6**	**25**	**16**	**5**	**64**

Maui’s dolphin, which are a sub-species of Hector’s dolphin, are classified as a critically endangered species. Their density has been identified for the STB as being less than 0.0005 dolphins per square nautical mile. Density increases north of Cape Egmont, peaking between the Raglan and Manukau Harbours, and extending to Kaipara Harbour. The distribution of Maui’s dolphin is presented in Figure 3.8 below.

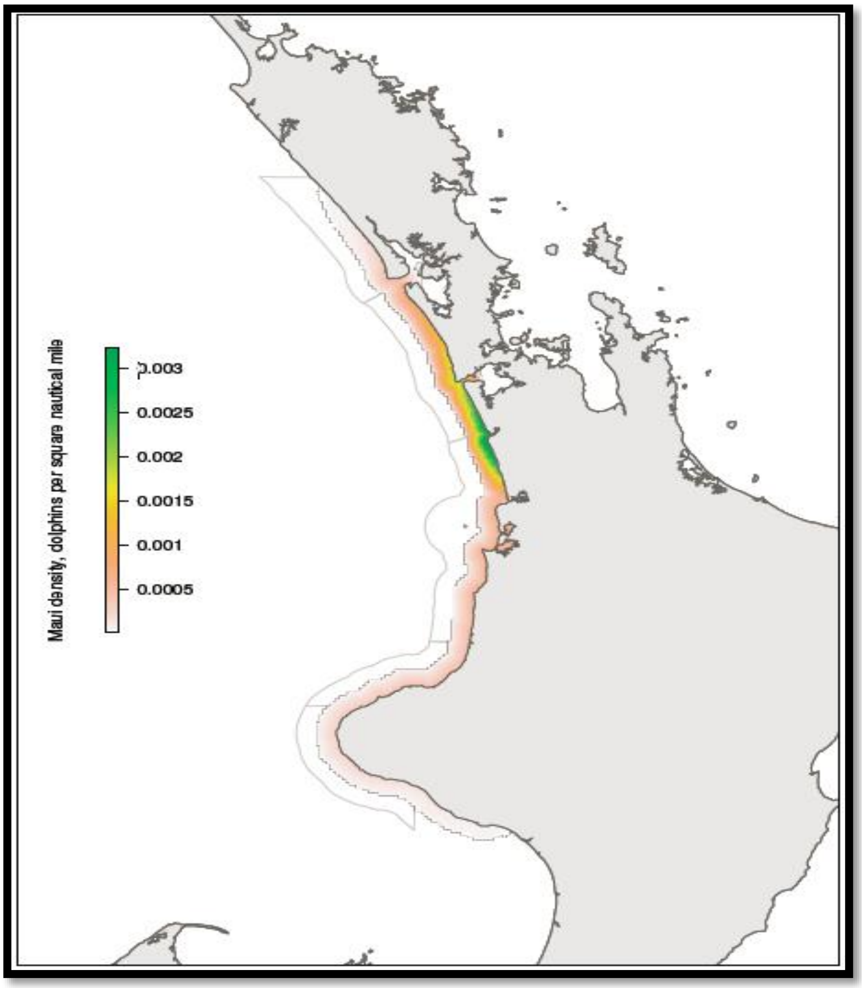

Figure 3.8: Maui's Dolphin distribution

Killer whales are classified as a nationally critical threatened species in New Zealand. Between 1980 and 2005 there were three sightings within the STB. The entire New Zealand population is less than 200, with broad distribution patterns across the North and South Islands. Killer whales may transition through the STB or use the area to forage for prey.

Southern right whales are considered nationally endangered due to whaling reducing population to an estimated 1,000. Southern right whales follow traditional annual migration routes between southern summer feeding areas and nearshore calving grounds in winter. They are mainly sighted in the waters around the Auckland and Campbell Islands, but there are occasional sightings around New Zealand, which may represent re-colonisation of breeding grounds largely unused since the 1830s. Two sightings have been recorded in the STB, a cow / calf pair in the spring of 1983 and the other a solitary animal in the winter of 2004.

NIWA was also commissioned to complete habitat modelling of the STB relating to the three endangered species (Torres et al. (2015)).[30] The purpose of Torres et al. (2015) was to gain further understanding of the suitability of the STB as a marine habitat for these endangered species. Appendix 3.4 to this IA contains the modelling outputs of habitat suitability. By way of summary, Torres et al. (2015) establishes the following:

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30 Torres, L.G., Compton, T., Fromant, A., 2013. *"Habitat models of southern right whales, Hector's dolphin, and killer whales in New Zealand"* NIWA Client Report No: WLG2012-28. October 2013. 61 pp. Updated November 2015.

- Habitat suitability for Hector's dolphin, and subsequently Maui's dolphin, in the project area is low;

- Low habitat suitability for killer whales was predicted in the project area. A band of average to above average habitat suitability for killer whales, corresponding to an area of increased sea surface temperature gradient, begins approximately 8 km seaward of the project area; and

- Low habitat suitability for southern right whales was predicted at and adjacent to the project area. A coastal strip within 5 km of the shoreline, had low to moderate suitability for this species suggesting that individuals may use this area as a migration corridor.

Cawthorn (2015) also undertook a survey of the marine mammals within the STB. A total survey time of 50 hours and 11 minutes was recorded, with a flight distance of 8,426 km. During this time a single pod of six to eight common dolphins and a total of seven fur seals and various other fauna (e.g. seabirds, fish and sharks) were observed.

Joint expert conferencing was held on 26 March 2014 as part of the previous marine consent application by TTR.[31] The experts at the conferencing agreed on the following with regard to marine mammals:

- Killer whale pods are likely to be transitory through the project area and the STB;

- Blue whale sightings mainly occurred around the 100 m depth contour with very few sightings inshore. The project area may be on the edge of blue whale feeding grounds, but feeding may still extend into this area;

- Beaked whales are typically found in water depths of approximately 200 m. As such, they are unlikely to be found in the project area. Sperm whales are also found in deeper waters and are unlikely to be found in the project area;

- Humpback and southern right whales are likely to be present in the project area and the STB on a seasonal basis (during their migration between the summer feeding grounds in the Antarctic and the winter calving and breeding grounds in the tropics);

- Pilot and false killer whales may use the project area and the STB over the summer months; and

- Common dolphins and New Zealand fur seals are widespread in the project area and the STB, and are found year-round.

3.8 Seabirds

NIWA was commissioned by TTR to assess the presence of seabirds in the STB (Thompson (2015a)).[32] The assessment identified that the majority of the seabird species present in the STB are relatively coastal in their distribution. This included blue penguins, shags, gulls and terns. However, the latter two taxa can extend into more offshore areas.

31 TTR Marine Consent Application – Joint Statement of Experts in the Field of Effects on Marine Mammals including Noise - Noise Conditions. 26 March 2014.

32 Thompson, D., 2013. *"Seabirds of the South Taranaki Bight"* NIWA Client Report No: WLG2013-15. March, 2013. 9 pp. Updated November 2015.

By contrast, and although some species have been observed from, and relatively close to the coast, albatross and petrel species tend to be more pelagic and wide-ranging in their distributions and will likely occur at times throughout the STB and the project area.

The project area does not support large breeding colonies of any avifauna species. The nearest offshore islands are the Nga Motu / Sugar Loaf Islands near New Plymouth, which support perhaps a few tens of thousands of breeding pairs of seabirds. However, a number of coastal estuarine sites are of significant value to coastal, shore, wading and migratory bird species. These include the Waikirikiri Lagoon and the Whanganui, Whangaehu, Turakina, Manawatu and Rangitikei River estuaries. These are, however, located a significant distance from the project area.

Of the seabird species present within the STB, five species have been examined in MacDiarmid (2015a) in further detail with regard to migration, habitat and diet, and to illustrate the scale of distribution and movement within the EEZ and beyond. These species, and their Union for the Conservation of Nature Red List[33] classification and a New Zealand Conservation status[34] is identified in Table 3.5 below.

Table 3.5: Seabird Species and Conservation Classification.

Seabird Species	Union for the Conservation of Nature Red List Classification	New Zealand Conservation Status
Gibson's albatross	Vulnerable	Threatened – nationally critical
Westland petrel	Vulnerable	At risk – naturally uncommon
Sooty shearwater	Near threatened	At risk – declining
Red billed gull	Least concern	Threatened – nationally vulnerable
Little blue penguin	Least concern	At risk – declining

Overall, there is considered to be a very low presence of seabirds within the project area.

3.9 Seascape and Visual Character

Boffa Miskell Limited (Boffa (2015)) was commissioned by TTR to assess the natural character, landscape, seascape, and visual amenity values of the project area and the STB.[35]

3.9.1 Seascape Character Types

The seascape of the STB was classified into the following three broad regional seascape character types based on the nature of the coastal margin and their associated beach sediment characteristics.

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33 http://www.iucnredlist.org/

34 Robertson, H., Dowding, J., Elliot, G., Hitchmough, R., Miskelly, C., O'Donnell, C., Powlesland, R., Sagar, M., Scofield, P., Taylor, G. 2012. Department of Conservation. *'New Zealand Threat Classification Series 4. Conservation status of New Zealand birds, 2012'*

35 Boffa Miskell Limited. 2013. "*Seascape and Natural Character and Visual Effects Assessment*". November 2015.

3.9.1.1 Dunes and Low Cliffs

The two coastal areas where this occurs within the STB are located between the mouth of the Whanganui River and the mouth of the Patea River. The larger of the areas occurs at Waiinu Beach and extends north to the mouth of the Patea River, with the smaller area being to the south along the foreshore of Castlecliff (refer to Appendix 3.5).

3.9.1.2 Fossil Sea Cliffs

This relatively small area extends for approximately 1.5 km to the north of Castlecliff, near the mouth of the Whanganui River and is characterised by stable hard rock cliffs backing sandy beaches (refer to Appendix 3.6).

3.9.1.3 Eroding Sea Cliffs

These extensive areas extend from north of the fossil cliffs near Castlecliff to a point south of Waiinu Beach, and from the mouth of the Patea River to Ohawe and beyond. These actively eroding steep sea cliffs, which extend along 70% of the STB coastline, contain narrow beaches where the sediment material comprises a mixture of sand and gravel with areas of soil deposited from the actively eroding escarpment face (refer to Appendix 3.7).

The defining elements and features for the regional seascape types have been primarily influenced by the nature and character of the visually prominent coastal margin. The coastal escarpment, dune systems and associated beaches which have been sculptured and shaped by past and ongoing erosion processes, clearly display very high levels of coastal natural character throughout most of the coastal environment of the STB.

3.9.2 Seascape Character Areas

Twenty seascape character areas have been identified in the coastal environment between Mania and Whanganui. The spatial relationship between the national, regional and district seascape scales defined for this assessment are illustrated in Appendix 3.8.

3.9.3 Natural Sediment Plumes

In addition to the distinctive coastline features that define and characterise the seascape, a particularly distinctive feature of the nearshore seascape (up to 5 km offshore) is the appearance of naturally occurring suspended sediment plumes.

While the appearance, extent and pattern of these plumes vary considerably, they are a characteristic feature of the STB. As noted in the sections above, the sediment plumes are largely derived from river and stream deposited material, active shoreline erosion processes and the re-suspension of bottom sediments as a consequence of sea current and wave action.

These plume patterns generally relate to natural processes such as would be expected at river mouths, in the vicinity of eroding sea cliffs and the patterns associated with tides, currents, and wave and weather conditions. Notwithstanding these variations, the natural sediment plumes are distinctive features that contribute to the high visual, recreational and amenity values of the seascape of the STB.

3.10 Archaeological Sites

Clough & Associates Limited was commissioned by TTR to identify the potential for the discovery of historic shipwreck sites within the project area, which included the identification of any existing archaeological sites of significance within the project area (Clough (2015)).[36]

Clough (2015) identifies that there are at least 126 documented shipwrecks in the Taranaki Region, of which 64 pre-date 1900. The remains of the majority of the shipwrecks are in unconfirmed locations, and only 11 of these wrecks have been successfully relocated in recent times. Twenty-three vessels have been recorded as lost along the coastline of South Taranaki at or near Patea, and 28 along the coast at or near Wanganui.

Clough (2015) concludes that there are no shipwrecks known to be present within the project area.

3.11 Existing Interests – Activities and Parties

3.11.1 Introduction

Existing interests are defined in section 4 of the EEZ Act as:

> *"…, in relation to New Zealand, the exclusive economic zone, or the continental shelf (as applicable), 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."*

Based on this definition, the sub-sections below have been identified as the potential existing interests in the project area, along with the parties who have these 'existing interests'.

3.11.2 Recreation and Tourism

Rob Greenaway & Associates was commissioned by TTR to identify recreation and tourism activities which occur in the surrounding environment that may be potentially affected by the project (Greenway (2015)).[37] The assessment identified the coastal area between Hawera

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[36] Clough and Associates Limited 2015. "*Trans-Tasman Resources South Taranaki Bight Offshore Iron sand Project: Archaeological Assessment."* August 2013, updated 3 December 2015. 22pp.

[37] Rob Greenaway & Associates, 2013. *"Trans-Tasman Resources Ltd Sea Bed Mining, South Taranaki – Recreation and Tourism Assessment of Effects"* 15 October 2013, updated November 2015. 43 pp.

and Whanganui as being potentially affected by the project from a recreation and tourism perspective.

Greenaway (2015) identifies that regionally important coastal marine recreation settings are based at the main public access areas and activity points at:

- Ohawe Beach;
- Waihai Beach;
- The mouth of the Tangahoe River;
- The mouth of the Manawapou River;
- Patea;
- Waipipi;
- Waiinu;
- Kai Iwi;
- Castlecliff;
- The fishing resource up to 20 km offshore; and
- The scenic diving setting off the North and South Traps.

An aerial survey of the STB found that the project area likely had minimal recreational fishing use, with the most frequented areas by recreational vessels occurring around New Plymouth and south of Waiinu Beach (refer to Appendix 3.9 of this IA). In this regard, the project area is considered to be a very low use recreation setting that is only rarely used for marine fishing due to its distance from the coastline of the STB.

With regard to tourism activity in the STB, Greenaway (2015) concludes that these activities are largely limited to six beach camp sites and three fishing charter operations – two operating from Patea and one from Whanganui.

Overall, the project is a very low use recreation setting which may be used only rarely for recreational fishing. Recreational sites of interest in the vicinity of the project area are the inshore recreation setting (surfing, swimming, walking, surfcasting and shellfish gathering), the near-coast diving sites, particularly the North and South Traps, and the marine fishing opportunity within 20 km of the coast. At a national level, the scale of recreation activity in the relevant coastal setting is relatively slight, with higher levels of activity north of Cape Egmont and south of Patea.

3.11.2.1 Existing Interest Parties – Recreation and Tourism

With regard to parties with lawfully established ‘existing interests’, those that relate to recreational fishing and tourism interests operating within the project area have been identified as:

- Charter Fishing operations:

  - South Taranaki Fishing Charters;
  - Fluffy Duck Charters Ltd; and
  - Hy-Jinks Fishing Charters.
- Recreational Boating and Fishing Clubs:
  - Patea and District Boating Club;
  - Ohawe Boating and Angling Club;
  - Opunake Boat and Underwater Club;
  - Opunake Surfcasting and Angling Club; and
  - Egmont Boat Club.
- South Taranaki Underwater and Dive Club;
- Mako Sub Aqua Club; and
- South Taranaki Volunteer Coastguard.

3.11.3 Maritime and Navigation

Marico Marino NZ Limited was commissioned by TTR to assess vessels movements in the STB and to assess the impact the project will have on commercial shipping vessels (Marico (2015)).[38]

The report analysed 12 months of automatic identification system data in the area encompassed by Cook Strait, Kahurangi Point and Cape Egmont, including Tasman Bay.

A total of 926 movements were detected over the 12-month period. By way of summary, 40.5% of vessels identified during the study period were dry cargo ships. The second highest vessel type were tankers, making up 9.4%. A detailed breakdown of the types of vessels recorded is included in Table 3.6 below.

Table 3.6: Total Numbers of Ship Stations in STB for April 2012 – March 2013.

Vessel Type	Unique Stations	Percentage (%)
Anchor Handlers	4	0.4
Buoys / Navigational Markers	6	0.6
Dry Cargo Ships	375	40.5
Dredges	3	0.3
Fishing	37	4.0
Naval	6	0.6
Passenger / Cruise Ship	35	3.8
Pilot Vessel	5	0.5
Recreational Craft	39	4.2
Research / Survey	13	1.4
Tankers	87	9.4
Tugs / Towing	20	2.2
Other	296	32.0
Totals	926	100

38 Marico Marine NZ Ltd. (2013) *"South Taranaki Bight Marine Traffic Study"* Report Number: 13UK934. July 2013. 62 pp. Updated November 2015.

A minimal amount of marine traffic travelled through, or near, the project area during the study period and this is considered to be a realistic reflection of the annual marine traffic volumes that will be expected while iron sand extraction activities are occurring. Marine traffic recorded during the study period is shown in Figure 3.9 below.

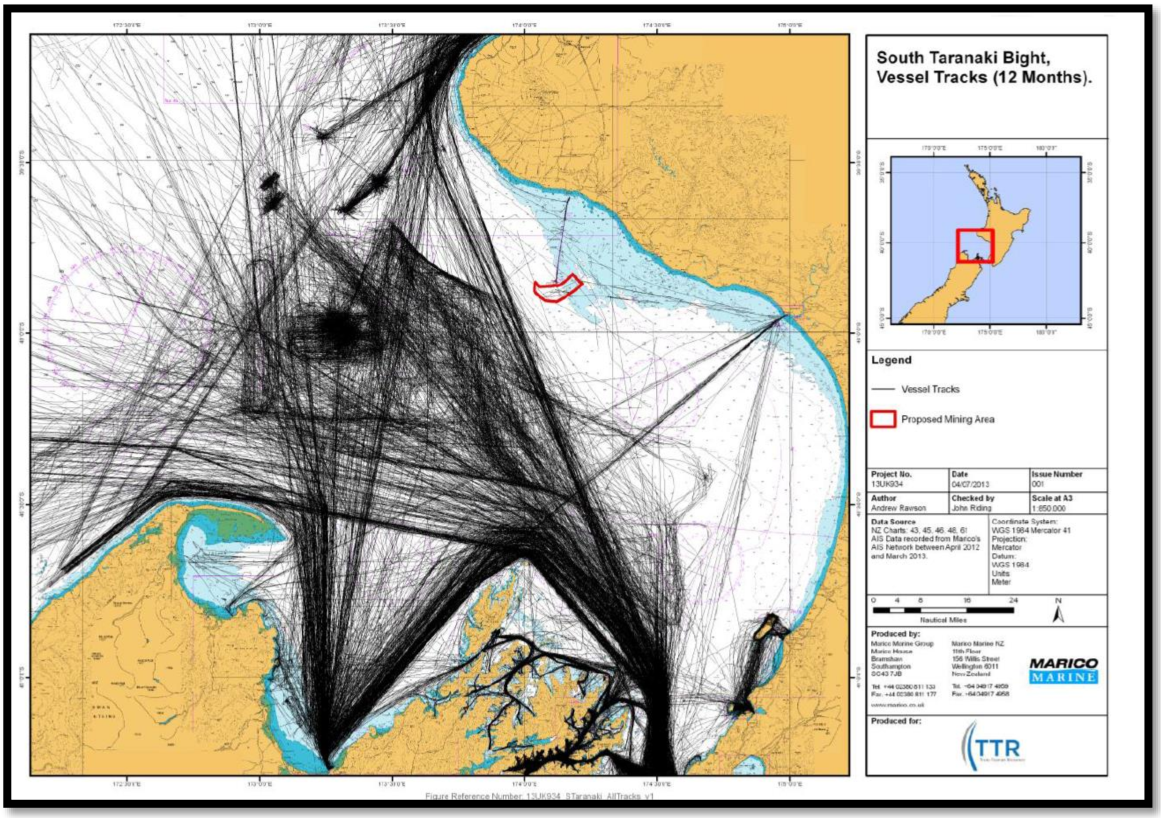

Figure 3.9: Marine Traffic through the STB: April 2012 – March 2013.

Marico (2015) concludes that the project area is well separated from the regular shipping routes and commercial fishing grounds.

As discussed in above and in Section 4.15.4 , marine traffic in and around the project area is scarce. The main marine traffic consists of smaller recreational fishing vessels and vessels carrying out exploration activities for TTR. It is on this basis that TTR does not consider that marine traffic constitute an existing interest that may be affected by the project.

3.11.4 Commercial Fishing and Aquaculture

3.11.4.1 Commercial Fishing

Fathom Consulting Ltd was commissioned by TTR to assess the commercial fisheries in the STB (Gibbs (2015)).[39] Further, and following consultation by TTR with the commercial fishing sector, an additional report was prepared by NIWA looking at commercial fishing within the STB, with a specific focus on the effort and catch for each fishing method over a

[39] Gibbs, N. South Taranaki Bight iron sand mining proposal – Assessment of potential impacts on commercial fishing. Fathom Consulting report to Trans-Tasman Resources Ltd. 5 July 2013 pp 38. Updated November 2015.

period from 2006 to 2015 (MacDiarmid et al. (2016))[40]. These two assessments are summarised below and reflect that commercial fishing has an existing interest in the STB in accordance with section 4(a) of the EEZ Act.

The STB is part of the Central (West) Fisheries Management Area ("**FMA**") known as FMA 8, which runs from Tirua Point in Taranaki to a point north of Titahi Bay near Wellington (refer to Figure 3.10 below). Despite the weather limitations, the area is considered to support a productive and diverse range of valuable inshore commercial fisheries.

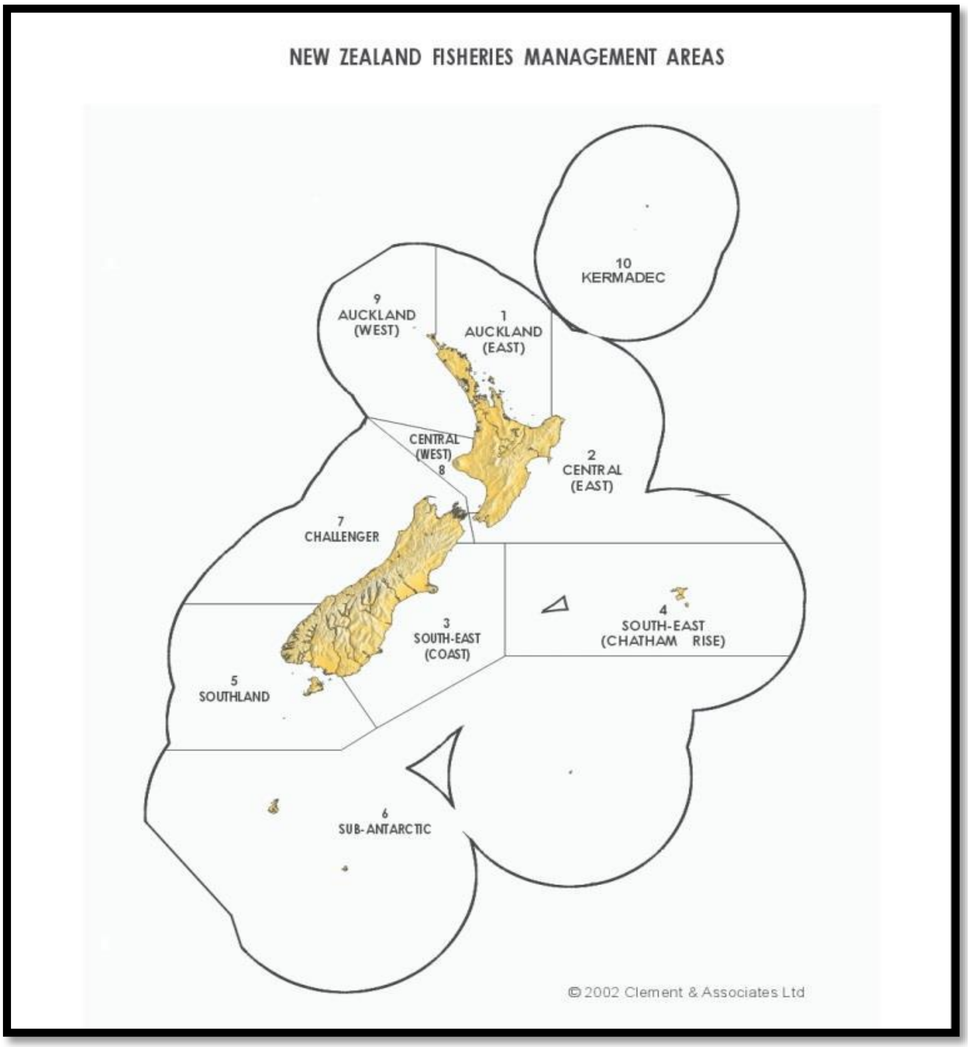

Figure 3.10: New Zealand Fisheries Management Areas.

Commercial fishers in the STB use a variety of fishing methods, including bottom trawling, mid-water trawling, set-netting, bottom long-lining, squid jigging, purse seining, trolling, potting or trapping, and drop lining. The main commercial fishing methods are bottom trawling (for trevally, leatherjacket, gurnard and snapper), midwater trawling (mainly for jack mackerel) and set-netting (mainly for school shark, rig and blue warehou). These methods account for 98% of the commercial fishing over the nine-year period assessed in MacDiarmid et al. (2016).

40 MacDiarmid, A., Ballara, S. South Taranaki Bight Commercial Fisheries – 1 October 2006 – 30 September 2015, Prepared for Trans-Tasman Resources Ltd, May 2016. pp26

Trawling occurs year-round with no obvious seasonality when viewed as a whole. However, the catch rates of key species are highly seasonal. In this regard, snapper and John Dory catch rates peak during October - March, while catch rates of trevally are highest in January - February. Catch rates of barracoota also tend to be highest during the summer months, while the catch rate of red gurnard tends to remain relatively constant throughout the year.

Mid-water trawling targets jack mackerel, with barracoota taken mainly as bycatch. The fishery occurs year-round, but there is a concentration of effort in December and January. A secondary peak occurs in July to August and is characterised by a greater proportion of tows targeting barracoota.

With regard to set lining, rig is mostly caught during spring and summer when the fish aggregate close to the shore. The main rig catches occur from September to March, with a peak in January. School shark is caught year-round, but the highest catch rates occur in April and May.

MacDiarmid et al. (2016) also identifies that rock lobster potting and crab potting were both common commercial fishing activities in the STB over the last nine years. The majority of the catch in the study area is caught in Area 935, which runs from just south of New Plymouth to Bulls, a distance along the coast of approximately 240 km.

Some fishing methods are excluded from parts of the STB. In this regard, trawling by vessels larger than 46 m was prohibited from an area in the STB just outside the territorial sea boundary in 1986. Set-netting from the coast out to 2 NM offshore in the area from Pariokariwa Point to Hawera was prohibited in 2012. Set-netting was also prohibited on vessels operating out to 7 NM offshore unless a Ministry for Primary Industries ("**MPI**") fisheries observer was on board.

Quota ownership in both the trawl and set-net fisheries is dominated by Talleys and Sanford. Te Ohu Kaimoana Trustee is also a major quota owner on behalf of Maori, and several other iwi-owned companies feature in the top 10 quota owners for stocks in the STB.

The lowest levels of overall fishing effort in the STB were in the central south sector, offshore of Whanganui and also close to the shore north of Opunake. The highest level of fishing effort is off the coastline between New Plymouth and Cape Egmont, and between Hawera and Whanganui (near the 50 m contour).

The project area has minimal overlap with the trawler fishing industry, which is mainly concentrated seaward of the 50 m contour. In contrast, the project area is located in water depths of between 20 and 42 m. The proportion of trawl catch taken within the project area is, therefore, likely to be minimal and can be provided for at other fishing locations within the STB. However, the commercial fisheries with the greatest overlap with the project area are the bottom trawl fisheries for leatherjackets and trevally, and the set-net fisheries for rig, carpet sharks, trevally, school shark, snapper and spiny dogfish.

3.11.4.2 Existing Interest Parties – Commercial Fishing

With regard to parties / representative bodies with lawfully established 'existing interests', those that relate to commercial fishing interests within the project area have been identified as:

- Sanford Ltd;
- Talley's Group Ltd;

- Te Ohu Kaimoana;
- Fisheries Inshore New Zealand;
- Aotearoa Fisheries Ltd;
- Raukura Moana Seafoods Ltd;
- Ngai Tahu Seafood Resources Ltd;
- Ngati Porou Seafoods Ltd;
- Pupuri Taonga Ltd;
- Alpine South Fishing Ltd;
- Shirley Shields and Catherine Boaler-Walls;
- Egmont Seafoods;
- Ian Brown;
- Nelson Vessels;
- Connor Family;
- Ian McDougall; and
- Lyle Jenkins.

The effects of the project on commercial fishing interests' area discussed in Section 4.15.1.

3.11.4.3 Aquaculture

If adverse weather conditions are present within the project area, there is the potential that some of TTRs project related vessels may seek shelter in Admiralty Bay. Admiralty Bay has been identified 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 within Te Tau Ihu (top of the South Island) region, where eight iwi groups are represented under the Te Tau Ihu Settlement Bill, currently hosts longline mussel farming and is part of the $276 million[41] aquaculture export industry within the Marlborough Sounds.

TTR project-related vessels would not undertake any activities within Admiralty Bay other than sheltering and therefore, will present no additional risks compared to any other vessel sheltering in Admiralty Bay at that time. TTR has assessed the proposed sheltering activities in Admiralty Bay against the Marlborough Sounds Resource Management Plan and consider that the anchoring of any project-related vessel within Admiralty Bay will not breach any of the Rules in the Plan.

[41] 2014 NZD value.

If disturbance to the seabed was greater than 20 m^3, the activity would be considered as discretionary under the Marlborough Sounds Resource Management Plan and a coastal permit would be required. However, due to the size of the vessels being used, the anchoring of any TTR project-related vessels will not disturb an area of seabed greater than 20 m^3; hence, no coastal permit will be required.

As vessels will only be using Admiralty Bay for safe harbouring in adverse weather events, and no resource consents or marine consents required for such activities, TTR does not consider that this activity constitutes an 'effect' any on party that may have any existing interest within this area.

TTR also note there is no aquaculture activities undertaken within the STB.

The potential effects of the project on the aquaculture industry at Admiralty Bay have been discussed in Section 4.15.2.

3.11.5 Kupe Joint Venture Parties

Kupe Joint Venture Parties New Zealand ("**Kupe JVP**") are the holders of Petroleum Mining Licence #38146, with Origin Energy as the operator, which gives Kupe JVP the rights and interests to the Kupe natural gas field, which is located approximately 30 km off the coast of Manaia. The production facility comprises an unmanned offshore platform, a 30 km single three phase pipeline to shore and an onshore production station (refer to Figure 3.11 below).

Approximately half of the project area is located within the mining licence area held by the Kupe JVP licenced area. The unmanned platform, pipeline and umbilicals are located approximately 1.2 km northwest of the project area.

Based on the above, Kupe JVP are considered a party who has a lawfully established 'existing interest' that may be affected by the project.

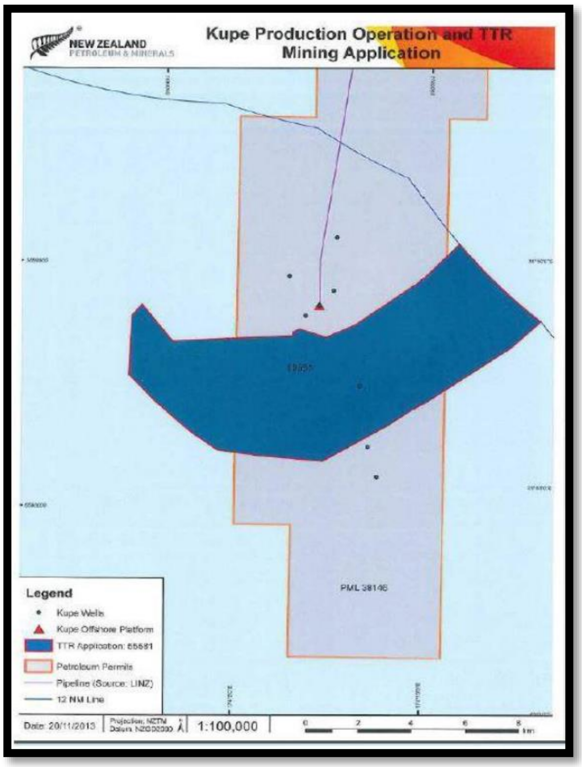

Figure 3.11: The extent of the Kupe Production area and project area.

3.11.6 Existing Marine Consents

Four marine consents have been granted by the EPA under section 62 of the EEZ Act for activities in the STB. These are:

- A marine consent granted to OMV New Zealand Limited on 26 August 2014 to continue its drilling programme for an exploration well, known as Whio-1, near the Maari wellhead platform (Decision number EEZ0200OMV). This marine consent is due to expire in December 2017;

- A marine consent granted to Shell Todd Oil Services ("**STOS**") on 10 September 2014 for various activities associated with the drilling of two exploration wells known as Ruru-2 and Maui-8 in the vicinity of the Maui field (Decision number EEZ0202STO). This marine consent is due to expire in December 2018;

- A marine consent granted to OMV New Zealand Limited on 15 December 2014 to complete a development drilling programme at the Maari field in accordance with its petroleum mining permit (Decision number EEZ000007). This marine consent is due to expire in December 2016; and

- A marine consent granted to STOS on 5 June 2015 to continue offshore activities associated with the Maui natural gas field operating in accordance with petroleum mining licence 381012 (Decision number EEZ000010). This marine consent is due to expire in 2050.

Therefore, the abovementioned parties are considered to have an 'existing interest' that may be affected by the project.

3.11.7 Existing Resource Consents

With regard to section 4(c) of the EEZ Act, consideration must be given to any activity that may be undertaken under the authority of an existing resource consent granted in accordance with the Resource Management Act 1991 ("**the RMA**").

No existing resource consents granted by Taranaki Regional Council, South Taranaki District Council or the Horizons Regional Council are identified as being near the project area. Further, no consented or permitted activities are considered to be potentially affected by the project due to the distance of the project area offshore.

3.11.8 Settlement of Historic Claims under the Treaty of Waitangi

TTR has not identified any relevant settlements of historical claims under the Treaty of Waitangi Act 1975 relevant to the activities for which marine consent and marine discharge consent is sought. In undertaking a review of settlements for historical claims, the review was restricted to claims relevant to the EEZ.

To date no historical settlements have included provisions covering the EEZ. However, based on the sediment plume modelling there is the potential for the sediment plume to migrate into the coastal marine area ("**CMA**"). Some tangata whenua groups may have a treaty interest in this area through a statutory acknowledgement.

The status of historical treaty settlements for tāngata whenua in the STB is detailed in Table 3.7 below.

Table 3.7: Status of historical treaty settlements and existing interests for iwi in the South Taranaki Bight.

Iwi Organisation	Legislation	Additional Comments
Te Runanga o Ngāti Ruanui	Ngāti Ruanui Claims Settlement Act 2003 Mandated iwi organisation Maori Fisheries Act 2004	Ngāti Ruanui has a statutory acknowledgement over the coastal area between the Waingongoro River and the Whenuakura River. The project area is located approximately 12 NM to west of the Ngāti Ruanui statutory acknowledgement area.
Te Kaahui o Rauru	Ngaa Rauru Kiitahi Claims Settlement Act 2005 Mandated iwi organisation Maori Fisheries Act 2004	Ngaa Rauru has statutory acknowledgement over the coastal area, which extends west to the Patea River. The project area is located approximately 12 NM to the west of the Ngaa Rauru statutory acknowledgement area.
Whanganui River Maori Trust Board (“**WRMTB**”)	Te Whiringa Muka Trust (part of WRMTB) is the mandated iwi organisation Maori Fisheries Act 2004	Represents Te Atihaunui a Pāpārangi (Whanganui Iwi) in Treaty settlements for Whanganui River settlement. Letter of Agreement signed August 2013. The Te Atihaunui a Pāpārangi rohe is approximately 45 km south east of the project area.
Te Runanga o Ngāti Apa Trust	Ngāti Apa (North Island) Claims Settlement Act 2004 Mandated iwi organisation Maori Fisheries Act 2004	The Ngāti Apa statutory acknowledgement area is located approximately 50 km to the south east of the project area.
Ngāti Raukawa ki te Tonga Trust	Mandated iwi organisation Maori Fisheries Act 2004	Claims being heard by the Porirua ki Manawatu District Inquiry. The Ngāti Raukawa ki te Tonga Trust rohe is approximately 70 km south east of the project area.
Te Ohu Tiaki o Rangitāne Te Ika a Māui Trust	Mandated iwi organisation Maori Fisheries Act 2004	Rangitāne o Manawatu, mandated by Tanenuiarangi Manawatu Incorporated, is in direct negotiations with the Crown. Heads of Agreement signed 1999. The Rangitāne o Manawatu rohe is located over 70 km south east of the project area.
Ngā Hapū o Ngāruahine Iwi Inc.	Mandated iwi organisation Maori Fisheries Act 2004	Deed of settlement signed August 2014 under the entity Te Korowai o Ngāruahine. The project area is located approximately 12 NM to the west of Ngāruahine’s area of interest, over which the Crown has agreed in principle to a coastal statutory acknowledgement.
Taranaki Iwi Trust	Mandated iwi organisation Maori Fisheries Act 2004	Deed of settlement signed in September 2015 under the entity Te Kahui o Taranaki. The south eastern boundary of the Taranaki Iwi area of interest is Ouri Stream. The project area is located approximately 12 NM to the west of the Taranaki Iwi area of interest.

Due to the separation between the project area and the areas of interest and statutory acknowledgement areas (12 NM at the closest point) of the groups identified above it is considered that there will typically be no effect on the 'existing interests' of these groups. The cultural effects of the project is discussed in Section 4.11 of this IA.

3.11.9 Settlement of Contemporary Claim under Treaty of Waitangi

All of the iwi organisations detailed in Table 3.7 above are mandated iwi organisations under the Maori Fisheries Act 2004, which implemented the agreements made under the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.

In addition, Te Ohu Kai Moana has an 'existing interest' in the project based on their statutory role as defined in the Maori Fisheries Act 2004. This Act implements the agreement made in the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.

3.11.10 Customary Fisheries

As noted in decisions on other marine consent applications, customary fisheries may constitute an 'existing interest' in accordance with section 4 of the EEZ Act.[42] On this basis, MacDiarmid et al. (2015b) identifies three iwi with customary fishing interests within the STB - being Nga Ruahine, Ngāti Ruanui and Ngaa Rauru. The findings of the report are summarised below.

At least 40 species of invertebrates (shellfish, crustaceans and fish) are customarily gathered or fished from the STB (refer Appendix 3.10). There is no comprehensive or systematic assessment of these fisheries though, without doubt, they are important for coastal iwi and hapu. There is also little information to indicate how these fisheries have trended over the last 100 years in relation to the development and growth of commercial and recreational fisheries.

The available information indicates that customary fishing likely occurs along most of the coast of the STB, especially where intertidal and shallow subtidal reefs occur. These locations tend to harbour a variety of fish and invertebrate kaimoana species. The project area at its closest point is 12 NM to the coastline and therefore, to any coastal based customary fishing areas.

Customary fishing offshore for finfish species is likely to vary depending on whanau access to suitable vessels and equipment, and the traditions of fishing for particular species. The customary fisheries offshore that have the greatest overlap with the project area are those for species such as rig and leatherjacket, which are abundant directly over the project area.

With regard to parties with 'existing interests', the parties with customary fisheries interests within or adjacent to the project area are consistent with parties those which are outlined in Table 3.7 above and those parties identified in Section 3.11.9.

Customary fishing interests have been further discussed in section 4.11 of this IA which includes provision of proposed consent conditions to ensure that any effects on customary fishing interests are monitored and managed to ensure that the project related effects are avoided, remedied or mitigated. Overall, it is considered that the project will not result in any effects on the existing customary fishing interests.

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42 STOS Maui Decision, Paragraph 119 – 4 June 2015.

3.11.11 Protected Customary Right or Customary Marine Title

There are no customary right or customary marine titles, which have been recognised under the Marine and Coastal Area (Takutai Moana) Act 2011 ("**MCA Act**"). Current applications that have been lodged that are relevant to the project area are:

- Ngā Ruahine has lodged an application for protected customary rights and customary title for the common marine and coastal area between the Taungatara and Waihi Rivers, but no decision had been made on this at the time of lodging this application; and

- Ngāti Koata has lodged an application for protected customary rights and customary title for the common marine and coastal area surrounding D'Urville Island (out to 12 NM), but no decision on this application had been made at the time of lodging this application.

4 ASSESSMENT OF EFFECTS

4.1 Introduction

In accordance with section 39(1)(c) of the EEZ Act, this section of the IA identifies the actual and potential effects associated with the establishment and operation of the project within the EEZ and the surrounding environment. The actual and potential effects of the project, including cumulative effects, are summarised and presented in the following sections:

- Economic effects;
- Social impacts;
- Sedimentation and optical water quality;
- Coastal processes;
- Ecology and primary productivity;
- Marine fauna;
- Marine mammals;
- Noise;
- Human health effects associated with the marine discharge activities;
- Cultural effects;
- Visual, seascape and natural character;
- Archaeology and heritage;
- Air quality;
- Existing interests;
- Other matters:
    - Environmental Monitoring Activities;
    - Anchor Deployment and Positioning;
    - Unplanned Oil / Fuel Spills; and
    - Jack Up Developments.

The assessments commissioned by TTR, which are summarised in the sections below, are considered to represent the best available information and are sufficiently comprehensive to provide a thorough and robust assessment of the actual and potential effects of the project. The assessments are based on relevant technical reports, workshops and discussions with science and planning experts, published reports and papers, and experience in marine ecosystems - including off the west coast of the South Island and in the South Taranaki marine environment.

With regard to the physical environment and ecological effects related to the project, Aquatic Environmental Sciences ("**AES**") have prepared an overview assessment of the ecological effects of the project (AES (2016a)).[43] This assessment also:

- Summarises what is known about the existing coastal environment based on previous published and unpublished reports and studies provided for the previous marine consent application by TTR, and new scientific assessments undertaken to provide greater certainty around the potential effects of the project;
- Assesses the ecological significance of the project on the coastal environment; and
- Described potential environmental threshold levels for environmental monitoring parameters.

AES (2016a) provides the basis for the summary of effects provided in Sections 4.4 and 4.6 of this IA.

4.2 Economic Effects

4.2.1 Introduction

Martin Jenkins (2015) undertook an economic impact analysis of the project for three study areas – local, regional and national.

The local study area consists of South Taranaki and Whanganui, where the project will occur. The regional study area is made up of four local authorities - South Taranaki, Whanganui, Stratford, and New Plymouth.

4.2.2 Assessment Methodology

The Jenkins (2015) assessment applies Input Output ("**I-O**") multiplier analysis approach, which is an internationally recognised method for identifying the economic effects that a defined expenditure has on a specified area in terms of GDP and employment.

The analysis identifies the direct expenditure within the study area associated with a project and assigns that expenditure to the relevant industry where it is likely to occur. It then applies regional multipliers to determine the direct, indirect and induced effects of that initial expenditure in terms of gross output, value added (GDP), and employment.

The I-O multiplier analysis approach was selected as it provides the ability to determine the economic benefit in terms of GDP and employment, at regional and local levels, particularly as the operational expenditure could be estimated and identified at a relatively detailed level. Furthermore, the analysis is not affected by changes in the price of iron ore or exchange rates.

Expenditure in each study area was based on TTR's operations budget and their understanding of where that expenditure was likely to be incurred.

The regional I-O tables and multipliers used were constructed from a detailed set of national industry accounts that measure the commodities produced by each industry and the use of

[43] Aquatic Environmental Solutions, 2016. *"Trans-Tasman Resources Ltd consent application: Ecological assessments"* January 2016.

these commodities by other industries and final users. Indirect and induced effects arise as an initial change in economic activity results in diminishing rounds of new spending as leakages occur through saving or spending outside the local economy.

This approach has been used widely in New Zealand and internationally to estimate regional economic impacts. It is consistent with that used in recent reports on the economic impact of the oil and gas sector on the Taranaki regional and New Zealand economies.

4.2.3 Summary of Economic Effects

4.2.3.1 Generated Economic Activity

Direct Expenditure

Based on the project's operations budget there will be an annual average spend of approximately NZ$254 million, approximately half of which will be spent in New Zealand. The projected expenditure locally, regionally and nationally is set out in Table 4.1 below.

Table 4.1: Operational expenditure in New Zealand, annual average

Industry	Expenditure (NZ $ mil)		
	Locally	**Regionally**	**Nationally**
Fabricated metal product manufacturing	21.3	21.3	21.3
Exploration and other mining support services	7.6	17.2	34.4
Scientific, architectural and engineering services	3.7	15.8	15.8
Other transport	2.0	10.4	10.4
Basic material wholesaling	0	6.5	32.6
Legal and accounting services	0	2.1	14.2
Health and general insurance	0	0	3.9
Total	34.6	73.4	132.7

Of the estimated NZ$254 million in annual spend, just over half (52.2%) is expected to be spent within New Zealand. Of this, NZ$73.4 million (55.3%) is expected to be spent in the regional area (Taranaki/Whanganui region), while just under half of that (47.1%; NZ$34.6 million) is expected to be spent within the local area (South Taranaki/Whanganui).

4.2.3.2 Economic Impact Analysis

National - New Zealand

The analysis suggests that the project will generate NZ$159 million in GDP and employ 1,666 people (directly and indirectly) in the New Zealand economy each year for the duration of the project. The direct, indirect and induced impacts of the project on the New Zealand economy are presented in Table 4.2.

Table 4.2: Economic impact of the project on the National area

New Zealand	Direct	Indirect	Induced	Total
Output ($ m)	132.7	121.5	94.9	349.1
GDP ($ m)	59.0	52.1	47.9	159.0
Employment (FTE s)	463	683	520	1,666

The operations budget suggests that NZ$132.7 million is expected to be spent directly on activities and businesses in New Zealand. The impact of this direct spend is estimated to generate NZ$59 million in GDP and directly employ 463 people.

To put this into context, the New Zealand economy has an estimated GDP of $224.6 billion and employs about 2.2 million people. The TTR project would have a relatively smaller impact nationally than it does at a regional or local level, increasing GDP by 0.7 of one percent and employment by less than one-tenth of one percent.

Regional - Taranaki / Whanganui

The project is expected to generate about NZ$50.6 million in GDP and employ 705 people (directly and indirectly) in the Taranaki / Whanganui economy each year for the duration of the project. The direct, indirect and induced impacts of the project on the Taranaki / Whanganui Region are presented in Table 4.3.

Table 4.3: Economic impact of the project on the regional (Taranaki / Whanganui) area

Taranaki / Whanganui	Direct	Indirect	Induced	Total
Output ($ m)	73.4	27.1	15.2	115.7
GDP ($ m)	30.4	11.5	8.7	50.6
Employment (FTE s)	367	218	120	705

The operations budget suggests that NZ$73.4 million is expected to be spent directly on activities and businesses based in the Taranaki / Whanganui Region. The economic impact of this direct spend is estimated to be NZ$30.4 million in GDP and directly employ 367 people.

To put this into context, the Taranaki / Whanganui economy has an estimated GDP of NZ$10 billion and employs about 75,300 people. The project would have a similar impact as in the local South Taranaki / Whanganui area, increasing GDP by half of a percent and employment by almost one percent.

Local - South Taranaki / Whanganui

The project is expected to generate NZ$18.6 million in GDP and employ 299 people (directly and indirectly) in the South Taranaki / Whanganui economy each year for its duration. The direct, indirect and induced impacts of the project on the South Taranaki and Whanganui districts is presented in Table 4.4.

Table 4.4: Economic impact of the project on the local (South Taranaki / Whanganui) area.

South Taranaki / Whanganui	Direct	Indirect	Induced	Total
Output ($ m)	34.6	6.6	3.9	45.1
GDP ($ m)	13.6	2.7	2.6	18.6
Employment (FTE s)	173	83	43	299

The operations budget suggests that NZ$34.6 million is expected to be spent directly on activities and businesses based in South Taranaki / Whanganui. This expenditure is estimated to directly generate NZ$13.6 million in GDP and employ 173 people.

To put this into context, the South Taranaki / Whanganui economy has an estimated GDP of NZ$3.5 billion and employs about 32,400 people. The TTR project would increase GDP by half a percent and employment by close to one percent.

4.2.3.3 Other Quantitative Impacts

Royalties and Taxes

As TTR is a mining permit holder they are required to pay royalties to the Crown in respect of all minerals obtained under that permit. The annual royalty is the greater of 2% Ad Valorem or 10% Accounting Profits. This revenue goes into the Crown's account and will likely be part of government expenditure, generating further employment, and is a component of GDP.

Royalties, taxes and profits will trend with iron ore price. The price of iron ore is unlikely to affect the economic impact of the project on the New Zealand economy as the majority of the economic impacts arise from the expenses associated with the project. The economic impact will continue unless the iron ore price falls below a break-even point for a prolonged period, forcing the project to cease operations.

Price rises in the price of iron ore will lead to greater royalties, taxes and profits, but these are less important to the economic effect analysis than operational costs.

The estimated minimum royalty payment to New Zealand each year, at an iron ore spot price of US$50/tonne, is approximately NZ$7 million, and the project would contribute approximately NZ$350 million per annum to New Zealand exports.

In comparison, petroleum, minerals and coal royalties in 2015 were about NZ$285 million of which minerals accounted for NZ$6 million (2%). Minerals and coal royalties were not expected to increase in 2016, while petroleum royalties were expected to decline by about 20%. If granted, the project would more than double the mineral royalty contribution to approximately NZ$13 million per annum and increase minerals contribution to royalties to about 5%.

As a New Zealand corporate, TTR must also pay income tax on assessable income up to a maximum rate of 28%.

Exports

Using the above example, iron sands exports from the project of NZ$350 million per annum would place it in the top 20 items exported from New Zealand. Combined with iron and steel, and articles of iron and steel, the category would have exports of close to NZ$1 billion.

Based on the recent historic lows in the iron ore spot price, a price of US$40/tonne would result in approximately NZ$312 million in annual exports. Total merchandise exports in the year to June 2015 were NZ$46 billion. Based on those figures, iron sands exports at NZ$312 million, would be 0.7% of total merchandise exports. If the price of iron ore were to be US$60/tonne, then iron ore exports would be approximately $430 million per annum and move up to 16th on the New Zealand's list of principle exports, and, when grouped with iron and steel and articles of iron and steel, it would move into the top 10.

The New Zealand Government has set a Business Growth Agenda target of increasing exports to 40% of GDP by 2025. Step-change increases in exports, such as from this project, will go some way toward achieving that target.

Employment

The project will directly require over 200 people to operate the offshore vessels, with a further 50 staff required in support, engineering, administration, environmental and other contracting roles. This will be required for the majority of the requested 35-year consent term for the project.

Further, approximately 35 people will be employed in corporate roles within TTR. All of these roles will be New Zealand-based. About three-quarters of these will be based outside of the Taranaki region, while about 10% will be based in South Taranaki. These ratios are estimates based on the current scope and scale of the project and are subject to change.

The project will also purchase many services from a number of other independent businesses in the local and wider region. These services include fuel bunkering, environmental monitoring, repairs and maintenance, health and insurance, and business services.

With regard to employment, TTR is committed to working with the local community to encourage local engagement and participation on the project. This includes both in the delivery of support services, but also in encouraging local employment directly on the project.

Heavy Fuel Oil Supply

HFO supply in New Zealand is currently limited with supplies provided from Auckland. It is estimated that an annual spend of nearly NZ$30 million on HFO is predicted. Therefore, the project requires a tailored solution to meet its HFO demand.

There is potential for the HFO to be supplied through the Marsden Point refinery, this would see increased economic activity out of Marsden Point in terms of fuel processing and storage. A third party supplier would then be contracted to transfer HFO to the project area as required.

An alternative option is the development of a dedicated HFO bunkering facility in Wellington or New Plymouth. This would require an investment of NZ$50 million and create up to 14 new jobs. Further business for the new bunker would then be captured by vessels travelling through Cook Strait and ships calling into Wellington / New Plymouth so the establishment of the operation could have flow-on economic effects for the region also. The final, preferred option will be determined if the application is granted.

4.2.3.4 Qualitative Impacts

As well as the quantitative impacts in terms of GDP, employment and government revenue, there are several qualitative benefits from the project.

Skills Development

TTR recognises the benefits from ensuring local people are employed in all aspects of the project operation. Possibly even more important is ensuring local people benefit from training, as this is an investment that will benefit the individuals, the community, and ultimately the project itself.

TTR is exploring opportunities with local government, businesses and Industry Training Providers to assist in providing the services needed to support the project. Further, TTR are committed to establishing a marine and technical skills training facility in Hawera. This will provide, among other skills, Marine Certification training, which is a prerequisite for people seeking work on the project. This is provided for through the proposed consent conditions and is further discussed in Section 4.3 (Social Impacts) of this IA.

Complementarity

The Taranaki Region has well developed oil and gas, dairy and engineering sectors. Each year, the oil and gas sector contributes about NZ$1.6 billion to the Taranaki Region economy and employs about 7,000 people in the region.

As the oil and gas and dairy sectors have grown, businesses, particularly in the structural and mechanical engineering, have adapted and developed their capability to provide support services to both sectors. These capabilities and skill sets are likely to be similar to those required by this project.

Further, the range of support services required for the project are similar to those used for the oil and gas industry. This means that the infrastructure and services are already in place and the sector is not having to start from scratch or import all of its services. A higher proportion of activity will be captured within the region.

For the Taranaki region, which considers itself to be the energy capital of New Zealand, the project will further add to its reputation and capability to support natural resource extraction industries.

Diversification

Countries, and indeed regions, are continually trying to diversify their economies so they are not overly reliant on any one industry. Industry diversification is often an objective for regional or national economic development agencies.

The South Taranaki / Whanganui and Taranaki / Whanganui areas both have a strong dependence upon the dairy, and energy sectors. Adding iron ore extraction broadens the industry mix in the areas. This will be particularly welcomed by the engineering sector.

4.2.3.5 Potential Costs

It has been argued that the project could have some level of adverse effects on other industries in the local and regional study areas, in particular, tourism and fishing. However, such effects are extremely difficult to determine or quantify and, as such, placing any monetary value on these effects is difficult.

There is limited activity in either of these industries in the study areas. As the project is offshore and is not visible from onshore, there is likely to be limited impact on tourism (Section 4.15.3). The commercial fishing industry is very small and in the event that there was an adverse impact, it would result in relatively low losses in activity * In accordance with the Marlborough Sounds Resource Management Plan (fully operative in August 2011), TTR will not undertake any activities that require a resource consent within Admiralty Bay; nor will they undertake any activities in relation to the project (Section 4.15.1). Recreational fishing is unlikely to be affected at all (Section 4.15.3). Overall, Jenkins (2015) concluded that, when considering the balance of economic effects of the project, the positive economic effects are significantly greater than any other effects.

This overall position was accepted by the DMC in their decision on the previous marine consent application, where they concluded that, while the value of the potential adverse effects is difficult to quantify, the project is likely to have a positive net economic benefit.[44]

4.2.3.6 Response to Initial EPA Review Query

With regard to the matters raised in the EPA letter dated 10 May 2016 following an initial review of the particular technical reports provided by TTR, the following matter was raised by the EPA with regard to the presentation of the economic effects:

- *On 9 March 2016, TTRL provided written responses to the EPA regarding its concerns on GHD's report on the economic effects of TTRL's proposed activities. That document contained material explanations which directly addressed some of the concerns raised in the GHD report. As outlined in the meeting on 9 March 2016, we recommend that TTRL includes this information in its formally lodged documents and specifically within its economic analysis. Providing this information in its formally lodged documents will enable the EPA's reviewer, and other parties to the marine consent process, to take account of this additional information.*

TTR confirms that they have not updated the Jenkins (2015) report as TTR have supplied the GHD expert (through the EPA) with separate confidential information addressing the expert's concerns. This information was supplied to the EPA under the terms of the signed Confidentiality Agreement on 28 January 2016. TTR would expect the EPA expert to be able to update any final review report, referring to the confidential information without duplicating any of it in the final peer review report.

4.3 Social Effects of the Project

4.3.1 Introduction

Further to the economic effects considerations discussed in Section 4.2 above, the social impact assessment focuses on the existing social environment and how that might be affected by the project. This section of the IA looks at the potential social impact effects of the project in further detail based on Austin et al. (2016) who undertook a social impact assessment of the project.

4.3.2 Assessment Methodology

Austin et al. (2016) followed the four principle elements of social impact assessment methodology in completing their assessment:

1. Scoping;

2. Profiling;

3. Analysis of potential effects; and

[44] TTR Marine Consent Decision, 15 June 2014. Para 753.

4. The identification of appropriate mechanisms to avoid or mitigate adverse effects.

The 'affected area' was defined at two scales in recognition that the potential effects could occur across a wide geographic area, with different communities and groups potentially affected in different ways:

- The 'local area' covered the coastal communities from Opunake to Whanganui city. It is the area with the closest association to the project operations.
- The 'wider area' covered the districts of New Plymouth, South Taranaki and Whanganui, which is the area most likely to experience employment-related effects.

The main findings on the potential social impact effects of the project are summarised below.

4.3.3 Summary of Potential Social Impacts

4.3.3.1 Employment

The project is predicted to create approximately 250 new jobs within the local and wider areas, with the wages largely expected to be spent in the local area. This is considered to be a positive effect of the project.

The offshore operations will enable a fly-in-fly-out / drive-in-drive-out workforce, therefore the workers could reside across a large geographical area. Based on Taranaki's existing offshore drilling operations in oil and gas, the majority of employees are expected to be based in Taranaki, Manawatu-Whanganui and Wellington. Potential social effects of a fly-in-fly-out / drive-in-drive-out workforce are:

- Helping to spread the benefits of job creation throughout the "local" and "wider" area rather than clustering jobs around the few land-based locations of the project;
- Avoiding most of the social costs often associated with a large non-resident workforce concentrated within an existing community, because the TTR project workforce will be based in a highly regulated, offshore environment; and
- Avoiding capacity issues for local service providers, which can occur when a large new workforce is resident in one specific land based area.

4.3.3.2 Local Businesses and Associated Employment

Positive social effects will be experienced in the communities with businesses providing services or supplies to the project. This will include manufacturing, maintenance, consumables and visitor accommodation. It is anticipated that these effects will occur in the local and wider area of the Taranaki Region, particularly New Plymouth, for the duration of the project with some of these effects already being experienced through the investigation phase of the project.

4.3.3.3 Income Levels

Many of the positions required for the project are expected to be well paid because of the technical skills requirements and offshore experience requirements. Therefore, the project has the potential to help to offset the lower than average household incomes currently experienced in the local and wider areas.

4.3.4 Management of Potential Adverse Social Impacts

To further ensure that the social impacts of the project are positive, TTR is committed to the provision of various community focused consent conditions, provided for through the proposed consent conditions that:

- Establish an annual community based fund to be administered by the South Taranaki District Council, in collaboration with TTR, 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;
- 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 perspective trainee process operators and maintenance support staff from the South Taranaki community who then can be employed by TTR for the project; and
- Establish and maintain a geotechnical and environmental monitoring base located in the port of Whanganui. The purpose of the base is to support the iron sand extraction activities by providing, as a minimum:
    - A permanent berthing site for a vessel;
    - A secure laydown area;
    - A storage area and warehouse;
    - An operation and maintenance workshop;
    - Administration offices; and
    - Scientific Laboratory.

Further to the above matters, in order to ensure that the community and interested parties are kept informed of the project, TTR will provide up to date information on the project's activities and environmental monitoring outcomes, including the baseline environmental monitoring. The information will be made available through a website maintained by TTR for the duration of the project and through regular community meetings, facilitated by TTR. These meetings will further keep the public informed of the project's activities and other matters that may be of interest to the public. The matters have been provided for in the proposed consent conditions included as Attachment 1 of this IA.

4.4 Sedimentation and Optical Water Quality Effects

4.4.1 Introduction

It is inevitable that the recovery of iron sands from the project area will have some impacts on sedimentation and optical water quality at the seabed, and in the water column. In this regard, AES (2016a) concludes that the immediate environment (i.e. where the extraction and re-deposition operations are occurring) will be temporarily impacted to a significant degree. However, it is the spatial and temporal extent of the effects beyond the immediate environment that require a more detailed assessment.

AES (2016a) states there are three main sources of sedimentation and optical water quality effects as a result of the project:

- The production of a sediment plume during the extraction of iron sands and the deposition of de-ored sediments back to the seabed and potential re-suspension;
- Physical disruption of the seabed during the extraction and re-deposition phases; and
- Effects on optical properties of the water column through suspended sediments.

4.4.2 Sedimentation and Sediment Plume Effects

4.4.2.1 Introduction

The production and dispersion of a sediment plume during the extraction of iron sands from the seabed is one of the key features of the project. TTR has committed considerable resources into understanding the potential sediment plume in terms of source material, concentration, dispersal, and spatial and temporal variability.

Following receipt of the DMC's decision on the previous marine consent application, TTR commissioned an extensive peer review of its technical assessments. TTR subsequently commissioned additional technical work by NIWA and others in relation to the sediment plume and modelling to provide certainty and greater confidence in the source terms used and model assumptions (and thus the interpretation of the potential effects of the project).

A key work-stream related to gaining certainty over the way discharged de-ored sediment behaves in the marine environment, particularly potential flocculation and settling rates for finer particles within the discharge. To address this matter, HR Wallingford ("**HRW**") conducted laboratory tests using sediment samples from the South Taranaki marine environment to build on the earlier assessments. This included refining settling velocity of the finest fraction, the erosive forces required to re-suspend this fraction following settling and the 'trapping' of the finest fraction within the pit during the project's operations.

The findings from the tests undertaken by HRW (Wallingford (2014)),[45] along with the updated sediment plume modelling, have been incorporated into the overall environmental assessments (AES (2016a)).

4.4.2.2 Assessment Methodology

<u>Bench Testing of Sediment Samples</u>

HRW completed additional sediment testing and investigations, which resulted in the incorporation of the following factors into the sediment plume model:

- Flocculation – a mechanism whereby fine sediment combines into faster-sinking aggregates;
- Sediment settling rates – the rate at which sediments settle to the seabed and become trapped within sand matrix; and
- Sediment re-suspension – the critical shear stress required to re-suspend deposited material.

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[45] H.R. Wallingford, 2014. *"Support to Trans-Tasman Resources – Laboratory testing of sediments"* DDM7316-RT002-R01-00. October 2014.

HRW was supplied with three samples of sediment that was collected from below the seabed in the Sediment Modelled Domain ("**SMD**"). The samples consisted of the following:

- Post-grind tailings;
- Pre-grind ultra-fines; and
- Tailings.

Each sample was tested with a focus on the flocculation, settling rates and sediment re-suspension.

Flocculation and Sediment Settling Rates

A series of what are known as 'jar tests' were conducted by HRW in order to assess how the three samples behaved when immersed in water. Settling velocity measurements indicate that most particles less than 63 microns ("**µm**") in diameter will be subject to flocculation and settle rapidly to the seabed at speeds of approximately 10 millimetres per second ("**mm/s**") in saline water. In reality, this means that such particles will behave similarly to fine sand and remain near the seabed.

Analysis of the results of the suspension mass tests indicate the following:

- Approximately 67% of fine fraction material less than 38 µm falls rapidly to the seabed;
- Approximately 33% of fine fraction material less than 38 µm falls at speeds of less than 0.2 mm/s;
- Approximately 15% of fine fraction material less than 38 µm falls at speeds of less than 0.1 mm/s; and
- Approximately 0.5% of fine fraction material less than 38 µm falls at speeds of less than 0.005 mm/s.

For the slowest settling sediment there is an expectation that this sediment would be subject to further flocculation over time as it advects and disperses within the environment and interacts with other sediment.

Sediment Re-suspension

Testing by HRW revealed the critical shear stress required for freshly deposited sediment to be re-suspended was in the range of 0.2 – 0.3 Pa, rather than the 0.1 Pa originally assumed by NIWA as part of the technical assessments for the previous marine consent application by TTR.

Re-run of Sediment Plume Model

The sediment plume model uses the Regional Ocean Modelling System, which is a widely accepted ocean / coastal model with optional embedded models of suspended sediment and sediment - bed processes.[46] The model grid resolutions vary between the domains - 2 km grids for the outer domains and 1 km for the inner domains (with the option of using a 500 m resolution). The 500 m resolution is used to investigate the sensitivity of the model results to the grid resolution, primarily at a 100 m grid size ocean bathymetry.

The model required the input of those parameters outlined below:

- Median grain size;
- Grain density;
- Porosity (when in the sediment bed);
- Sediment class;
- Background sediments (river and sea derived);
- Input rates;
- Proportion of background sediment sizes;
- Settling velocity (when in the sediment bed);
- Critical bed shear stress for erosion;
- Erosion rate parameter;
- Iron sand recovery derived sediments;
- Hydro cyclone overflow discharge; and
- De-ored sediment discharge.

Based on Wallingford (2014), the modelling of near-field processes and plume around the discharge is based on effectively all the fine sediment fractions settling at 10 mm/s depositing on to the seabed within the excavated pit. The finer fractions with slower settling rates are expected to remain well mixed in the water column. An important aspect of the new modelling work is that the slowest settling fractions have been shown to combine in the process of flocculation to form faster settling aggregates.

The sediment plume dispersion model was rerun by NIWA incorporating the determined data on source rates, sediment parameters and processes, as well as improvements to the way background suspended sediments are treated. Two source locations were considered in the modelling – one at the inner edge of the project area ("**Location A**") and one at the outer edge ("**Location B**"). The analysis was based on the sediment being introduced over 1,000 days and the reporting has focused on the median (50th percentile) and 99th percentile of effects. The area being considered was broken into three regions:

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46 Haidvogel, D.B., Arango, H., Budgell, W.P., Cornuelle, B.D., Curchitser, E., Di Lorenzo, E., Fennel, K., Geyer, W.R., Hermann, A.J., Lanerolle, L., Levin, J., McWilliams, J.C., Miller, A.J., Moore, A.M., Powell, T.M., Shchepetkin, A.F., Sherwood, C.R., Signell, R.P., Warner, J.C., Wilkin, J. (2008). *"Ocean forecasting South Taranaki Bight Iron Sand Extraction Sediment Plume Modelling in terrain-following coordinates: Formulation and skill assessment of the Regional Ocean Modelling System"*. Journal of Computational Physics 227(7): 3595–3624.

- The Greater Cook Strait Region;
- The SMD; and
- The Patea Shoals.

The majority of the discussion on the sedimentation effects assessment is based on effects that occur in the SMD, as shown in Figure 3.1. This SMD covers approximately half of the STB (approximately 13,300 km^2) and covers the area where any potentially significant impacts from the project could occur.

4.4.2.3 Findings on Sediment Plumes

The modelled background levels of suspended sediment concentration are shown in Appendices 4.1 and 4.2. By way of summary, the sediment plume is shown to predominantly travel in an east-southeast direction from its source. An important consideration is the naturally occurring background levels of suspended sediment concentrations experienced within the SMD.

Background suspended sediment concentrations are higher inshore and decline offshore, and away from the river sources. Median background near-surface concentrations reach over 20 mg/L and the 99^{th} percentile is typically up to 100 mg/L close to the coastline (with a maximum over 200 mg/L close to major rivers) (refer to Appendix 4.1). The median concentrations at the seabed are over 100 mg/L and 99^{th} percentile levels over 1,000 mg/L (refer to Appendix 4.2).

Median surface concentrations around the project site are typically 0.4 mg/L closer to the shore and approximately 0.05 mg/L in more offshore locations. Near-bottom suspended sediment concentrations are typically less than 1 mg/L, with a 99^{th} percentile of less than 10 mg/L. Winter levels tend to be higher than those reached in summer.

The dispersion of suspended sediments in the SMD, and its effects on physical and biological environments, depends on a variety of factors – including tidal currents, larger scale current flows, upwelling off Farewell Spit, freshwater inputs from major rivers, wind direction and weather events. Modelling of the sediment plume in dominant southwest and southeast winds is shown in Appendices 4.3 and 4.4 respectively.

There is also a temporal consideration with a time series now modelled for suspended sediment concentration at locations 2 km, 8 km and 20 km from the project area. The modelling results show how the sediment plume's presence and severity will change over time and the 'spikiness' of the natural suspended sediment concentrations.

The net differences between 'background' and 'extraction plus background' at the locations 2 km, 8 km and 20 km away from the project area are:

- An increase in median suspended sediment concentrations at the 2km location from 0.4 to 1.5 mg/L and an increase at the 99^{th} percentile from 5.5 to 6.8 mg/L;
- An increase in median suspended sediment concentrations at the 8 km location from 0.5 to 1.3 mg/L and an increase at the 99^{th} percentile from 6.9 to 7.1 mg/L; and
- An increase in median suspended sediment concentrations at the 20 km location from 0.9 to 1.4 mg/L and an increase at the 99^{th} percentile from 10.5 to 10.8 mg/L.

The examples of the model runs for sediment plume development showing median sedimentation concentrations in surface waters and on the seabed when iron sands extraction is occurring at Location A are shown in Figures 4.1 and 4.2 respectively.

Figure 4.1 shows that suspended sediment concentration in the plume will be very low, with suspended sediment concentrations of 1.45 mg/L around Location A. The comparison of background, with background plus iron sand extraction activities concentrations, shows a slight movement offshore of the 1 mg/L threshold of about 6 km outwards over the Patea Shoals. The ecological implications of such differences are discussed in Section 4.6 of this IA.

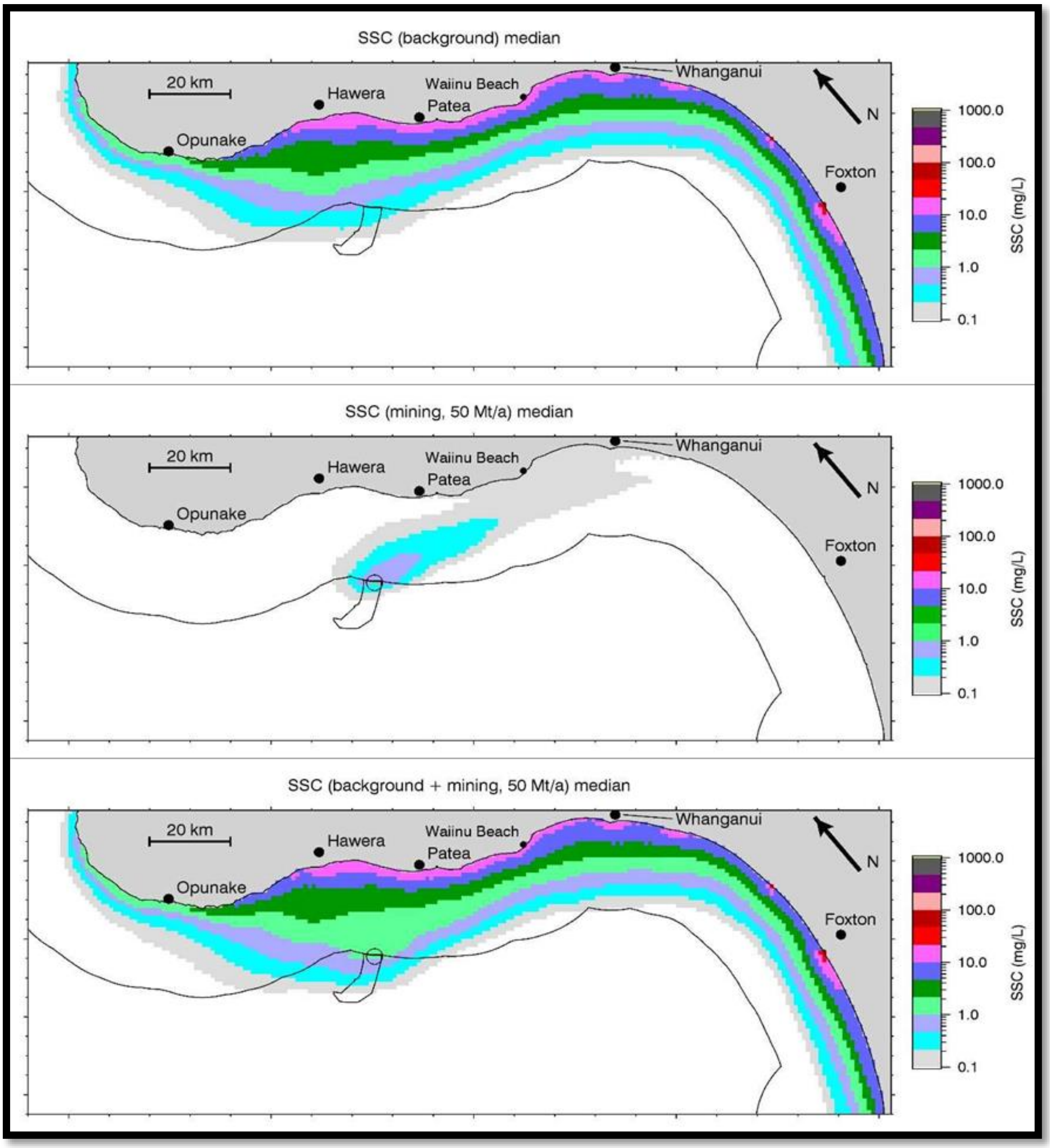

Figure 4.1: Median near-surface concentration of suspended sediment from mining (50 Mt/a) at source Location A. Background SSC (top panel); mining-derived SSC (middle panel); and background plus mining-derived SSC (bottom panel). An open circle of 2 km radius in the middle and bottom panels indicates the source location of the sediment plume.

Figure 4.2 shows that median background suspended sediment concentrations in the near-bottom waters can be in excess of 200 mg/L close to shore and 1,000 mg/L near the mouth of major rivers. When accounting for the sediment plume as a result of the project, the only perceptible difference is within 2 - 3 km of the source.

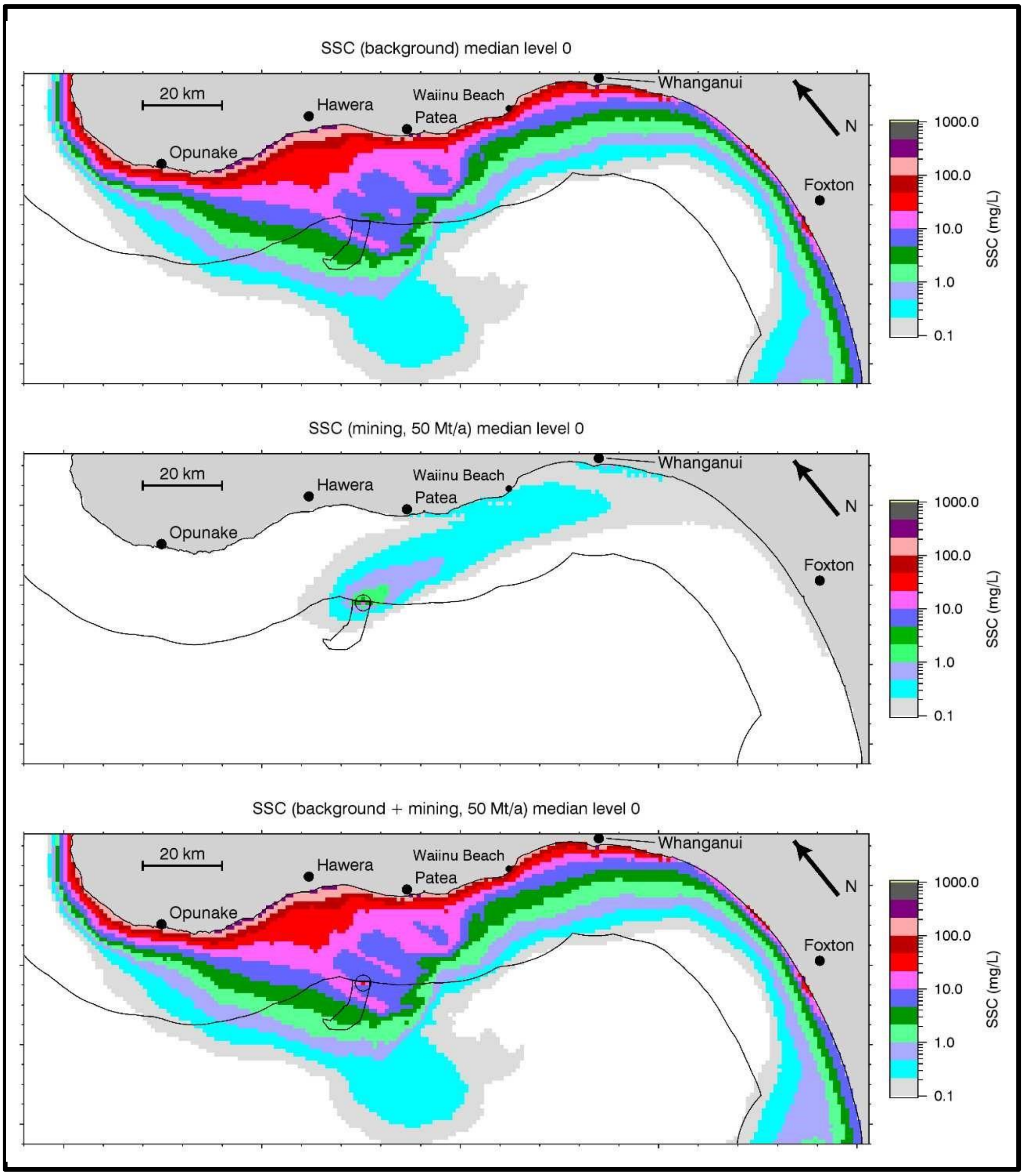

Figure 4.2: Median near-bottom concentration of suspended sediment from mining (50 Mt/a) at source Location A. Background SSC (top panel); mining-derived SSC (middle panel); and background plus mining-derived SSC (bottom panel).

Although the modelling shows the sediment plume interacting with the coast between Patea and Foxton, concentrations are only 0.1 - 0.2 mg/l. These levels are indistinguishable from background, naturally occurring levels.

The highest surface suspended sediment concentrations for Location A are 1.45 mg/L (median) and 8.2 mg/L (99th percentile) at the source, while 20 km down current of the source the surface concentrations are predicted to be 0.35 mg/L (median) and 2.8 mg/L (99th percentile). Again, the concentrations beyond the immediate project area are very small and generally indistinguishable from background levels. Suspended sediment concentrations for Location B were considerably lower than those at Location A.

4.4.2.4 Sedimentation Effects as a Result of Deposition

The deposition of sediments as a result of release of the de-ored sediments has the potential to smother marine environments.

NIWA modelled the levels of deposition and reported the results for the maximum five and 365-day deposition rates. The results demonstrate that the deposition rate can only be distinguished from background rate out to a maximum of a few kilometres of the source of the sediment plume. Once the project is operating the deposition could occur over a reasonably extensive area, but at rates between 0.01 – 0.05 mm over five days. Such levels are indistinguishable from what occurs naturally and it is only at the source of the deposition, where ‘background plus extraction’ is distinguishable from 'background’.

The modelling shows that the maximum deposition at the source will be 0.6 mm and 1.1 mm for the five and 365 day accumulations respectively. Erosion, dispersion and resettlement of sediments from the excavated pits are likely to be at very low rates, with rates of less than 0.01 mm over two years up to 10 km away from the pit area.

Overall, suspended sediment concentrations in these plumes will be insignificantly small relative to the naturally occurring background levels of suspended sediments in the SMD.

4.4.2.5 Response to Initial EPA Review Query

With regard to the matters raised in the EPA letter dated 10 May 2016 following an initial review of the particular technical reports provided by TTR, the following matters were raised by the EPA with regard to presentation of the sediment modelling results:

- *Some issues relating to the presentation of sediment modelling results and the degree of precision that is provided (Section 6.1.1 of the DHI report).*

TTR notes that the primary form of presentation of the results is via graphs with a logarithmic colour scale running from 0.1 to 1000 mg/L. The same colour scale is used for all plots and the large ratio (104) between the extremes of this range is necessitated by the very large spread in concentrations occurring in nature. Each band in the colour scale spans a factor of two (2.15 to be precise).

While it may seem excessive to show concentrations as low as 0.1 mg/L, where background concentrations offshore are typically ~ 0.5 mg/L or more, with the higher threshold of 0.3 mg/L adopted previously, modelling outputs resulted in a position of having plots of median surface suspended sediment concentrations for mining-derived sediment from Location B that were almost completely blank (i.e. below the threshold), but with discernible optical effects.

Regarding the accuracy of the model for mining-derived sediments, TTR note that it will not be possible to establish this directly until, and unless, the consent is granted and the proposal implemented. TTR note that the proposed consent conditions (refer to Attachment 1) include an Operational Sediment Model Validation process.

- *More detailed outputs of changes in light attenuation at specific sites to determine predicted changes in light levels over time to assist in determining the duration, frequency and pattern of any low-light events (paragraph 30 of the GHD report).*

While the above EPA comment suggests that a more detailed output may be useful, TTR note that paragraph 30 and 31 of the GHD review report states *"…As discussed above some additional outputs of the model could be useful, if provided, however they are mainly expected to be used by the ecology team undertaking the impact assessment on the marine and benthic ecology.*

This optical effect study uses an optical model with a high level of complexity has very detailed inputs and is considered to represent best practice."

On this basis, no further information has been provided.

- *More detailed outputs for TSS levels at specific sites within the STB to assist in determining the duration, frequency and pattern of any high TSS events (paragraph 28 of the GHD report).*

While the above comment suggests that a more detailed output may be useful, TTR note that paragraph 28 of the GHD review report states *"Considering that the modelling approach and methodology used are sound and that the input and parameters assumptions have been determined using additional lab testing, the results are considered to be a reasonable estimate of the predicted suspended sediment concentrations."*

On this basis, no further information has been provided in response to this comment.

4.4.2.6 Summary

Increases to the suspended sediment concentrations around the project area and the SMD have been extensively modelled by NIWA using a wide range of input parameters to best understand the actual and potential sedimentation effects associated with the project.

Based on the modelled outputs of suspended sediment concentrations from the project it is concluded that effects near the project area will be moderate. Closer to the coast the effect of project derived sediment will be insignificant as project derived sediment levels are not discernible relative to the naturally occurring background levels in the high energy coastal environment. This conclusion is significantly different from that reached with the previous application and has been arrived at following considerable additional analysis of the way that project derived sediment will behave in the marine environment.

Potential effects of the sediment plume and management of those effects on water quality, ecology, fauna, and coastal processes is further discussed below in the relevant sections of this IA.

4.4.3 Optical Water Quality Effects

4.4.3.1 Introduction

The optical effects of the project have been assessed in AES (2016a) and which incorporates elements of the sediment plume modelling undertaken by NIWA.

The sediment plume model outputs have been used to refine and model the impacts on optical properties of the water column. The changes of potential concern in terms of water column and seabed ecology are underwater visibility for visual feeders and light attenuation for primary producers (i.e. water column and seabed micro-algae and seabed and reef macroalgae). As for the sediment plume, there is considerable background variability in optical properties and the effects of the project are likely to be highly variable in time and space - depending on prevailing conditions.

The optical model outputs have been used to assess the impacts on optical water quality as a result of the project which are discussed below.

4.4.3.2 Actual and Potential Effect on Optical Water Quality

To analyse the actual and potential effects on the optical water quality of the SMD from the project, three descriptive transects were placed through the main axis of the sediment plume as shown in Figure 4.3. They can be described as follows:

- Northwest to southeast from the coast at Hawera across the northeast corner of the project area to approximately 36 km offshore;
- West to east from beyond the western most point of the project area on the 12 NM line to Whanganui; and
- Along the coastline from west of Hawera to Tangimoana (between Whanganui and Foxton).

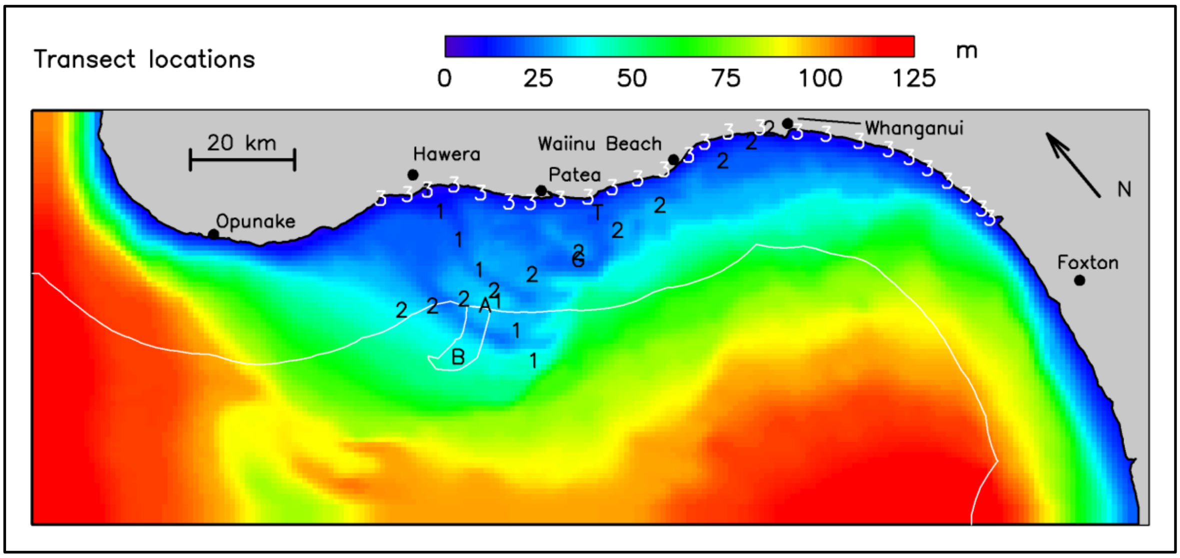

Figure 4.3: Descriptive transects to show optical effects underlain by SMD bathymetry Note: A: Mining site (A) in plume modelling; B: Mining site (B) in plume modelling; G: Graham Bank; T: The Traps.

4.4.3.3 Eutrophic Zone Depth

Iron sand extraction activities at Location A (refer to Figure 4.3 above) will cause a discernible reduction in eutrophic zone depth (which is the depth at which the down-welling irradiance has fallen to 1% of its surface value).

The disturbance of the seabed associated with the iron sand extraction activities leads to increased suspended sediments in the water column. This increase has the potential to have a shading effect which can lead to lower euphotic zone depths. The degree to which euphotic zone depth is reduced depends on how the suspended sediment plume behaves.

The modelling outputs show that the movement of the sediment plume will most commonly be in an easterly direction from the project area. Because there is substantial variability in how the plume behaves, both in terms of the direction it moves and how rapidly the sediment disperses or settles, any temporary potential optical water quality effects reduce as the distance from the extraction area increases.

Overall, eutrophic zone depths are greater in deeper water, further from the coast, and smaller over shallower water and near the coast. This is a result of greater concentrations of suspended sediments, colour dissolved organic matter and phytoplankton in shallower water. Figures 4.4 and 4.5 show the results of the optical water quality modelling.

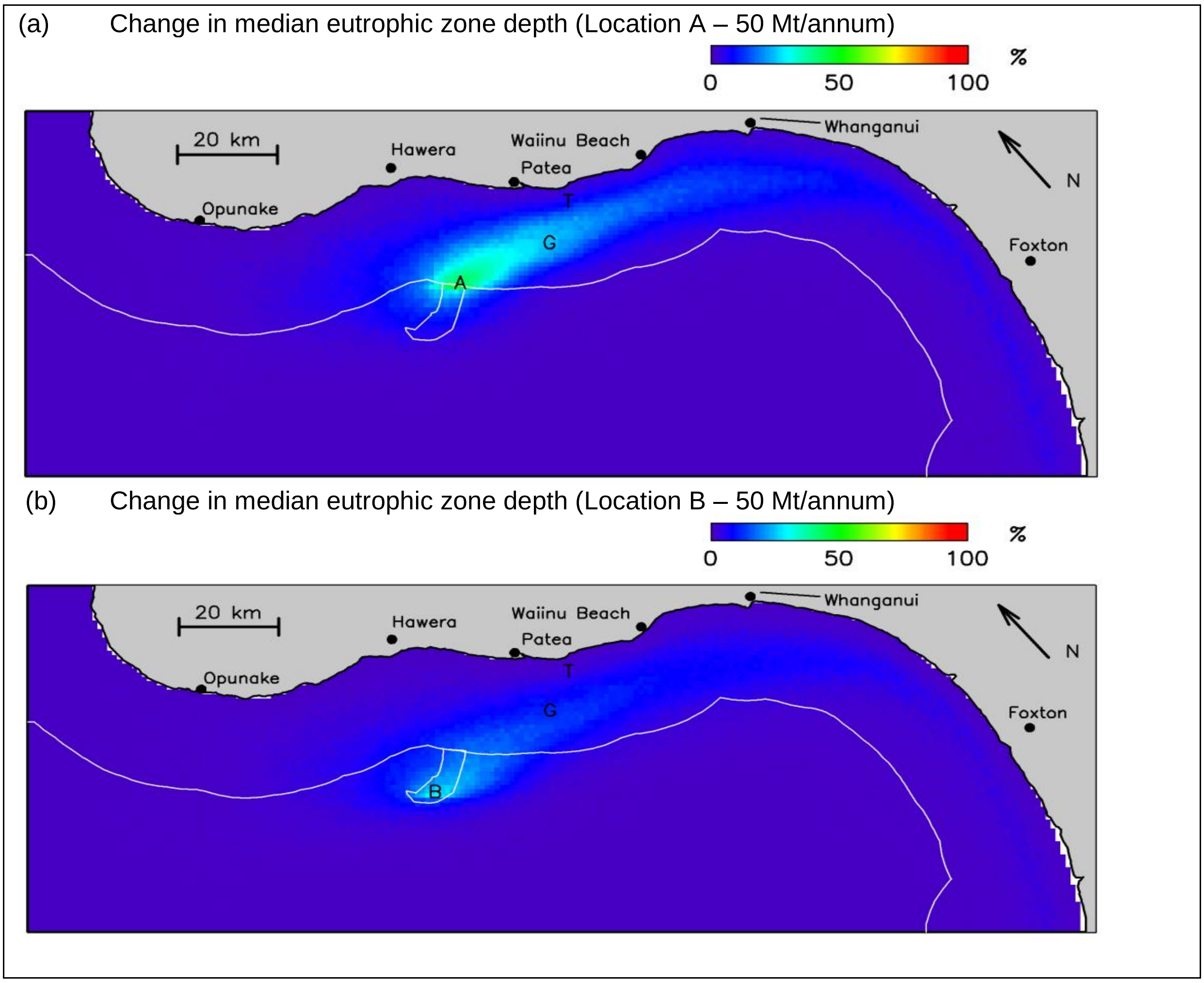

Figure 4.4: Modelled reduction in median eutrophic zone depth (%) at Location A (top panel) and Location B (bottom panel).

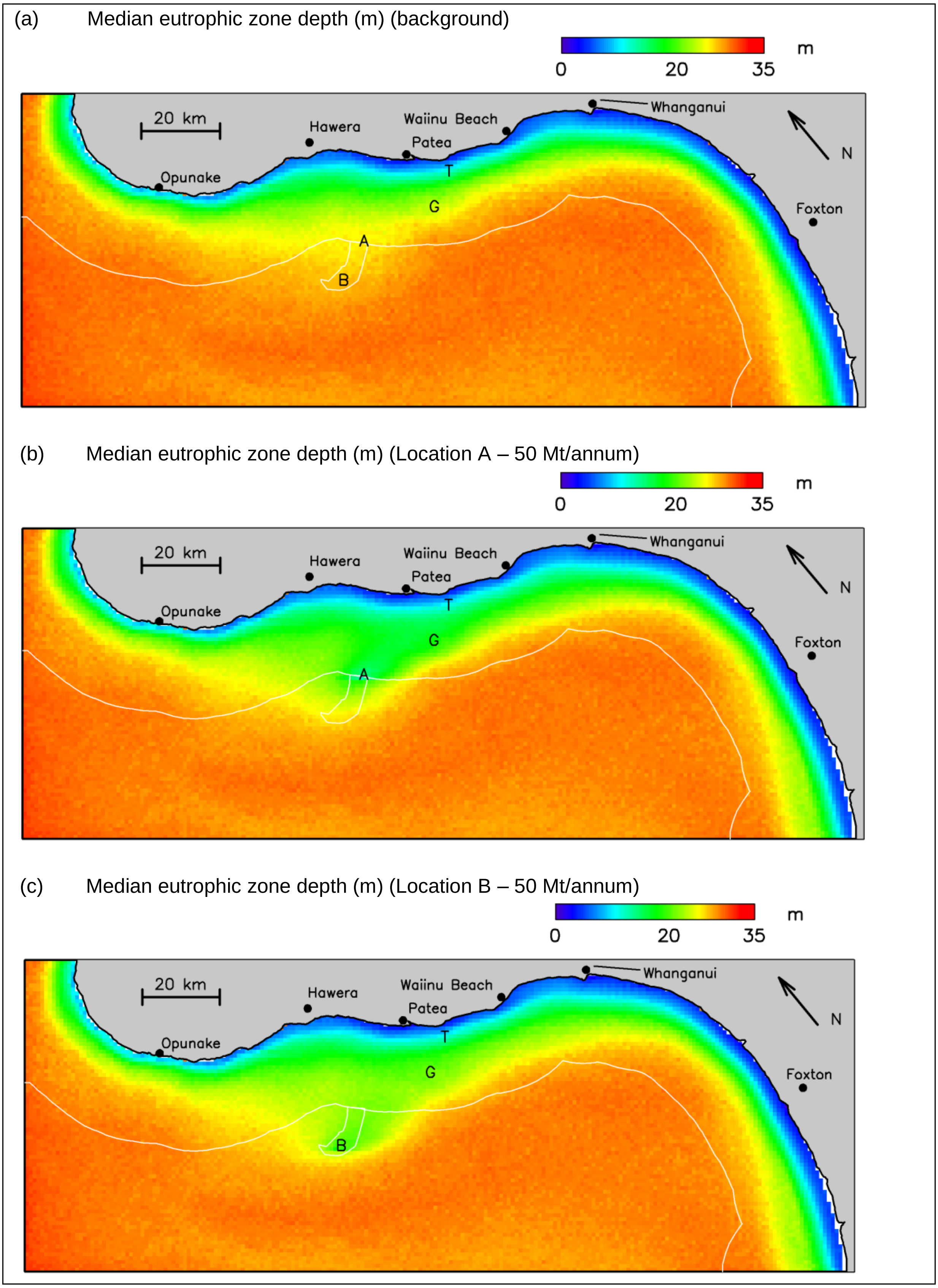

Figure 4.5: Modelled eutrophic zone depth at Background Levels (top panel), Location A (middle panel), and Location B (bottom panel).

4.4.3.4 Horizontal Visibility

As a result of the increased depths of the eutrophic zone, the horizontal visibility (black disk visibility) decreases. Figures 4.6 and 4.7 show the percentage reduction in median midwater visibility and the modelled median midwater visibility in metres, respectively. The main patterns are:

- There are significant reductions in midwater visibility due to the project close to the extraction area, and these effects decrease with distance from the project area;
- Reductions in midwater visibility at a given time depend on the movement of the sediment plume and how rapidly the sediment discharged by the project is mixed and sinks out of the water column. The predominant area affected is a region around Location A with a tail stretching to the east; and
- There are likely to be only very small effects of the project on midwater visibility on the alongshore transect.

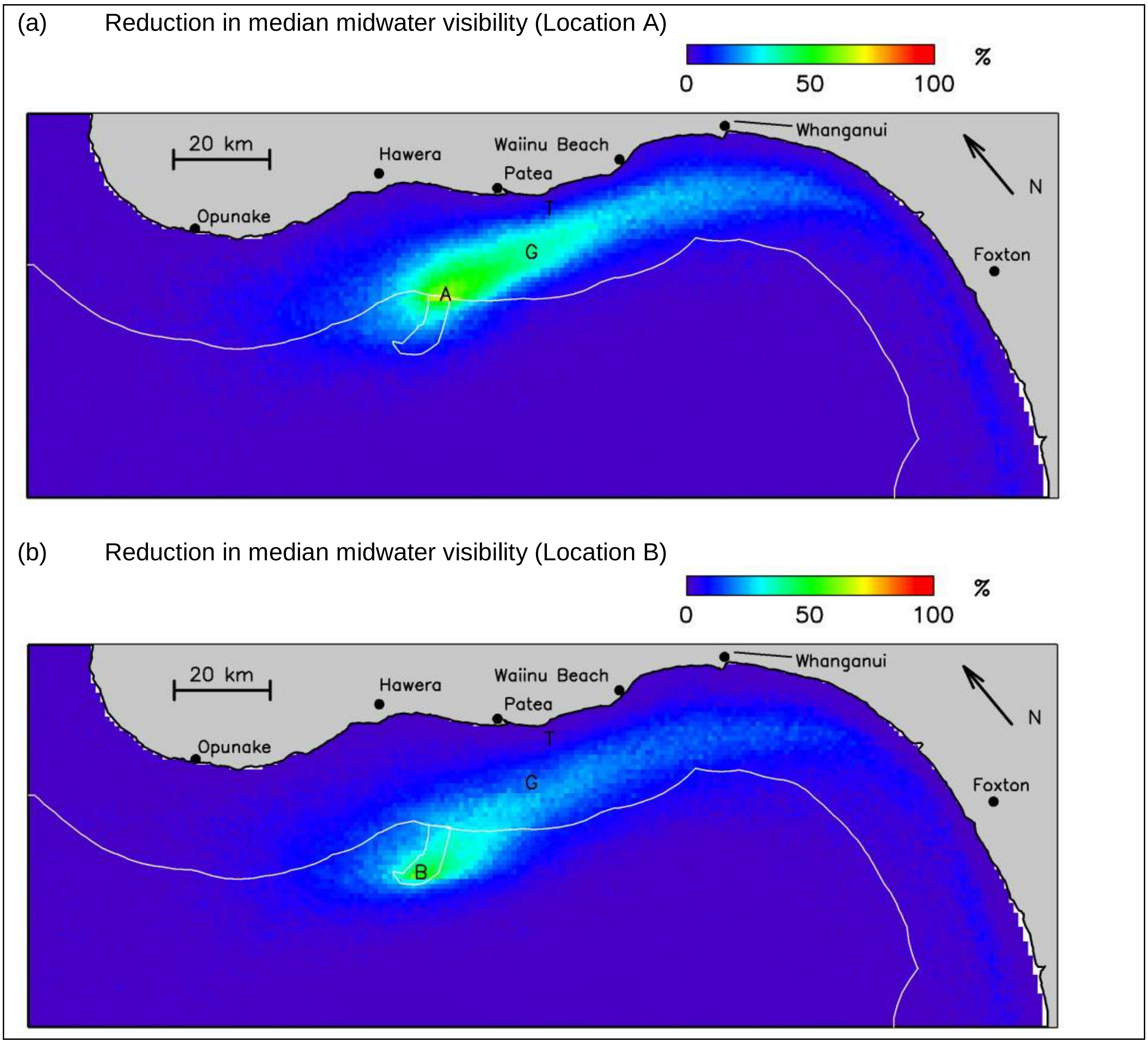

Figure 4.6: Modelled change in midwater horizontal visibility at Location A (top panel) and Location b (bottom panel).

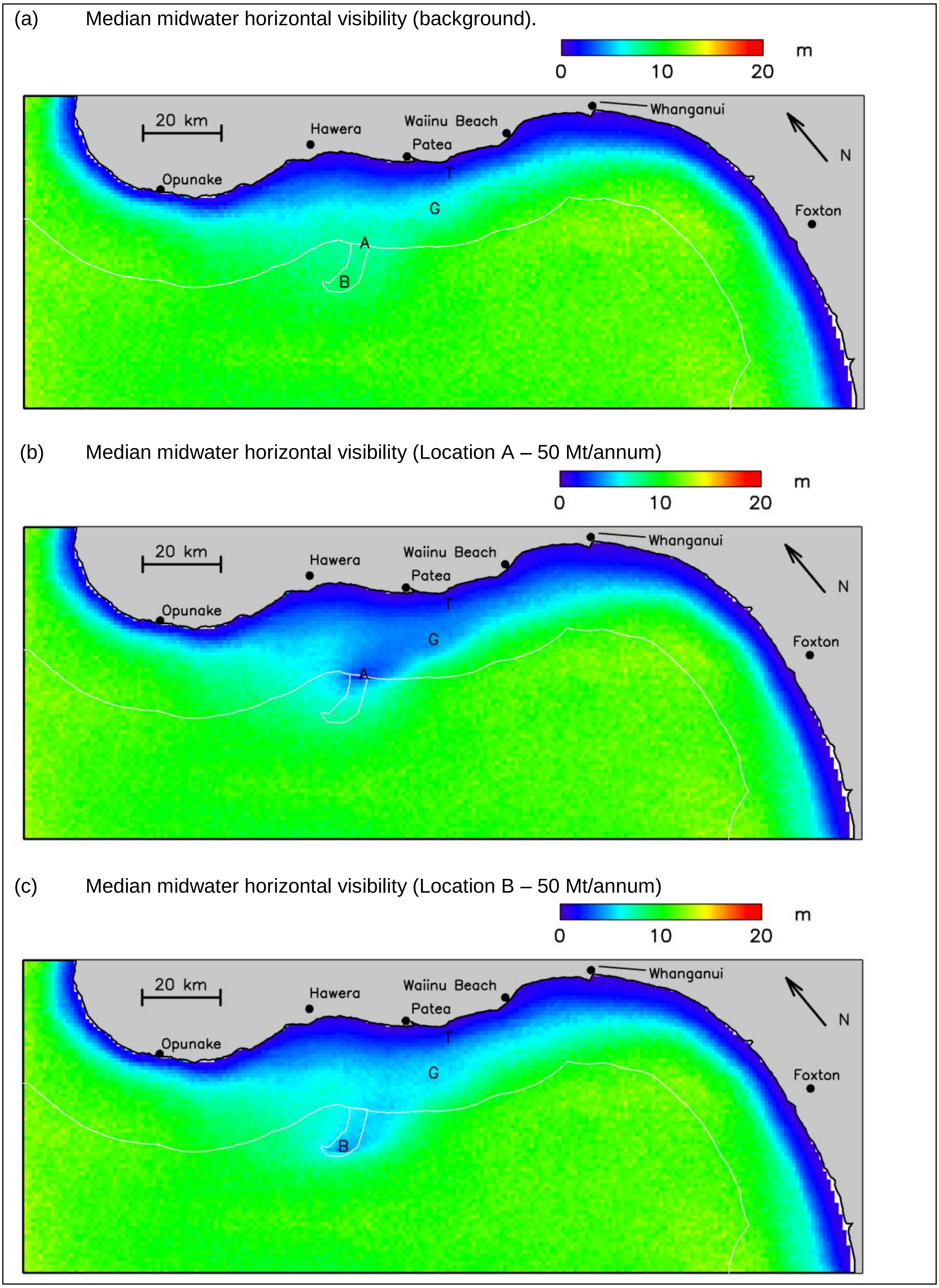

Figure 4.7: Modelled midwater horizontal visibility at Background Levels (top panel), Location A (middle panel), and Location B (bottom panel).

4.4.3.5 The Traps and Graham Bank

Modelling data at the Traps and Graham Bank was extracted to investigate the site specific optical water quality effects at these locations in greater detail.

Median underwater visibility at the Traps will be reduced by 13 – 15% when extraction activities occur at Location A, and by 3 – 5% as a result of activities at Location B. The number of 'good visibility days'[47] at the Traps that will be lost due to the iron sand extraction activities are predicted to be between 24 – 26 days per year as result of iron sand extraction activities at Location A and between 6 – 10 days per year as a result of activities at Location B - out of a total of 125 good visibility days per year.

The median euphotic zone depth at the Traps is predicted to reduce by 11% due to iron sand extraction activities at Location A, and reduce by 3% due to activities at Location B. The number of days with more than 1% light at the seabed is predicted to reduce from 138 days/year to 106 days/year as a result of iron sand extraction activities at Location A and 127 days/year as a result of activities at Location B.

The optical modelling predicts that the median underwater visibility at Graham Bank will be reduced by 37 – 38% as a result of iron sand extraction activities at Location A and by 16 – 17% as a result of activities at Location B. The number of 'good visibility days' lost at Graham Bank due to iron sand extraction activities at Location A are predicted to be between 67 – 71 days per year and between 22 – 24 days per year as a result of activities at Location B - out of a total of 204 – 207 good visibility days/year.

The median euphotic zone depth at Graham Bank is predicted to reduce by 24% due to iron sand extraction activities at Location A, and by 12% as a result of activities at Location B. The number of days with more than 1% light at the seabed is predicted to reduce from 216 days/year to 121 days/year as a result of iron sand extraction activities at Location A and to 171 days/year as a result of activities at Location B.

4.4.3.6 Water Colour

Estimates of the effect on sea colour as seen by an observer with a bird's-eye-view (e.g. persons in a plane) for three scenarios (no extraction (background), with extraction at Location A, and with extraction at Location B) have been provided.

Appendix 4.3 (1) shows the change in water colour as a result of 2.5 days of westerly winds, which is the most dominant wind direction in the project area. There is no evidence of colour differences within approximately 5 km of the coast, but clear differences were identified further away from the coast and especially around the source plume area.

Further examples of the sediment plume visibility are shown in Appendix 4.3 (2 – 4).

4.4.3.7 Changes to Water Column Light Intensity

Changes to the intensity of light in the water column has the potential to affect the primary production of phytoplankton (Kirk (2011)).[48]

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47 Defined as a horizontal visibility of more than 5 m.

48 Kirk, J.T.O., 2011. *"Light and photosynthesis in aquatic ecosystems"* Cambridge University Press. Cambridge.

With regard to the project, the changes to the intensity of light in the water column is calculated based on the optical modelling. Appendix 4.4 shows the modelled change in the water column light intensity at Location A and B, while Appendix 4.5 shows the modelled water column light. A summary of the modelling results is contained in Table 4.5 below.

Table 4.5: Modelled Effect of the Project on Water Column Light.

Measure of water column light	Background	Location A	Location B
Mean water column light as a proportion of surface light over the SMD (m)	5.5	5.4	5.4
Median change (%)		- 0.3	- 0.4
Maximum change (%)		- 45.5	- 26.6
Mean change over the SMD (%)		- 1.9	- 1.6

The results show that water column light generally increases with distance away from the coast because suspended sediment, colour dissolved organic matter and elevated phytoplankton concentrations near the coast reduce the penetration of light into the water, and because the water is shallower than further offshore.

Large reductions in light in the water column only occur very close to the location of extraction activities, with maximum reductions of 27 – 46% depending on where the iron sand extraction takes place (i.e. Location A or B). The mean change in water column light averaged over a large region is a more reliable measure of the predicted effect of the project on primary production in the water column. The mean change in water column light due to the project over the SMD will be small: -1.9% (extraction at Location A) and -1.6% (extraction at Location B).

These results have been used to inform the assessment of the effect of the project on primary productivity in the SMD which have been discussed in Section 4.6 of this IA.

4.4.3.8 Changes to Light at the Seabed

Light reaching the seabed can be used by benthic algae for primary production. The amount of light reaching the seabed was modelled before and after iron sand extraction activities. A summary of the modelling results is contained in Table 4.6 below.

Table 4.6: Predicted Changes to Optical Properties and Primary Production.

Parameter	Measure	Background	Location A	Location B
Integrated water column light as proportion of surface	SMD mean (m)	5.5	5.4	5.4
	Mean change over SMD (%)		- 1.9	- 1.6
	Highest point change (%)*		- 45.5	- 26.6
Water column PP	Mean change over SMD (%)		- 1.0	- 0.8
	Highest point change (%)*		- 22.7	- 13.3
Proportional seabed area with light > limit (mol/m^2/d)	Area with E>0.04 (% of SMD)	28.6	26.6	26.9
	Area with E>0.4 (% of SMD)	11.2	9.4	9.7
	Change in area with E>0.04 (%)		- 6.8	- 6.0
	Change in area with E>0.4 (%)		- 16.5	- 13.8

Parameter	Measure	Background	Location A	Location B
Light at the seabed	Mean total over SMD (Gmol/d)	3.3	2.5	2.8
	Daily mean E over area of seabed with E>0.4	0.86	0.66	0.72
	Change in SMD total (%)		- 22.8	- 15.5
	Highest point change (%)*		- 95.1	- 91.8

Notes: PP: Primary Productivity
SMD: Sediment Model Domain
*: Dependent on the spatial scale of the modelling

The average proportions of the seabed within the modelled area with mean light intensity greater than 0.04 and 0.4 light at the seabed per cubic metre per day ("**mol/m^2/d**") is estimated to be 29% and 11% respectively. As a result of the project the light intensity in these areas is predicted to reduce by 2% and 1 – 2% respectively.

The largest reductions are predicted to occur around the active extraction areas with maximum reductions of between 92 – 95% depending on the specific location. The maximum change should not be over-interpreted in terms of its ecological significance, and the mean change in total light at the seabed averaged over the modelled area is a more reliable measure of the predicted effects of the project on benthic algae. The effects of these reductions on the ecology are discussed in Section 4.6 below.

Based on the background optical model, the annual-average light at the seabed within the modelled area that receives more than 0.04 mol/m^2/d was estimated to be 0.86 mol/m^2/d where there was a mean seabed light in the modelled area of 3.3 Gmol/d.

With regard to the project, the mean seabed light is predicted to reduce to 2.5 Gmol/d (iron sand extraction at Location A) and 2.6 Gmol/d (iron sand extraction at Location B). These are equivalent to annual-average light at the seabed within the modelled area that receives more than 0.04 mol/m^2/d of 0.66 mol/m^2/d (Location A) and 0.72 mol/m^2/d (Location B). This is a reduction of 23% (Location A) and 16% (Location B).

This reduction reflects the fact that for much of the time the plume of fine sediment passes over relatively shallow seabed which would otherwise be relatively well lit. Most of the modelled area is deep and / or overlain by turbid water, and receives little seabed light. Therefore, the project would have an insignificant effect when considered against the naturally occurring background of levels within these areas.

4.4.3.9 Optical Water Quality Effects Summary

There is substantial natural variability in optical water quality properties in the SMD, with greater natural turbidity and sediment effects closer to the coast due to the predominately natural processes occurring in this environment.

Any optical water quality effects experienced will rapidly decrease over distance from the extraction area. The natural background conditions would be resumed soon after any iron sand extraction activities cease.

The findings can be further summarised as:

- The recovery of iron sand and the resulting sediment plume is predicted to have insignificant effects on optical properties within 5 km of the coastline of the STB;

- Reductions in light availability in the water column are likely to be predominantly to the east of the project area, but over the SMD will average only 1.9% (extraction activities at Location A) and 1.6% (extraction activities at Location B) - with up to a 25% reduction within 20 km down current of the extraction site;

- The reduction in total light (not light used for primary production) at the seabed is likely to be mostly to the east of the project area and is predicted to be 23% and 16% of the SMD for Locations A and B respectively. Optical properties would return to previous levels within a few days of iron sand extraction activities ceasing;

- At the Traps, the euphotic depth will potentially be reduced by between 13 – 15% for extraction activities at Location A and 3 – 5% for extraction activities at Location B. The days that more than 1% light reaches the seabed will be reduced by 24 – 26 days, and 6 - 10 days respectively (out of 125 days/yr); and

- At Graham Bank, the euphotic zone depth will be reduced by 37 - 38% and 16 - 17% for extraction activities at Locations A and B respectively, and the days that 1% of surface light reaches the seabed will reduce by 95 and 45 days for extraction activities at Locations A and B respectively (out of 216 days/yr).

While there is potential for there to be a localised decrease in optical water quality in the immediate vicinity of the iron sand extraction activities, any effects will rapidly diminish as the distance from the source increases. Further, any effects within 5 km of the coastline are predicted to be minimal and consistent with naturally occurring background optical water quality levels.

4.5 Effects on Coastal Processes

4.5.1 Shoreline Processes and Coastal Stability

4.5.1.1 Introduction

NIWA was engaged to model wave characteristics, coastal and sedimentary processes in the SMD and assess the effects of iron sand extraction on the landforms and geomorphic character of the shore, physical drivers (waves and currents) of coastal processes, sediment processes, and coastal stability.

As discussed in previous sections of this IA, additional investigations, including the NIWA sediment plume modelling and measurements of oceanographic processes in the SMD, have been undertaken to inform this IA.

The modelling and assessments have assisted in assessing the effects of sediment transfer on coastal processes and determining whether the project would influence shoreline geomorphology and coastal stability of the project area and the greater STB. The findings of the reports that have informed this IA are discussed in further detail below.

4.5.1.2 Assessment Methodology

To assess the shoreline processes and coastal stability, extensive field investigations that were conducted by NIWA over two years, including the measurement of currents and the range of winds experienced in the STB.

Beach profile surveys and observations were made at eight sites between Ohawe and Kai Iwi, spanning a stretch of 70 km along the SMD coastline. The profiles were surveyed over an 11-month period (providing 352 profile records), and captured a wide range of wave conditions including sizeable storm events. In addition to beach profiles, surface sediments were collected from around the mid-tide mark at each of the profiles to determine sediment source and composition.

Data from field measurements informed modelling of tidal currents from which processes of coastal deposition and erosion could be inferred. As part of studies of sediment plume generation and advection, the fate of de-ored sediments returned to the seabed was investigated. Results from modelling evaluated the potential for seabed material to be transported away from the extraction area by waves and currents, and therefore the connection between seabed material at the project site, and sand deposition and erosion processes on the shore.

4.5.1.3 Summary of Potential Effects

Potential effects of the project on shoreline processes and coastal stability include:

- Effects on sediment transfer and coastal deposition, affecting natural landforms and beach profile physical drivers of erosion affecting geomorphic character.
- Modify natural hazard processes and coastal stability.

Sediment Transfer and Coastal Deposition

The project will generate sediment plumes and increased rates of sediment deposition as a result of the disturbance of the seabed and these effects will be experienced within the project area and, to a much lesser degree, extend to the adjacent coastal area particularly to the east and south.

Plume modelling results demonstrate that the very fine sediment generated during the project operations would primarily drift in a southeast direction from the source towards the shore with the majority of the suspended material settling out prior to reaching the shore. The modelling shows that some of it does contribute to the naturally occurring sedimentation on the seabed in the near-shore environment in the area of Patea and Whanganui.

When considering the natural processes present in the deep water and near-shore environments, as well as the fine nature of the de-ored sediments, very little sediment originating from the operation is expected to arrive at the shoreline within the SMD.

With regard to the deposition effects of waves, changes in wave height and direction as a result of the project, these will be very minor and any associated change is considered to be insufficient and will not influence or contribute to the erosion of the already dynamic coastal environment. Therefore, the following conclusions with regard to coastal deposition can be reached:

- The natural landforms and geomorphic character of the beaches and cliffs is unlikely to change as a result of the project; and
- Changes in shoreline stability are highly unlikely.

Further, the grainsize of sediment on the beaches is unlikely to change as beach sediments primarily come from cliff erosion and river outwash.

Coastal Stability and Hazards

The geomorphic character of the cliffs will not change as a result of the project, but there could potentially be a change in the rate of erosion of the cliffs if the buffer of beach sands and gravel are stripped away.

However, as agreed by SKM (Huber et al. (2014)) as part of the initial EPA evaluation, the project operation is predicted to have only less than minor effects on the beach erosion and accretion. Under natural conditions these environments are highly variable particularly in the STB coastal environment, the influence of the project on the stability of the coastal zone is predicted to be minimal and therefore, the potential for the project to result in an increase in the occurrence of coastal hazards is also minimal.

4.5.1.4 Management of Potential Effects on Shoreline Processes and Coastal Stability

Mitigation measures beyond the location of the project area, being far off shore, and the design of the project methodology are generally impractical, due to the large scale over which oceanographic and coastal processes operate.

In their decision on the previous marine consent application, the DMC concluded that they did not consider that the project would have a significant effect on the physical environment. [49] With this in mind, TTR's proposed mitigation measures are therefore focussed on monitoring the impact of project activities to determine whether the actual effects are consistent with those which have been predicted and assessed as part of this IA. If monitoring demonstrates that the shoreline process and coastal stability effects are greater than those predicted, and where this results in an adverse effect, operational response measures would be implemented to address these effects, including revising the extraction methodology.

4.5.2 Wave and Surf Characteristics

4.5.2.1 Introduction

TTR engaged NIWA to complete near-shore wave modelling considering the impacts of the project on wave characteristics and eCoast Marine Consulting and Research ("**eCoast**") was engaged to further investigate the impact of the project on surf breaks in the STB (Mead (2015))[50].

The deposition of de-ored sediments will fill the majority of the extracted areas and in some cases result in mounds. These re-filled pits and mounds have the potential to alter the direction of wave approach and wave height in the project area, and therefore alter longshore transport of sediment, and the patterns of erosion and accretion at the shoreline. These matters are discussed below.

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[49] TTR Marine Consent Decision. 15 June 2014. Para 530.

[50] Mead. S., eCoast Marine. 2013. *"Potential Effects of Trans-Tasman Resources Mining Operations on Surfing Breaks in the Southern Taranaki Bight"* Memo 21 July 2013 updated November 2015.

4.5.2.2 Assessment Methodology

Eight hypothetical configurations of the seabed were developed by NIWA to represent the possible states of the seabed during the project operations.

The worst case scenario consisted of an 8 – 9 m mound at the southwest end of the operational area and a 9 – 10 m pit at the northeast end.

The other seven configurations represented lesser levels of disturbance at intermediate stages in the project operations.

The complete set of hypothetical bathymetry modifications was tested using a set of scenario–based simulations, and each compared with a “baseline” simulation using unaltered bathymetry.

With regard to the surf break impacts associated with the project, Mead (2015) undertook the following:

1. Identification and description of surf breaks that could potentially be impacted;

2. Determination of the range of wave and wind conditions that result in good surfable conditions at each site;

3. Development of wave scenarios for modelling;

4. Development of bathymetry scenarios for mounds and holes generated during mining and incorporation into existing bathymetry (undertaken by TTR / NIWA);

5. Transformation modelling of the identified wave conditions using the existing and modified bathymetries for each case (undertaken by TTR / NIWA);

6. Development of difference plots and analysis of wave parameters (height and direction) at each of the surfing breaks; and

7. Assessment of impacts on surfing breaks.

4.5.2.3 Summary of Potential Effects

Waves

The largest effect on waves as a result of the project will occur in the immediate vicinity of the pits and mounds that remain as a result of the project.

Most of the hypothetical configurations tested produced local changes in wave height of up to 20 – 30 cm, or 7 – 12%. These were correlated with changes in mean wave period of less than 0.5 seconds for the worst case scenario (an 8 – 9 m mound at the southwest end of the operational area and a 9 – 10 m pit), and less than 0.25 seconds for all other configurations.
These localised project area effects were then considered as changes in wave characteristics at the shoreline, the worst case scenario effects, as modelled, are shown in Figure 4.8 below.

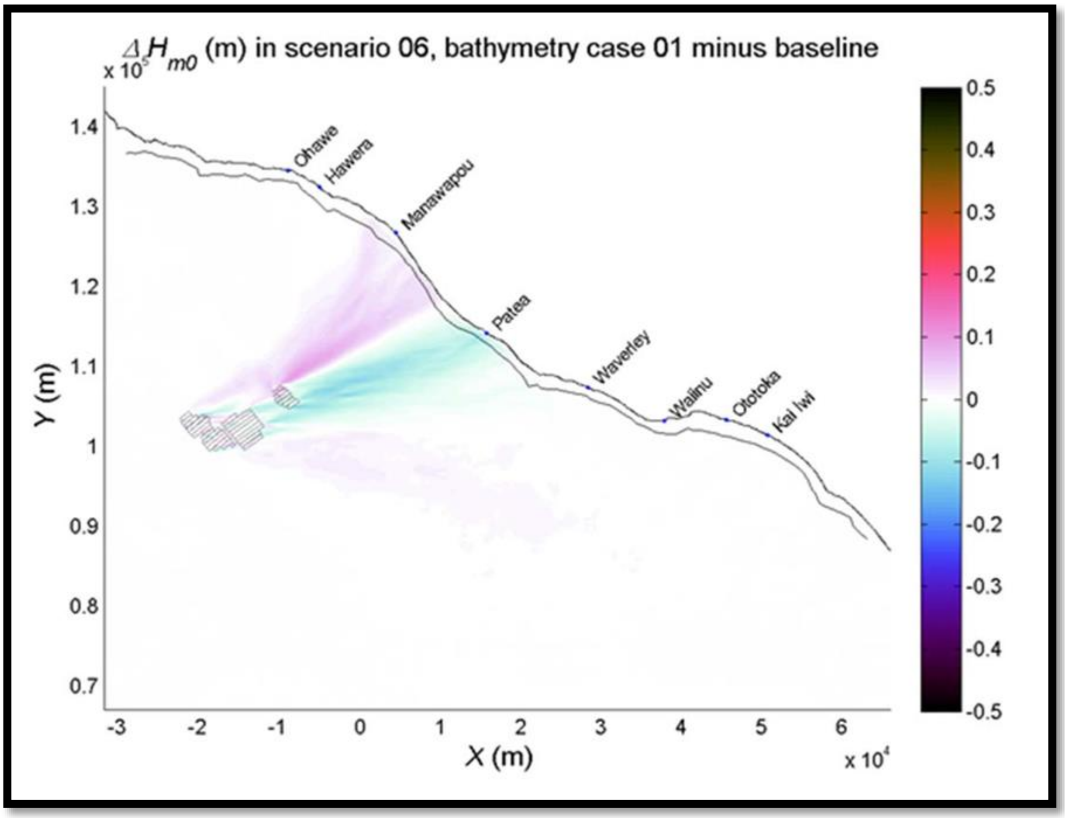

Figure 4.8: **Difference between significant wave height for case 1 and existing bathymetry, over the model domain, for environmental scenario 6 (2.4 m high waves from the SW). Note: The locations of the extraction areas are marked in grey. Beaches surveyed in related studies are named. The 10 m isobath (depth contour) is marked by a black line.**

By way of summary the following is predicted under the worst case scenario:

- Increases in wave height in the order of 100 mm around the Manawapou River outlet.
- Decreases in wave height in the order of 100 mm around Patea.
- An increase in wave period of less than 0.5 seconds north of Patea.
- A decrease in wave period of less than 0.1 seconds at Patea.

Full results of all eight configurations are set out in Table 4.7 below. By way of summary changes in waves height at the 10 m isobaths range from 0.8 – 8.6% or 4.1 – 11.3% across the full model domain. Changes in wave direction are 1 – 2 degrees, this is considered to be insignificant when compared with variability throughout the year.

Table 4.7: Maximum changes in significant wave height predicted for the eight bathymetry modification cases.

Extraction case	Full domain H max (m)	Full domain H max (%)	10 m isobath H max (m)	10 m isobaths H max (%)
1	0.282	11.3	0.104	8.6
2	0.222	8.3	0.042	3.6
3	0.284	12.7	0.044	3.3
4	0.263	7.1	0.046	4.1
5	0.219	7.2	0.050	4.5
6	0.249	7.2	0.016	1.3
7	0.173	6.0	0.021	1.8
8	0.092	4.1	0.009	0.8

Near-shore wave changes as a result of mooring the IMV within the project area were also modelled. The worst case scenario for this found that some vessel orientations produced changes in height of up to 15 mm at Patea and that other orientations produced changes in the order of 5 – 10 mm and these correspond to changes in the order of 0.8% and 0.4%, respectively.

Overall, the impacts of the project operations, including the project related vessels, on the wave environment within the project area and at the coast were considered to be insignificant.

Surf Breaks

As discussed above, the project operations will result in changes to the seabed (both local deepening and raising of the seabed in the form of pits and mounds), which can potentially affect waves by refraction (bending the wave path) and diffraction (lateral dispersion of wave energy) and locally by shoaling (changing the wave height) them as they pass over the modified seabed. This in turn could then potentially impact on surfing breaks on the coast.

Mead (2015) undertook extensive modelling of the wave environment and found that the principle changes in surf break characteristics arise from changes in the offshore wave climate. The modelling concluded that because the project area is located over 20 km offshore, the effects on wave characteristics, and therefore surf breaks, are considered to be insignificant.

This is demonstrated in the modelled output shown in Figure 4.9 below, which shows the predicted change in wave height for waves over 3 m at the coast. By way of summary, any changes to the wave characteristics at the shoreline will be in the order of ±100 mm. The potential impacts on wave heights are considered insignificant with respect to impacts on wave and surfing quality.

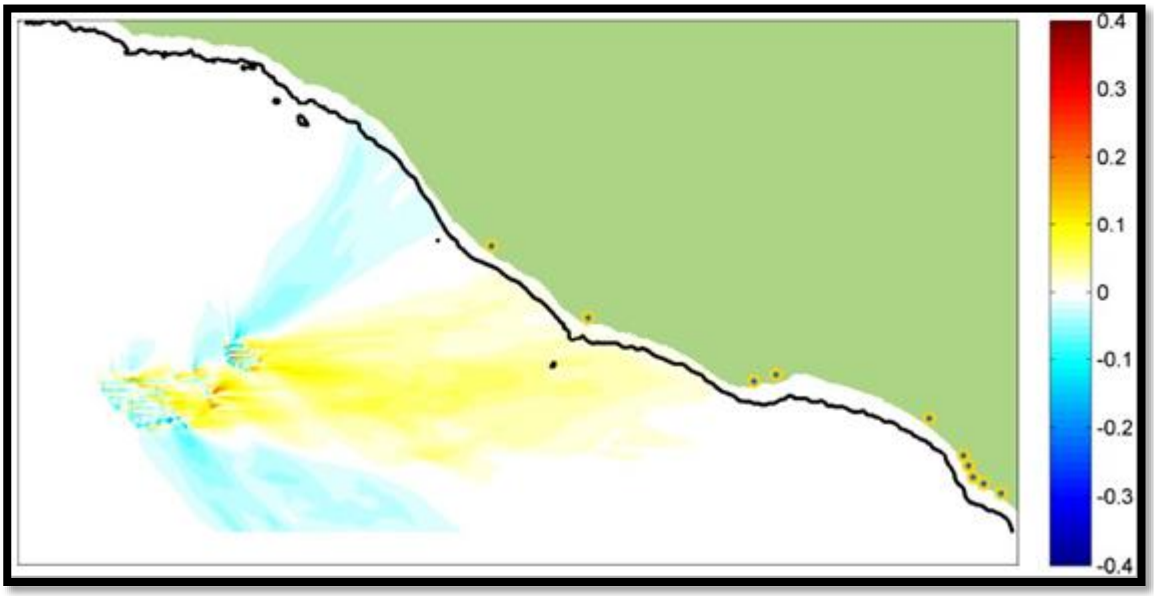

Figure 4.9: Change in height of 3 m waves from the WSW, 16 second period.

4.5.2.4 Re-deposition Effects on Wave and Surf Characteristics

The effects on waves and surf characteristics are pre-dominantly related to the pits and mounds produced as a result of the project operations. Modelling predicts that for a 10 m deep pit and a 9 m high mound, at 35 m water depth, it will take approximately 100 years for waves and currents to reduce the pit volume by 90% and 20 years for the mounds to be reduced by 90%.

Residual pits and mounds will occur at the end of the lanes in which iron sand recovery and deposition occurs. In these circumstances it is likely that pit depths and mound heights will be significantly smaller than the case presented above and therefore, so will the time taken for pit infilling and mound deflation than presented above.

As with coastal processes, TTR's position on wave and surf characteristics, that any effects would be no more than minor, was accepted by the DMC in their decision on the previous marine consent application, which also concluded that these effects would be no more than minor. [51]

4.6 Ecology and Primary Productivity Effects

4.6.1 Introduction

With respect to the effects on the ecology and benthic environment, the DMC when considering the previous marine consent application by TTR found that:[52]

- The project area is a high-energy environment with mobile sediments, sand inundation of reefs, sand scouring of reef habitats and high water turbidity in nearshore areas. It is typical of soft-sediment habitats subject to regular disturbance, colonised by fast-growing, opportunistic species able to withstand temporary burial by natural sediment movement and to recolonize disturbed habitats rapidly;

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51 TTR Marine Consent Decision. 15 June 2014. Para 506.
52 TTR Marine Consent Decision. 15 June 2014. Para 290.

- No differences were found between the benthic communities in the project area and communities in similar habitats in adjacent areas in the STB;

- None of the species collected during the benthic surveys are listed as threatened in the New Zealand Threat Classification System lists;

- The project area will be significantly disturbed with near total mortality of benthic fauna and the deposited material returned to the seafloor;

- Recovery of the benthic environment will commence almost straight away after re-deposition of sediment, and is expected to be fully recovered within 10 years;

- Areas outside the project area will be subject to sedimentation and reduced light levels as a result of the sediment plume;

- The sediment plume will result in reduced energy input to the seafloor with consequent reductions in benthic productivity and flow-on effects through the food web. There may be a potential reduction of up to 36% in energy input to the seabed ecosystem;

- Assessment of the potential effects of the sediment plume on the benthic environment is based on the sediment plume modelling. The modelling was accepted by other experts as being the appropriate and best available methodology;

- There are more sensitive biogenic benthic areas to the south and west, and rocky reefs are located inshore of the project area. Based on the previous model outputs, there is unlikely to be any more than minor sedimentation from the sediment plume in these areas, apart from the Graham Bank; and

- The modelling results provided with the original consent application showed a significantly higher level of sediment likely to reach the North and South Traps than the revised modelling on which the expert witness discussions were based.

The revised assessment of effects is summarised below.

With regard to the ecological effects related to the project, the key potential impacts are:

- Loss or physical disturbance of seabed habitat and the communities associated with these habitats;

- Impacts on physiological processes including clogging of respiratory surfaces and feeding structures and processes for animal biota;

- Smothering of benthic habitats and communities;

- Avoidance of areas of disturbance and sediment plumes by fish, birds and mammals;

- Reductions in primary production in the water column (phytoplankton) and on the seabed or reefs (micro-algae living on the seabed ("**MPB**") and macro-algae) through reduced light availability;

- Reduced prey and prey detection for fish, birds and mammals; and

- Accidental release of contaminants (nutrients and toxic compounds).

When considering the effects of the project, any evaluation must take into account the severity, and the spatial and temporal extent, including recovery, of these effects.

The spatial effects depend on the scale of the impact, such as development of a sediment plume, compared with the distribution of different communities and their mobility, and with sedentary taxa and the communities expected to be most impacted.

It should also be acknowledged that the dynamic and complex nature of the environment of the STB, the range of habitats and the lack of defined boundaries for most physical and biological processes makes the assessment of effects on ecosystems particularly challenging.

These effects are discussed in further detail in the following sections of this IA.

4.6.2 Assessment Process

When assessing the overall ecological effects of the project, AES (2016a) has incorporated the approach adopted by Dr Dan McClary in his expert evidence on behalf of TTR for the previous marine consent application by TTR (McClary (2014)).[53] In addition, AES has relied upon international expertise and experience with projects involving dredging and reclamations in the coastal environment, as well as published and unpublished reports and papers.

Cahoon et al. (2015) also includes consideration of the spatial and temporal extent of the modelled sediment plume, more information on optical property relationships with suspended sediment, and closer examination of light-primary producer relationships.[54]

The updated assessment in this IA uses the same approach for the scale of effect as that developed for the Ministry for the Environment ("**MfE**") with expected severity of effects rated from negligible to severe (see Table 4.8 below for classifications). The assessment also includes more information on threshold levels, sensitivity of organisms to the potential effects and recovery times from the project.

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53 McClary, D. 2014. Statement of Evidence in chief of Dr Dan McClary on behalf of Trans-Tasman Resources Ltd. 17 February 2014.

54 Cahoon, L.B., Pinkerton, M., Hawes, I., 2015. *"Effects on primary production of proposed iron-sand mining in the South Taranaki Bight region" October, 2015.*

Table 4.8: Consequence levels for the intensity of the activity. Summary descriptions of the six sets of consequence levels for the proportion of the habitat affected, the impact on the population, community or habitat, and the likely recovery period.

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 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- 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

Under the previous marine consent application by TTR, McClary (2014) identified 40 potential effects considered to be ‘low’ environmental risk and the following potential effects as being of ‘moderate’ to ‘high’ risk:

- Effects on benthos within the direct extraction and deposition area, particularly direct effects on the tubeworm *Euchone sp A*;
- Effects on benthos in the close vicinity of the extraction and deposition area;
- Potential impacts on biogenic offshore habitats due to potential ‘choking’ effects; and
- Potential effects of unplanned events including biosecurity incursions and oil spills.

The project related effects are discussed in further detail in the sections below and are based on the conclusions from AES (2016a) unless otherwise stated.

4.6.3 Effects on Ecology and Primary Productivity

4.6.3.1 Physical Disturbance

With regard to disturbance, the area directly impacted by the project will be approximately 5 km^2 per year, which is extracted in blocks of 900 m x 600 m (0.54 km^2) which on average occurs over a 30-day period. The benthic habitat in this area, including at the surface and down to the maximum cut depth of up 11 m below the seabed, will be physically removed in totality.

McClary (2014) estimated that the area of the STB that falls between 20 and 40 m depth occupies an area of approximately 1,860 km^2. Thus, to put the project area into perspective, approximately 0.03% of this total area would be impacted per month or 0.3% per year by the project. In terms of the SMD, this represents 0.04% per year. The ongoing extraction of iron sand will mean blocks within the project area will be at different stages of recovery for the duration of the project.

The main direct physical impact on aquatic communities will be the physical removal of sessile and sedentary taxa, as well as relatively immobile taxa, within the project area. It is likely that all larger, hard-bodied organisms will be screened out at the intake point, but larger soft-bodied organisms will be destroyed if they are drawn up through the crawler intake pump. Smaller organisms such as bacteria and protozoa, and possibly some polychaete worms, will survive the extraction process and be re-deposited on the seabed in the de-ored sediments.

4.6.3.2 Suspended Sediment Effects

The effects of increases in suspended sediment and sedimentation are shown schematically in Figure 4.10 below. The most likely potential effects are through directly impacting on physiological processes, smothering and indirect effects through reduced light impacting on primary production and biota that rely on phytoplankton, MPB and macro-algae.

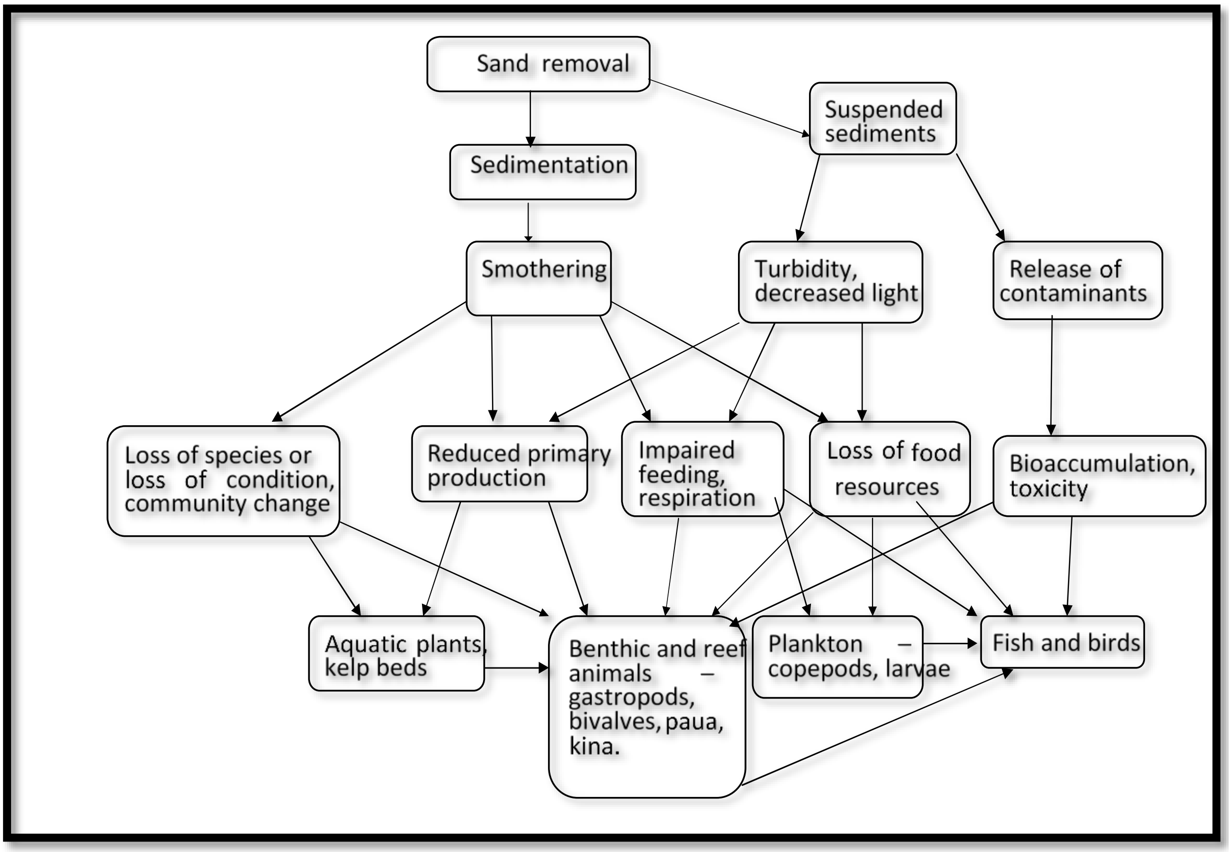

Figure 4.10: Schematic diagram of effects of suspended and settled sediment.

AES (2016a) identifies that the factors which drive primary production include physical processes such as major currents, winds, upwelling, nutrient supply, light availability, and grazing impacts by benthic and planktonic animals. Nutrient availability is considered to be a more important driver of water column phytoplankton production than light availability in these coastal systems but there will be spatial and temporal patterns in these drivers.

Assessing the impacts on primary producers is particularly challenging because of the dynamic and complex processes involved and that there are no fixed boundaries for these organisms. For example, while many primary producers, particularly phytoplankton, may have turnover rates of a few days and thus most of the primary production will be considered *in-situ*, others such as MPB and macro-algae will integrate conditions over much longer periods. The supply of nutrients advected into the STB from the upwelling areas as well as organic matter that is produced in these plumes, are likely to be very important to the STB and overall carbon flow in the region.

The potential effects of the sediment plume on primary production has been further assessed based on revised sediment plume and optical property models, literature searches of relevant information and additional local and international expert input in Cahoon et al. (2015). The background to the approach taken, the assessment of effects on primary production and results of that assessment have been revised from the earlier work carried out prior to the previous marine consent application in order to give greater certainty and address issues raised by the DMC. The following summary of effects is based largely on AES (2016a) interpretation of the Cahoon et al. (2015) findings unless otherwise referenced.
Propagation and dispersal of a sediment plume will result in absorption and backscattering of light which will in turn reduce light availability for phytoplankton and benthic plants. Water

column primary production averaged over the SMD would reduce by 1% and 0.8% when extraction is occurring at Locations A and B respectively, with the main reduction focused close to the extraction site. However, because of natural variability, these effects would be essentially indistinguishable when considered at the SMD scale.

The high natural interannual and seasonal variability in optical properties and primary production in the region mean that a chronic reduction of up to 1% due to the project is very unlikely to lead to fundamental changes in the structure and processes associated with primary production of phytoplankton.

Macro-algae will be found wherever there is a hard substrate and sufficient light (0.1 – 1% of surface light) reaches the seabed which includes rocky reefs, particularly inshore, the Traps area, areas with high levels of shell debris, and some cobbled areas on the deeper margins of banks.

Macro-algae, in particular kelp beds, are a very important habitat for a range of invertebrates (including the likes of kina and paua) and fish. Recruitment processes are important in determining the distribution and abundance of kelp populations. In a study off the Otago Peninsula Fyfe (2000)[55] found the kelp *Macrosystis pyrifera* has a "recruitment window" when light and temperature requirements are met and allow the establishment of sporophytes. Recruitment was observed along the Otago coastline through spring and summer months following thinning of the canopy during winter storms. Similar processes in macro-algae recruitment are expected to operate within the project area and the adjacent areas in the SMD.

Cahoon et al. (2015) predicted there could be some reductions in macroalgal growth but impacts are likely to be indistinguishable from natural variability at areas inshore where there are naturally high suspended sediment concentrations, including the Traps which is located some 20 km away.

There is little information on the distribution of MPBs in the SMD although photos of the seabed indicate features consistent with the presence of MPBs. The area where production by MPBs can be expected is the area bounded by the 30 – 35 m contour and compromises much of the Patea Shoals, particularly the eastern Patea Shoals, including Graham Bank.

The high variability in the amount of light reaching the seabed (annual average has a standard deviation of 25% and can vary by +36% and -32% compared to long term means) suggests that the communities in the region, particularly inshore, are pre-disposed to tolerate variability similar to that predicted for the effects of the sediment plume. Therefore, the project would be unlikely to lead to unnaturally low benthic production in the SMD, outside the natural envelope.

Reductions in light at the seabed will be highest close to the sites where operations are occurring (extraction and deposition). The reduction in light levels at these sites could be up to 95% but only a very localised effect (an extent of less than 10 km from the recovery site). This reduction in light and subsequent effects on primary producers at the seabed are likely to be highly variable and episodic, ranging from negligible to moderate, depending on the location, the prevailing wind and current conditions, as well as naturally high levels of suspended sediment entering the SMD from the rivers inshore.

AES (2016a) identifies that taking into account the latest refinements / updated information and revised understanding on the predicted sediment plume, benthic primary production

[55] Fyfe, J. E. 2000. *"Remote sensing of Macrocystis pyrifera beds near Pleasant River, Otago*". Master of Science thesis, University of Otago, Dunedin, New Zealand.

averaged over the SMD is predicted to reduce by 19% (extraction at Location A) and 13% (extraction at Location B).

Area specific reductions in benthic primary production (and thus carbon flux to seabed) could be reduced by up to 40% in the area to the east of the extraction area where the sediment plume moves over the relatively shallow (20 – 40 m deep) sandy area, which is part of the Patea Shoals and includes the Graham Bank. The growth effects on these areas may be impacted however, a complete loss of benthic biomass is not likely to occur.

The effects of optical properties on primary production of phytoplankton, MPBs and macro-algae is predicted to rapidly return to pre-project levels within a few months following the ceasing of extraction in an area. This is due to the natural processes occurring which would result in the suspended sediment being flushed out of areas where it has potentially accumulated.

The benthic and planktonic biological communities cover a range of feeding modes including filter feeders, visual predators, suspension feeders, and deposit feeders. Animals living on the seabed will rely on *in-situ* production as well as production that falls out of the water column.

There are few estimates of water column versus seabed primary production but this could vary from 2:1 to 10:1 and the fraction of primary production transferred to the seabed is likely to be approximately 15%. Cahoon et al. (2015) estimates that total primary production would be reduced over the SMD by 1.9% (range 1.6 – 2.2% depending on detrital flux rates and degree of primary production by MPB) for extraction at Location A and 1.4% (range 1.2 – 1.7%) for Location B. Energy flow to the seabed averaged over the SMD would reduce by 5.8% (range 3.1 – 11.9%) for Location A and 4.1% (range 2.3 – 8.3%) for Location B.

Additional effects such as those associated with release of nutrients in pore water will be negligible when compared to the existing background environmental effects.

Overall, there will be decreases in MPB production and organic carbon flux to the seabed and its communities in close proximity to the area of extraction operations that would exceed natural variability. However, because of inherent variability at the regional scale, effects would be indistinguishable from natural variability experienced for short lived biota.

Some effects at the local scale could be propagated more widely through more mobile animal taxa, but this is unlikely to lead to changes in the communities or consequential effects at the wider scale. AES (2016a) identifies that these conclusions represent sound scientific assessments and lie within the bounds of reasonable probability. AES (2016a) further stated that it must also be emphasised that these effects will be transient in nature due to the mobile extraction operations and thus no area will be impacted long term.

4.6.3.3 Benthic Communities

The assessment of the effects of a sediment plume on the benthic communities requires a good understanding of:

- The communities present and the values (e.g. biodiversity, food for higher trophic levels) of those communities;

- The spatial and temporal scale of the severity and dispersion of the sediment plume;

- The tolerances of the communities to increased suspended sediment concentrations; and

- The potential for recovery from the effects.

Since the previous consent application was considered, more information has been collected and a more robust assessment has been undertaken in AES (2016a), as summarised in the sections below.

Open water ecosystems are dynamic and often in a state of perpetual change with periodic disturbances due to storm and other events. This perpetual change is not detrimental to benthic systems as it maintains diversity by resetting communities.

Benthic communities are often in a state of transition because of seabed disturbance by wave and current activity and can be represented by both opportunistic early successional taxa. This is dominated by small polychaetes and taxa which reproduce rapidly and disperse easily. Later this is dominated by more stable larger successional taxa (large gastropods and bivalves). Adults tend to be more tolerant of higher suspended sediment concentrations than larval forms and deposit feeders and burrowers more tolerant than suspension feeders.

Areas of ecological value in the project area and the wider region that would be potentially impacted are:

- North and South Traps – “urchin burrows”, rocky outcrops with sea urchin (*Evechinus chloroticus*), red and brown algae and a diverse invertebrate and fish community;

- Graham Bank – coarse-sandy shelly habitat with scallops and hermit crabs;

- Inshore and mid-shelf reefs off Patea and Hawera – support very abundant and diverse algae, invertebrate and fish communities, mostly close inshore;

- Biogenic habitat off shore:

    - Bivalve rubble characterised by large populations of the robust dog cockle, *Tucetona laticostata* at depths of 26 – 83.5 m for live specimens and 44 – 69 m for shell hash;

    - Bryozoan rubble at depths greater than 60 m that support diverse benthic assemblages (bryozoan, sponges, ascidians etc, and

- Coralline red algae on shell rubble inshore and at the 40 – 50 m contour.

AES (2016a) identifies that the project area is dominated by a “wormfield” benthic community.

Although the direction of the sediment plume will be variable, depending on prevailing weather conditions, the prevailing direction that it will travel is to the north east. The benthic habitat and communities in this eastern area and across the Patea Shoals are very similar to those described for the project area itself in terms of epifauna in general, although some bivalves such as *Glycymeris modesta* were more abundant as well as a slightly more diverse echinoderm community being common to the northeast. The substrate also tended to get coarser to the east and northeast of the project area with more medium-coarse sand and fine gravels.

Outside the project area, the direct and indirect effects on benthic communities as a result of the sediment plume may manifest through:

- Smothering resulting in the loss of organisms;
- Clogging of gills and feeding apparatus and other physiological processes such as respiration;
- Loss or changes to food resources;
- Indirect effects of light attenuation and primary production of algae, macro-algae and MPB; and
- Impacts on larval supply and retention.

AES (2016a) identifies that based on the revised information, attenuation of light and its effects on primary production and carbon fluxes could manifest to higher trophic levels but would only really be a higher risk close to the specific extraction area.

Although some effects on the benthic habitat close to the operation are unavoidable, comparison of suspended sediment concentrations that would be experienced by benthic biota with tolerance levels allows assessment of the potential significance of increased suspended sediment concentrations from sediment plume development. Although information is limited for some taxonomic groups there is a good body of information from New Zealand studies on the effects of suspended sediment on a range of benthic biota including molluscs, polychaete worms, and sea urchins, and kelps and other macro-algae.

AES (2016a) stated that studies by Hawkins et al. (1999)[56], Clarke & Wilbur (2000)[57] and Hewitt & Norkko (2007)[58], found suspension feeding animals, such as cockles and mussels, can actually benefit from suspended sediment as it aids processing of foods or they can adapt their feeding processes to changes in suspended sediment levels. Condition of cockles (*Austrovenus stuchburyi*) did not decline until suspended sediment concentrations reached 400 mg/L and development of oyster eggs was impacted at levels over 188 mg/L and larvae at suspended sediment concentrations of 750 mg/L. The greenshell mussel (*Perna canaliculus)* can adjust its filtering processes very effectively and will continue filtering even at levels of 1000 mg/L (Hawkins et al. 1999). Some species are more sensitive with condition of the horse mussel (*Atrina)* impacted by levels over 80 mg/L (Ellis et al.

56 Hawkins, A.J.S.; James, M.R.; Hickman, R.W.; Hatton, S.; Weatherhead, M. (1999). *Modelling of suspension-feeding and growth in the green-lipped mussel Perna canaliculus exposed to natural and experimental variations of seston availability in the Marlborough Sounds, New Zealand*. Marine Ecology Progress Series Vol. 191: 217-232.

57 Clarke, D.G. & Wilber, D.H. (2000). *Assessment of potential impacts of dredging operations due to sediment resuspension*. DOER Technical Notes Collection (ERDC TN-DOER-E9).

58 Hewitt, J.E. & Norkko, J. (2007*). Incorporating temporal variability of stressors into studies: An example using suspension-feeding bivalves and elevated suspended sediment concentrations*. Journal of Experimental Marine Biology and Ecology 341: 131-141.

2002[59]). Some deposit feeding polychaete worms, heart urchins and pipis show some effects if concentrations are over 80 mg/L (Hewitt et al. 2001, Nicholls et al. 2003[60]).

Polychaete tube worms dominated the community at the project site itself and heart urchins are an important taxa on reefs and in habitats at depths over 60 m. James et al. (2009)[61] suggested that concentrations of 100 mg/L over short periods (days/weeks) was a reasonable level that would prevent risk of impacts on the more tolerant taxa in Otago Harbour and Blueskin Bay.

Taking into account that the communities in the STB, including those that may be potentially impacted, may include some more sensitive species then periodic levels high sedimentation (over 80 mg/L) could be tolerated by most species. These limits are summarised in Table 4.9.

AES (2016a) notes that duration of increased suspended sediment exposure should be taken into account as most taxa could tolerate short increase events. It is acknowledged that the sediment plume effects on the benthos more than a few kilometres away from the extraction source is likely to be transient, because of the variable currents and wind conditions influencing the plume's behaviour.

Table 4.9: Suspended sediment concentration that have been found to affect benthic invertebrates.

Author	Species	Sediment Concentration*
Hewett et al. 2001[62]	Cockle (*Autrovenus stutchburyi*)	300-400 mg/L
Hewett et al. 2001	Pipi (*Paphies australis*)	75 mg/L
Nicholls et al. 2003	Gastropod (*Zeacumantus lutulentus*)	>750 mg/L
Hawkins et al. 1999	Green lipped mussel (*Perna canaliculus*)	1,000 mg/L
Schwarz et al. 2006[63]	Kelp (*Ecklonia radiata*)	20 mg/L
Schwarz et al. 2006	Paua and kina larval mortality	35 mg/L
Schwarz et al. 2006	Paua and kina	18-74 mg/L

* Levels that had an impact on condition/growth

In the SMD the inshore region naturally experiences suspended sediment concentrations with a median of 10 mg/L and over 100 mg/L at times in surface waters and a median of 100 mg/L and peaks of 1,000 mg/L near the seabed. The suspended sediment concentrations resulting from project operations would add less than 2 mg/L to suspended sediment concentrations in surface waters near the coast and most of the time would add <0.2 mg/L to this area. Thus, the effects on the inshore biota would be expected to be indistinguishable from the effects of naturally occurring background suspended sediment concentrations.

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59 Ellis, J.; Cummings, V.; Hewitt, J.; Thrush, S.; Norkko, A. (2002). *Determining effects of suspended sediment on condition of a suspension feeding bivalve (Atrina zelandica): results of a survey, a laboratory experiment and a field transplant experiment*. Journal of Experimental Marine Biology and Ecology 267: 147-174.

60 Nicholls, P.; Hewitt, J.; Halliday, J. (2003). *Effects of suspended sediment concentrations on suspension and deposit feeding marine macrofauna*. NIWA Client Report HAM2003-077, Project ARC03267. Pp 1-6.

61 James, M.; Probert, K.; Boyd, R.; Sagar, P. (2009). *Biological resources of Otago Harbour and offshore: assessment of effects of proposed dredging and disposal by Port Otago Ltd*. NIWA Client Report HAM2008-152, Project: POL08201.

62 Hewitt, J.; Hatton, S.; Safi, K.; Craggs, R. (2001). *Effects of suspended sediment levels on suspension feeding shellfish in the Whitford embayment*. Prepared for the Auckland Regional Council. Report no. ARC01267. 32 p

63 Schwarz, A.; Taylor, R.; Hewitt, J.; Phillips, N.; Shima, J.; Cole, R.; Budd, R. (2006). *Impacts of terrestrial runoff on the biodiversity of rocky reefs*. New Zealand Aquatic Environment and Biodiversity Report No. 7. Ministry of Fisheries.

The highest levels of suspended sediment concentrations in surface waters at the extraction site itself would be 1.45 mg/L as a median and 8.2 mg/L as the 99th percentile and less than 2.8 mg/L at 20 km downstream, thus effects, if they were to occur would be indistinguishable from natural variability beyond the immediate area of disturbance. Near the seabed, suspended sediment concentrations would be up to a median of 1 mg/L and 99th percentile of 5 mg/L up to 20 km away from the source and up to 14 mg/L at the source itself.

Small grazing and suspension-feeding invertebrates found on rocky reefs are an important trophic link between primary producers and fish, with kelp often being the main habitat. In addition to being indirectly impacted by decreased light levels for plant growth, these communities can be impacted directly by clogging of feeding apparatus or smothering of food resources such as epiphytes.

Epifaunal abundance, biomass and productivity were found to be 50% lower at turbid sites (up to 16 mg/L) than "cleaner" sites (undetectable to 7 mg/L) off the Whitianga Harbour by Schwarz et al. (2006). Using a range of natural concentrations Schwarz et al. (2006) found a drop-off in mussel and oyster condition at suspended sediment concentrations over 26 mg/L and sponges at over 15 mg/L.

With regard to the project, even if very small suspended sediment concentrations in the plume reached the inshore region off Patea they would have minimal effects. In addition, the documented inshore communities along this coast are required to tolerate considerably higher levels of suspended sediment concentrations which occur, for example, during natural storm events and often persist for a period after the storm event has passed.

Benthic algae and kelp beds support diverse and abundant invertebrate and fish communities inshore and on mid-shelf reefs. Increased suspended sediment concentrations can reduce light availability which in turn can impact on the growth and condition of reef macro and micro-algae and the animals that rely on them.

The larger kelps, such as *Macrocystis pyrifera,* are often subject to die-off during winter storms and have “recruitment windows” when light and temperature requirements allow establishment of sporophytes. Time averaged suspended sediment concentrations at inshore sites off New Plymouth in depths of less than 0.5 m where the common kelp *Ecklonia radiata* occurs, were found to range from 3.4 - 150 mg/L naturally (Schwarz et al. 2006).

AES (2016a) states that the small increases in suspended sediment concentrations, if they were to occur inshore, would be indistinguishable from the naturally occurring background suspended sediment levels.

The project generated sediment plume would infrequently go offshore from the extraction area and the sediment plume modelling results indicate that the bryozoan beds offshore at depths greater than 60 m would rarely experience any sediment plume influence and if they did so suspended sediment concentrations would be less than 1 mg/L. Further, the seabed in deeper areas is also likely to naturally be sediment depositional zones as they are rarely disturbed by wave activity due to their depth being beyond the limit of wave influence.

MacDiarmid et al. (2015a) reviewed the spatial and foraging ecology of key invertebrate fauna in the STB to provide some scale to the potential effects of the project. Most of the invertebrate species gathered recreationally or for cultural reasons are found inshore in the intertidal or subtidal zone and include various mussel species, crabs, mud-snails, pipis, surf clams (purimu), rock oyster (karaura), paua, sea tulip (kaeo) and cats eyes (pupu). As discussed above, these species presently occur in coastal environments and experience episodic periods of high suspended sediment concentrations due to river inputs and resuspension during storm events.

Summary – Effects of Suspended Sediments on Benthos

Direct effects of suspended sediment on these communities include smothering, effects on feeding and other physiological processes, and indirect effects of changes to food availability, and larval supply. Most of the effects have been assessed as low risk or indistinguishable from natural variability, apart from potential interference with physiological processes and reduced carbon flux in areas close to the extraction activity.

Most taxa have been shown to be relatively tolerant of significantly higher levels of suspended sediment than will be experienced as a result of the project operations even that occurring close to the site itself. Suspended sediment concentrations in the plume that could potentially reach the inshore reefs, kelp beds and associated fauna are low compared with naturally occurring background levels and thus will have minimal effects. Similarly, more diverse offshore bryozoan beds would only be impacted occasionally and not at levels that would cause adverse effects.

4.6.3.4 Zooplankton and Larval Fish

Neritic or coastal zooplankton contain a range of taxa including copepods, salps, and larval crustacea, bivalves and fish. The distribution of many benthic invertebrates depends on dispersal by currents for recruitment and colonization. Most species are able to tolerate relatively high levels of suspended sediment concentrations, at least for a short period, and in the case of copepods will have several generations a year. Thus populations are able to rapidly recover following disturbance events.

Suspension and filter-feeding zooplankton can be affected by high levels of suspended sediments. Arendt et al. (2011)[64] found concentrations of fine sediment above 20 mg/L can clog zooplankton respiratory surfaces and / or feeding apparatus as well as impair prey detection. Considerably higher levels would be required to have a significant impact with Wilber & Clarke (2001)[65] finding fish eggs and larvae were only impacted if suspended sediment concentrations were over 500 mg/L. Any impact if it were to occur would be short-term as these populations will move through the region with the currents and zooplankton have rapid generation times of days to months. Suspended sediment concentration in near surface waters are predicted to increase by up to 3 mg/L away from the source and in a well-defined plume.

As discussed in Section 4.4.3.3, effects on primary producers can also impact on higher trophic levels that depend on phytoplankton as their major food resource. However, these indirect effects, if they were to occur, would not alter the zooplankton community or impact on production.

In the Joint Expert conferencing under the previous consent application, experts agreed that the additional sedimentation from the project operations will have no additional level of effect over that which is occurring naturally. The experts also agreed that the effects of the project

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[64] Arendt, K.E.; Dutz, J.; Jonasdottir, S.H., ; Jung-Madsen, S.; Mortensen, J.; Møller E.F.; Nielsen, T.G. 2011. *"Effects of suspended sediments on copepods feeding in a glacial influenced sub-Arctic fjord"*. Journal of Plankton Research 33: 1526–1537

[65] Wilber, D. H.; Clarke, D. G. (2001). *"Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries"*. North American Journal of Fisheries Management 21:855-875.

on rock lobster larvae would be minor, as inshore reefs are located within naturally turbid waters, indicating a tolerance of species to such conditions. Further, it was agreed that monitoring of zooplankton would not be necessary.[66]

Subsequently, with respect to the effects on zooplankton in their decision on the previous application the DMC found that the effects on zooplankton were driven by the predicted changes in primary production.[67]

Overall, as concluded in AES (2016a), the neritic zooplankton community and its distribution depends on the prevailing currents and advective processes as well as *in-situ* primary production. Away from the source suspended sediment concentrations are predicted to be well below levels that would impact on these communities. Zooplankton communities can be highly transient, depending on the currents, and if impacted, affected inconsequential and populations would recover rapidly.

While the ecological effects resulting from the project are expected to be indistinguishable from natural variability, the proposed Baseline Environmental Monitoring Plan ("**BEMP**") and Environmental Monitoring and Management Plan ("**EMMP**") provide for ecological monitoring within the project area and the STB, and identify the different parameters being monitored and the associated monitoring programmes. These have been discussed in further detail in Section 5 of this IA and provided for through the proposed consent conditions included as Attachment 1 of this IA.

4.6.3.5 Response to Initial EPA Review Query

With regard to the matters raised in the EPA letter dated 10 May 2016 following an initial review of the particular technical reports provided by TTR, the following matter was raised by the EPA with regard to primary productivity:

> *To further quantify the effects on primary productivity within the South Taranaki Bight (STB) and at specific sites of ecological significance it is recommended that TTRL provide:*
>
> - *A hydrodynamically driven model of primary production that includes phytoplankton and microphytobenthos production (Section 4.3.1 of the DHI report).*

TTR has considered this issue at length and in summary TTR considered this approach, but concluded that:

1. This approach was not scientifically feasible based on existing knowledge;

2. It was not reasonable to expect the amount of field research needed to gather the information to be carried out as part of the application process;

It is further noted that the Joint Witness Statement of Experts in the fields of Optical Effects[68] (26 March 2014), Paragraph 23 stated that *"We all agree that changes to PP by phytoplankton, benthic microalgae and seaweed as a result of changes in the predicted*

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[66] TTR Marine Consent Application by Trans-Tasman Resources Ltd. Joint Statement of Experts in the Field of Fish and Zooplankton. Dated 20 March 2014. Para 25 & 37

[67] TTR Marine Consent Decision. 15 June 2014. Para 252.

[68] Joint Statement of Experts in the Field of Optical Effects Dated 26 March 2014. Para 23

changes in light would be both scientifically challenging and unreasonably expensive to measure. High uncertainty in predictions of changes to PP would likely remain even after considerable scientific study."

Overall, it is TTR's position that the provision of a hydrodynamically driven model is not likely to provide substantial improvements in the ability to forecast effects on primary productivity.

4.6.4 Ecological Effects from Sediment Deposition

Sedimentation impacts will be most prominent where the de-ored sediments are re-deposited. Close to the operations area suspended sediment will also settle out of the water column potentially smothering the local benthic community.

As described in Section 4.4, many taxa found in the inshore environment will be exposed to naturally high levels of sediment deposition, while offshore in deeper water is a general deposition zone for fine sediments originating from land based sources.

AES (2016a) considers that there is now a reasonable body of evidence on the effects of sedimentation on benthic communities, including a number of New Zealand studies in harbour environments (refer to Table 4.10 below). Experiments in a range of studies, mostly on the Manukau Harbour, have shown that generally most soft-bottom species can only escape a maximum burial depth of 2 – 10 cm depending on the species and type of material deposited (Norkko et al. 1999[69], 2001[70]).

Table 4.10: Tolerance levels for a range of invertebrates and microalgae to sediment deposition.

Author	Species	Sediment Deposition
Norkko et al. 2001	Various benthic species	3-7 mm clay
Doorn-Groen 1998[71]	Sessile animals including corals	1.7 mm/14 days
Norkko et al. 1999	Shrimps and crabs	9 cm
Devinny & Volse 1978	*Macrocystis* mortality of germlings (90%)	10 mg cm^{-2} (~0.45 mm Hepburn evidence)
Schiel et al. 2006	Macro-algae germlings attachment	2 mm

Some benthic taxa, such as the bivalves *Nucula* and *Macomona* and some polychaete worms, can survive and escape burial under at 20 – 30 cm of sand while 50% of *Zethalia zelandica,* a small trochid wheel shell did not survive burial in 17 cm of sand or 3.8 cm of mud (Paavo & Probert 2005[72]). This clearly demonstrates the difference in effects between sandy versus muddy depositions.

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69 Norkko, A.; Thrush, S.F.; Hewitt, J.E.; Norkko, J.T.; Cummings, V.J.; Ellis, J.I.; Funnell, G.A.; Schultz, D. (1999). *Ecological effects of sediment deposition in Okura estuary*. NIWA Client Report ARC90243 prepared for Auckland Regional Council, North Shore City Council, and Rodney District Council. July.

70 Norkko, A.; Talman, S.; Ellis, J.; Nicholls, P.; Thrush, S. (2001). *Macrofaunal sensitivity to fine sediments in the Whitford embayment*. NIWA Client Report ARC01266/2.

71 Doorn-Groen, S.M. (2007). *Environmental monitoring and management of reclamations works close to sensitive habitats*. Terra et Aqua 108. 3-18 p.

72 Paavo, B.; Probert, K.P. 2005. *Infaunal assemblages in coastal sediments at dredge dredged sediment disposal sites of Otago, New Zealand*. Marine Sciences Department (University of Otago) report. 111 pp.

The deposition of clay material, will have the greatest effect with experiments in the Auckland Region demonstrating that layers as thin as 3 – 7 mm had some impact on macrofauna and rapid accumulations of 20 mm can smother entire benthic communities (Norkko et al. 1999). The material being re-deposited at the project area will primarily consist of fine sediments with very little clay, further reducing the potential for smothering effects occurring.

Cockles (tuaki), pipis and tuatua are important for recreational and cultural harvesting in coastal environments. AES (2016a) identifies that pipis are active burrowers and can be found buried in up to 100 mm of sand and larger ones can even tolerate up to 400 mm. While limpets and whelks are highly sensitive to the silt /clay content of the substrates, some surface grazing animals like the gastropod snail *Zeacumantus lutulentus* are relatively robust to high levels of settled sediments and some crabs show a preference for fine silts and muds. Shrimps and some crabs can survive up to 9 cm of deposition but cockles and other molluscs generally start responding at levels of 20 – 30 mm, depending on the grain size.

Most MPBs are adapted to dynamic environments and episodic events and disturbances due to sediment resuspension and deposition. Many species are also motile and will migrate through thin layers of deposited sediments.

Sedimentation can impact on macro-algae and rocky shore communities through effects on settlement, recruitment, growth, and survival. Indirect effects include loss of photosynthetic capacity with a film of a few millimetres of sediment potentially reducing photosynthesis of plants. While most established alga can survive burial for short periods, attachment of germlings can be impacted by a light dusting of sediment (Schiel et al. 2006[73]) and relatively heavy settlement (2 mm) can prevent attachment altogether.

Some intertidal algae can remain intact after three months of burial but growth is inhibited, while others do not survive burial under thick sediments for a month. Deposits of up to 3 - 7 mm can have a negative effect on microphytes (microscopic benthic algae) and repeated additions over several months have been found to have a cumulative negative effect. Coralline crusts have been found to be unaffected by burial in sand for a few months at a time.

Average sedimentation rates over the SMD are estimated to be 0.5 - 1 mm/yr in the sediment plume which is virtually indistinguishable from naturally occurring background levels and will have negligible, if any, effects on benthic communities outside the excavation pit and immediate surrounding area.

In the extraction area, where the sediment is re-deposited initially, there will be no living benthic community but the community would rapidly recover through settlement of larvae and transport of adults into the area through water movement through the site. Very few animals would be able to migrate through the several metres of deposited sediment in the operational area and thus the degree of recovery will depend on the level of recruitment from outside sources, the way the material is deposited, and the length of time since the seabed was excavated.

The sampling of infauna commissioned by TTR focused on organism in the 5 cm surface layer. Holes from deep burrowing mantis shrimps are commonly found in inshore sandy habitats but NIWA found very few surface holes/burrows and caught no shrimps in dredge tows across the Patea Shoals.

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[73] Schiel, D.R; Wood, S.A.; Dunmore, R.A.; Taylor, D.I. (2006). *Sediment on rocky reefs: Effects on early post-settlement stages of habitat-forming seaweeds*. Journal of Experimental Marine Biology and Ecology. 331:158-172.

4.6.4.1 Response to Initial EPA Review Query

With regard to the matters raised in the EPA letter dated 10 May 2016 following an initial review of the particular technical reports provided by TTR, the following matter was raised by the EPA with regard to sedimentation effects:

- *The impacts of elevated Total Suspended Solids (TSS) on the larvae of species, other than crayfish, and whether larval settlement periods are likely to be impacted by TTRL's activities have not been considered (Section 4.3.2 of the DHI report).*

TTR respond to this comment as follows:

Two aspects should be considered here.

- For the soft sediment species occurring near the mining area or in the main part of the plume larval settlement periods are poorly described or unknown. There is generally a spring and summer peak in larval production and settlement but this will not be the case for every species. The most practical measure of impact will be to monitor of benthic species in the mined areas, and to monitor benthic community structure at a range of sites outside estimated to be at a greater or lesser risk of impact (gradient design) from the plume or deposition of sediments. This has been provided for within through the BEMP and EMMP (refer to Section 5 of this IA) which provide for ecological monitoring before and during extraction activities.

- For larvae of rocky reef species that occur near-shore, the mining will only slightly increase suspended sediment concentrations or decrease light conditions in the water column thus effects on larval and adult populations will be minimal.

4.6.4.2 Summary – Effects of Deposition

There are two sources of material that would deposit on the seabed: material that has had the iron sand removed and is re-deposited on the seabed near the excavation activity; and finer material that settles after being dispersed by the sediment plume. The predicted levels of sedimentation has been modelled over five and 365-day accumulation periods and indicate that average sedimentation rates over the SMD will be 0.5 - 1 mm/yr which will be virtually indistinguishable from natural levels and is negligible compared with known tolerance levels for benthic invertebrates and macro-algae.

4.6.5 Recovery from Suspended Sediments and Deposited Sediment Effects

AES (2016a) identifies that recovery of the ecological environment will depend on the type of sediment present, extracted and deposited, the severity of the effect, potential for migration into the area, and the availability of larval and adult recruits.

Experiments carried out as part of studies around maintenance dredging by Port Otago Ltd provide some indication of recovery following disposal of dredge spoil (Paavo & Probert 2005). In those experiments, muddy spoil from Dunedin Harbour was deposited off Aramoana and the recovery was followed and showed that it took up to 180 days for the disposal site to recolonise and have a similar community to a site protected from disposal. It should be noted that recolonisation was much quicker for sand disposal with the community being similar to pre-deposition within 12 days.

For the project area, beyond the extraction area, where predominantly sandy material will be deposited, recovery would be expected to be quicker because only a thin layer would settle out from the sediment plume. The re-deposited material will be similar to that extracted in terms of particle size which will aid recovery of the communities. Recovery in the extraction area as the sand is re-deposited would be expected to be longer, as it would rely on recruitment and advection from outside the area, although this recovery would start as soon as the material is deposited on the seabed.

Surveys following dredging at the Port of Auckland and the disposal of 262,000 m^3 of dredged material in the Hauraki Gulf found there was an initial increase in abundance and diversity of benthic communities then a decline (Gowing et al. 1997[74]). Early successional communities, which included the likes of tube-dwelling polychaetes, were evident immediately after disposal followed by an increase in longer lived successional stages eight and 11 months after disposal (found at 45% of sites at the disposal site compared to 68% at control sites after 11 months). A number of overseas studies (Newell et al. 1998) have shown that while communities associated with muds may recover within months, communities in sand deposits are likely to be in a transitional stage and take up to two – three years to recover. Some longer lived species in these communities, such as heart urchins and large bivalves, which are found in the STB, could take several years to fully recover in the actual area where sands are extracted but there would be some movement into the area immediately after the recovery activities move to the next extraction block.

Seabed material from the STB was used by NIWA to experimentally assess the recolonisation expected to occur in the STB. The experiments had to be conducted in Wellington Harbour because of the exposed nature of the STB, and although the focus was on assessing the effects of removing iron from the sediments, the results do provide some indication of recovery. Beaumont et al. (2013) identified that the experiment was run for seven months after which time several "opportunistic species" (e.g. copepods and small polychaetes such as *Capitella capitata*) were found to have recolonised the sediments.

Beaumont et al. (2013) identifies that the existing environment in the project area is a very exposed, highly dynamic sandy environment where much of the benthic community will be exposed to episodic disturbances from wave events and river inputs during high rainfall events. The existing community is dominated by short-lived, opportunistic and early successional stages. The abundant polychaete worms *Euchone* and *Aricidea,* as well as syllid and photid polychaete worms and isopod *Pseudaega* spp, found in the area of potential impact, are known as early colonisers and along with the low abundance of longer lived organisms is indicative of an environment that is regularly disturbed.

The community further offshore (60 m water depth) is dominated by later successional stages (certain bryozoans, sponges, larger gastropods and higher numbers of motile taxa) while the bivalve rubble habitat in shallower waters supports early successional stages (encrusting corraline algae, small encrusting invertebrates). The dominance by early successional stages in the area potentially impacted suggests that recovery should be relatively rapid and likely to be at the scale of months to a few years. Recovery of some taxa such as small polychaete worms would be expected to start within a few weeks of the extraction operations moving to another block within the project area.

<u>Summary – Recovery from Suspended Sediments and Sedimentation</u>

74 Gowing, L.; Priestley, S.; Kennedy, P. 1997. *"Monitoring the Hauraki Gulf dredgings disposal site using REMOTS and other established sampling techniques".* Presented at the Pacific Coasts and Ports '97. Christchurch, Centre for Advance Engineering, University of Canterbury.

The recovery of the benthic environment as the iron sand recovery operations moves across the site will depend on the type of sediment, the severity of effects from excavation and the sediment plume and availability of re-colonisers and recruitment. The existing community is dominated by short-lived, opportunistic and early successional stages but with populations of some larger longer-lived taxa also occurring. The dynamic nature of the environment means abundance and diversity for most groups is relatively low. The offshore community is more diverse and contains larger and late successional stage taxa.

The dominance by opportunistic taxa in the region directly impacted by excavation and the sediment plume means recovery is likely to be rapid once the excavation and re-deposition moves away, with recovery of the likes of polychaete worms likely to start immediately. Larger, long-lived taxa may take several months to a few years to recover. There is likely to be a gradation in recovery as the activities move to new blocks each year.

4.6.6 Ecological – Cumulative Effects

The project has the potential to create elevated suspended sediment concentrations, above those which are naturally occurring, immediately around the operational area. However, this effect will not present issues in respect of cumulative ecological effects with any other activities as there are no other activities within the STB area that will generate sediment plumes as a result of their ongoing operation.

Further, from the standpoint of primary production and most other ecological components, it is very difficult to estimate or assess cumulative effects, as most of the effects of the project's operations on the biota are transient in space and time. There are not considered to be any obvious project related activities that would result in cumulative impacts for other parts of the ecological system.

Overall, it is concluded that the potential cumulative effects are difficult to assess in this case due to the nature of the activity and the existing environment. Further, it is reasonable to summarise cumulative effects on the basis that the project will not result in adverse cumulative effects as any effects will only be present while project operations occur and once completed, the areas will being to recolonise almost immediately and any additional plume effects above the naturally occurring background levels will be removed.

4.6.7 Trace Metal Effects on Sediment and Water Quality

Contaminants, such as heavy metals and PCBs, can potentially affect offshore biota through direct toxic effects and bioaccumulation into the food web. Contaminants in the sediments of the STB, such as heavy metals, were assessed by AUT (2013).

As part of their assessment, AUT (2013) completed an analysis of the sediment content of the acid volatile sulphides and simultaneously extracted trace metals to determine the concentrations of trace metals in suspensions of sediment in seawater. The assessment further investigated whether the grinding of enriched iron sand increases the potential of the sand to release trace metals when suspended in seawater. The findings of AUT (2013) have been summarised below.

4.6.7.1 Assessment Methodology

To inform their assessment, sampling of seawater and sediments was undertaken at five sites within the project area. One sediment core sample and 20L of seawater was collected at each of the sample sites with a further sample of sediment slurry and another 20L of seawater collected at a later date from two further targeted sites.

The samples were subject to a range of analysis and testing upon which the findings of AUT (2013) are based. These findings have been summarised below.

4.6.7.2 Summary of Potential Trace Metal Effects

Dilute-acid Soluble Metals in Deep Sediment

The concentrations of dilute-acid soluble cadmium, copper, lead and zinc in deep sediments were of the same order of magnitude as their maximum concentrations in surface sediment sampled.

For cadmium, copper and zinc, there was no evidence for the consistent trend of increasing concentrations with increasing sediment depth below the seabed. The sediment concentrations of lead decreased with depth below the seabed at three of five sites.

Overall, the testing results infer a low probability of adverse effects of these dilute-acid soluble metals on benthic ecosystem functioning.

The concentrations of dilute-acid soluble chromium and nickel in deep sediment were often one order of magnitude higher than their maximum concentrations in surface (reference site) sediment.

Furthermore, at four of the five sites, chromium and nickel concentrations increased with increasing depth below the seabed. Additional analyses of sediment slurry collected to a maximum depth of 18 m below the seabed did not reveal evidence for such a trend.

No consistent increase with depth in the concentrations of dissolved nickel in the slurry was found. The concentrations of chromium in the slurry were below the detection limit.

Trace Metals in Sediment Suspensions

For all metals except nickel, the concentration in seawater suspensions of deep sediment (elutriate) were either below detection limit (chromium, copper, lead, zinc) or, if a metal was detected (cadmium), the concentration did not exceed the ANZECC and ARMCANZ[75] guideline for the protection of 99% of marine species. The detection limit of copper was below the guidelines for the protection of 95% of marine species.

The concentrations of nickel in the seawater suspensions of deep sediments (all five sites) and surface (reference site) sediment (three of five sites) were equal or larger than the ANZECC & ARMCANZ guideline concentrations for the protection of 99% of marine species. However, the nickel concentration never exceeded the guideline concentrations for the protection of 95% of marine species. Assuming that the nickel concentration in STB seawater equals the detection limit for nickel, it would only require an 83-fold dilution of the elutriate extract to decrease the highest nickel concentration measured to below guideline concentrations for the protection of 99% of marine species.

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[75] ANZECC & ARMCANZ, 2000. *"Australian and New Zealand Guidelines for Fresh and Marine Water Quality"*. National Water Quality Management Strategy Paper No 4. Australian and New Zealand Environment and Conservation Council, Agricultural and Resource Management Council for Australia and New Zealand, Canberra.

The concentration of copper in seawater suspensions of the enriched iron sand was negatively linearly correlated (r = -0.89) with the size of the suspended iron sand particles. The average elutriate copper concentrations of as-received and the coarse iron sand fraction exceeded the ANZECC and ARMCANZ guideline for the protection of 99% of marine species. Based on the conservative assumption that STB seawater contains 0.25 parts per billion copper only a 20-fold dilution would be required to decrease the concentration to below the concentration limit for the protection of 99% of marine species.
In contrast, the average copper concentrations in elutriates of medium and fine coarse iron sand exceeded the guideline for the protection of 80% of marine species. Here, a 160-fold dilution would decrease these concentrations to below the concentration limit for the protection of 99% of marine species.

With regard to mercury, a natural source of mercury is from volcanic and geothermal activity, however in volcanic sources it is related to the emission of gaseous mercury into the atmosphere and generally not concentrated within volcanic sediment. Given that the source material of the iron sand is volcanic rock and ash, which has formed at over 700 degrees, and that the vapour temperature of mercury is 356 degrees, there is a very low probability of accumulated mercury within the offshore sediment deposits in the STB. Where mercury occurs in volcanic hot springs and epithermal deposits it predominately forms as the sulphide mineral cinnabar. Microscope or Qemscan (Quantitative Evaluation of Minerals by Scanning electron microscopy) analysis has not observed this mineral in the Taranaki offshore iron sands.[76]

Effect of Grinding on the Dilute-Acid Soluble Metal Content of Enriched Iron Sand

A sample of magnetically enriched iron sand was ball milled to three average sizes, 276 µm, 183 µm and 23 µm. TTR will be grinding sediment to a P80 of 120 µm (P80 i 80% of the passing size). The average concentrations in this iron sand of dilute - acid soluble chromium, nickel and zinc decreased after each of the first two grinds but increased after the third grind to 171%, 150%, and 162% of that in the extract of the original material.

In contrast, for copper and lead, the average concentrations in the extracts of the first two grinds did not significantly differ from that of the original material, but the third grind increased these concentrations to 193 µm and 132% of the concentration in the extract of the as-received iron sand.

The concentrations of dilute-acid soluble cadmium were below reporting limits in both the original material and ball-milled magnetically enriched iron sand.

Elutriate tests with magnetically enriched and ball milled iron sand were conducted to investigate if grinding of iron sand will increase trace metals concentrations in the seawater that feeds the iron sand through TTR's grinding mills.

These tests revealed concentrations of cadmium, lead and nickel below the limits of reporting for all sediment samples. Chromium was detected only in elutriates of the fine sediment fraction; zinc was detected in elutriates of all sediment samples. For both metals, the concentration averages for each sand size fraction did not exceed the ANZECC & ARMCANZ guideline for the protection of 99% of marine species. Therefore, a low probability of adverse effects of these metals on ecosystem functioning of the STB water column is inferred.

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76 Statement of Evidence of Matt Brown on Behalf of Trans-Tasman Resources, 15 February 2013, adaption of paragraph 59.

Bioaccumulation Effects of Mercury

With regard to mercury, in his evidence presented on behalf of TTR in the hearing on the previous application[77], Dr Vopel identified that:

> *"Mercury was not included in our analyses because I did not expect the offshore iron sand of South Taranaki Bight to contain elevated quantities of anthropogenically or naturally derived mercury. The volcanic activity that produced the iron resource in South Taranaki Bight will not have resulted in accumulation of mercury in the offshore iron sands. Volcanoes discharge mercury into the atmosphere along with high temperature ejecta. Ultimately, the oceanic environment receives part of this mercury through atmospheric deposition but this deposition is a global rather than a local process. Overall, the average yearly emission of mercury from volcanoes into the atmosphere is small relative to natural terrestrial fluxes to the atmosphere and modern anthropogenic (pollution) mercury fluxes.*
>
> *I note that Chrystall and Rumsby (2009)[78] identified geothermal emissions as a natural sources of mercury in New Zealand with local effects on freshwater biota, that is, increased mercury concentrations in fish caught in geothermally-influenced lakes (Kim 1995)[79] or in sediment of a lake that contains a natural geothermal spring. The authors noted that most concerns are over the issue of accumulation of anthropogenic mercury in aquatic ecosystems. I argue that such accumulation is unlikely in the offshore sand of South Taranaki Bight. Elevated mercury concentrations in offshore sediment have been detected elsewhere near oil drilling sites (Gulf of Mexico) and such concentrations were associated with discharge of cuttings drilled with synthetic-based mud (Trefry 2007)[80] or, for methyl mercury, related to higher sediment organic matter content in the vicinity of offshore oil production platforms (Delaune et al. 2008)[81]."*

On this basis, any bioaccumulation effects that relate to mercury have not been considered further as part of this application. Bioaccumulation in seafood with regard to human health effects have been discussed further in Section 4.10 which focuses on copper and nickel.

4.7 Marine Fauna Effects

4.7.1 Fish

4.7.1.1 Introduction

TTR commissioned NIWA to undertake an assessment of potential effects on fish and fisheries in the STB (MacDiarmid et al (2015b)). NIWA also undertook an assessment on the potential effects of light from project operations on fish (Thompson (2015b))[82].

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77 Statement of Evidence in Chief of Dr Kay Vopel on behalf of Trans-Tasman Resources, 15 February 2013, Paragraphs 66-67.

78 Chrystall L, Rumsby A (2009) Mercury inventory for New Zealand. Technical Report prepared for the Ministry for the Environment. Pattle Delamore Partners Limited, August 2009.

79 Kim JP (1995) Methylmercury in rainbow trout (Oncorhynchus mykiss) from Lakes Okareka, Okaro, Rotomahana, Rotorua and Tarawera, North Island, New Zealand. Science of the Total Environment 164:209–219.

80 Trefry JH, Trocine RP, McElvaine ML, Rember RD, Hawkins LT (2007) Total mercury and methylmercury in sediments near offshore drilling sites in the Gulf of Mexica. Environ. Geol. 53:375–385.

81 DeLaune RD, Devai I, Hou A, Jugsujinda A (2008) Total and methyl Hg in sediment adjacent to offshore platforms of the Gulf of Mexica. Soil & Sediment Contaminations 17:98–106

82 Thompson, D. 2013. *"Effect of ships lights on fish, squid, and seabirds".* NIWA Client Report WLG2013-16. Updated November 2015.

Information on the distribution and abundance of reef fish, pelagic fish and demersal or seabed associated fish species have been described using predictive models based on survey information conducted around New Zealand, together with a set of environmental predictor variables developed by NIWA (Smith (2008))[83]. The model predictions were produced by applying a statistical analysis to diver surveys of fish abundance using environmental and geographic variables as predictors. The general features of the distribution, abundance and ecology of rock lobsters were also identified on the basis of extensive studies conducted elsewhere in New Zealand.

The potential effects of the project on fish have been identified as:

- Entrainment of fish within project equipment;
- Loss or physical disturbance of seabed habitat and the communities associated with these habitats;
- Impacts on physiological processes, including clogging of respiratory surfaces and feeding structures and processes for animal biota;
- Smothering of benthic habitats and communities;
- Displacement from areas of disturbance by sediment plumes;
- Reductions in primary production in the water column (i.e. phytoplankton) and on the seabed or reefs through reduced light availability;
- Reduced prey and prey detection for fish; and
- Noise effects on some fish species.

These effects have been discussed in further detail below, although noise effects are discussed in Section 4.9 of this IA.

Entrainment of Fish in Project Equipment

MacDiarmid et al. (2015b) identifies that the majority of fish species will avoid becoming entrained in any operational machinery associated with the project, particularly the crawler, as they will typically be able to avoid areas of the physical disturbance.

It is, however, possible that the intake water velocity near the extraction nozzle of the crawler (up to 6 m/s) will cause the occasional entrainment of smaller fish - due to these fish not being able resist the suction. The likelihood of such occurrences are very low due to the likely low abundance of fish in the project area during operations and the natural instinct of fish to move away from disturbed areas, including noise sources. Therefore, any potential effects of entrainment are unlikely to be significant. This conclusion was also accepted by the DMC[84] in their decision on the previous marine consent application, who noted that the various experts agreed that there would be little opportunity for fish to become entrained and that any potential effects would not be significant.

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83 Smith, A.N.H. 2008. *"Predicting the distribution and relative abundance of fishes on shallow subtidal reefs around New Zealand"*. NIWA Client Report WLG2008-9.

84 TTR Marine Consent Decision. 15 June 2014. Para 375.

Disturbance and Sedimentation Effects

MacDiarmid et al. (2015b) identifies that the direct and indirect effects of suspended sediment on fish populations must take into account the level of suspended sediment generated by the project compared with the naturally occurring background levels, the tolerance levels of different species, and the duration and spatial extent of the effect above tolerance levels.

The potential effects of the sediment plume and associated changes in turbidity and suspended sediment from the project include:

- Impacts on physiological processes such as respiration and feeding;
- Impaired visibility for prey detection;
- Loss or changes in feeding area and food resources; and
- Loss or changes in spawning areas.

With regard to sediment effects on fish species, Lowe (2013)[85] and Page (2014)[86] have identified that suspended sediment concentrations of 2 mg/L and 3 mg/L are the lowest levels that would be avoided by pelagic and demersal fish respectively. Acute and chronic impacts would be expected to be at much higher levels. In a recent study on juvenile snapper in estuaries Lowe (2013) reported 35 - 40 mg/L as the level that started affecting foraging strategies, and declining condition. Page (2014) provides a very comprehensive list of published threshold concentrations with most species only impacted beyond avoidance or a reduction in feeding, at levels well over 500 mg/L. As discussed in Section 4.4.2 of this IA, such levels would not be encountered within the project area (not even right at the extraction / deposition source).

Based on the sediment plume modelling by NIWA, the only location where suspended sediment concentrations would be perceptible above natural background limits is within 2 – 3 km of the source. In this regard, the median concentration of suspended sediments in surface waters at the source (Location A) will be 1.45 mg/L and the 99th percentile concentration will be 8.2 mg/L. At a location approximately 20 km down current the median concentration will be 0.35 mg/L and a 99th percentile concentration being 2.8 mg/L. Near the seabed the median suspended sediment concentrations at the source will be 14 mg/L and the 99th percentile concentration 45 mg/L, while at a location approximately 20 km down current the median concentration will be 1 mg/L and the 99th percentile concentration up to 5 mg/L.

As previously noted in this IA that inshore areas of the STB already experience naturally high levels of suspended sediment concentrations. The levels resulting from the project would be within the range of natural variability of suspended sediment concentrations experienced by fish populations in the STB.

As noted in Section 3.6.1 of this IA, Ching et al. (2015) used spatial information on the occurrence and foraging of different fish species, a suspended sediment concentration of 3 mg/L and the potential dispersion of the sediment plume to assess the scale of potential effects from the project. The assessment demonstrated that less than 1% of the area

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85 Lowe, M.L. (2013). *Factors affecting the habitat usage of estuarine juvenile fish in northern New Zealand*. Doctor of Philosophy in Marine Science. University of Auckland, Auckland: 238.

86 Page, M. (2014). *Effects of total suspended solids on marine fish: pelagic, demersal and bottom fish species avoidance of TSS on the Chatham Rise*. NIWA Client Report No: WLG2014-7, 25 p.

occupied by the different fish species found in the STB would potentially be impacted by the project and that any effects would be negligible or minor.

Fish are also ‘fully motile’, which means they have the ability to select their preferred habitat, and as a result, avoid or remove themselves from unfavourable habitats (e.g. areas of high sedimentation). This would further reduce the potential for the sediment plume from the project to adversely affect fish species.

The only species identified as being potentially affected in a more than minor way was the eagle ray. This is due to 8% of its core distribution in the STB coinciding with the area potentially impacted by the sediment plume. However, as this species typically concentrates in inshore areas at certain times of the year, where suspended sediment concentrations are naturally high, the use of 3 mg/L concentration as a threshold for effects is likely to be very conservative when considering potential impacts on eagle rays. Eagle rays are also commonly encountered in harbours and estuaries where suspended sediment concentrations can be very high. Therefore, MacDiarmid et al. (2015b) concludes that the overall effect on eagle rays, and other ray species, will be no more than minor.

In addition, and as has been found with dredging programmes elsewhere New Zealand, the disturbance of sediment could enhance the availability of food for fish (at least initially) as invertebrates are disturbed and potentially made available for fish.

Finally, it is noted that the joint expert conferencing[87] held as part of the previous marine consent application by TTR recorded agreement between the various experts that the increase in sediments in the water column is unlikely to cause sub-lethal effects or growth effects - except at the immediate source of the sediment plume. Further, it was agreed by the experts that any detectable direct effects of decreases in water clarity on fish populations are highly unlikely.

Spawning and Feeding

While there is the potential for the sediment plume from the project to affect spawning sites, particularly during the earlier phase of spawning, the project area and area potentially affected by the sediment plume is not identified as being an important spawning area or juvenile nursery for any fish species.

For fish that spawn inshore, any effects are likely to be within the range of background levels of suspended sediment concentrations that the fish populations naturally encounter due to the nature of the high energy environment of the STB.

Therefore, any potential effects of suspended sediment concentrations on spawning would likely be no more than minor given the relatively small scale of the project area in the context of the STB. This position was accepted by the DMC in their decision on the previous marine consent application, who found the loss of spawning area is not significant as the project area forms a small percentage of the STB and the region does not support an extensive fish nursery.[88]

With regard to feeding effects and food sources, the project area has not been identified as providing extensive feeding grounds for fish species within the STB. Further, the loss of any feeding areas is not likely to be significant as the methodology for the extraction of iron

87 Joint Statement of Experts in the Field of Effects on Fish and Zooplankton dated 20 March 2014.
88 TTR Marine Consent Decision. 15 June 2014. Para 372.

sands from the seabed (being extraction of segmented blocks of a total project area) allows for the re-colonisation of marine areas immediately after project operations cease.

Light Effects

Artificial night lighting influences fish foraging, schooling behaviour, spatial distribution, predation risk, migration and reproduction. These effects can combine to affect the community ecology of fishes and both their prey and predators.

An artificial nocturnal lighting source from a vessel operating in a relatively fixed location, or over a relatively small spatial extent, could potentially affect marine fish in the following ways:

- Small fish species may be attracted to an artificial light source because the artificial light also serves to focus their marine plankton prey;
- Feeding increases with prey density in high light conditions;
- An increase in abundance of relatively large predatory fish around the illuminated area(s); and
- Behaviour changes of fish to maintain their position within the illuminated area(s).

With regard to the project, any such effects of vessel lights will be extremely localised and minimal. In this regard, while local increases in fish abundances may occur it is highly likely that any such attraction of fish towards the IMV will have a negligible effect at a population level. This is due to the small number of fish that could aggregate in the water column around the IMV at any one time, as well as the spatial scale of the IMV in the context of the STB.

4.7.1.2 Response to Initial EPA Review Query

With regard to the matters raised in the EPA letter dated 10 May 2016 following an initial review of the particular technical reports provided by TTR, the following matter was raised by the EPA with regard to fisheries:

> *The assessment of impacts on fish species is sometimes described at the scale of the relevant Fisheries Management Area (FMA) and sometimes at the scale of the STB. To provide a greater understanding of impacts on fish species, and potentially fishers, at a local scale it is recommended that:*
>
> - *Impacts on fish species are presented at the scale of the STB as well as the relevant FMA. (Section 4.3.3 of the DHI report).*

TTR notes that the difference in approach is because for quota species, such as barracoota, a stock area has been assigned by MPI Fisheries Assessment Working Groups and impacts have been assessed against these. For non-quota species, such as eagle rays, no similar reference area is available and the technical advisors have used distribution in the modelled domain area as the conservative approach.

Additionally, TTR consider that the scale of FMA is appropriate for species managed by quota as impacts need to be assessed for the population. MPI have deemed these areas appropriate for populations of quota species based on species biology, ecology, movements etc.

4.7.1.3 Management and Monitoring of Potential Effects on Fish

Joint expert conferencing held as part of the previous marine consent application by TTR concluded that baseline monitoring of fish stocks should occur for a minimum period of one year.[89] The experts were in agreement that although specific monitoring of species abundance around the project area was not warranted, reef fish should be monitored at the North and South Traps, Graham Bank, and at the biogenic shell and bryozoan areas south of the project area.

These recommendations have been provided for in the EMMP (discussed in Section 5.5 of this IA) and incorporated into the proposed consent conditions provided in Attachment 1 of this IA.

4.7.2 Seabirds

4.7.2.1 Introduction

Thompson (2015b) considers the potential effects of artificial lights from ships on fish, squid, and seabirds in the project area, while Ching et al. (2015) assesses the ecological effects of the project on seabirds – with a particular focus on Gibson's albatross, Westland petrel, sooty shearwater, red-billed gull and little blue penguin. The following section provides a summary of these reports.

The assessment of potential effects on seabirds included a review of beach patrol surveys. These surveys involved volunteers collecting dead birds washed up on beaches, who complete patrol cards and return them to the Ornithological Society of New Zealand, who calculate annual tallies. In addition, information from other published and unpublished sources was used to determine the species of seabirds that are likely to be associated with the STB.

4.7.2.2 Effects on Seabirds

The potential for effects on seabirds from the project include:

- Species presence and habitat effects;
- Sedimentation and foraging effects; and
- Effects from vessel lighting.

With respect to species presence and habitat, it is considered that the STB supports a relatively modest seabird assemblage and does not support large breeding colonies for any species. Because many of the typical species occurring in the STB are relatively coastal in their distribution, they are unlikely to be impacted by the project. Such species include blue

[89] Joint Statement of Experts in the Field of Effects on Fish and Zooplankton dated 20 March 2014, para 33 and 34.

penguin, shags, gulls and terns, although the latter two species can extend to more offshore areas. By contrast, albatross and petrel tend to be more pelagic and wide-ranging in their distribution and will likely occur anywhere throughout the STB.

Potential effects on seabirds recorded in the area of the STB potentially affected by the sediment plume from the project will be negligible because of their mobility and wide foraging range.
Ching et al. (2015) selected five representative species for more in-depth assessment - the Gibson's albatross, Westland petrel, sooty shearwater, red-billed gull and little blue penguin.

It was concluded that the STB was not a particularly important area for Gibson's albatross and that the project would have negligible effects on this albatross.

The Westland petrel is considered to be of high conservation value (although not on the threatened list) due to its restricted mainland breeding distribution and modest population size. The at-sea distribution of this species during the winter breeding season spans central New Zealand, including the STB. It is likely that this species could occur in the project area, but it is noted the project area is relatively small compared to the overall distribution of Westland petrels (i.e. less than 0.1%). As such, any potential effects will be negligible.

Sooty shearwaters are found throughout New Zealand when breeding. Based on a relatively conservative estimate of their spatial distribution, the extent of the sediment plume from the project with surface level suspended sediment concentrations above 2 mg/L would represent less than 0.01% of foraging area. Sooty shearwaters wide ranging foraging and depth range, compared with the area potentially affected by the project, means any potential effects will be negligible.

Red-billed gulls are found around the entire coastline of New Zealand, including the STB. The STB does not have a major breeding colony and the area potentially affected by the sediment plume represents less than 0.1% of the coastal distribution of this species. Therefore, any potential effects will be negligible.

Little blue penguins are found in coastal areas around New Zealand. The closest breeding sites are over 50 km away from the extent of the sediment plume from the project and the area potentially affected is less than 0.1% of the area available. As such, any potential effects on little blue penguins will be negligible.

With regard to sedimentation and foraging effects, it is noted that the dredging programme for Port of Melbourne included threshold suspended sediment concentration limits for protecting terns and gannets of 25 mg/L. In contrast, suspended sediment concentrations at the surface will only be up to 8 mg/L at source and less than 3 mg/L 20 km down current. As such, the levels will be well below those used to protect these bird species present and, therefore, any potential effects as a direct result of the sediment plume will be negligible.

With regard to lighting effects, it was agreed by experts as part of the joint conferencing for the previous marine consent by TTR that lighting was potentially the most significant effect for seabirds due to the risk of collision with vessels.[90] Deck lights and standard navigational lighting on the operational vessels, particularly the IMV, FSO vessel and AHT, have the potential to attract nocturnal birds. These lights may also attract squid and fish, which may in turn attract birds for feeding. However, it is considered that the remoteness and distance offshore of the project area from major breeding colonies of seabirds will assist in ensuring any potential effects from vessels are minimised. Further, vessel design and on board management practices will assist to further reduce the potential for any adverse effects on

[90] TTR Marine Consent Decision. 15 June 2014. Para 400.

seabirds. In circumstances where collisions do occur, it is unlikely that any collision incidents would have a significant effect at a population level because the number of individuals affected would be small.

It is considered that the project would be unlikely to have any measurable population level impact on seabirds.

4.7.2.3 Management of Potential Effects

Overall, it is considered that the project will only result in indirect negligible effect on seabirds.

Artificial lighting emitted from operational vessels will increase the presence of artificial nocturnal light locally, but is unlikely to have any measurable population level effects on seabirds. However, to ensure that there are appropriate measures in place to minimise any adverse effects on seabirds, the following procedures will be implemented:

- Alerting vessels to the risk associated with the use of lights and other deck lighting, particularly on nights when visibility is poor and in the vicinity of seabird islands;

- Black-out blinds will be mandatory on all portholes and windows with external lighting kept to the minimum required for safe navigation and operation of vessels;

- Keeping deck lights to a safe minimum when at anchor or close inshore overnight; and

- Providing information on how to treat and release birds found on deck.

TTR will also prepare a Seabird Effects Mitigation and Management Plan in consultation with DOC. The purpose of the plan is to minimise any adverse effects on classified seabird species at a population level, and to ensure that there is no adverse effects on seabirds resulting from lighting, oil spills and the sediment plume. Further details on the development and implementation of this plan is provided in the proposed consent conditions provided as Attachment 1 of this IA and the draft Seabird Effects Mitigation and Management Plan has been provided as Appendix 5.3 to this IA.

Section 5 of this IA provides an overview of the proposed monitoring and management framework for the project. This includes discussion on the BEMP and the EMMP that will ensure that any effects associated with the project are appropriately monitored and managed throughout the proposed 35 year term of the consents.

Overall, it is considered that the potential effects of the project on marine fauna will be minor and will be further minimised through the proposed monitoring, management and mitigation measures provided for through the various management plans and the proposed consent conditions.

4.8 Marine Mammals

4.8.1 Introduction

Torres et al. (2015) undertook habitat modelling of southern right whales, Hector's dolphin and killer whales, while Cawthorn (2015) undertook a cetacean monitoring for the project.

Further, the effects of the project on marine mammals has been assessed in MacDiarmid et al. (2015a).

The potential effects of the project on marine mammals include:

- Avoidance of areas of disturbance and sediment plumes;
- Reduced prey and prey detection;
- Displacement from habitat;
- Risk of collision with project related vessels; and
- Noise effects.

The effects of the project on marine mammals is discussed further in the sections below, although potential noise effects are considered in Section 4.9 of this IA.

4.8.1.1 Whales

Blue whales have been observed in the western and central parts of the STB, predominantly at depths of between 50 – 150 m. However, MacDiarmid et al. (2015a) concludes that they are unlikely to occur within the project area, which is thought to be at the edge of their feeding grounds. Further, whales would seek to avoid the specific areas within the project area where iron sand extraction activities are occurring due the noise and disturbance effects.

In addition, the extent of the area where suspended sediment concentrations will be above 2 mg/L as a result of the project (being the level which would cause some disturbance to the feeding and foraging activities of blue whales) represents only 0.2% of the known foraging area of blue whales – excluding the shallower areas of the STB. As such, MacDiarmid et al. (2015a) concludes that any displacement or impacts on blue whale feeding would be negligible.

As noted in Section 3.7 of this IA, southern right whales prefer sheltered shallow coastal waters. No southern right whales have been observed within the project area, with the only sightings in the STB being to the north of the project area. Ching et al. (2015) concludes that the project would not impact on southern right whales when considering their typical range, habitat and behaviour.

Similarly, killer whales are found throughout New Zealand and the STB is only a moderately favourable habitat. Given that the prey of killer whales (e.g. school shark and rays) are found throughout the STB, it is unlikely that the project will impact on the habitat of killer whales.

Pilot whales commonly feed on squid and have a wide distribution around the coastline of New Zealand. The project area, and wider area of the STB potentially impacted by the project, is minimal compared to the total area of foraging and feeding habitat for pilot whales. As such, any potential effects are deemed to be negligible for this species.

4.8.1.2 Dolphins

MacDiarmid et al. (2015a) identified that the majority of the STB is unsuitable habitat for Hector's dolphin, as well as the sub-species Maui's dolphins - which is at a very high risk of extinction. Hector's and Maui's dolphins prefer areas of low water clarity and are opportunistic feeders. Ching et al. (2015) concludes that the project is likely to have negligible effects on Hector's dolphin due to the absence of sightings in the STB, their preference for areas of low water clarity, and the likely negligible effects of project on prey species.

With respect to the common dolphin, it is found throughout the coastal waters of New Zealand. A common prey is jack mackerel which is widely distributed in the STB and along the coastline.

When considering the large area occupied by the common dolphin around New Zealand, and its ability to range over an extensive area, Ching et al (2015) concludes that any potential effects on the common dolphin population in the STB will be negligible.

4.8.1.3 Seals

The New Zealand fur seal is found throughout New Zealand and has been increasing in numbers in recent years. They typically forage offshore at night, but do forage inshore as well. Tracking has shown that mean foraging trips are approximately 100 km, meaning that the project area could be accessed from the nearest colonies (Stephens Island and Sugar Loaf Island).

At sea sightings have observed fur seals in the project area and the area potentially affected by the sediment plume. Based on its foraging area, potential displacement and extent of potential effects on marine ecology and fisheries, Ching et al. (2015) concludes that any potential effects on fur seals will be negligible.

4.8.1.4 Vessel Collision

As the project will result in a number of vessels operating within the project area and the STB at any one time, there is the potential for collision impact effects on marine mammals. It was accepted by the DMC as part of their decision on the previous marine consent application that the risk of collision is low due to the relatively low speeds of vessel operating in the project area and the relatively low number of vessels involved in the project compared to the number already operating within, and travelling through, the STB.[91]

While the risk of a collision is low, any collision could result in minor injuries, maiming or the death of marine mammals. Given this, the potential effects are difficult to quantify. However, the potential for effects will be minimised by the use of personnel training and operational measures (which are discussed below).

It should also be noted that marine mammals, like fish, will avoid the project area if underwater conditions are not suitable. Further, and as discussed above, MacDiarmid et al. (2015a) concludes that the project area is not of particular biological importance to any marine mammal species – and marine mammals are only likely to be present in the broader area at certain times of year. This conclusion was accepted by the DMC in their decision on the previous marine consent application.[92]

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[91] TTR Marine Consent Decision. 15 June 2014. Para 333.

[92] TTR Marine Consent Decision. 15 June 2014. Para 350.

4.8.2 Management of Potential Effects on Marine Mammals

While the project will have negligible to minor effects on marine mammals, TTR is proposing a number of mitigation measures relating to potential effects on marine mammals. These are specified in the proposed consent conditions included as Attachment 1 of this IA, and include:

- The establishment of protocols should marine mammals be encountered during the project;
- The provision for marine mammals observers, and mounted cameras, on project vessels during start-up operations and while vessels are in transit;
- The development of a Marine Mammal Management Plan as well as notification requirements to DOC for incidents and sightings;
- Operational controls relating to the avoidance of potential collisions with marine mammals; and
- Monitoring of marine mammals is provided for in the proposed BEMP and EMMP.

The proposed consent conditions are generally consistent with those which were proposed as part of the previous marine consent application, but have been further developed through consultation with DOC and other stakeholders. These conditions will assist in ensuring that any potential adverse effects on marine mammals are minimised and that management protocols are in place to address any potential unforeseen effects.

Finally, the DMC concluded in their decision on the previous marine consent application, that the final consent conditions proposed were comprehensive and likely would have addressed any concerns associated with marine mammals.[93]

4.9 Noise Effects

4.9.1 Introduction

Hegley Acoustic Consultants were commissioned by TTR to undertake an assessment of the noise related effects of the project, with a particular focus on any noise impacts on marine mammals present in the area (Hegley (2015)).[94]

Hegley (2015) identifies that no measurements of existing noise conditions at the project site have been undertaken due to adverse sea conditions. However, measurements have been undertaken in a calm harbour mouth with no shipping activity in order to provide an understanding or possible noise conditions in calm sea conditions. Noise measurements were also undertaken at the Port of Lyttelton, with cargo ships arriving and departing, to demonstrate sound peaks of the ships passing at low speed within 100 m of the receiver.

As detailed in Section 3.11.3 of the IA, a significant number of ship movements occur within 10 NM of the project area and this will have the effect of increasing existing noise levels by up to 132 dB as a ship passes.

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93 TTR Marine Consent Decision. 15 June 2104. Para 350 – 351.

94 Hegley, N., 2013. *"Trans-Tasman Resources Ltd – Offshore Iron Sand Extraction and Processing – Assessment of Noise Effects"* Report No 9101. Updated November 2015. 24 pp.

4.9.2 Summary of Noise Effects

Hegley (2015) assessed the potential noise emitted by the crawler (pump motor drive and the extraction pump booster of a cutter suction dredge (excluding the cutter head)).

TTR have referenced the agreed noise limits against the studies and reports provided by De Beers Marine from the Institute for Maritime Technology (South Africa) [95]. These reports provide empirical data of the level of noise generated by crawler operations. From these reports it can concluded that the levels of low frequency noise produced by vessels of the off-shore mining industry are essentially the same as merchant vessels.

4.9.2.1 Crawler Noise

Hegley (2015) assumes that if the crawler noise is at least at the background sound, less 10 dB, it will be heard. Thus, the masking effects of the existing noise environment can be predicted based on the sea noise being around 132 dB. This means if the crawler is operating at no more than approximately 122 dB, the sea noise will mask most generated noise. Hegley (2015) identifies a noise level of 122 dB will be achieved at approximately 300 m from the crawler. The assumed levels of the crawler sound spectrum, used by Hegley in his report was verified by the Institute for Maritime Technology report, which was introduced by Hegley in his evidence with the original TTR marine consent hearing of 2014. This report supports the adoption of the agreed (DOC) noise conditions.

4.9.2.2 Vessel Noise

Based on noise measurements of container ships, the noise from the IMV will likely be 188 dB at 1 m when transiting, the FSO vessel will be 185 dB at 1 m when transiting, and the AHT's will be 170 dB at 1 m.

Measurements from *MV Overseas Harriette* demonstrate that noise levels from vessels will be approximately 14 dB lower when they are operating in the project area and vessel speeds are low. Hegley (2015) expects a similar relationship for vessels associated with the project.

4.9.2.3 Noise Effects on Marine Fauna

Noise generated by the project has the potential to affect the underwater environment for fish and sea mammals. Figure 4.11 shows the audiograms (i.e. the noise levels which can be heard) of three dolphins and whales species found in coastal waters off Northern Europe and Figure 4.12 shows the reported hearing thresholds for the beluga, humpback and killer whales compared to humans.

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[95] Coley, N.P. 1995. Institute for Maritime Technology, Environmental Impact Study: *Underwater radiated noise II, Document No: TV0010-950048-730.*

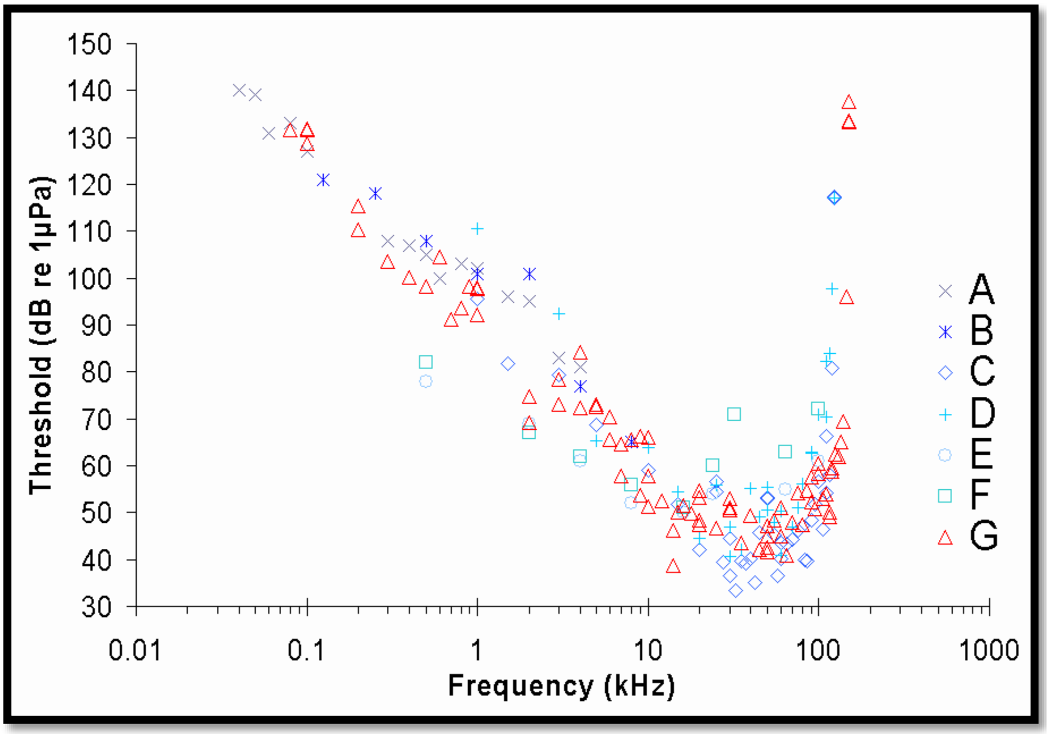

Figure 4.11: **Hearing thresholds for White whales and Bottlenose dolphins Note: (A) White whale from Johnson et al. (1989); (B) White whale from Awbury et al. (1988). (C) & (D) White whale female and male from White et al. (1978). (E) & (F) White whale female and male from Ridgway et al. (2001). (G) Bottlenose dolphin from Johnson (1967).**

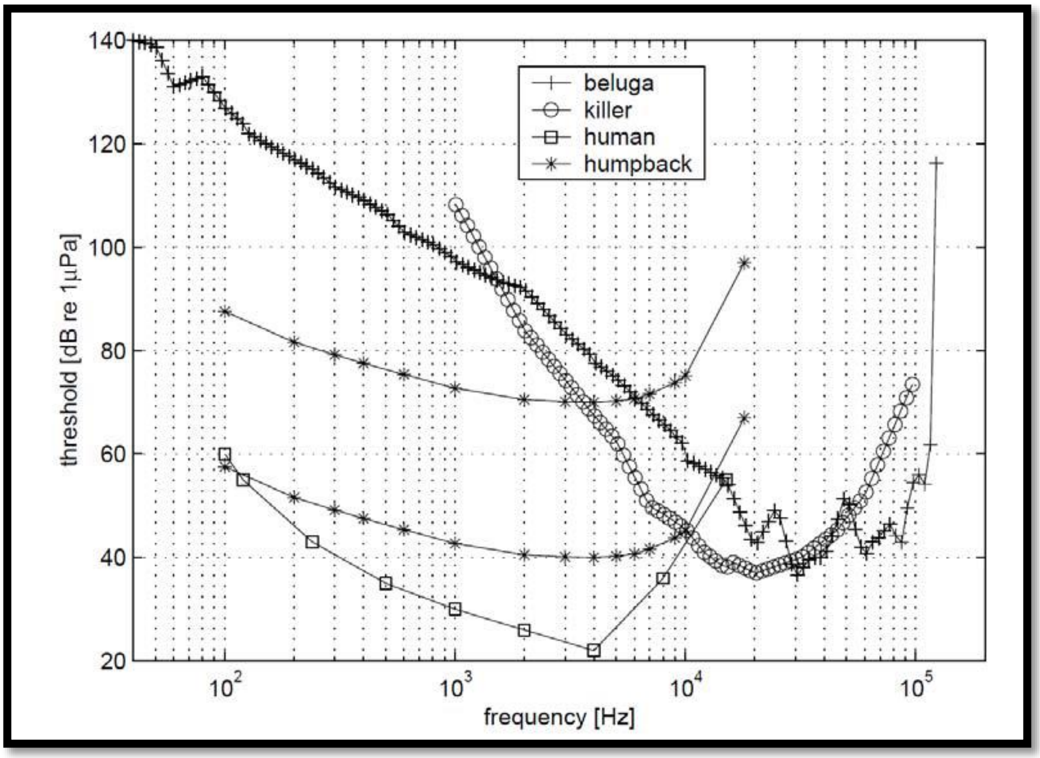

Figure 4.12: **Audiograms of Beluga, Killer and Humpback whales, and Humans**

With regard to operational noise, typical acoustic characteristics of the re-deposition sonar are:

- Frequency: 20 – 200 kHz.
- Beamwidth: 4° - 4.5°.
- Pulse length: 100 µs.

Hegley (2015) identifies that previous studies have shown that marine mammals tend to be adapted for living in noisy underwater environments, and typically have hearing thresholds that are much less sensitive than those adapted for the atmospheric environment. For this reason, it is considered that marine species are able to tolerate much higher levels of noise.

The frequencies used by porpoise (and assumed to be similar for Hector's dolphin) are:

- Low frequency sounds at 1.4 – 2.5 kHz for communication;
- Sonar-clicks (echolocation) at 110 – 140 kHz;
- Low-energy sounds at 30 – 60 kHz; and
- Broadband signals at 13 – 100 kHz.

All of these frequencies are well above those predicted to occur from the project.

While the hearing of the dolphin and whales is best between about 10 – 100 kHz, they can hear to relatively low frequencies - providing the noise level generated is relatively high. As an example, for the sound to appear as loud for the dolphin at 1 kHz as at 10 kHz it would need to be approximately 40 dB louder at 1 kHz than 10 kHz.

As noise from the project is generally toward the lower end of the hearing threshold for dolphins and at the lower end of their vocalisation range, it is concluded that effects will be less than had the sound been above 10 kHz.

The potential effects of the project associated with noise as identified by Hegley (2015) are:

- The masking of marine mammal communication systems, echolocation signals and passive listening capabilities; and
- Disturbance of normal behaviour resulting in displacement from habitat areas.

The potential impacts types from noise are:

- Permanent threshold shifts that result from unrecoverable tissue damage;
- Temporary threshold shifts that result in a temporary reduction in hearing sensitivity and;
- Behavioural response threshold shifts.

Table 4.11 below sets out the approximate noise levels of the project (above the threshold of hearing for dolphins and whales).

Table 4.11: Noise level (dB re 1 µPa) above the threshold of hearing.

Distance from extraction (m)	Level Above the Threshold of Hearing	
	Suction Dredge	Cutter Suction
50	51	59
100	45	53
250	37	45
500	31	39
1000	25	33
1500	21	29

Note: Shaded areas indicate general iron sand extraction noise is expected to be masked by the ambient sound

Overall, and assuming there are marine mammals present during the iron sand extraction activities, there is not expected to be any more than some temporary alteration to the behaviour of marine mammals in the vicinity of the project area.

With regard to fish, there is an extraordinary diversity in hearing resulting in different auditory capabilities across species. While many fish species hear in the range of about 30 Hz to 1 kHz, some fish can hear up to 3 kHz. It is concluded that there will not be any negative communication effects for fish when considering the noise generated as a result of the project.

4.9.2.4 Response to Initial EPA Review Query

With regard to the matters raised in the EPA letter dated 10 May 2016 following an initial review of the particular technical reports provided by TTR, the following matter was raised by the EPA with regard to noise effects:

- *Some issues relating to noise have not been addressed in TTRL's application documents such as the noise that may be generated from the drilling by the Geotechnical Support Vessel (Section 4.3.4 of the DHI report).*

As identified in the last paragraph of Section 4.9.2, since the submission of Hegley (2015) report, TTR have obtained studies and reports provided to De Beers Marine from the Institute for Maritime Technology (South Africa). These reports provide empirical data of the level of noise generated by crawler operations. These reports demonstrate that the levels of low frequency noise produced by vessels of the off-shore mining industry are essentially the same as merchant vessels.

Further, the conditions, as outlined in Section 4.9.2.5 and as agreed between TTR and DOC, are considered to be reasonable and achievable to mitigate any adverse effects on marine mammals.

4.9.2.5 Management of Potential Effects on Noise

Joint expert conferencing on noise effects was undertaken as part of the previous marine consent application by TTR.[96] While there was no agreement on noise limits and frequencies produced, the experts agreed that setting a noise limit at a distance from the iron sand extraction activities is an appropriate management approach.

[96] TTR Marine Consent Application – Joint Witness Statement - Noise Conditions. 11 April 2014.

Further, in setting a noise limit, the experts agreed it was important to consider not only the sounds level but also the frequency spectra of any noise. It was also generally agreed that a condition of the following nature would address the noise effects associated with the project:

> *"The consent holder shall comply with the following requirements in relation to underwater noise:*
>
> *a) The combined noise from the IMV and Crawler operating under representative full production conditions shall be measured nominally 10m below the sea surface at 300m, 500m, 750m and 1000m from the port or starboard side of the IMV. The combined noise level at 500m shall not exceed 130dB 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; and the overall combined noise level at 500m across all frequencies shall not exceed a sound pressure level of 135 dB re 1µPa RMS linear; and*
>
> *b) 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)."*

TTR has provided for the inclusion of further operational measures that will assist in reducing any potential noise effects on marine mammals. These include:

- The provision of a Marine Mammal Management Plan, which will seek to ensure any adverse noise effects are avoided to the extent practicable; and
- The use of suitably trained observers to conduct pre-start observations over a 500 m radius surrounding the IMV for at least 30 minutes to ensure no whales or dolphins are present; and
- Any start-up will be completed as a 'soft start'. That is, equipment shall be gradually increased in power over a minimum period of 20 minutes.

TTR has included conditions of this nature in the proposed consent conditions provided as Attachment 1 of this IA.

4.10 Human Health Effects of the Marine Discharge Activities

4.10.1 Introduction

Regulation 35 identifies of the EEZ Regs 2015, identifies that where an application is made for a marine discharge consent, in addition to the matters identified in section 39 of the EEZ Act, an IA must be supported by an assessment of the health effects that may result from the discharge activities.

For the purpose of this application, the marine discharge consent activities relates to the discharges of harmful substances from the project's operations being the following 'mining discharges':

- The release of seabed material (sediments) as a result of seabed disturbance during grade control drilling activities;
- The release of seabed material (sediments) as a result of the seabed disturbance during the crawler extraction operations;

- De-ored sediments and any associated contaminants discharged back to the water column from the IMV, and their deposition back on the seabed; and

- The release of seabed material (sediments) as a result of taking of sediment and benthic samples associated with environmental monitoring.

As part of the previous application, TTR engaged Dr Francesca Kelly to prepare an evidence brief (Kelly (2014)[97]) for the EPA hearing that focused on the likelihood of risk to human health from contaminants. The evidence brief focused on where exposure to contaminants might arise through seafood consumption and contact recreation exposure. These potential health effects have been discussed in further detail below.

Kelly (2014) also considered the human health risks of the discharge to contaminants to air from the operational vessels. These effects are not a direct effect from the marine discharge consent activities so have not been discussed in the section further however, they have been considered in Section 4.14 of this IA which looks specifically at the air discharges associated with the project.

There are no other actual or potential adverse effects of the project on human health.

4.10.2 Human Health Effects of the Discharge Activities

4.10.2.1 Contaminants Present within the Discharges

When considering each of the marine discharge activities to determine the potential extent of any health effects that may arise, it is important to understand the contaminants that are present in each discharge.

With regard to the contaminants present in the 'mining discharges' associated with the disturbance of the seabed during grade control drilling, crawler operation and monitoring, it is only the naturally occurring trace metals within the seabed that will be present.

When considering the nature of the trace metals present, it is noted in Section 4.6.7 above that there is the potential for trace metals (copper, zinc, etc) that are present in the underlying seabed material to be disturbed, excavated and redistributed over the seabed during project operations.

With regard to the de-ored sediments, as outlined in Section 2.3.3 of this IA, the processing of the seabed material to remove the iron ore concentrate is done by magnetic grinding and filtering. No chemicals are added or used in the processing, therefore the remaining de-ored sediments comprise of only natural seabed materials extracted from the seabed with the iron ore concentrate removed, thus the only potential contaminants within this discharge is any existing contaminants naturally occurring in the marine environment typically in the form of trace metal compounds.

As far as the potential distribution of any contaminants, de-ored sediments, including any trace metals, are slurried with resalinated water and discharged back into the water column within the project area which is beyond the 12 NM mark. Further, there is the potential for the sediment plume from the extraction and discharge process to extend towards the coastline and inside the 12 NM mark.

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97 Statement of Evidence in Chief of Dr Francesca Kelly on behalf of Trans-Tasman Resources Ltd. 15 February 2014.

When considering the potential human health effects of the trace metal component of the seabed materials, Kelly (2014) selected copper and nickel because of the potential for the release of concentrations during the project operations based on the properties of the seabed materials identified in the assessment described in Section 4.6.7 of this IA. The potential human health effects that may arise as a result of these trace metals are typically derived from consumption of seafood that may have been exposed to these contaminants in the marine environment and then harvested for consumption.

For the reasons outlined in Section 4.6.7.2, mercury has not been considered with regard to human health effects.

Kelly (2014) identified that the New Zealand Drinking Water Guidelines, which are primarily based on the World Health Organisation guidelines, identifies that copper in concentrations usually encountered in food or water is not considered a direct health risk, with nickel not being identified in the Guidelines due to the assessed low toxicity. Further, direct information from Total Diet Studies[98] provides information about patterns of food type exposure in the New Zealand population.

Kelly (2014) concluded that any elevations of copper or nickel in seafood, if they were to arise, will be below the amounts of any consequence for human health as a result of consumption of contaminated food.

Copper and nickel are also known to have ecological effects on fish, invertebrate and shellfish growth at concentrations below those that have adverse effects on human health. These effects have also been considered in Section 4.6.7.

There is nothing about the effects of the project on the physical environment relating to the physiological aspects of human health to the extent that the generic concerns of the project might result in anxiety or other mental health issues. It is beyond the ability of TTR to influence this and any attempt at establishing a causal link would be impossible to determine.

4.11 Cultural Effects

4.11.1 Introduction

This section of the IA summarises the assessment of effects of the project as they relate to the cultural values of iwi within the STB.

The assessments are primarily based on consultation undertaken to date and, where consultation has not been successful, an independent expert report has been prepared. TTR consider that this information represents the best available information at the time of lodging the application.

One of the key concepts raised during consultation with iwi was kaitiakitanga and the important role iwi and hapū play in the management of resources as kaitiaki. TTR understands kaitiakitanga is a broad concept that has important cultural and spiritual dimensions. Kaitiakitanga ensures sustainability of resources, in a physical, spiritual, economic and political sense. The authority to protect a resource stems from the broader viewpoint of whakapapa with kaitiakitanga is an exercise of obligation, mana, of prestige, of hapū and iwi.

98 http://foodsafety.govt.nz/policy-law/food-monitoring-programmes/total-diet-study/

The Te Taihauāuru Iwi Fisheries Forum Fisheries Plan 2012- 2017 makes the following statement about kaitiakitanga which summarises much of the concerns iwi have regarding the cultural impacts and the effect on iwi of the Project:

> *Without kaitiakitanga informing our decisions, our cultural identity and traditions become lost in modern society. Kaitiakitanga is based on mātauranga. Our mātauranga is founded on a holistic perspective; we are part of our environment. Our environment nurtures our mauri, and our mana remains powerful*[99].

This section of the IA also summarises TTR's proposed mitigation measures to provide for any adverse effects on cultural values that may occur as a result of the project.

4.11.2 Cultural Values Assessment

Following the unsuccessful approaches to engage with Ngāti Ruanui as part of the pre-application process, TTR engaged Tahu Potiki, an independent cultural expert from the Ngāti Tahu and Ngāti Mamoe iwi, to prepare a Cultural Values Assessment ("**CVA**")[100] for the iwi groups who have a connection with the STB and the project area, with a focus on Ngāti Ruanui's cultural values.

The CVA addresses the following:

- Methodology used in the CVA;
- Ngāti Ruanui and the STB;
- Maori and Ruanui World View;
- Effects of the Project on Cultural Values.

These matters have been summarised below.

Methodology used in the CVA

In preparing the CVA, the primary source of information was an analysis of iwi submissions received as part of the previous EPA application process. These submissions identified some of the issues of importance from a cultural perspective. Where available, other publications and documentation on cultural values within the STB were also used.

The CVA process would have ideally been informed by a Cultural Impact Assessment ("**CIA**") from Ngāti Ruanui and included extensive communication with primary source informants, particularly Ngāti Ruanui representatives / elders. However, neither of these have been possible as, despite numerous approaches to Ngāti Ruanui authorities, spokespeople and knowledge holders, there has been a collective refusal to meet with any TTR representatives to discuss the application. A detailed summary of TTR's consultation process with Ngāti Ruanui has been provided in Section 6.3.2 of this IA.

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99 Te Taihauāuru Iwi Forum Fisheries Plan 2012-2017, pp. 6
100 Cultural values Assessment and Analysis by Tahu Potiki. May 2016

Ngāti Ruanui and the STB

TTR acknowledges that Ngāti Ruanui holds mana whenua, and are kaitiaki, over areas of the STB including areas that will be affected by the project. It is on this basis that their cultural view and values are considered important and are relevant to the project. TTR has attempted to provide for a modern sensitivity to cultural concepts and landscapes therefore, allowing these matters to be taken into consideration and provided for as part of the project however, this has been hindered by the lack of direct consultation with Ngāti Ruanui.

The CVA identifies that its purpose is not to convey the view of Ngāti Ruanui in any way. Rather, the intention is to outline general Maori values and concepts in the hope to provide some understanding of the potential impacts of the project on Ngāti Ruanui and to assist in considering measures to mitigate any impacts should the marine consent and marine discharge consents be granted.

The boundaries of Ngāti Ruanui are well defined and recognised on the STB coast as extending from the mouth of the Waingongoro River to the mouth of the Whenuakura River. This incorporates the culturally significant Patea River and several important fishing reefs and wahi tapu sites adjacent to the coastline.

Historical account of Ngāti Ruanui's use of the coastline are detailed and show an intimate knowledge the resources the coast had to offer. It was a means of sustainability, a travel highway and a place of ritual or the kaitiaki and atua.

The coast supplied the people of Ngāti Ruanui with a constant supply of food resources. Reefs provided koura, paua, kina, pupu, papaka, pipi, tuatua, and many other species of reef inhabitants. More mobile kaimoana species such as hapuka, moki, kanae, mako, and patiki swim between the reefs off the Ruanui coastline.

Names such as Rangatapu, Ohawe Tokotoko, Waihi, Waokena, Tangahoe, Manawapou, Taumaha, Manutahi, Pipiri, Kaikura, Whitikau, Kenepuru, Te Pou a Turi, Rangitawhi, and Whenuakura depict the whereabouts of either a fishing ground or reef of significance to Ngāti Ruanui.

All along the STB shoreline from Rangatapu to Whenuakura food can be gathered and the Ngāti Ruanui people were skilled in catching and gathering kaimoana. Historically, the Ngāti Ruanui fishermen were considered very resilient and would stay at seas for days at a time. Food gathering and mahinga kai practices have been maintained and continue amongst present day Ngāti Ruanui.

Traditions of taniwha and sacred rocks are abound and it led the Ruanui people to be regularly involved in spiritual rituals in an effort to protect the people from misfortune and to assure bountiful harvests from the ocean.

Maori and Ruanui World View

The CVA identifies that there is a generic 'Maori World' view that affects the perspective of all things Maori and cultural values, and is one that is typically understood across all iwi. This view is based on whakapapa (genealogy or lineage) and tells a linear tale from a void through until the creation of humankind. There are subtle differences in different iwi versions but the central themes and characters are consistent and based, on the information available, it is considered that Ngāti Ruanui's beliefs are no different from a traditional view.

The Ngāti Ruanui whakapapa is considered to follow the general Polynesian creation story in that ancestors originated from Hawaiki and arrived in the region in the waka over the sea.

This provides a strong connection with the ocean and Tangaroa (god of the oceans), and identifies the spiritual relationship between Ngāti Ruanui and Tangaroa. This connection establishes a mauri to the sea and waterways of Ngāti Ruanui's rohe.

With regard to cultural values, the Maori World view is that all things come from the original point of creation which is a source of divine power, being mana. Mankind and other earthly manifestations are not the mana itself, they are merely a vessel or channel for mana. The residual impact of mana is tapu (sacred). Where there is mana the influence creates an effect that is holy or tapu and this can be transferred to people or places. Behaviour associated with tapu is one of the most culturally persistent beliefs amongst Maori meaning that certain places are avoided or treated with reverence because of traditional associations with powerful ancestors.

Taonga (treasure or valued objects) are another culturally persistent Maori concept. Traditionally the term was employed to determine something treasured in the whakapapa based Maori world. All taonga also had a kawai tupuna or whakapapa that connected it to a kaitiaki (guardian) or atua (ancestors with continuing influence or gods). In modern times the concept of taonga has been redefined by the Courts and the Waitangi Tribunal. It has a legal status that continues to be debated and is, arguably, distant from the original Maori use of the word.

Wahi tapu (sacred place or site) are a form of taonga. Wahi Tapu are sites that were considered sacred for a number of different reasons but primarily due to their association with an ancestor or ancestral events that caused the area to become affected by tapu. The general location of these areas would be known by the people but the laws of tapu would control their behaviour in terms of accessing them. These sites can include the land, sea, forests, lakes and rivers as well as place and things associated with life and death.

To determine exactly what creates wahi tapu and what does not is somewhat problematic. If it was merely ancestral association or connection with an ancestor then the entire country could be considered a wahi tapu but instead there are certain activities or events that lend themselves to this character and, it would be fair to say, in a hierarchical manner.

Wahi Tapu ki te Moana, sacred sites on the water and coast, were also a common occurrence. In the Maori world view, there is much evidence to suggest that certain ocean features had a status assigned to them and in some instances a wider importance is suggested. Cook Straight, for example, is a scared site but it is important to note that despite the entire waterway being considered tapu it does not preclude fishing or utilisation of the ocean space. There is reference to other rituals being observed and kaitiaki within the strait as well.

Mauri is the actual life force connection between gods and earthly matter. The Maori world view is that all things have a mauri including inanimate objects so it can be found in people, animals, fauna, fish, waterways, rocks, mountains. The mauri is, as a life force, is also the generator of the health of a person or place. If mauri is damaged, then the owner or the seat of that mauri is vulnerable or also damaged. However, if mauri is damaged the Maori world view is that it can be restored. There are considered to be many examples of fishing and coastal mauri amongst Ngāti Ruanui.

Effects of the Project on Cultural Values

With regard to the impacts of the project on the mauri of the coastal area, if one considers the coast from a purely traditional cultural perspective as a series of toka and fishing grounds imbued with mauri and tapu the question is then whether project has or will affect the mauri.

If the fisheries have abandoned an area and other life are noticeably absent then the mauri is potentially considered to be damaged. There are other signs of a depleted mauri but tohunga (cultural experts) are best placed to assess the state and consider remedies with regard to cultural effects.

However, if these resources were affected then measures could be taken to restore the mauri using traditional methods. There is no evidence that suggests that the presence of 'foreign' activities along the coastline would not, if impacted, allow the mauri to be re-established although, if totally destroyed or diminished, it is somewhat problematic to fully restore. It is important to note that it can be restored to a certain level where it has been affected.

Where mauri has been affected, a common restoration practice is the use of ritual solutions, including rahui (restricted access or exclusion) or karakia (prayer or blessing), that allow for damaged mauri to be strengthened however, these rituals are not effective if mauri has been destroyed completely.

In contemporary Maori environmental management, tangata whenua have the role of kaitiaki (or guardians) of their coastal resources. As such they have assumed the responsibility to ensure that the mauri (or life essence) of these resources is safeguarded.

A contemporary interpretation of mauri needs to be considered in the context of environmental mitigation and this is an appropriate response to the modern mauri analysis. The basic premise is that mitigation of environmental effects are claimed to be cultural mitigation that draws on Western interventions.

In contrast, if one was to adhere strictly to the traditional metaphysical or spiritual approach to mauri, remedies exist within a Maori world view that would also allow for its restoration. For example, Ngāti Ruanui still employ the ritual restoration as is evidenced in 2013 following the death of a whale on Patea Beach. Local iwi placed a rahui over the site for the period of one month thus restricting certain activities in the area. Further, it is understood that local tohunga continue to monitor the Taranaki coastline and ocean resources and perform karakia to protect the spiritual integrity and ensuring the ongoing health of the mauri.

The CVA identifies one matter that has been difficult to assess is the potential for damage to mauri. TTR is unaware of any submission or evidence from Ngāti Ruanui raising specific issues regarding mauri of particular fishing grounds or fishing reefs provided as part of the previous application process. That said it would be understandable for the iwi to be concerned about such things and to seek reassurance as to what mitigations might be available.

The CVA identifies that the knowledge of mauri can be considered in two parts. Firstly, there is the general religious philosophy of mauri as a life force principle as outlined above. It represents health and vitality and is the key indicator of the state of a fishing ground or hunting area. Secondly is the knowledge held locally about the personal atua, the protective kaitiaki and the form they are known to take and the general observation of the state of taonga species throughout the seasonal calendar. The CVA identifies that despite concerns that may be harboured by the iwi they certainly hold the requisite skills to competently administer appropriate spiritual interventions and direction.

Ngāti Ruanui have submitted that TTR have not paid regard to the taonga status of the Ngāti Ruanui fishery. TTR consider recognition and protection of sacred areas and taonga species to be a priority where they are provided with accurate and credible information. In the absence of any direct engagement by Ngāti Ruanui, TTR have had no choice but to regard the information provided by the Iwi Fisheries Forum (as discussed in Section 4.11.3 below) to have fulfilled this objective.

That said there is currently no indication that any specific traditional fishing grounds have been identified as being threatened by the project. In fact, the CVA identifies that the general monitoring of recreational and commercial fisheries is a comprehensive response to overall fisheries management.

There have been several other concerns raised by Ngāti Ruanui including matters of a technical nature, fisheries impact and consultation. Despite the lack of consultation and engagement, to address the concerns, TTR have included proposals for monitoring, detailed scientific analysis provided where available and opportunities for Ngāti Ruanui to take a central role in monitoring and communication. The CVA identifies that the measures (identified in Section 4.11.4 below and as provided for in the Proposed Consent Conditions provided as Attachment 1 to this IA) proposed by TTR to address the actual and potential cultural effects of the project provide a genuine transparent commitment to meet the concerns raised by Ngāti Ruanui and other tangata whenua within the STB.

One of the concerns left unaddressed are the cultural impact matter. Despite attempts from TTR to work with Ngāti Ruanui to provide a CIA an agreement has not been reached nor has one been produced. On this basis, the CVA, which has been summarised above, is an attempt to provide a comprehensive view of cultural concerns one would expect to be considered in decision making regarding the potential for the project to impact on the cultural values of iwi within the STB.

4.11.3 Te Tai Hauauru Fisheries Forum

The Iwi Fisheries Forum was established through the development of the FMA 8 and in response to the Treaty of Waitangi Fisheries Settlement and the Maori Fisheries Act. The Iwi Fisheries Forum consists of representatives of the following iwi:

- Te Rūnanga o Ngāti Tama;
- Te Rūnanga o Ngāti Mutunga;
- Te Ātiawa Settlements Trust;
- Taranaki Iwi Trust;
- Nga Hapū o Ngāruahine Incorporated;
- Te Rūnanga o Ngāti Ruanui Trust;
- Te Kaahui o Rauru (Ngā Rauru);
- Te Rūnanga o Ngāti Apa (North Island);
- Te Ātihaunui a Pāpārangi;
- Ati Awa ki Whakarongotai Charitable Trust;

- Muaupoko Tribal Authority Inc;
- Raukawa ki te Tonga Trust / Te Rūnanga o Raukawa;
- Te Patiki Holdings Trust Board (Ngāti Hauiti); and
- Tanenuiarangi Manawatu Incorporated (Rangitaane o Manawatu).

As a result of extensive consultation, the Iwi Fisheries Forum provided TTR with the Forum Report on the customary values and matauranga Maori matters affected by the project (refer to Appendix 4.6). This section discusses those values and the means by which TTR proposes to provide for these values.

TTR note that following the release of the Forum Report, Ngāti Ruanui confirmed that they did not endorse the Forum Report or its findings.

The purpose of the Forum Report is to help to bridge the gap between western science and matauranga Maori by better communicating the local indigenous knowledge and identifying aspects that can be incorporated into the monitoring and management associated with the project. The findings of the Forum Report have been used by TTR to develop management and monitoring programmes in partnership with the Iwi Fisheries Forum and fully recognise kaitiakitanga. However, the Forum Report further notes that it is not the role of the Iwi Fisheries Forum to speak on behalf of all those who have mana moana/ mana whenua and that each iwi should also have the right to comment on the application.

The investigations that informed the report involved hui with relevant iwi that have 'mana moana / mana whenua connections' to the STB coastline. The cultural information was shared through Tāngata Tiaki (individuals who authorise customary fishing within their rohe moana) in the discussion on the effects of the project, as well as extensive hui with TTR.

In preparing the report, the approach taken involved the iwi and the Iwi Fisheries Forum examining the updated application and scientific information provided by TTR to assess if the iwi issues have been identified and provided for. Where data gaps or concerns were identified these were presented to TTR to enable them to form recommendations and pathways for involvement in the monitoring of the project and to enhance the iwi role of Kaitiaki or Tāngata Tiaki within the affected areas. Further, the Iwi Fisheries Forum reviewed the past submissions received from Maori on the previous application to *'gain context and possibly further insights into the aspects of the coastal marine area that are valued by Maori and tāngata whenua'* with a focus on matauranga Maori and customary fishing.

The Forum Report identifies that a detailed work programme has been provided (Appendix 1 of the report) and that the process to date has followed the stages below:

- Establish tikanga processes and protocols with the Iwi Fisheries Forum;
- Identify and collect, through wananga, hui and hikoi, matauranga Maori-based concerns and questions that can be used as a basis for analysing current impact assessments; and
- Present those significant customary interests identified in a series of map and through Geographic Information Systems (provided in Section 8 of the Forum Report).

The Forum Report further identifies that *"it does not attempt to provide a comprehensive account of all individual iwi history, whakapapa, connections and tikanga practices within the marine environment. Instead, what we are presenting is an analysis of those customary (tāngata whenua) interests in the coastline through providing sites of significance to customary species or fishing practices."*

The Forum Report places significant emphasis on the Forum Fisheries Plan, which is identified as a MPI recognised iwi management plan that should be considered with regard to any activity occurring within FMA 8 which the project area is located within. The Forum Fisheries Plan is relevant for consideration for any management or monitoring of cultural matters associated with the project with the key principles of the Forum Fisheries Plan being to provide for kaitiakitanga, protection of important and / or taonga customary species, and provision of non-commercial customary fishing for future generations.

The Forum Report identifies there were 27 different sites of significance with regard to customary fisheries shown in the maps in Section 8 of the Forum Report. These sites and the areas in which they are located can be summarised as follows:

- *North Taranaki to Patea* – not considered to be affected by the project. This area does contain significant customary fishing areas that are in contrast to the rest of the Taranaki Bight both from an ecological and cultural perspective and traditionally has been used to collect species such as paua, crayfish, kina, kelp and some fish species. It is recommended that this area is used as a 'control site' for monitoring of customary fishing interests.

- *Patea to Waitotara* – potentially affected by the project. This area has the most ecologically significant customary fishing grounds of the Taranaki area being the North and South Traps and the Rolling Grounds.

  - *North and South Traps* - important customary fishing sites and sites of abundant ecological diversity due to the seabed morphology. The sites are considered significant due to the mauri it contains based on its abundant ecological diversity and the contribution it makes to maintain the health of surrounding areas.

  - *Rolling Grounds* - of equivalent significance to the North and South Traps and are considered to be associated to the mobile sand dune system that occurs offshore. Sites within the Rolling Grounds are seasonal fishing grounds where specific species are targeted at certain times of year. The inter-dune areas or interfluves are considered as important feeding and possibly spawning ground of certain migratory marine fish species (particularly rig) that inhabit these areas.

- *Waitotara to Kai Iwi* - potentially affected by the project. Identified as an important whale nursery or feeding area where certain whale species visit at various times of year.

- *Kai Iwi to Kaitoke (Whanganui)* – unlikely to be affected by the project. A number of sites located along this section of the coastline. The most prominent site would be Tuteremoana, which is a fishing reef and considered by some as a Pa site yet it is clearly a waahi tupuna site (places that are important to Maori for their ancestral significance and their associated cultural and traditional values). The river mouth sites are significant with respect to migratory freshwater species e.g. eel and lamprey. This stretch of coastline is significant as there is a dramatic change in the coastline as it becomes more dominated by a sandy coastline and seabed with species of interest such as rig, kahawai and gurnard. Further, the Ototoka mussel beds were specifically mentioned for not only their mussel resource but also for the fact that iwi have been monitoring and managing that site in accordance with their tikanga to restore this site which has been successful. This is also a present day exemplar for the practise of kaitiakitanga.

- *Kaitoke, Ratana to Tangimoana* – unlikely to be affected by the project. This long sandy coastline is in direct contrast to the Taranaki coastline. Similarly, the sites and the connections with the iwi who occupy and utilise this area are also very different. The shellfish along this coastline takes prominence. It is important to also note that related to the shellfish are the crustaceans and Snapper/Kahawai/Gurnard that are believed by iwi to exist in symbiosis with the shellfish and are hence considered part of an intricate ecosystem. Along this coastline the sand, its movements and the dunes are highly recognised morphological features that play an important part within the culture, history and whakapapa of the iwi. Within these features many fishing camps and fish processing areas were established that formed central points within the iwi social and economic structures. Marine mammals were recognised as being associated with Ratana and this association is well documented.

- *Tangimoana to Manawatu River* – not considered to be affected by the project. This stretch is again similar to the previous coastline but is recognised for more abundant shellfish beds and freshwater fish migrations e.g. whitebait and eel.

- *South of the Manawatu River* – not considered to be affected by the project. While sites in this stretch of the coastline were not mapped it has been suggested that areas directly south of the Manawatu River and specifically toheroa beds provide a good control site. It is considered that these toheroa beds are outside of the affected area and are only impacted by naturally occurring high sediment loads from the Manawatu River. Similarly, the Toheroa is also seen from a cultural perspective as separate from the wider marine ecosystem of the Taranaki Bight and more related to terrestrial freshwater systems.

The Forum Report identifies the following recommendations with regard to the project and providing for cultural values:

1. TTR should develop a formal Memorandum of Partnership ("**MoP**") or Memorandum of Understanding ("**MoU**") with the Iwi Fisheries Forum. As part of this agreement TTR and the Iwi Fisheries Forum will recognise the kaitiakitanga role of the Iwi Fisheries Forum's iwi and develop an agreed upon monitoring plan. TTR should resource the monitoring plan as appropriate.

2. TTR should recognise and actively incorporate kaitiakitanga into its future management and monitoring programmes. This should:

    a. Provide the Iwi Fisheries Forum with the results of its environmental monitoring programme and Including the Iwi Fisheries Forum membership on any environmental review committees;

    b. Provide the Iwi Fisheries Forum members the opportunity to participate in future monitoring operations and research; and

c. Provide the Iwi Fisheries Forum the opportunity to review and provide comment on any environmental management plans.

3. TTR should develop a set of cultural based indicators and sites that should be used for future monitoring and adaptive management processes.

4. The Iwi Fisheries Forum should be engaged and resourced to monitor these sites in accordance with TTR's monitoring process. A list of possible monitoring sites and species are provided below based on this analysis.

Cultural Monitoring Sites	***Indicators***	***Species/ Details***
North and South Traps	Primary Production	Ecological integrity/ diversity/ abundance
The Rolling Grounds	Rig	Abundance and Health
Ototoka	Mussels	Abundance
Whanganui/ Kai Iwi	Gurnard/ Kahawai/ Tuna (eels)	Abundance (particularly the number of eels in glass eel migrations)
Waitotara – Tangimoana	Whales	Occurrences
Moana Roa	Pipi (surf clams)	Abundance and distribution
Pukepuke	Tuna (glass eel)	Abundance
FMA 8	Blue Cod and Snapper	Health of species
Manahi	Reef species	Ecological integrity/ diversity/ abundance
Puketapu	Reef species	Ecological integrity/ diversity/ abundance
South of Manawatu (Hokio)	Toheroa	Abundance and distribution

5. Conditions should be created whereby if negative impacts are discovered through monitoring on the above sites TTR will undertake all practical steps to determine if its activity is the cause of the effect. If TTR is found to be the cause of any negative impact, then actions must be undertaken by TTR through adjusting its activity to mitigate and lessen the impact on the above sites.

a. If the sites or species impacted cannot be rectified by TTR then TTR should mitigate the loss in other ways. This should be formalised in the MOU/MOP.

6. TTR should be required to invest in a financial bond to compensate for any negative impacts on customary fishing activities.

7. TTR will agree to remove all equipment or machinery from the seabed within a reasonable timeframe should there be any event that results in equipment becoming stranded.

TTR has committed to providing for the recommendations in the Forum Report through the provision of the following aspects in the proposed consent conditions included as Attachment 1 to this IA:

1. The Kaitiakitanga Reference Group ("**KRG**") (Condition 34) should include at least one delegated Iwi Fisheries Forum representative as this will provide for the kaitiakitanga role and allow for input into the proposed Kaimoana Monitoring Programme ("**KMP**") (Condition 38), the BEMP and EMMP, as well as enabling

input into the review of environmental monitoring results from a cultural perspective;

2. Further to the inclusion of an Iwi Fisheries Forum representative in the KRG, TTR proposed that an Iwi Fisheries Forum Representative is offered a position in the Technical Review Group (Condition 28). With regard to involvement in future monitoring and reviews, TTR has identified that iwi representatives shall be responsible for the monitoring work under the KMP and the KRG will be provided with monitoring results and asked to review and provide input from a cultural perspective;

3. It is proposed that cultural based indicators be incorporated into the KMP (Condition 38);

4. The parties responsible for the monitoring of cultural sites is provided for through the provisions of the KMP and identifies that iwi representatives shall be provided the opportunity to undertake the monitoring;

5. The proposed conditions provide a mechanism for responding to breaches of pre-determined environmental performance thresholds;

6. Proposed condition 83 provides for a $100,000,000 public liability insurance cover that provides for the cost of environmental restoration in the event that it is required as a result of an unplanned event that has occurred, as a result of the any activities authorised by any consent granted.

7. Proposed condition 64 provides for any machinery or associated equipment lost overboard of any vessel associated with the project, as soon as practicable, be recovered where recovery is viable.

It is considered that through the adoption of the proposed consent conditions, any actual or potential effects of the project on the cultural values identified by the Iwi Fisheries Forum will be avoided, remedied or mitigated.

4.11.4 Cultural Effects Mitigation

Based on the positive consultation achieved with some tangata whenua interests and the directions received with regard to addressing the cultural impacts of the project, TTR has proposed specific tangata whenua focused consent conditions be included in any marine consent and marine discharge consent granted for the project.

While it is accepted that the focus of these conditions is on the 'physical' aspects of the cultural impacts of the project, TTR considers that the proposed consent conditions also are a way to of providing for the 'intangible' or 'metaphysical' cultural impacts (e.g. effects on mauri) associated with the project.

TTR proposes the following conditions with regard to tangata whenua and cultural values:

- That the relationship of tangata whenua with the STB be recognised and provided for through the provision of a Kaitiaki Reference Group. The purpose of the KRG is to:

    - Recognise the kaitiakitanga of tangata whenua and their relationship with the STB;

- Review and advise TTR on the suitability of the KMP (discussed below);
- Provide for the ongoing involvement of tangata whenua, who have a relationship with the STB as kaitiaki, in monitoring the effects of the project;
- Provide for kaitiaki responsibilities and values to be reflected in the monitoring of the project area and of the surrounding marine environment undertaken under these consents, including:
  - To advise TTR on monitoring for change to risk, or threat to the cultural values of the STB;
  - To evaluate the data obtained from physical monitoring insofar as it relates to the cultural values of the STB and the effects on those values from the project and, in the event that changes to effects are identified, advise TTR on possible monitoring or operational responses;
  - To advise TTR on the appropriateness of any operational responses as they relate to cultural values, proposed by others;
  - To provide a means of liaison between tangata whenua and TTR 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 and other tangata whenua groups who have a relationship with the STB.

- Provide for the preparation, implementation and management of a specific KMP with the objective to provide for the monitoring of species important to customary needs, including from customary fishing grounds around the project area and STB, of Maori who have a relationship to the STB;
- Where practicable, TTR will use its best endeavour to engage tangata whenua representatives, including but not limited to Ngāti Ruanui and Te Tai Hauauru Regional Fishing Forum representatives, to undertake monitoring identified in any KMP related to the project; and
- Following the commencement of project operations, TTR will provide Ngāti Ruanui an annual fund of [$TBC] per year to be used for environmental initiatives and/or for the cultural well-being of Ngāti Ruanui.

Conditions providing for the above, as well as further matters related to cultural values, have been provided for in the proposed consent conditions provided as Attachment 1 of this IA.

4.12 Visual, Seascape and Natural Character Effects

4.12.1 Introduction

Boffa (2015) has assessed the natural character, landscape, seascape, and visual amenity values related to the project as well as the potential effects of the project on these values. The findings of their report have been summarised below.

4.12.2 Assessment Methodology

To inform Boffa (2015), visibility mapping using the zone of theoretical visibility approach was undertaken to establish from what location, both onshore and offshore, aspects of the project would be visible. Because the IMV will be in different locations within the project area during its lifetime, two locations were selected for the zone of theoretical visibility analysis, namely:

1) The shoreward limit of the project area (22.2 km offshore) (Figures 4.13 and 4.14 below); and

2) The centre of the project area (28 km offshore) (Figures 4.15 and 4.16 below).

The justification behind this is that the project will be most visible from the shoreward limit, while the centre of the project area provides a theoretical median visibility.

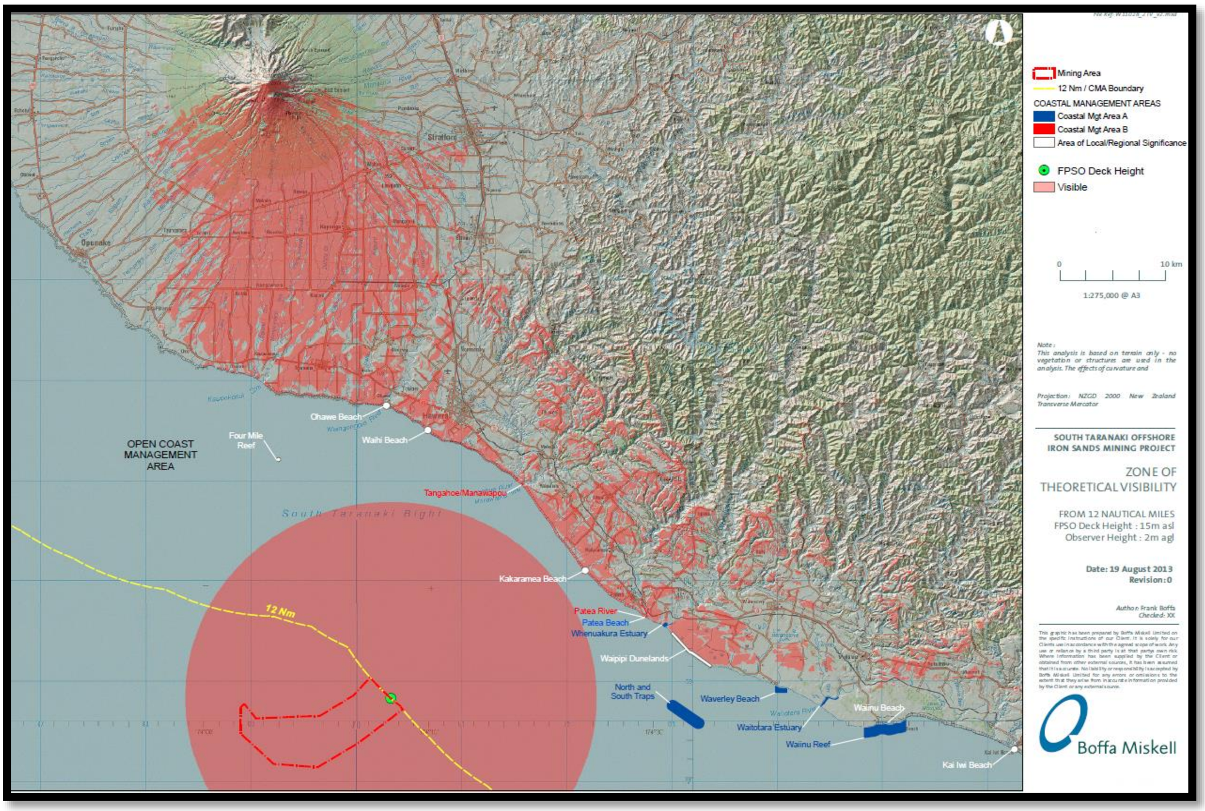

Figure 4.13: ZTV from 12 NM IMV Deck Height: 15 m above sea level, Observer Height: 2 m above ground level

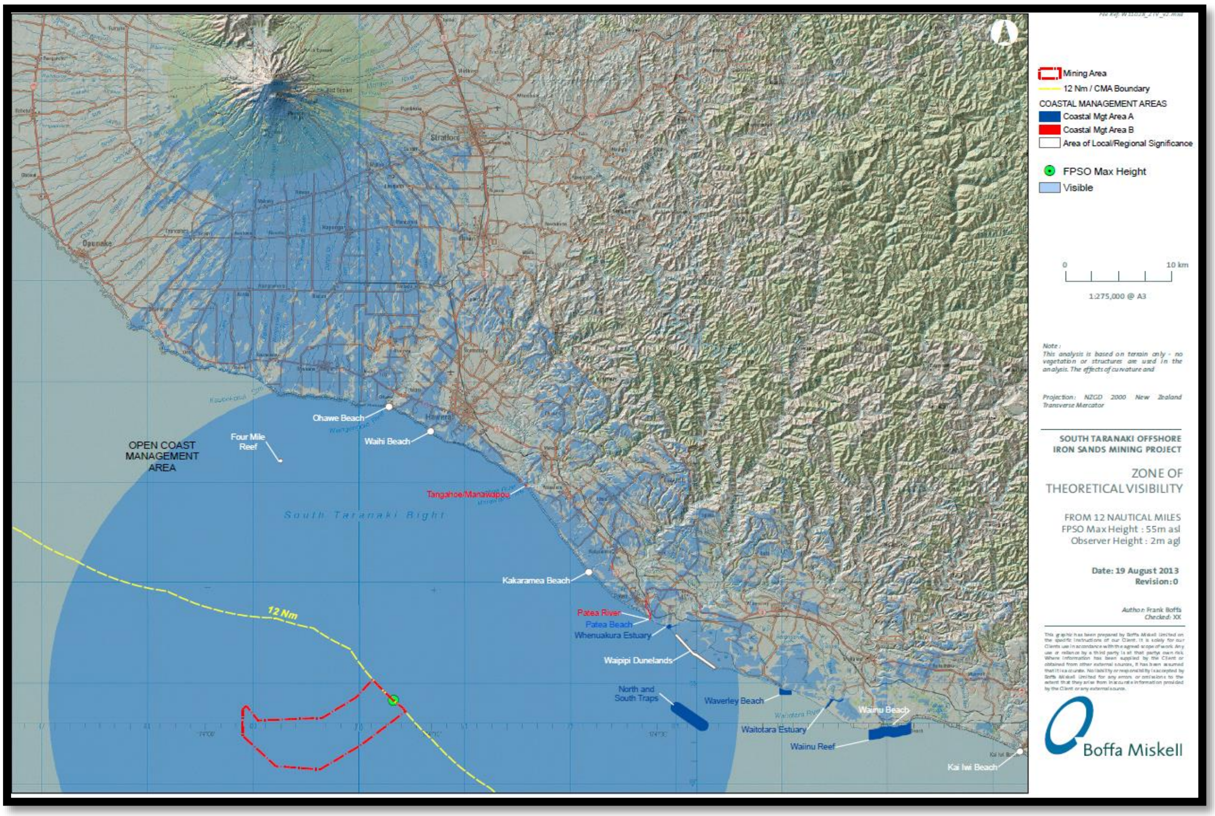

Figure 4.14: **ZTV from 12 NM IMV Deck Height: 55 m above sea level, Observer Height: 2 m above ground level.**

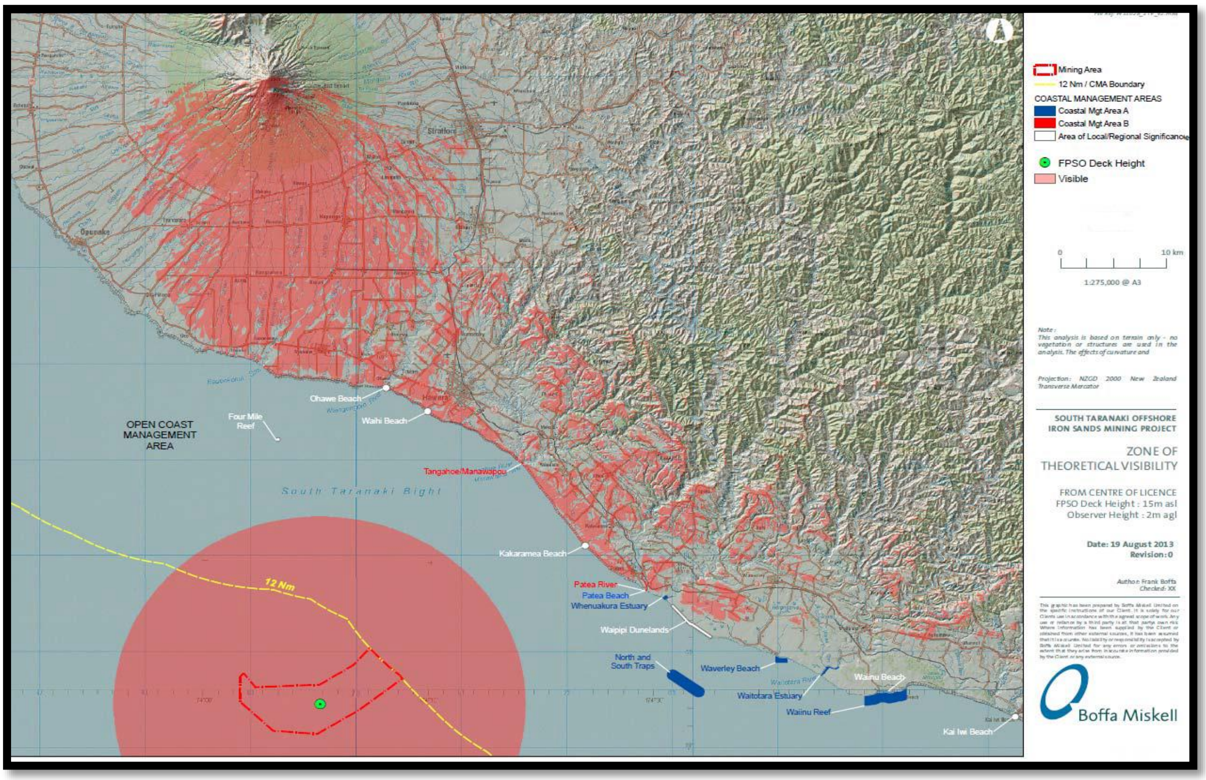

Figure 4.15: **ZTV from centre of Application Area IMV Deck Height: 15 m above sea level, Observer Height: 2 m above ground level.**

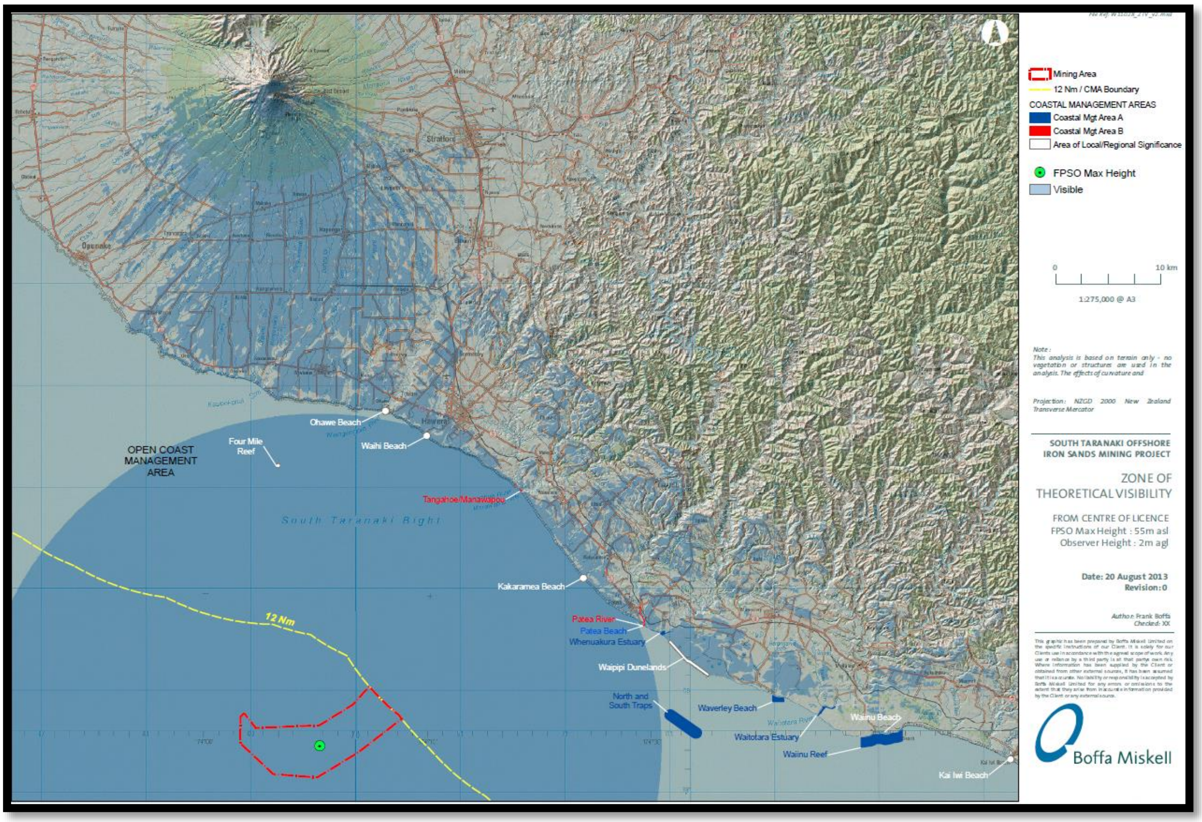

Figure 4.16: ZTV from centre of Application Area IMVIMV Deck Height: 55 m above sea level, Observer Height: 2 m above sea level.

4.12.3 Summary of Potential Effects

As outlined in Boffa (2015), the visual, natural character and landscape effects are categorised as follows:

- Visual effects from specific viewing points and audiences.
- Effects on natural features and natural landscapes.
- Effects on natural elements, patterns and processes (the natural character of the coastal environment).

While the visibility of the IMV will be high from marine areas within 10 – 15 km of the vessel itself, the visual effects are assessed as being low overall and are unlikely to be perceived as being visually intrusive or adverse. While the IMV is large, its associated and smaller support vessels will also be present, and in some cases visible from the coastline for extended periods of time, the surface marine activities associated with the project are considered to be minor overall. Further, where project related vessels are visible, they will likely be seen as an “appropriate” working seascape activity especially in an already busy STB marine environment.

In addition to vessels, the project operations will generate a sediment plume that will extend beyond the project area due to the plume’s transient nature. However, as described in Section 4.4, the presence of the plume will be decreasing as distance from the source of the disturbance increase. The visual effects of this sediment plume are considered to be relatively low, as for the most part the plume will not be visible from land-based viewpoints.

Further, these land-based viewpoints areas already experience a high degree of visual disturbance due to the high energy environments close to the coast.

Boffa (2015) identifies that there is the potential for a visual impact of the sediment plume on recreational boaters but any potential effect will be highly variable and dependent on weather and sea conditions and the offshore location of the recreational vessels. While the size and pattern (scale) of the sea surface colour change may be extensive and significant in its seascape context, its significance in terms of recreational / amenity values will be lower, given the relatively low levels of recreational activity that occurs within the project area. It is important to acknowledge that any sediment plume, however, will only be evident during times when iron sand recovery is being undertaken, which is considered to be approximately 70% of the year, and accordingly this effect is reversible.

Visual effects of the sediment plume on recreational and commercial aircraft will be the most apparent, however, any effects will only be experienced by transient visitors to the area and will be highly dependent on the weather conditions and seas state at the time.

With regard to natural landscape and features, Boffa (2015) considers that the offshore location of the project effectively avoids any direct effects on any areas that have outstanding natural features, landscapes or seascapes within the STB as these areas are typically within the CMA environment. This position is consistent with Policy 15(a) of the New Zealand Coastal Policy Statement ("**NZCPS**") which seeks the avoidance of adverse effects on such landscapes and features in the coastal environment.

Additionally, by working within a defined project footprint, smaller than the total project area, and re-distributing de-ored sediments into already works areas will further assist in avoiding and mitigating the potential for project related adverse effects in the natural landscape and feature values. Overall, Boffa (2015) states that the significance of effects on natural features and landscape is low and can be classified as minor.

Natural character is used to describe that naturalness of an area in terms of its natural elements, patterns and process. The effects of the project on the natural character on the STB coastal environment need to be considered. Boffa (2015) found that due to the location and position of the project area being over 12 NM offshore, the overall effects of the project on the natural character of the area were deemed to fall into the moderate to minor significance category. This position was accepted by the DMC in their decision on the previous marine consent application.[101]

A summary of the effects as a result of the project, with the level of effect outlined in bold, is provided below:

- Offshore Vessels – **Minor**;
- Natural Features and Landscapes / Seascapes – **Minor**;
- Sediment Plumes – **Moderate**; and
- Natural Character – **Moderate to Minor**, however within the vicinity of the project area considered to be major.

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[101] TTR Marine Consent Decision. 15 June 2014. Para 566.

4.12.4 Visual Cumulative Effects

In terms of visible cumulative effects, the sediment plume will not add appreciably to the natural background levels of suspended sediments within the inshore and nearshore coastal marine environments of the STB. There will however, be increased visual effects in terms of the offshore and distant offshore coastal environments where currently there are no visible sediment plumes in the surface water under the majority of the offshore conditions.

Boffa (2015) found that from some CMAs, cumulative effects may be more apparent than others however, given the limited extent of elevated coastal viewpoints and the variability of the plume, cumulative effects are not likely to be perceived as being significant or adverse.

From aircraft, cumulative effects will be apparent and are likely to be widespread in extent but visibility will be directly related to the sea surface state.

Overall, based on Boffa (2015), the assessment is that the significance of any visual cumulative effects will be no more than minor.

TTR's position on the project's impact on natural character, natural features and landscapes being minor to moderate (localised within the iron sand recovery area) was supported by the DMC in their decision on the previous marine consent application, who concluded that visual effects associated with project vessels were minor, any visual effects of the sediment plume would be moderate, and any impacts on natural features and landscape / seascape and natural character, other than within the actual operations area, would be minor, particularly in the inshore and nearshore waters and coastline environments. [102]

4.13 Archaeology and Heritage Effects

4.13.1 Introduction

Clough (2015) assessed the archaeological values of the project area and the potential effects of the project operations.

Clough (2015) focusses on the potential for historic shipwrecks to be discovered within the project area during the iron sand recovery operations.

4.13.2 Assessment Methodology

The Clough (2015) assessment methodology involved:

1. Reviewing multi-beam sonar data collected during bathymetric surveys undertaken by NIWA by covering five locations within the project area;

2. A desk-based review of literature relevant to shipwrecks along the South Taranaki coast to provide historical detail and supplement the bathymetric survey data; and

3. Review of information relating to recorded archaeological sites on the landward side of the South Taranaki coastline close to the project area was also reviewed to provide further background information.

[102] TTR Marine Consent Decision. 15 June 2014. Para 570 - 572.

4.13.3 Summary of Archaeological and Heritage Effects

Clough (2015) identifies that when determining archaeological and heritage effects related to the project, a legally protected archaeological site is defined as a shipwreck or debris that pre-date 1900 and is an indicator of having archaeological or heritage value.

The coastal waters of the Taranaki Region has a detailed history of shipwrecks with at least 126 documented shipwrecks - 64 of which pre-date 1900. Twenty-three vessels are recorded to have been lost in the vicinity of Patea, and 28 in the vicinity of Whanganui. Of the recorded shipwrecks with their known location that pre-date 1900, 14 are in the vicinity of Patea and 20 in the vicinity of Whanganui. However, there are no known shipwrecks located within the project area.

Furthermore, based on the review of the NIWA multibeam sonar data (Pallentin et al. (2015))[103], there is no significant wreckage or any signs of significant debris exposed on the seabed within the project area.

While the location of the numerous documented shipwrecks in the Taranaki Region have not been confirmed, Clough (2015) concluded that there is a low potential risk of wreckage buried beneath the seabed being uncovered during the project operations.

With regard to archaeology and heritage effects, Cough (2015) concluded that:

- There should be no constraints on the project on archaeological grounds, as no shipwrecks are known to be present within the project area;
- The potential for previously unrecorded shipwrecks within the project area is low;
- Further archaeological investigations / monitoring of the project area is not necessary; and
- If a pre-1900 shipwreck is encountered during the project operations, a discovery protocol for shipwreck finds should be implemented.

4.13.4 Management of Potential Effects on Archaeology

Based on the recommendations from Cough (2015), TTR proposes to implement the following protocol in the event of the accidental discovery of a pre-1900 shipwreck during project operations:

- Should a number of artefacts / debris or a substantially intact wreckage be discovered in a discrete area, work would cease in the immediate area while the find is identified;
- In the first instance, efforts will be made to identify what the items are and the likely age of the discovery. This would involve the items being photographed, the location recorded and a recorded description of the find. The collected information would then be sent to an archaeologist consultant for identification and assessment;

103 Pallentin. A., Gerring. P., Wolez. S., Fenwick. M. *"Multibeam Survey in Southern Taranaki Bight. Prepared for Trans-Tasman Resources Ltd"* Updated November 2015

- If the wreckage is not a legally protected archaeological site (i.e. post 1900), a record of the article would be made and works would resume; and

- If a discovery is confirmed to pre-date 1900, it is a legally protected archaeological site under the Heritage New Zealand Pouhere Taonga Act 2014 ("**Heritage Act**"). Consequently, it will be necessary for TTR to contact Heritage New Zealand Pouhere Taonga ("**Heritage New Zealand**") and obtain an archaeological authority before works affecting the site are resumed.

This protocol is reflected in the proposed consent conditions provided as Attachment 1 of this IA.

In their decision on the previous marine consent application, the DMC noted that they did not dispute the conclusions on archaeological and heritage effects and confirmed that there should be no constraints on the project on archaeological grounds. Further, the DMC concluded that the information provided was certain and adequate for assessment purposes and were satisfied that the conditions proposed by TTR would appropriately address any archaeological remains that may have been discovered if consent had been granted.[104]

Overall, the project will not result in any adverse effects on any known archaeological features or heritage values. If undiscovered features are encountered during the project, sufficient procedures will be implemented to ensure that any effects will be appropriately provided for through consultation and, where necessary, approval from Heritage New Zealand.

4.14 Air Quality Effects

4.14.1 Introduction

Tonkin and Taylor Limited ("**T&T**") were engaged to assess the dispersion and effects of emissions from the combustion of HFO to produce energy from the proposed gas turbine (T&T (2015a))[105], or reciprocating engines (T&T (2015b))[106], located on the IMV. These reports provide further information in response to matters raised in the first application process.

4.14.2 Assessment Methodology

Discharges to air from the HFO gas turbines or reciprocating engines comprise combustion products. The air pollutants considered in T&T (2015a & b) included fine particulate matter (PM_{10}), sulphur dioxide, nitrogen dioxide and carbon monoxide from the operation of seven engines located on the IMV vessel, consisting of six 12V46 engines and one R1, seven cylinder engine. The emission rates considered were based on information provided by the proposed engine suppliers, as well as the United States Environmental Protection Agency Applicability Determination Index emission factors and calculations by T&T, using plant and process data supplied by TTR.

T&T (2015a & b) used a 3D meteorological dataset developed for the project area using terrain and land use information, observations from six meteorological surface sites and 3D upper air data developed by another meteorological model. The maximum ground level

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104 TTR Marine Consent Decision. 15 June 2014. Para 579 & 582.

105 Tonkin and Taylor, 2013a *"Offshore Iron sands project – Air Dispersion Modelling Study – Gas Turbines"* T&T Ref: 29303, 31 pp. August 2013. Updated November 2015.

106 Tonkin and Taylor, 2013b *"Offshore Iron sands project – Air Dispersion Modelling Study – Reciprocating Engines".* T&T Ref: 29303, 32 pp. October 2013. Updated November 2015.

concentrations of pollutants were predicted by using air dispersion modelling (the CALPUFF dispersion model) over a 52 km x 40 km grid (100 m grid resolution) surrounding the project area, including the coastline to the northeast of the project area.

The CALPUFF dispersion model was used to predict contaminant concentrations in the vicinity of the project operations. The results of modelling were compared to relevant air quality assessment criteria, including the Ministry for the Environment Ambient Air Quality standards ("**MfE AAQS**") and National Environmental Standards for Air Quality ("**NESAQ**"), to assess the potential effects to human health and the environment.

4.14.3 Summary of Potential Effects

The modelling predicted that maximum offshore ground level concentrations of NO_2 and Sulphur Dioxide ("**SO_2**") (1 hour (99.9%) and 24 hour averages) exceed the relevant New Zealand air quality standards and guidelines (MfE AAQS and NESAQ) (Table 4.12 below).

Table 4.12: Maximum allowable ground level concentrations of contaminants.

Contaminant	Time Average	Maximum Ground Level Concentration (µg/m³)		Air Assessment Criterion (µg/m³)
		Offshore	Onshore	
Particulate matter (PM10)	24 hour	4.4	0.6	50
	Annual	0.14	0.024	20
Nitrogen dioxide	1 hour (99.9%)	313	60	200 (9 exceedances allowed per 12 months
	24 hour	160	22	100
	Annual	5.3	0.9	40
Sulphur dioxide	1 hour (99.9%)	453	87	350 (9 exceedances allowed per 12 months)
	24 hour	231	31	Must not exceed 570. 120
Carbon monoxide	1 hour (99.9%)	75	14	30,000
	8 hour	67	12	10,000

These exceedances are predicted to occur in the vicinity of the IMV and beyond the 12 NM limit therefore, T&T (2015a & b) concluded that the public are unlikely to become exposed to these air discharges. However, there is the potential for staff on board the IMV to be exposed to elevated concentrations of NO_2 and SO_2 however, these discharges will occur from the exhaust system of the vessel which is located well above the working areas of the IMV.

T&T (2015a & b) identify that the predicted ground level concentrations of all contaminants onshore are below the relevant health-based air assessment criteria. It is noted that 20 µg/m³ is the World Health Organisation 24-hour average guideline, which does not currently have any regulatory status in New Zealand.

4.14.4 Management of Potential Effects on Air Quality

In assessing discharges to air, T&T (2015a & b) considered that emissions from fuel combustion for energy production in gas turbines of reciprocating engines will have only minor effects on air quality.

In joint expert conferencing for the first hearing on the first application, held on 26 March 2014[107], experts noted that the air concentrations of SO_2 exceeded the MfE AAQS but the predicted air discharge concentrations for the project would be within the New Zealand Workplace Exposure Standards. Therefore, they concluded that discharges would not impact human health or air quality, have a no more than minor effect and could be addressed by conditions of consent. This was accepted by the DMC in their decision on the previous marine consent application.[108]

To provide for the high SO_2 discharges, the experts agreed that it was appropriate to include a condition that would limit the sulphur content of any fuel used in the project related vessels, being that a content of 3.5% wet weight sulphur content is the appropriate limit based on air quality and health effects.[109] This limit has been provided for in the proposed consent conditions provided as Attachment 1 of this IA.

Further, as identified in their decision on the previous marine consent application, the DMC agreed with the experts that the project's air discharges would have a no more than minor effect and found that the human health effects, of which air discharge effects are associated, were manageable and could have been addressed by consent conditions.[110]

4.15 Effects on Existing Interests

4.15.1 Commercial Fishing Effects

4.15.1.1 Introduction

TTR commissioned Gibbs (2015) and MacDiarmid et al. (2016) to assess the potential impacts of the project on commercial fishing interests present in the STB.

Additionally, to further understand the effects of the project on commercial fishing interests, TTR has also undertaken direct consultation with commercial fishing industry representatives. This consultation process has been summarised in Section 6.3.13 and the assessment of the effects of the project on commercial fishing interests have been summarised below.

Further to the commercial fishing impacts discussed below, the potential impacts of biosecurity effects on aquaculture activities within the coastal waters of Admiralty Bay was also assessed by TTR. An assessment of biosecurity effects is included as Section 4.15.2 of this IA.

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107 TTR Marine Consent Application – Joint Statement of Experts in the Field of Air Quality and Health Effects. 26 March 2014.

108 TTR Marine Consent Decision. 15, June 2014. Para 452.

109 TTR Marine Consent Application – Joint Statement of Experts in the Field of Air Quality and Health Effects. 26 March 2014. Para 30.

110 TTR Marine Consent Decision. 15 June 2014. Paras 483 & 484.

4.15.1.2 Assessment Methodology

In preparing their report, Gibbs (2015) completed a desktop study of the commercial fishing industries in the STB, sorted by fishing method. This was followed by an assessment of the potential impacts on commercial fishing, which are categorised as:

1. Impacts arising from the spatial exclusion of commercial fishing activity;

2. Effects of the project operations on fish species that are caught by commercial fishers in the immediate project area;

3. Effects of the project's extraction activity on fish species that are caught by commercial fishers in offsite areas (e.g. coastal reefs); and

4. Broader impacts, including impacts on quota value and downstream businesses.

MacDiarmid et al. (2016) looked at the catch and effort data from the MPI database "Wharehou" for the study area which includes the project area and used this information to draw conclusions on the commercial fishing activity within the project area.

The data consists of all fishing and landing events associated with any set of fishing trips that reported a positive catch or landing of any species between 1 October 2006 and 30 September 2015. MacDiarmid et al. (2016) summarises the effort and catch for each fishing method over the last nine completed fishing years based on statistical analysis methods and for each of the principal methods of capture, which indicates the spatial distribution of the fishery in the STB. The spatial distribution of the effort and catch was then compared to the estimated area where the suspended sediment concentrations resulting from the project related sediment plume will potentially be above the 2 mg/L threshold (a conservative indicator for that may result in fish avoiding an area, as discussed in Section 4.7.1 and below) 50% (median) and 1% (99^{th} percentile) of the time.

4.15.1.3 Summary of Potential Effects

Species Abundance

During the project operations, commercial fishing may be affected by the abundance of fished species within the project area and in the adjacent coastal waters.

The main driver that has the potential to impact on the abundance of fish within the project area is the sediment plume however, noise and other vessel related effects also have the potential to affect abundance. The sediment plume also has the potential to impact the rock lobster industry along the Taranaki coast.

Section 4.4 of this IA discusses the sedimentation effects and the modelling undertaken to quantify the extent of the area affected by the project related sediment plume.

As identified in Section 4.7.1, 2 mg/L and 3 mg/L are the lowest suspended sediment concentrations that would be avoided by pelagic and demersal fish respectively however, it was noted that acute and chronic impacts would be expected to occur at significantly higher levels. Lowe (2013) reported that suspended sediment concentrations of 35-40 mg/L as being the level that started affecting foraging strategies, and declining condition for juvenile species. Further, a separate study, Page (2014), looking at the fish species avoidance of total suspended sediments on the Chatman Rise provided a comprehensive list of threshold concentrations that showed that most species were only impacted beyond avoidance or a reduction in feeding, at suspended sediment concentrations levels well in excess of 500 mg/L.

With regard to this project, such levels would not be encountered even right at the project's extraction and discharge source or near the seabed where naturally occurring levels are the highest. Appendix 4.7 shows the contours where suspended sediment concentrations are above the 2 mg/L threshold at which marine fish avoid sediments 50% and 1% of the time when extraction occurs at the innermost (Location A) and outermost (Location B) points of the project area.

Displacement of Catch and Spatial Displacement

With regard to the proportion of total catch displaced by the project, MacDiarmid et al. (2016) plots show that the highest level of overall commercial fishing effort in the STB occurs off the coast between Hawera and Whanganui near the 50 m depth contour. The highest concentration of catch is beyond the 50 m contour, reflecting the large catch from the mid-water trawl fishery.

The MacDiarmid et al. (2016) analysis indicated that the bottom trawl and set net fisheries have the greatest amount of overlap with the project area, therefore both of these fisheries will experience some spatial displacement as a result of any exclusion zones around the project related vessels.

While it is proposed that over the requested consent term of 35 years the IMV will recover iron sands from the whole of the project area, 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.

Fishery-specific factors that contribute to impact of spatial exclusion include:

- The spatial distribution of the harvested species;
- The proportion of total catch taken in the excluded area;
- The practicality and cost of catching the species at other locations;
- Cumulative impacts of all spatial exclusions in the fishery; and
- Sustainability and utilisation implications arising from displaced fishing effort (e.g., displaced effort can put pressure on other parts of the fish stock or may increase tensions between recreational and commercial fishers).

The project has the potential to displace set net catch of school sharks within the immediate vicinity of the area being worked. While the overall proportion of school sharks taken from the project area is likely to be small, this fishery is already constrained by regulatory limits to protect Maui's dolphin. This has pushed set net efforts south into the STB and into waters beyond the 7 NM line.

The amount of displaced catch as a result of the project will be relatively small in comparison to the overall catch volumes, as such there will be no negative impacts on quota value, downstream businesses or fish stocks. Further, because of the wide distribution of the trawling fishery any current catch within the project area could, in future, be caught elsewhere with minimal increase in fishing cost.

The specific effects of the project have been considered further below.

4.15.1.4 Bottom Trawling

MacDiarmid et al. (2016) identified that the main species caught by bottom trawling in most years was red gurnard, with 150–324 trawls per year and an average total catch of over 260 tonnes per year for the period. Several other species were consistently caught, including tarakihi, blue warehou, trevally, John Dory, flatfish, leatherjacket, barracoota, and snapper. Target bottom trawling for jack mackerel, although less common than for these other species, produced a total catch for the period of 895 tonnes, similar to that of leatherjacket and barracoota.

Bottom trawling was spread out over much of the STB which includes the project area, with the main areas of effort and catch near the 50 m depth contour, particularly adjacent to New Plymouth, between Opunake and Hawera, south of Whanganui, and in the southwest corner of the study area, to the north of Tasman Bay.

The percentage of species catch falling within the area where suspended sediment concentrations are above the 2 mg/L threshold 1% of the time when project operations occurs at the innermost (Location A) and outermost (Location B) points of the project area, is on average less than 5% for most species.

For leatherjackets and trevally about 5-10% and 7-12% of the total catch respectively fall within the 1% area. The proportion of species catches falling inside the areas where suspended sediment concentrations are above the 2 mg/L threshold at which marine fish avoid sediments 50% of the time is less than 1% for all species.

Based on the MacDiarmid et al. (2016) findings, any effect on the catch displaced from the trawl fishery as a result of the project is likely to be minimal, and is unlikely to result in any wider negative impact on commercial fishing or fisheries. Further, any displaced bottom trawling catch can be caught elsewhere in the FMA 9 with minimal increase to overall cost.

4.15.1.5 Midwater Trawling

MacDiarmid et al. (2016) found midwater trawling in the study area mostly targeted jack mackerel, with a small amount of barracoota, and single trawls targeting hoki. In terms of both effort and total catch, midwater trawling for jack mackerel has been the most important fishery in the area, with almost 90,000 tonnes caught during the period, from just over 4,500 trawls.

Midwater trawling tends to be in deeper water with most reported trawls well beyond the 50 m depth contour and focussed on a region parallel to the coast between Opunake and Whanganui. Fishing effort and catch has been most intense in the northern part of this area.

MacDiarmid et al. (2016) found no overlap between midwater trawling in the STB and the predicted areas affected by the project operations.

4.15.1.6 Set Netting

MacDiarmid et al. (2016) found that set netting in the STB targeted four main species or species groups: rig, school shark, blue warehou, and flatfish; with a moderately consistent level of effort in each year. Other species consistently targeted, but with total catches of 400 tonnes or less, were butterfish, grey mullet, kahawai and yellow-eyed mullet. Several other species were very occasionally targeted.

Set netting was widespread throughout the study area, but focused on the coastline around New Plymouth and between Hawera and Whanganui around or within the 50 m depth contour.

There was a lower level of set netting effort recorded between this latter area and Tasman Bay and also along other parts of the coastline, but no effort or catch recorded in the central south region of the area.

The distribution of set netting catch and effort in the STB does not appear to have changed much before and after the introduction of set-netting restrictions. However, the total catch for all set netting combined in the study area averaged 500 tonnes per year before the set netting restrictions came into effect and 400 tonnes per year thereafter; a decrease of about 20%.

The percentage of species catch for the study area falling within the area where suspended sediment concentrations are above the 2 mg/L threshold, 1% of the time is 17% for rig, 13% for carpet sharks and trevally, 10% for school shark, 8% for snapper, 7% for spiny dogfish, insignificant levels for northern spiny dogfish and common warehou, and 13% for other species combined. The proportion of species catches falling inside the areas where suspended sediment concentrations is above the 2 mg/L threshold 50% of the time is less than 1% for all species.

MacDiarmid et al. (2016) found that the set net catch and effort displaced by the project operation will primarily affect the school shark target fishery. The overall proportion of school shark catch displaced from the project area is unknown but is likely to be small due to the small spatial extent of the active extraction areas where exclusion will occur. MacDiarmid et al. (2016) noted that in the case of set netting, even a small amount of displaced catch may still be perceived as significant by affected fishers because this fishery has been subject to extensive area closures to protect Maui's dolphin.

4.15.1.7 Cray-Fishing

MacDiarmid et al. (2016) concluded that because rock lobsters spend most of the year associated with subtidal reefs, most of the commercial catch is likely to be taken at these localities. However, in winter and summer larger (greater than 1.5 kg) rock lobsters may move offshore to depths greater than 25 m to feed on shellfish such as dog cockles, scallops and horse mussels and commercial fishermen may seasonally target rock lobsters on these shellfish beds.

From what could be attained, MacDiarmid et al. (2016) concluded that it is highly likely that most, if not all, commercial rock lobster fishing within the STB takes place close inshore outside the areas affected by project operations. However, there is the potential for these fisheries to be affected by the project related sediment plumes, this has been discussed further in Section 4.15.1.10 below.

4.15.1.8 Abundance of Commercial Fish Species

The effects of the project on the fish populations and mortality have been discussed in Section 4.7.1. MacDiarmid et al. (2015b) concluded that deaths of demersal and pelagic fish species caused directly by the project are unlikely and that the use of seawater to pump iron sands to the IMV is likely to have negligible effects on the larvae of fish species or their planktonic prey.

Based on these conclusions the project is unlikely to affect the abundance of commercially fished species in the project area or beyond.

4.15.1.9 Spatial Distribution

MacDiarmid et al. (2015b) has suggested that demersal and pelagic fish species will move away from the project operations area due to underwater noise, surface lights, vessel movements and the sediment plume.

As commercial fishing will also be excluded from the project operation area, any temporary change in distribution of commercially fished species at the site is unlikely to have a negative effect on commercial fishing. Such displacement may even mitigate any effects of spatial displacement of fishing activity if the displaced fish are able to be caught elsewhere in the FMA.

Once iron sand extraction in a particular block has ceased, the resumption of commercial fishing in that area will be dependent on the recolonisation of the area by commercially fished species. MacDiarmid et al. (2016) concluded that there is unlikely to be any short or long-term effects on commercial fisheries as a result of changes to fish distribution within an area which has previously been worked. This position is based on:

- The seabed environment in the vicinity of the project operation is highly dynamic, with high rates of natural disturbance;
- The sandy habitats have relatively low species abundance and richness; and
- There is no significant relationship between iron concentration and community structure (meaning that pre- and post-mining species composition is likely to be similar).

In addition, once the project operation shifts to a new area, the worked area will start to recolonise and re-establish rapidly, further demonstrating the short-term nature of any potential effects.

4.15.1.10 Offsite Impacts

Offsite impacts on commercial fishing may occur if the project affects the marine environment in ways that alter the productivity, abundance or distribution of fisheries resources of commercial significance.

If sediment disperses further out into the EEZ (away from the coast), it is unlikely to have an adverse effect on pelagic and demersal fish species as these species are mobile and can move away to unaffected areas. Sediment from the project is therefore unlikely to have an adverse effect on commercial fisheries seaward of the project area, such as the mid-water trawl fishery for jack mackerel and barracoota.

Sediment dispersing onto coastal reefs of the STB may result in reef ecosystems and associated species being affected through physical burial, ablation, clogging of respiratory systems and a reduction of primary production through shading.

The level of impact is dependent on the amount of sediment introduced into the reef environment, the nature of the sediment (e.g. size) and its persistence in the reef environment.

The predominant commercial fishery likely to be affected is rock lobster and impacts include:

- Smothering of juvenile lobsters (juveniles are less mobile and therefore less likely to migrate to unaffected reefs);
- Trophic level impacts (rock lobsters are predatory species and may be affected if their prey is smothered); and
- Impacts on larval dispersal.

The degree of impact on fisheries along the Taranaki coast will depend on the amount of sediment that is introduced into the reef environment over and above the naturally occurring background range, and the persistence of this sediment in the coastal environment. As described in the Coastal Processes section of this IA (Section 4.5), the naturally high levels of wave energy in the STB is likely to prevent the accumulation of additional sediments within the reef ecosystems along this coast.

There are several inshore shellfish species present in the STB that are not currently fished commercially but have the potential to be developed in the future, namely paua and surf clams.

As a sedentary species, paua is unlikely to be able to move away to unaffected reefs and is therefore vulnerable to sediment effects. Paua are grazers and may be indirectly affected if their algal food sources are smothered.

Surf clams are found in, and immediately beyond, the surf zone of exposed sandy beaches, out to 10 m deep. The mobile surf zone environment is unlikely to be affected by sedimentation from the project.

4.15.1.11 Management of Potential Effects on Commercial Fishing

TTR does not propose that commercial fishing be excluded from the entire project area while extraction operations are occurring. Instead a 1 NM buffer from the centre of the IMV, incorporating the IMV, crawler, anchors and FSO vessel, is proposed. This will be a dynamic buffer moving approximately every ten days when the anchor moorings are moved. The establishment of this discrete buffer area within the project area will allow for commercial fishing to occur in the remaining project area.

Additional mitigation measures have been proposed to minimise the impacts of the project on commercial fishing in the STB and include:

- Establishing a coordinated approach between works in the project area and commercial fishing activities;
- Developing a contact list of companies and vessels operating in the project area;

- Designing and implementing a communication system to alert vessel operators to the intended location and duration of project operations on a regular basis;
- Developing a more precise understanding of the location and seasonality of set net effort in the project area, and designing the operational extraction plan to minimise any impacts on this fishery;
- Undertaking the project operations in a manner that minimises the risk of sediment dispersal in the wider marine environment; and
- Enabling a process through which TTR and the commercial fishers can coordinate the development of the iron sand extraction area for the succeeding 12-month period.

In preparing the new application, TTR commissioned both an independent review of the commercial fishery in the STB and undertook extensive consultation with the commercial fisheries industry.

As a result, TTR considers that they have an improved understanding of the potential impacts on the commercial fishing industry. Further, the implementation of mitigation measures and ongoing consultation with the industry will result in effects of the project on the commercial fisheries and the commercial industry being minimised. The mitigation measures, as they specifically relate to commercial fishing and aquaculture, have been provided for as Attachment 1 of this IA.

4.15.1.12 Commercial Fishing Exclusion – Cumulative Effects

Subsequent to approval from MNZ, as discussed in Section 4.15.1.11, TTR is proposing a limited safety buffer zone located around the IMV during project operations. This will occupy approximately 10 km^2, based on a dynamic 1 NM radius around the IMV.

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. As noted in Section 4.15.1.6 of this IA, the overall proportion of school shark taken from the project area is likely to be small.

However, even a minimal amount of displacement may be considered significant by the affected fishers due to the history of spatial exclusion in the nearshore parts of the set net fishery where rig and blue warehou are targeted. Regulatory closures to protect dolphins have pushed additional set net effort south into the Taranaki Bight and outwards into deeper waters beyond 7 NM. These cumulative effects may potentially leave some set net fishers with limited flexibility to respond to even small additional exclusions in the future.

As the amount of displaced catch in both the trawl and set net fisheries will be small, 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 are anticipated as a consequence of spatial displacement.

Overall, the scale of the proposed exclusion area is relatively small in the broader context of the STB. Accordingly, it is considered that the potential risk of any cumulative impact from a navigational sense is low.

4.15.2 Effects on Biosecurity

4.15.2.1 Introduction

Barry Forrest, Senior Marine Ecologist at the Cawthron Institute, assisted TTR in their assessment of the potential biosecurity effects of the project.

Marine biosecurity effects relevant to the project relate to the prevention, detection, and management of NIMS and harmful marine organisms ("**HMO**") that may be on or within project vessels before they enter New Zealand waters. NIMS and HMO are primarily associated with the use and management of ballast waters and vessel biofouling.

In terms of sensitive areas, particular importance was placed on the Admiralty Bay aquaculture industry as this has the potential to be adversely affected by NIMS and HMO due to the potential use of Admiralty Bay for shelter during adverse weather events. Admiralty Bay aquaculture consists of longline mussel farming and it contributes to the NZ$276 million (2014) in exports from the Marlborough aquaculture industry.

It is noted that the biosecurity matters are managed by MPI under the Biosecurity Act 1993 however, consideration of these effects with regard to the project is warranted under the section 59(2)(b)(i) requirements of the EEZ Act that relate to the effects of activities not regulated by the EEZ Act.

4.15.2.2 Summary of Potential Effects

Ballast Water

Ballast water is used on large vessels for balance and is typically pumped in to maintain safe operating conditions throughout a voyage. This practice reduces stress on the hull, provides transverse stability, improves propulsion and manoeuvrability, and compensates for weight lost due to fuel and water consumption. Ballast water is taken on board at the port of departure and commonly discharged upon arrival at the destination.

There is the potential that the project could involve a significant discharge of ballast water in comparison with the volume typically discharged in New Zealand ports due to the CEV arriving empty and departing full. Ballast water and the associated suspended sediment within that water can harbour a wide variety of marine organisms, including NIMS and HMO, at various life stages that have potential to adversely affect New Zealand's existing marine life, and aquaculture industry.

Vessel Biofouling

Vessel biofouling is the accumulation of NIMS and HMOs on the external surfaces of vessels or equipment, and in niche areas of vessels, such as recesses and 'sea chests'[111].

Approximately 87% of New Zealand's 200 NIMS are likely to have been transported by vessel biofouling.

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111 A recess in the hull that provides an intake reservoir from which piping systems draw raw sea water.

Vessels typically accumulate biofouling as antifouling coatings age and niche areas, such as sea chests, can often be significantly fouled, even when marine growth prevention systems are used. Additionally, the operational profile of some of TTR's project vessels (slow moving or stationary for extended periods of time) has the potential to make them prone to biofouling.

Other possible mechanisms involving the transportation of organisms include transportation via the anchors deployed at a range of locations that could result in HMO transfer via sediment movement from one location to the next location.

Aquaculture

The potential for HMOs, especially those transported through vessel biofouling, to establish in Admiralty Bay is of particular relevance to the aquaculture industry. TTR proposes to use Admiralty Bay for shelter during adverse weather events. As such, there is potential for the Admiralty Bay aquaculture industry to be exposed to NIMS and HMO. If NIMS or HMO are transferred into these areas they can have a detrimental effect on the aquaculture activity through adverse effects on growth and contamination of species, and in some cases mortality.

4.15.2.3 Management of Potential Biosecurity Effects

Given the difficulties in addressing NIMS once established, managing the activities that introduce them to New Zealand waters and contribute to their spread is the considered to be the best approach.

In TTR's case this involves ensuring good biosecurity practices for vessel or equipment movements, in particular those vessels originating from overseas. TTR's mitigation methods for biosecurity effects from ballast water and vessel biofouling are detailed below.

Ballast Water

Vessels entering New Zealand waters are required to mitigate risks from ballast water under the Import Health Standard 2015[112] ("**IHS**"), MPI has encouraged operators to adopt these standards for vessels in the EEZ. The IHS stipulates that sediment from ballast tanks must not be discharged into New Zealand waters, this includes sediment that has settled and been removed from ballast tanks and other such equipment.

Additional ballast water management options include ballast water treatment ("**BWT**"). When the IMO Convention for *"The Control and Management of Ships' Ballast Water and Sediments 2004"* comes into force[113] BWT systems will be required on all vessels and the system must, as a minimum, be on the MPI List of Approved BWT systems, or be an equivalent system approved by the IMO. The proposed consent conditions include the requirement for all vessels to have BWT systems on board to the minimum standard identified above.

Further, to ensure that potential effects on aquaculture in relation to Admiralty Bay are minimised, TTR has committed to not discharge ballast water directly into Admiralty Bay, unless under emergency situations and there is no other realistic alternative. This has also

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[112] Ministry for Primary Industries - *"Import Health Standard – Ballast Water from all Countries"* 16 December 2015.

[113] This will occur 12 months after 30 countries ratify the convention, likely to occur in the near future.

been provided for through the proposed consent conditions provided as Attachment 1 of this IA.

Vessel Biofouling

Biofouling on vessels arriving in New Zealand is managed by MPI under the Craft Risk Management Standard[114] ("**CRMS**"), which becomes mandatory in 2018. The CRMS requires that vessels arrive with a "clean hull"[115] as defined in relation to thresholds of allowable macrofouling. For long stay vessels (>21 days), allowable biofouling consists of a slime layer and goose barnacles on any hull surface.

The initial development of the project will involve the import of long stay vessels and equipment from overseas. These will largely remain in place for the duration of the project. In addition to meeting the CRMS for long stay vessels, TTR will ensure that to the extent feasible, vessels and equipment will be "squeaky clean" (i.e. no slime layer or goose barnacles present) upon arrival into New Zealand.

Short stay vessels, such as the CEVs, will be required to adhere to the short stay standards. For these vessels, the most practical way to address biosecurity issues is to follow 'best practice' approaches such as the application of antifoul coatings, the operation of marine growth prevention systems on sea-chests, and in-water inspections with biofouling removal as required.

Further, the IMO guidelines advocate that operators develop a vessel specific Biofouling Management Plan and maintain a Biofouling Record Book detailing all inspections and biofouling management measures undertaken on the vessel. TTR has provided for the provision of a Biosecurity Management Plan consistent with the MPI and IMO guidelines, for each vessel, as part of the proposed consent conditions provided as Attachment 1 of this IA. As part of the Biosecurity Management Plan, TTR will require as a minimum, annual hull inspections with spot cleaning to remove high risk biofouling (including target HMOs), and the inspections and cleaning would include niche areas, such as sea chests, for their project vessels.

Aquaculture

The occurrence of HMOs at the project area itself is unlikely to present a significant risk to aquaculture as the potential for any HMO spreading to Admiralty Bay by natural dispersal is greatly reduced. This is due to the distance and the low suitability of intermediate habitats (deep, soft sediments) between Admiralty Bay and the project area. Therefore, the primary concern is from project vessels entering Admiralty Bay and transferring of such organisms.

The primary management method is to prevent HMOs from entering New Zealand waters, involves ensuring good biosecurity practices for vessels or equipment originating from overseas.

As discussed above, restrictions on vessel entry and discharges within Admiralty Bay and the requirement of a Biosecurity Management Plan prepared for each vessel are provided for in the proposed consent conditions. It is considered that these management approaches

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114 Ministry for Primary Industries, 2014. *"Biofouling on Vessels Arriving to New Zealand – CRMS BIOFOUL"* 15 May 2014.

115 CRMS, Part 2.1(1). Defined under 2.1(2) as *"…no biofouling of live organisms is present other than that within the thresholds below".*

will ensure that any potential biosecurity effects that may result from the project are negligible.

4.15.2.4 Summary

Overall, with regard to the project's biosecurity effects, the potential risk to Admiralty Bay and regional aquaculture values is small as the risk arises from infrequent and short duration visits by vessels seeking shelter within the area.

If the border management measures outlined above are implemented, the potential for TTR project vessels to transport new-to-New Zealand HMO is extremely low.

Overall, provided the proposed measures are implemented and complied with, it is considered that any biosecurity effects related to the project will be negligible.

4.15.3 Recreation and Tourism Effects

4.15.3.1 Introduction

As outlined in Section 3.11.2, Greenaway (2015) identifies the recreational and tourism activities that occur in the STB, and assessed how the project would affect tourism and recreational values and users.

Greenaway (2015) is based on an extensive literature review, outcomes from consultation meetings and stakeholder interviews, a coastal recreation survey and site counts, a low-level overflight of the STB and project area, site visits, and a review of relevant technical reports prepared for the project.

Overall, the STB is a regionally important setting for marine recreation activities, in particular, fishing, diving and surfing. The extent of the sediment plume produced by the project and the impact of the project on wave characteristics, coastal morphology and stability have been covered in Sections 4.4 and 4.5 respectively.

The potential impacts on the recreation and tourism activities within the STB are discussed below.

4.15.3.2 Summary of Potential Effects

Greenaway (2015) identified that the regionally important coastal and marine recreation and tourism settings in the STB are centred around the main public access and activity points, located at Ohawe Beach, Waihi Beach, the mouths of the Tangahoe and Manawapou Rivers, Patea, Waipipi, Waiunu, Kai Iwi and Castlecliff. Further, the STB recreational areas include the coastal fishing and cray-fishing resource extending approximately 20 km off shore (at The Traps and Graham Bank). On the coast, the level of shellfish gathering is difficult to quantify, but Greenaway (2015) considers it a locally important recreational activity.

The coastal and near coastal areas extending north from Patea to Cape Egmont are relatively lightly fished in comparison to that south of Patea and in the North Taranaki Bight. Greenaway (2015) found that very little recreational fishing occurs more than 20 km offshore along the entire west coast of the North Island and within the vicinity of the project area.

Tourism activity in the STB region is limited to six beach camp sites and three fishing charter operations, one operating from Whanganui and the other two from Patea.

Greenaway (2015) concluded that the various scales (shown in bold below) of potential effects of the project on recreation and tourism interests as a result of the project are:

- Changes to water clarity from the project – **Minor** (see Section 4.4.3).

  Potential effects related to water clarity include:

  - Turbidity effects, underwater visibility and the smothering of biota;
  - The location of the sediment plume in relation to diving and recreational areas and the effects of increased sediments on reef systems; and
  - Resuspension of returned sand (loose mining tailings) during storm events or other wave actions and the potential for long-term turbidity effects.

- Changes on coastal wave pattern of surfing breaks – **Minor** (see Section 4.5.2).
- Changes to sediment budget and the effects on beach and sand bar replenishment – **Minor** (see Section 4.5.1).
- Recolonisation rates of biota in the project area and trophic effects on the recreational fishing resource – **Minor** (see Section 4.6).
- Toxicity of returned sand to the seabed and effects on biota and in turn the recreational fishing resource – **Minor** (see Section 4.6).
- The effects of the new development on the ‘clean green’ environmental reputation of New Zealand and the “100% Pure” tourism brand – **Minor**.

4.15.3.3 Management of Potential Effects on Recreation and Tourism

Due to the minor effects on recreation and tourism there was little consideration of effects, mitigation and management in Greenaway (2015) and on this basis, there are no conditions included in the proposed consent conditions that related to adverse effects on recreation and tourism.

The one exception is that recreational fishing has been included as a parameter to be monitored in the proposed BEMP and EMMP for the project to assist in expanding the data source on recreational fishing within the STB.

Further to the above, the DMC findings on recreation and tourism effects as part of their decision on the previous marine consent application, concluded that it was considered unlikely that the project would impact New Zealand’s global tourism reputation on the basis that the effects of the project were consistent with those described in the application.[116]

[116] TTR Marine Consent Decision. 15 June 2014 – Para 711.

4.15.4 Navigation and Commercial Shipping Effects

4.15.4.1 Introduction

As identified in Section 3.11.3, Marico (2015) undertook a comprehensive investigation of marine traffic movements and navigational safety within the STB.

R N Barlow and Associates Limited was engaged to further provide an assessment of the maritime and navigational impacts of the project (Barlow (2015)[117].

The following section contains a summary of the navigational safety and commercial shipping effects related to the project and within the STB based on the Marico (2015) and Barlow (2015) reports.

4.15.4.2 Assessment Methodology

In preparing its report, Marico (2015) reviewed 12 months of AIS transponder data (which records vessel movements) in the STB. The only vessels missing from the data set were small, typically recreational, vessels not fitted with AIS transponders.

4.15.4.3 Summary of Potential Effects

Both Marico (2015) and Barlow (2015) found that there was considerable variability in shipping activity, but that data showed that the project area has low levels of existing transit activity.

There are well demarcated shipping routes for dry cargo and liquid tanker transport between New Plymouth, Nelson and through the Cook Strait, and these routes are well away from the project area as the area is not located in the most direct route between these ports.

Near project traffic density was found to be generally low to very low, with only a handful of vessels transiting through the project area in the 12-month data period (58 vessel movements in the 12-month period or one movement every six days). The majority of vessels operating adjacent to the project area were engaged with servicing the Kupe gas rig operation.

Barlow (2015) considers the project area is located in an area of very low traffic density and the project would have very little impact, if any, on navigational safety in the STB. Additionally, the IMV and project related vessels will typically be located within smaller, 900m x 900m, working blocks within the 67 km^2 project area.

Additionally, the project area is removed from regular marine traffic routes and activities, and Barlow (2015) considers that it would not be in conflict with other marine traffic and commercial shipping activities in the STB area.

The data collected has shown there to be both a low number of vessel encounters, indicating a low risk of collision and the marine environment provides for sufficient space for vessels to navigate around the project area at a safe distance.

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[117] Barlow, R. N. 2015. *"Trans Tasman Resources Ltd, South Taranaki Bight, Offshore Iron Sand Extraction and Processing project – Report on the Maritime and Navigational Impacts of the project"* November 2015.

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.

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.

4.15.4.4 Management of Potential Effects

Given the low level of marine traffic through the project area, Barlow (2015) considers that the project could use standard marine watch-keeping systems to avoid interface with other vessels. Based on the existing marine traffic data there is no need for any remote management of vessel traffic through the project area. TTR will ensure that all vessels involved in the project are fitted with AIS data transponders to assist in the management of marine traffic.

With regard to protocols for transferring of fuels, during the joint expert conferencing[118], the following management protocols were agreed:

- All other vessels contracted for bunkering and the associated machinery will be of relatively recent design and will comply with international standards;
- System designs will be informed by international best practice in bunker fuel handling, formal risk analysis and assessment, and will incorporate all reasonably practical measures to ensure safe bunkering and fuel transfer, and also to enable safe vessel and iron sand recovery operations;
- The operating procedures for fuel transfers should be incorporated into the “Project Safety Case” and approved by MNZ;
- Hydrodynamic studies should be undertaken for transfer operations to ensure the operating procedures and upper operating limits are properly determined during the risk analysis and Hazard and Operability Study;
- In addition to prevailing and forecast meteorological conditions, transfer operations carried out away from the project area must be undertaken in a manner that does not create a navigation hazard to shipping and occurs out of recognised shipping routes.
- Transfer operations should be undertaken with the receiving vessel at anchor or under the dynamic position system or making steerageway only;

118 Joint Statement of Experts in the Field of Navigational Safety dated 26 March 2014, para 25.

- The project operations manuals and contingency plan should be constructed around a comprehensive "Project Safety Case", which should be applied to all project operations.

- The "Project Safety Case" should also provide the basis for applications to MNZ for fuel and product transfer operations at sea, as required under the Marine Protections Rules Part 103[119].

Various management protocols have been proposed to further ensure that effects on navigation are mitigated and, where possible avoided. The measures have been addressed through the requirement of a Collision (Loss of Position) Contingency Management Plan for the project which has been provided for through the proposed consent conditions provided as Attachment 1 of this IA.

Further to the traffic issues, due to the nature of the project there is the potential for items to be dropped overboard from project related vessels. These items have the potential to impact on other marine traffic particularly bottom trawlers. In order to address any potential impacts, as part of the operational protocols, TTR requires that if any item, equipment or machinery greater than 1 m x 1 m in size is lost overboard from any project or operational vessel, it shall be collected from the seabed as soon as is practicable.

Where it is not practicable to recover the item, TTR will record the location and depth where the item was lost overboard and the type of item lost. This information will then be provided to the EPA, the Coastguard and the Harbour Master (if within the 12 NM limit) and placed on the TTR website within 24 hours of the item going overboard. It is considered that this protocol will ensure that any potential adverse effects that may result from items being lost overboard will be avoided. This has also been provided for in the proposed consent conditions.

When considering the above information and the proposed management protocols, the overall effects of the project on navigation and commercial shipping are considered to be no more than minor. This position was supported by the DMC in their decision on the previous marine consent application, who concluded that their findings on marine traffic effects are likely to be no more than minor. [120]

4.15.5 Effects on Other Existing Interests

4.15.5.1 Kupe JV

As discussed in Section 3.11.5, Kupe JV are a party with an 'existing interest' that may be affected by the project. However, TTR's mineral mining permit (no. 55587) contains clauses 11 to 17 that provide for the interaction between the project and Kupe JVP. On this basis it was generally accepted by the DMC as part of the previous marine consent application by TTR, that Kupe JVC's interests have been recognised and provided for in the mineral mining permit.[121] Their interests have been considered further through consultation with Origin Energy (the operators of the Kupe JVP field) as discussion in Section 6.3.12 of this IA and additional measures have been incorporated into the proposed consent conditions included as Attachment 1 of this IA.

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119 Maritime New Zealand *"Marine Protection Rules Part 103: Notifications – oil & noxious liquid substance"* Retrieved 1/12/15. http://www.maritimenz.govt.nz/Rules/List-of-all-rules/Part103-marine-protection-rule.asp

120 TTR Marine Consent Decision. 15 June 2014. Para 726.

121 TTR Marine Consent Decision 15 June 2014. Para 720.

4.15.5.2 Existing Marine Consent Holders

As discussed in Section 3.11.6, there are four parties who currently hold existing marine consents under the EEZ Act. While all of these marine consents are considered existing interests in accordance with section 4(b) of the EEZ Act, it is noted that three of the existing marine consents will likely be expired by the time iron sand extraction activities occur within the project area, following the proposed baseline monitoring programme of two years, therefore they are not deemed to be affected by the project.

Further, Figure 4.17 below shows the oil and gas fields of the Taranaki Region which the existing marine consents relate to. The TTR project area is located next to the Kupe field and is in excess of 50 km away from the sites related to the existing marine consents, particularly those linked to the Maui natural gas field. Based on the assessment of effects in Section 4 of this IA, any effects of the project will generally be localised around the project area with the potential for the sediment plume to extend towards the coastal environment. Therefore, it is not considered that the existing marine consent holders are affected by the project.

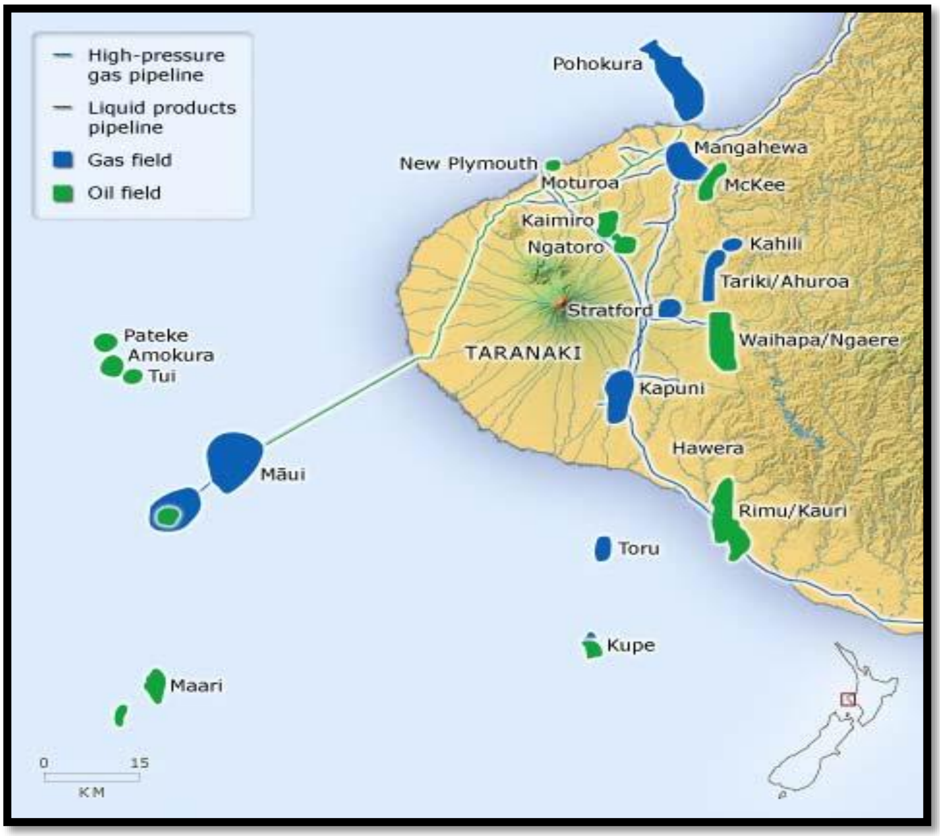

Figure 4.17: A general indication of the Taranaki Region's oil and gas fields. The TTR project area is located adjacent to the Kupe field in the bottom right of the image.

4.15.5.3 Settlement of a Contemporary Claim

As discussed in Section 3.11.9, there are 'existing interest' considerations for parties with regard to the settlement of contemporary claims under the Treaty of Waitangi. The Maori Commercial Aquaculture Claims Settlement Act 2004 provides for the settlement of contemporary Treaty of Waitangi claims to commercial aquaculture. TTR note that within the STB there are no aquaculture settlement areas gazetted but is it noted, while not affected as part of the project, Ngati Koata have interests in the Marlborough Sounds.

The effects of the project on Ngāti Koata interests (the potential for biosecurity effects on aquaculture) is discussed above in Section 4.15.2 of this IA and concluded that any effects of the project will be appropriately avoided, remedied or mitigated through the proposed consent conditions which have been prepared following consultation (refer to Section 6.3.7) with Ngāti Koata.

4.16 Other Considerations

4.16.1 Environmental Monitoring Activities

4.16.1.1 Introduction

As previously described in the IA, a BEMP and an EMMP have been developed for the project. Both of these documents provide for a range of individual monitoring programmes to ensure that any project related effects are detected and quantified for the various environmental receptors in the STB. The following environmental monitoring activities are proposed to occur in the EEZ:

- Deployment of moored equipment;
- Vertical profile measurements;
- Acoustic surveys;
- Water sampling;
- Zooplankton sampling;
- Epibenthic surveys via video transects and drop cameras;
- Benthic grab sampling; and
- Bathymetry surveys.

Table 4.13 below provides a summary of the environmental monitoring components which will take place during the BEMP and EMMP, and defines which activities will be undertaken in the CMA and the EEZ.

Table 4.13: Summary of individual monitoring programmes and techniques.

Monitoring techniques (with the potential to physically interact with the seabed and/or water column)	**Individual Monitoring Programmes**											
	Water quality/sedimentation	**Model validation**	**Oceanography**	**Primary productivity**	**Zooplankton**	**Subtidal benthos**	**Subtidal/intertidal reefs**	**Marine mammals**	**Underwater noise**	**Kaimoana**	**Will this occur in EEZ?**	**Will this occur in the CMA?**
Deployment of moored equipment (turbidity loggers, PAR sensors and Aqua Troll units, LSST frames, ADCP / AWAC meters, sediment traps, acoustic devices for marine mammal detection, sea noise loggers)	✓	✓	✓	✓				✓	✓		✓	✓
Vertical profile measurements (Chl-a, conductivity, temp, pH, PAR, SSC, DO, depth)	✓	✓		✓							✓	✓
Acoustic surveys (underwater noise compliance)									✓		✓	✓
Water sampling (metals, nutrients, conductivity, temp, pH, turbidity, clarity, colour, phytoplankton and micro-zooplankton)	✓	✓		✓							✓	✓
Zooplankton sampling (zooplankton)					✓						✓	✓
Epibenthic surveys (Video tows and remote drop cameras)						✓	✓			✓	✓	✓
Benthic grab sampling (macrofauna and physio-chemical surveys)						✓					✓	✓
Bathymetry surveys in EEZ (Seabed mapping of project area and reef mapping)			✓				✓				✓	✓
Diver Surveys and hull cleaning (for routine maintenance)											✓	X

Each monitoring activity and the potential effects of the activity are summarised below.

4.16.1.2 Deployment of Moored Monitoring Equipment

As part of both the baseline and environmental monitoring programme, the deployment of semi-permanent monitoring equipment will be required.

Mooring of the Equipment

Specific mooring configurations that will be utilised for each deployment is still to be confirmed but the typical configuration will consist of the following; each mooring will consist of two large anchor blocks with a heavy chain connecting the two which will be connected to a surface buoy that will be appropriately marked (i.e. flashing lights, coloured yellow, radar reflector) and suitable for the weather conditions the buoy will experience within the STB.

The footprint of the mooring blocks placed on the seabed for noise monitoring is likely to be between 1 m^2 to 2 m^2 and between 4 m^2 to 8 m^2 for the water quality and sedimentation monitoring moorings.

The instruments will be attached below the surface buoy and on the seabed to record all the required data. Following deployment, a 'Notice to Mariners'[122] will be issued for each mooring deployment and those moorings that are placed within the CMA will go through the requisite consenting process with the TRC.

Additional ground line moorings for some instruments may be used, which are spatially separated from the mooring blocks by a ground line to a weighted plate or similar which is also deployed on the seabed. The weighted plate is likely to have a footprint of approximately 0.6 m^2 and could weigh up to 150 kg. The ground line between the two mooring components could be up to 100 m in length and would typically consist of a 12 mm double braid sinking rope.

Potential Effects

Localised disturbance to the seabed will occur during the deployment of each mooring. This disturbance will involve the crushing of any sessile benthic organisms or displacement of mobile benthic and epibenthic organisms in the immediate vicinity of the mooring as it makes initial contact with the seabed.

Once moorings are established, any disturbance to the seabed is expected to be minimal as equipment will be static on the seabed, and given the mobile nature of the sediments in the STB it is likely that the moorings and chain will become covered by sediment. If the mooring blocks are not covered, they may provide suitable settlement habitat for benthic invertebrates due to the presence of a hard substrate in an otherwise mobile sandy benthic environment.

Where ground line moorings are used the ground line will be sufficiently weighted that it is likely it will settle into the substrate and remain stationary, therefore minimising the potential to drag across the seabed causing disturbance.

The total area of seabed disturbed by each noise monitoring mooring deployment would be in the order of 2 – 4 m^2. It is initially proposed that two moorings for monitoring noise will be deployed in the EEZ resulting in a total disturbance of approximately 4 – 8 m^2 of seabed from the placement of the mooring block. This would increase as other additional moorings are deployed as part of the environmental monitoring programme. For each water quality and sedimentation mooring that is deployed the total area of disturbance would be in the order of 4 m^2 to 8 m^2 for each deployment.

Given the mobile nature of the sediments in the STB, the opportunistic species that have been found to occur there (i.e. polychaetes) and the fact that no extremely sensitive habitats or species have been found to date surrounding the project area, any environmental effect on the marine benthic environment from the placement of the mooring blocks in the EEZ is considered to be negligible.

122 http://www.linz.govt.nz/sea/maritime-safety/notices-mariners

4.16.1.3 Vertical Profile Measurements

Potential Effects

Vertical profile measurements will be collected from 19 sampling sites in the EEZ on a monthly basis during the BEMP and will increase to a fortnightly basis once iron sand extraction activities commence. The effects of vertical profile measurements will be negligible as all measurements are instrument based, and the sampling equipment will only be present in the water column for the period of time taken to deploy the water sampler to the required depth, gently touch the seabed and then to subsequently retrieve it to the surface.

4.16.1.4 Acoustic Surveys

Potential Effects

Any effects from acoustic surveys on the water column will be negligible as no physical sample is collected, the hydrophone will not come in contact with the seabed and will only be present in the water column for a short period of time at each distance set back (approximately 1 hour).

4.16.1.5 Water Sampling

Potential Effects

Water samples will be collected from 19 sampling sites in the EEZ on a monthly basis during the BEMP and on a fortnightly basis once iron sand extraction activities commence. Approximately 5 L of water will be collected for both seabed and surface samples resulting in approximately 30 L of water collected at each sample station. Not all 30 L will be used for laboratory testing and the remaining water will be discharged back over the side in the same location it was collected. Therefore, from the 19 sample sites within the EEZ, each sampling event will remove approximately 570 L of water from the STB.

Given the size of the STB, the effects of the water take as a result of the sampling will be negligible on the marine environment. Further, the sampling equipment will only be present in the water column for the period of time taken to deploy the water sampler to the required depth and to subsequently retrieve it so there will not be any effects associated with that aspect of the monitoring.

4.16.1.6 Zooplankton Sampling

Potential Effects

The removal of all zooplankton captured in each descent of the net through the water column is inevitable and although this may represent hundreds of individual animals per descent, the scale of this impact is negligible given the very low volume of water column sampled during zooplankton tows compared to the volume of water and the natural variability in zooplankton populations within the STB.

Zooplankton species are typically short-lived with high reproductive outputs which allow them to persist in marine environments where the constant threat of predation is overcome by high mortality rates. These life history strategies mean that zooplankton species are resilient to environmental disturbance.

The effects of zooplankton sampling will be negligible and sampling equipment will only be present in the water column for the period of time taken to deploy the net to the required depth and to subsequently retrieve it. The sampling net will not make contact with the seabed due to the procedures that will be in place to ensure this therefore, any effects as a result of zooplankton sampling will be negligible.

4.16.1.7 Epibenthic Surveys

<u>Potential Effects</u>

In the large part, the intention of the drop camera and video tows is to operate them just above the seabed, which will:

- Minimise disturbance to the seabed; and
- Facilitate better imagery through the reduction of suspended sediment associated with seabed contact.

Given this proposed methodology for seabed observations, minimal disturbance to the seabed is predicted to occur.

4.16.1.8 Benthic Grab Sampling

<u>Potential Effects</u>

The double Van-Veen has a maximum sample depth of 0.16 m and in harder sand sediments additional weight can be mounted to the frame of the grab to ensure sufficient penetration to collect the required depth/volume. For the grab sampler, each sample collected will disturb 0.2 m^2 of seabed and will remove 0.02 m^3 of substrate, and as each site is sampled in triplicate, this will represent a disturbance of 0.6 m^2 and removal of 0.06 m^3.

Using the proposed benthic sampling approach, in the first three years of monitoring there will be 19 sites within the EEZ. This equates to 11.4 m^2 of seabed disturbed and 1.14 m^3 removed for every sampling programme, and to enable an assessment of seasonality, the benthic sampling programme will be undertaken quarterly. Therefore, for each monitoring year the benthic grab sampling will disturb an area of 45.6 m^2 and will remove 4.56 m^3 of seabed. Following the completion of the iron sand extraction programme there will be four years of environmental monitoring taking place or until a point which the EPA approves for the monitoring programme to cease.

After each year of iron sand extraction, in order to assess the recovery of the benthic environment (both sediment structure and infauna/macrofauna) three additional sampling sites will be included in the area when extraction has recently occurred. Therefore, after the first three years, the increase in area of disturbance each year will be 1.8 m^2 and 0.18 m^3 removed.

Grab samplers are routinely used for deep water monitoring in the marine environment and each deployment will result in a slight depression in the seabed once the sample is removed; however, due to the benthic currents observed in the STB, these depressions are not likely to remain for long.

The scale of these discrete sampling events is very small when considered in the context of the large area over which it will occur; whereby the 19 sampling sites are sparsely spaced over a total area of approximately 400 km^2. Hence, given the scale of the monitoring programme it is considered that the small amount of disturbance will have no significant environmental effects on the benthic environment. There have not been any known taxa or communities of special conservation or scientific interest identified thus far that could be influenced by the placement of the sample site within the environmental monitoring programme.

4.16.1.9 Bathymetry Surveys

Potential Effects

Despite the fact that Multi-Beam Echo Sounder ("**MBES**") surveys produce sound waves, there are currently no requirements under the DOC's 'Code of Conduct for Minimising Acoustic Disturbance to Marine Mammals from Seismic Survey Operations'[123] in relation to undertaking MBES surveys. Likewise, it has been determined from previous surveys that operators conducting MBES surveys have not had to comply with the EEZ Act. For this reason any effects of MBES surveys on the marine environment are considered to be negligible.

4.16.2 Anchor Deployment and Positioning

Anchoring of the project related vessel, primarily the IMV, will cause direct disturbance of the seabed during anchor placement, removal and re-deployment. No sensitive marine habitats have been identified in the anchoring area and IMV anchoring will occur in the vicinity of the extraction area which itself will be subject to significant disturbance.

The anchor deployment for the IMV involves installation of four standard Stevpris-type anchors, each attached by anchor chain and 90-110 mm diameter, tensioned steel cables directly to the IMV. The anchors are moved during the course of the crawler extraction programme (Section 2.3.3.2), but other than the direct disturbance caused by the anchor placement, removal and redeployment, the anchor system will have only a limited range of sweep during project operations. This four-point anchoring system will have a lesser environmental effect than conventional anchoring with a 360 degree sweep.

Furthermore, anchor deployment will be largely within areas which will be or have been subject to extraction and re-deposition so that effects of anchoring will be negligible considering these areas would have already been, or will be, subject to seabed disturbance and sediment removal.

There will be some areas of seabed disturbance outside of the project's extraction area but this will be restricted to when the IMV is working the extraction lanes adjacent to the project boundary. This will require the laying of anchors outside of the project area for short periods of time until the IMV moves further into the project area. Any disturbance associated with this anchor placement is considered to be no more than minor as the surrounding seabed is typical soft sand and sediments and any anchor sweep will be minimal.

There is the potential for there to be an effect on the benthic environments surrounding the project area however, the risk of adverse effects is considered to be low due to the area of disturbance when considered against the total seabed area within the STB.

[123] http://www.doc.govt.nz/Documents/conservation/native-animals/marine-mammals/seismic-survey-code-of-conduct.pdf

4.16.3 Unplanned Oil Spill Events

4.16.3.1 Introduction

TTR's application process is not requesting consent from the EPA to authorise any unplanned oil or fuel spills as these activities are regulated by the Maritime Transport Act. However, TTR considers it prudent to assess the potential effects of such an activity as part of this IA in order to understand what type of controls and mitigation measure should be incorporated into the operational management plans as part of the project.

The potential ecological effects of unplanned oil spills relate to the ecotoxic characteristics of spilt material and in the case of oil spills, to physical smothering of mobile and sessile marine biota. Therefore, it is necessary to understand the expected trajectory of any oil spills if an unplanned discharge event occurs to identify which environments are likely to be impacted, as this enables more detailed contingency planning and mitigation measures to be provided for in the event that an unplanned discharge activity does occur.

4.16.3.2 Oil Spill Trajectory Modelling

As part of the first application process, in order to better understand the likely oil spill trajectory, TTR engaged MetOcean Solutions Limited to prepare an oil spill trajectory report (MetOcean (2104))[124] which used modelled data to predict the trajectory of varying sizes of spill events.

To inform MetOcean (2014), an 11-year database containing all the likely trajectories for an oil spill from the IMV located in the centre of the project area was produced. Oil spills were tracked continuously from 1999 to 2009 until they beach or leave the modelled region. This technique provides a robust statistical basis to quantify the most likely pathways for oil in the unlikely event of a spill from the IMV (another project related vessel), and from this knowledge an assessment of the coastal areas that are most likely to be affected can be reliably determined. Results from the trajectory database were examined for the seasonal conditions, showing the relative probabilities for beaching and statistics for beaching times.

MetOcean (2014) identified that the hydrocarbon used in the modelling was 380 HFO as this is consistent with what will be used by the IMV. Modelling outputs showed that weathering of this oil is expected to result in around 20% of the released volume evaporating or being dispersed 120 hours from initial release. The results showed that wind speed has a significant effect on the amount of dispersion, evaporation and mechanical weathering experienced by the oil. Accordingly, while the stronger wind conditions may lead to shorter beaching times, it may be the more moderate winds that result in the highest volumes of oil reaching the shore.

Analysis of the trajectory database showed that some 92.4 – 97.8% of oil spill events are predicted to result in a beaching outcome of some sort. The spring season was shown to have the highest probability of beaching (97.8%) while autumn has the lowest (92.4%). The minimum time between an oil spill and beaching varies throughout the seasons; from 12.5 hours in summer to 16.6 hours in spring and autumn.

A series of coastal beaching probability maps were produced, and maps of beaching probabilities are provided for each season. The region of the Taranaki coast most likely to be affected from an oil spill is located in the STB in the vicinity of the Rangitikei River Mouth (refer to Appendices 4.8 – 4.11).

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124 MetOcean Solutions Limited. *"Oil Spill Trajectory Modelling. TTR mining barge, New Zealand. Prepared for Trans-Tasman Resources."* January 2014.

The worst-case outcome of an accidental release of 100 metric tonnes of 380 HFO was also investigated. The release date in the 11-year trajectory database that produces the maximum beaching outcome was identified, and the coastal impacts associated with that scenario were quantified. The area with the highest impact is in the STB near Whanganui, where oil concentrations of 4.79 m^3 per kilometre of coastline were predicted.

4.16.3.3 Considerations of Effects and Mitigation

MetOcean (2014) concluded that potential oil spill effects would be of moderate – significant environmental risk primarily as a consequence of the potential dispersion characteristics of HFO, and the ecological sensitivity of the nearfield ecotype which is identified as the Traps (more than 20 km distant, and submerged) and the coastal areas of the STB.

As the likelihood of unplanned oil spills can only be minimised through effective management and operational controls, TTR has committed to preparing a comprehensive Spill Contingency Management Plan that will be prepared as required by, and in consultation with, MNZ.

It is considered that such an approach is consistent with industry best practice and will address the risks of unplanned oil spills and associated mitigation measures necessary to reduce the oil spill ecological risk levels to as low as reasonably practicable. The provision of this plan has been provided for in the proposed consent conditions in Attachment 1 of this IA.

4.16.4 Jack – Up Development Impacts

OCEL Consultants NZ Limited ("**OCEL**"), provided an analysis of the geotechnical implications of the de-ored sediments produced as a result of the project for any future deployment and founding of mobile jack-up drill rig platforms used in the oil and gas industry (OCEL (2015)).[125]

OCEL, in conjunction with NZ Diving and Salvage Limited, has undertaken five geotechnical investigations using OCEL designed and diver operated subsea geotechnical drilling rigs for jack-up rig deployment off the West Coast of the North Island of New Zealand.

4.16.4.1 Summary of Effects

For the purposes of the analysis, the de-ored sediments are a fine, non-cohesive, relatively high specific gravity sand material deposited in loose condition on the seabed in previously worked seabed areas. Prior to the project being undertaken, the substrate has been identified as very dense sand by OCEL and NZ Diving and Salvage Limited during their field investigations.

Prior to the deployment of any mobile jack-up drilling rig at an offshore location, a seabed geotechnical investigation is required and an evaluation made of the footing / spudcan penetration at the location.

The geotechnical investigation will typically establish the soil strength parameter for the seabed strata to allow a prediction of the extent to which the jack-up spudcans will penetrate into the seabed and identify any potential for a 'punch through' type bearing capacity failure that could jeopardise the safety of the rig.

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[125] OCEL, 2015. *"Implications of Loose Tailing Seabed Material on Future Jack-Up Deployment in the South Taranaki Bight".*

The principle concern with regard to these set ups is related to the presence of soft or loose layers and the bearing pressure bulb developed by the spudcan load. The presence of soft or loose bearing layers on the seabed is less of a concern as the weight of the jack-up will typically force the spudcans well into, or through, the soft top layers until these layers become compressed or a harder substrate is reached.

The bearing loads exerted by jack-up rigs are in the order of 400 kPa, and as a consequence the spudcans will penetrate into the seabed in conditions other than very dense or high bearing capacity seabed conditions which are relatively rare. In loose or soft conditions the penetration can be several metres. The calculated penetration for spudcans into the loose seabed was estimated at 6 m.

Therefore, it is considered that the presence of the de-ored sediments will have no influence on the design of the foundations for any fixed platform structures in the future that may be located within the project area. These structures would be expected to have pile foundations extending deep into the seabed, therefore the nature of the shallow seabed layer is close to insignificant in terms of jack-up foundations.

OCEL (2015) states that irrespective of whether the seabed consists of loose, re-deposited de-ored sediments over previously worked areas or untouched seabed, a geotechnical investigation is required at the site prior to jack-up deployment and this consists of at least one borehole. If a jack-up rig was deployed within the project area following the completion of the project operations, the geotechnical investigation would identify the nature of the seabed, including any de-ored sediments, prior to deployment. Consolidation, enhanced by the high specific gravity of the de-ored sediments, and some seabed densification due to wave action will have occurred altering the properties from when the de-ored sediments were first deposited.

The presence of the de-ored sediments, and their potentially loose nature does not have any significant implications for any future deployment and founding of mobile jack-up drill rig platforms on the seabed. The spudcans will sink further into the seabed than for the untouched seabed case, therefore, they attain the ultimate bearing load capacity resistance required, but this is not of significance given that jack-ups are set up to recover spudcans no matter their depth into the seabed.

5 MONITORING AND MANAGEMENT FRAMEWORK

5.1 Introduction

TTR is proposing to implement a comprehensive monitoring and management framework as part of the project and which has been incorporated into the proposed consent conditions. The framework is a multi-stage approach that provides for:

- The formation of a Technical Review Group ("**TRG**") to assist in providing TTR with technical advice with respect to the management, supervision and monitoring of the environmental effects of the project for the duration of the marine consent;
- An Operational Sediment Plume Model ("**OSPM**") that will enable TTR to manage the project in order to comply with consent conditions and to provide an effective mechanism to assist in:
  - The development of the environmental response methodologies that are applied with respect to suspended sediment concentrations (derived from a suspended solids - turbidity relationship developed during the BEMP);
  - Predicting background and extraction derived suspended sediment concentrations to inform the management of the project;
  - Distinguishing operationally derived contributions to suspended sediment concentrations from background processes; and
  - Forecasting sediment plume dynamics, including but not limited to, intensity and geographic spread.
- A BEMP that will guide the collection of data to validate the baseline environment. The baseline data that is collected will also be used to validate the environmental performance thresholds already identified and to confirm the actual effects of the project against the baseline environment;
- An EMMP that will guide the identification of the key aspects of the monitoring and management regime to be implemented by TTR. The information collected through the BEMP will be incorporated in the final version of the EMMP;
- Various management plans that specify the operational / management requirements and protocols to ensure that adverse effects of the project are avoided, remedied and mitigated; and
- Post-extraction monitoring to confirm that the biological environment within the project area is recovering following the completion of iron sand extraction activities.

TTR commissioned SLR Consulting Limited ("**SLR**") to prepare the BEMP and EMMP for the project. Copies of these draft monitoring plans are attached as Appendices 5.1 and 5.2 to this IA.

TTR also commissioned AES to prepare an overview of the monitoring programme that will be required for the project and the identification of an appropriate methodology for determining environmental performance thresholds that are not to be exceeded (AES

(2016b)).[126] The advice provided by AES has formed the basis for the ecological monitoring programmes for the project and has assisted in determining the key consent conditions and objectives of the EMMP.

The BEMP, EMMP and the various management plans have also been refined via input from the technical experts engaged by TTR and following consultation with the EPA, key stakeholders and parties with existing interests in the STB.

The proposed consent conditions outlined in Attachment 1 of this IA, set out the anticipated role of the TRG, the requirements of the OSPM, and the objectives of the various monitoring and management plans. These matters are also discussed further detail in the sections below.

5.2 Technical Review Group

TTR will facilitate the formation of a TRG, which will assist in providing TTR with technical advice on monitoring, supervision and management of the environmental effects of the project for its duration. The TRG will be established prior to the implementation of the BEMP and will remain in existence for the duration of the project.

The TRG will consist of one suitably qualified and experienced representative chosen by each of TTR, TRC, KRG, DOC, commercial fishing interests and the Forum. It is intended that the representatives on the TRG will, collectively, have relevant expertise in the key environmental, ecosystem, matauranga Maori and engineering components being monitored and managed.

The role of the TRG is to provide technical oversight and advice to TTR which includes, but is not limited to the following:

- Review and provide advice on the appropriateness of the environmental monitoring parameters prior to the commencement of the BEMP;
- Compare monitoring data against the background data to assist in determining if any activities of the project's activities have resulted in adverse effects that were not anticipated at under this IA;
- Consider and make recommendations on the following:
    - The appropriateness of the Response Limit and Compliance Limit values and the ISQG-Low and ISQG-High values;
    - Potential Operational Responses that may be implemented based on the investigations into the causes of any breach of the Response Limits or Compliance Limits or any ISQG-Low or ISQG-High values
    - The implementation of any Operational Responses;
    - The need for any new Response Limit and/or Compliance Limit for any parameter or for any new ISQG-Low and ISQG-High values being monitored; and

126 James, M.R., MacDiarmid, A., 2016. *"Trans-Tasman Resource Ltd consent application: Ecological Monitoring"* February, 2016. 13 pp.

  - Any revised Response Limit and/or Compliance Limit value determined.

- Community knowledge and matauranga Maori issues when reviewing the monitoring data;

- An annual review of each year's monitoring results, which will be reviewed and compared against the previous monitoring data collected and the environmental performance thresholds for suspended sediments and sediment quality; and

- Make recommendations to TTR that a review of the consent conditions is necessary for the purpose of avoiding, remedying or mitigating adverse environmental effects from the project that is appropriate to be dealt with at a later stage.

The TRG will meet annually during the BEMP; however, for the first five years following commencement of the iron sand extraction activities the TRG will meet quarterly, and then annually thereafter to review and discuss the previously submitted monitoring and annual reports. Following each meeting, minutes will be provided to the EPA and on TTR's website within 10 working days of each meeting being held.

All monitoring data, and any interpretation of its significance with respect to any environmental trends, will be provided by TTR to the TRG. The TRG will review the data and any interpretation information, and then make recommendations to TTR on any operational or management actions that may be necessary.

TTR will provide a copy of the TRG's review of the annual monitoring data and the EMMP to the EPA as part of the annual report it submits. This will include any recommendations from the TRG with respect to any actions or changes to the EMMP or the iron sand extraction activities that are considered necessary. TTR will also include commentary detailing whether these recommendations have been accepted and the reasons why any recommendations have not (if appropriate).

Any recommendations made by the TRG to adapt either the BEMP or the EMMP, or to undertake additional mitigation / management measures, will be based on the comparisons of the available monitoring data against previous monitoring data and / or background levels that identify adverse project-related impacts. TTR considers that this approach is important as it improves the decision-making process and minimises any potential uncertainty.

5.3 Operational Sediment Plume Model

TTR will develop, maintain and utilise an OSPM to assist with the management of project operations. The OSPM will assist in:

- The development of the environmental response methodologies that are applied with respect to suspended sediment concentrations;

- Predicting background and extraction derived suspended sediment concentrations to inform the ongoing management of the project; and
- Distinguishing operationally derived contributions to suspended sediment concentrations from background processes.

Water quality, sedimentation and oceanography data collected during the baseline monitoring programme under the BEMP will be important to validating and refining the existing sediment plume model to ensure accuracy of the results.

The requirement to maintain the OSPM, including the need to calibrate and validate the model, is specified in the proposed consent conditions.

The monitoring programmes within the BEMP and the EMMP will also be utilised to feedback into the OSPM. The OSPM will be regularly calibrated and validated with real time measurements (e.g. turbidity, sedimentation, particle size and currents) derived from the ongoing physical monitoring data. This process will occur every six months during the baseline environmental monitoring period, for the first three years of iron sand extraction activities, and every two years thereafter.

5.4 Baseline Environmental Monitoring Plan

5.4.1 Introduction

The baseline environmental monitoring programme that will be undertaken via the BEMP is a fundamental component of the project, with the overarching purpose being to build on the existing environment information collated as part of the preparation of this application. The monitoring carried out under the BEMP will also serve to validate the OSPM and assist with refining the methodologies and environmental management thresholds proposed in the EMMP.

5.4.2 Purpose and Scope of the BEMP

The purpose of the BEMP is to:

- Establish a baseline environmental data that further identifies natural background levels in the STB, while also taking into account seasonal variations. This baseline data will provide the means by which any potential effects of the project can be quantified;
- Confirm the current understanding of the seasonality and natural variability of environmental parameters that will be monitored under the EMMP;
- Provide data to validate the OSPM;
- Provide data to verify that the ‘Response Limit’ and ‘Compliance Limit’ suspended sediment concentration values are appropriate following the validation of the OSPM. These values will ensure actions to avoid, remedy or mitigate project-related effects are implemented at the appropriate time;
- Confirm that the identified sampling locations are the best suited for the EMMP;
- Confirm the objectives of the EMMP are appropriate;
- Confirm that the parameters being monitored and the chosen methodology is the best suited for the EMMP; and
- Ensure compliance with all regulatory requirements.

The BEMP has been prepared to ensure that, as a minimum, a baseline set of data is collected over a two-year period.

5.4.3 Monitoring Design and Methodology

The baseline environmental monitoring programme, as outlined below, will be undertaken at specific sites throughout the project area and surrounding environment that are unique to the different environmental components being monitored. The monitoring sites have been selected to achieve the objectives of each individual monitoring programme, and to provide robust baseline data on the environmental conditions and communities at each location. A number of the monitoring sites will also overlap to enable a full picture of the environmental components to be gathered. The monitoring locations to be used as part of the baseline monitoring programme are identified in Figures 5.1 – 5.5 below.

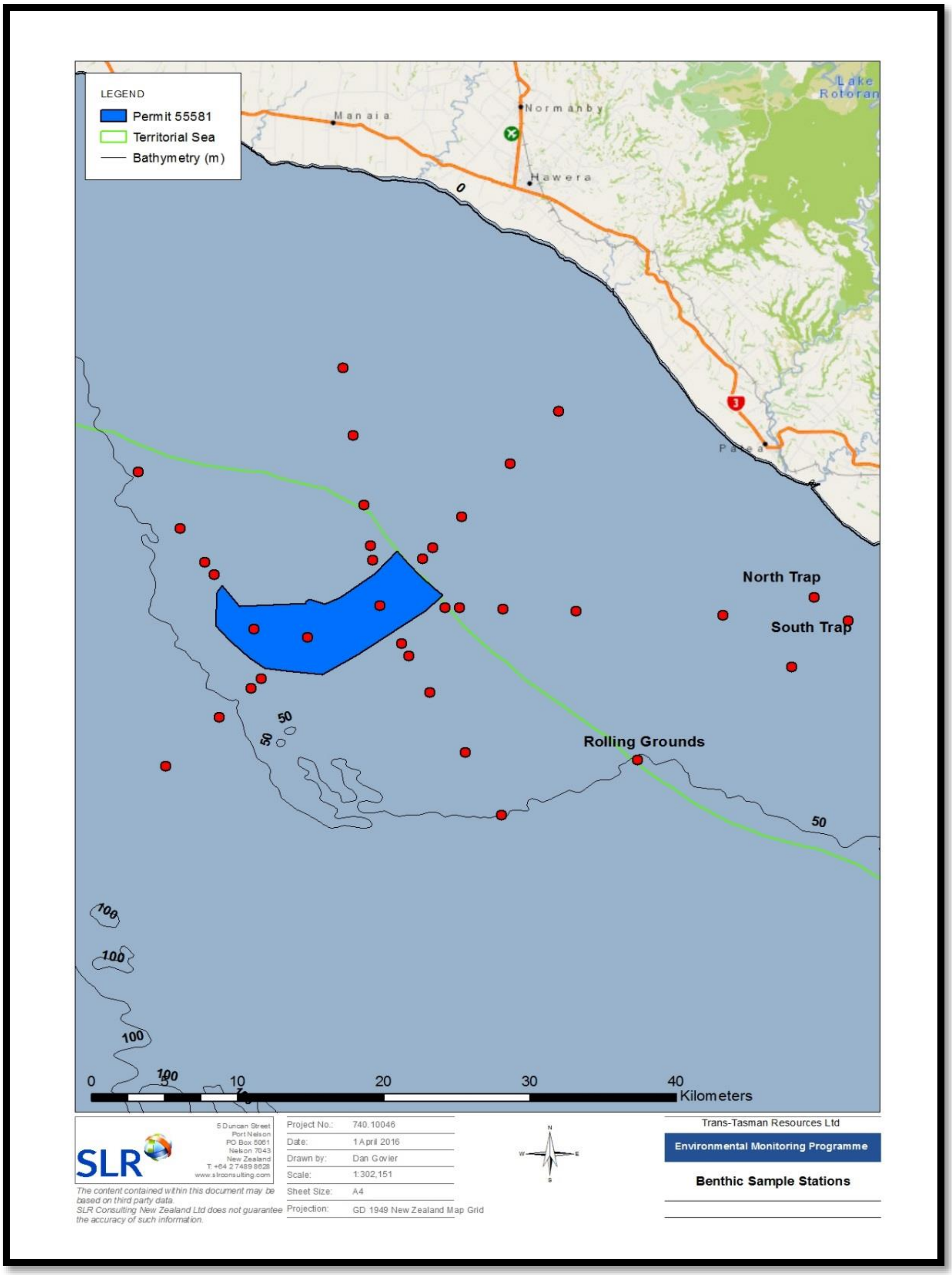

Figure 5.1: Location of benthic monitoring stations in relation to the Project Area.

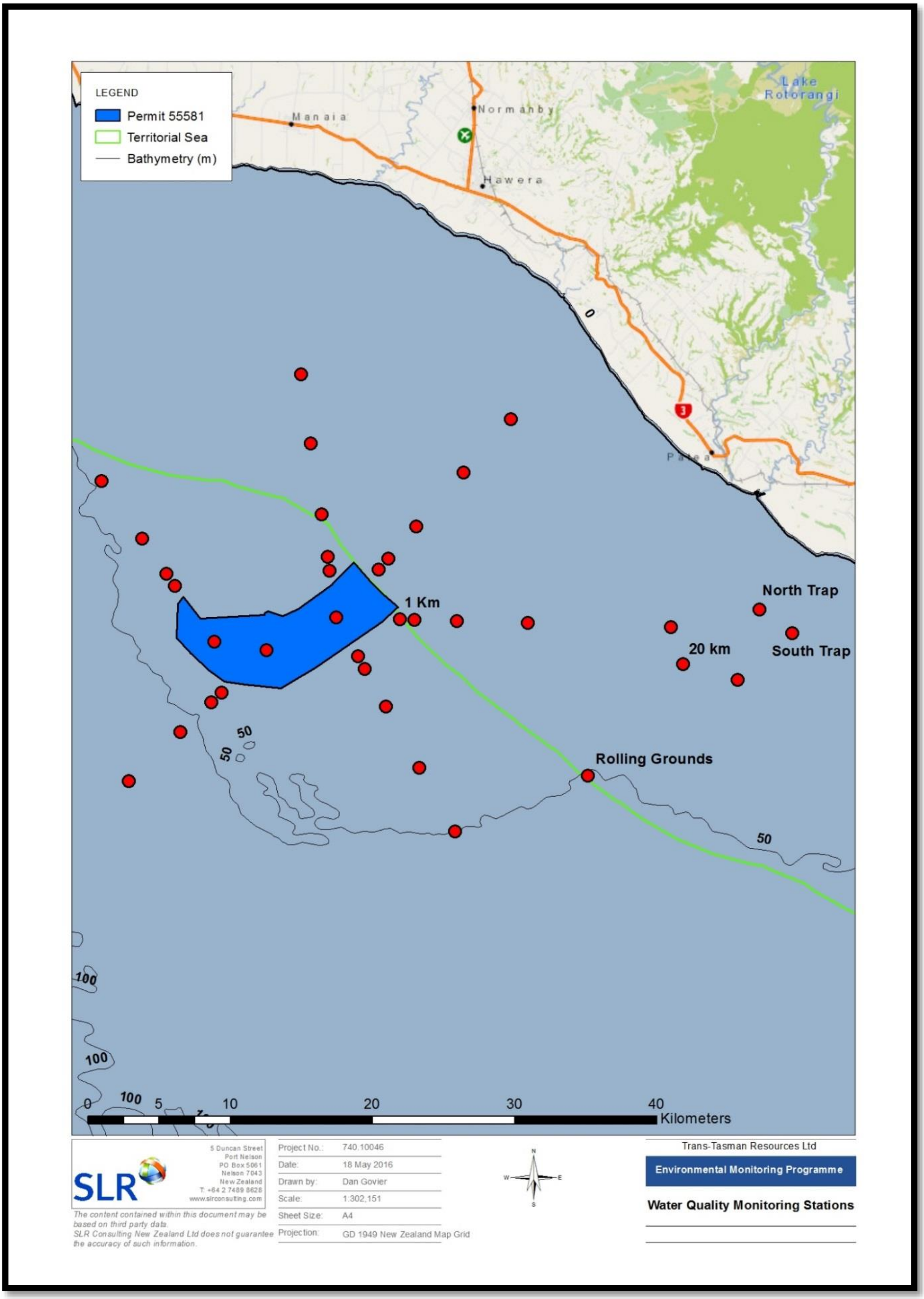

Figure 5.2: Location of water quality monitoring stations in relation to the Project Area.

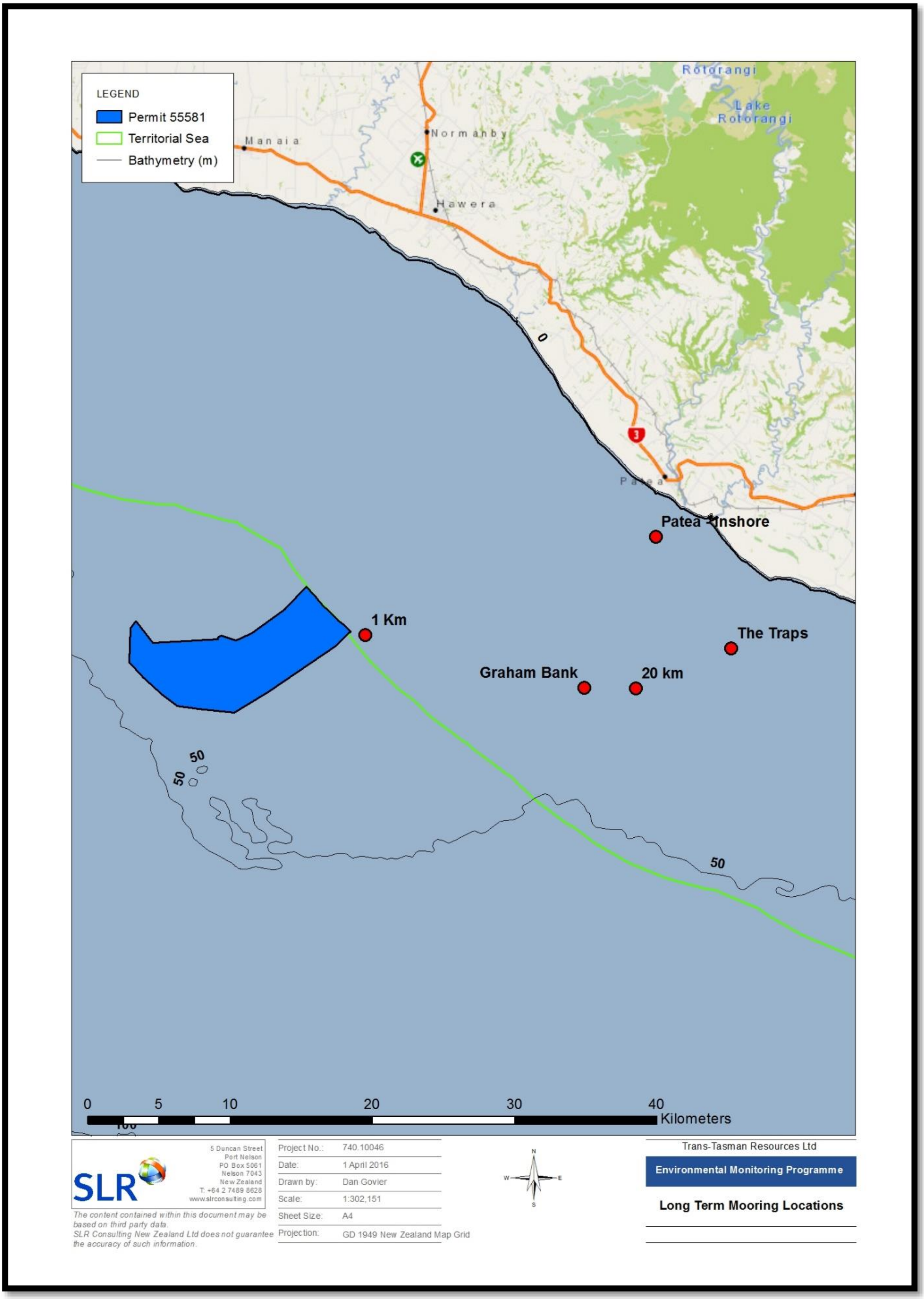

Figure 5.3: Location of fixed moorings in relation to the Project Area.

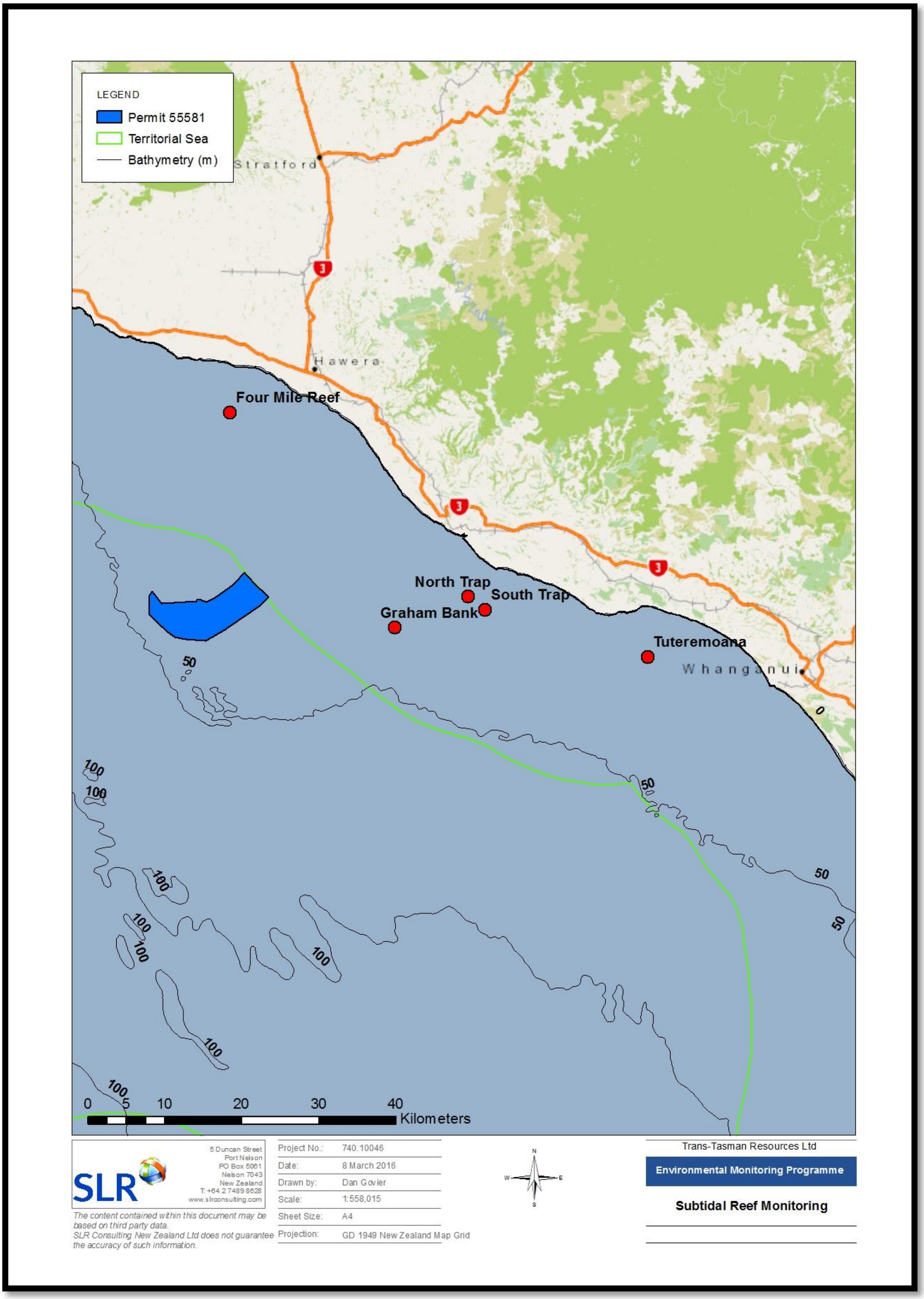

Figure 5.4: Location of subtidal monitoring sites in relation to the Project Area.

Figure 5.5: Location of intertidal monitoring sites in relation to the Project Area.

In addition to the very frequent collection of physical environment variables, sampling will typically occur on a quarterly basis, as this will provide information on the seasonal variation in ecological communities and water column characteristics within the STB.

A 'Before After Gradient' design is to be used for the water quality and sedimentation, primary productivity, zooplankton and subtidal benthos aspects of the BEMP. This design approach has been selected as it allows TTR to continue to undertake environmental monitoring once the extraction of iron sands is occurring and facilitates a direct comparison between the baseline and operational periods. The design means that sample locations are distributed at variable distances from the project area.

5.4.4 Monitoring Programmes

The BEMP is made up of ten separate monitoring programmes, with each programme addressing a separate environmental parameter. A summary of each of the programmes is provided below:

- Water quality and sub-tidal sedimentation - an indicator of potential changes in suspended sediment concentrations and sediment settlement behaviour in the STB;
- Model Validation – verification of assumptions underpinning the sediment plume modelling and validation of predicted outcomes;
- Oceanography – an indicator of potential changes in coastal zone processes;
- Primary production – an indicator of potential changes to the overall primary productivity of the STB;
- Zooplankton – an indicator of potential changes to zooplankton in the STB in proximity to the project area and validation of predictions built into the technical assessments that support this IA;
- Subtidal benthos – an indicator of potential changes to ecosystems of subtidal benthos in the STB in proximity to the project area;
- Subtidal and intertidal reefs – an indicator of potential changes to ecosystems of subtidal and intertidal reefs in the STB in proximity to the project area;
- Marine mammals – an indicator of potential changes to marine mammal occurrence in the STB in proximity to the project area;
- Underwater noise – validation of predictions in the technical assessments that support this IA and provide a baseline indicator of the scale of noise effects in the STB in proximity to the project area; and
- Recreational fishing – an indicator of potential changes to recreational fish populations and fishing in the STB in proximity to the project area.

The objectives of each monitoring programme, along with a summary of the monitoring methodologies, is set out in Table 5.1 below.

Table 5.1: Baseline Monitoring Programmes: Objectives and methodologies provided for in the BEMP.

Monitoring Programme	Objectives	Summary of Methods
Water quality and sub-tidal sedimentation	• Provide a baseline assessment of water quality in the STB; • Provide baseline data of suspended sediment concentrations in the STB; and • Provide data to inform other components of the monitoring programme, in particular the OPSM validation.	• Deployed mooring; • Turbidity; • Photosynthetically Available Radiation ("**PAR**") logger; • Temperature; • Conductivity; • Depth; and • Gross sedimentation (settlement tubes).
Model Validation	• Provide high quality data for the validation of the Sediment Plume Model used in the IA. This model will be used to inform the development of the OSPM that will be run during iron sand extractions to differentiate between background suspended sediment concentrations levels and project-related suspended sediment concentrations. • Provide high quality temporal and spatial resolution of the currents and turbidity characteristics of the STB to understand natural variability of these parameters. • Obtain a time-series of in-situ suspended sediment concentrations, particle size distribution and settling velocity data along with current and wave measurements to allow determination of critical shear-stresses for re-suspension and settling.	• Turbidity/moored sensors and profiles • Sedimentation • Currents measurements • Waves/moored instruments • Particle size and settling velocity/moored instruments and profiles
Oceanography	• Provide a baseline assessment of coastal processes and bathymetry in the STB; and • Provide data to inform the OPSM validation.	• Deployment of Acoustic Doppler Current Profilers ("**ADCP**") for measuring waves; and • Deployment of Acoustic Wave and Current ("**AWAC**") instruments for measuring currents.

Monitoring Programme	Objectives	Summary of Methods
Primary productivity	• Provide a baseline assessment of primary productivity in the STB.	• Phytoplankton community composition, chlorophyll-a levels in the water column, micro-zooplankton community composition, chlorophyll-a in surficial sediments; • Light availability - Photosynthetically Active Radiation logger; and • Turbidity - Nephelometric Turbidity Unit ("**NTU**") logger.
Zooplankton	• Provide a baseline assessment of zooplankton (e.g. biomass, abundance and diversity) in the STB; and • Provide a baseline assessment of water colour and clarity in the STB.	• Zooplankton diversity, abundance and distribution; and • Surface water colour and clarity.
Subtidal Benthos	• Provide a baseline assessment of infaunal and epifaunal communities (abundance and diversity) in the STB; and • Provide a baseline assessment of sediment characteristics (sediment grain size, redox potential and pH) in the STB.	• Ecological benthic sampling programme; • Abundance and diversity of infauna and epifauna; • Sediment physico-chemical characteristics; and • Microphytobenthos.
Subtidal and Intertidal Reefs	• Provide a baseline assessment of subtidal and intertidal reef communities in the STB.	• Intertidal and subtidal ecological surveys using both quantitative and qualitative methods; • Drop camera photo-quadrats; and • Diver surveys.
Marine mammals	• To conduct surveys to describe the variability of marine mammal relative abundance and distribution in the STB prior to the commencement of iron sand extraction activities.	• Incidental sightings; • Systematic observations; • Aerial surveys; and • Acoustic surveys.

Monitoring Programme	Objectives	Summary of Methods
Underwater noise	• Establish baseline underwater noise characteristics in the vicinity of the project area prior to the commencement of iron sand extraction activities; and • Provide data to inform the Marine Mammal Monitoring Programme.	• Fixed-point underwater noise surveys.
Recreational fishing	• Provide a baseline assessment of recreational fishing (target species and fishing effort) in the STB.	• Catch per unit effort, total abundance, size and vessel counts.

Data analyses will be specific to each baseline monitoring programme. All of the analyses proposed have been selected due to their ability to provide robust, meaningful and accurate outputs which will provide valuable insights into spatial and temporal changes in biological and physical variables of interest.

5.4.5 Reporting

Each baseline monitoring programme will have a unique reporting schedule as detailed in the respective monitoring programme sections, as summarised in Table 5.2 below.

Table 5.2: Reporting schedule for Baseline Monitoring Programme.

Report	Of Relevance to:										Reporting timeframe
	Water Quality & Sedimentation	Model Validation	Oceanography	Primary Productivity	Zooplankton	Subtidal Benthos	Subtidal and Intertidal Reefs	Marine Mammals	Underwater Noise	Recreational Fishing	
Daily Trip Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Due to TTR within 24 hours of the completion of each monitoring day
Monthly Monitoring Report	✓			✓							Due within 20 working days of the end of each monthly survey
Quarterly Monitoring Report			✓		✓	✓					Due within 30 working days of the end of each quarterly survey
Annual Monitoring Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Due within 40 working days of the end of the monitoring year
OSPM Validation Report		✓									Due within 40 working days of the completion of the baseline phase
Laser In-Situ Scattering and Tranmissometer ("LSST") Deployment Report		✓									Due within 20 working days after the retrieval of the LSST
Aerial Survey Report								✓			Due within 20 working days of survey completion
Final Monitoring Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Due within 60 days after baseline programme completion

All reports except daily trip reports will be provided to the EPA and the TRG, and will typically follow the outline below:

- A non-technical Executive Summary;
- Introduction with relevant background information and a review of previous monitoring results;
- Methodology, including field, statistical and laboratory procedures, descriptions of sites sampled (including GPS coordinates); maps indicating sampling locations;
- Data analysis and results, presented in tables and figures (including photographs), as well as a trend analysis and interpretation of analytical data collected and a

discussion of the results. Raw or summarised data will be presented in appendices; and

- Conclusions and Recommendations.

The reporting requirements that are common to all monitoring programmes include a Daily Trip Report, an Annual Monitoring Report and a Final Monitoring Report. Further detail on each of these reports is provided below.

Daily Trip Report

A Daily Trip Report will be completed for all monitoring programmes for each day of field work. An approved template will be utilised for this purpose, with the completed reports being submitted to TTR within 24 hours of completion of each monitoring day.

Annual Monitoring Report

For each monitoring programme an Annual Monitoring Report will be prepared. These reports will outline the following environmental components:

- A summary report on all monitoring undertaken in the previous 12 months;

- Details of monitoring proposed for the next 12 months;

- Details of any TRG reviews of the annual monitoring data, along with any recommendations of any actions or changes to the BEMP for the subsequent 12 months; and

- Appendices containing raw data from the preceding 12 months of monitoring.

Final Monitoring Report

For each monitoring programme a Final Monitoring Report will be prepared at the completion of the baseline monitoring programme, being two years as a minimum.

These reports will include a full data analysis, data summaries and interpretation of all data collected throughout the two-year baseline phase. A critical component of these reports will be the inclusion of any recommendations by the TRG for monitoring design modifications to be incorporated into the EMMP.

5.4.6 Post Monitoring Process

Following the completion of the baseline monitoring, the data will be used to validate the relevant environmental performance thresholds for the project.

The purpose of the validation process is to confirm that the numerical values of the environmental performance thresholds are appropriate following the validation of the OSPM, and based on the baseline environmental data collected.

The proposed consent conditions outline a specific process for the validation of the environmental performance threshold limits for suspended sediment concentrations, being the Response Limit and Compliance Limit. Under this process the thresholds will be validated by TTR by incorporating the baseline environmental monitoring data with the same methodology previously used to determine the thresholds.

The purpose of this review is to confirm that the revised thresholds are consistent with those identified in Schedule 2 of the proposed consent conditions and if not, the new threshold limits will then replace those in Schedule 2. For clarification, the process is not reviewing the use of the 80^{th} and 95^{th} percentile figures chosen for the Response Limit and Compliance Limit but simply validating the numeric values attached to these figures.

The outcomes of any review of the thresholds shall be provided to the TRG for review and comment prior to lodgement with the EPA.

The consent conditions propose that in the event that the validation process results in a change to any threshold in Schedule 2, the EPA shall certify the change by way of issuing a Memorandum of Certification. Further, any change to the thresholds shall not require a change of consent conditions but be identified through the Memorandum of Certification issued by the EPA and be included as an updated Schedule to the consent conditions.

Once the environmental performance thresholds have been validated they will be incorporated into the final EMMP, which will then be submitted to the EPA for certification at least one month prior to the commencement of any iron sand extraction activities.

5.5 Environmental Monitoring and Management Plan

The EMMP is a continuation of the BEMP. It is the overarching document for the monitoring and management of the project related effects and sets out the process for the ongoing environmental monitoring once the iron sand extraction activities commence.

The key components of the EMMP are summarised below.

5.5.1 Purpose and Scope of the EMMP

The overall purpose of the EMMP is to ensure that any project related effects are effectively and efficiently monitored and managed throughout the term of the project. This includes:

- Ensuring compliance with all regulatory requirements;
- The development of objectives for the monitoring and management associated with the project;
- Implementation of environmental monitoring programmes including sampling design, methodology, frequency, duration and monitoring locations;
- Verifying environmental performance through information about any project related effects as they occur;
- Identification of the operational responses to be undertaken if environmental thresholds for suspended sediment concentrations and sediment quality are reached;
- Details of data analysis and processing for all parameters being monitored; and
- Reporting methods and frequency for all parameters being monitored.

The EMMP sets out TTR's proposed approach to avoid, remedy or mitigate any potential adverse effects of the project through monitoring. An Environmental Management Strategy ("**EMS**") will provide early detection of changes in the STB ecosystem, and enable modifications to occur to the project as appropriate. The EMMP:

- Outlines the EMS;
- Identifies key areas for attention in respect of ongoing monitoring;
- Details the environmental thresholds as well as the Operational Response measures available to address any exceedances in the thresholds; and
- Presents details for each element of the monitoring programme.

The individual monitoring programmes have been developed to enable the monitoring of project-related changes to the marine environment so that, if necessary, early detection will enable appropriate management responses to be implemented.

For each of the individual monitoring programmes provided for, the EMMP identifies:

- The purpose and objectives of the monitoring programme;
- The sampling approach, design and methodology (including locations, frequency / timing);
- Where necessary, identification of the appropriate environmental performance thresholds and actions to be incorporated if these levels are reached;
- Data / statistical analysis and processing methods, and interpretation of findings; and
- Reporting and community involvement.

The design and implementation of each of these monitoring programmes will ensure that any project related adverse effects are appropriately identified and, where relevant, avoided, remedied and mitigated.

The EMMP has also been prepared to align with the proposed consent conditions provided as Attachment 1 of this IA. The requirements of the conditions have been incorporated into the relevant sections of the EMMP and will be further refined after the completion of the BEMP and prior to the commencement of the extraction activities.

5.5.2 Environmental Management Strategy and Monitoring Overview

5.5.2.1 Environmental Management Strategy

The EMS (and the EMMP) is essential for the successful implementation of the project through:

- Ensuring compliance with the proposed consent conditions;
- Highlighting key environmental objectives, mitigation measures and monitoring programmes to be adhered to; and

- Reporting requirements.

If any anomalies or unexpected results are found as part of the environmental monitoring programme, then the EMS identifies a framework for addressing any such events.

The objective of the EMS is to undertake a science-based, systematic approach to monitoring and managing the effects of the project on the STB.

The following protocols have been identified as drivers for the EMS and, in turn, the EMMP as a whole:

- Plan, monitor and evaluate the parameters identified for the shared environmental concerns and issues;
- Establish appropriate thresholds for Operational Response; and
- Establish potential Operational Response measures to address any issues if they develop.

The above protocols will be implemented through the environmental monitoring framework, which incorporates four components identified as being key for effective management of project related effects. These components are:

- Planning;
- Monitoring;
- Evaluation; and
- Action.

A detailed diagram illustrating the environmental management framework, including how environmental management decisions will be informed, is provided in Figure 5.6 below.

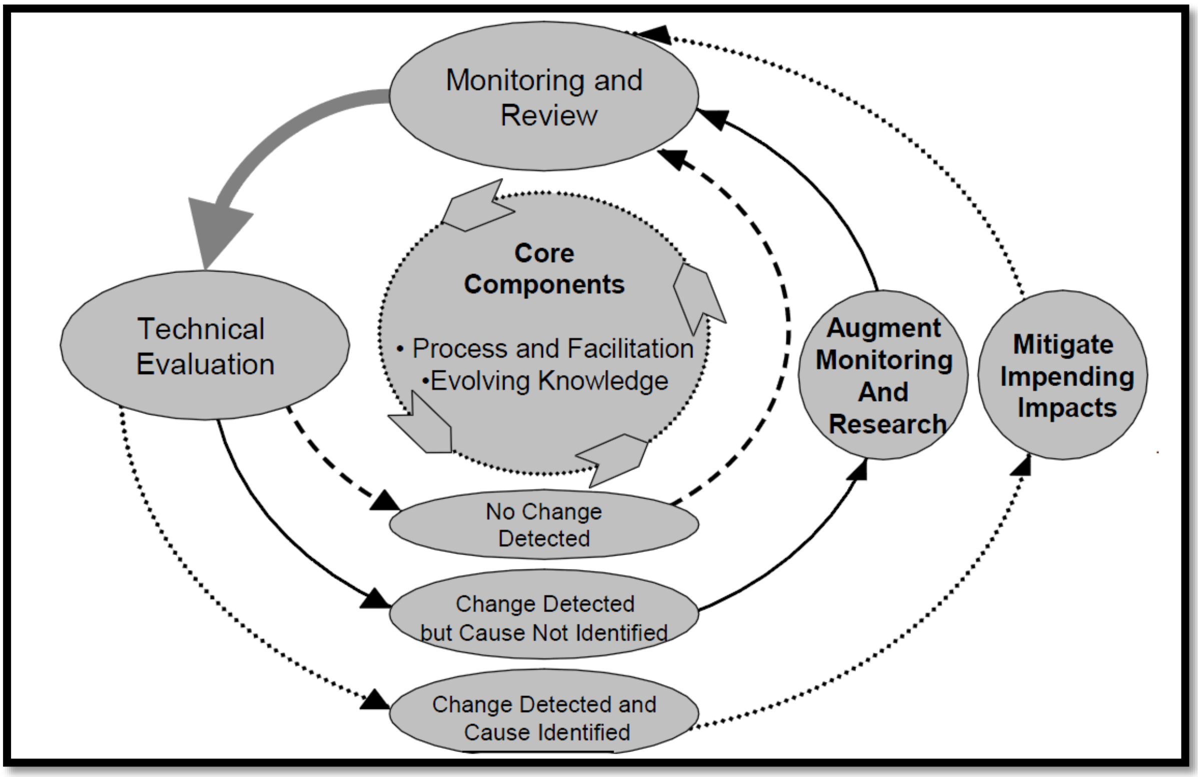

Figure 5.6: Conceptual Environmental Management Framework.

5.5.2.2 Monitoring Programme Overview

The critical elements of an environmental monitoring programme is that it needs to be practical, sufficiently robust to detect changes if they were to occur, and take into account the tolerances of important biota and natural variability in time and space.

The monitoring programme will include fixed monitoring sites to provide continuous measurements of sedimentation, light levels and oceanographic conditions to monitor for compliance, as well as assist in the ongoing OSPM validation. These fixed monitoring sites will be supplemented with regular synoptic surveys at pre-determined monitoring locations to monitor for compliance, changes over time to the marine environment and communities, as well as the recovery of the seabed following the deposition of de-ored sediments. Further, each of the monitoring locations have been designated to assist in achieving the specific objectives of the individual monitoring programmes. These locations are consistent with those provided for in the BEMP, shown in Figures 5.1 – 5.5 above.

The development of this EMMP has been based on recognition of the key habitats and ecosystem components identified within the STB and their interactions with the primary impact sources (i.e. turbidity and sedimentation) resulting from iron sand extraction as well as the findings and recommendations from the BEMP.

Following the collection of monitoring and sampling information, all data will be analysed, interpreted and reported through quarterly and annual reports, as provided for in the EMMP and the proposed consent conditions. For each of the parameters being monitored, the analyses proposed have been selected due to their ability to provide robust, meaningful and accurate outputs. The analyses will provide insights into spatial and temporal changes in biological and physical variables, and enable any project related impacts to be identified and their scale/magnitude assessed.

Notwithstanding the TRG involvement, for various aspects of the EMMP TTR intends to involve the community, stakeholders and / or iwi members to enable these parties to gain a better understanding of sampling methodology and why these methods are being utilised as a way to assess the potential effects of the project. Where community involvement cannot be undertaken (i.e. due to offshore monitoring), presentations of findings from the monitoring programmes will be provided with the opportunity for everyone to gain an insight into the methodologies and what results are being recorded compared to what was predicted in the technical assessments. This will primarily occur through a dedicated website and as part of community meetings both of which are provided for in the proposed consent conditions.

Table 5.3 provides an overview of the monitoring programmes that will be implemented as part of the EMMP and summarises the key indicators and parameters that will be provided for.

Table 5.3: Overview of Monitoring Programmes and Methodologies provided for in the EMMP.

Monitoring Programme	Objectives	Methods
Water Quality and Sedimentation	• Provide an early warning indicator of potential for impact on sensitive receptors due to deteriorating water quality. • Provide contextual water quality and sedimentation data in the investigations of recorded impacts on benthic and reef ecosystems. • The continued collection of water quality data in conjunction with the BEMP that accounts for spatial and temporal variability of turbidity, typical for the STB. • Monitoring of sedimentation rate.	• Deployed Mooring • Turbidity • PAR • Temperature • Conductivity • Depth • Gross Sedimentation (settlement tubes)
Model Validation	• Provide data for the validation of the OSPM results. • Provide calibration and validation data for the enhancement of the Hydrodynamics and Sediment Transport models that will be run to simulate actual conditions during the project under the OPSM. • Provide temporal and spatial resolution of the currents and turbidity characteristics during the project to support validation of numerical models under a range of conditions. • Obtain time-series of in-situ suspended sediment concentrations, particle size distributions and settling velocity along with current and wave measurements to allow determination of critical shear-stresses for re-suspension and settling as well as differentiation between background and extracted material suspended sediment concentrations.	• Turbidity / moored sensors and profiles • Sedimentation • Currents / moored and vessel based transects • Waves / moored instruments • Particle size and settling velocity / moored instruments and profiles
Oceanography	• Detect changes or trends in oceanographic processes that could not be identified via coastal processes; • Enable the detection of any adverse coastal processes attributable to the project; • Early detection of any significant coastal processes to allow the project to be adapted or the implementation of management measures; • Validation of the OPSM and informing the real-time sediment plume model during the iron sand extraction phase of the project; and • Provision of a long-term data set of oceanographic data within the STB.	• Deployment of ADCP for measuring waves • Deployment of AWAC for measuring currents

Monitoring Programme	Objectives	Methods
Primary Productivity	• Investigate the potential effects of iron sand extraction and deposition on primary productivity by plankton. • Determine how primary productivity indicators respond to gradient of effect with distance from operational project areas.	• Phytoplankton community composition, Chlorophyll-a levels in the water column, micro-zooplankton community composition, chlorophyll-a in surficial sediments, • Light availability - PAR logger • Turbidity - NTU logger
Zooplankton	• Assess the potential effects of iron sand extraction on the biomass, abundance and diversity of zooplankton communities. • Assess the potential effects of iron sand extraction on water colour, clarity, and compare data to zooplankton abundance, diversity and biomass results.	• Zooplankton diversity, abundance and distribution • Surface water colour and clarity
Subtidal Benthos	• Investigate the potential effects of iron sand extraction on the abundance and diversity of soft-bottom infauna and epifaunal communities within and surrounding the extraction area. • Determine whether there are significant changes in sediment characteristics (sediment grain size, redox potential and pH) following iron sand extraction; and assess how any changes affect abundance and diversity of soft bottom communities. • Follow the subsequent recovery of any infauna and epifauna communities that may be impacted and relate this to depth of sedimentation, nature of sediment and redox potential. • Determine the recolonisation of the de-ored sediment after it has been deposited back on the seabed.	• Ecological benthic sampling programme • Abundance and diversity of infauna and epifauna • Sediment physico-chemical characteristics • Microphytobenthos
Subtidal and Intertidal Reefs	• Investigate the potential effects of iron sand extraction on the abundance and diversity of selected subtidal and intertidal reef communities in the STB. • Investigate the levels of sand inundation/depletion around selected intertidal reef systems along the STB coastline.	• Intertidal and subtidal ecological surveys using both quantitative and qualitative methods. • Drop camera photo quads. • Diver surveys

Monitoring Programme	Objectives	Methods
Marine mammals	• To ground-truth the predicted impacts of iron sand extraction on marine mammals; and • To conduct surveys to describe the variability of marine mammal relative abundance and distribution in the STB during and after iron sand extraction.	• Incidental sightings • Systematic observations • Aerial surveys • Acoustic surveys
Underwater Noise	• Establish underwater noise characteristics at selected locations within STB relative to the noise contour established by way of marine consent condition.	• Fixed-point underwater noise surveys • Underwater noise: vessel surveys
Recreational Fish	• Monitor and report on key recreationally targeted fish species to determine if changes to recreational fishing and fish catch occur from the project.	• Catch per unit effort, total abundance, size, Vessel counts
Biofouling and Biosecurity	• Early detection of new marine pests introduced into the STB. • To allow implementation of marine pests emergency response where any Introduced Marine Pests are detected.	• Invasive species presence or absence

5.5.3 Environmental Performance Thresholds

The EMMP incorporates environmental performance thresholds into the monitoring of suspended sediment concentrations in the STB. The thresholds are linked to specific monitoring locations within the STB and will be verified following the completion of the BEMP.

The proposed consent conditions, and as provided for in the EMMP, specifies that when a threshold is reached it will prompt a management response to be implemented to ensure that any potential adverse effects are avoided, remedied or mitigated.

A summary of the background 50th (median), 80th and 95th percentiles of surface and near-bottom suspended sediment concentrations at 11 sites in the STB are provided in Table 5.4 below. These data were extracted from the predictive sediment plume models (refer to Section 4.4.2 of this IA) and will further be verified following the baseline environmental monitoring programme.

Table 5.4: Background 50th (median), 80th and 95th percentiles of surface and near-bottom suspended sediment concentration (SSC) at 11 sites in the STB. Data extracted were from the predictive sediment plume models

STB sites (in order of increasing 95th percentile background SSC in surface waters)	Background percentiles (SSC mg/L)					
	Surface			Bottom		
	50th	80th	95th	50th	80th	95th
Rolling Grounds	0.06	0.27	1.10	0.56	3.49	15.03
Graham Bank	0.53	1.60	1.97	12.29	32.32	82.07
Source A to Whanganui 1km	0.32	0.95	2.40	5.24	16.62	43.68
Source A to Whanganui 20km	0.76	2.07	5.51	10.95	28.39	74.54
South Traps	2.75	5.80	10.53	15.80	36.98	93.88
North Traps	3.19	6.70	12.16	20.30	45.77	111.62
Tuteremoana	4.28	7.94	13.27	8.19	23.23	61.82
Puketapu	2.60	6.80	17.76	125.52	251.16	510.17
Pukepuke	6.35	12.96	26.15	5.66	33.40	105.62
Patea	14.33	25.63	50.93	101.87	221.29	438.64

The two thresholds for the compliance have been identified as the ‘Response Limit’ and the ‘Compliance Limit’ - being the 80th and 95th percentile of naturally occurring background suspended sediment concentrations respectively. These limits have been determined based on the ecological monitoring assessment by AES (2016b).

Further to the suspended sediment concentration thresholds, the Interim Sediment Quality Guideline-Low (“**ISQG-Low**”) and the Interim Sediment Quality Guideline-High (“**ISQG-High**”) value for metals, metalloids, organometallic and organic compounds in the ANZECC have also been used as performance thresholds for the project with respect to sediment quality.

Following the completion of the baseline environmental monitoring programme provided for in the BEMP, additional environmental thresholds may be identified upon recommendation from the TRG.

5.5.3.1 First Compliance Level

The first environmental performance level is the Response Limit and the ISQG-Low value. If either of these levels are reached at a monitoring site, the following actions will be undertaken by TTR:

- Immediately analyse the monitoring data in further detail to confirm if the breach is a result of a project related activity or a natural occurrence;

- Where the breach is a result of a project related activity, an additional round of environmental monitoring at the location/s of the breach will be immediately undertaken and the EPA will be notified of the exceedance;

- If the additional monitoring results are still at, or above, either of the levels but are not greater than the 'Compliance Limit' or the ISGQ-High value, TTR will initiate investigations as to the cause and identify an appropriate operational response to ensure that the relevant threshold level is no longer breached (see section below);

- No later than five working days following the completion of the investigation, TTR will provide the investigation results to the TRG for review, including recommendations on proposed operational responses to address the breach. The TRG shall provide a response within ten working days of receiving the investigation;

- No later than five working days following the receipt of the response from the TRG, TTR shall provide the EPA with a report summarising the investigations undertaken. The report shall identify the proposed operational response/s to be implemented, and state why such responses are considered appropriate. The report shall include a summary of any commentary or recommendations from the TRG and, where necessary, an explanation as to why any of the TRG recommendations have not been accepted;

- Implement the response/s and undertake a further round of environmental monitoring at the location of the initial breach; and

- If the further monitoring demonstrates that the results are still above the level, TTR shall undertake further investigations into the cause and identify further operational responses to address the ongoing breach following the process provided for above. The results of this further investigation and the recommendations shall be complied into a report to be submitted to the EPA prior to any of the further recommendations being implemented.

5.5.3.2 Second Compliance Level

The second environmental performance level is the Compliance Limit and the ISQG-High value. If either of these levels are reached at a monitoring site, TTR will immediately cease all iron sand extraction activities, notify the EPA, and undertake the following actions:

- Immediately initiate an investigation into the cause of the breach and identify the operational response/s to be implemented;
- No later than five working days following the completion of the investigation above, TTR will provide the investigation results to the TRG for review, including recommendations on proposed operational responses to address the breach. The TRG shall provide any response within ten working days of receiving the investigation;
- No later than five working days following the receipt of the response from the TRG, TTR shall provide the EPA with a report summarising the investigations undertaken. The report shall identify the proposed operational response/s to be implemented, and state why such responses are considered appropriate. The report shall include a summary of any commentary or recommendations from the TRG and, where necessary, an explanation as to why any of the TRG recommendations have not been accepted;
- Implement the response/s and, once implemented, undertake a further round of environmental monitoring at the location of the breach; and
- The iron sand extraction activities may not recommence until TTR can demonstrate, to the satisfaction of the EPA that the operating regime can ensure that the compliance limit or the ISQG-High value is no longer being breached.

5.5.3.3 Operational Responses

Operational / management options that TTR may implement in the event that the environmental performance thresholds are reached include:

- The review of the iron sand excavation plan and scheduling;
- The review of the iron sand excavation particle size distribution;
- The review of the mining discharge particle size distribution;
- The review of operational efficiency of process equipment;
- Undertake additional monitoring;
- A reduction in grinding and / or repair / replace processing equipment;
- The adjustment of the extraction depth of iron sands;
- Limiting the meteorological and oceanographic conditions under which extraction activities take place (i.e. wind speed and sea state);
- The relocation of the IMV;

- Lower extraction rates; and

- Ceasing iron sand extraction activities pending full review of the cause of the exceedances.

The appropriate operational / management response will be determined following an investigation into the cause of the breach. The final response selected will be subject to review from both the TRG and the EPA. Approval from the EPA, in a technical capacity, will also be required before any response is implemented.

Figure 5.7 below illustrates the approach TTR will implement if any exceedance to the Response or Compliance Limits for suspended sediment concentrations occurs as determined through the environmental monitoring programme.

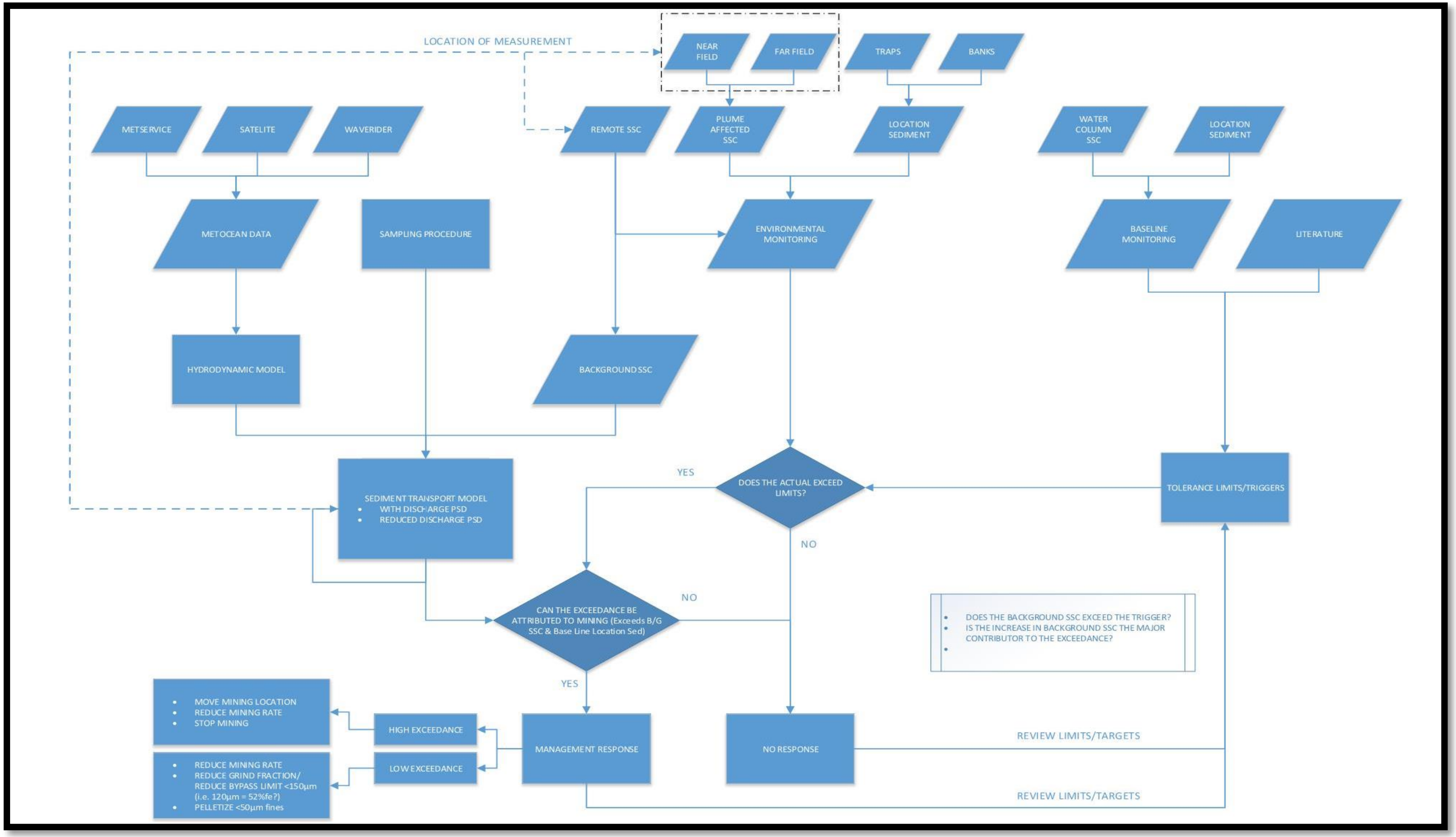

Figure 5.7: TTR's environmental management approach for suspended sediment concentrations in relation to Response and Compliance Limits.

5.5.4 Monitoring Programmes

The EMMP sets out a robust monitoring programme to ensure regulatory compliance and to provide confirmation that project related effects are consistent with those considered as part of the technical assessments prepared to support this IA. The monitoring programmes in the BEMP will be carried over to the EMMP, with the addition of the following programme:

- Biosecurity – to ensure the operational aspects of the project are consistent with the requirements under the Biosecurity Act 1993.

The monitoring required under the EMMP shall be implemented one month prior to the commencement of the iron sand extraction activities and continue for the life of the project.

5.5.5 Reporting

Each monitoring programme will have its own reporting schedule as detailed in the respective monitoring programme sections, and as summarised in Table 5.5 below.

Table 5.5: Reporting schedule for the environmental monitoring programmes in the EMMP.

Report	Of Relevance to:											Reporting timeframe
	Water Quality & Sedimentation	Model Validation	Oceanography	Primary Productivity	Zooplankton	Subtidal Benthos	Subtidal and Intertidal Reefs	Marine Mammals	Underwater Noise	Recreational Fishing	Biosecurity	
Daily Trip Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Due to TTR within 24 hours of the completion of each monitoring day
Monthly Monitoring Report	✓	✓										Due within 20 working days of the end of each monthly survey
Quarterly Monitoring Report			✓	✓	✓	✓	✓					Due within 30 working days of the end of each quarterly survey
Annual Monitoring Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Due within 40 working days of the end of the monitoring year
OSPM Validation Report		✓										Due within 40 working days of the completion of the baseline phase
LSST Deployment Report		✓										Due within 20 working days after the retrieval of the LSST
Aerial Survey Report								✓				Due within 20 working days of survey completion
Final Monitoring Report	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Due within 60 days after baseline programme completion
Response Limit Breach	✓											Due to EPA immediately (within 48 hours) of the discovery of a breach
Compliance Limit Breach	✓								✓			Due to EPA immediately following the discovery of a breach
Quarterly Operational Report (marine mammal start-up)								✓				Due within 40 working days of the end of each quarter
Underwater Noise Monitoring Report									✓			Due within 20 working days of monitoring being undertaken
Biosecurity In-water Inspection Report											✓	Due within 20 working days of inspection completion
Biosecurity Post-cleaning Report											✓	Due within 20 working days of completion of cleaning

The reporting requirements that are common to all monitoring programmes include a Daily Trip Report, an Annual Monitoring Report and a Final Monitoring Report. Further detail on each of these reports which is consistent with that which was described for the BEMP reporting in Section 5.4.5 above.

Further to the above, reporting to the EPA under the proposed consent conditions will include the provision of an annual report that outlines the following with regard to environmental monitoring:

- A summary report on all monitoring undertaken in accordance with the EMMP in the previous 12 months;
- Details of all monitoring proposed, including any changes to the monitoring provided for in the EMMP, for the next 12 months;
- Details of any exceedances of the environmental performance thresholds, any management actions implemented in response, and the measures adopted to assess and report on the outcome of these management responses; and
- Details of the review by the TRG on the annual monitoring data and the EMMP, along with any recommendations with respect to the EMMP or the iron sand extraction activities, and how these were provided for as well as any reasoning as to why recommendations were not accepted.

Each annual report will be provided to the EPA within 60 working days following the end of each annual reporting period, being 12 months following the commencement of the iron sand extraction activities.

In addition to the annual report, quarterly operational reports will also be submitted to the EPA. The information in these reports will primarily have an operational focus, but some environmental data will be included (i.e. the number of delayed starts and other mitigation on account of marine mammals). These reports will be provided to the EPA within 40 working days of the end of each quarterly monitoring period.

5.6 Management Plans

Further to the monitoring programmes, TTR will prepare management plans that detail how various management commitments not covered by the monitoring programmes will be addressed to ensure the specific requirements of the proposed consent conditions are complied with. The management plans to be prepared are:

- Spill Contingency Management Plan;
- Collision (Loss of Position) Contingency Management Plan;
- Marine Mammal Management Plan;
- Seabirds Effects Mitigation and Management Plan;
- Biosecurity Management Plan; and
- Biofouling Management Plan.

Each management plan will clearly identify its objectives and the methods by which the objectives will be achieved. The management plans and objectives have been further discussed, where relevant, in Section 4 of this IA.

As a requirement of the proposed consent conditions, the final management plans will be submitted to the EPA for certification at least three months prior to the commencement of iron sand extraction activities. These management plans will be considered 'living documents' and will be subject to review and change as required throughout the duration of the project. The EPA will be provided a copy of the most update to version of the management plans. The draft versions of the Marine Mammal Management Plan and the Seabirds Effects Mitigation and Management Plan have been provided as Appendix 5.3 and 5.4 respectively.

5.7 Post–Extraction Monitoring

Further to the baseline and project related environmental monitoring, TTR is proposing to undertake post-project monitoring. The purpose of this monitoring is to identify whether the biological environment within the project area is recovering following the completion of iron sand extraction activities.

This will be provided for through the implementation of a Post-Extraction Monitoring Plan ("**PEMP**") and will extend for a period of four years following the cessation of the project. It is intended that the monitoring programme will be amended as required based on the advice of the TRG, the previous monitoring results and any environmental management actions undertaken over the course of the iron sand extraction activities. The PEMP will address the following:

- The roles and responsibilities of parties who are to undertake each aspect of the post-extraction monitoring;
- Objectives for the post-extraction monitoring;
- The role of the TRG and their review process with regard to post-extraction monitoring;
- The identification of the sampling design and methodology for each of the parameters being monitored, including the frequency, duration and monitoring locations;
- Procedures for comparing the post-extraction monitoring data against the background data to assist in determining if the biological environment within the extraction area is recovering;
- Details of data analysis and processing for all parameters being monitored; and
- Reporting methods for all parameters being monitored.

The PEMP will also specify that TTR is required to prepare and submit annual reports to the EPA that summarise:

- The post-extraction monitoring undertaken in the previous 12-month period;
- The post-extraction monitoring to be undertaken in the next 12-month period;
- The data collected from the monitoring undertaken;
- A summary of any commentary or recommendations from the TRG and, where necessary, an explanation as to why any TRG recommendations have not been accepted; and
- A summary report of the findings of the monitoring undertaken with conclusions drawn as to the recovery and overall biological health of the project area.

The final stage of the post-extraction monitoring will be the preparation of a final post-extraction monitoring report that provides:

- A summary of all of the monitoring undertaken in the previous four years;
- A summary report of the findings of the monitoring undertaken with conclusions drawn as to the recovery and overall biological heath of the project area; and
- Final commentary or recommendations from the TRG and, where necessary, an explanation as to why any of the TRG recommendations have not been accepted.

The PEMP will be provided to the EPA for certification at least three months prior to the completion of iron sand extraction activities.

5.8 Proposed Consent Conditions

With regard to consent conditions, section 63(1)(a) of the EZZ Act states:

> *"The Environmental Protection Authority may grant a marine consent on any condition that it considers appropriate to deal with adverse effects of the activity authorised by the consent on the environment or existing interests."*

As reference in previous sections of this IA, TTR has prepared a set of proposed consent conditions for this marine consent and marine discharge consent application which TTR considers will address any adverse effects associated with the project. Further, the conditions will enable TTR to manage and monitor the project to ensure that the effects are consistent with those which were assessed as part of the application process.

TTR acknowledges the positive input that it has received from the various existing interest parties and stakeholders in drafting the proposed consent conditions and accepts that these conditions may continue to be refined through further consultation and in the lead up to any hearing on the application.

The proposed consent conditions are provided for as Attachment 1 to this IA.

5.9 Summary

The implementation of the monitoring programmes and management plans will ensure that any project related effects will be effectively and efficiently monitored and managed. Additionally, the PEMP will provide confirmation on how the environment within the project area is recovering following the completion of the iron sand extraction activities.

In addition, the formation of the TRG will provide valuable technical advice and assistance for TTR and the EPA with regard to the monitoring and management of the effects of the project. The representation on the TRG from multiple stakeholders and parties with existing interest in the STB will provide a breadth of technical expertise and a balanced perspective when considering the environmental aspects of the project.

The proposed consent conditions, which provide for the project's monitoring and management framework, will ensure that any adverse effects of the project are appropriately provided for.

6 CONSULTATION

6.1 Introduction

Section 39(1)(d) of the EEZ Act requires an IA to identify persons whose existing interests are likely to be adversely affected by the activity. For those parties, section 39(1)(e) of the EEZ Act requires that an IA describes any consultation undertaken with those who have existing interests which are likely to be adversely affected by the activity.

The parties with existing interests that may be affected by the project have been identified in Section 3.11. Where relevant, the consultation process with these parties has been summarised below.

6.2 The Consultation Process

6.2.1 TTR's Consultation Process Overview

As identified in Section 1.1 of this IA, the previous marine consent application was declined by the EPA. The DMC identified that one of the key reasons for the application being declined was that it had a lack of confidence in the extent to which existing interests were appropriately taken into account as part of the application.

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 with the following aims:

- To allow stakeholders to determine the manner in which they wanted to be engaged and participate in setting a mutually acceptable timetable for engagement;
- Provide honest communications in a respectful manner;
- Demonstrate fairness in all dealings; and
- Facilitate building mutually beneficial and sustainable working relationships.

TTR began its consultation process for this new application in March 2015 and the process consisted of the following steps:

- Identifying parties with 'existing interest' as defined by the EEZ Act;
- Making contact with those existing interest parties to offer consultation and establish a preferred method for the process;
- Engaging with the parties in their preferred method, and provide requested project information in multiple formats including face-to-face presentations and the provision of technical assessments and reports;
- Enabling a process where the feedback for the parties consulted with was considered and where relevant to the project operations, incorporated into the planning and

management principles of the project and incorporated as a crucial component of the consent application; and

- Maintaining an open line of communication through the application process and ensure that this relationship is provided for following lodgement and, if consent is granted, throughout the project.

For the most part TTR consider that this engagement process has been successful.

An overview summary of the engagement process is provided below.

March – April 2015

Acknowledging concerns that had been raised publicly around what was portrayed by the projects opponents to be a new and experimental concept, in March 2015, TTR facilitated a visit for interested stakeholders to De Beers Marine (Pty) Ltd ("**DBM**") in Cape Town, South Africa. DBM have operated a seabed diamond mining operation off the South Africa and Namibian coastlines for the last 20 years, using similar machinery to that which TTR proposes to use in the STB.[127] DBM are TTR's technical advisors.

The intention of the visit was to provide parties with the opportunity to "see and feel" the proposed equipment, witness the tried and tested technology supporting the TTR proposal and meet the scientists and regulatory authorities involved in monitoring DBM's established offshore diamond mining activities. Parties were provided unfettered and unguided access to DBM's environmental data and monitoring results.

Invitations for this visit was extended to iwi (especially mana whenua), EPA, TRC, DOC, MNZ, and commercial fishing representatives. The invite was accepted by the EPA, TRC, and representatives of the Iwi Fisheries Forum.

The agenda of the visit is provided as Appendix 6.1 respectively.

April – October 2015: Pre-engagement

Following the trip to DBM, TTR commenced its pre-consultation engagement process by initiating contact with all existing interest parties regardless of whether they were deemed to be affected by the project or not. TTR acknowledged all criticism in respect to the first application and communicated that it was committed to addressing those concerns in its revised application.

TTR allowed for each party to dictate the manner in which they would like the engagement to progress. Each party was introduced to the TTR staff and made aware of TTR's intention to lodge the new application for the project. At this early stage of the process, parties were also provided with a fact sheet detailing the project and the EPA application process, as well as details of where and how more information could be obtained. The contact details of TTR staff were also provided.

In total, the pre-engagement consisted of over 80 face-to-face engagements, and over 40 email and telephone communications, with a wide range of stakeholders including, iwi, business and community interest groups.

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[127] Richardson, K (2007). "A perspective of marine mining within De Beers" SAIMM Conference, Hydrotransport 17, 7–11 May 2007.

October 2015 – Present: Formal Engagement

Informed by the initial application and the pre-engagement process, TTR began formal engagement with existing interest parties in October 2015. The key element to this stage of the consultation process was the hand-over of an appropriately detailed information package on the project. The purpose of this information package was to inform parties of the revised proposal and enable the facilitation of meaningful engagement by ensuring the parties had the information they needed to actively participate in the consultation process. This is provided in Appendix 6.2 to this IA.

The stakeholder information package included detailed information about the project and its predicted effects, an independent report on the local, regional and national economic benefits of the project, a visual animation of the Project, and underwater videos of the proposed project area, Northern and Southern Traps, and Grahams Bank and the general details and conclusions of new scientific research conducted by TTR addressing issues identified during the first hearing.

The information package was presented to those parties with existing interests in the manner they specified during the pre-engagement process. This involved 40 face-to-face presentations that brought together a range of parties to listen, ask questions, and provide feedback. It was emphasised that feedback was crucial to addressing their concerns and collaboratively developing mitigating strategies for the project. TTR actively sought feedback from each party following each presentation.

Feedback from Stakeholders

Generally, the feedback TTR has received in respect to its engagement presentations and the project has been constructive. Of particular interest to the parties has been the proposed consent conditions, environmental management / monitoring plans and other mitigation measures that TTR are proposing to include as part of the application.

Appropriate mitigation measures and monitoring / management plans have been developed by incorporating the feedback received by the different parties who participated in the engagement process.

TTR has been working closely with the EPA and the Nga Kaihautu Committee, the EPA's Maori Advisory Committee who provides cultural advice to the DMC and provides feedback on the engagement process. In particular, TTR has kept EPA and Nga Kaihautu Committee informed of the challenges it is facing with regard to engagement with some of the existing interest parties and, where appropriate, sought advice on those issues.

All parties have been encouraged to maintain an open dialogue with TTR and have been given the opportunity to request additional scientific reports in order to undertake their own independent reviews. TTR requested those stakeholders sign a Confidentiality Agreement to protect the Intellectual Property and sensitive scientific information contained in some of the reports.

To date, DOC, the Iwi Fisheries Forum, EPA, Inshore Fisheries and commercial fishing groups, Origin Energy Resources (Kupe) Limited ("**Origin Energy**") and TRC have signed confidentiality agreements and have been provided with the specific reports requested. In some instances feedback has been received on the technical reports and this has been considered and, where relevant to the project activities, has been addressed in the relevant sub-sections of Section 4.

Ongoing consultation has been occurring with the majority of the existing interest parties throughout the course of the pre-application process and these processes and the outcomes have been further summarised in Section 6.3 below.

6.3 Consultation Outcomes

6.3.1 Introduction

Further to the consultation described in Section 6.2, TTR's general principle for consultation with the existing interest parties has been through the following process:

- TTR provided a suite of project information that described the project that consent was being requested and included the results of various technical reports / assessments that support the application. All stakeholders were provided the opportunity to request detail reports and further information on the project. TTR required parties to sign a Confidentiality Agreement as the detailed technical and scientific reports contained information that was developed at significant cost and effort to TTR, and its uncontrolled release would not only disqualify future patent applications but would cause unreasonable prejudice to TTR's commercial position as it could be used by its competitors to their advantage. In circumstances where parties were not prepared to sign this agreement the sensitive information was not released.

- Following the provision of the project information, TTR invited parties to participate in meetings providing the opportunity to discuss the project and to enable face to face discussions to occur. Not all parties accepted the invitation however, in some cases only a single meeting occurred and for others many meetings took place.

- Where requested, generally between meetings, TTR provided additional information in response to queries, comments and questions raised by interested parties. This information typically consisted of draft conditions, management plans, and responses to specific queries on matters within technical reports that warranted further technical response. This information allowed for various parties to provide feedback into the project specifically around draft conditions and management plans. Where relevant to the project and considered appropriate by TTR, this feedback has been incorporated into the related documents.

- As a final stage of consultation, TTR attempted to reach an agreed position with parties that identified points of agreement and disagreement. Where prepared, these have been included in the summaries below.

The sub-sections below provide an overview of the consultation undertaken with particular 'existing interest' parties and stakeholders.

6.3.2 Ngāti Ruanui

A disappointing aspect of the engagement process to date has been the lack of participation by Te Runanga o Ngāti Ruanui, the recognised mandated representative body for Ngāti Ruanui on environmental matters.

From the beginning TTR has made it clear that it recognised Ngāti Ruanui's position as tangata whenua. Ngāti Ruanui made a point of referring to the legal costs it had accrued as part of TTR's withdrawn appeal and identified it as a potential stumbling block. As a gesture of good faith and in the interest of developing a positive, open and principled engagement, TTR agreed to cover all Ngāti Ruanui's legal costs relating to TTR's withdrawn appeal. Despite this, and other continued initiatives, any attempts to engage constructively with Ngāti Ruanui (which have been documented), have met with little success.

As part of this new application process, TTR has only been able to meet with Ngāti Ruanui on one occasion, which was in September 2015. The meeting concluded with an agreement that Ngāti Ruanui would complete a CIA, which would be financed by TTR. However, despite continuing efforts from TTR, Ngāti Ruanui are yet to progress this, and as such TTR engaged an independent consultant to complete a CVA (summarised in Section 4.11.2). TTR and the independent consultant remain open to consulting with Ngāti Ruanui at any stage throughout the consenting process.

On 16 May 2016, TTR sent an email to Ngāti Ruanui in good faith. The email stated that as TTR continued to maintain a desire to develop a meaningful, positive, and open relationship with mana whenua they included a copy of the proposed consent conditions specifically identifying the conditions which were drafted in an attempt to provide for ongoing tangata whenua involvement, as well as proposed measures to address effects on cultural values.

In a response to TTR's email, Ms Debbie Packer (on behalf of Ngāti Ruanui) on 20 May 2016, made the following unsubstantiated assertions about the breakdown in consultation, which have been summarised below:

- That despite having received the proposed conditions, comprehensive stakeholder package, being part of the Iwi fishing forum and personally meeting with the management of TTR, Ngāti Ruanui continued to be unclear about TTR's environmental practises, and restated their need of all TTR's detailed science data in order to assess the validity of the conditions proposed;

- That they regarded the required confidentiality agreement as non-commercial because it placed restrictions on Ngāti Ruanui. Ngāti Ruanui regarded this is an unprecedented move and pointed to this as being the single aspect responsible for the breakdown in the engagement process;

- That TTR's intent to show good faith and communicate with Ngāti Ruanui continued to fall short of Ngāti Ruanui's best practice engagement protocols that they routinely apply to the numerous energy companies they engage with;

- That despite Ngāti Ruanui continuously appealing for transparency of information, specifically the science environmental research, Ngāti Ruanui considered that TTR has 'stonewalled' them, leaving mana whenua as kaitiaki in the unenviable position of not being able to qualify or determine TTR's best environmental practises;

- That Ngāti Ruanui did not support or recognise the report provided by the Iwi Fisheries Forum and were offended that Ngāti Ruanui would be expected to complete a CIA in the absence of environmental data;

- That Ngāti Ruanui had made numerous attempts to communicate their concerns to TTR through the Chair, legal counsel and more recently they engaged a communications advisor to facilitate their view to TTR, which has not been validated;

- That Ngāti Ruanui has met with EPA at the Iwi Chairs Forum in Waitangi suggesting solutions to get objective environmental research with Ngāti Ruanui offering to pay half as TTR wouldn't disclose information. Ngāti Ruanui assert that this was initially supported but when the EPA manager returned to Wellington the offer was rescinded;

- That the communications and politics involving the undermining of Ngāti Ruanui from TTR (as shared with TTR Chair and TTR legal counsel) has been fraught and resulted in Ngāti Ruanui displacement through this process;

- That Ngāti Ruanui has attempted numerous times to resolve and will remain open minded however, until TTR shares it data, there is little that can be done at this stage; and

- That Ngāti Ruanui noted that under the previous application, TTR disclosed all information, although the methodology kept changing, the communications was of higher quality.

On 26 May 2016, TTR responded to Ms Packer's email stating:

> *"Whilst we do not agree with the assertions you make regarding the provision of this information I can only reiterate that TTR and its Board remains committed to establishing a relationship with Ngāti Ruanui and as such, TTR continues to be available to meet at your convenience to discuss the project and all the information provided."*

No further response has since been received from Ngāti Ruanui.

Despite the unsuccessful consultation process, TTR recognises that Ngāti Ruanui holds mana whenua over the project area and acknowledge that Ngāti Ruanui did not support the first marine consent application and, therefore, believe they are unlikely to support this application.

TTR has provided Ngāti Ruanui with all the available information throughout the process and has provided multiple opportunities to access the detailed and, in some case confidential, scientific reports. TTR has continued to try to engage with Ngāti Ruanui to better understand their concerns and where possible find ways to address them. TTR remains willing to engage with them at any time. However, in order to progress the marine consent and marine discharge consent applications, as described in Section 4.11.2 of this IA, TTR engaged Mr Tahu Potiki to provide a CVA of the project area with a specific focus on Ngāti Ruanui.

6.3.3 Te Tai Hauauru Iwi Fishing Forum

Consultation was undertaken with the Iwi Fisheries Forum as part of the pre-application process for this application. As part of the consultation, TTR was afforded the opportunity to present their stakeholder engagement package to the Iwi Fisheries Forum at Pungarehu Marae up the Whanganui River. The information was well received and some good discussions evolved. TTR has had a very good working relationship with the Iwi Fisheries Forum.

As a direct result of the consultation process, the Iwi Fisheries Forum prepared the Forum Report, a detailed cultural values assessment that informs TTR of their customary interests within the project area and includes potential measures to be incorporated into the project to provide for any potential adverse cultural impacts that may result from the project. Where these measures were directly related to the project they have been included in the proposed consent conditions provided for in Attachment 1 of this IA. The Forum Report and mitigation measures have been discussed in detail in Section 4.11.3 of this IA.

6.3.4 Nga Ruahine

Engagement and discussions with the CEO and Chair of Te Korowai o Nga Ruahine have occurred to brief them about the status of our new marine consent and marine discharge consent application. TTR met with CEO and Chair formally to present TTR's stakeholder engagement package and respond immediately to any issues that were raised. TTR encouraged the leadership of Nga Ruahine to communicate what other engagements they would like within their iwi. There were no requests made however, recently they did ask for a confidentiality agreement to enable them to access the more detailed reports. TTR sent Te Korowai o Nga Ruahine a confidentiality agreement to sign late June 2016, however no response has been received to date.

As identified above, consultation was undertaken with the Iwi Fisheries Forum, of which Nga Ruahine are a part of, as part of the pre-application process for this application.

6.3.5 Nga Rauru Kiitahi

TTR met with the CEO and Chair of Nga Rauru informally to discuss the status of the new marine consent and marine discharge consent application. TTR had an opportunity to meet with the CEO and a few members of their Paepae Rangātira ropu to present the stakeholder engagement package and respond to any issues that required a response. There was good interaction where TTR were able to explain in more detail different aspects of the project. TTR were given another opportunity to formally meet with the CEO and the Chair to address any outstanding issues. TTR made available the opportunity for Nga Rauru Kiitahi to be further engaged with marae and or hapu if there was a need.

To date there has not been any requests for further engagement by Nga Rauru Kiitahi. There have been phone calls from the CEO asking for an up-date on the lodgement of the new application. TTR will formally notify Nga Rauru Kiitahi once the consent has been lodged with the EPA.

TTR note that consultation was undertaken with the Iwi Fisheries Forum, of which Nga Rauru are a part of, as part of the pre-application process for this application.

6.3.6 Other Iwi

An opportunity arose to present the TTR stakeholder engagement package to the other iwi in Taranaki. The purpose of the hui was to inform the other iwi in Taranaki of the project and provide a forum for open discussion on any concerns that the iwi may have on the project. The iwi who attended the information evening were:

- Taranaki Iwi - John Niwa (board member), Te Atiawa Hemi Sundgren (CEO) and Liana Poutu (Chair);

- Ngāti Mutunga - Paul Cummins (CEO);

- Ngāti Maru - Glen Peri; and

- Ngāti Tama - Greg White, who put in a late apology.

6.3.7 Admiralty Bay / Aquaculture Parties

As discussed in Section 3.11.4.3, if adverse weather conditions are present within the project area, there is the potential that some of TTRs project related vessels may seek shelter in Admiralty Bay. Admiralty Bay lies within Te Tau Ihu (top of the South Island region), where eight iwi groups are represented under the Te Tau Ihu Settlement Claim.

Despite these eight iwi groups being of relevance to Te Tau Ihu, only one of these groups (Ngāti Kōata) have applied for customary marine title and protected customary rights through a recognition agreement with the crown over Admiralty Bay as outlined in Section 3.11.11. Ngāti Kōata hold Admiralty Bay and D'Urville Island as taonga (sacred) and in respect of this, TTR engaged with Ngāti Kōata to provide details around the potential for project-related vessels to take shelter in Admiralty Bay during adverse weather conditions.

In accordance with the Marlborough Sounds Resource Management Plan (fully operative in August 2011), TTR will not undertake any activities that require a resource consent within Admiralty Bay; nor will they undertake any activities in relation to the project. The sole purpose of entry into Admiralty Bay will be sheltering from the weather. As a result, TTR engaged with Ngāti Kōata to provide an update on the project and to provide information about what would take place in the event that a vessel enters Admiralty Bay to seek shelter. The outcomes of which are identified in Section 6.3.7.1 below.

TTR also tried to engage with Ngāti Kuia in relation to the sheltering of vessels within Admiralty Bay; however, Ngāti Kuia were unavailable to engage at that time due to a heavy workload. TTR have committed to keep in touch with Ngāti Kuia by providing information as the marine consent and marine discharge consent process commences.

With regard to the other parties with commercial interest within Admiralty Bay, TTR has undertaken consultation with representatives of the commercial fishing industry. This consultation has been discussed in Section 6.3.13.

6.3.7.1 Ngāti Koata

Consultation was undertaken with representatives from Ngāti Koata as part of the pre-application process prior to lodgement of the application.

Through this process, Ngāti Koata identified that their concerns were limited to the potential for any effects to occur within Admiralty Bay as a result of anchoring or discharges, as this area was important to them with regards to aquaculture activities.

To address their concerns Ngāti Koata proposes the inclusion of specific conditions to provide for the following:

- Ngāti Koata are notified if any vessels have to head to Admiralty Bay to seek shelter during adverse weather;
- Ngāti Koata are notified if there are any discharges in Admiralty Bay;
- That Ngāti Koata can have their iwi marine mammal observer on board while any vessels are in Admiralty Bay to monitor for marine mammals; and
- That Ngāti Koata can have input on the anchor location should a vessel go in there.

TTR has agreed to provide for these matters and has included specific conditions to address these requests in the proposed consent conditions provided in Attachment 1 of this IA.

6.3.8 Department of Conservation

Extensive consultation was undertaken with representatives from DOC as part of the pre-application process prior to lodgement of the application.

Through the consultation process DOC was provided with a number of TTR’s technical reports to assist them in understanding the project before the IA was completed. DOC was also provided with the draft consent conditions and given the opportunity to provide feedback.

Various matters were raised by DOC through their review of TTR’s draft conditions particularly with regard to matters relating to marine mammals and seabirds, and the proposed monitoring and management regime. Through this consultation process TTR has adopted all of the recommendations from DOC into the proposed consent conditions provided as Attachment 1 of this IA and the BEMP and EMMP discussed in Section 5.

6.3.9 Taranaki Regional Council

Consultation was undertaken with representatives from TRC as part of the pre-application process prior to lodgement of the application. This process and the outcomes have outlined in a letter from TRC, dated 1 July 2016, which has been summarised below.

The consultation began approximately two years before this application was lodged and involved:

- Multiple face-to-face meetings between senior TRC staff and TTR representatives;
- The exchange of information on a confidential basis;
- TRC attendance at expert conferencing; and
- Input to proposed consent conditions.

Through new application, and as part of the consultation process, TTR has addressed the majority of issues TRC had with the previous application primarily relating to impacts associated with sediment chemistry and waves, coastal processes, and surf breaks.

With regard to economic effects, TRC identified that they consider that a fit-for-purpose assessment has been undertaken to identify the positive economic benefits of the project, and believe that the proposed consent condition cement some of these in place.

TTR understands that the key remaining issue for TRC is the impact of the sediment plume on primary productivity and the potential carry on effects within the marine food web. In terms of potential wider ecosystem effects, TRC's main concerns relate to damage to sensitive benthic habitats and effects resulting from the smothering of worm fields as an important potential food source.

Given that the impacts of the sediment plume are predicted to largely occur within the Taranaki coastal marine area, TRC has a significant interest in the management aspects of the project. Should consent be granted, TRC supports taking a precautionary approach around uncertainties of adverse effect, the adoption of an adaptive management approach, setting consent conditions, confirming the scope and content of the EMMP, and collaborative monitoring and enforcement between the EPA and TRC.

TRC are in agreement with TTR that controlling and monitoring suspended sediment concentrations should be the primary tool for managing the potential effects of the project. TRC support the proposed frequency distribution of suspended sediment concentrations limits, in addition to an absolute suspended sediment concentrations limit, in order to maintain suspended sediment concentrations within predicted levels.

Finally, TRC have not been supplied with a copy of this IA before lodgement, as such, TRC have indicated that they will reconsider their stance on the point summarised above and make a submission on the project once the application has been received and assessed.

6.3.10 South Taranaki District Council

Consultation was undertaken with representatives from STDC as part of the pre-application process prior to lodgement of the application. This consultation involved multiple face to face meetings, emails exchanges and provision of additional information where requested.

The consultation with STDC culminated with a signed agreement between TTR and STDC ('**the Agreement**"). Under the Agreement, TTR is committed to providing for the following consent conditions:

- *The Consent Holder shall provide the public with up to date information on the iron sand extraction activities and environmental monitoring, including the baseline 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.

- *For the duration of these consents, the Consent Holder shall provide for and facilitate community meetings to keep the public informed of the iron sand extraction activities 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-monthly (during the months of February and July of each year) for the first five (5) years of the iron sand extraction activities and annually at all other times.

  At least four (4) weeks prior to the commencement of any community meeting, notice shall be placed on the Consent Holder's website 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.

- *Following the commencement of iron sand 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.

- *Within three (3) months of confirming that construction will commence 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 perspective 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 iron sand extraction activities.

  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.

With regard to the above conditions, if the marine and marine discharge consents are granted and the DMC appointed does not impose the conditions, TTR undertakes to comply fully with their requirements as if they were conditions of the consents.

6.3.11 Whanganui District Council

Consultation was undertaken with representatives from WDC as part of the pre-application process prior to lodgement of the application. This involved two formal engagements with the Whanganui District Council. Present at the meetings was the Mayor Annette Main, Deputy Chair, Ken Mair (Te Atihau-a-paparangi), Grant Huwyler (Ngāti Apa), Marty Davis (Nga Rauru), and other members of the Whanganui District Council.

The first engagement was informing the Whanganui District Council that TTR will be submitting a new marine consent and marine discharge consent application since the first application was declined. TTR discussed the lessons learnt from the first application and explained the approach for the new consent application.

The second engagement was presenting the stakeholder engagement package to the Council members and explaining the intent to set up a geotechnical support base out of Port Whanganui.

The engagements have been interactive and TTR look forward to be building a robust working relationship with the Whanganui District Council, local iwi and other local key stakeholder groups moving forward.

6.3.12 Origin Energy Resources (Kupe) Limited

TTR have been engaging with Origin Energy (as the operator at Kupe JVP) and continue to pursue reaching agreement on a co-operation agreement for undertaking activities in the project area.

Through the consultation process, Origin was provided with a copy of the stakeholder engagement pack, proposed draft conditions and various technical reports related to the project, and given the opportunity to provide feedback. A face to face meeting was held in Origin's New Plymouth Office with the joint venture parties' representatives, and another meeting with key members of the Kupe operations team.

Origin requested further information related to their concerns, which TTR provided a full response along with the offer of a workshop discussion. TTR also provided Origin with a draft co-operation agreement based on best practice International Marine Contractors Association Guidelines on Simultaneous Operations (IMCA SIMOPS).

Other non-technical matters were raised by Origin through their review of TTR's proposed conditions particularly with regard to ensuring that TTR would operate within the requirements of not only the EEZ Act but also other relevant marine regulations requirements and seabed bathymetry following extraction. TTR has included additional wording within the proposed conditions in the form of advice notes and additional wording within conditions to address Origin's comments.

It is TTR's expectation that Origin Energy will make a formal submission on the application once it has been lodged.

6.3.13 Sanford Limited/ Commercial Fishing Industry

Through TTR's consultation with the commercial fishing industry the following concerns were identified:

- The provision of an exclusion area including trevally and shark fishing grounds;
- The alteration of the bathymetry that may affect trawling gear;
- Downstream plume effects on bryozoan beds;
- Environment alteration;
- Cumulative effects of the fishing industry being affected by various restrictions and exclusion zones; and
- Unplanned events and oil spill risk.

As previously discussed in Section 3.11, through the consultation process it was agreed between TTR and Sanford that NIWA was be engaged to provide a summary of the effort and catch for each fishing method over the period from 2006 to 2015 and indicate the spatial distribution of the fishery in the STB. This information has been considered when assessing the effects of the project on commercial fisheries.

Additionally, as part of the consultation process the commercial fishers' representatives were provided with a number of TTR's technical reports to assist them in understanding the project before the IA was completed. They were also provided with earlier versions the draft consent conditions and given the opportunity to provide feedback on these.

Feedback was received particularly with regard to matters relating to provision for six monthly meeting as part of the ongoing engagement process if the consents are granted as well as the inclusion of monitoring of seafood resources in the BEMP and EMMP. The purpose of the ongoing engagement is to establish a co-ordinated approach between the iron sand extraction activities and the commercial fisheries activities. TTR has provided for requirement of these meetings in the proposed consent conditions provided as Attachment 1 of this IA, drafts of which were provided to the industry for comment.

6.3.14 Recreation and Tourism Operators

Consultation was undertaken with representatives from the various recreation and tourism operators that have been identified Section 3.11.2 as part of the pre-application process prior to lodgement of the application. This consultation involved multiple face to face meetings, emails exchanges and the provision of the stakeholder engagement package and additional information as requested.

7 STATUTORY FRAMEWORK

7.1 Introduction

The EEZ Act is the principal legislation for the sustainable management of natural resources in the EEZ and the continental shelf. It does this by allowing for the regulation of certain activities that were previously unregulated in the EEZ and continental shelf. The overarching purpose of the EEZ Act is *"to promote the sustainable management of the natural resources of the exclusive economic zone and the continental shelf".*

This section of the IA sets out the statutory framework against which the marine consent and marine discharge consent applications are to be assessed against in accordance with the EEZ Act.

7.2 Purpose and Principles of the EEZ Act

7.2.1 Purpose

Section 10(1) of the EEZ Act states:

> *"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"*

Sustainable management is defined in section 10(2) of the EEZ Act as follows:

> *"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."*

The resources to be sustainably managed under the EEZ Act are *"the natural resources of the exclusive economic zone and continental shelf"*. Section 4(1) of the EEZ Act defines the environment as:

> *"The natural environment, including ecosystems and their constituent parts and all natural resources, of:*
>
> *(a) New Zealand:*
>
> *(b) the exclusive economic zone:*
>
> *(c) the continental shelf:*

(d) *the waters beyond the exclusive economic zone and above and beyond the continental shelf."*

Section 4(1) of the EEZ Act also defines natural resources as:

"(a) in relation to the exclusive economic zone, includes seabed, subsoil, water, air, minerals, and energy, and all forms of organisms (whether native to New Zealand or introduced); and

(b) in relation to the continental shelf, means the mineral and other non-living resources of the seabed and subsoil and sedentary species."

Further, section 10(3) of the EEZ Act identifies what the EPA, as the decision maker, must take into consideration to determine if an application within the EEZ meets the overall purpose of the EEZ Act. It states:

"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."

The decision-making criteria referred to in section 10(3)(a) of the EEZ Act are provided in sections 59 and 60 of the Act and the information principles are found in section 61 of the EZZ Act. These provisions are discussed in detail in Section 7.5 below.

7.2.2 International Obligations

Section 11 of the EEZ Act addresses New Zealand's obligations to implement international conventions relating to the marine environment. It 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:

(c) the International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL):

(d) the Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter, 1972 (the London Convention)."

New Zealand's international obligations are binding on the Crown, which fulfils New Zealand's sovereign obligations. It has been established in previous marine consent decisions granted by the EPA[128] *"that the relevant obligations of the Crown are expressly encapsulated by Parliament in the EEZ Act and other legal instruments, such as the other marine management regimes, and do not require additional consideration to be applied by the EPA to the decision-making criteria and information principles contained in the EEZ Act."*

[128] Shell Todd Oil Service Ltd. Marine Consent EEZ000010 Decision. 4 June 2015. Paragraph 137.

7.2.3 Te Tiriti o Waitangi – Treaty of Waitangi

Section 12 of the EEZ Act addresses the Treaty of Waitangi and the Crown's responsibility to it. It states:

> *"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 Maori Advisory Committee) provides for the Maori Advisory Committee to advise the Environmental Protection Authority so that decisions made under this Act may be informed by a Maori 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."*

Matters of cultural relevance are addressed through the EPA's obligation to notify relevant iwi groups of marine consent applications under the EEZ Act, the ability for DMCs to receive specialist advice on matters pertaining to iwi perspectives, the obligation to have regard to any submissions received by iwi, and the requirement to take into account the effect of activities on existing interests (which for this project includes iwi interests in commercial and customary fishing).

Further to these requirements, TTR has attempted to undertake an extensive consultation programme with iwi in order to better understand their potential interests in the project area and the potential effects of the project (this is documented in Section 6 of the IA). Through this process, TTR has attempted to understand iwi interests and develop measures to manage any potential effects on the values / interests via the proposed consent conditions. An assessment of the potential cultural impacts of the project has been undertaken in Section 4.11 of this IA.

It is considered that through engagement with iwi, the preparation of a CVA with a focus on Ngāti Ruanui interests, and through the provision of specific iwi focused consent conditions that provide for their ongoing relationship with the coastal environment as kaitiaki, that appropriate recognition has been given to the principles of the Treaty of Waitangi in accordance with section 11 of the EEZ Act.

7.3 Restrictions on Activities Other Than Discharges and Dumping

Sections 20(1) and (3) of the EEZ Act outlines that no person may undertake an activity within the EEZ or the continental shelf unless the activity is permitted or authorised by a marine consent.

Section 20(5) explicitly states that section 20 does not apply to discharges of harmful substances.

Table 7.1 below identifies the activities for which TTR is seeking marine consent.

Table 7.1: Marine Consent Requirements.

Section of the EEZ Act	Activity for which Marine Consent Required	Project Element
s20(2)(a)	The construction, placement, alteration, extension, removal, or demolition of a structure on or under the seabed.	• 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. • The placement, movement and removal of the crawler on or under the seabed. • The placement, movement and removal of the grade control drilling equipment on or under the seabed. • The placement, movement and retrieval of moored environmental monitoring equipment on or under the seabed.
s20(2)(d)	The removal of non-living natural material from seabed or subsoil.	• The removal of sediment from the seabed and subsoil using the crawler and by grade control drilling. • The taking of sediment and benthic grab samples from the seabed and subsoil associated with environmental monitoring.
s20(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.	• 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. • 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. • The disturbance of the seabed and subsoil associated with the placement, deployment, retrieval and mooring of environmental monitoring equipment. • The disturbance of the seabed and subsoil associated with the taking of sediment and benthic samples associated with environmental monitoring.
s20(2)(f)	The deposit of any thing or organism	• The re-deposition of de-ored

Section of the EEZ Act	Activity for which Marine Consent Required	Project Element
	in, on, or under the seabed.	sediments in, on or under the seabed. • 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).
s20(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.	• 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. • The disturbance and damage of the seabed and subsoil as a result of seabed material extraction via the crawler, the re-deposition of de-ored sediments, and the grade control drilling. • The disturbance and damage of the seabed and subsoil as a result of the placement, deployment, retrieval and mooring of environmental monitoring equipment. • The disturbance and damage of the seabed and subsoil as a result of the taking of sediment and benthic samples associated with environmental monitoring.
s20(4)(a)	The construction, mooring or anchoring long-term, placement, alteration, extension, removal, or demolition of a structure, part of a structure, or a ship used in connection with a structure.	• 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. • The placement, movement and removal of the crawler in the water column above the seabed. • The placement, movement and removal of the grade control drilling equipment in the water column above the seabed. • The placement, deployment, retrieval and mooring of environmental monitoring equipment in the water column above the seabed.

Section of the EEZ Act	Activity for which Marine Consent Required	Project Element
s20(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.	• Vibration (noise) caused by the IMV and crawler during iron sand extraction activities.

There are other activities associated with the project that are not regulated in accordance with the EEZ Act or its regulations. This are documented in Section 1.4.4 of this IA. However, the EPA must have regard to these activities, and their potential effects on the environment, in accordance with section 59(2)(b)(i) of the EEZ Act when considering the project. The potential effects of the project, including those that are not regulated by the EEZ Act, have been considered in Section 4 of the IA.

Section 38 of the EEZ Act specifies that any person may make an application for a marine consent to undertake a discretionary activity, and that the application must be made in the prescribed form. In this regard, the application must describe the proposal for which marine consent is sought and include an impact assessment prepared in accordance with section 39 of the EEZ Act. Section 38 also states that its requirements do not apply to the discharge of harmful substances.

Section 39(1) of the EEZ Act identifies what an impact assessment must contain to enable the EPA to make a decision on an application for marine consent. Section 39(2) of the EEZ Act states:

> *(2) An impact assessment must contain the information required by subsection (1) in—*
>
> *(a) such detail as corresponds to the scale and significance of the effects that the activity may have on the environment and existing interests; and*
>
> *(b) sufficient detail to enable the Environmental Protection Authority and persons whose existing interests are or may be affected to understand the nature of the activity and its effects on the environment and existing interests.*

Table 7.2 below identifies the requirements of section 39(1) of the EEZ Act and where they are addressed within this IA. Based on the requirements of section 39 being met, it is considered that the marine consent application meets all of the section 38 requirements.

Table 7.2: Section 39 Impact Assessment Information Requirements.

Information Requirement	Location Addressed in IA
(1) An impact assessment must—	
(a) describe the activity for which consent is sought; and	Section 2 – The project.
(b) describe the current state of the area where it is proposed that the activity will be undertaken and the environment surrounding the area; and	Section 3 - Existing Environment.
(c) identify the effects of the activity on the environment and existing interests (including cumulative effects and effects that may occur	Section 4 – Assessment of Effects.

Information Requirement		Location Addressed in IA
	in New Zealand or in the sea above or beyond the continental shelf beyond the outer limits of the EEZ; and	
(d)	identify persons whose existing interests are likely to be adversely affected by the activity; and	Section 3.11 – Existing Interests.
(e)	describe any consultation undertaken with persons described in paragraph (d) and specify those who have given written approval to the activity; and	Section 6 – Consultation.
(f)	include copies of any written approvals to the activity; and	N/A
(g)	specify any possible alternative locations for, or methods for undertaking, the activity that may avoid, remedy, or mitigate any adverse effects; and	Section 2.7 – Consideration of Alternatives.
(h)	specify the measures that the applicant intends to take to avoid, remedy, or mitigate the adverse effects identified.	Section 5 – Monitoring and Management Framework and proposed consent conditions.

7.4 Restrictions on Discharge Activities

Section 4(1) of the EEZ Act defines 'mining discharges' as:

> *"…in relation to a harmful substance, means a discharge made as an integral part of, or as a direct result of, a mining activity"*

Further, section 4(1) also identifies a 'harmful substance' as:

> *"…any substance specified as a harmful substance by regulations made under this Act"*

With regard to 'regulations made under this Act, the EEZ Regs 2015 applies to the discharge activities. Regulation 4(d) of the EEZ Regs 2015 identifies that *"sediments from mining activities other than petroleum extraction'* is a *'harmful substance'".*

Based on the description of the project in Section 2 of this IA, the project has the potential generate the following 'mining discharges' from the following 'integral parts of' the project:

- The 'mining discharges', being:
    - De-ored sediments and any associated contaminants discharged back to the water column from the IMV;
    - The release of disturbed seabed material (sediments) as a result of the seabed disturbance during the crawler extraction operations; and
    - The release of seabed material (sediments) as a result of the seabed disturbance during grade control drilling activities

Section 20A(2)(a)(ii) of the EEZ Act regulates the discharge of harmful substances in the EEZ and into, or onto, the seabed below it from ships - if the discharge is a mining discharge, while section 20A(2)(b)(iii) of the Act also regulates mining discharges from ships into, or onto, the continental shelf.

Section 20C of the EEZ Act contains provisions on the restriction on mining discharges from ships. As the discharge activities meet the definition of a *'mining discharges'* and subsequently a *'harmful substances'*, section 20C of the EZZ Act applies. It states that:

> *"(1) No person may discharge a harmful substance (if the discharge is a mining discharge) from a ship —*
>
> *(a) into the sea of the exclusive economic zone or above the continental shelf beyond the outer limits of the exclusive economic zone; or*
>
> *(b) into or onto the continental shelf.*
>
> *(2) However, a person may discharge the harmful substance in the circumstance described in subsection (1) if the discharge is a permitted activity or authorised by a marine consent or section 21, 22, or 23."*

Therefore, in accordance with the requirements of section 20C(2) of the EEZ Act a marine consent is required to authorise the mining discharges from the project.

With regard to the consents required, section 87A(1) of the EEZ Act states that:

> *"(1) This subpart applies in relation to an activity described in subpart 2 of Part 2."*

As the mining discharges are identified as *"an activity described in subpart 2 of Part 2"*, a marine discharge consent is required for those activities that are not a marine consent identified in accordance with section 20C(2) of the EEZ Act. The EEZ Regs 2015 also apply to these activities.

The EEZ Regs 2015 requirements are discussed below.

7.4.1 EEZ Regulations

The EEZ Regs 2015 came into effect on 31 October 2015 after the transfer of the regulation of certain discharge and dumping activities from the MTA.

The EEZ Regs 2015 apply to discharges *"from - ships, if the discharge is a mining discharge"* and *"from – structures involved in a mining activity"* into the EEZ and the continental shelf. Part 2 of the EEZ Regs 2015 contains the provisions relating to the discharge of sediments. With regard to the mining discharges from the project, Regulation 10 states:

> *"The discharge of sediments, other than a discharge that is permitted by regulation 7, 8, or 9 or prohibited by regulation 11, is classified as a discretionary activity under the Act."*

As the discharge is from iron sand extraction activities it does not comply with Regulations 7 to 9. Therefore, the mining discharges from the project are considered to be a ***discretionary activity*** under Regulation 10 and a marine discharge consent is required.

In terms of the matters that must be provided for in the IA, Regulation 35 identifies that, in addition to the matters identified in section 39 of the EEZ Act, an IA must describe the effects on human health of the discharge activity.

7.4.2 EEZ Act Requirements

Part 2, Subpart 2 of the EEZ Act outlines the restrictions and prohibitions on discharges and dumping in the EEZ.

Section 20C of the EEZ Act requires the discharges to be authorised by a marine consent and the mining discharges are a ***discretionary activity*** in accordance with section 10 of the EEZ Regs 2015. Therefore, the activities must be considered in accordance with the requirements of Part 3, Subpart 2A of the EEZ Act.

Sections 87A – J of the EEZ Act outline the matters that need to be provided for with regard to an application for a discretionary activity marine discharge consent, as well as the EPA's decision-making process. In this regard, section 87B of the EEZ Act allows for any party to make an application for a marine discharge consent as a discretionary activity. Similar to the requirements for marine consents, section 87B also outlines that any application for a marine discharge consent must be made in the prescribed form, fully describe the proposal, and include an impact assessment prepared in accordance with section 39 of the EEZ Act (as well as any regulations).

It is considered that this IA, and the application documents which accompany it, meet the necessary requirements of section 87B of the EEZ Act. An assessment of the effects of the discharges has been provided for in Section 4 of this IA. Further, as this IA has considered all project related activities together, Table 7.1 above is also relevant when considering the marine discharge activities and where they have been considered in the IA.

Sections 87D – 87E of the EEZ Act outline the matters the EPA shall consider in regard to marine discharge consents. The key matters are those described in section 59(2) of the Act and any effects on human health of the discharge of harmful substances if the consent is granted. Section 59(2) of the EEZ Act has been considered further below.

7.5 EPA's Decision Making Criteria

7.5.1 Overview – Marine Consents

Sections 59 and 60 of the EEZ Act set out the matters which the EPA must take into account and have regard to when considering an application for marine consent.
Section 59 of the EEZ Act states:

> ***"59 Environmental Protection Authority's consideration of application***
>
> *(1) This section and sections 60 and 61 apply when the Environmental Protection Authority is considering an application for a marine consent and submissions on the application.*
>
> *(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; and*

(c) the effects on human health that may arise from effects on the environment; and
(d) the importance of protecting the biological diversity and integrity of marine species, ecosystems, and processes; and
(e) the importance of protecting rare and vulnerable ecosystems and the habitats of threatened species; and
(f) the economic benefit to New Zealand of allowing the application; and
(g) the efficient use and development of natural resources; and
(h) the nature and effect of other marine management regimes; and
(i) best practice in relation to an industry or activity; and
(j) the extent to which imposing conditions under section 63 might avoid, remedy, or mitigate the adverse effects of the activity; and
(k) relevant regulations; and
(l) any other applicable law; and
(m) any other matter the EPA considers relevant and reasonably necessary to determine the application.

(3) The EPA must have regard to—

(a) any submissions made and evidence given in relation to the application; and
(b) any advice, reports, or information it has sought and received in relation to the application; and
(c) any advice received from the Maori Advisory Committee.

(4) When considering an application affected by section 74, the EPA must also have regard to the value of the investment in the activity of the existing consent holder.

(5) Despite subsection (3), the EPA must not have 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.

(6) Subsection (5)(c) does not apply if the person has given written approval but the person withdraws the approval by giving written notice to the EPA—

(a) before the date of the hearing, if there is one; or
(b) if there is no hearing, before the EPA decides the application."

Section 60 of the EEZ Act states:

"60 Matters to be considered in deciding extent of adverse effects on existing interests

In considering the effects of an activity on existing interests under section 59(2)(a), the Environmental Protection Authority must 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."

And finally, section 61 of the EEZ Act states:

“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.”

7.5.2 Overview – Marine Discharge Consents

Sections 87D – F set out the matters that must be considered in coming to a decision on an application for marine discharge consent.

Section 87D states:

“87D Environmental Protection Authority’s consideration of application

(1) This section and sections 87E and 87F apply when the Environmental Protection Authority is considering an application for a marine discharge consent or a marine dumping consent and submissions on the application.

(2) The EPA must take into account,—

(a) in relation to the discharge of harmful substances,—

(i) the matters described in section 59(2), except paragraph (c); and

(ii) the effects on human health of the discharge of harmful substances if consent is granted; and

…

(3) Section 59(3) applies to the application for a marine discharge consent or a marine dumping consent.”

Section 87D of the EEZ Act is similar to section 59 of the EEZ Act, which outlines the considerations for marine consents, in that it identifies the matters that the EPA must take into account when making a decision on an application for a marine discharge consent.

The matters are generally consistent between marine consents and marine discharge consents being that discharge consents must consider particular section 59 matters but not all of them. The primary difference between the two types of consents is that marine discharge consents must also consider human health effects associated with the discharges.

Section 87E states:

> ***"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."*

Section 87E is also consistent with section 61, which identifies the information principles for marine consents, however, section 87F does not provide for an *'adaptive management approach'* to be considered *'If favouring caution and environmental protection…'*

The relevant matters for consideration for both the marine consent and marine discharge consent applications have been discussed in further detail below.

7.5.3 Sections 59(2)(a) and (b) – Effects on the Environment and Existing Interests

Sections 59(2)(a) and (b) of the EEZ Act relate to both the marine consent and marine discharge consent applications.

The effects of the project on the environment and existing interests are addressed comprehensively in Section 4 of this IA. With respect to effects on the environment, including cumulative effects, of the extraction of iron sands and the discharge of waste mining material, the key conclusions from Section 4 of the IA are:

- The project would result in a positive economic effect to both the local and wider regions as well as New Zealand;
- Any adverse effects associated with the project are not significant, especially when considered against the naturally occurring background environment;
- A relatively small area of the seabed will be disturbed at any one time and the de-ored material will generally be deposited in the vicinity of where it was removed;
- Due to the high natural spatial and temporal variability, effects of the project on primary production will be localised and at the regional scale will be minor and indistinguishable from natural variability;
- Disturbed areas will typically be worked once thus allowing the environment to recover quickly from the disturbance and rehabilitation of marine organisms will occur within a short timeframe;

- Any potential effects on fish, seabirds and marine mammals will be localised and within the project area and are considered to be minor or less than minor;

- Any effects are limited to the duration over which the extraction activities occur (plus a short window of recovery following sediment excavation). Put another way, there are no “legacy effects” (as would occur, for example, with leachate production from a refuse landfill) meaning that once the activity ceases, the environment will return to normal very quickly; and

- The proposed consent conditions and management plans will further ensure that any potential effects associated with the project will be appropriately avoided, remedied or mitigated.

With respect to existing interests, the key conclusions in Section 4 are:

- Existing interests have been identified through extensive consultation by TTR;

- The design of the project has taken into consideration the existing interests within the project area and neighbouring STB area and has incorporated procedures to ensure that any effects on these interests will be avoided, remedied or mitigated;

- The effect of the project on existing shipping and navigation routes is considered to be low to very low;

- The proposed consent conditions have been refined through consultation with those parties with existing interests; and

- TTR has committed to the provision of an annual fund that further provides for existing iwi interests to be enhanced.

Further to the matters identified in section 59(2)(a), section 60(a) – (d) of the EEZ Act also identifies matters for consideration relating to existing interests. These matters are addressed below:

(a) *The area that the activity would have in common with the existing interest*

The project area is located within an area in the STB that is primarily used by commercial fisheries. There are also existing oil and gas platforms and pipelines in the surrounding area, but none are located within the project area. Some recreational and customary fishers may also fish the waters near the project area, but it is a considerable distance offshore and, therefore, difficult to access in small recreational craft.

(b) *The degree to which both the activity and the existing interest must be carried out to the exclusion of other activities*

While the project area is approximately 66 km^2, the actual working area per year will be much smaller at approximately 5 km^2. During this time, for reasons of health and safety, TTR requires exclusive use of the area designated for working.

With regard to existing interests, no interests have been identified that require exclusion and TTR has undertaken to work collaboratively with commercial fishing interests to ensure operations are well-planned and any disruptions are minimised.

(c) *Whether the existing interest can be exercised only in the area to which the application relates*

None of the existing interests are considered exclusive to the project area.

(d) *Any other relevant matter*

Other matters related to existing interests have been considered in Section 4 of this IA.

Section 59(2)(i) also requires the decision-maker to take into consideration *"the effects of activities that are not regulated under this Act".* For the purpose of this IA, these activities have been identified in Section 1.4.4 of this IA.

Where these abovementioned activities have implications on the project related EEZ Act activities, assessments of the potential adverse effects of the abovementioned activities have been undertaken under Section 4 of this IA. In summary, other than unforeseen oil spills, any effects associated with the above activities will not result in any adverse effects that are more than minor or are not avoided, remedied or mitigated by the proposed consent conditions.

7.5.4 Sections 59(2)(c) and 87D(2)(ii) – Effects on Human Health

Section 59(2)(c) relates to marine consent applications only as section 87D(2)(i) of the EEZ Act specifically excludes the consideration of this section in relation to the discharge of harmful substances. However, it is noted that section 87D(2)(ii) does require the EPA to consider the effects on human health of the discharge of harmful substances if a marine discharge consent is granted. On that basis, effects on human health, as they relate to both sections of the EEZ Act, have been considered below.

With regard to the human health effects that may arise from the environmental effects (section 59(2)(c)), Section 4 of this IA concludes that there are no expected human health effects that will result from the project. In this regard, none of these activities are considered to cause any human health effects as environmental effects are expected to be localised and short-term while the disturbance occurs.

With regard to human health effects, Section 4.10 of this IA concludes that there are no human health effects related to the mining discharges as the de-ored sediments will not have any contaminants or other materials added into the natural material prior to being re-deposited that could potentially result in any adverse effects on the environment or people.

There are other aspects of the project that have health and safety consideration, but these aspects are related to the health and safety of workers on-board the operational vessels. These aspects are subject to the requirements of the Health and Safety at Work Act 2015 ("**HSW Act**), which is administered by WorkSafe New Zealand.

Overall, it is considered that there are no adverse effects on human health that result from environmental effects of the project, including the marine discharges.

7.5.5 Section 59(2)(d) – Protection of Biological Diversity and Integrity of Marine Species, Ecosystems, and Processes

The EPA is required to take into account the importance of protecting the biological diversity and integrity of marine species, ecosystems and processes in accordance with section 59(2)(d) of the EEZ Act.

The effects as they relate to these matters have been assessed in detail in Section 4 of this IA. The assessment of effects concludes that the project will not result in any significant or permanent adverse effects on biological diversity, or the integrity of marine species, ecosystems and processes.

Further, it is considered that benthic macro-fauna communities are likely to be the most prone to being affected by the extraction and deposition of seabed materials. However, any adverse effects will be localised to the area of disturbance and temporary due to the extraction methodology. In addition, affected areas will start to re-colonise once the extraction activity ceases in the area.

The proposed consent conditions will also assist in ensuring that biological diversity and the integrity of marine species, ecosystems and processes in the STB are protected.

7.5.6 Section 59(2)(e) – Protection of Rare and Vulnerable Ecosystems and the Habitats of Threatened Species

The EPA is required to take into account the importance of protecting rare and vulnerable ecosystems and the habitats of threatened species in accordance with section 59(2)(e) of the EEZ Act.

As identified in Section 3.4 of this IA, there are no ‘rare and vulnerable ecosystems’ within the project area. However, there is the potential for some effects to be experienced beyond the project area in the CMA. Any effects experienced in this area, thus potential effects on any section 59(2)(e) areas within the CMA, will be avoided, remedied or mitigated through the project design and the proposed consent conditions.

With regard to the habitats of threatened species, Section 3.7 of this IA identifies that the project area is known to have the presence of Hector’s dolphin, and the sub-species Maui’s dolphin, as well as large cetaceans - including the blue whale - which all fall within the classification as ‘threatened’ or ‘endangered’ species. Section 4.8 of the IA discusses the potential effects of the project on marine mammals and notes that while the project has the potential to impact on these species, the project design has incorporated specific measures to ensure that any effects on these species are minimised. These measures include, but are not limited to, the provision of ‘soft-starts’ of vessels during operations, the use of observers when vessels are in motion, the establishment of protocols for mammal encounters, the provision of specific training to staff on-board vessels, as well as the preparation of a Marine Mammal Management Plan.

The measures noted above have been incorporated into the proposed consent conditions and will further assist in the protection of the habitats of threatened species.

7.5.7 Section 59(2)(f) – The Economic Benefit to New Zealand of allowing the Application

The EPA is required to take into account the economic benefit to New Zealand of allowing the application in accordance with section 59(2)(f) of the EEZ Act.

Sections 1.3 and 3.2 identify the economic aspects of the project and provides an overview of the current local and regional economies. Section 4.2 also outlines that there will be a positive economic benefit locally, regionally and nationally as a result of the project.

The positive effect on the national economy will be through employment, taxes and royalties. The regional and local economies will also receive positive economic effects through employment, establishment of offices and other necessary services related to the project, and through associated expenditure in the local and regional communities. The positive economic effects include:

- The estimated minimum royalty payment to New Zealand each year, at an iron ore spot price of US$40/tonne, is approximately NZ$6.15 million;

- The contribution of approximately NZ$312 million to New Zealand exports;
- The project will directly require over 200 people to operate the offshore vessels, with a further 50 staff required in support services; and
- The project is expected to generate about NZ$159 million in GDP and employ 1,666 people (directly and indirectly) in the New Zealand economy each year for the duration of the project.

It is considered that the project will have an economic benefit on a local, regional and national scale if the consents are granted.

7.5.8 Section 59(2)(g) – The Efficient Use and Development of Natural Resources

The EPA is required to take into account the efficient use and development of natural resources in accordance with section 59(2)(g) of the EEZ Act.

TTR has invested a significant amount of time and financial resources in assessing the feasibility of iron sand extraction in the STB. The results of this investigation identified that there is an iron sand resource present that can be extracted using industry best practice methods that will result in very localised, reversible environmental effects, while ensuring that the targeted iron sand is efficiently extracted.

As the processing of the seabed material removes only the targeted iron sand, and returns the remaining material to the seabed, it is considered that the project is an efficient use of the natural resource and by returning the de-ored material to the seabed allows the natural ecosystems to be sustained.

It is considered that the project provides for the efficient use and development of natural resources.

7.5.9 Section 59(2)(h) – The Nature and Effect of Other Marine Management Regimes

The EPA is required to take into account the nature and effect of other marine management regimes in accordance with section 59(2)(h) of the EEZ Act.

Section 7 of the EEZ Act defines a marine management regime as "*the regulations, rules, and policies made and the functions, duties, and powers conferred under an Act that applies to any 1 or more of the following: (a) territorial sea; (b) exclusive economic zone; (c) continental shelf."* The regimes are typically established through provisions in other Acts or Regulations.
The four Government agencies operating marine management regimes relevant to this application are:

- DOC – who are responsible for marine mammals and protected species within the STB;
- MNZ – responsible for maritime rules for some discharges and oil spills;
- MPI – responsible for managing fisheries within the EEZ and territorial waters, and biosecurity at New Zealand's boundaries; and
- WorkSafe New Zealand – responsible for administering legislation to provide a safe workplace.

TTR has consulted with all of the above mentioned parties and has incorporated particular methods, plans and procedures into the project design to ensure that they comply with all of the necessary requirements of other marine management regimes. These include the provision of a Marine Mammal Management Plan, Spill Contingency Management Plan, Health & Safety Plan, and a Biosecurity Management Plan, as well as the requirement of training for staff working on vessels, and procedures for dealing with biosecurity risks.

TTR is committed to meeting the requirements of all other marine management regimes and where there is crossover between the requirements of those regimes and the EEZ Act, these have been provided for through the proposed consent conditions.

It is considered that the project appropriately provides for the nature and effects of other marine management regimes.

7.5.10 Section 59(2)(i) – Best Practice in Relation to an Industry or Activity

The EPA is required to take into account best practice in relation to industry or activity in accordance with section 59(2)(i) of the EEZ Act.

As outlined in Sections 2.3 and 2.6 of this IA, the iron sand extraction process is considered to have been developed and designed with regard to best practice and the methods incorporated are consistent with that approach. TTR has invested significantly in ensuring that the project follows the best practice approach as it means that the iron sand extraction operation is as efficient and effective as possible, thus minimising any adverse effects associated with the project.

With regard to industry, the following outlines the best practice maritime management measures undertaken by TTR to ensure the vessels involved with the project are compliant with IMO conventions and New Zealand maritime rules[129] - particularly with regard to vessel safety, operation and navigation.

IMV

During the iron sand extraction phase, the IMV will operate continuously for 24 hours per day / seven days per week. It will be moored on four anchors each extending up to 1 NM from the vessel utilising a DPS, as outlined in Section 2.3.2.1 and the position of the anchors will be lit at night.

The IMV will show the lights and shapes for a vessel restricted in its ability to manoeuvre when at anchor, as required by the Maritime Rule 22.27. Working lights will also be obvious to other marine traffic as required by Maritime Rule 22.30. The IMV will also be fitted with an AIS transmitter/receiver to alert traffic to its presence and for the officer of the watch to monitor nearby traffic.

IMV and FSO Vessel

As described in Section 2.3.6, the FSO vessel will operate as the transfer vessel between the IMV and the CEV. It will station itself by a DPS adjacent to the bow of the IMV and connect the floating transfer hoses to receive the ore concentrate slurry. Whilst approaching and when within the navigational safety buffer zone around the IMV, the FSO vessel will be restricted in its ability to manoeuvre and will show the lights and shapes as required by Maritime Rules 22.27 and 22.30.

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129 Maritime New Zealand, 2015. *"Maritime Rules – Part 22: Collision Prevention"* Retrieved November 2015. http://www.maritimenz.govt.nz/Rules/Rule-documents/Part22-maritime-rule.pdf

FSO Vessel and CEV

As described in Section 2.3.7, the transfer operation between the FSO vessel and the CEV will take place with the CEV at anchor and the FSO vessel either moored to it or under DPS in close proximity to the CEV. The CEV will show the lights and shapes required for a vessel at anchor under Maritime Rule 22.30 (1) and (2), the FSO vessel, when transferring cargo and under DPS will show the lights required by Maritime Rule 22.27, otherwise the lights for a vessel at anchor as required under Maritime Rule 22.30.

Anchor Handling Tug

The AHT will be used to deploy and move the anchors of the IMV as required, when doing so it will exhibit the lights of a towing vessel and meet the relevant requirements of Maritime Rule 22.24. The AHT may also be used to transfer stores and equipment to and from other vessels and the shore.

Refuelling Vessel

The refuelling vessel will supply the IMV and FSO vessel with HFO as and when required whilst being positioned alongside these vessels. This will primarily occur at sea as outlined in Section 2.4, but at times may occur within a harbour or port area. The refuelling vessel will have double containment for fuel to reduce the chance of storage tank failures. Whilst refuelling the vessel will be restricted in it manoeuvrability, it will show the lights and shapes as required under Maritime Rule 22.27.

Comprehensive operating manuals will be drawn up to manage the fuel transfer operation and a Spill Contingency Management Plan will be prepared in consultation with MNZ.

Maritime Safety

Further, to ensure maritime safety the following will occur:

- All major vessels will be classed by a member of the International Association of Classification Societies.
- Vessels will be compliant with the SOLAS, as well as Maritime Rule of New Zealand.
- Any other smaller vessels will be registered under the New Zealand Safe Ship Management System.
- The vessels will be equipped with:
    - Navigation equipment, (including electronic and paper charts) as required by the IMO Conventions and New Zealand Maritime Rules.
    - Radar, AIS and an extensive communications suite to detect and communicate with other vessels in their proximity and the shore.
    - Lifesaving equipment as required by the Safety of Life at Sea Convention and New Zealand Maritime Rules, the crews will be fully trained and competent to operate the lifesaving equipment.

Further to the matters above, the presence of the project vessels in the STB will be an asset to, and enhance any, search and rescue operations in the area. The project will also be serviced by helicopters operating out of Whanganui, Hawera and / or New Plymouth, which will potentially be available to supplement the current rescue helicopter services in times of emergency.

Under Maritime Rule 22.18, other vessels are required to keep out of the way of the IMV as it is *"a vessel restricted in its ability to manoeuvre"*. TTR will discuss with MNZ the imposition of a dynamic buffer around the IMV that extends beyond its anchors as this consideration is outside what the EPA can consider under the marine consent and marine discharge consent applications.

As demonstrated throughout this IA, TTR considers that the application of "best practice" has been provided for in relation to all aspects of the project and the proposed consent conditions will further ensure that the project is undertaken in accordance with best practice as it relates to the project.

7.5.11 Section 59(2)(j) – The Extent to Which Imposing Conditions Might Avoid, Remedy, or Mitigate the Adverse Effects of the Activity

The EPA is required to take into account the extent to which imposing conditions under section 63 of the EEZ Act might avoid, remedy, or mitigate any adverse effects of the activities for which consent is being sought.

The conclusions of the assessment of effects in Section 4 of this IA is that the project will generally result in minimal effects on the environment. Further, any effects will typically be short-term and localised to the area in which the extraction operations are to occur.

As outlined in Section 5 of this IA, TTR has proposed detailed monitoring and management programmes to address the potential effects of the project on the environment. Further, the programmes will identify and provide for measures, in the form of operational and management responses, to be implemented if there are unexpected adverse effects that result from the project. These programmes and operational responses, as well as other controls, have been provided for within the proposed consent conditions.

7.5.12 Section 59(2)(k) – Relevant Regulations

When considering both the marine consents and marine discharge consents, the EPA is required to take into account the relevant regulations. Regulations are defined in section 4 of the EEZ Act to mean regulations made under the EEZ Act.

There are two relevant regulations for this application being:

- The Exclusive Economic Zone and Continental Shelf (Environmental Effects – Permitted Activities) Regulations 2013 ("**EEZ Regs 2013**"), which state which activities are permitted activities for the purpose of the EEZ Act and the conditions for undertaking those activities without a marine consent; and

- The EEZ Regs 2015 which control discharges and dumping in the EEZ and beyond.

The purpose of the EEZ Regs 2013 is to prescribe certain activities as being permitted under the EEZ Act and identify conditions which must be complied with when undertaking such activities. The EEZ REGS 2013 also identify the EPA is also the responsible party for monitoring compliance with any conditions.

Regulation 5 provides for prospecting and exploration as a permitted activity provided the conditions in clause (2) of the regulation can be met. These conditions include notification to the EPA prior to the commencement of works, compliance with pre-activity requirements, undertakes and provides to the EPA an initial environmental assessment, ensuring that only the necessary material is taken from the seabed, and ensuring that all necessary measures to avoid, remedy or mitigate adverse effects are taken. While the grade control drilling activities could potentially fall for consideration under this regulation, TTR considers that the drilling activities will not meet the relevant requirements of the EEZ Regs 2013 and therefore, require a marine consent. The basis for this positon is due to the high number of drill operations over the term of the project, notification cannot be guaranteed to be provided to the EPA within the prescribed timeframe (40 days) as this will cause unnecessary delays in the extraction activities. The marine consents related to this activity has been provided for in Table 7.1 above.

The EEZ Regs 2015 requirements have been discussed in Sections 1.4.2 and 7.4, where it is concluded that under the regulations that the mining discharges associated with the project are discretionary activities and therefore, requires marine discharge consents under the EEZ Act.

TTR does not consider any other regulations relevant for consideration in regard to the project.

7.5.13 Section 59(2)(l) – Any Other Applicable Law

When considering both the marine consents and marine discharge consents, the EPA is required to take into account any other applicable laws that are relevant to the TTR application.

The following are considered to be the relevant statutes:

- Biosecurity Act;
- Continental Shelf Act;
- Crown Minerals Act;
- Fisheries Act 1996 ("**the Fisheries Act**");
- HSW Act;
- HSNO Act;
- Heritage Act;
- MCA Act;
- Marine Mammals Protection Act 1978;
- Marine Reserves Act 1971;
- Maritime Transport Act;
- RMA;
- Resource Management (Marine Pollution) Regulations 1998;
- Submarine Cable Act; and
- Wildlife Act 1953 ("**Wildlife Act**").

Each is discussed below.

7.5.13.1 Biosecurity Act

The Biosecurity Act was enacted to reform the law relating to the exclusion, eradication, and effective management of pests and unwanted organisms. The 2012 reform also added Part 8A to the Biosecurity Act which extends the existing provisions to the EEZ. This was in response to increased economic activity in the EEZ.

Biosecurity risks have been discussed and assessed in Section 4.15.2 of this IA, this assessment has included the identification of the procedures and management measures necessary to ensure that any risks are avoided, remedied or mitigated.

Sections 24E to 24K of the Biosecurity Act deals with Craft Risk Management Standards, and specifies requirements to be met for the effective management of risks that are associated with the entry of foreign craft into the EEZ and New Zealand territory.

All TTR project related vessels will be required to comply with the requirements of Part 3 – Importation of Risk Goods, including the Craft Risk Management Standards and Import Health Standards, and Part 4 – Surveillance and Prevention under the Biosecurity Act.

Further biosecurity risks associated with the project may potentially arise through the management of ballast waters and vessel biofouling associated with the operation of the vessels. As part of standard operational requirements, TTR will implement controls and procedures that identify how these risks are managed primarily through the requirement for vessels to comply with the requirements of the BMP.

Consent conditions can be imposed as part of any marine consent granted, requiring ballast water and hull biofouling to comply with the requirements of the Biosecurity Act and conventions guidelines for the management of ballast water and hull biofouling. The proposed consent conditions have included conditions of this nature.

TTR is committed to continue to engage with the Ministry of Primary Industries on matters of biosecurity under the Biosecurity Act during the course of the project and this has been provided for through the BMP requirements.

There are no Pest Management Strategies prepared under the Biosecurity Act that are relevant to the project. For completeness, it is noted Pest Management Strategies have been prepared by the TRC and the Horizons Regional Council; however these pest management strategies relate to management of pests on land and are not relevant to the EEZ area to which the project relates.

It is considered that the project will comply with the provisions of the Biosecurity Act and any regulations made under that Act.

7.5.13.2 Continental Shelf Act

The Continental Shelf Act vests all rights that are exercisable in New Zealand with respect to the continental shelf and its natural resources (defined as mineral and other non-living resources of the seabed and subsoil of those submarine areas that extend beyond 12 NM to 200 NM, and in some areas to the outer edge of the continental margin (the extended continental shelf)) for the purpose of exploring the shelf and use those resources.

Prior to 24 May 2013, the Continental Shelf Act provided for the granting of licences for prospecting and mining on the continental shelf, including imposition of conditions on any licences granted. On 24 May 2013, the Continental Shelf Amendment Act 2013 inserted a new Section 5AA into the Continental Shelf Act which provided for matters related to the mining of minerals on the continental shelf.

Section 5AA specified that the Crown Minerals Act and any regulations made under that Act, as far as they are applicable and with any necessary modifications, apply to mining activities for minerals other than petroleum in the seabed or subsoil of the continental shelf. In effect, this meant that any new applications or subsequent mining licences would be processed under the Crown Minerals Act as if the Continental Shelf Licence was a prospecting or exploration permit under the Crown Minerals Act.

TTR held a Continental Shelf Licence (No. 50753) for minerals prospecting over a 3,314 km^2 of the continental shelf under the Continental Shelf Act. The licence was granted and commenced in 17 December 2010 for a period of four years which expired on 16 December 2014.

On 26 July 2013, TTR applied for a new mining permit, that include the project area for these consents, which is located within the area over which the now expired Continental Shelf Licence 50753 covered. As detailed in Section 1.3, the mining permit (Mining Permit No. 55581) has since been granted under the Crown Minerals Act.

Further to the above, the Continental Shelf Act enables safety zones to be created to protect existing offshore installations. The project area borders the identified Kupe Safety Zone attached to the existing Kupe Natural Gas Platforms (refer to Figure 7.1) however, the project area does not impede on this area.

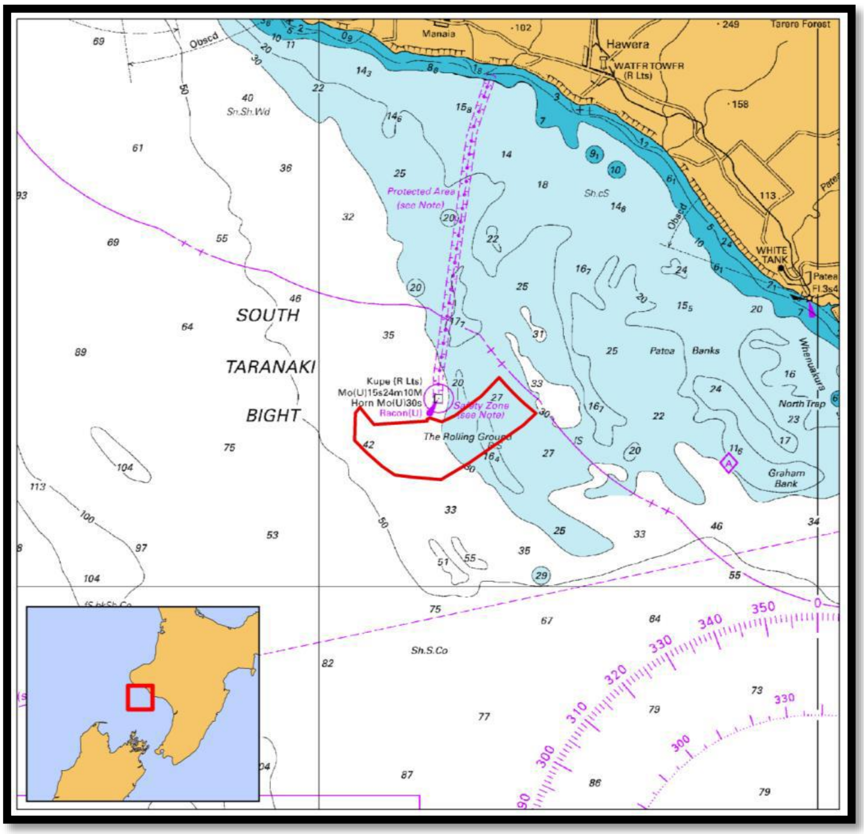

Figure 7.1: Kupe Safety Zone as identified under the Continental Shelf Act 1964.

It is considered the, where relevant, the project complies with any requirements of the Continental Shelf Act.

7.5.13.3 Crown Minerals Act

As identified above, following the May 2013 Continental Shelf Act amendment, the management of activities relating to prospecting, exploration and mining of Crown-owned mineral resources within the EEZ was transferred to the Crown Minerals Act. As such, approvals for the prospecting, exploration and mining of Crown-owned minerals resources are now administered by New Zealand Petroleum and Minerals, a branch of the Ministry of Business Innovation and Employment.

TTR's Crown Minerals Act tenements are located off the west coast of the North Island of New Zealand to the north and south of Cape Egmont, which the project area falls within. TTR was granted an Exploration Permit (No. 54068) for five years commencing on 17th December 2012, which expires on 18 December 2017. Also adjacent to the project area is Prospecting Licence 50753, which was granted to TTR on the 17th December 2010 and expires on the 16th of December 2018. This licence was granted under the Continental Shelf Act.

As outlined in Section 1.3 and mentioned above, TTR has been issued a Mining Permit (No. 55581) under the Crown Minerals Act. This IA relates to marine consent and marine discharge consent applications under the EEZ Act for iron sand operations in the STB area, that are included within the area provided for by Mining Permit No. 55581.

The Crown Minerals Act sets out the reporting regulations for active Tier 1 mining permits. The purpose of the reports is to ensure TTR is operating in accordance with good industry practice, and is tracking the resource and reserves in accordance with a recognised reporting code. TTR will be reporting to the Joint Ore Reserves Committee (2012) standard. Mine plans are also required to be submitted annually, this includes an outline of the extraction operations to occur for the following year along with an extraction schedule. These matters have been further provided for through the proposed consent conditions by way of an annual Operational Assessment Report.

7.5.13.4 Fisheries Act

<u>General</u>

The Fisheries Act establishes a framework for managing customary, recreation and commercial fishing, in New Zealand. The Fisheries Act is administered by the Ministry of Fisheries.

The Fisheries Act manages the allocation of rights to go fishing, the creation of taiapure (local customary fishery covering estuarine and littoral waters - Part IX) and mataitai areas (Maori customary fishing areas - section 186), and the recovery of costs from the commercial fishing industry.

TTR's project will occur in *'New Zealand fisheries waters'* as defined in the Fisheries Act.

The majority of the provisions of the Fisheries Act deal with quota management and access to fisheries under different fishery management regimes established in accordance with the provisions of the Fisheries Act.
Fishing interests are recognised by the EEZ Act as lawfully established existing activities which are 'existing interests'. These 'interests' need to be taken into account by the EPA when determining applications for marine consents and marine discharge consents, in accordance with section 59(2) of the EEZ Act.

The potential impacts of TTR's project on customary, recreational and commercial fishing are addressed in Sections 4.11, 4.15 and 4.15.1, respectively.

Customary Fishing

The Maori Fisheries Act 2004 implements the agreements made under the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.

Section 3.11 of this IA sets out information on iwi associations within the STB including iwi customary associations within and surrounding the project area. In summary, there are no taiapure or mataitai areas existing within or in close proximity to the project area. However, existing fishing and seafood gathering by iwi in the STB has been identified as an existing interest in the IA. The effects of the project have been discussed in detail in Section 4.11 of this IA.

As provided for through the proposed consent conditions, mitigation measures have been proposed to ensure that any effects on cultural fishing sites will be minimised. These measures include the establishment of a Kaimoana Monitoring Programme to provide ongoing information about the fish and shellfish stocks of relevance to Maori within the STB coastal areas. It is expected that this programme will provide valuable information to Maori and assist in the long-term management of the customary kaimoana stocks.

Recreational Fishing

Section 4.15.3 of this IA assesses the recreational fishing effects associated with the project. In summary, the project area was found to be a very low use recreational setting, which may be used only rarely for recreational marine fishing due to being so far offshore. There is the potential for some minor and localised effects at the iron sand extraction sites due to the exclusive use of the extraction zone, turbidity effects and short term effects on habitat in the recently mined seafloor. However, due to the distance offshore and the low recreational fishing activity, the public notification of working mining areas and the ability for recreational fishers to avoid any mining areas, there are unlikely to be any adverse effects on recreational fishing at a local, regional or national scale.

Commercial Fisheries

Section 4.15.1 of this IA assesses the commercial fishing effects associated with the project. TTR has undertaken extensive consultation with the commercial fisheries representatives and the outcomes of this process resulted in the inclusion of consent conditions that provide for regular ongoing meetings between TTR and representatives of the commercial fishing industry. The purpose of the meeting is to establish and provide for a co-ordinated approach between the iron sand extraction activities and commercial fishing activities.

The consultation process also identified the value of Admiralty Bay to New Zealand’s aquaculture sector. In order to protect the existing interests within this area TTR agreed to include conditions of consent that exceed current regulatory requirements and has voluntarily prohibited the discharge of any ballast water or other materials within Admiralty Bay as well as restricting use of the area to only sheltering during storm events other than in emergency situations.

The requirements to meet regularly with aquaculture interests and the restrictions on use of Admiralty Bay have been incorporated into the proposed consent conditions.

Provided the proposed consent conditions are adopted, it is considered that any effects on the existing interests of commercial fisheries will be avoided, remedied or mitigated.

7.5.13.5 HSW Act

Section 39(4) of the EEZ Act states:

> *"…any measures required by or under the Health and Safety in Employment Act 1992 that may have the effect of avoiding, remedying, or mitigating the adverse effects of the activity on the environment or existing interests."*

It is noted that the HSW Act has superseded the Health and Safety in Employment Act 1992 which is referred to in section 39(4) of the EEZ Act. The HSW Act has implications on how TTR manages the project operations but it does not have a direct impact on the effect of avoiding, remedying, or mitigating the adverse effects of the activity on the environment or existing interests.

Notwithstanding this, there are many operational health and safety considerations to be taken into account for the project and TTR has developed a comprehensive set of health and safety initiatives which will address the health and safety matters of the project. The initiatives are summarised in Appendix 7.1 of this IA. Additionally, TTR's Health and Safety, and Environment and Community policies are appended as Appendices 7.2 and 7.3 to this IA.

Further to its initiatives and policies, TTR is liaising with MNZ and Worksafe New Zealand in respect of developing a suitable approach for the overarching health and safety management for the project. As part of this approach and prior to the commencement of any operations, TTR will be required to identify and evaluate all hazards that have the potential to cause a major accidents and, subsequently, identify suitable control measures to address these hazards. However, to reiterate, these are not related to the effects of avoiding, remedying or mitigating the adverse effects of the activity on the environment or existing interests.

7.5.13.6 HSNO Act

The HSNO Act sets out controls on the use of hazardous substances and came into effect in two stages. Provisions relating to new organisms took effect in July 1998, and provisions relating to hazardous substances came into force on 2 July 2001. The HSNO Act is administered by the EPA.

In TTR's case the substances that fall under the HSNO Act jurisdiction are:

- HFO and diesel (refer Section 2.4); and
- Residual Clean-in-Place chemicals from reverse osmosis system (refer Section 0).

Storage and handling of HFO and diesel on all project related vessels will be managed to ensure compliance with requirements under the HSNO Act for the avoidance of unintended ignition and for the segregation of incompatible substances. Further, TTR will implement a Spill Contingency Management Plan to provide for any unplanned spill events that may occur.

All Clean-in-Place chemicals used in the reverse osmosis system will be collected and retained for onshore disposal by approved contractors.

Storage and handling of all potentially hazardous substances will be managed to ensure safe practices consistent with requirements under the HSW Act, and the HSNO Act.

7.5.13.7 Heritage Act

The Heritage Act prohibits the modification or destruction of an archaeological site unless an Archaeological Authority for the modification or destruction is obtained from Heritage New Zealand. This Authority is in addition to any resource consents required under the RMA for the modification or destruction of the heritage feature.

An archaeological site is defined in the Heritage Act as follows:

> *"any place in New Zealand, including any building or structure (or part of a building or structure), that—*
> *(i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and*
> *(ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; ..."*

It is noted that the meaning of "archaeological site" refers to "a place in New Zealand," including any place within the territorial limits of New Zealand, including the EEZ.

The archaeological assessment of the project contained in Section 4.7 of this IA, identifies that no archaeological sites, particularly shipwrecks, are known to be present within the project area. However, in accordance with the Heritage Act, if a pre-1900 shipwreck and debris should be discovered during any extraction operations it would be necessary for TTR to obtain an Archaeological Authority before any further work can be carried out that may affect the site.

This process has been provided for through the proposed consent conditions.

7.5.13.8 MCA Act

The MCA Act repealed the Foreshore and Seabed Act 2004 and restored any customary interests in the common marine and coastal area ("**CMCA**") that has been extinguished by that Act. The CMCA extends from the line of mean high water springs to the outer limits of the territorial sea, but does not include land in the CMA already in private ownership or that held by the Crown as a conservation area, a national park or a reserve. No part of the project area is located within the territorial sea being an area not exceeding 12 NM from the low water mark of the coast.

The MCA Act also provides for the recognition and protection of protected customary rights. As a general rule, a consent authority must not grant a consent for an activity in a protected customary rights area if the activity has, or is likely to have, adverse effects that are more than minor on the exercise of a protected customary right.

The MCA Act also restores the right to Maori to seek customary marine title which recognises property rights of Maori that have continued since or before acquisition of Crown sovereignty to the present day. It also protects existing uses and rights, including navigation and fishing rights, and resource consents granted before the MCA Act commenced. It is important to note that the MCA Act does not affect Crown ownership of nationalised minerals.

In accordance with the EEZ Act, a *'protected customary right'* or *'customary marine titles'* as defined under the MCA Act are deemed as an *'existing interest'* in the EEZ Act, and shall be taken into account by the EPA when determining applications for marine consents and marine discharge consents, in accordance with section 59(2)(b) of the EEZ Act.

It is also noted that section 45(1) of the EEZ Act requires the EPA to serve a copy of any application for a marine consent on *'customary marine title groups'* and *'protected customary right groups'*.

The MCA Act defines 'customary marine title groups' and 'protected customary right groups' as follows:

> *customary marine title group –*
> *(a) means an applicant group to which a customary marine title order applies or with which n agreement is made and brought into effect; and*
> *(b) includes a delegate or transferee of the group if the delegation or transfer is made accordance with tikanga*
>
> *protected customary right groups –*
> *(a) means an applicant group to which a protected customary rights order applies or with which an agreement is made; and*
> *(b) includes a delegate or transferee of the group if the delegation or transfer is made in accordance with tikanga*

At the time of writing this IA, there are no customary rights or customary marine titles, nor are there applications for titles, under the MCA Act relating to the project area. It is noted that Ngāruahine has lodged an application for customary title for the CMCA between the Taungatara and Waihi Rivers however, this area is outside the project area.

7.5.13.9 Marine Mammals Protection Act

The Marine Mammals Protection Act provides for the conservation, protection and management of marine mammals. The Marine Mammals Protection Act is administered by DOC and applies to the coastal marine environments waters within the territorial sea and out beyond the EEZ.

Under the Marine Mammals Protection Act, a permit from the Minister of Conservation is required for anyone to "hold" or "take" a marine mammal, whereby "take" is defined to include any actions that harm, harass, injure and attract a marine mammal.

Section 3(a) of the Marine Mammals Protection Act gives specific responsibility to DOC for the administration and management of marine mammals and marine mammal sanctuaries. Further, conservation management strategies establish objectives for the integrated management of marine mammals under the Marine Mammals Protection Act (section 3(c)). The purpose of these conservation management strategies is to establish objectives for management of marine mammal sanctuary(s) (section 3(d)).

The Minister of Conservation may also approve a 'population management plan' in respect of one or more species, being threatened species or other species of marine mammal (section 3(e)).

Section 22 deals with the Ministers powers to define, by notice in the Gazette, any place and declare it to be a marine mammal sanctuary. In defining and declaring a sanctuary, the Minister may specify the activities that may or may not be engaged in within the sanctuary and may impose restrictions in respect of the sanctuary.

There are currently six marine mammal sanctuaries in New Zealand including the West Coast North Island sanctuary, shown in Figure 7.2 below, which is the only sanctuary within the general vicinity of this project.

<u>Marine Mammals Protection (West Coast North Island Sanctuary) Notice 2008</u>

The issuing of this notice created a marine mammal sanctuary along the northern part of the west coast of the North Island. The explanatory note states that the notice *"creates a marine mammal sanctuary along part of the west coast of the North Island, and restricts seismic surveys in the whole of the sanctuary and mining activities in part of the sanctuary. The sanctuary includes areas where Hector's dolphin are found."*

The boundaries extend alongshore from Maunganui Bluff in Northland to Oakura Beach, Taranaki in the south. The sanctuary's offshore boundary extends from mean high water springs to the 12 NM territorial sea limit. The total area of the sanctuary is approximately 1,200,086 ha and covers 2,164 km of coastline, as shown in Figure 7.2 below.

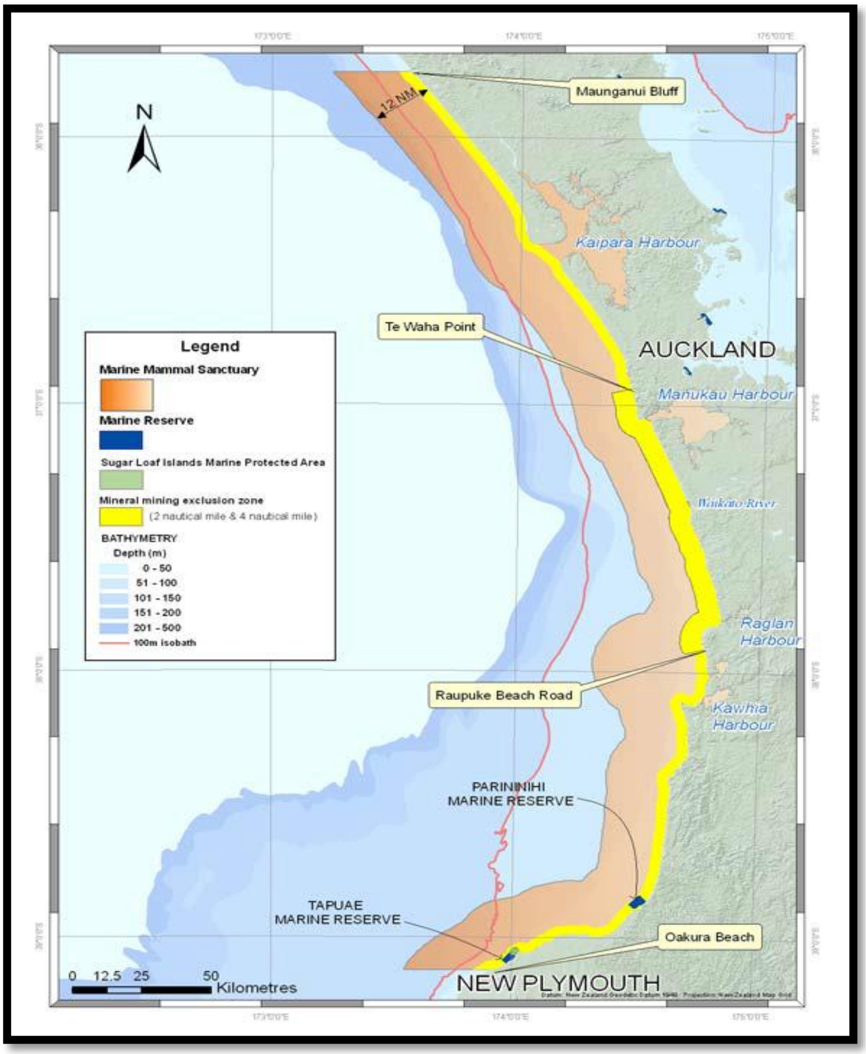

Figure 7.2: Boundaries of Marine Mammals Protection (West Coast North Island Sanctuary).

Within the sanctuary boundaries there are restrictions on seabed mining activities and acoustic seismic survey work. The NZ Gazette notice for a marine mammal sanctuary specifies the areas in which these restrictions apply.

The project area is located approximately 100 km south from this sanctuary and is therefore, not subject to any restrictions imposed within this area.

Other Mammal Effects

The impacts of the project have been assessed in terms of potential effect on marine mammals in Section 4.8. In summary, the potential key effects of the project are:

- **Noise effects** - it has been concluded that there is not expected to be a more than minor temporary alteration to the behaviour of marine mammals in the immediate vicinity of the extraction area. Further, given the low numbers of marine mammals observed in the area any effects of noise generated by extraction activities are expected to be no more than minor. Additionally, ‘soft-start’ and other operating procedures will be implemented to minimise the potential noise effects on marine mammals; and

- **Risk of collision with operational vessels** - it is concluded that overall, given the low vessel speeds during excavation, and the low number of operational vessels proposed in addition to those already using the STB, that the additional risk to any marine mammals that may be present in the project area is extremely low. Operational procedures will be implemented through management plans to further minimise the potential for any effects on mammals. These measures include observers and video recordings on each vessel, and the requirement of avoidance measures when mammals are encountered when the vessels are in motion.

TTR has included various mitigation measures and operational controls, including the provisions of a Marine Mammal Management Plan, in the proposed consent conditions for the project. These conditions are considered to further avoid, remedy or mitigate any potential adverse effects on marine mammals that occur as a result of the project. The proposed consent conditions as they relate to marine mammals have been prepared in consultation with, and generally accepted by, DOC through the pre-lodgement consultation process.

7.5.13.10 Marine Reserves Act

The Marine Reserves Act provides for the establishment of marine reserves over specified areas of the foreshore and territorial sea. Section 3(1) of the Act states *“the provisions of this Act shall have effect for the purpose of preserving, as marine reserves for the scientific study of marine life, areas of New Zealand that contain underwater scenery, natural features, or marine life, of such distinctive quality, or so typical, or beautiful, or unique, that their continued preservation is in the national interest.”*

Within marine reserves, a range of activities are prohibited including fishing, removal of material, dredging, discharging or dumping of any matter, construction or any other direct human disturbance.

There are two Marine Reserves in the Taranaki area being Parininihi and Tapuae Marine Reserves. Both are located to the north of project area:

(i) Parininihi Marine Reserve protects a 1,800 ha portion of the subsea environments located in the southern most reaches of the Taranaki Bight and protects an isolated offshore reef in the shadow of the White Cliffs/Parininihi. Within the reserve boundaries, all marine life, habitat, objects and structures are protected. The reserve is managed by a Joint Advisory Committee of Ngāti Tama Iwi and DOC; and

(ii) Tapuae Marine Reserve is located on the Taranaki coast close to New Plymouth. The 1,404 ha reserve adjoins the Sugar Loaf Island Marine Protected Area where a complexity of caves, canyons and crevices, boulder fields, mud and sand hosts a diverse and flourishing range of sea life.

The project related activities will not take place within or in close proximity to either of these identified marine reserves, identified under the Marine Reserves Act.

7.5.13.11 Maritime Transport Act

The Maritime Transport Act and associated Marine Protection Rules previously regulated the discharge of harmful substances from ships or offshore installations, and the dumping of waste or other matter, beyond the territorial sea. However, as of 31 October 2015, as a result of the EEZ Act and the Maritime Transport Act amendments passed in 2013, there has been a transfer of responsibility for regulating these activities from MNZ to the EPA through the EEZ Act. Therefore, as at 31 October 2015, Part 200 (which previously provided for discharges) was revoked and Part 131 entered into force.

The effects of all discharges from TTR's operations are discussed and evaluated in other sections of this IA as required by section 59(2)(a) of the EEZ Act.

Further to the discharges, Part 131 of the Marine Protection Rules is relevant to the project.

Maritime New Zealand Marine Protection Rules, Part 131: Offshore Installation – Offshore Installations – Oil Spill Contingency Plans and Oil Pollution Prevention Certification

The purpose of Part 131 is to ensure that offshore installations operating in New Zealand continental waters and in the internal waters of New Zealand have marine oil spill contingency plans that will support an efficient and effective response to an oil spill.

Part 131 also ensures that certain pollution prevention equipment and arrangements on board installations meet international performance standards and in-service maintenance requirements.

Part 131, in conjunction with the EEZ Regs 2015, gives effect to the provisions of the MARPOL and the International Convention on Oil Pollution Preparedness, Response and Co-operation 1990 in respect of offshore installations.

Offshore installation is defined under Part 131 to include:

> *"(a) any artificial structure (including a floating structure that is not a ship) used or intended to be used in or on, or anchored or attached to, the seabed for the purpose of the exploration for, or the exploitation or associated processing of, any mineral, oil or gas.*
> *…"*

The IMV is by this definition an *"installation"* because it is an *"artificial structure …intended to be used in or on, or anchored or attached to, the seabed for the purpose of … the exploitation or associated processing of, any mineral, oil or gas"*.

Under Subpart A, 131.21, a person must not operate an offshore installation, in this case the IMV or other operational vessels, without the MNZ Director's written approval of an oil spill contingency plan containing the matters prescribed in Part 131 that are appropriate to the operation of that installation. Further, rules under Part 131 set out the process for approval, consultation, amendment etc with regard to any such plans.

Section 2.3 of this IA provides a project overview including details of the vessels and each stage of the processing, and Section 2.4 sets out the matters related to fuel, including oil in the form of HFO and diesel, storage, handling and use.

TTR is committed to preparing and implementing a Spill Contingency Management Plan for the project prepared in accordance with the requirements of Part 131, and in consultation with MNZ, and submitted for approval to the Director of MNZ. This has been further provided for through inclusion in the proposed consent conditions.

7.5.13.12 RMA

In accordance with section 59(2)(a) of the EEZ Act, the EPA is required to take into account effects that may occur outside of the EEZ - including areas that are within the jurisdiction of the RMA. Further section 59(2)(h) of the EEZ Act requires the EPA to take into account *'the nature and effect'* of the RMA when considering marine consent and marine discharge consent applications.

The provisions of the RMA apply both on land and extend seaward to the outer limits of the CMA - being the extent of the 12 NM limit. The jurisdictional boundaries of the TRC or the STDC are shown in Figure 7.3 below.

The proposed compliance monitoring that is detailed within the BEMP and the EMMP will take place both within the EEZ and the CMA. The location of the permanent monitoring stations that will be placed within the CMA will be within the jurisdictional waters of the TRC. Even though the specific details have not been confirmed as to the mooring configuration and surface buoy arrangement, TTR is aware that a coastal permit (likely a discretionary occupational consent) will be required from the TRC prior to the BEMP commencing.

A resource consent application and supporting assessment of environmental effects will be submitted to the TRC for processing as soon as the relevant mooring and buoy details are confirmed. TTR note that the application for the placement of the moorings and surface buoys will be submitted in accordance with the relevant rules of 'Regional Coastal Plan for Taranaki' in adherence to the RMA 1991. No moorings will be placed within the CMA without prior resource consent approval.

Notwithstanding the above, Part 2 of the RMA is considered below.

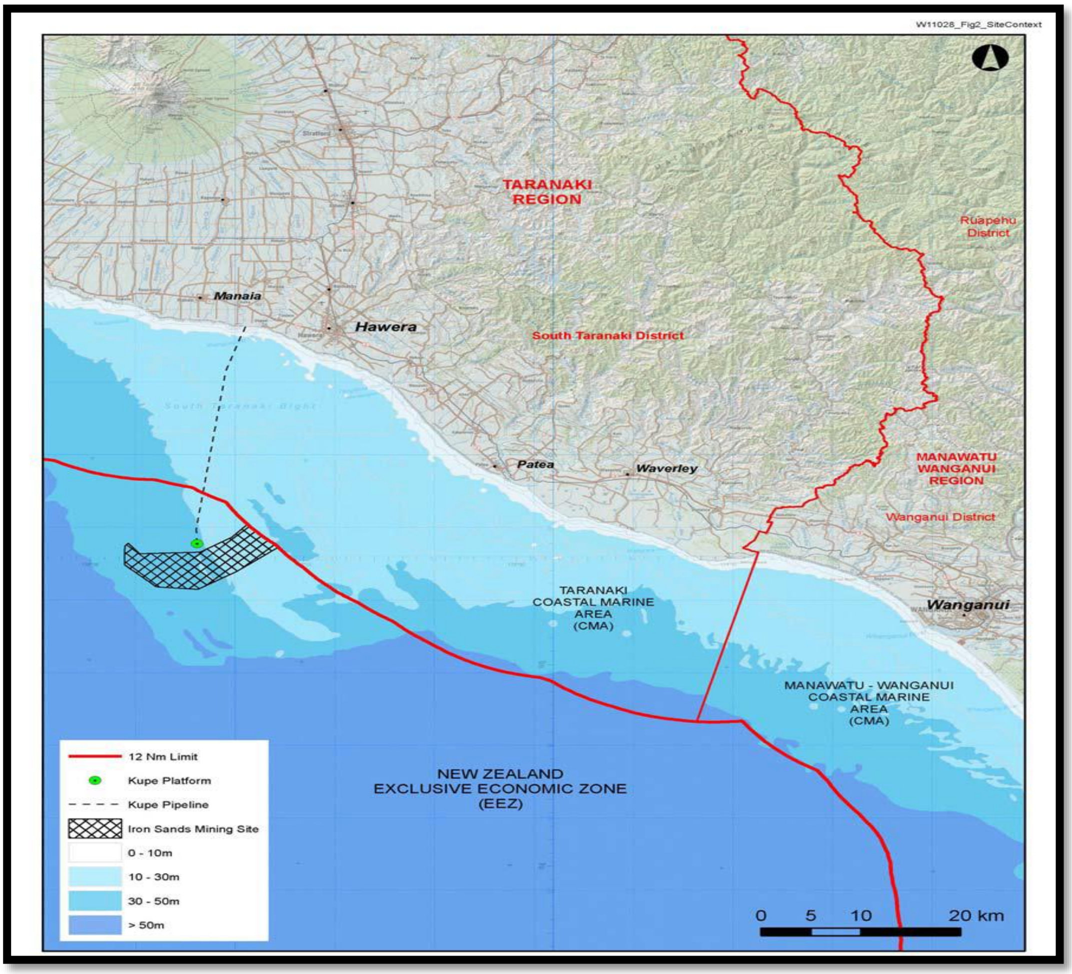

Figure 7.3: Site context and governance boundaries of the regional and district councils.

Purpose and Principles of the RMA

Section 5 of RMA sets out the purpose of the RMA, which is to *"promote the sustainable management of natural and physical resources..."*

The application of Section 5 of the RMA involves a 'broad overall judgement approach' as to whether an activity will promote the sustainable management of natural and physical resources. It is, however, noted that the definition of sustainable management does differ between the EEZ Act and the RMA, and the definition of the 'environment' in the EEZ Act is limited to the natural environment values.

Section 6 of the RMA states, in achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall *"recognise and provide for…"* the relevant matters of national importance. Consideration is given to relevant matters from section 6 of the RMA in Table 7.3 below.

Section 7 (Other matters) of the RMA, states in achieving the purpose of the RMA, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall *"have particular regard to…"* specified relevant other matters. The relevant matters in section 7 of the RMA are set out in Table 7.3 below.

Table 7.3: Consideration of the Section 6 and 7 of the RMA in this Impact Assessment.

Section of the RMA		Consideration in this IA
Section 6 matters		
6(a)	the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development;	Section 4.12 of this IA concludes that the project's effects on natural character will be minor and will not disrupt the natural character values of the coastal environment – particularly given that the STB already experiences high suspended sediment concentrations from natural sources.
6(b)	the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development;	Section 4.12 of this IA notes the project by its remote offshore location effectively avoids direct adverse effects on any identified outstanding natural features, landscapes and seascapes in the STB.
6(c)	the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;	No significant habitats (including rare or vulnerable ecosystems or habitats of threatened species) have been identified as being affected by the project. However, provisions have been put in place to ensure that any effects on threatened or endangered species are where practicable, avoided, otherwise minimised.
6(d)	the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers;	The project will be located between 22 and 36 kilometres offshore in the STB. As such, it will not impact on public access to areas of the CMA that are valued for recreation etc.
6(e)	the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wāhi, and other taonga;	The effects of the project on the relationship of Maori and their culture and traditions with their ancestral lands, water and sites of significance to iwi is assessed in Section 4.11 of this IA.
6(f)	the protection of historic heritage from inappropriate subdivision, use, and development;	The project will not involve the disturbance of the seabed within the CMA or damage to any known historic heritage sites.
6(g)	the protection of protected customary rights.	As stated above in relation to the MCA Act, there are no protected customary rights in the vicinity of

Section of the RMA	Consideration in this IA
	the project area. However TTR will continue to liaise with iwi regarding any the protection of any customary interests.
Section 7 matters	
7(a) kaitiakitanga; and 7(aa) the ethic of stewardship;	The kaitiakitanga and stewardship of the waters of the STB by the iwi and hapū have been considered in consultation with local iwi and are assessed in Section 4.11 of the IA.
7(b) efficient use and development of natural and physical resources: and 7(g) any finite characteristics of natural and physical resources:	The extraction operations of the project are focused within the project area which is located within the EEZ. The assessment of effects in Section 4 concludes that there will not be any effects within CMA that are not able to be avoided, remedied or mitigated through the project design or the proposed consent conditions.
7(c) the maintenance and enhancement of amenity values:	Section 4.12 of the IA notes that overall the effects on visual amenity are considered to be low and the project will not be visually intrusive from identified areas of recreation and amenity. Any potential effects on recreational amenity are also assessed overall as being low.
7(d) intrinsic values of ecosystems:	Section 4.6 of this IA concludes that the project is not considered to present any issues in respect of protection of biological diversity in the STB area, notwithstanding localised effects in the extraction and immediate deposition areas. Further, no rare or vulnerable ecosystems or habitats of threatened species have been identified.
7(f) maintenance and enhancement of the quality of the environment:	The extraction operations of the project are focused within the project area which is located within the EEZ. Therefore, the project is not expected to impact on the quality of the environment under the RMA jurisdiction.

With regard to the requirement of section 8 of the RMA to take into account the principles of the Treaty of Waitangi, it is considered that this matter has been canvassed in Section 7.2.3 of this IA, in relation to the discussion on the requirements, set out in section 12 of the EEZ Act.

New Zealand Coastal Policy Statement

The NZCPS is a national policy statement under the RMA and came into effect on 3 December 2010. The purpose of the NZCPS is to achieve the purpose of the RMA in relation to the coastal environment of New Zealand. The NZCPS is to be applied by persons exercising functions and powers under the RMA.

As previously identified, no part of the project area is located within the CMA however, some potential effects arising from the project may occur in the CMA and wider coastal environment, as defined by Policy 1 of the NZCPS.
The NZCPS has only been assessed to the extent which the potential effects arising from the project operations can occur within the coastal environment and the CMA (as defined by the RMA). An assessment of the project in terms of the relevant matters in the NZCPS is detailed in Appendix 7.4 of this IA.

Overall, it is concluded that the project is not inconsistent with the relevant provisions of the NZCPS.

Regional Policy Statement for Taranaki

The Regional Policy Statement for Taranaki ("**RPST**") became operative on 1 January 2010.

The boundary of the Taranaki region extends to the seaward limit of the CMA adjoining the Taranaki region and does not include any of the project area.

Appendix II of the RPST identifies *"High quality or high value areas of the coastal environment"*. The coastal areas listed in Appendix II are identified in the Inventory of Coastal Areas of Local or Regional Significance in the Taranaki Region (2004). This inventory identifies important areas in the CMA and in adjacent land within the coastal environment.

Appendix II of the RPST also notes the coastal areas identified are not necessarily an exhaustive selection and on occasion, other parts of the coast may have natural, ecological or cultural values that are regarded as important to the region. The areas identified in Appendix II of the RPST that may experience potential effect arising from the project are as follows:

- Ohawe Beach
- Waihi Beach
- Manawapou-Tangahoe River Mouths and Cliff Tops
- Kakaramea Beach
- Patea Beach and River Mouth
- Whenuakura Estuary
- Waipipi Iron sands
- Waverley Beach
- Waiotara Estuary and Dunes
- Waiinui Beach and Reef
- North and South Traps

Section 4 of this IA considers the potential effects on these areas.

Further, Appendix II of the RPS states, *"Taranaki is recognised nationally and internationally for its surfbreaks. Surfbreaks depend on the presence of a combination of suitable seabed shape, swell direction and power, swell corridors that allow swells to arrive at the surfbreak and wind direction and force. High quality or high value surfbreaks in Taranaki attract surfers from throughout New Zealand and overseas as well as locally. High quality or high value surfbreaks of regional importance are shown in Figures 7 to 19 (of Appendix II). The surfbreaks have been identified using the Council's inventory of Coastal Areas of Local or Regional Significance in the Taranaki Region (2004), the Surfing Guide (2004) published by Wavetrack and by consultation with local surfers."*

The high value surf breaks of regional importance are shown in Appendix II of the RPS and those that have been considered in Section 4.5.2 of this IA are:

- Waiinui Reef; and

- The Point / Fences.

The potential effects of the project with regard to surf breaks within the Taranaki Region, including the two identified above, have been assessed in Section 4.5.2 of this IA and any effects were deemed to be insignificant.

Further to the above, an assessment of the project against the relevant matters in the RPST is provided in Appendix 7.4.

Overall, based on the conclusions of this IA and the assessment in Appendix 7.4, it is considered that the project is not inconsistent with the RPST.

Regional Coastal Plan for Taranaki

The Regional Coastal Plan for Taranaki became operative on 1 October 1997 and applies to the CMA adjoining the Taranaki Region extending from mean high water springs out to the 12 NM limit.

Management Areas for the CMA in Taranaki

The Plan identifies four coastal management areas for the CMA in Taranaki.

1) Areas of outstanding coastal value;

2) Estuaries within the CMA that are permanently open to tidal movements;

3) Port Taranaki being a highly modified environment; and

4) The open coastline.

Areas where amenity values are of regional importance

Policy 3.2 of the Regional Coastal Plan identifies areas where amenity values are determined to be of regional importance. Based on the technical assessments accompanying the IA, the Regional Coastal Plan includes three areas that may be potentially affected by the project, as follows:

- Ohawe Beach
- Waverley Beach
- Waiinu Beach

Areas of Outstanding Coastal Value

Policy 4.1 of the Regional Coastal Plan identifies areas of outstanding coastal value that shall be managed in a way that gives priority to avoiding adverse effects on the outstanding coastal values of each area. Based on the technical assessments accompanying the IA, there are five sites that may be potentially affected by the project as follows:

- Waitotara Estuary;
- Waiinu Reef;
- Waverley Beach;

- North and South Traps; and
- Whenuakura Estuary.

Appendix 7.5 shows the general locations and classifications of the Coastal Management Areas including the areas of outstanding coastal value for the Taranaki Region.

An assessment of the project in terms of relevant matters in the Regional Coastal Plan for Taranaki is detailed in Appendix 7.4.

Overall, based on the conclusions of this IA and the assessment in Appendix 7.4, it is considered that the project is not inconsistent with the Regional Coastal Plan for Taranaki.

South Taranaki District Plan

The South Taranaki District Plan was made operative in December 2004. South Taranaki District Plan has jurisdiction over the South Taranaki District to the landward edge of the mean high water springs mark. STDC has no jurisdiction over the CMA.

The primary management technique used in the South Taranaki District Plan is zoning. Five zones cover the district, being Rural, Residential, Commercial, Industrial and Rural Industrial Zones.

Coastal Protection Areas

The South Taranaki District Plan identifies Coastal Protection Areas, being areas defined along the coastline by location, landscape and topography as part of the natural environment which is particularly susceptible to damage from the adverse effects of activities. These areas are also identified as being potentially most affected by coastal processes including erosion of the coastal cliffs.

TTR's project has no direct effect on the area or zones of jurisdiction of the South Taranaki District.

An assessment of the project in terms of relevant matters in the South Taranaki District Plan is detailed in Appendix 7.4.

Overall, based on the conclusions of this IA and the assessment in Appendix 7.4, it is considered that the project is not inconsistent with the South Taranaki District Plan.

Proposed South Taranaki District Plan

The Proposed South Taranaki District Plan was notified on 15 August 2015 and the submission period closed on 12 October 2015. One hundred and one submissions were received on the plan and further submissions closed on 29 January 2016. The plan still needs to go through the public hearing process and further appeals periods before becoming operative. The STDC expects that it will be operative by November 2016. Once operative, the Proposed South Taranaki District Plan will supersede the South Taranaki District Plan 2004.

As stated in the previous section, the South Taranaki District jurisdiction extends to the landward edge of the mean high water spring mark and TTR's project has no direct effect on the area of jurisdiction of South Taranaki District.

An assessment of the project in terms of relevant matters in the Proposed South Taranaki District Plan is detailed in Appendix 7.4.

Overall, based on the conclusions of this IA and the assessment in Appendix 7.4, it is considered that the project is not inconsistent with the Proposed South Taranaki District Plan.

Horizons One Plan

The Horizons Regional Council One Plan became operative on 19 December 2014.

Chapter 8 of the Horizons One Plan defines the coastal environment of the Manawatu-Whanganui region as *"the CMA together with an area landward of MHWS where coastal qualities and influences predominate."*

The Plan describes the region's coastline which covers some 120 km from Waiinui Beach in the north to Waikawa Beach to the south, as being *"characterised by narrow sandy beaches backed by sea cliffs in the north, and sandy beaches backed by a dynamic dune system from Whanganui southwards. The coast is a high energy shore with wave heights commonly exceeding 3 metres. The dominant climatic feature is the wind, which is predominantly westerly, and which has had a major effect on the physical shape of the west coast."*

An assessment of the project in terms of relevant matters in the One Plan is detailed in Appendix 7.4.

Overall, based on the conclusions of this IA and the assessment in Appendix 7.4, it is considered that the project is not inconsistent with the Horizons One Plan.

Wanganui District Plan

Wanganui District Plan was made operative in 2004. The Wanganui District Plan covers the management of the land within the Wanganui District. The Wanganui District Plan has jurisdiction over the Whanganui District to the landward edge of the mean high water springs mark. Whanganui District Council has no jurisdiction over the CMA.

An assessment of the project in terms of the relevant matters in the Wanganui District Plan is contained in Appendix 7.4.

Overall, based on the conclusions of this IA and the assessment in Appendix 7.4, it is considered that the project is not inconsistent with the Wanganui District Plan.

7.5.13.13 Resource Management (Marine) Pollution Regulations 1998

These regulations control the dumping and discharges from ships and offshore installations within the CMA boundary. The regulations deal with the dumping of waste and discharges from vessels including oil, sewage, garbage and ballast water.

All activities associated with the mining discharges and other project related discharges are considered under the EEZ Act and have been included in the assessments and considerations of this IA.

Aside from those matters provided for under the EEZ Act, there will be no dumping of waste or discharge from vessels into the CMA, arising from the project.

7.5.13.14 Submarine Cable Act

The Submarine Cable Act governs the management of submarine cables (both electricity and communications) and gas and fuel pipelines. The Submarine Cable Act is administered by the Ministry of Transport and provides for the protection for submarine cables and pipelines by allowing for the creation of cable protection areas or cable protection zones. Within these cable protection zones, it is an offence for a ship to anchor or to conduct most types of fishing.

The Submarine Cable Act also lists offences against the Act, which include causing damage to submarine cables and pipelines.

The Ministry of Transport website records there are 11 cable protection areas (commonly known as Cable Protection Zones ("**CPZ**")) established around the country. The following CPZs are located in the STB:

- Area 8: Oaonui;
- Area 10: Maui A and B; and
- The Pohokura Protection Area (no number).

The project area is outside any of the CPZs identified above therefore, the project will not impact on the cable protection areas identified under the Submarine Cable Act.

7.5.14 Section 59(2)(m) – Any Other Matter Relevant and Reasonably Necessary to Determine the Application

No other matters are considered relevant and reasonably necessary to determine either the marine consents or marine discharge consents application.

7.6 Conditions

TTR has prepared a set of proposed consent conditions (refer to Attachment 1 of this IA).

TTR considers that the implementation of the proposed consent conditions will further ensure that any project related effects will be appropriately provided for thus satisfying the statutory requirement of section 10(2)(c) of the EEZ Act being *"avoiding, remedying, or mitigating any adverse effects of activities on the environment."* and in turn assisting in meeting to overall "*sustainable management"* purpose of the EEZ Act.

When drafting the proposed consent conditions, TTR has had regard to section 63(1)(a) of the EZZ Act which states:

> *"The Environmental Protection Authority may grant a marine consent on any condition that it considers appropriate to deal with adverse effects of the activity authorised by the consent on the environment or existing interests"*

Regard has also been given to section 63(2) – (4) of the EEZ Act which identifies the types of conditions that the EPA can impose:

> *"(2) The conditions that the EPA may impose include, but are not limited to, conditions—*
> *(a) requiring the consent holder to—*
> *(i) provide a bond for the performance of any 1 or more conditions of the consent:*

(ii) obtain and maintain public liability insurance of a specified value:
(iii) monitor, and report on, the exercise of the consent and the effects of the activity it authorises:
(iv) appoint an observer to monitor the activity authorised by the consent and its effects on the environment:
(v) make records related to the activity authorised by the consent available for audit:
(b) that together amount or contribute to an adaptive management approach.
(3) However, the EPA must not impose a condition on a consent if the condition would be inconsistent with this Act or any regulations.
(4) To avoid doubt, the EPA may not impose a condition to deal with an effect if the condition would conflict with a measure required in relation to the activity by another marine management regime or the Health and Safety in Employment Act 1992."

With regard to the conditions of marine discharge consents, section 87G of the EEZ Act simply states:

" The following provisions apply to a marine dumping consent or marine discharge consent granted under section 87F:
(a) Sections 65 to 67, which relate to conditions:
…."

Section 65 of the EEZ Act relates to the provision of bonds, section 66 relates to monitoring conditions, and section 67 relates to the appointment of observers. Each of these sections refer to conditions imposed under section 63. On that basis, while not explicitly identified in the EEZ Act, it is considered that section 63 of the EEZ Act is also relevant to marine discharge consents.

7.7 Adaptive Management

With regard to the marine consents applications, 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) of the EEZ Act defines an 'adaptive management approach' as including:

"(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."

The decision-maker can impose conditions on a marine consent in accordance with section 63 of the EEZ Act in order to apply an adaptive management approach.

The project includes a robust monitoring and management framework, described in Section 5 of this IA. However, it is noted that the overall purpose of this framework is to ensure that:

- The environmental performance thresholds are not reached; and
- The actual effects of the project are in line with those which were assessed as part of the application.

Given the findings of this IA on potential effects of the activity on the environment and existing interests, it is considered that the marine consents can be granted as sought, and no further consideration needs to be given to an adaptive management approach in accordance with section 61(3) of the EEZ Act.

7.8 Duration of Consent

As provided for under section 73 and section 87H(2) of the EEZ Act, TTR is requesting the marine consents and marine discharge consents be granted for the maximum allowable duration, being 35 years.

With regard to the marine discharge consents, section 87H(3) of the EEZ Act states that when making a determination on a duration of consent, the EPA must comply with sections 73(2)(b) and (c), 87D (consideration of section 59(2) matters) and 87E (based decision on best information available (consistent with section 61 matters)) of the EEZ Act.

With regard to marine consents, section 73 of the EEZ Act sets out matters relevant to determining the duration of the consent and, as identified above, section 73(2)(b) and (c) are also relevant to marine discharge consents. 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."*

When considering section 73(2)(a), as identified in Section 7.5 of this IA, it is considered that the project complies with sections 59 and 61 of the EEZ Act. As such TTR does not consider that there are any matters in sections 59 and 61 of the EEZ Act that would require the duration of the consent to be less than the 35 years sought.

When considering section 73(2)(b), TTR is requesting the maximum allowable duration under the EEZ Act of 35 years for both the marine consent (section 73(1)(a)) and the marine discharge consent (section 87H(2)). The EPA is required to take into account that this is the duration sought.

When considering section 73(2)(c) of the EEZ Act, the following legislative authorisations are associated with the project:

- Minerals Mining Permit (No. 55581) issued under sections 25 and 29A of the Crown Minerals Act 1991 for the extraction of iron sands from the STB for a 20 year term commencing on 2 May 2014: and

- Exploration Permit (No. 54068) for five years commencing on 17 December 2012, which expires on 18 December 2017.

When having regard to the requirements of sections 59, 61, 73 and 87H of the EEZ Act, and in light of the purpose of the Act, it is considered that the 35 year duration of the marine consent and marine discharge consents is appropriate.

7.9 Conclusion

Overall, it is considered that the granting of the both the marine consent and marine discharge consent applications, subject to the imposition of appropriate conditions, would promote the sustainable management of natural and physical resources and ensure that adverse effects on the environment, including effects on existing interests, are appropriately avoided, remedied or mitigated.

With the proposed extraction and re-deposition methodology, and the proposed consent conditions, it is considered that the life-supporting capacity of the environment will be safe-guarded.

The project will also result in significant economic and social benefits which will in turn have wider effects in the local and regional economies and communities as well as contributing to the national economy.

When taking into account all aspects of the project, with the exception of the iron sand resource itself, which will be removed, the project will sustain the potential for the natural resource (being the seabed material) to meet the needs of future generations.

Further, the project is consistent with all other relevant legislation and statutory requirements that relate to different aspects of the project.

Therefore, when assessing the project as a whole, it is considered to be consistent with the overall purpose of *“sustainable management”* of section 10 of the EEZ Act.

8 CONCLUDING STATEMENT

TTR has lodged an application with the EPA to undertake iron sand recovery activities within approximately a 66 km^2 area of the STB for a period of 35 years. This application follows a similar marine consent application lodged in 2013 by TTR that was declined by the EPA.

Following the EPA decision on TTR's first marine consent application, TTR has undertaken an extensive amount of additional science work to address the short-comings identified by the DMC during the first hearing. This work has focused on the sediment plume modelling with the revised model outputs which have been incorporated into the updated technical assessments that have informed this IA.

The actual and potential effects associated with the project have been considered in accordance with requirements of the EEZ Act. When considering the overall effects of the project, the majority of the effects are considered to be minimal and in some case moderate. In no instances are the effects predicted to be significant or to a level that cannot be addressed through adequate monitoring and management, as is included in the proposed consent conditions.

The project will result in a number of positive economic and social effects through the creation of employment opportunities and the stimulation of the local and wider economies.

Additionally, TTR has presented detailed baseline and environmental monitoring and management plans that will ensure that any effects resulting from the project will be appropriately provided for through monitoring of effects and providing for management protocols to be implemented for any effects which are greater than that which have been identified in the assessment of effects.

In preparing this IA and the marine consent and marine discharge consent application, TTR has undertaken extensive consultation with existing interest parties, tāngata whenua and the wider community. The comprehensive consultation process has had mixed results but it is considered that overall, it has had a positive influence on the application and in many instances the outcomes of consultation have been incorporated into the project and provided for through the proposed consent conditions.

With regard to the statutory framework which the application falls within, it is considered that the project is not inconsistent with the relevant aspects of the EEZ Act and the other relevant legislations.

Overall, based on the conclusions outlined in this IA, it is believed that the marine consent application for the extraction of iron sands from the project area within the STB should be granted, subject to the proposed consent conditions provided with the IA.

ATTACHMENT 1

PROPOSED MARINE AND MARINE DISCHARGE CONSENT CONDITIONS

1. GLOSSARY

ANZECC 2000	Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000
BEMP	Baseline Environmental Monitoring Plan
Crawler	Seabed Sediment Extraction Device
DOC	Department of Conservation
EEZ Act	Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
EMMP	Environmental Monitoring and Management Plan
EPA	Environmental Protection Authority
HNZ	Heritage New Zealand Pouhere Taonga
IMO Guidelines	International Marine Organisation 2011 'Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species'
IMO	International Maritime Organisation
ISQG-High	Interim Sediment Quality Guideline-High
ISQG-Low	Interim Sediment Quality Guideline-Low
MNZ	Maritime New Zealand
OSPM	Operational Sediment Plume Model

1.1. Definitions

1.1.1. Operational Sediment Plume Model ("OSPM")

The OSPM is the numerical modelling tool used to predict suspended sediment concentration levels and behaviour as they relate to the project activities. The OSPM will provide immediate forecasts of both the density and extent of the generated sediment plume throughout the project incorporating measured characteristics of the sediment as well as the latest meteorological and ocean forecasts.

The OSPM is subject to ongoing verification and review throughout the life of the project.

1.1.2. Mine Planning and Scheduling

Mine planning and scheduling provides an ongoing process that identifies and describes the geology, degree of mineralization, and quality of the mineral deposit of the extraction area, thus enabling Trans-Tasman Resources Limited to plan and execute the most efficient and environmentally sustainable mining operation.

The mining schedule has scheduling parameters related to the use of the remote crawler operations and the Integrated Mining Vessel that influence the mining process. These factors include optimal block dimensions, grade (iron content) of the mining block, orientation of the Integrated Mining Vessel, plant constraints as well as time in use models to ensure a realistic schedule is obtained.

Mining schedules are prepared three, twelve (12) and twenty four (24) months ahead of extraction activities and are continuously updated before and during mining operations in response to changes in the scheduling parameters.

Mine planning provides for the preparation of a medium term Mine Plan that outlines the proposed mining activities and schedule of extraction for a twelve (12) month period. The plan also provides the necessary information required for the completion of the Operational Assessment Report required by these consent conditions.

Typical Inputs into the mine planning process include:

- Geological information;
- Geotechnical information;
- Mining method and layouts;
- Metallurgical information;
- Extraction strategy; and
- Loss and dilution factors.

1.1.3. Grade Control Drilling

Grade control drilling is an exploratory process where seabed samples are taken to further define the extent of the extraction area, as well as providing information on the quality of the iron ore concentrations within an extraction area. The drilling process involves the use of a reverse circulation drilling rig designed to take samples of seabed material at one (1) m intervals to a maximum depth of eleven (11) m below the seabed. Seawater is used as a drilling lubricant and as a transport medium for bringing the samples to the surface.

Grade control drilling is an ongoing process that takes place ahead of extraction operations and allows for adjustments of mining schedules and mineral grade projections, and also helps to define material changes that could affect mining operations and the processing plant.

The actual spacing of the grade control drilling will be adjusted over time but typically results in a 100 m by 100 m spacing to provide accuracy and can provide information for the mine schedule up to two (2) years in advance of actual mining activities.

2. INDICATIVE MARINE CONSENT AND MARINE DISCHARGE CONSENTS CONDITIONS

2.1. Administrative Conditions

2.1.1. Details of Marine Consents and Marine Discharge Consents

Name of Marine Consent and Marine Discharge Consents Holder:	Trans-Tasman Resources Limited
Marine Consent and Marine Discharge Consents Granted Date:	TBC
Purpose of Consents Granted:	TBC
Expiry Date:	TBC
Site Location:	TBC
Legal Description:	TBC

2.1.2. Term of the Marine Consents and Marine Discharge Consents

1.	Pursuant to s73(1)(a) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (“EEZ Act”): a. The marine consents for s20 activities; and b. The marine discharge consents for s20B and s20C activities. will expire 35 years after the date on which they are granted.

2.1.3. Lapse Period

2.	These consents shall lapse ten (10) years after the date of their granting unless the consents are given effect to prior to that date.

2.1.4. Activities in Accordance with the Application

3.	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 [add lodgement date] and in addition to the requirements of the Maritime Transport Act and Marine Protection Rules. Where information contained in the application documents is contrary to the conditions of these consents or where information contained in the application documents is contradictory within itself, the conditions will prevail.

2.2. Operational Compliance Requirements

2.2.1. Operational Standards and Compliance Levels

4.	The Consent Holder shall ensure that activities authorised by these consents do not result in an exceedance of : a. Subject to b. below, any ‘Compliance Limit’ identified in Schedule 2; or b. Any modified numerical values of ‘Compliance Limit’ determined in accordance with Condition 17 (in which case a. above will no longer apply; or c. 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. For the purpose of these consents, any reference herein to either ISQG-High or Interim Sediment Quality Guideline-Low (“ISQG-Low”) is deemed to be a reference to the ISQG-High or ISQG-Low values for metals, metalloids, organometallic and organic compounds provided in the ANZECC

	2000, or any subsequent versions thereof.
5.	In the event that environmental monitoring identifies that a 'Response Limit' identified in Schedule 2, or any ISQG-Low value, has been exceeded, but has not reached the 'Compliance Limit' in Schedule 2 or the ISQG-High value, the Consent Holder shall undertake the following actions to demonstrate that the relevant 'Compliance Limit' (Condition 4) will not be breached: a. Analyse the monitoring data in further detail to confirm if the exceedance is a result of an activity authorised by these consents within forty eight (48) hours of becoming aware of any exceedance and within a further twenty four (24) hours advise the EPA of the exceedance and the reason(s) why in the opinion of the consent holder the exceedance is not a result of the activities authorised by these consents. As soon as practicable the EPA shall advise the consent holder of its acceptance of the explanation and whether additional monitoring is required pursuant to Condition 5g; b. Where the exceedance is a result of an activity authorised by these consents, immediately, but not later than forty eight (48) hours, undertake an additional round of environmental monitoring at the location/s of the exceedance and notify the Environmental Protection Authority ("EPA") of the exceedance; c. If the additional monitoring results are still at or above the 'Response Limit', or any ISQG-Low value, but are not greater than the 'Compliance Limit' or the ISGQ-High value, the Consent Holder shall, within forty eight (48) hours of becoming aware of the further results, initiate investigations as to the cause and identify an operational response that will ensure that the relevant 'Response Limit' is no longer exceeded; d. No later than five (5) working days following the completion of the investigation in (c) above, the Consent Holder shall provide the investigation results to the Technical Review Group (Condition 28) for review, and to provide recommendations on proposed operational responses to address the exceedance. The Technical Review Group shall provide any response within ten (10) working days of receiving the investigation results unless otherwise agreed by the EPA; e. No later than five (5) working days after the ten (10) day working period referred to in (d) above has expired, the Consent Holder shall provide to the EPA for approval in a technical certification capacity, a report summarising the investigations undertaken, identify the proposed operational response/s to be undertaken, and state why such responses are considered appropriate in order that compliance with consent limits is maintained, including a summary of any commentary or recommendations from the Technical Review Group and, where necessary, an explanation as to why a Technical Review Group recommendation has not been accepted; f. Immediately following their approval, the Consent Holder shall implement the response/s and undertake a further round of environmental monitoring at the location of the initial exceedance; g. If the further monitoring demonstrates that the results are still above the 'Response Limit' identified in Schedule 2, or any ISQG-Low value, the Consent Holder shall undertake further investigations into the cause and identify further operational responses to address the on-going exceedance following the process provided for in (c), (d) and (e) above. The results of this further investigation and the recommendations shall be complied into a report to be prepared by a suitably qualified and experienced person(s) and submitted to the EPA for approval of the recommended operational responses in a technical certification capacity, prior to any of the further recommendations being implemented; and If within five (5) working days the EPA has not approved the recommendations, or advised the Consent Holder that they are have not yet been approved, the recommendations will be deemed to have been so approved.
6.	In the event that environmental monitoring identifies that an activity authorised by these consents has resulted in a 'Compliance Limit' identified in Schedule 2, or any ISQG-High value, being breached, the Consent Holder shall immediately cease all iron sand extraction activities and notify the EPA of the breach. Following any such breach the Consent Holder shall undertake the following actions: a. Immediately, but not later than 48 hours, initiate an investigation into the cause of the breach and identify the operational response/s to be implemented; b. No later than five (5) working days following the completion of the investigation in (a) above,

	the Consent Holder shall provide the investigation results and recommendations to the Technical Review Group for review, and to provide recommendations on proposed operational responses to address the breach. The Technical Review Group shall provide any response within ten (10) working days of receiving the information unless otherwise agreed by the EPA; c. No later than five (5) working days after the ten (10) working day period referred to in (b) above has expired, the Consent Holder shall: i. Prepare a report summarising the investigations undertaken, identify the proposed operational response/s to be undertaken, and state why such responses are considered appropriate including a summary of any commentary or recommendations from the Technical Review Group and, where necessary, an explanation as to why a Technical Review Group recommendation has not been accepted; and ii. Provide the report to the EPA for approval of the recommended operational responses in a technical certification capacity, that the proposed operational response(s) are an appropriate response to the breach. d. Immediately, but not later than forty eight (48) hours, following their approval, the Consent Holder shall implement the response/s and, once implemented, undertake a further round of environmental monitoring at the location of the breach; e. The iron sand extraction activities may not recommence until the Consent Holder can demonstrate, to the satisfaction of the EPA that the operating regime can ensure that the ‘Compliance Limit’, or any ISQG-High value (Condition 4), is no longer being breached; and If within five (5) working days the EPA has not approved recommencement, or advised the Consent Holder that it has not yet been approved, the recommencement will be deemed to have been so approved.
7.	Further to the Quarterly and Annual Reports required by Conditions 79 and 80, on the completion of any operational response/s undertaken in accordance with the conditions of these consents, the Consent Holder shall, as soon as practicable but no later than ten (10) working days, provide a report to the EPA detailing the circumstances which resulted in either the ‘Response Limit’ or the ‘Compliance Limit’ being exceeded or breached, the investigations, and any subsequent management operational response or management actions undertaken (including any commentary from the Technical Review Group and any changes to management plans, operational documentation and training) in order that compliance with consent limits is maintained.
8.	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. In the event that there is a discharge or spill of oil or fuels, the Consent Holder shall implement all necessary operational responses as set out in the Spill Contingency Management Plan 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. For the purpose of these consents, the Spill Contingency Management Plan shall be prepared following consultation with Maritime New Zealand (“MNZ”), and shall outline the protocols, methods and responses to be implemented after any unplanned discharge or spill to the environment and identify the measures to be taken to avoid, remedy or mitigate, to the greatest extent practicable, any adverse environmental effects resulting from the discharge or spill.
9.	The Consent Holder shall provide for six (6) monthly meetings between itself and representatives of the commercial fishing industry nominated by Fisheries Inshore New Zealand. The purpose of the meetings shall be to enable both parties to share relevant information and to establish a coordinated approach between the iron sand extraction activities and commercial fishing activities, including communications protocols. The first meeting shall occur no later than six (6) months prior to the commencement of the iron

	sands extraction activities and 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 members and the EPA, within twenty (20) working days of each meeting being held.
10.	At all times during the term of these consents, the Consent Holder shall comply with the Seabird Effects Mitigation and Management Plan ("SEMMP") that has been prepared and implemented following consultation with the Department of Conservation ("DOC"), the purpose of which is that: a. There are no adverse effects at a population level of seabirds of the species classified under the New Zealand Threat Classification System as "Nationally Endangered", "Nationally Critical" or "Nationally Vulnerable" or classified "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; ii. Spills; and iii. The effect of sediment in the water column on diving birds that forge visually, are avoided to the greatest extent practicable. The SEMMP shall as a minimum: i. Establish how to mitigate, and where possible avoid, adverse effects on seabirds from vessel lighting including the Integrated Mining Vessel, Floating Storage and Offloading Vessel and other support vessels; ii. Establish indicators of adverse effects 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"; iii. Identify responses/ actions to be undertaken by the Consent Holder if the indicators in (ii) are reached; and iv. 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) and submitted to the EPA for approval in a technical certification capacity that the requirements of this condition have been met.
11.	Notwithstanding the requirements of Conditions 12 or 49 and 61, with respect to marine mammals (excluding seals), the Consent Holder shall comply with the following: a. The Marine Mammal Management Plan ("MMMP") that has been prepared and implemented following consultation with DOC, the purpose of which is: • There are no adverse effects at a population level on: o Blue whales; or o Marine mammal species classified under the New Zealand Threat Classification System as "Nationally Endangered", "Nationally Critical" or "Nationally Vulnerable"; or o Marine mammal species classified as "Endangered" or "Vulnerable" in the International Union for the Conservation of Nature "Red List"; • Adverse effects on marine mammals include but are not limited to effects arising from: o Noise; o Collision and entanglement; o Spills; and

- The effects of sediment in the water column,

are avoided to the greatest extent practicable.

The MMMP shall include as a minimum:

i. Procedures and protocols to minimise the risk of whale and dolphin entanglement; and

ii. A training framework relating to marine mammal operational responses; and

iii. Integrate any obligations under the Marine Mammals Protection Act 1978 and Marine Mammals Protection Regulations 1992, or any subsequent Regulations.

The MMMP shall be prepared by a suitably qualified and experienced person and submitted to the EPA for approval in a technical certification capacity that the requirements of this condition have been met.

b. At all times during the exercise of these consents, the Consent Holder shall ensure that 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 positon where a clear field of vision is provided over the forward section of the vessel and beyond the bow;

c. The Consent Holder shall ensure that 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 be 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 42). The purpose of the cameras is to record passage of the vessels and any contact with marine mammals while in motion;

d. The Consent Holder shall ensure that at all times its 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;

e. The Consent Holder shall require all employees and contractors to record any sightings of whales or dolphins including the date, time and, where possible, GPS position of the vessel;

f. The Consent Holder shall immediately report any sightings of Maui's or Hector's Dolphins to DOC;

g. Masters of all vessels shall reduce speed to a safe minimum 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;

h. Helicopters servicing the operation shall (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;

i. The Consent Holder shall report any marine mammal strikes, entanglements, injuries or deaths to DOC and the EPA as soon as practicable following any such event;

j. If a, strike, entanglement, injury or death involves Maui's or Hector's Dolphin, the Consent Holder shall, where possible, recover the carcass, immediately notify DOC and the EPA of that recovery and return it to shore as soon as possible for collection by DOC subject to the Consent Holder's obligations under the Marine Mammals Protection Act 1978 or any subsequent Regulations;

k. The Consent Holder shall keep records 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 DOC staff upon request and Annual Report required by Condition 80; and

l. Any other relevant operational response in relation to marine mammals that has been

	certified by the EPA. Any observer engaged by the Consent Holder shall first be approved by the EPA in accordance with s67(3) of the EEZ Act.
12.	At all times during the operation of marine vessels and / or equipment, the Consent Holder shall comply with the following requirements in relation to underwater noise: a. The combined noise from the Integrated Mining Vessel 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 Integrated Mining Vessel; 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 Integrated Mining Vessel, 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 one (1) month of commencement of iron sand extraction activities and if less than 80% of full production condition, a further measurement will be made within one (1) month of iron sand extraction activities reaching 90% of full production conditions; 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. Should the operation of the Integrated Mining Vessel 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 one (1) month of the change to demonstrate compliance with Condition 12(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.*
13.	Within twenty (20) working days of any noise monitoring undertaken in accordance with Condition 12, 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; and c. A summary of the noise levels measured, including broadband and one third octave band frequency data and compliance of the operation with respect to the noise standards specified in Condition 12.

2.2.2. Baseline Environmental Monitoring

14.	Prior to the commencement of any iron sand extraction activities, the Consent Holder shall ensure that a minimum of two (2) years of baseline monitoring has been undertaken and shall, as a minimum, include monitoring of: • Suspended sediment concentrations; • Sediment quality; • Subtidal and intertidal biology; • Optical water quality; • Physio-chemical parameters; • Seafood resources; • Marine mammals; • Underwater noise; • Seabirds; • Commercial fishing**;** and • Recreational fishing. The Consent Holder shall prepare, and undertake baseline environmental monitoring, in accordance with the procedures and methods, and at the locations and for the duration and frequency detailed in the approved Baseline Environmental Monitoring Plan ("BEMP") the purpose of which is to: a. Establish a baseline 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 iron sand extraction activities; c. Provide data to validate the background data used in the Operational Sediment Plume Model, which predicts the sediment transportation processes in the South Taranaki Bight; d. Provide data to verify that the 'Response Limit' and 'Compliance Limit' values in Schedule 2 are appropriate following the validation of the Operational Sediment Plume Model; e. Identify any other parameters that should have limits applied to them; f. Confirm that the parameters being monitored and the chosen design, location and methodology is the best suited for the environmental monitoring during iron sand extraction activities; and g. Ensure compliance with all regulatory requirements and guidelines. The BEMP shall also include: i. The roles and responsibilities of parties who are to undertake the baseline environmental monitoring; ii. Objectives for the baseline environmental monitoring associated with these consents; iii. Identification of the parameters being monitored, including sampling design, methodology, frequency, duration and monitoring locations; iv. Details of data analysis and processing for all parameters being monitored; and v. Report methods for all parameters being monitored. The BEMP shall be prepared by a suitably qualified and experienced person(s), independently peer reviewed and then reviewed by the Technical Review Group with regard to the appropriateness of the intended monitoring to meet the purposes of the BEMP as set out in Condition 14. The BEMP together with comments and recommendations of the Technical

	Review Group including, where necessary, an explanation as to why a Technical Review Group recommendation has not been accepted shall be submitted to the EPA for approval in a technical certification capacity that the BEMP meets the requirements of this condition at least three (3) months prior to the commencement of the baseline environmental monitoring programme. If within thirty (30) working days the EPA has not approved the BEMP, or advised the Consent Holder that it has not yet been approved, the BEMP will be deemed to have been so approved.
15.	The Consent Holder may amend the BEMP at any time, but any changes will only come into effect once they have been approved by the EPA, acting in a technical certification capacity that such amendment is consistent with purposes and follows the preparation and review processes of Condition 14 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 approved the amended BEMP, or advised the Consent Holder that it has not yet been approved, the amended BEMP will be deemed to have been so approved. *Advice Note: 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 shall submit any such amendments as soon as practicable.*
16.	For the purpose of all monitoring in accordance with the conditions of these consents, the Consent Holder shall undertake monitoring at all 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 immediately, but no later than twenty-four (24) hours following, notify the EPA of any such occurrence identifying: i. What monitoring was affected and for how long; and ii. When the monitoring will recommence.
17.	Prior to the commencement of the iron sand extraction activities and following completion of the baseline environmental monitoring required under Condition 14, the Consent Holder shall determine updated numerical values of the 'Response Limits' and 'Compliance Limits' in Schedule 2 of these consents utilising the methodology specified in Schedule 3 to the satisfaction of the EPA. The review of the numerical values must be undertaken by suitably qualified and experienced person(s) and submitted to the Technical Review Group for review and comment prior to being submitted to the EPA. In the event that the numerical values of the 'Response Limits' or 'Compliance Limits' as a result of monitoring are different from the numerical values of the 'Response Limits' and 'Compliance Limits' in Schedule 2 of these consents, then the updated numerical values shall supersede the numerical values of the 'Response Limits' and 'Compliance 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 will be identified as part of the Environmental Monitoring and Management Plan ("EMMP") required under Condition 21.

2.2.3. Operational Sediment Plume Model

18.	At all times during the term of these consents, the Consent Holder shall maintain an Operational Sediment Plume Model, in order to manage the iron sand extraction activities to comply with the conditions of these consents and to provide an effective mechanism to assist in: a. The development of the environmental response methodologies that are applied with respect to Suspended Sediment Concentrations (derived from a suspended solids -

	turbidity relationship developed during the BEMP); b. Predicting background and extraction derived Suspended Sediment Concentrations to inform the management of the iron sand extraction activities; c. Distinguishing operationally derived contributions to Suspended Sediment Concentrations from background processes; and d. Forecasting, as accurately as possible, sediment plume dynamics including but not limited to: • Intensity; and • 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 to best enable iron sand extraction activities to maintain compliance with the response and compliance limits for suspended sediment concentrations at the locations in Schedule 2. The Operational Sediment Plume Model shall be developed and maintained by a suitably qualified and experienced person(s). An OSPM report must be prepared to summarise the establishment, calibration, validation and operation of the OSPM. The OSPM is to be updated, and then independently peer reviewed by a suitably qualified and experienced person at the following intervals: (a) Once at the conclusion of the BEMP period prior to any iron sand extraction activities; (b) During iron sand extraction activities immediately following each calibration and validation exercise at frequencies defined in Condition 19. The scope of the OSPM independent review shall include the model, its calibration, validation, availability and applicability of forcing data and the use of the OSPM in management of the iron sand extraction activities. The advance fine sediment identification methods and sampling density (Condition 47) shall be included within the review scope. The OSPM report and updates together with the independent peer review shall be provided to the Technical Review Group for review prior to lodgement with the EPA. The OSPM report and updates together with the comments and recommendations of the peer reviewer and the Technical Review Group and an explanation as to why a recommendation has not been accepted shall be provided to the EPA for approval in a technical certification capacity that the OSPM satisfies the requirements of Condition 18 a-d and included in the Annual Monitoring Report in Condition 70.
19.	The Consent Holder shall calibrate and validate the Operational Sediment Plume Model at least: a. Every six (6) months during the BEMP and for the first three (3) years of iron sand extraction activities; and b. Every twenty-four (24) months thereafter, utilising the sediment data from the BEMP (Condition 14), the Operational Assessment Report (Condition 47) and the on-going monitoring information collected in accordance with Conditions 20 and 21.

2.2.4. Environmental Monitoring Requirements

20.	Following the completion of the baseline monitoring provided for in Condition 14 and the review of the Suspended Sediment Concentration limits under Condition 17, the Consent Holder shall, as a minimum, undertake monitoring of: • Suspended Sediment Concentrations, as measured from grab samples and as calculated from continuous turbidity measurements.

	• Sediment quality; • Subtidal and intertidal biology; • Optical water quality; • Physio-chemical parameters; • Seafood resources; • Marine mammals; • Underwater noise; and • Recreational fishing, to ensure that the activities authorised by these consents: a. Comply with the 'Compliance Levels' or 'Updated Compliance Limits' identified in Condition 4: and b. Do not result in any adverse effects that were not anticipated at the time of the granting of these consents. Without limiting the requirement of b. above, an adverse effect will be deemed to have occurred if the actual 25, 50, 80 and 95 percentile Suspended Sediment Concentration values during any six (6) month period (as calculated from observed turbidity measurements) are, for that same period and in the opinion of the EPA, significantly greater than the background (no mining) percentile values predicted by the validated Operational Sediment Plume Model (Condition 18) or the values specified in Schedule 2. The environmental monitoring under this condition shall commence one (1) month prior to the commencement of the iron sand extraction activities authorised by these consents.
21.	The environmental monitoring required by Condition 20, shall be o prepared, reviewed and approved in accordance with Conditions 21–23 and the reporting requirements of Condition 80; and o undertaken in accordance with the procedures and methods detailed in the EMMP that has been approved by the EPA acting in a technical certification capacity, the purpose of which is to: 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 baseline environmental monitoring programme provided for in the BEMP has been incorporated into the EMMP; c. Outline the process for the on-going validation of the Operational Sediment Plume Model including the calibration and validation of the plume component of the model; d. Identify the limits contained in Schedule 2, and the ISQG-Low and ISQG-High values, and, where relevant, a copy of any Memorandum of Certification issued by the EPA certifying a change to a limit in Schedule 2; 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; f. Identify the Technical Review Group membership, and their evaluation process in accordance with Conditions 28 – 32; g. Identify the operational responses to be undertaken if 'Response Limits' and 'Compliance Limits' are reached or if unanticipated adverse effects are identified; h. Detailed data analysis and processing for all parameters being monitored; and i. Define the reporting methods and schedule for all parameters being monitored.
22.	The EMMP shall be prepared by a suitably qualified and experienced person(s), independently peer reviewed and then reviewed by the Technical Review Group. The EMMP together with comments and recommendations of the Technical Review Group including, where necessary, an

	explanation as to why a Technical Review Group recommendation has not been accepted shall be submitted to the EPA for approval in a technical certification capacity that the EMMP meets the requirements of this condition at least three (3) months following the completion of the baseline environmental monitoring programme. If within twenty (20) working days the EPA has not approved the EMMP, or advised the Consent Holder that it has not yet been approved, it will be deemed to have been so approved.
23.	The Consent Holder may amend the EMMP at any time, but any changes will only come into effect once they have been approved by the EPA, acting in a technical certification capacity that: a. Such changes are consistent with the monitoring parameters of Condition 21; b. The processes set out in Condition 22 have been followed; 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 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 approved the amended EMMP, or advised the Consent Holder that it has not yet been approved, the amended EMMP will be deemed to have been so approved. *Advice Note: 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 shall submit any such amendments as soon as practicable.*
24.	Following the completion of the iron sand extraction activities authorised by these consents, the Consent Holder shall undertake four (4) years, or such lesser time as approved by the EPA, of post-extraction monitoring of the biological environment within the consent area, the purpose of which is to collect data to demonstrate whether the biological environment within the extraction area is recovering following the completion of the iron sand extraction activities. The post-extraction monitoring shall be provided for in a Post-extraction Monitoring Plan which shall include as a minimum: a. The roles and responsibilities of parties who are to undertake each aspect of the environmental monitoring; b. Objectives for the post-extraction monitoring associated with these consents; c. A description of the Technical Review Group, their role and their evaluation process in accordance with Conditions 28 – 32; d. Identification of the sampling design and methodology for each of the parameters being monitored, including the frequency, duration and monitoring locations; 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. For the purpose of this condition, the Consent Holder shall, at least three (3) months prior to the completion of the iron sand extraction activities, provide to the EPA for approval in a technical certification capacity, a Post-extraction Monitoring Plan that focuses on the post-extraction biological monitoring within the extraction area. If within twenty (20) working days the EPA has not approved the Post-extraction Monitoring Plan, or advised the Consent Holder that it has not yet been approved, it will be deemed to have been so approved.

25.	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 Technical Review Group, 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; d. Any remediation undertaken and the results of any such remediation; e. A summary of any commentary or recommendations from the Technical Review Group and, where necessary, an explanation as to why any Technical Review Group 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 heath of the extraction area.
26.	Within sixty (60) working days of the completion of the post-extraction monitoring programme, the Consent Holder shall, following consultation with the Technical Review Group, 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 forty eight (48) month period; b. A summary report of the findings of the monitoring undertaken with conclusions drawn as to the recovery and overall biological heath of the iron sand extraction area; and c. Identification of any commentary or recommendations from the Technical Review Group and, where necessary, an explanation as to why any Technical Review Group recommendation has not been accepted.

2.2.5. Data Collection

27.	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.

2.2.6. Technical Review Group Evaluation

28.	At least three (3) months prior to the commencement of the BEMP required by Condition 14, the Consent Holder shall provide for the formation of a Technical Review Group, the role of which is to provide technical oversight, and advice to the Consent Holder, including but not limited to the following: a. Prior to its lodgement with the EPA, review and advise on the appropriateness of the monitoring provided for in the BEMP (Condition 14), any review of the BEMP (Condition 15) and review and advise on the EMMP (Condition 22); b. Compare the monitoring data against the background 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 following matters: i. The appropriateness of the numerical values of the ‘Response Limit’ and ‘Compliance Limit’ in Schedule 2, and the ISQG-Low and ISQG-High values; and / or ii. The implementation of operational responses provided for under these consents; iii. Potential operational responses that may be implemented based on the investigations into the causes of any exceedance or breach of any Schedule 2 limit, or any ISQG-Low or ISQG-High values (Conditions 5 and 6); and / or iv. The need for any new ‘Response Limit’ and / or ‘Compliance Limit’ for any parameter, or for any new ISQG-Low and ISQG-High values, being monitored in accordance with

	Condition 20; and / or v. Any revised numerical values of the ‘Response Limit’ and / or ‘Compliance Limit’ determined in accordance with Condition 17. d. Community knowledge and “matauranga maori” issues when reviewing the monitoring data; e. The environmental management component of the iron sand extraction activities by an annual data review whereby each year’s monitoring results will be tabulated, reviewed, and compared against the previous monitoring data collected and the limits identified by the conditions of these consents; and f. Make recommendations to the Consent Holder that a review of the consent conditions be undertaken for the purpose of avoiding, remedying or mitigating 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 Technical Review Group shall, as a minimum, consist of one suitably qualified and experienced representative chosen by each of the following parties: • The Consent Holder; • Taranaki Regional Council; • Fisheries Inshore New Zealand; • The Kaitiakitanga Reference Group (Condition 34); • Te Tai Hauauru Regional Fishing Forum; and • DOC. Each representative shall have specialist expertise in one or more of the key environmental, ecosystem, matauranga maori and engineering components being monitored. At any time during the term of these consents, the Technical Review Group 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 Technical Review Group’s functions. The decision on whether to act on such a recommendation will rest with the Consent Holder after consultation with the EPA.
29.	The Consent Holder shall maintain the Technical Review Group 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.
30.	The Consent Holder shall convene meetings of the Technical Review Group: a. Annually, following the completion of each year of monitoring, during the baseline environmental monitoring period; b. Then, for the first five (5) years following the commencement of the iron sand extraction activities, 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 baseline 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 iron sand extraction activities ceased.

31.	The Consent Holder shall fund the administration of each meeting of the Technical Review Group and shall meet all actual and reasonable costs incurred by any other specialists seconded to the Technical Review Group, as provided for in Condition 28.
32.	Minutes of each of the Technical Review Group meetings, 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 42), within ten (10) working days of any meeting being held.

2.3. Relationship with Tangata Whenua

33.	The relationship of tangata whenua, including but not limited to Ngati Ruanui, with the South Taranaki Bight is to be recognised and provided for by the Consent Holder through: a. Provision for the establishment and maintenance of a Kaitiakitanga Reference Group (Condition 34); b. Provisions for involvement of the Kaitiakitanga Reference Group, in accordance with their defined role, in: i. Technical Review Group (Condition 28); and ii. Kaimoana Monitoring Programme (Condition 38).
34.	Within one (1) month of the commencement of these consents, the Consent Holder shall provide to tangata whenua, including but not limited to Ngati Ruanui, 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 Ngati Ruanui, and their relationship with the South Taranaki Bight; b. Review and advise the Consent Holder on the suitability of the Kaimoana Monitoring Programme (Condition 38); 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 iron sand extraction area and of the surrounding marine environment undertaken under these consents, including: i. To advise the Consent Holder on monitoring for change 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 iron sand 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 Ngati Ruanui, and the Consent Holder through providing a forum for discussion about the implementation of these consents; and e. Be responsible for receiving requests for, and facilitating the provision of, any cultural ceremonies by tangata whenua, including but not limited to Ngati Ruanui, 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.*
35.	Once the Kaitiakitanga Reference Group is formed the Consent Holder shall provide details of its membership, and any subsequent changes, to the EPA.

36.	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.
37.	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.
38.	At least one month prior to the commencement of any iron sand extraction activities authorised by these consents, the Consent Holder shall prepare a Kaimoana Monitoring Programme following consultation with the Kaitiakitanga Reference Group. 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 Maori 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. The Consent Holder shall ensure that the EPA has a copy of the most update version of the Kaimoana Monitoring Programme at all times.
39.	With regard to Condition 38, where practicable the Consent Holder shall use its best endeavour to engage tangata whenua representatives, including but not limited to Ngati Ruanui and Te Tai Hauauru Regional Fishing Forum representatives, to undertake the monitoring identified in the Kaimoana Monitoring Programme. The Consent Holder shall meet the actual and reasonable costs related to implementing the Kaimoana Monitoring Programme subject to the receipt of itemized invoices.
40.	Following the commencement of iron sand extraction activities, the Consent Holder shall provide Ngati Ruanui an annual fund of [$XX] per year to be used for environmental initiatives and/or for the cultural well-being of Ngati Ruanui.
41.	In the event that a Kaitiakitanga Reference Group has not been established four (4) months following the date of the offer made by the Consent Holder required by Condition 34, 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 34 – 40.

2.4. Community Relationships

42.	The Consent Holder shall provide the public with up to date information on the iron sand extraction activities and environmental monitoring, including the baseline 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.
43.	For the duration of these consents, the Consent Holder shall provide for and facilitate community meetings to keep the public informed of the iron sand extraction activities 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 iron sand extraction activities and annually at all other times. At least four (4) weeks prior to the commencement of any community meeting, notice shall be placed on the Consent Holder's website (Condition 42) 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.
44.	Following the commencement of iron sand 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.
45.	Within twelve (12) months of the commencement of 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 perspective 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 iron sand extraction activities. 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.
46.	Prior to the commencement of any iron sand 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 iron sand extraction activities 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 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 shall only occur subject to any such consents being granted.*

2.5. Operational Documentation and Training

2.5.1. Operational Assessment Report

47.	No less than three (3) months prior to the commencement of any iron sand extraction activities as 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 iron sand, 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 microns ("μm") in the area subject to extraction via grade control drilling conducted in accordance with the requirements for a 'measured' resource by "The Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves, 2012 or subsequent editions (the "JORC" standard) (see 1.1 Definitions). The Operational Assessment report is to demonstrate that when averaged over the reported period the occurrence of <8μm sediments does not exceed 1.8% of the total sediment extracted; and f. Procedure for avoiding identified fine sediments to the extent necessary to meet the Particle Size Distribution Limits and to meet the Suspended Sediment Concentration limits as defined within Schedule 2.

2.5.2. Operational Documentation

48.	The Consent Holder shall make a hard copy of these conditions (including the most recent version of the EMMP, other management plans and any other relevant documentation required by the conditions of these consents) available for the EPA to inspect at any time: a. At the Consent Holder's head office; and b. On-board all TTR operated project vessels.
49.	Pursuant to s25(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 activity associated with 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 subsequent Regulations. 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.

50.	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 iron sand 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 79.
51.	The Consent Holder shall comply with the Collision (Loss of Position) Contingency Management Plan which shall be prepared following consultation with MNZ, and as a minimum demonstrate how the objectives set out below will be achieved, being to: a. Outline the processes, methods and responses to be implemented after any unplanned event that potentially results in mooring failure or loss of position; and b. Identify 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. A copy of the Collision (Loss of Position) Contingency Management Plan is to be held on all operational vessels and at the Consent Holder's head office and shall be provided to the EPA upon request.

2.6. Operational Controls

2.6.1. Removal of Material from the Seabed

52.	The Consent Holder shall not remove more than 12.5 million tonnes of seabed material during any three (3) month (rolling average) period, and 50 million tonnes of seabed material during any twelve (12) month (rolling average) period for the term of these consents. The Consent Holder shall continuously record the amount of seabed material removed and report on this as part of the Quarterly Operational Report required by Condition 79.
53.	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. 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 79.

2.6.2. Particle Size Distribution

54.	Monitoring and recording of Particle Size Distribution, and the rate and volume of the discharge shall be continuously recorded. The information collected during recording and monitoring of this condition shall be reported on as part of the Quarterly Operational Report required by Condition 79.

2.6.3. Deposition of Material on the Seabed

55.	The Consent Holder shall ensure that the discharge of all de-ored sediment from the hydro-cyclone overflow and the hyperbaric filter, takes place by means of a dedicated pipe which discharges from the Integrated Mining Vessel at a nominal distance of four (4) m above the seabed.
56.	The Consent Holder shall ensure that the direct deposition of de-ored sediment onto the seabed shall not occur within 200 m of the seaward boundary of the Coastal Marine Area.
57.	The Consent Holder shall ensure that all pits remaining at the end of each mining lane are 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 79. *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.*
58.	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. b. Other than at the commencement of each mining lane, all de-ored sediment is backfilled into the mining lanes.
59.	The Consent Holder shall ensure re-deposition mounds at the start of each mining lane are no higher than nine (9) m above the pre-mined seabed level. The height and GPS position of any such mounds created during the deposition of de-ored sediments shall be recorded and reported on in the Quarterly Operational Report required by Condition 79.

2.6.4. Operational Vessel – "Soft Starts"

60.	The Consent Holder shall ensure that any startup, whether related to commencement or re-commencement after a break, of the iron sand extraction activities 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 Integrated Mining Vessel, Crawler and any associated plant. Soft starts may only commence in daylight hours and during good sighting conditions (visibility to at least 500 m).
61.	Prior to each startup, the Consent Holder shall use suitably trained observer(s), in accordance with Condition 49, to conduct pre-start observations over a 500 m radius (mitigation zone) surrounding the Integrated Mining Vessel for at least thirty (30) minutes to ensure no whales or dolphins are present within the mitigation zone. If any whales or dolphins are observed in the mitigation zone during pre-start observations, then the soft start shall be delayed until the 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 79 and the Annual Report required by Condition 80. Any observer engaged by the Consent Holder shall first be approved by the EPA in accordance with s67(3) of the EEZ Act.

2.6.5. Mooring of the Integrated Mining Vessel

62. All mooring lines and associated anchors for the Integrated Mining Vessel shall be located within the area bounded by the co-ordinates set out below and within the boundary shown in Schedule 4):

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
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

63. The Consent Holder shall ensure that the Integrated Mining Vessel is anchored to the seabed at all times when the Crawler is operating.

64. 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 is practicable.

Where it is not practicable to recover the equipment, the Consent Holder shall record the

	location and depth that the item was lost overboard and the type of item. This information shall be provided to the EPA, the Coastguard and the Harbour Master (if within the twelve (12) nautical mile limit) and placed on the Consent Holder's website (Condition 42) within twenty four (24) hours of the item going overboard.

2.6.6. Placement of a Crawler on the Seabed

65.	During the iron sand extraction activities authorised by these consents, the Consent Holder shall only use, or place, one (1) Crawler on the seabed at any time.

2.6.7. Archaeological Remains (Shipwrecks)

66.	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 iron sand extraction area, are discovered during iron sand extraction activities that are of potential historical or cultural importance, the Consent Holder shall immediately stop iron sand extraction activities within the discovery area.
67.	The Consent Holder shall record all discoveries made under Condition 66 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.
68.	Further to the requirements of Condition 67, the Consent Holder shall notify the EPA of any discoveries made in accordance with Condition 66. Additionally, the Consent Holder shall consult with HNZ and iwi representatives 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.
69.	If the discoveries under Condition 66 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 iron sand extraction activities recommencing within the discovery area.
70.	The Consent Holder shall not recommence iron sand extraction activities 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 69. The Consent Holder shall inform the EPA of the outcome of any engagement with HNZ as soon as practicable following the completion of any engagement process.

2.6.8. Discharges from the Operational Vessels

71.	The Consent Holder shall not dispose of, or discharge, any chemicals or harmful substances at sea. All hazardous and/or oily waste shall be stored on board each vessel for transport in suitable containers or packaging to an authorised shore side reception facility. For the purpose of this condition, 'harmful substances' do not include any 'mining discharges' from the iron sand extraction activities as defined by s4 the EEZ Act or any biodegradable hydraulic fluid / oils from the Crawler.
72.	All fuel used in the operational vessels shall have a sulphur content no greater than 3.5% (w/w) by weight. A record of all fuel used and the sulphur content, in any of the vessels shall be kept and provided as part of the Annual Report required under Condition 79. The record shall be made available to the EPA upon request.

2.6.9. Biosecurity Management

73.	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 iron sand extraction activities authorised by these consents, unless the vessel 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 subsequent version thereof.
74.	The Consent Holder shall ensure that: a. All overseas vessels that are to be permanently located in the vicinity of the project area, including but not limited to the Integrated Mining Vessel and Crawler; and b. All vessels servicing the iron sand 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 permanently located in the vicinity of the project area, special measures to minimise biofouling risk shall be considered as part of a Biosecurity Management Plan developed under Condition 74. Any vessel that does not comply with the above requirements shall not be used for any part of the iron sand extraction activities authorised by these consents.
75.	Notwithstanding the requirements of Conditions 72 and 73, the Consent Holder shall, prior to the commencement of iron sand extraction activities, and following consultation with the Ministry for Primary Industries and a nominated representative from Aquaculture New Zealand, prepare a Biosecurity Management Plan, the purpose of which is to ensure that there are effective procedures in place to manage biosecurity risk from overseas and domestic vessels. The Biosecurity Management Plan 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 Organisation 2011 'Guidelines for the Control and Management of Ships' Biofouling to Minimize 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 Biosecurity Management Plan 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 Biosecurity Management Plan shall be updated as necessary to reflect the most up-to-date standards and shall be made available to the EPA upon request.
76.	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 75(a)(iv)) to a nominated representative of the Aquaculture Industry, as appointed by Aquaculture New Zealand, and to the EPA.
77.	TTR related project vessels shall only enter 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 realistic alternative; and b. MNZ, the Marlborough District Council, Aquaculture New Zealand and a nominated representative of Ngati Koata are notified as soon as practicable following the occurrence of any such emergency event.
78.	Prior to the anchoring of any TTR related project vessel in Admiralty Bay in accordance with Condition 77, the Consent Holder shall notify Ngati Koata as soon reasonably practicable and, to the extent practicable: a. Provide the opportunity for a nominated representative from Ngati Koata to have input in the anchoring location within the bay; and b. Provide the opportunity for a nominated Ngati Koata iwi observer to monitor the presence of marine mammals.

2.7. Reporting

2.7.1. Quarterly Operational Report

79.	The Consent Holder shall prepare a Quarterly Operational Report summarising the iron sand extraction activities undertaken for the previous quarter (three (3) months). The Quarterly Operational Report shall include, as a minimum, the following operational information: a. GPS positions of anchor placements on the seabed and coordinates illustrated on a map with the iron sand extraction area clearly marked;

	b. GPS positions of the Crawler placement and tracks during iron sand extraction activities 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 removed and deposited seabed material; e. Maximum and average depth of seabed removed 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 seabed material (from bathymetry); h. Location and height above the seabed of discharge pipe whilst discharging seabed material; i. Details of any complaints received, including the Complaints Log; and j. Details of any investigations, including recommendations, undertaken by the Consent Holder, the Technical Review Group or the Kaitiakitanga Reference Group including a summary of any commentary or recommendations from the Technical Review Group and, where necessary, an explanation as to why any Technical Review Group 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 61; and m. Any other components required by the conditions of these consents. The Consent Holder shall provide the Quarterly Operational Report to the EPA within forty (40) working days of each quarter ending (being 31 March, 30 June, 30 September and 31 December) during the iron sand extraction activities authorised by these consents.

2.7.2. Annual Report

80.	Notwithstanding the requirements of Condition 79, or the reporting requirements outlined in the EMMP provided in accordance with Condition 21, the Consent Holder shall prepare an Annual Report for the previous twelve (12) month period from the commencement of iron sand 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 iron sand extraction activities. Each Annual Report shall include, as a minimum, the following information: a. 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 80(a)i; iii. The volume and mass of materials extracted and 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. b. A summary report on all monitoring undertaken in the previous twelve (12) months in accordance with the EMMP required under Condition 21; c. Details of monitoring proposed for the next twelve (12) months in accordance with the EMMP required under Condition 21; d. Details of any exceedances of the limits as identified in Conditions 4 and 12 as well as any management / mitigation action(s) implemented in response to any exceedance including details of any investigations; e. A record of all fuel used, and the sulphur content of the fuel, for each TTR project related vessel as required under Condition 72; f. A record of pre-start observations as required by Condition 61; g. Details of the Technical Review Group review of the annual monitoring data and the EMMP, along with recommendations for any actions or changes to the EMMP or the iron sand extraction activities, and how these were provided for as well as any reasoning as to why recommendations were not accepted; and h. Any other component required by the conditions of these consents. The Consent Holder shall provide the Annual Report to the EPA within sixty (60) working days of the completion of each twelve (12) month monitoring period.
81.	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 80. The EPA shall be informed of any such changes no later than five (5) working days prior to commencement of works in the modified areas.

2.8. Review Condition

82.	Within one (1) month of the receipt of an Annual Report or following the Consent Holder receiving a recommendation from the Technical Review Group, the EPA may serve notice on the Consent Holder, in accordance with ss76 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 an existing limit in Schedule 2 or any ISQG-Low and ISQG-High values; and / or b. Including new ‘Response Limits’ or ‘Compliance Limits’ additional to those identified in Schedule 2 or any new ISQG-Low and ISQG-High values; and / or c. To deal 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. Review the adequacy of monitoring.

2.9. Risk Management

83.	The Consent Holder shall ensure that it maintains insurance in respect of its potential liability for loss or damage while giving effect to these consents, including but not limited to public liability

	insurance for a sum not less than NZ$100,000,000 (2016 dollar value) for any one claim or series of claims arising from giving effect to these consents. At a minimum, the public liability insurance shall cover all costs of environmental restoration required as a result of an unplanned event occurring during the exercise of these consents.
84.	The Consent Holder shall submit a certificate demonstrating that it holds the insurance required by Condition 83 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.

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

SCHEDULE 2 - SUSPENDED SEDIMENT CONCENTRATION (SSC) 'RESPONSE LIMIT' AND 'COMPLIANCE LIMIT'

South Taranaki Bight Sites	Percentiles (SSC mg/L)			
	Surface		Bottom	
	Response Limit - 80th	Compliance Limit - 95th	Response Limit - 80th	Compliance Limit - 95th
Rolling Grounds	0.3	1.1	3.5	15.3
Graham Bank	1.7	4.5	32.8	84
Source A to Whanganui 1 km	1.1	2.7	16.9	44.2
Source A to Whanganui 20 km	2.3	5.9	29	76.6
South Traps	6.3	11.1	37.7	97.4
North Traps	7.2	12.4	46.5	115
Tuteremoana	8.5	13.6	23.7	62.5

Note 1: The source of the numerical values of the levels of "naturally occurring" background limits contained in the Schedule 2 above 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 response and compliance limits contained in Schedule 2 above are to be considered as inclusive of both natural and mining derived suspended sediment concentrations.

Note 2: Turbidity may be used as a proxy for suspended sediment concentrations when assessing against the limits in Schedule 2.

Note 3: The numerical values of Schedule 2 that represent the 80th and 95th percentile limits at a location may be amended by way of the process set out in Condition 17 but any change to the percentiles themselves (for instance amending 80th percentile to 85th) can only be changed by way of Condition 82.

SCHEDULE 3 – METHODOLOGY FOR REVIEWING THE SUSPENDED SEDIMENT CONCENTRATION ‘RESPONSE LIMIT’ AND ‘COMPLIANCE LIMIT’ NUMERICAL VALUES IN SCHEDULE 2

The suspended sediment concentrations collected as part of the Baseline Environmental Monitoring Programme (BEMP) will be used to calibrate and validate the Operational Sediment Plume Model and provide data to verify the ‘Response Limit’ and ‘Compliance Limit’ numerical values set in Schedule 2. As per Condition 19, calibration and validation of the Operational Sediment Plume Model will occur every six (6) months during the BEMP and for the first three years of iron sand extraction activities, and then every 24 months thereafter with independent peer review as per Condition 18.

Validation will occur by statistically comparing the modelled and actual measured values to provide a measure of the Operational Sediment Plum 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 R^2 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 response and 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 BEMP period comparisons are to make use of as much of the aggregated time-series data as possible.

As per Condition 17, in the event that the updated numerical values of the ‘Response Limits’ or ‘Compliance Limits’ are different from the numerical values of the ‘Response Limits’ and ‘Compliance Limits’ in Schedule 2, then the updated numerical values of the ‘Response Limits’ or ‘Compliance Limits’ shall supersede the numerical values of the ‘Response Limits’ and ‘Compliance Limits’ in this schedule. Any updated numerical values of the response or compliance limits shall represent “background” conditions and not be influenced by any actual or model simulated iron sand extraction activity.

SCHEDULE 4 – PLAN OF CONSENTED INTEGRATED MINING VESSEL MOORING AREA BOUNDARY