TRANS-TASMAN RESOURCES LTD

# TARANAKI VTM PROJECT

Fast-Track Act Application

15 April 2025

# TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

## ATTACHMENTS

Attachment 1: Proposed Marine Consent Conditions

Attachment 2: NZIER - Economic impact assessment of TTRL's Taranaki VTM Iron Sands Project – March 2025

Attachment 3: Siecap - Taranaki VTM Project Pre-Feasibility Study Offshore Iron Sands Project, March 2025

Attachment 4: Siecap - Metallurgical Review: Recovery of Vanadium from Taranaki VTM Project NZ - February 2025

# EXECUTIVE SUMMARY

**Outstanding Opportunity for New Zealand**

Trans-Tasman Resources Limited ("**TTR**") is applying for marine consents under the Fast-track Approvals Act 2024 ("**FTA**") to enable all activities associated with the recovery of iron sand deposits containing the critical minerals vanadium and titanium (vanadiferous titanomagnetite ("**VTM**") resource) from the South Taranaki Bight ("**STB**"). The Taranaki VTM project ("**Project**") is located within New Zealand's Exclusive Economic Zone ("**EEZ**"), between 22km to 36km offshore in waters ranging from 20m to 50m deep.

TTR has discovered and drill defined a 3.2 billion tonne ('**Bt**") world-class VTM resource in the STB and been granted a mining permit to undertake iron ore extraction and processing operations to produce iron ore concentrates for export. Seabed in the Project area consists of a layer of volcanic sand 20-30m deep. The company plans to extract 50 million tonnes ("**Mt**") of seabed material a year, process on board a mining vessel to recover and export 5Mt of high value iron ore concentrates containing vanadium and titanium metal by-products. The process returns the remainder of the de-ored material (approximately 45Mt) to the seabed in a controlled manner to minimise the generation of suspended sediment in the water column (the plume).

This Project represents a transformative opportunity for New Zealand's economy and environmental leadership. TTR has invested more than $85 million over 15 years in the Project to undertake resource discovery, extensive development work and planning including:

- Mineral exploration and geophysical surveys;
- Seabed drilling;
- Sample processing and analysis;
- Mineral resource definition and reporting;
- Bulk sampling;
- Pilot plant processing;
- Metallurgical testwork;
- Engineering and process design;
- Specialist Marine Vessel design;
- Marine research, surveys and monitoring;
- Environmental impact studies;
- Market research;
- Feasibility studies;

> Economic impact assessment;
> Wide ranging consultation and engagement; and
> Independent expert peer reviewed assessments.

The objective of the Project is to maximise the extraction of the VTM concentrates from the mineral deposit, subject to suitable environmental controls.

The Project will generate significant economic growth, foster regional employment, and position New Zealand as a significant western world producer and exporter of critical minerals essential for the transition to clean energy technologies and other critical sectors. The Project has comprehensive environmental safeguards, with the environmental effects being managed by an extensive set of 109 proposed consent conditions and a set of detailed management plans that will protect the STB marine environment.

The Project will extract 50Mt of iron sands per year and mechanically recover, by magnetic separation, 5Mt annually of heavy mineral sands concentrates containing iron ore, vanadium and titanium, for export.

The operation is essentially a seabed dredging operation with shipboard processing, concentrate washing and direct dewatering, and off-loading onto bulk carrier vessels for export, with approximately 90% (~45Mt) of the material extracted being returned unadulterated immediately to the seafloor in a controlled process into an adjacent, previously extracted area. There are no toxins or chemicals used as the process is entirely mechanical using physical properties of the iron sands to separate the target minerals.

An animated video can be viewed at: TTR Taranaki VTM Project Operations Video.

The extracted iron ore is used to produce steel that is essential for all modern economic activity and for maintaining our standard of living and well-being. Magnetite is playing a crucial and growing role in the push toward green steel production. Unlike traditional hematite-based processes, magnetite requires less energy to reduce in a direct reduced iron (DRI) setup, especially when paired with hydrogen as the reducing agent. This not only slashes carbon emissions but also makes magnetite a preferred feedstock for emerging low-carbon steel technologies. As the industry shifts away from coal-based blast furnaces, magnetite is fast becoming the backbone of a cleaner, more sustainable steel future. Steel and steel alloys are widely used in industry, construction, agriculture, food production, transport, commerce, communications, and energy production and transmission. Vanadium is required to strengthen steel and is a key component for utility-scale battery storage and is essential for renewable energy storage systems. Titanium is a vital component of clean energy technologies, aerospace, aircraft, electronics, paints, paper, medical instruments and implants and is used in a wide range of industrial applications.

TTR is seeking a 35-year consent term which would normally be applied for under the Exclusive Economic Zone (Environmental Effects) Act 2012 (“**EEZ Act**”) with the actual extraction activity taking place over a 20-year period. The balance of the consent term will be used for pre-commencement marine monitoring and research and post operation marine monitoring and decommissioning activities. With stringent environmental safeguards and low impact sustainable mineral recovery practices, the Project aligns with New Zealand’s economic, environmental, and social goals.

The Project timeline will commence with the establishment of a head office in New Plymouth and with the work required to establish the operation. This work includes a bankable feasibility study (“**BFS**”) and financing of the NZ$1 billion required for the Project. This will result in a regional spend of about $25 million over the first year, the employment of about 35 to 40 professional staff by TTR and the engagement of a range of expert consultants in environmental, economic, engineering and ship building, metallurgical, geological, accounting, mineral marketing and corporate finance disciplines.

The completion of the BFS will lead to a Final Investment Decision (“**FID**”) being made to proceed with the Project financing and development of the Taranaki VTM Project. This work will be followed by a two-to-three-year period for construction, commissioning, personnel recruitment, training as well as implementing the Environmental Management and Monitoring Plan (“**EMMP**”), the Pre-commencement Environmental Monitoring Plan (“**PCEMP**”) and setting up of the Technical Reference Group (“**TRG**”), the Kaitiakitanga Reference Group (“**KRG**”) and the Kaimoana Monitoring Programme (“**KMP**”).

The Taranaki VTM Project will deliver strong economic benefits to the Taranaki region and nationally. Independent economic impact assessment by the New Zealand Institute of Economic Research (“**NZIER**”) includes:

> **Employment Creation** - Directly employ over 300 high-value positions in Taranaki, a further 170 jobs in the region in services, 1,125 jobs in the region in logistics, services, provisioning, supplies, bunkering, maritime operations, heavy engineering and training activities (regional support) and indirectly creating more than 1,365 jobs nationwide. The Project will also actively support regional and national workforce development;

> **Regional Investment** - An annual spend of NZ$234 million in Taranaki on employment, services and regional support activities particularly in areas like New Plymouth, Hawera and Whanganui;

- **Regional and National Boost to GDP** - NZIER estimate positive economic impacts in the region with the Project increasing Taranaki's annual GDP by $222 million and, for the nation, boosting New Zealand's GDP by $265 million;
- **Head Office in New Plymouth** - The head office will employ 35 professional staff in corporate management, HR, health and safety, ore marketing, metallurgy, geosciences, recruitment, accounting and project administration;
- **Hawera Training and Logistics** - A training institute will be established along with a helicopter logistics base for personnel and supplies transfers to the offshore vessels;
- **Port of Taranaki and Whanganui Port Upgrades** - Supply, maritime logistics, marine research and monitoring, geology and grade control drilling vessels will be based at the Ports;
- **Institutions, Community and University Grants** - TTR will establish an indexed $50,000 per year Charitable Trust for community and cultural grants in South Taranaki. There will be flow-on indirect investment in universities, grants for community and cultural activities, scholarships, marine research and government institutions minerals and metallurgical research capabilities will strengthen over the 30 years of operational marine research and monitoring to be undertaken;
- **Government Revenues** - At current prices, the annual royalty payment for iron ore and vanadium is estimated to be between NZ$36 million and NZ$39 million in the Project's first seven years of operation, increasing to about NZ$54 million per annum thereafter. This is additional to an annual corporate tax paid to the Crown ranging from NZ$91 million to NZ$136 million;
- **Export Revenue and Foreign Exchange Earnings** - At current market prices the VTM concentrates will generate NZ$854 million (US$496 million) of foreign exchange revenues annually from the export of high-value iron ore and vanadium concentrate contributing significantly to New Zealand's balance of trade and will be one of NZ's top 12 exporters;
- **Major Capital Investment in Leading Edge Technology -** NZ$1 billion (US$602 million) capital investment in proven leading edge mineral recovery and proprietary technology and marine research; and
- **Long-Term Industry Impact** - The Project has the potential to make a major contribution to the Government's stated aim to double the mining sector's export value to more than NZ$3 billion by 2035.

The Project's success will establish a precedent for leveraging New Zealand's natural resources and minerals sustainably to drive economic growth and global competitiveness.

*Minister for Resources Hon Shane Jones said in Parliament on 18 September 2024: "Minerals, including vanadium, located in inordinately large content and quantities off the coast of Taranaki, will add not only to the climate change journey but they represent a new source of great wealth."*

**Scale of the Project**

The area of extraction is approximately 44km² within the 66km² area of the Cook South deposit which is the size equivalent of a few land-based dairy farms. At any one time, the disturbed area totals approximately 0.3km², or an area approximately the same as the footprint of Sky Stadium in Wellington. The entire mining permit area represents just 0.18% of the 36,000km² area of the STB, which is a large ocean area with considerable commercial activity such as commercial shipping and fishing, oil and gas exploration and production, harbour dredging and now, potential offshore wind energy installations.

**Table 1.1: Relative Scale of Operation**

| LOCATION | Approx km² | Approx % of EEZ | **Approx % of STB** |
|---|---|---|---|
| Exclusive Economic Zone (EEZ) (Approx 15 x NZ Land Area) | 4.1 million | ~0.0016% | - |
| South Taranaki Bight | 36 thousand | 0.9% | 100% |
| Marine and Benthic Protected Areas | 1.7 million | 42% | 2.1% |
| TTR Mining Area within MMP55581 | 66 | 0.0016% | 0.18% |
| TTR Area of Operations at Any One Time | 0.3 | <0.00001% | <0.001% |

**Strategic Importance**

The strategic value of iron ore, vanadium and titanium cannot be overstated. With increasing global demand for renewable energy and technological advancements, securing a geopolitically stable and sustainable supply of these materials places New Zealand at the forefront of the clean energy transition. The Project's ability to meet domestic and international demand ensures long-term economic stability and growth.

TTR has discovered and reported a 3.2Bt VTM iron sands resource [1] grading 10.17% $Fe_2O_3$, 0.05% $V_2O_5$ and 1.03% $TiO_2$ containing 1.6Mt of vanadium pentoxide ("**$V_2O_5$**") ranking it globally as a world-class titanomagnetite iron sand deposit and one of the largest known drilled, analysed and JORC reported deposits of the critical mineral, vanadium.

The Taranaki VTM Project positions New Zealand as a significant global player, potentially becoming the third-largest vanadium producer in the world and the largest in the western world. By harnessing this resource, New Zealand not only enhances its export portfolio, introduces more resilience into its economy, contributes to geo-political autonomy in resource supply but also contributes to global sustainability goals.

TTR has granted mining permit MMP55581 over the mineral resource within the EEZ containing 1.88Bt VTM resource where the Pre-feasibility Study ("**PFS**") mine plan can deliver production of 5Mt of VTM mineral concentrates a year for export grading 56-57%Fe, 0.5%$V_2O_5$ and 8.5%$TiO_2$.

**Environmental Leadership**

Environmental stewardship is central to the Taranaki VTM Project. TTR's proposal has been subjected to detailed environmental assessments and its implementation will employ best practices, and be further informed by pre-commencement monitoring, to ensure that any environmental impacts will be transient, localised and short-term in nature.

The VTM recovery operation includes:

> **Removing top 5 metres of Seabed -** TTR is dredging the top 5m (on average — sometimes up to 11m, or as little as 1m) from a layer of volcanic sand deposits 20-30m deep. The higher grade iron sand "sits on top" of the existing 20-30m of seabed sand;

> **Minimal Disturbance -** The operation affects an area of less than 0.3km$^2$ at any given time and following the redeposition of sand to the seafloor, recolonisation of the marine benthos will begin. As a result, from an ecological perspective, the seafloor will "return to normal" within two to five years. The total area of disturbance (approximately 0.0016%) represents a negligible portion of New Zealand's entire EEZ area of over 4,000,000km$^2$;

> **No Chemicals or Toxins Used -** The modern seabed mineral removal process is all-natural with the dredged sands being passed through a mechanical magnetitic separator with seawater to extract the VTM concentrate, about 10% of the volume. The residual de-ored sediment, 45Mt a year being 90% of the dredged material, is

1 ASX release 1 March 2023

continuously returned to the seafloor from where it came, in a controlled manner to minimise the generation of suspended sediment in the water column (the plume);

- **The Plume -** The plume generated by returning the de-ored sands to the seafloor is very localised. 1 to 2km from the redeposition location, the plume will be invisible to the naked eye and entirely dispersed within 15km from the operation. The plume is confined and will be largely negligible adding 0.5 to 1.5mg/L of Suspended Sediment Concentration ("**SSC**") into the ocean where naturally occurring SSC range from 10mg/L to over 100mg/L and periodically exceed over 1,000mg/L SSC. To put this into perspective, an Olympic-sized swimming pool holds approximately 2.5 million litres of water. An increase of 0.5 to 1.5 mg/L of suspended sediment equates to roughly 1.25 to 3.75 kilograms of sediment added across the entire volume.
- **Emissions Profile -** Project operations will produce fewer carbon emissions per tonne of concentrate compared to other iron sand and hard rock iron ore mines around in the world. Producing only 62kg $CO^2$ per tonne of concentrate, TTR's operations have less than half the carbon emissions compared to traditional land-based mining (average 120 to 250kg $CO^2$/t) which is dominated by process driven landside activities. There are environmental advantages that extend beyond the immediate extraction operations. By providing critical minerals for clean energy technologies, the Project indirectly supports global efforts to reduce greenhouse gas emissions. TTR's commitment to continuous rehabilitation and monitoring ensures that the environment is restored and maintained, setting a benchmark for sustainable marine mining practices.

**Managing Environmental Effects**

Thanks to the efforts of TTR, the Project area and surrounds are one of the best studied marine environments in New Zealand. Every potential effect of the sediment discharge on marine life has been considered and peer reviewed by independent experts including effects on primary producers such as phytoplankton, effects on mussels, sponges and other reef fauna, effects on other benthic organisms, effects on fish, effects on marine mammals and effects on seabirds. In all instances independent experts have concluded that the effects, which will be managed through the proposed consent Conditions, will not result in material harm.

Dr Alison MacDiarmid, NIWA Regional Manager, concludes in her expert reports and evidence:

> *"The proposed mining area in the STB is one of the best studied shallow exposed shelf marine environments in New Zealand";*

*"There's a wealth of studies generated by the applicant [TTR] that add to a body of existing information" with "The effects so small and perhaps impossible to measure", and concludes,*

*"Granting consent, subject to the proposed conditions, will avoid material harm, and will favour caution and environmental protection in relation to the effects of the proposed mining operations"*.

TTR will undertake environmental monitoring in accordance with the procedures and methods, at the locations, and for the duration and frequency detailed in an EPA-certified EMMP. The EMMP will ensure the monitoring required is appropriate to ensure that the activities authorised by the consents do not result in any adverse effects that were not anticipated at the time of the consent approvals.

By way of context, the Project area, as part of the STB, has very exposed, high energy, highly dynamic sandy environments, very turbid seas with relatively high SSC loads of 10 to 1,000's mg/L of SSC and thus is subjected to frequent episodic disturbances from current, wave, tidal and storm events, and river inputs during high rainfall events.

The area is heavily bottom trawled by the commercial fishing industry and is a busy seaborne container and bulk shipping trade route. There have never been any marine recreational activities or sports (including diving, swimming, surfing or recreational fishing) undertaken in the area 22km to 36km offshore. It is simply too far out and weather and ocean conditions significantly limit anything but the operation of large commercial vessels within this area of the STB. The Project will not result in any effect or impact on the South Taranaki coastline, beaches or environment or on food gathering sites along the coast.

In the course of identifying key ecological areas in the marine area where mineral extraction and sediment redeposition is proposed, research was undertaken by the National Institute of Water and Atmospheric Research ("**NIWA**") and TTR using seismic and sonar scans, hundreds of photos and physical samples, instrument measurement and video footage. A representative video of the seafloor within the proposed area of mineral extraction can be viewed at: NIWA ROV Seabed Video of MMP55581

The studies show the overall environmental effect of TTR's proposed operation will be negligible to minor and, therefore, situate the Taranaki VTM at the most benign end of extractive processes. It is no more impactful than ploughing or harvesting a field – a result of which is immediate detrimental impact on organisms (mostly microalgae and microphytobenthos less than 1mm in size) in the immediate area followed by rapid recolonisation and recovery in a relatively short time scale (a few months).

Other common and accepted human development activity (such as creating a subdivision or building a road) have similar environmental impacts but generally these are permanent whereas the Taranaki VTM Project's impacts are transient and temporary and the disturbed area will quickly recover.

TTR's process ensures recovery starts immediately after sediment deposition (the extracted areas are continuously refilled) and conservative assessments by experts indicates the areas will be fully rehabilitated within two years after deposition. The benthic community is already well adapted to disturbance and will recover rapidly, expected to be within weeks to months once extraction has moved beyond the immediate area.

TTR will manage environmental effects of the Project by working to a comprehensive set of consent conditions and detailed management plans that are subject to the ongoing approval and scrutiny of the compliance regulator, the EPA. The plans, agreed with a wide range of stakeholders and the EPA, outline how TTR would operate and sustainably manage the resource, and protect the marine environment from any permanent adverse effects. The consent conditions require activities to cease if the effects exceed those permitted, with remedial action to be taken.

TTR expects to be held accountable to high environmental and other standards operating to international best practice.

**The Plume**

The most significant and contentious effect of the Project is the discharge of natural sediments and associated plume. Throughout the duration of the consents, TTR will maintain an Operational Sediment Plume Model ("**OSPM**") in order to ensure that activities authorised by the consents comply with the conditions and to provide an effective mechanism to predict background and mining derived SSC, forecast sediment plume dynamics and geographical spread in real time.

As outlined, TTR intends to return about 45Mt of this natural sediment (the de-ored sand) to the seafloor in a controlled manner via a discharge pipe, about 4m above the seabed.
The plume generated from returning the sands will be largely negligible. It will have the effect of adding 0.4 to 1.5mg/L of SSC into the ocean.

TTR's system to extract and redeposit the sediment is designed to minimise the plume effect. The amount of sediment being added into the STB by Taranaki rivers flowing into the STB far exceeds the plume suspended sediment fraction of 1mg/L on average by over 15 to 100 times. The median level of naturally occurring suspended sediment in the STB near shore areas, where most of the rocky reefs are, is 10mg/L SSC and periodically exceeds over

1,000mg/L SSC, particularly near river mouths. Local marine life is already well adapted to such a dynamic, sediment laden environment.

The discharged material is entirely natural with the majority settling quickly and directly onto the seafloor. A proportion of the finer SSC content will remain suspended in the water for longer and will be dispersed by currents. Within 2 to 3km from the discharge location, the sediment introduced will be indistinguishable from natural conditions.

TTR's operating conditions will limit the intensity of the plume and its effect on the environment.

**Oil and Gas**

TTR has an operating agreement in place with the Kupe Joint Venture Operator to co-ordinate and inform each other on our activities in the STB.

TTR will prepare a Collision (Loss of Position) Contingency Management Plan ("**CCMP**") certified by the EPA following consultation with the Kupe Operator. The purpose of the CCMP is to demonstrate how the objectives set out in the conditions are achieved and to outline the specific operating procedures to be implemented during the seabed material extraction operations.

As well, TTR will implement a Simultaneous Operations Plan ("**SIMOPP**") in accordance with the requirements of IMCA M 203 Guidance on Simultaneous Operations (SIMOPS) following consultation with the Kupe Operator. The purpose is to define operating procedures when two or more vessels are operating in close proximity to each other, oil and gas drilling and safeguarding of existing platform and pipeline infrastructure.

**Fishing and Fisheries**

The scientific data collated to inform the Project demonstrates the overall effects on fish species and populations will generally be no more than minor, and that there will be no effect on either the abundance or health of the commercial or recreational fisheries in the STB.

TTR will meet every six (6) months with representatives of the commercial fishing industry including any representatives nominated by Seafood NZ. The purpose of the meetings shall be to enable parties to share relevant information and to establish a co-ordinated approach between TTR's mining activities and commercial fishing activities, including communications protocols. As well, commercial fisheries representatives are included on the TRG that provides technical advice to TTR. TTR has an operating agreement in place with Sanfords Limited, one of the largest quota holders in Fishing Management Area 8.

**Marine Mammals**

TTR will prepare a Marine Mammal Management Plan ("**MMMP**") to be certified by EPA that has been prepared following consultation with the Department of Conservation and the KRG. The MMMP sets procedures and protocols to minimise the risk of whale and dolphin entanglements, ensure there are no adverse effects on marine mammals in the STB and training for marine mammal operational responses.

Studies of marine mammals within the STB include data from the Department of Conservation and marine mammal observers on vessels, oil and gas installations, aerial observations including an 8,426km aerial survey in 2015 by TTR, and the Dr Torres 2017 study.

The main population of Blue/Pygmy Blue whales according to sightings is approximately 50 to 120km west of TTR's permit area, in water depths greater than 70m. The Blue whale is an oceanic animal, preferring deep water on the edge of the continental shelf and in the middle of the ocean to coastal waters.

Historically, there have only been two recorded sightings of Maui's dolphins in the STB and none in the last 50 years. This is because the majority of recorded sightings of the critically endangered Maui's dolphins occur north of Cape Egmont with the main population living between Raglan and Kaipara Harbour, 230 to 370kms north of TTR's Mining Licence area.

**Noise Levels**

TTR has gained expert evidence that says none of the marine mammals, including whales, on record in the STB would be affected by behavioural disturbance as a result of the location of its vessels, mobile subsea sediment extraction device or noise from its operations. The conditions developed by TTR and the Department of Conservation, address the underwater noise effects of the proposal and incorporate an extensive suite of further marine mammal management and operational measures to provide for any adverse effects.

**Seabirds**

There are no major nearby colonies of sea-going birds. Seabirds such as albatross and petrel, along with the migratory birds resident in coastal estuaries are wide-ranging and therefore relatively unaffected by the comparatively small area of TTR's operations.

TTR will prepare a Seabird Effects Mitigation and Management Plan ("**SEMMP**") certified by EPA that has been prepared following consultation with the Department of Conservation and the KRG. The SEMMP sets out indicators of any adverse effects on seabirds in STB, identify responses and monitoring requirements and reporting of bird strike.

Of the more range-restricted seabirds, gulls and terns have been identified as most commonly able to extend offshore. The fairy prion is a petrel and are found in Cook Strait islands. Stephen's Island is the nearest Cook Strait Island to TTR's operation, some 80km south.

Less likely to extend offshore are little blue penguins, which feed inshore because most of their dives are only 2m in depth and further out to sea they could suffer predation from marine mammals and sharks.

**Biosecurity Management**

TTR will prepare a Biosecurity Management Plan ("**BMP**") certified by the EPA in consultation with the Ministry for Primary Industries and Aquaculture New Zealand to ensure overseas vessels undertake acceptable measures for biofouling to minimise the transfer of invasive aquatic species.

All operational vessels carrying ballast water that travel to and from overseas ports, including bulk carriers, will be required to have a shipboard ballast water treatment system as part of their charter agreements with TTR. The ballast water treatment system shall be in the Ministry for Primary Industries List of Approved Ballast Water Treatment Systems, or be an equivalent system approved by the International Maritime Organisation.

**Spill Prevention and Waste Management**

TTR will be required to 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, TTR will implement all necessary operational responses, including the measures set out in oil spill contingency plans required under Parts 130A and 131 of the Marine Protection Rules, to ensure that any adverse effects associated with such event/s are remedied or mitigated.

There will be no disposal, or discharge, of any harmful substances at sea. All hazardous and/or oily waste shall be stored on board each project vessel and transported to a shore side facility that is authorised to accept such material.

**Risk Management**

TTR will maintain public liability insurance of not less than NZ$500,000,000 (2025-dollar value) for any claim or series of claims arising from our operations to cover costs of environmental restoration and damage to the marine environment, assets of existing interests or infrastructure in the STB as a result of an unplanned event occurring during operations.

TTR will provide the EPA with a Post Extraction Monitoring Plan ("**PEMP**") for certification. Following the completion of the seabed material extraction activities TTR will undertake five (5) years of post-extraction monitoring of the biological environment, including heavy metal concentrations, within the consent area and its surrounds, the purpose of which is to assess whether recovery of the benthic environment, as defined in the conditions, has been achieved.

**Consultation**

TTR undertook an extensive and wide-ranging stakeholder engagement process including but not limited to, regional and local authorities, commercial fishing, oil and gas, recreational fishing, diving and boating clubs, and charter operators and government agencies. TTR has tried repeatedly to engage with Taranaki Iwi, but all advances have been rebuffed. Nevertheless, the Project has undertaken to incorporate mātauranga Māori into its operational framework and TTR has endeavored to address concerns through conditions that require it to establish and maintain:

> A Kaitiakitanga Reference Group ("KRG") with Ngāti Ruanui, Ngaa Rauru Kitahi and Ngāruahine (and others);

> A Technical Reference Group ("TRG") that provides technical advice to TTR includes representatives of Te Tai Hauāuru Regional Fishing Forum, the KRG, TRC, Fisheries, DOC, Kupe Operator and others with specialist expertise in mātauranga Māori; and

> A Kaimoana Monitoring Programme ("KMP") to be prepared and implemented following consultation with the KRG.

The intent of these conditions is to recognise the kaitiakitanga of tangata whenua and to ensure the ongoing involvement of iwi in monitoring the effects of the Project.

Following the commencement of mining operations, TTR will establish a Charitable Trust to provide an annual inflation adjusted fund of $50,000 per year to be administered by the South Taranaki District Council in collaboration with the company. 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.

**Alignment with the Purpose of the Fast-track Approvals Act and Government Policies**

The Project meets the overarching purpose of the FTA as it will provide both national and regional benefits by significantly increasing New Zealand's and the Taranaki and Manawatu - Whanganui Regions' Gross Domestic Product ("**GDP**") and employments numbers.

The Taranaki VTM Project aligns with the following Government policy:

1. **New Zealand Government Coalition Agreements 2023:** These agreements of 23 November 2023 provide priorities for mining development projects including:

    > Explore the potential for a critical minerals list with a preferential pathway for development for these minerals;

    > Prioritise regional and national projects of significance for approvals;

    > Investigate strategic opportunities for NZ's minerals resources, including vanadium; and

    > Develop a plan to develop these opportunities.

2. **MBIE Briefing to Minister of Resources:** In a briefing to Minister Jones on 27 November 2023, the Ministry of Business, Innovation & Employment ("**MBIE**") estimated an 'in the ground' value of [TTRs] Taranaki iron sand at NZ$100 billion with additional offshore marine iron sand deposits along the coast of up to NZ$275 billion.

3. **GNS Report Mineral Potential of New Zealand:** GNS released its report on the Mineral Potential of New Zealand on 29 August 2024 identifying a wide range of potential economic mineral resources that could be developed. The report details TTR's JORC-reported Taranaki VTM resource at 3.2Bt of 10.17% $Fe_2O_3$, 1.03% $TiO_2$ and 0.05% $V_2O_5$ containing over 1.6Mt vanadium pentoxide in the Cook, Kupe and Tasman north and south deposit blocks in STB as one of the opportunities for development. The world class VTM resource discovery offers New Zealand the opportunity to be a long term iron ore exporter and lead producer of critical minerals internationally.

4. **Critical Minerals List for New Zealand**: MBIE released *A Critical Minerals List for New Zealand* on 31 January 2025. Vanadium and titanium are both included in the list compiled by international resource consultants Wood Mackenzie. Development of the TTR Project could elevate NZ to be the third largest vanadium producer globally with 10,000t vanadium after China (39,000t) and Russia (11,760t), and the western world's largest producer ahead of South Africa (4,480t) and Brazil (2,800t).

    Vanadium and titanium are also included in Australia, USA, Canada, UK, EU and China's critical minerals lists.

5. **Minerals Strategy for New Zealand to 2040:** MBIE also released *A Minerals Strategy for New Zealand to 2040* on 31 January 2025. This strategy has a vision for a minerals sector that delivers for New Zealand, now and into the future, by supporting a

productive and resilient economy through responsible and sustainable practices. The aim is to double NZ's mineral exports to $3 billion by 2035.

TTR's offshore Taranaki iron sand deposits, containing vanadium and titanium used in a wide range of industrial applications including iron and steel making, superalloys, pigments, carbides, chemical catalysts and redox flow batteries for renewable energy storage, have been identified in the strategy as an opportunity to underpin growth by scaling up our existing exports and by realising new mineral [export] opportunities. Importantly, the magnetite within these sands aligns with the growing demand for green steel production, offering a low-emission feedstock for hydrogen-based steelmaking processes. The export of high-value iron ore and vanadium concentrate by TTR, generating foreign export earnings in the order of $854 million per year, will contribute significantly to New Zealand's balance of trade and the Government's aim to double mineral export revenues over the next 10 years.

The Project's alignment with the Government's mineral-related policies underscores its importance as a catalyst for economic and environmental progress. By integrating regional and national priorities, the Taranaki VTM Project serves as a model for sustainable resource development.

**Conclusion**

TTR's Taranaki VTM Project will deliver sustainable jobs; a boost to national employment, much-needed infrastructure investment in Taranaki and Whanganui; taxes and royalties to the Crown, at no cost to New Zealand taxpayers, and with a minimal, confined and short-term impact on the STB marine ecosystems.

The Project delivers substantial economic benefits, strengthens the nation's position in critical mineral markets, and exemplifies sustainable development, with robust environmental protections, community engagement, and alignment with national goals. The Project deserves support.

The Project's broader benefits include producing critical minerals needed for the clean energy transition, supporting the green steel industry, and ensuring minimal environmental impact. It will also make a contribution to NZ's economic well-being, foreign exchange credits and balance of payments.

TTR's commitment to innovation, environmental stewardship, and social responsibility ensures that the Taranaki VTM Project will not only meet but exceed expectations, providing enduring benefits for New Zealand and its citizens.

# 1. INTRODUCTION

## 1.1 OVERVIEW

Trans-Tasman Resources Limited ("**TTR**") is applying for marine consents under Fast-track Approvals Act 2024 ("**FTA**") to enable all activities associated with the recovery of iron sand deposits from an area of approximately 66km$^2$ of the South Taranaki Bight ("**STB**") that is within New Zealand's Exclusive Economic Zone ("**EEZ**"). The proposal is referred to as the Taranaki Vanadium Rich Titanomagnetite ("**VTM**") project ("**Project**").

The Taranaki VTM project is a listed project under Schedule 2 of the FTA and this report constitutes a substantive application for marine consents that would otherwise be applied for under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 ("**EEZ Act**"). To apply under the FTA, the project must be eligible to apply for a corresponding approval under a specified Act, marine consents under the EEZ Act in this case. This Impact Assessment ("**IA**") is provided to support the marine consent application and the approval sought for the project are set out in Section 4 of this IA.

For marine consents to be approved under the FTA process, consideration must be given to the decision-making criteria (Clause 6(1) of Schedule 10 of the FTA) giving the greatest weight to the purpose of the FTA. The project meets the overarching purpose of the FTA as it will provide both national and regional benefits by significantly increasing New Zealand's and the Taranaki and Manawatu - Whanganui Regions' Gross Domestic Product ("**GDP**") and employments numbers. Details on the project rationale and economic benefits are provided in Section 1.5. and Section 5.2 of this IA.

## 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. In 2022, TTR became a 100% owned subsidiary of Australian Securities Exchange ("**ASX**") listed company Manuka Resources Limited (ASX:MKR) [2].

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 deposits is able to be undertaken without the

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[2] Manuka website: https://www.manukaresources.com.au/

detrimental effects on communities and the environment that are often associated with traditional land-based mining operations as a result of almost no land disturbance.

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, the recovery of the VTM resource from the STB will meet the requirements of the EEZ Act (Schedule 10, clause 4(b) of the FTA) while also meeting the purpose of the FTA (Section 3 of the FTA) by providing for a development project with significant regional or national benefits. In addition, TTR is committed to working with local communities and tangata whenua to achieve sustainable and enduring benefits for the Taranaki Region and New Zealand.

## 1.3 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 originally granted for 65.76km$^2$ of land area with a 20 year term commencing on 2 May 2014 (refer to **Appendix 1.1**). An extension of the land area to 242.57km$^2$ was granted on 12 July 2024 (refer to **Appendix 1.2** and Figure 1.1 below). The permit is subject to specific conditions and does not of itself authorise TTR to commence recovery activities. 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 applied to the EPA for the requisite marine consents in 2016. The EPA granted the consents in 2017 subject to a comprehensive suite of conditions. Subsequently, the EPA's decision was appealed and litigated extensively over many years, with the outcome in 2021 that the EPA was directed to reconsider TTR's application. In March 2024, TTR abandoned that consenting process in favour of the FTA process. A summary of previous applications can be found in Section 1.5 of this IA.

This IA is underpinned by a comprehensive suite of technical assessments which have described the potential effects of the proposal and how they can be addressed. Much of this information was prepared to support the 2016 application, but it remains current and the best available, although aspects have been updated in several instances.

TTR has invested more than NZD$85 million since 2007 into exploration, resource discovery and definition, engineering, environmental research and economic analysis on the development of a world-leading approach to low-impact, environmentally responsible seabed mineral recovery. This application is the culmination of the investment and research undertaken by TTR over more than 15 years in what it believes is a nation building project for New Zealand.

The project area encompasses approximately 65.76km$^2$ located between 22 and 36 kilometres ("**km**") [3] off the coastline of South Taranaki (refer to Figure 1.1 below). TTR proposes to extract up to 50 Mt of seabed material per year, targeting the VTM resource. Of the extracted material, approximately 10% by volume, will be processed into 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, following which, re-colonisation of the disturbed area will start to occur. TTR's extraction methodology is designed so that each area within the project area will only be disturbed once during the mining activities thus further assisting with the recovery of the disturbed areas.

3 This equates to between 12 and 19 nautical miles ("**NM**").

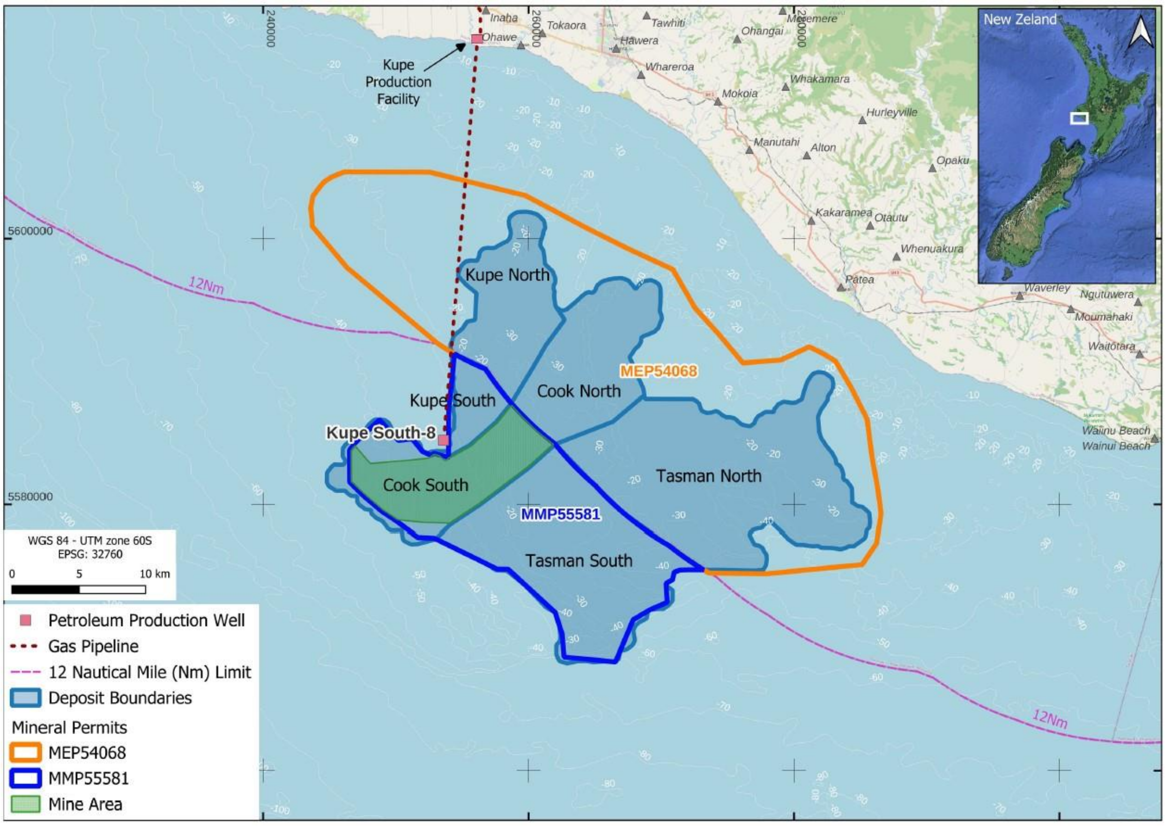


**Figure 1.1:** **TTR Location Plan of Taranaki VTM Deposits, STB**

## 1.4 PROJECT RATIONALE

Because of the projected long-term international demand for iron sand, including vanadium and titanium, the VTM project will provide a valuable and strategic source of export revenue for New Zealand. 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). Middle Eastern steel producers would be particularly drawn to the low emissions generated by this project as several of them are actively pursuing new, low emission steel production facilities. Significant local employment will be generated by this project and training opportunities for many classes of operators will lead to stable long term careers for many people in the region.

The Government's latest Business Growth Agenda 2015 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$265 million and increase national employment numbers by approximately 1,365 through direct, indirect and induced jobs. As such, the project will contribute to the Government's goals in the country's Business Growth Agenda.

The majority of the project's operational spend will occur in the Taranaki and Manawatu - Whanganui Regions. The Economic Impact Assessment undertaken by New Zealand Institute of Economic Research (NZIER, 2025) [4] (refer **Attachment 2**) estimates that, for these regions combined, the operations phase of the project will raise the GDP by NZD$222 million and create approximately 1,123 direct, indirect and induced jobs.

The project will create a total of 303 new full-time equivalent jobs across the Taranaki Region and Whanganui District. In the operational phase of the project, TTR will employ 173 crew members to operate the project related vessels, with over 50 staff members required to support, engineer, perform environmental monitoring, and conduct fuel bunkering roles. There will also be 35 staff who will undertake general administration roles for the day-to-day operation of the Project. TTR also plans to establish a new head office in New Plymouth requiring 35 marketing and corporate management roles. TTR is committed to focusing on sourcing services, supplies and people from the local community where possible, and is aiming for at least 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 Project will add significantly to New Zealand's export earnings. Based on our assumed long-term average iron ore price (US$90 per metric ton), vanadium price (US$5.45 per pound) and the 2024 average exchange rate (NZ$=US$0.58), the Project is expected to generate a total export revenue of NZ$854 million per annum. Within this total, about NZ$658 million per annum will be from exporting iron ore concentrate, and NZ$196 million will be from exporting vanadium. To put that in context, it would be in the top 12 of New Zealand exports by itself. When combined with "Iron and Steel", it would double exports in this category adding up to a value of around NZ$1.69 billion, which would be about 2.6 percent of the total exports (refer Table 1.1 below).

[4] NZIER. 2025. Economic impact assessment of TTR's Taranaki VTM Iron Sands Project A report for Trans-Tasman Resources Limited (Attachment 2)

Table 1.1: New Zealand's Principal Exports (Year ended June 2024).

| Export category | $Million |
|---|---|
| Dairy Produce | 18,991 |
| Dairy | 18,991 |
| Meat | 8,616 |
| Forest Products | 5,705 |
| Fruit and Nuts | 4,010 |
| Seafood | 1,958 |
| Machinery and Mechanical Appliances | 1,919 |
| Aluminium | 1,560 |
| Casein and Caseinates | 1,557 |
| Electrical Machinery and Equipment | 1,106 |
| Precious Stones, Metals and Jewellery | 970 |
| **TTR iron ore with co-products vanadium and titanium** | **854** |
| Iron and Steel | 837 |
| Mineral Fuels | 778 |
| Vegetables | 520 |
| Plastics | 482 |
| Wool | 448 |
| Raw Hides, Skins and Leather | 268 |
| Live Animals | 208 |
| Fabrics, Textiles and Apparel | 140 |
| Tallow | 100 |
| Other | 190 |

Additionally, the project's annual royalty payment is estimated to be between NZ$36 million and NZ$39 million in the first seven years of operation, increasing to about NZ$54 million per annum thereafter. This equates to an annual corporate tax paid to the Crown ranging from NZ$91 million to NZ$136 million. To put that in context, data from New Zealand Petroleum and Minerals shows that petroleum, minerals and coal royalties were about NZ$221 million, of which minerals accounted for just over NZ$14 million.

## 1.5 PREVIOUS APPLICATIONS

TTR has made two previous applications to the EPA for marine consent under the EEZ Act, the first commencing in October 2013 and the second in August 2016.

The relevant requirements of the FTA in this regard, are as follows:

(a) The relevant requirements in sections 43(2) and 13(4)(u), which state:

> *"whether any activities that are involved in the project, or are substantially the same as those involved in the project, have been the subject of an application or a decision under a specified Act and,—*
>
> *(i) if an application has been made, details of the application: and*
>
> *(ii) if a decision has been made, the outcome of the decision and the reasons for it."*

(b) The relevant requirements in sections 43(2) and 13(4)(y)(vii), and clause 2(1)(b) of Schedule 10, which collectively require the present application to contain:

> *"additional information about whether the applicant has already made an application for consent under the EEZ Act in relation to the project, and, if so,—*
>
> *(i) details of any application made; and*
>
> *(ii) the decisions made on that application"*

### 1.5.1 The 2013 Application and EPA Decision

In October 2013 TTR applied to the EPA for marine consents for substantially the same activities as those covered by the present application. Consent was not sought for discharge of de-ored sediment, because at that time such discharges were not regulated under the EEZ Act. The discharge was treated by TTR, and by the EPA's decision-making committee, as an effect of the other activities that required marine consent.

The EPA's decision-making committee decided that the information was the best available, but was insufficient for the committee to be confident about the effects of the project on the environment, or the ability to appropriately manage those effects. The committee considered whether an adaptive management approach could be used (as adaptive management was, at that time, not prohibited for any of the activities regulated by the EEZ

Act), but held that an adaptive management would not favour caution and environmental protection, and therefore refused consent.

The EPA's decision on TTR's 2013 application is of limited relevance for present purposes, given:

> It was not a decision on a marine discharge activity;

> It was a decision that took account of a potential adaptive management approach;

> It was a decision based on less information than is available to support the present application; and

> It was a decision made by an EPA decision-making committee (i.e. not a higher authority).

### 1.5.2 The 2016 Application and EPA Decision

In response to the decision on its 2013 application, TTR commissioned experts to undertake additional scientific studies of the existing environment in and around its proposed mining site, and to provide updated assessments of the effects of the project on that environment and existing interests. It commissioned experts to review and refine the physical models that supported the effects assessments, with a particular focus on obtaining a comprehensive understanding of the discharge effects (sediment plume source, sediment characteritics and dispersion, optical properties and so on). Where appropriate, peer reviews, including by international experts, were obtained to ensure the work was robust.

Once that work was complete, TTR lodged a new application with the EPA in August 2016. The application was supported by 42 technical reports covering the physical environment, benthic ecosystems, primary productivity, fish, marine mammals, seabirds, seascape and visual character, archaeological sites and existing interests.

By 2016 the EEZ Act had been amended, so that one of the activities requiring consent was the discharge of de-ored sediment, and an adaptive management approach was prohibited in relation to that activity.

The EPA's decision-making committee granted the consents in August 2017.

In respect of environmental effects the committee held that the impact of most effects would be felt at a localised scale, that conditions would limit the effects of discharge, and that the benthos of the mining area would recover over time. In respect of existing interests, the committee held that there would be little or no effects on commercial fishing, minor effects on recreational fishing and diving, and conditions could manage the interrelationship with the operator of adjacent petroleum mining. The committee concluded that granting consent would meet the purpose of the EEZ Act.

### 1.5.3 Appeals concerning the EPA Decision

The EPA's 2017 decision was appealed to the High Court by environmental advocacy groups and iwi representatives. They argued there were many errors of law in the decision.

The High Court found [5] there was one error—that the consents applied a prohibited adaptive management approach—and for that reason it quashed the EPA's decision and referred the applications back to the EPA to reconsider.

The High Court's decision was appealed to the Court of Appeal. The Court of Appeal disagreed with the High Court that the consents applied an adaptive management approach, but found that there were other errors of law in the EPA's decision. [6] So, for different reasons than the High Court, it upheld the outcome of the High Court's decision: the applications were referred back to the EPA to reconsider.

The Court of Appeal's decision was appealed to the Supreme Court. The Supreme Court's reasoning—which is addressed below in greater detail—differed from the Court of Appeal's, yet it reached the same outcome, finding that there were errors of law in the EPA's decision, and referring the applications back to the EPA for reconsideration. [7]

The EPA appointed a new decision-making committee to reconsider the applications in accordance with the appeal outcomes, and reconsideration hearings began in March 2024. TTR withdrew the applications at the end of March 2024.

### 1.5.4 Relevance of Prior Decisions on TTR's 2016 Application to the Present Application

The reasoning of the High Court and Court of Appeal on TTR's 2016 application is of no relevance as it was supplanted by the decision of the Supreme Court. The Supreme Court's decision is the most authoritative guidance on the correct application of some key provisions of the EEZ Act in particular:

> Section 10(1)(b) (protection of the environment from pollution)

> Section 11 (international obligations)

> Section 59(2)(a) and (l) (Tikanga)

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[5] *Taranaki-Whanganui Conservation Board v Environmental Protection Authority* [2018] NZHC 2217.

[6] *Trans-Tasman Resources Ltd v Taranaki-Whanganui Conservation Board* [2020] NZCA 86.

[7] *Trans-Tasman Resources Ltd v Taranaki-Whanganui Conservation Board* [2021] NZSC 127.

- Section 59(2)(h) (the nature and effect of other marine management regimes)
- Section 61(2)(favouring caution and environmental protection)
- Section 63(conditions)
- Section 64 (adaptive management)

However, the statutory framework for the present applications is not set by the EEZ Act, but by the FTA, and the relevance of the Supreme Court's guidance is affected by that. The FTA identifies specific provisions of the EEZ Act for consideration, but they are required only to be "taken into account", which is not an absolute standard. [8] Further, they are explicitly required to be given less weight than the purpose of the FTA. These matters, and the relevance of the Supreme Court's guidance are all addressed in Section 8.

## 1.6 APPROACH TO MINIMISING EFFECTS AND THEIR MANAGEMENT

While the benefits of the project are significant and clearly meet the purpose of the FTA, as discussed in Section 8.3.21 of this IA, environmental effects must be managed appropriately.

Section 5 of this IA provides an assessment of the actual and potential effects of the project, based on the technical assessments commissioned by TTR. Many of the technical assessments have recommended the implementation of measures to avoid, remedy or mitigate potential adverse effects on the environment. These recommendations have shaped the development of a robust suite of proposed consent conditions as provided in Attachment 1 to this IA. Notably, these proposed consent conditions are similar to those which have already been subject to enquiry by the Courts in the process described in Section 1.5 above and have adopted the recommendations set out in the previous 2017 decision from the EPA.

Section 6 of this IA summarises the key management and mitigation measures proposed by TTR for the project. Further, TTR's activities would also be managed by comprehensive management plans developed with appropriate input from technical experts. These management plans are listed in Section 6.6 and provided for in the proposed consent conditions.

Overall, TTR is seeking approval for a regionally and nationally significant project that is clearly aligned to New Zealand's development goals, and which, subject to the

[8] See section 8.2, below.

implementation of the proposed effects management measures, appropriately addresses the project's potential adverse environmental effects.

## 1.7 APPROACH TO ENGAGEMENT WITH TANGATA WHENUA, COMMUNITY, STAKEHOLDERS AND INTERESTED PARTIES

Acknowledging the historical engagement and consultation undertaken as part of previous application processes, TTR has adopted and promoted an active and open stakeholder engagement approach with tangata whenua, and the relevant local, regional and central government agencies. In doing this, TTR has met all consultation requirements set out in Section 11 of the FTA.

Section 7 of this IA provides an overview of TTR's consultation on the project including a description of the pre-lodgement consultation requirements under Section 11 of the FTA.

## 1.8 REPORT STRUCTURE

All matters required to be addressed under the FTA and 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 based on the information provided in Siecap[9] (2025b).

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

**Section 4** Details the approvals required and sought under the FTA and EEZ Act.

**Section 5** Provides an assessment of the actual and potential effects on the environmental, effects on existing interests and positive effects as a result 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 and existing interests.

**Section 6** 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,

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9 Siecap - Taranaki VTM Project Pre-Feasibility Study Offshore Iron Sands Project – March 2025b (Attachment 3).

remedy or mitigate potential effects on the environment, including a set of the proposed consent conditions for the project.

| | |
|---|---|
| **Section 7** | 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 8** | Sets out the relevant FTA and EEZ Act statutory framework against which the marine consent application has been made and assesses the project in relation to the provisions of the both the FTA and EEZ Act and other relevant legislation and marine management regimes. |
| **Section 9** | Sets out the relevant FTA and EEZ Act statutory framework and assesses the project against that framework, including other marine management regimes and Treaty of Waitangi obligations. |
| **Section 10** | Provides a concluding statement to this IA. |

# 2. PROJECT DESCRIPTION

## 2.1 PROJECT AREA

The project area in which the iron sand (with co product vanadium and titanium) recovery activities will take place encompasses an area of approximately 65.76km$^2$ within the STB (refer to Figure 1.1). The project area is located between 22 and 36km off the coast in the EEZ (i.e. outside of the 12Nm limit) and in waters that are between 20 and 50m 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 drilling campaigns, TTR has identified areas of higher-grade iron sand within the project area that extends to depths of 20 – 30m below the existing seabed level. The extent of the resource to be extracted is a maximum of 11m below the existing seabed level, with an average over the project area 5m. 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)) [10], which provides strict standards for public reporting.

Siecap (2025b) (refer to **Attachment 3**) reports a JORC Mineral Resource in the STB with a total combined Indicated and Inferred mineral resource of 3.2Bt (3,157Mt) @ 10.17% $Fe_2O_3$, 1.03% $TiO_2$ and 0.05% $V_2O_5$ at a 7.5% $Fe_2O_3$ cut-off grade. The extent of the resource is depicted in Figure 1.1 below.

Vanadium is present as a co-product in the resource and would be a substantial source of the metal, or its compound, from future processing. The 10.17% $Fe_2O_3$, 0.05% $V_2O_5$ and 1.03% $TiO_2$ contains 1.6Mt vanadium pentoxide ranking the deposit as one of the larger drilled vanadium deposits globally.

The mineral resource estimate for the Cook North and Cook South Blocks reports a combined Indicated and Inferred recoverable mineral resource of 1,188.6Mt @ 11.17% $Fe_2O_3$, 1.14% $TiO_2$ and 0.05% $V_2O_5$ generating 84.0Mt concentrate at a grade of 56.18% Fe, 8.36% $TiO_2$ and 0.51% $V_2O_5$ at a 3.5% DTR cut-off grade. 914Mt tonnes of this mineral resource is located within the Cook South block, which is the subject of the present application.

Siecap (2025a) [11] (refer to **Attachment 4**) notes that vanadium is critical mineral for construction, aerospace, and for renewable energy technologies, particularly vanadium redox flow batteries (VRFBs) used for large scale energy storage. Vanadium plays a critical role in decarbonisation and energy resilience and is identified by MBIE as a critical mineral in its Critical Minerals List for NZ [12]. Global demand for vanadium exceeds supply and the risk to the supply is elevated by global production being concentrated in counties with geopolitical concerns. In 2025, MBIE released the new Minerals Strategy for New Zealand [13] which is supported by the TTR's development of the vanadiferous titanomagnetite iron sand concentrate and securing a stable supply of vanadium. The Metallurgical Review report findings specify that the recovery rate for extracting vanadium from iron sands under

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10 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

11 Siecap - Metallurgical Review: Recovery of Vanadium from Taranaki VTM Project NZ - February 2025a (Attachment 4).

12 https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/minerals-and-petroleum/critical-minerals-list

13 New Zealand Ministry of Business, Innovation, and Employment (MBIE) (2025). A Minerals Strategy for New Zealand to 2040: ISBN (print): 978-1-991316-29-5.

laboratory conditions peaked at 79% with a sustainable sodium salt roasting-water leaching process.

## 2.3 PROJECT OVERVIEW

### 2.3.1 Introduction

This section, in accordance with the requirements of section 39(1)(a) of the EEZ, as well as schedule 10, clause 4 and section 43(1)(e)(ii) of the FTA, 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. The descriptions below are a summary of the detailed project information contained in Siecap (2025).

### 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**");

> Bulk Cape-sized Export Vessel ("**CEV**");

> Anchor Handling Vessel ("**AHV**");

> Refuelling Vessel;

> Geotechnical Support Vessel ("**GSV**"); and

> Environmental Monitoring Vessel ("**EMV**").

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 [14] 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

[14] 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.

available 8,760 hours per annum (i.e. 71% of the time). The down time is factored in due to the likelihood of severe sea states and harsh weather conditions.

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.

An IMV is provided in Figure 2.1 below.

**Figure 2.1: Integrated Mining Vessel (IMV)**

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 and Automatic Centralised Control Unmanned Systems, 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:

- IMO MSC/Circ.645: Guidelines for the design and operation of dynamically positioned Vessels;
- Common Structural Rules for tankers and bulk carriers;
- IMO Resolution A.468 (XII), 1981 Code on noise levels on board ships;
- ISO 6954 Guidelines for overall evaluation of vibration in merchant ships (1984);
- International Electrotechnical Commission (IEC), Publication no. 92 for electrical installations on-board ships;
- IEEE 45-2002 Recommended Practice for Electrical Installations on Board of Ships;
- Electromagnetic compatibility of electrical and electronic installations on ships, IEC 533;
- CAA – Rules and regulations for helicopter operation on UK sector (CAP 437) – latest edition;
- IMCA M 103 – Guidelines for the design and operation of dynamically positioned ships;
- IMCA M 404
- OCIMF for ship to ship transfer of fuel oil;
- American Petroleum Institute ("**API**"); and
- American Welding Society ("**AWS**").

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 submerged subsea sediment extraction device / seabed crawler ("**SBC**"), 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 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 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

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

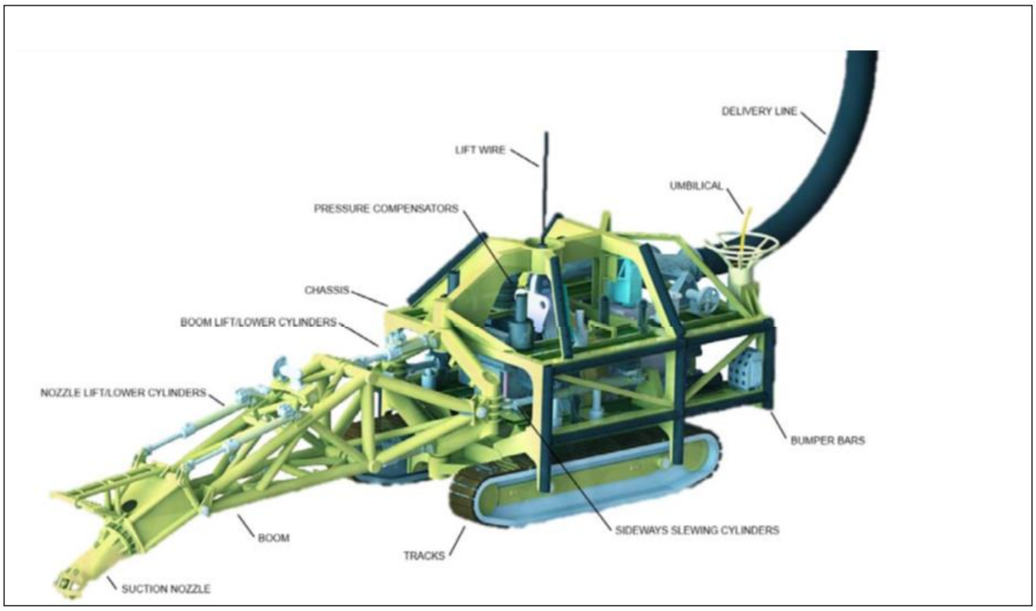


**Figure 2.2: Example of the SBC Configuration**

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

Each SBC weighs approximately 420 tonnes with a depth rating of 70 m. The SBCs 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 SBC will typically be 1.5 to 2 metres per second ("**m/s**"), with the velocity degrading rapidly as the distance increases from the nozzle. The intake velocity 1m from the nozzle is calculated to be a maximum of 0.5 m/s.

All hydraulic and lubricating fluid for the SBCs 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 SBC off the IMV and lower it into position on the seabed during the launch phase, as well as retrieving the SBC 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 4m 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 Floating Storage and Offloading vessel ("**FSO**") with a cargo capacity of 60,000 tonnes. The FSO vessel will be designed to be a Dynamic Positioning 2 (DP-2) [15] 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 site 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.

[15] 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.

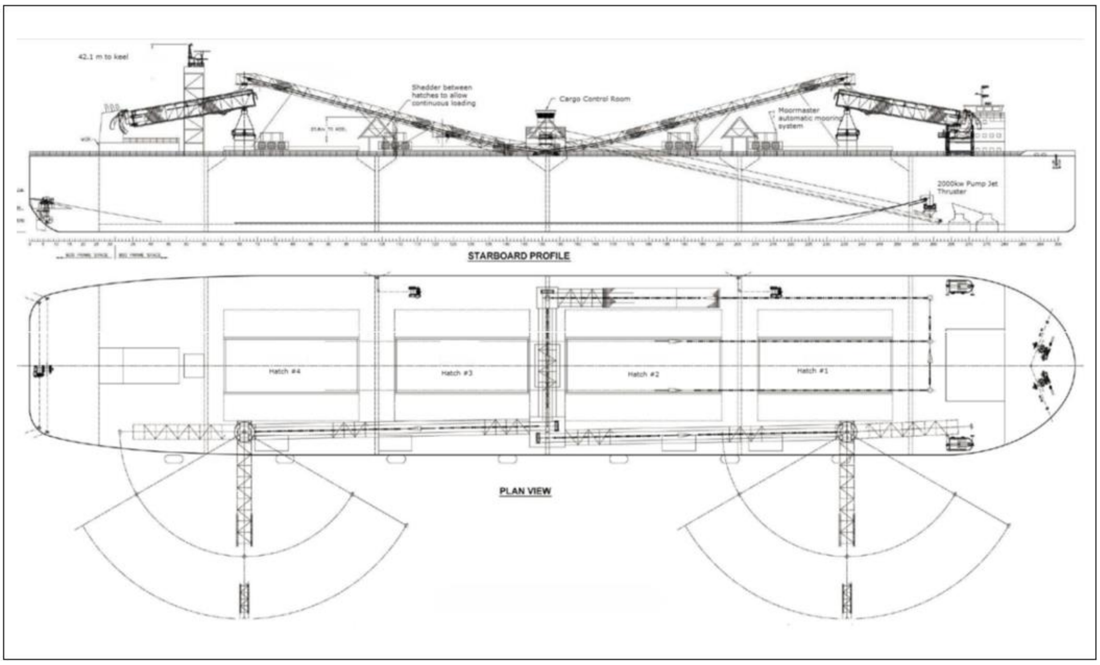


Figure 2.3: FSO vessel 60,000 Self-unloading Transhipment Shuttle Vessel – General Arrangement

### 2.3.2.4 Bulk Carrier Export Vessels

Bulk carrier export vessels ("**CEV**") 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 international markets.

### 2.3.2.5 Anchor Handling Vessel

The project includes provision for a full-time 80 tonne bollard pull anchor handling vessel ("**AHV**") to assist with the relocation and placement of the anchors and mooring lines for the IMV. The AHV 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 AHV will be collected and transferred onshore for disposal by approved operators.

#### 2.3.2.6 Geotechnical Support and Environmental Monitoring Vessels

The geotechnical support vessel ("**GSV**") and environmental monitoring vessel ("**EMV**") will be a multipurpose vessel that will be capable of undertaking grade control drilling and environmental monitoring activities within the STB, while based at Whanganui Port.

The GSV 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 11.4m in height with the base of 2.4m by 2.4m, 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 10.5m by 7m;

> 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 10m;
- The anchor spread is typically 150m (depending on metocean conditions) from the vessel with the anchors located by buoys;
- The anchors are typically 2 x 145 kg SARCA (S/H/H/P) galvanised anchors with two x 50 $m^2$" 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 subject to sea conditions.

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 1m vertical intervals to a maximum depth of 11m below the seabed.

Grade control drilling will be undertaken on average to a 100m 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 40 minutes.

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 driverless, 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 5.9 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 SBC. 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.

***Subsea Sediment Extraction***

The SBC's sediment extraction process will use seawater jets to mobilise the free flowing sediment in front of and adjacent to the SBC's extraction nozzle. This has been shown to create a free flowing slurry that is easily drawn into the SBC'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 11m below the surrounding seabed, and on average 5m below the surrounding seabed.

Each detailed extraction area or block is sized at approximately 300m x 300m. The IMV, and SBC, 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 SBC will turn 180° and continue adjacent to the previous pass.

Figure 2.7 below illustrates the subsea sediment extraction process outlined above.

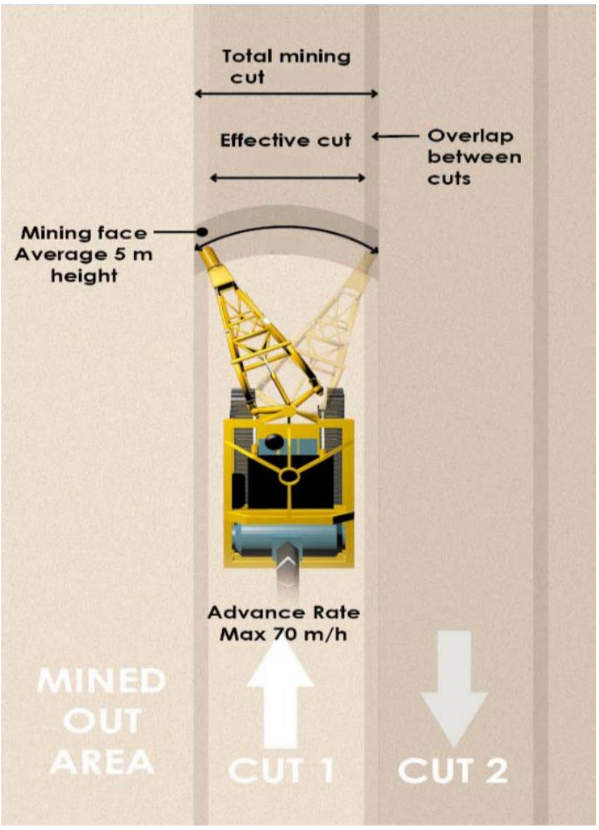


Figure 2.6: General Sediment Extraction Methodology

***SBC Positioning in Relation to the IMV***

Following the anchors being set and the SBC 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 SBC 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 [16]. 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:

> 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"

[16] ABS Classification Society, an International Association of Classification Societies (IACS) certified body.

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 SBC 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.

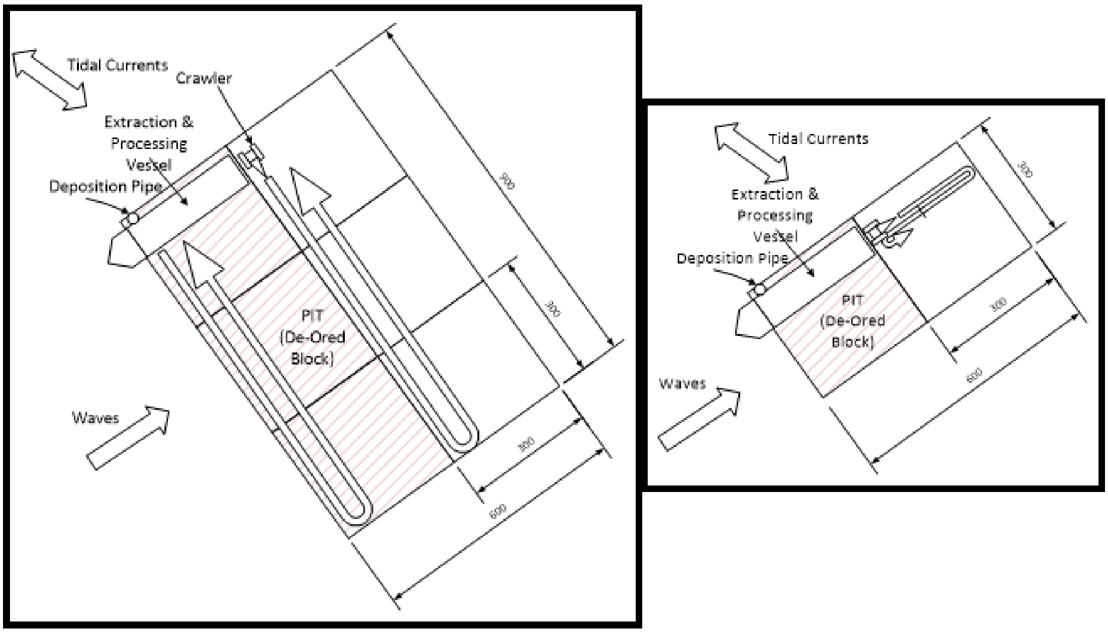


Figure 2.7: Sequence of Typical Extraction Operations

### 2.3.4 Processing Methodology

The project will involve the extraction of up to 50 Mt of seabed material per year. Around 10% of the extracted material will be processed into iron ore concentrate for export (i.e. up to 5Mt on a rolling 12-month average), with the remaining material (approximately 45 Mt) 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 to 57% iron content.

The process steps are summarised as follows:

> Screening: The process uses a vibrating screen effectively removing any +3.5mm 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 [17]: 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 45Mt (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 sequence represented in Figure 2.9 below.

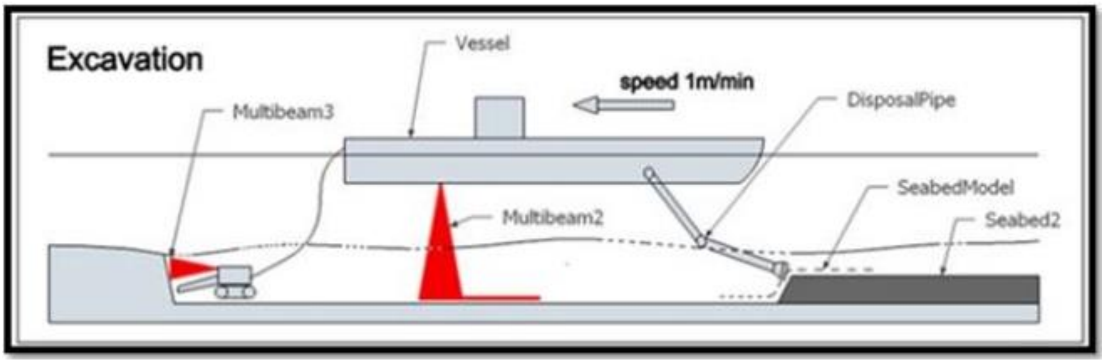


**Figure 2.8: Sequence of Extraction Operation**

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 seabed. Due to the variation of the water depth, seabed height and the vessel motion it will be required for

[17] **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.

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 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 110m 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.

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 1m 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 2km away from the IMV so that the vessels involved in the transfer process do not interfere with any operational movements of the IMV or the AHV in the active extraction block.

Subject to maritime safety requirements identified in Section 8.3.6.11, the transfer of iron ore concentrate is expected to take place in the STB in a location in the southwest 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.

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 FSO. 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 57m 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 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.

### 2.3.10 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.

## 2.4 CONSIDERATION OF ALTERNATIVES

### 2.4.1 Introduction

Section 39(1)(i) 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.

### 2.4.2 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 65.76km$^2$, TTR will only extract sediment from an average area of approximately 5km$^2$ per annum. As per the proposed conditions, TTR will be required to submit an operational assessment report prior to the commencement of extraction works, and annually thereafter, which outlines the area to be targeted for the following twelve months and includes bathymetry information, extraction plan schedules. In addition, both quarterly and annual reports in addition to an annual technical review of its operations and monitoring results.

### 2.4.3 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 12NMlimit, as close as 11km 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 12Nm limit.

### 2.4.4 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 SBC 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 SBC and re-deposition method enables de-ored sediments to be discharged at a nominal distance of 4m 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.

### 2.4.5 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.

# 3. ENVIRONMENTAL SETTING

## 3.1 INTRODUCTION

This section of the IA provides a summary of the current state of the project area and the natural environment surrounding the area. The information provided accords with the requirements of section 39(1)(b) of the EEZ, as well as schedule 10, clause 4 and section 43(1)(e)(ii) of the FTA.

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.

The research and assessment work is of varying age from 2012 to 2025. The less recent work was reviewed and updated where necessary to support TTR's 2016 application and the 2024 application. A further review of this information has been undertaken as part of the preparation of this application, to ensure the information is sufficiently up-to-date to be reliable and commensurate with the relevant effects, and to satisfy the statutory requirements in Section 8 to make decisions using the best available information. Notwithstanding, TTR's proposal provides for a suite of monitoring to occur prior to any excavation activities being undertaken and one of the purposes of this monitoring is to confirm the current understanding of the seasonality and natural variability of environmental parameters that will be monitored during seabed material extraction activities and to provide data to validate the background data. This process will ground-truth and validate the currently available information in advance of any extraction works commencing.

## 3.2 PHYSICAL ENVIRONMENT

### 3.2.1 Geological Setting

NIWA's Assessment of the geological conditions of the project area and STB [18] identifies the shore-connected Holocene sand prism that is up to 20m thick at the coast, and extends

[18] 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.

seaward to approximately 22 to 29km 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 to 3m of muddy sediment (at water depths of 50 to 100m), which becomes the dominant seabed and sub-seafloor material in water depths greater than 100m.

The assessment 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. The assessment 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.

### 3.2.2 Climate

NIWA's assessment of the climate and weather of the Taranaki Region [19] 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 36km offshore it will be highly exposed to winds from every direction. The Maui A platform, which is located 70km 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. A similar pattern can be expected within the project area given the lack of any land mass or other factors that may influence the passage of wind in the area.

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

Table 3.1: Mean Monthly and Annual Wind Speed (kph) for Maui A Platform [20]

| | 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 NIWA's assessment include the following:

> Sea surface temperature: averages 14 to 15ºC throughout the year;

> Air temperature: summer 15 to 22ºC, winter 8 to 12ºC;

> Rainfall: 140 days of rain per year, 1,100 to 1,200mm/year as measured at Hawera;

> Sunshine hours: 2,025 to 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.

Noting that the above statements are based on historic climate data, the pre-commencement monitoring programme (refer to Section 6.4 below) provides for a suite of monitoring to occur in prior to any excavation activities being undertaken and one of the purposes of this monitoring is to confirm the current understanding of the seasonality and natural variability of environmental parameters that will be monitored during seabed material extraction activities and to provide data to validate the background data.

### 3.2.3 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

[20] From all available data in 2014.

oceanographic measurements data [21] as well as a shoreline monitoring data [22] 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 2.5km of the coastline of the STB. An assessment of nearshore optical water quality was produced as a result of these surveys. [23]

The various assessments by NIWA are summarised below.

#### 3.2.3.1 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 50m contour to the coast, with the proportion explained by the tidal constituents ranging from 40% to 78%. Between 40 to 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 to 0.25m/s, with higher and lower speeds occurring on spring and neap tides respectively. The orientation of the tidal flow is in a northwest to southeast 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 1m/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 were from the west and southeast, with strong winds producing currents in a constant direction for more than 24 hours.

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[21] 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 2015a.

[22] 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 2015b.

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

Under calm conditions there is a prevailing current over the Pātea Shoals 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. During times of moderate to strong west to northwest winds, the prevailing southeast drift was considerably enhanced. 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 50m is a high-energy environment with significant wave heights in excess of 2m routinely experienced. Significant wave heights of up to 7.1m were measured during the seven-month instrument deployment as part of the 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.

***Suspended Sediment Concentrations***

Measurements taken around the project area and across the Pātea Shoals as part of the oceanographic studies by NIWA recorded typical maximum concentrations of suspended fine sediment near the sea surface of up to 25 milligrams per litre (“**mg/L**”), with higher peaks inshore after significant rainfall or following significant wave activity.

Offshore, near the 50m water depth, near-surface suspended fine sediment concentrations were typically less than 10mg/L with small peaks occurring during or just after periods of significant rainfall, which is indicative of river inputs of suspended-fine sediments.

Inshore suspended fine sediment concentrations of up to 1,900mg/L were recorded close to the seabed, mostly associated with high wave activity. Further offshore over the proposed mining area and in adjacent areas the seabed suspended fine sediment concentrations were typically less than 10mg/L, but were recorded up to 80mg/L. The highest concentrations were not always associated with rainfall events or wave activity, but could also be a result of advection from up current of the area.

During calm periods no coarse sands were recorded suspended in the water column. But the data demonstrated that periods of increased suspended sediment concentrations coincided with large wave events. It is estimated that sediment transport nearshore along this coast is up to 2.1 cubic metres (“**$m^3$**”) per meter width of seabed during large storm events.

At a monitoring site approximately 15km from shore to between the shoreline and boundary of the project area to 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. During this time the maximum sediment flux within the project area was 0.0519kg/s/m at the shoreward limit and 0.0002kg/s/m at the seaward limit.

#### 3.2.3.2 Nearshore Optical Water Quality

Acknowledging that this area is outside of the project footprint, to establish the existing nearshore (within 2.5km of the shore) optical water quality and, in turn, understand the wider existing environment, 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 10m 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 increasing water 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 some 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.[24] SKM identified that the assessments by NIWA were generally comprehensive owing to the extensive field investigation that had been undertaken.

[24] 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.

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. [25] There were no areas of disagreement, and no areas of uncertainty were identified beyond normal measurement error and natural variation.

### 3.2.4 Sediment Movement

An assessment of the nearshore (outside the project footprint and adjacent to the shoreline) and offshore (inclusive of the project footprint) sediment movement process occurring in the STB was undertaken by NIWA. [26] NIWA 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 to 50m 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 southeast 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 3.1** 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.

NIWA 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 per year (“**$m^3$/yr**”) in the northwest at Ohawe. This reduces south eastward along the coastline to approximately 2 million $m^3$/yr at Kai Iwi.

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

26 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.

#### 3.2.4.1 Shoreline Monitoring

An 11-month beach monitoring programme along the South Taranaki coastline was undertaken by NIWA[22] 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.

NIWA identified 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 over the reach of waves.

Given the limited storage, NIWA considers that a large fraction of the entire beach volume is being washed offshore and onshore on a regular basis.

#### 3.2.4.2 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 Pātea, Whenuakura, Waitotara and Whanganui Rivers. The total annual yield from the various rivers is approximately 2,930,600m$^3$/year (or 5,861,200 tonnes/year).

NIWA[26] 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 (km²) | 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 |
| Pātea | 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 |

#### 3.2.4.3 Existing Surface Suspended Sediment Concentrations

As part of the sediment plume modelling for the project, NIWA completed remote sensing to evaluate the background near-surface suspended sediment concentrations in the STB. The STB environment can be split into three sections inshore to offshore with the 5th, 50th (median) and 90th percentiles of near-surface suspended sediment concentrations compared between remote sensed and modelled data. Table 3.3 below identifies the modelled and remote sensed suspended sediment concentrations within three different sections of the STB.

**Table 3.3: Comparison of modelled and remote sensed existing near-surface 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 12Nm territorial limit |
|---|---|---|---|
| 5th | > Modelled to 2mg/L;<br>> Remote-sensed ~2mg/L (but highly variable) | > Modelled = 0.01mg/L;<br>> Remote-sensed ~0.1mg/L | > Modelled <0.001mg/L;<br>> Remote-sensed ~0.1mg/L |

| Suspended Sediments Concentration (percentile) | Near coast between Hawera and Whanganui | At the shoreward side of the project area | Beyond the 12Nm territorial limit |
|---|---|---|---|
| 50th (medium) | > Modelled = 10 to 15mg/L;<br>> Remote-sensed = 10 to 20mg/L | > Modelled = 0.3 to 0.4mg/L;<br>> Remote-sensed = 0.5mg/L | > Modelled ~0.001mg/L;<br>> Remote-sensed = 0.2 to 0.5mg/L |
| 90th | > Modelled = 40 to 60mg/L (100mg/L at Whanganui River mouth);<br>> Remote-sensed = 40 to 60mg/L. | > Modelled = 3mg/L;<br>> Remote-sensed ~3mg/L | > Modelled ~0.01mg/L;<br>> Remote-sensed ~1mg/L |

The purpose of this exercise was two-fold:

> To establish the existing near-surface 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 5.4 of this IA below.

### 3.2.5 Seabed Morphology and Sediments

The assessment of sediment transport by NIWA[26] includes an outline of the seabed morphology and sediments within the STB. It notes that the inner continental shelf, out to 50m depth, is approximately 30km wide off Hawera, widening to approximately 40km off Pātea, and then narrows immediately south to widths of approximately 20km wide at Whanganui.

The topography of the shelf off Pātea and Waitotara is characterised by banks, shoals and ridges. These features are generally large in size with some individual features offshore from Pātea being more than 20km long and 5 to 10m 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 30m 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 30m 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 to 12m 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 50m and have presumably been formed by strong oscillatory currents approaching 1m/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 3.1 below.

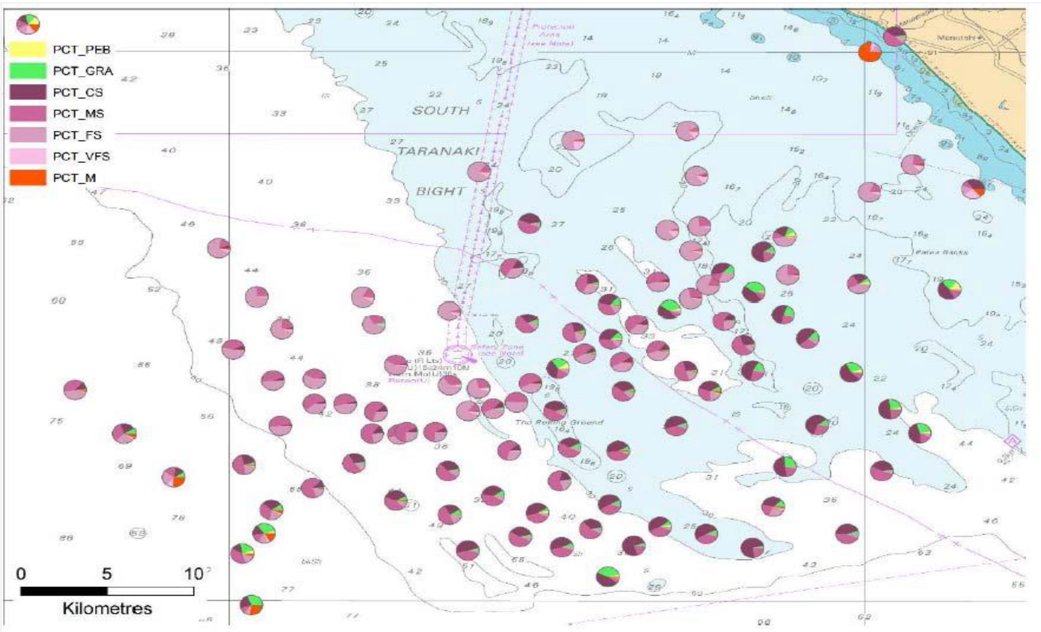


**Figure 3.1: Grain size of the sediments in the STB.**

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

### 3.2.6 Seabed Sediments Chemistry

TTR commissioned Auckland University of Technology ("**AUT**") to assess the potential for the project to displace, modify and suspend anoxic sediment, and make sediment bound contaminants available to biota. [27] To understand these potential effects, AUT investigated the following:

> Selected physical properties of the target sediment;

> The sediment content of acid volatile sulphides 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 20L of seawater at five sites within the project area, and sediment slurry and 20L of seawater at two further sites. AUT 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 sulphides. There was no evidence for an increase with depth below the seafloor in sediment organic matter and acid volatile sulphides 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 18m, 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.

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[27] 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: TTR 20138 October 2013

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.

### 3.2.7 Significant Natural Features, Landscapes and Seascapes

TTR commissioned Boffa Miskell (Boffa) to identify the natural features and landscapes/seascapes of the project area and the STB with potential to be affected by the project. [28]

#### 3.2.7.1 Significant Natural Features/Landscapes

Boffa[28] identified the following potentially relevant significant areas/site:

> Three areas that the Taranaki Regional Coastal Plan identifies as having amenity values of regional importance: Ohawe Beach, Waverley Beach and Waiinu Beach;

> Five areas/sites that the Taranaki Regional Coastal Plan identifies as being of outstanding coastal value: Whenuakura Estuary, North & South Traps, Waverley Beach, Waitotara and Waipipi Dunes.

#### 3.2.7.2 Seascape Character Types

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 sculpted 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.

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28 Boffa Miskell – Visual Effects Report and Graphic Supplement – November 2015

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

#### 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 Pātea River. The larger of the areas occurs at Waiinu Beach and extends north to the mouth of the Pātea River, with the smaller area being to the south along the foreshore of Castlecliff (refer to **Appendix 3.2**).

#### Fossil Sea Cliffs

This relatively small area extends for approximately 1.5km 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 3.3**).

#### 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 Pātea 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 3.4**).

### 3.2.7.3 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 3.5**.

### 3.2.7.4 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 5km 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.

## 3.3 ECOLOGY

### 3.3.1 Benthic Ecosystems

#### 3.3.1.1 Nearshore Epibenthos / Shallow Infauna

An assessment of the benthic habitats, macrobenthos and surficial sediments of the nearshore environment was undertaken by NIWA. [29]

Sampling of 36 seabed sites was undertaken using underwater video and still images, followed by the collection of representative grab samples and benthic dredge collections for sediment and microbenthic surficial samples. Figure 3.2 shows the 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 within the proposed project area (PPA). Sites 1-26 are nearshore sites (main figure), Sites CS1-CS10 are cross-shelf transect sites (insert) in Figure 3.2 below.

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[29] 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.

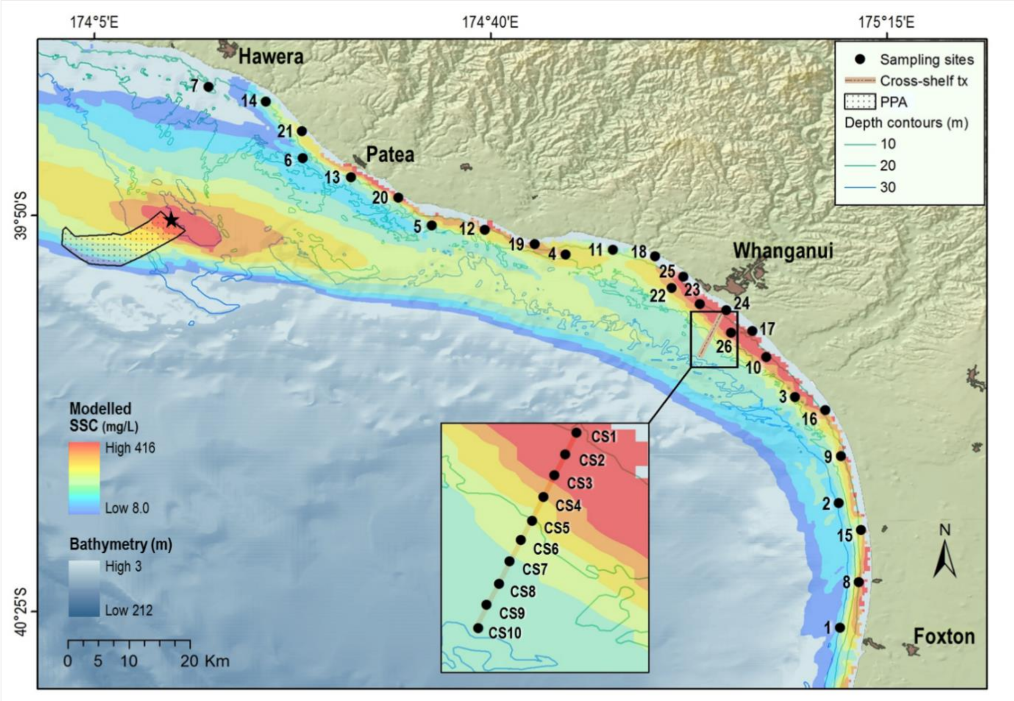


**Figure 3.2: Location of sampling sites along the south Taranaki coastline**

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 to 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 3.3 below.

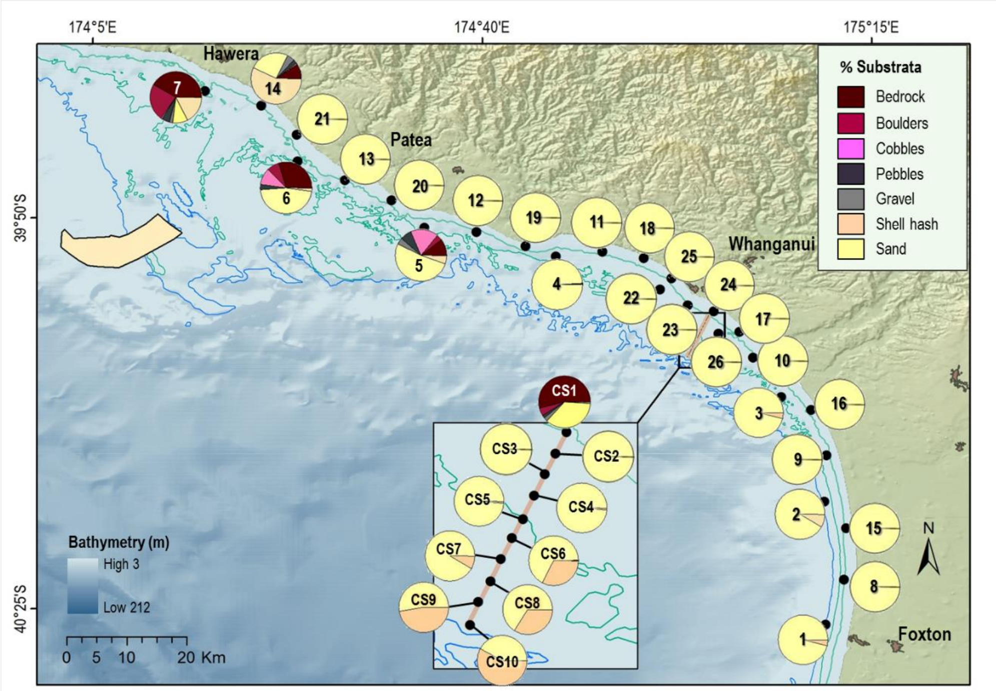


Figure 3.3: **Seabed substratum types at nearshore (1-26) and cross-shelf transect (CS1-CS10) sites within the STB.**

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

### 3.3.1.2 Offshore Benthic Ecology

The Pātea Shoals is an area of seabed located between 25 and 40km off the coast of Taranaki in water depths of between 25 and 45m which includes the project area, as generally shown in Figure 3.4 NIWA conducted a survey on the benthic (seabed) fauna in this area [30].

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

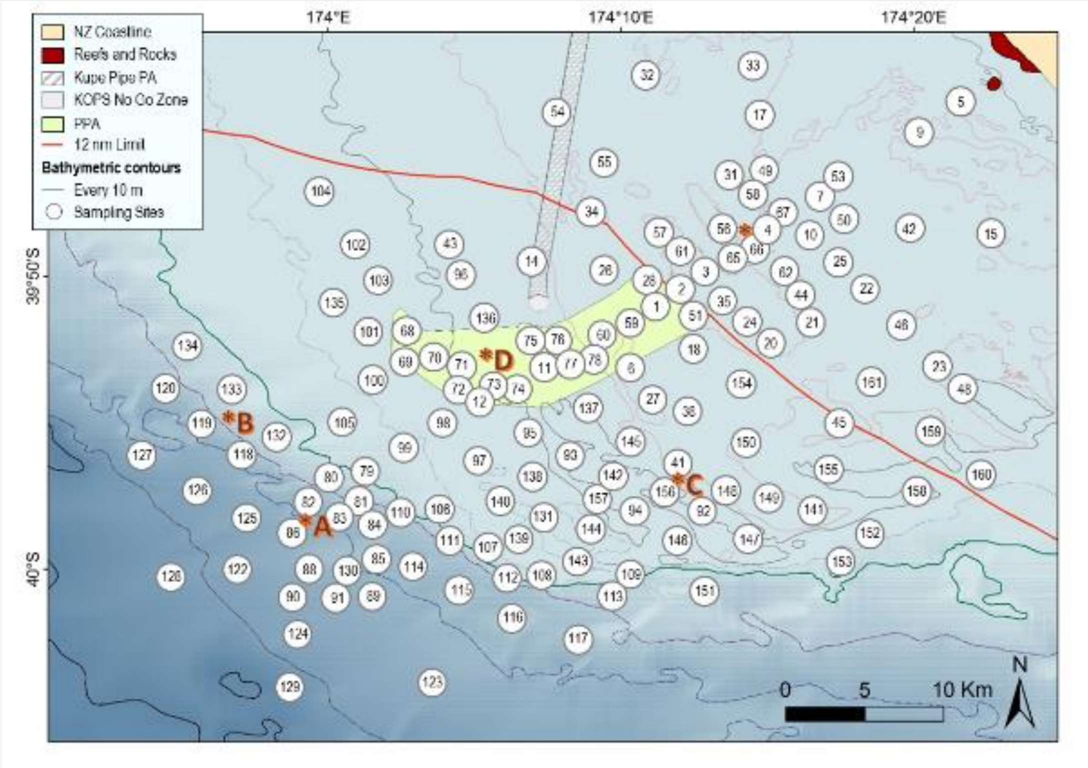


**Figure 3.4: Location of sampling sites across Pātea Shoals within the STB [31].**

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.

NIWA[30] identified seven seabed habitat types in the region sampled, with the seabed in the PPA typically consisting of sand waves and worm communities (i.e. wormfields). The wormfields were dominated by one species, *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, while small scattered rocky outcrops on the inner shelf had diverse macrobenthic

[31] PPA = Proposed Project Area; Kupe Pipe PA = Kupe Pipe protected area; KOPS no go zone = Kupe Oil Platform Safety no go zone. Depth contours are in 10ters em intervals. *A-*C indicate the areas initially considered by TTR for deposition of de-ored sediments before rejecting these options, *D indicates TTR's proposed extraction/deposition area/PPA. '*' Indicates the inner shelf area prior to contraction of the PPA to the area shown.

assemblages. More recently, NIWA [32] identified further areas of rocky reef in this same general area, and it is highly likely that other areas of rocky reef occur in this area inshore of the PPA and may be known to the local fishing and diving community but remain to be formally mapped. However, at this stage there is no indication that rocky reefs occur on the Pātea Shoals seaward of the Territorial Sea Boundary.

Deeper reefs offshore were characterised by two habitat types:

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

> The bryozoan rubble habitat growing on shell debris at depths of greater than 60 m.

Both these deeper habitats support diverse assemblages dominated by sessile suspension-feeding taxa (e.g. bryozoans, sponges, ascidians, brachiopods and epiphytic bivalves) and motile taxa such as crabs and gastropods.

[32] Morrison et al. (2022). Offshore subtidal rocky reef habitats on Pātea Bank, South Taranaki. NIWA Client Report 2022229AK, 211 p. see Policy-and-Planning-February-2023-web-version-v2.pdf (trc.govt.nz)

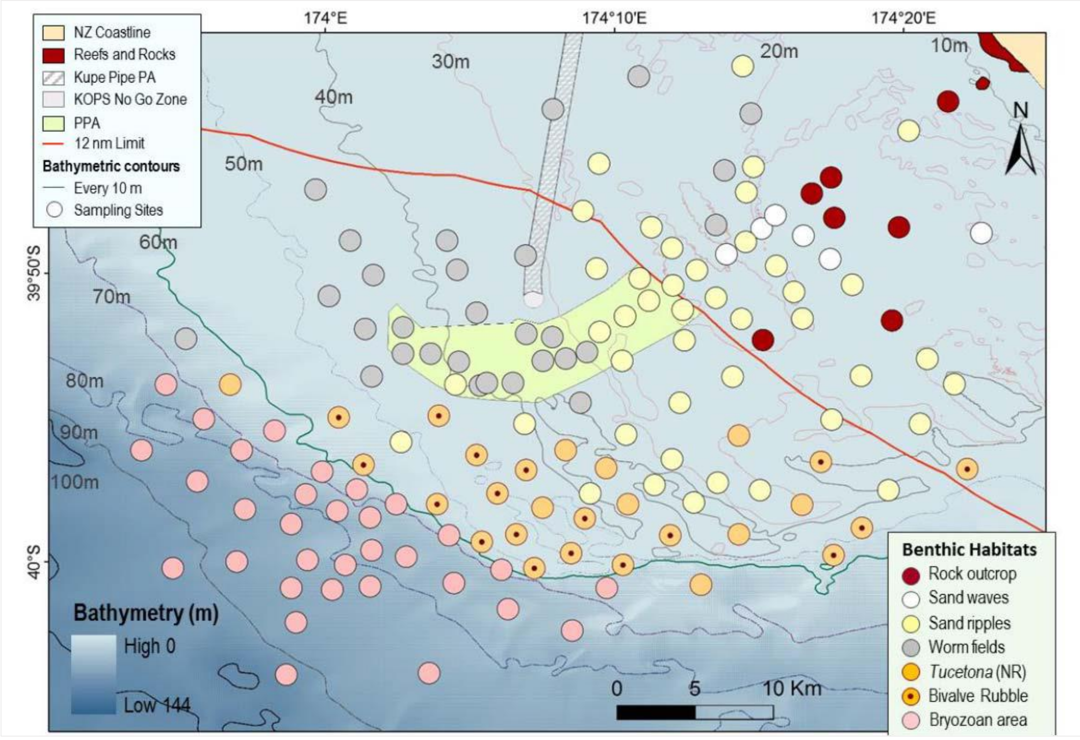


**Figure 3.5: Seabed habitat types observed at each site within the Pātea Shoals area of the STB.**

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. NIWA[30] 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 coralline 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.

Recent models of the predicted probability of occurrence in the STB are available for 17 mainly reef or shell hash associated benthic invertebrate genera including 9 corals, 2 sponges, 3 bryozoans, 2 lamp shells, and 1 bivalve, which include one or more species of habitat forming/sensitive environment species (Lundquist et al. 2020) [33]. In part these models use the information previously collected by NIWA during benthic surveys undertaken for TTR and while useful for predicting the occurrence of these genera outside the areas sampled do not change the general descriptions presented above.

#### 3.3.1.3 Polychaete Worm Communities

NIWA[30] identified 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 Pātea 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 3.6).

[33] Lundquist, C., Stephenson, F., McCartain, L., Watson, S., Brough, T., Nelson, W., Neill, K., Anderson, T., Anderson, O., Bulmer, R., Gee, E., Pinkerton, M., Rowden, A., Thompson, D. (2020) Evaluating Key Ecological Areas datasets for the New Zealand Marine Environment. NIWA Client Report 2020109HN. Prepared for the Department of Conservation, 138 p. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-protected-areas/mpa-publications/evaluating-kea-datasets-2020.pdf

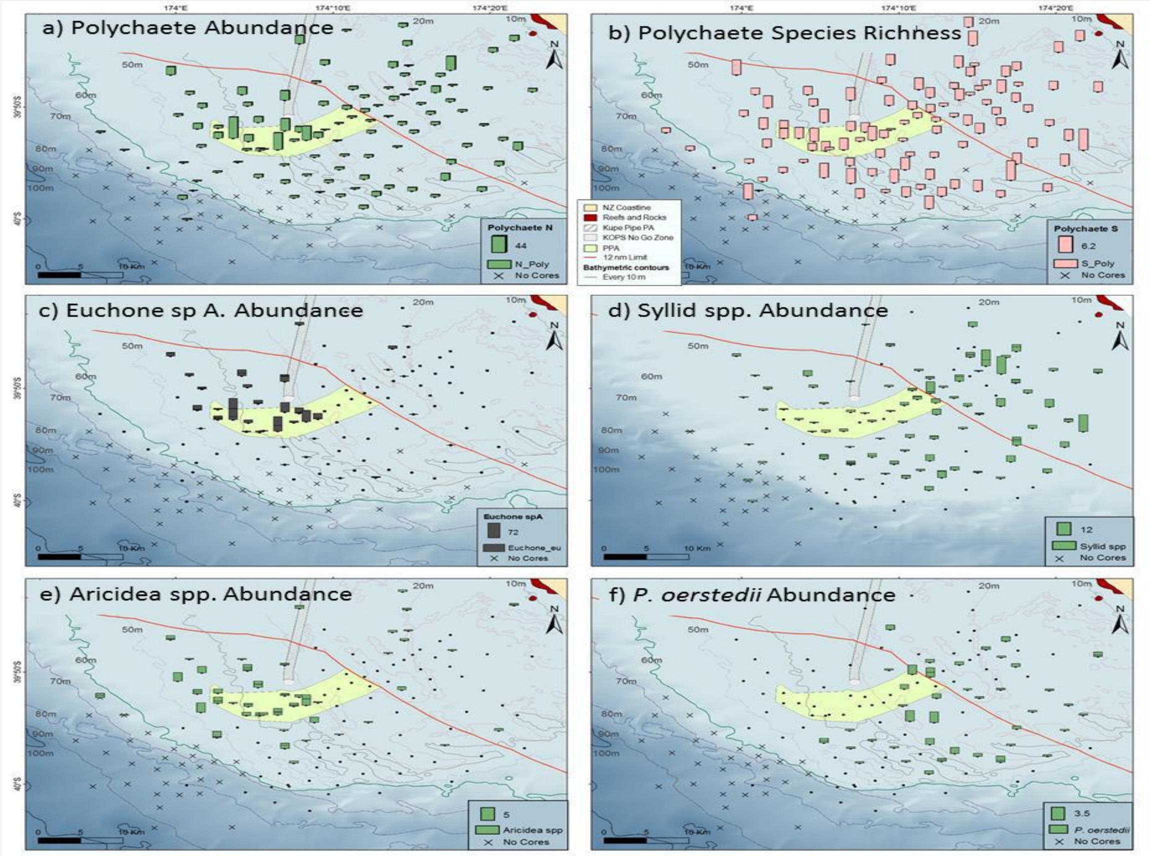


Figure 3.6: **Spatial distribution of polychaete worms per site sampled from the top 0-5 cm section of sediment [34].**

### 3.3.2 Primary Productivity

#### 3.3.2.1 Phytoplankton

TTR commissioned NIWA to undertake baseline assessments of the STB [35] [36]. These studies identify 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

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[34] 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 per 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.

[35] 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.

[36] Pinkerton, M., Schwarz, J., Gall, M., Beaumont, J. (2013). Satellite ocean-colour remote sensing of the South Taranaki Bight from 2002 to 2012. NIWA Client Report No: WLG2013-14 Rev 1, 74 p.

Kahurangi Shoals and the rivers that discharge into the STB. It is important to note that NIWA[35] concludes that nutrients are the main limitation on primary production rather than light availability based on observed nutrient levels, phytoplankton biomass and primary production.

NIWA used locally-tuned algorithms and 10 years of satellite observations 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, NIWA[35&36] 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 micrograms per litre (“**µg/l**”)) as a result of river runoff and decreased to an annual median of 0.2 µg/l offshore (greater than 10km 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 of deep nutrient rich waters over the Kahurangi Shoals off the coast of northwest South Island and possibly, at times, in Cook Strait that are then advected into the STB from the southwest or the southeast respectively. In some cases these blooms can exceed 4 µg/l.

NIWA[35] 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.

No significant long-term trends in chlorophyll *a* concentrations were observed from the ten years of remote sensed data.

#### 3.3.2.2 Microphytobenthos

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 Pātea Shoals, NIWA[30] 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.

#### 3.3.2.3 Macroalgae

Macroalgae (brown, green and red algae) typically occur on rocky outcrops which were found at five of the 36 inshore STB sites (14%) sampled by NIWA[29]and were detected at seven of the 144 Pātea Shoals sites (5%, all within the Territorial Sea) visually surveyed using video transects by NIWA[30]. Within these seven transects hard substrata made up only 3.8%

of the area sampled indicating the rarity of rocky reef habitat and associated macroalgal communities on the Pātea Banks.

#### 3.3.2.4 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 the primary producers and fish and marine mammals.

As identified by NIWA [37], 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.

NIWA [38] 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.

NIWA[38] 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

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[37] 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 2015a.

[38] 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.

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 gelatinous filter feeding salpszooplankton species salps, are likely typically 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 zooplankton assemblages in very shallow nearshore waters (mean depth of 8 m)) where orbital velocities are very high.

While acknowledging that the assessment by NIWA[38] represents a snapshot 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 Pātea 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.

### 3.3.3 Fish Species

The following section contains a summary of the distribution of fish species as they relate to the project area. This information is based on an assessment of the fish species in the STB undertaken by NIWA [39] and the more recent publication by Lundquist et al. (2020) [40], produced as part of the KEA modelling project undertaken by NIWA for the Department of Conservation and publicly available.

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39 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 2015b.

40 Lundquist, C., Stephenson, F., McCartain, L., Watson, S., Brough, T., Nelson, W., Neill, K., Anderson, T., Anderson, O., Bulmer, R., Gee, E., Pinkerton, M., Rowden, A., Thompson, D. (2020) Evaluating Key Ecological Areas datasets for the New Zealand Marine Environment. NIWA Client Report 2020109HN. Prepared for the Department of Conservation. https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-protected-areas/mpa-publications/evaluating-kea-datasets-2020.pdf

### 3.3.3.1 Marine Fish

#### Introduction

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

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.

#### Reef Fish

In 2020, NIWA used ensemble predictions from boosted regression tree and random forest species distribution models to describe the predicted probability of occurrence of 51 species of reef fish throughout New Zealand on a 250 $m^2$ grid, updating the work of NIWA in 2013[41]. In 2013, NIWA modelled reef fish distribution around New Zealand, based on diver surveys conducted nationwide, together with a set of environmental and geographical predictors. Rare and/or cryptic species, for which little or no count data were available, were not included. The predicted distributions of reef fishes were produced by applying boosted regression trees to the diver surveys of fish abundance, using environmental and geographic variables as predictors. The predicted distribution probabilities (which range from 0 to 1) for the 51 reef fish taxa were combined (summed) to produce estimates of reef fish species richness in the STB (Figure 3.7).

[41] Smith, A.N., Duffy, C., Anthony, J., Leathwick, J.R. (2013) Predicting the distribution and relative abundance of fishes on shallow subtidal reefs around New Zealand. Department of Conservation, Wellington. https://www.doc.govt.nz/documents/science-and-technical/sfc323entire.pdf

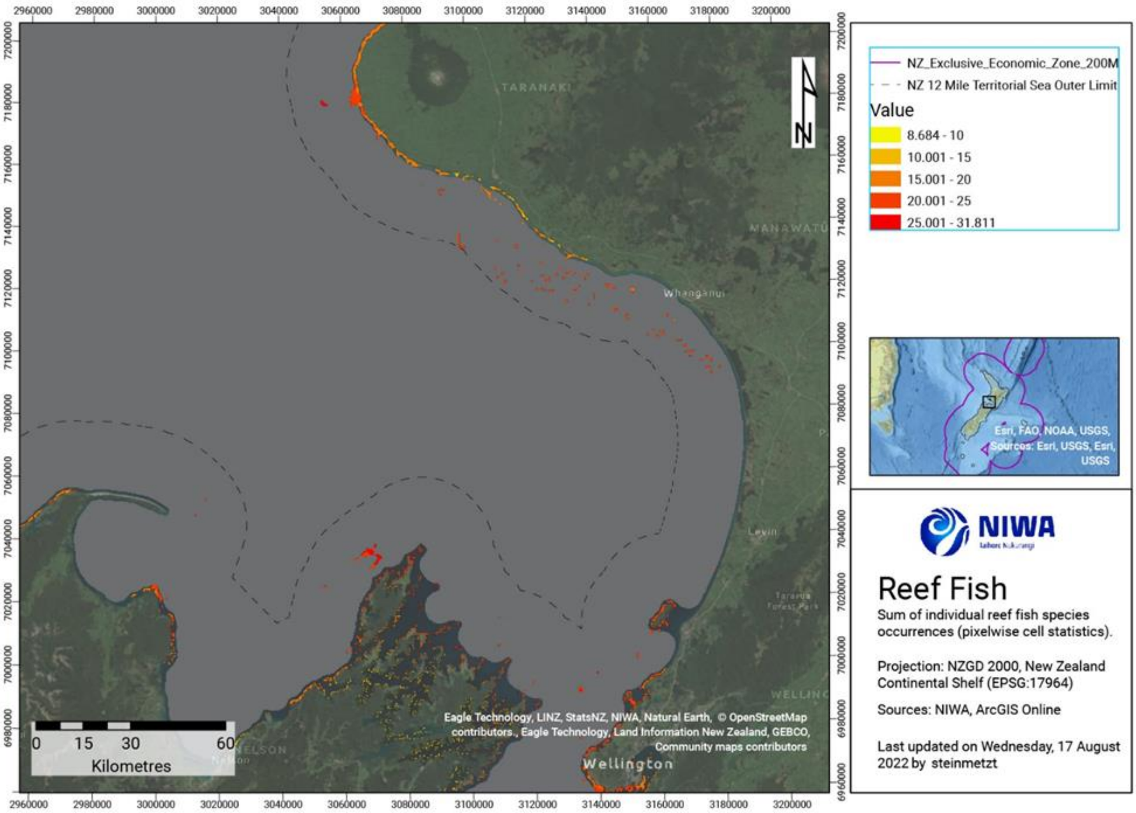


**Figure 3.7: Predicted reef fish species richness in the STB, based on species distribution models for 51 reef fish taxa from Lundquist et al. (2020).**

The inshore reefs along the Taranaki coastline support relatively modest reef fish diversity (typically 8-10 species of the 51 species modelled), whereas reefs further offshore support a more diverse reef fish assemblage (typically 20+ species).

NIWA[39] found reef fish species that are particularly common on reefs in the STB include butterfly perch *Caesioperca lepidoptera*, banded wrasse *Notolabrus fucicola*, sweep *Scorpis lineolatus*, several species of triplefins *Forsterygion*, *Notoclinops*, *Obliquichthys* and *Ruanoho* spp., scarlet wrasse *Pseudolabrus miles*, red moki *Cheilodactylus spectabilis*, Parore *Girella tricuspidata* and butterfish *Odax pullus*.

The distribution of reef fish in the STB was predicted based on models developed from comprehensive dive surveys and habitat information. NIWA[39] 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 NIWA. [42]

[42] 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.

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).

#### Demersal and Pelagic Fish

NIWA in 2020, using methods outlined above for reef fish, explored demersal fish distributions throughout New Zealand's EEZ. Distributions were produced for 239 demersal fish taxa, based on fish species occurrence records (n = 391198) from 1979 to 2016, which were extracted from the research trawl database 'TRAWL'. The data were groomed to only keep those records identified to species level, collected using bottom trawls and within the New Zealand EEZ.

The predicted distribution probabilities (which range from 0 to 1) for 239 fish taxa produced by NIWA in 2020 were combined (summed) to produce estimates of demersal fish species richness in the STB on a 1km$^2$ grid (Figure 3.8).

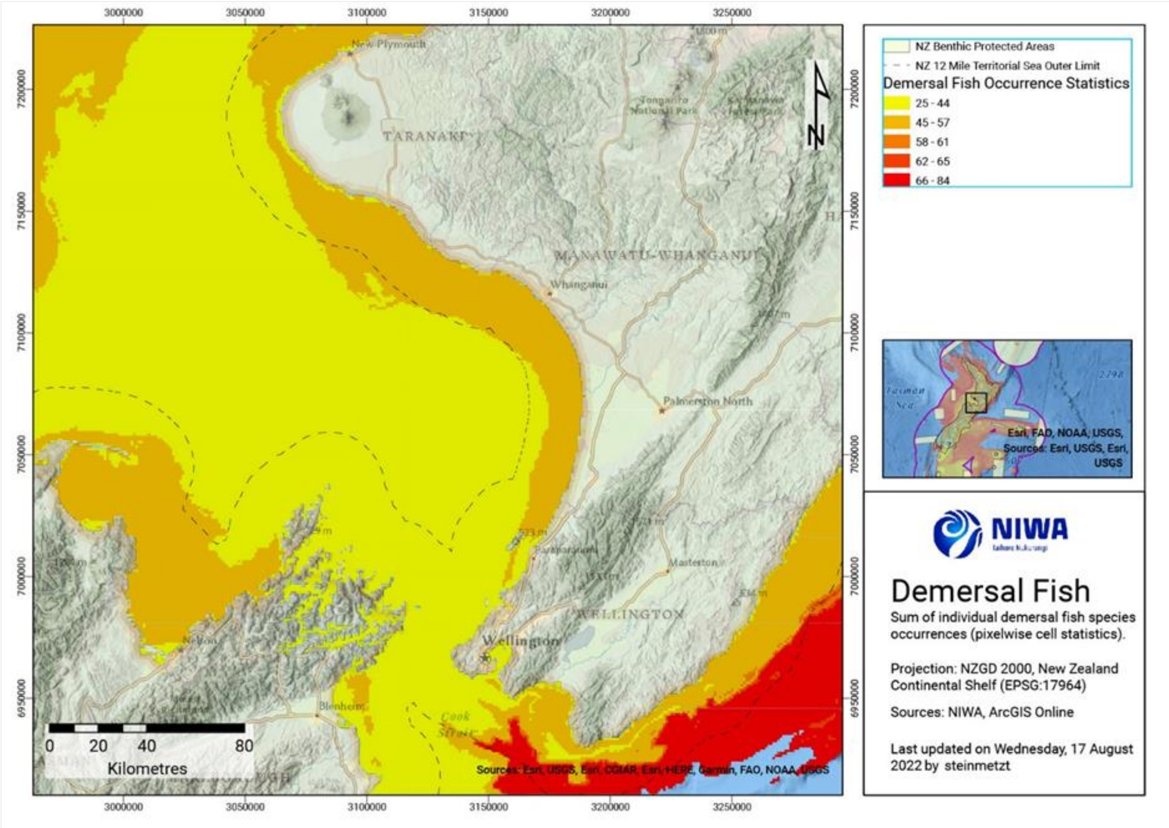


**Figure 3.8: Predicted demersal fish species richness in the STB based on species distribution models for 239 demersal fish taxa. KEA modelled data, Lundquist et al. (2020).**

The majority of the STB supports a relatively modest number of demersal fish species (25-44 species, of the 239 species modelled, for nearly all of the STB beyond the 12NMlimit), but species richness increases shoreward, with the Pātea Shoals supporting 45-57 species (Figure 3.8). Overall, the demersal fish species richness in the STB 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. 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. Other species present within the project area include barracoota, carpet shark, John Dory, kahawai, red cod, school shark, spiny dogfish, tarakihi, common warehou, and witch. None of these species are recognised or listed as being endangered or threatened.

#### Spawning and Juvenile Fish - General

NIWA[39] 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.

NIWA[39] 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.

Other reports reviewed by NIWA[39] show low abundances of juveniles of the following species were present within the STB: arrow squid, barracoota, blue warehou, 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.

### 3.3.3.2 Crayfish

Red crayfish (also known as kōura and red rock lobster (*Jasus edwardsii*) 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 sex, size and maturity and typically ranges from a few metres to a few kilometres. It has been identified that crayfish have a 'home reef' that they will return to throughout their lifetime.

Immediately after mating and moulting in late autumn and early summer respectively, male crayfish may migrate 1-2km offshore across sand flats to feed off shellfish, and egg-brooding female may make for temporary 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 on rocky reefs throughout the STB as this is their typical habitat.

#### 3.3.3.3 Freshwater Migratory (Diadromous) Fish

New Zealand has 35 species of freshwater fish, most of which are endemic and almost half are diadromous to 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 diadromous species found in the project area and the STB is provided below.

**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.

**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 to 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.

**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.

### 3.3.4 Marine Mammals

#### 3.3.4.1 Information sources

There has been a significant amount of research, scientific reports and publications relating to marine mammals within the South Taranaki Bite (STB) region, including within the project area, over the last 10+ years. Specifically, there has been more than 50 new scientific papers and reports produced about marine mammals within the region since 2017 (Childerhouse (2023)) [43]. These data have considerably expanded our knowledge and understanding of marine mammals within the region. A complete list of reports and publications that were considered during the development of this IA is provided in the supplementary technical package. These data sources have been supplemented by additional sources including online library search systems, general online search platforms, reviews of published and unpublished literature including grey literature and the consideration of expert opinion. Overall, the IA has drawn on all of these available data sources in developing a summary of the existing environment for marine mammals.

A summary of key data sources with particular relevance to marine mammals within the STB region include:

> NIWA[37] [39] provided a detailed assessment of the STB environment with details on marine mammals within the region and including assessments of potential ecological impacts of the proposed consent activity;

[43] Childerhouse S (2023) Expert evidence of Dr Simon John Childerhouse on behalf of Trans Tasman Resources Limited. 19 May 2023.

> Martin Cawthorn Associates [44] reported on dedicated marine mammal aerial surveys every 2-3 months for over two years which covered more than 8,400km of transects of the project area and surroundings. The surveys only recorded one sighting of common dolphins and 4 sightings of New Zealand fur seals within the proposed survey area;

> NIWA [45] used sighting and survey data to model habitat suitability for blue whales, southern right whales and Hector's dolphins. The research concluded that the proposed project area in the STB appears to be of low suitability for all three species of threatened cetaceans. While the modelling approach has some limitations (e.g. use of primarily non-systematic survey data and observer effort bias), the general conclusions are consistent with our understanding of the ecology of these three species.

> NIWA[45] concluded that habitat suitability for Hector's dolphins (as a surrogate for Maui dolphins) in the proposed project area was low but that coastal areas inshore of the proposed project area were predicted to have greater suitability as habitat for Hector's dolphins - although this does not mean that dolphins will necessarily be found there. Currey et al. (2012) found that Maui dolphin density was less than 0.0005 Maui dolphin per square nautical mile inshore of the project area.

> Derville et al. [46] described the nearshore distribution of Maui dolphin and their relationship with environmental features. It also provides new information about the relative habitat suitability of the west coast North Island for Maui dolphins, including the project area.

> Stephenson et al. [47] [48] developed species occurrence and diversity hotspot models for species of Cetacea to predict spatial distributions and identify hotspots based on available sighting records. Models for rarely sighted species showed reasonable fits to available sightings and showed high predictive power for commonly sighted species. Cetacean distribution patterns varied from highly localised, nearshore (e.g., Hector's dolphin), to more ubiquitous (e.g., common dolphin) to primarily offshore species (e.g.,

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

45 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.

46 Derville S et al. (2016) Environmental Correlates of Nearshore Habitat Distribution by the Critically Endangered Māui Dolphin. Marine Ecology Progress Series 551: 261–75.

47 Stephenson F et al. (2020a) Spatial distribution modelling of New Zealand cetacean species. New Zealand Aquatic Environment and Biodiversity Report No. 240. May 2020.

48 Stephenson F et al. (2020b) Modelling the Spatial Distribution of Cetaceans in New Zealand Waters. Diversity & Distributions 26(4): 495–516, https://doi.org/10.1111/ddi.13035.

blue whale). The STB was identified as an important area both for species richness (i.e., the number of different species that occur in an area) and spatial prioritisation (i.e., a method for assessing the representativeness of species in an area) when the high levels of uncertainty were included in the assessment. A selection of predicted probability occurrence maps for various species are included in **Appendix 3.6**.

> Stephenson et al.[48] predicted the following probability of occurrence for species within the project area including (i) very low probability for Hector's and Māui dolphins; (ii) a low-moderate probability for blue whales; and (iii) a high probability for common dolphins.

> MacKenzie et al. [49] provides an updated spatially explicit fisheries risk assessment for most New Zealand marine mammal populations. While the focus of the paper is fishing impacts, there is some useful information about the spatial distribution of marine mammals in the STB.

> Childerhouse [50] provided an updated assessment of marine mammals within the STB and project area for the TTR consent application in 2013 with additional marine mammal assessments provided for both the 2016 and 2024 consent applications. A full list of relevant material has been provided in the supplementary technical package to this Impact Assessment.

#### 3.3.4.2 Marine mammal species and status

The most comprehensive data set available for marine mammal information within the STB region is the Department of Conservation's ("**DOC**") Marine Mammal Sighting, Stranding and Incident database [51]. This database represents the best available data for marine mammals within the region. Summaries of these data and other data are provided in the following Tables, Figures and Appendices:

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49 MacKenzie DI, Fletcher D, Meyer S, Pavanato H (2022) Updated spatially explicit fisheries risk assessment for New Zealand marine mammal populations. New Zealand Aquatic Environment and Biodiversity Report No. 290. 218 p. McConnell HM (2022) Statement of Evidence of Helen Maree

50 Childerhouse S (2023) Expert evidence of Dr Simon John Childerhouse on behalf of Trans Tasman Resources Limited, para 16. 19 May 2023.

51 Department of Conservation (DOC) (2023) Data extract from DOC marine mammal sighting and stranding databases including: (i) Māui and Hector's dolphin database incidents; (ii) Māui and Hector's dolphin database sightings; (iii) NZ marine mammal dataset incidents; and (iv) NZ marine mammal database sightings. Extracted on 1 May 2023. Data available from Department of Conservation.

> Table 3.4 provides a summary of all the available marine mammal records from the STB region held in the database up to April 2023 and also includes a summary of the status of each species under the NZ Threat Classification System and the IUCN system;

> Table 3.5 provides a summary of marine mammal records for the project area held in the database up to April 2023, including 10km and 20km buffers around it;

> Figure 3.9 shows the locations of marine mammal records in the STB region from the DOC Marine Mammal Database to April 2023;

> Appendix 3.6 shows the locations of all records in the STB region presented on a species-by-species basis for the 20 species that had the most records;

> **Appendix 3.7** shows maps of the predicted probability occurrence (i.e. spatial distribution) of various species of marine mammals in the New Zealand EEZ including for the STB region;

> Figure 3.10 shows the mean probability of blue whale presence within the STB as predicted by the BRT whale model reported in Barlow & Torres [52];

> Figure 3.11 shows the temporal occurrence pattern of blue whale song detections within the STB region reported in Barlow et al. [53]; and

> Figure 3.12 shows the annual cycle of blue whale calling activity as detected from acoustic monitoring moorings within the STB region reported in Barlow et al. [54]

While the data available in the DOC Marine Mammal database represent the best available data, this data set has some potential limitations, including that these records are primarily collected in a non-systematic manner, are not necessarily representative of marine mammal diversity within either the project area or the wider STB region, and species identifications are generally not confirmed by experts. These potential limitations must be taken into account when interpreting these data. Notwithstanding these potential limitations, these data sets represent the best available sighting, stranding and incident data for marine mammals within the region.

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[52] Barlow DR, Torres LG (2021) Planning Ahead: Dynamic Models Forecast Blue Whale Distribution with Applications for Spatial Management. The Journal of Applied Ecology 58(11): 2493–504. https://doi.org/10.1111/1365-2664.13992.

[53] Barlow DR et al. (2023a) Temporal Occurrence of Three Blue Whale Populations in New Zealand Waters from Passive Acoustic Monitoring. Journal of Mammalogy 104(1): 29–38. https://doi.org/10.1093/jmammal/gyac106.

[54] Barlow DR et al. (2023b) Environmental Conditions and Marine Heatwaves Influence Blue Whale Foraging and Reproductive Effort. Ecology and Evolution 13(2):e9770. https://doi.org/10.1002/ece3.9770.

Overall, these data sets, scientific reports and publications and the provided Tables, Figures and Appendices provide a wealth of robust data upon which to assess the distribution, abundance and behaviour of marine mammals within the STB and the project area. The following sections provide individual summaries for some of the key species found within the STB region.

**Table 3.4 Assessment of marine mammal sighting, stranding and incident data for the STB region from the DOC Marine Mammal Database to April 2023 including threat status [55]**

| Species | No. of records | Threat status – NZTCS 2019 | Threat status – IUCN |
|---|---|---|---|
| Andrews' beaked whale | 3 | Data deficient | Data deficient |
| Antarctic minke whale | 6 | Data deficient | Not threatened |
| Arnoux's beaked whale | 22 | Data deficient | Least concern |
| *Baleen whale* | 61 | - | - |
| *Beaked whale* | 15 | - | - |
| Blainville's beaked whale | 3 | Data deficient | Least concern |
| Blue whale | 158 | Data deficient (Pygmy blue & Antarctic blue) | Endangered |
| Bottlenose dolphin | 62 | Threatened - Nationally endangered | Least concern |
| Bryde's whale | 6 | Threatened - Nationally critical | Least concern |
| Common dolphin | 406 | Not threatened | Least concern |
| Crabeater seal | 3 | Non-Resident - Vagrant | Least concern |
| Cuvier's beaked whale | 36 | Data deficient | Least concern |
| *Dolphin* | 24 | - | - |

55 Number of marine mammal sightings and incidents in the Taranaki region of interest up to 27 April 2023. When the species identification was unknown, but the record confirmed what group the animal(s) were, this was counted under the species groupings in italics. Data source: DOC marine mammal sighting and incident database (downloaded on 30 April 2023); Additional blue whale sightings provided by Dr. L. Torres in 2017).

| Species | No. of records | Threat status – NZTCS 2019 | Threat status – IUCN |
|---|---|---|---|
| Dusky dolphin | 127 | Not threatened | Least concern |
| False killer whale | 8 | At Risk - Naturally uncommon | Not threatened |
| Fin whale | 9 | Data deficient | Vulnerable |
| Gray's beaked whale | 55 | Not threatened | Least concern |
| Hector's and Maui dolphins | 686 | Threatened - Nationally vulnerable (Hectors); Threatened - National critical (Maui) | Endangered (Hector's); Critically endangered (Maui) |
| Hector's beaked whale | 3 | Data deficient | Data deficient |
| Humpback whale | 165 | Non-Resident Native - migrant | Endangered (Oceania sub-population) |
| Leopard seal | 31 | At Risk - Naturally uncommon | Least concern |
| Long-finned pilot whale | 112 | Not threatened | Least concern |
| Minke whale | 21 | Data deficient (Antarctic minke & Dwarf minke) | Least concern (Common minke); Near Threatened (Antarctic minke) |
| New Zealand fur seal | 15 | Not threatened | Least concern |
| Orca | 241 | Threatened - Nationally critical | Data deficient |
| Pantropical spotted dolphin | 1 | Non-Resident Native - Vagrant | Least concern |
| *Pilot whale* | 40 | - | - |
| *Pinniped* | 2 | - | - |
| Pygmy blue whale | 7 | Data deficient | Data deficient |

| Species | No. of records | Threat status – NZTCS 2019 | Threat status – IUCN |
|---|---|---|---|
| Pygmy right whale | 22 | Data deficient | Least concern |
| Pygmy sperm whale | 55 | Data deficient | Least concern |
| Risso's dolphin | 8 | Data deficient | Least concern |
| Ross seal | 1 | Non-Resident Native - Vagrant | Least concern |
| Rough-toothed dolphin | 1 | Data deficient | Least concern |
| Sei whale | 15 | Data deficient | Endangered |
| Shepherd's beaked whale | 8 | Data deficient | Data deficient |
| Short-finned pilot whale | 1 | Data deficient | Least concern |
| Southern bottlenose whale | 2 | Data deficient | Least concern |
| Southern right whale | 115 | At Risk - recovering | Least concern |
| Southern right whale dolphin | 8 | Data deficient | Least concern |
| Spectacled porpoise | 1 | Data deficient | Least concern |
| Sperm whale | 69 | Data deficient | Vulnerable |
| Strap-toothed whale | 26 | Data deficient | Least concern |
| Striped dolphin | 3 | Data deficient | Least concern |
| Subantarctic fur seal | 4 | Non-Resident Native - Vagrant | Least concern |
| *Toothed whale* | 1 | - | - |
| **TOTAL** | 2668 | | |

Table 3.5: Number of marine mammal sightings in the area of the proposed consent area, and in the 5km and 10km buffer area around it from the DOC Marine Mammal Database to April 2023 [56]

| Species | Within the project area | Within 5km buffer of the project area | Within 10km buffer of the project area |
|---|---|---|---|
| Blue whale | 0 | 0 | 1 |
| Minke whale | 0 | 1 | 0 |
| Common dolphin | 1 | 4 | 4 |
| Hector's or Maui dolphins | 0 | 0 | 1 |
| Orca | 0 | 1 | 0 |
| **TOTAL** | 1 | 6 | 6 |

[56] Data source: DOC marine mammal sighting and incident database (downloaded on 30 April 2023); Additional blue whale sightings provided by Dr. L. Torres in 2017).

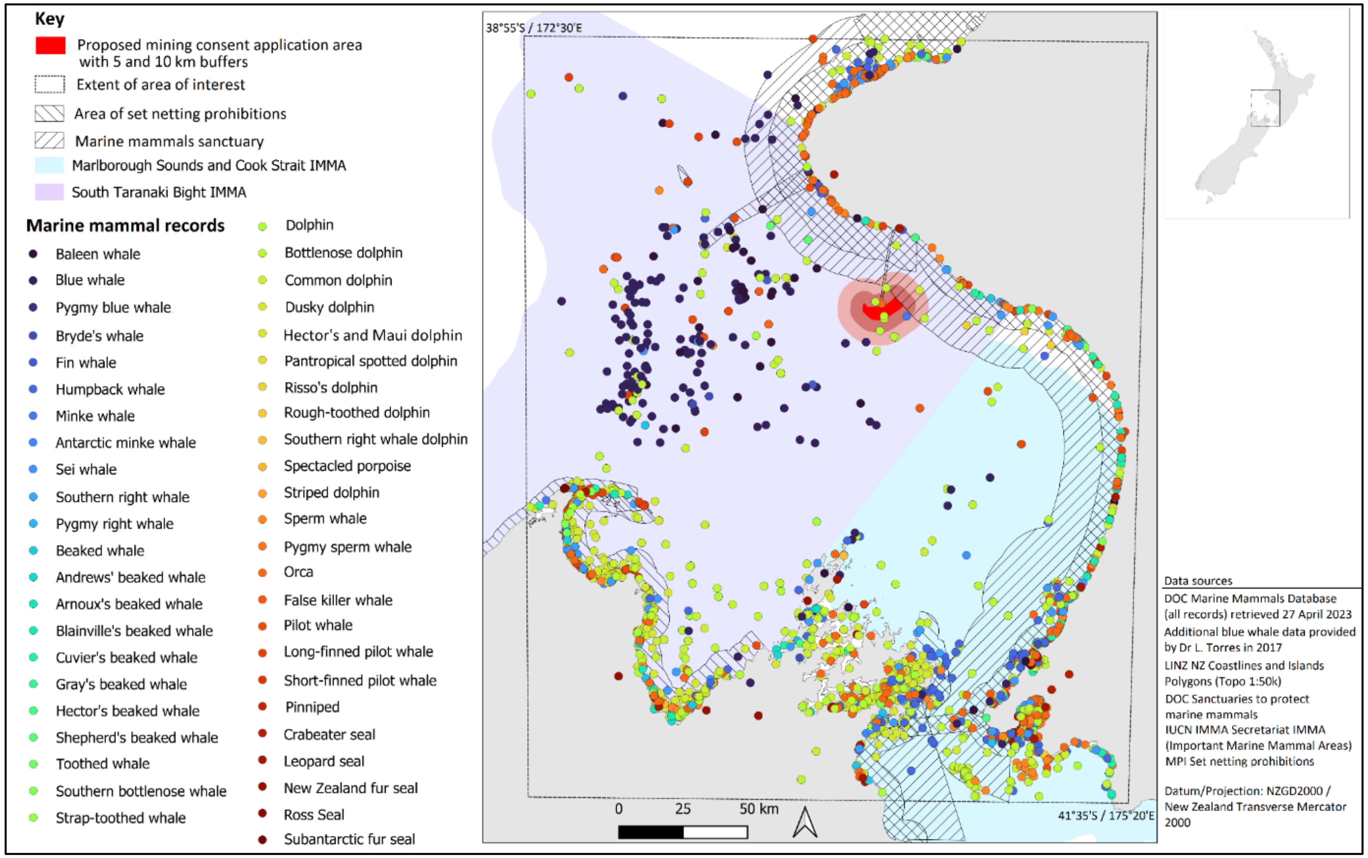


Figure 3.9: Locations of marine mammal sightings and incidents in the Taranaki region of interest from the DOC Marine Mammal Database to April 2023 [57]

57 When the species was unknown, but the record confirmed what group the animal(s) were, this was counted under the species groupings in italics. Data source: DOC marine mammal sighting and incident database (downloaded on 30 April 2023); Additional blue whale sightings provided by Dr. L. Torres in 2017).

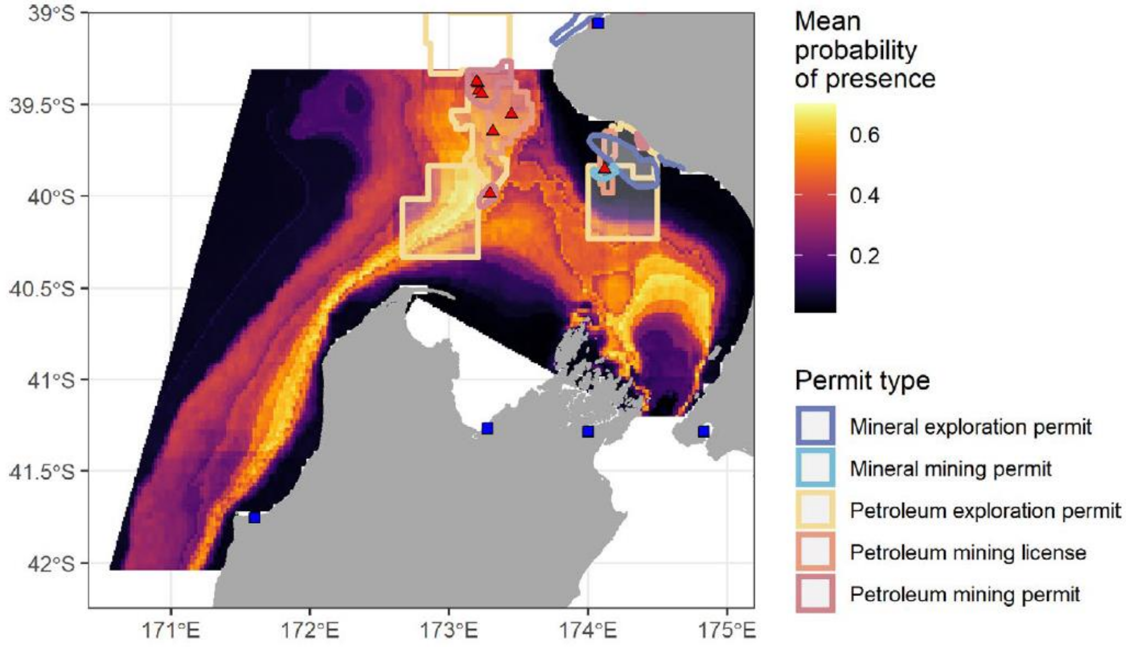


Figure 3.10: **Mean probability of blue whale presence predicted by the BRT whale model, calculated across 100 bootstrap runs [58].**

[58] Adapted from Figure 6 from Barlow & Torres (2021).Anthropogenic pressures are overlaid, including petroleum and mineral permit areas (as of May 2021), ports (blue squares) and active oil rigs (red triangles).

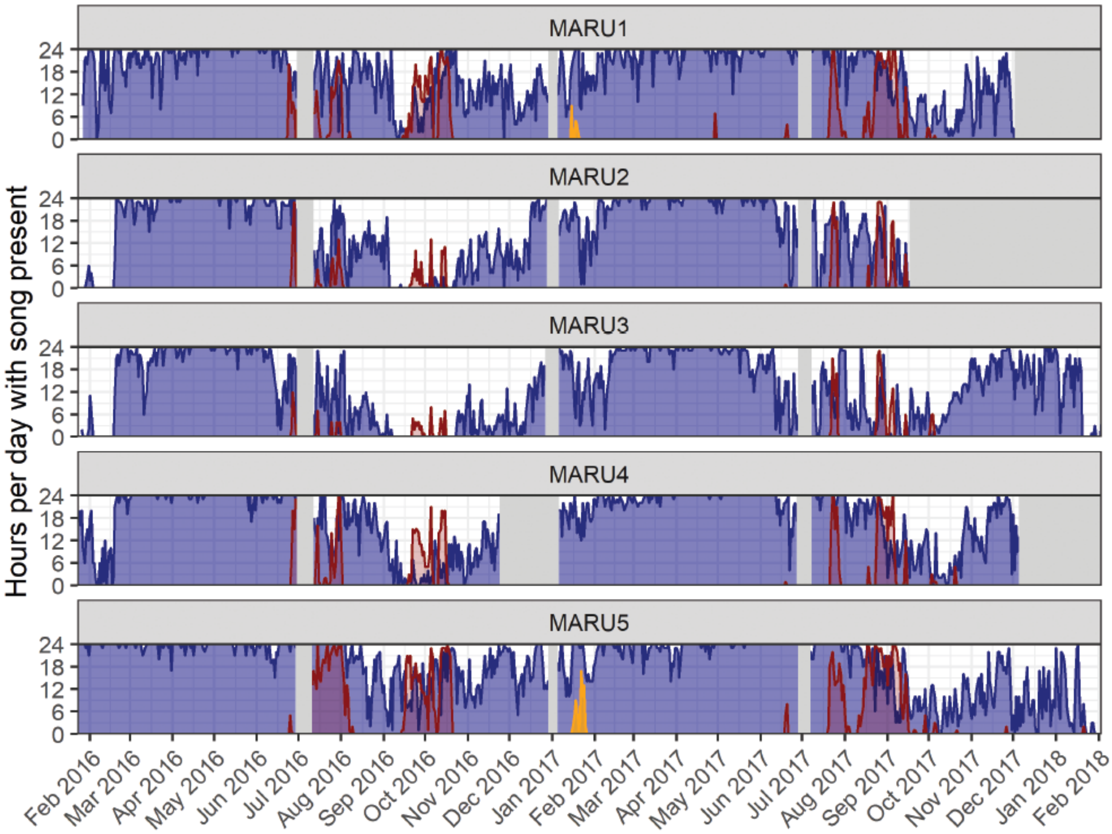


**Figure 3.11: Temporal occurrence pattern of New Zealand (dark blue), Antarctic (red), and Australian (yellow) blue whale song detections at each of the five hydrophones.** [59]

[59] Adapted from Figure 3 in Barlow et al. (2023a). The y-axis represents the number of hours per day that blue whale song was detected, and the x-axis represents the recording period. Grayed out sections represent gaps in recording due to hydrophone refurbishment.

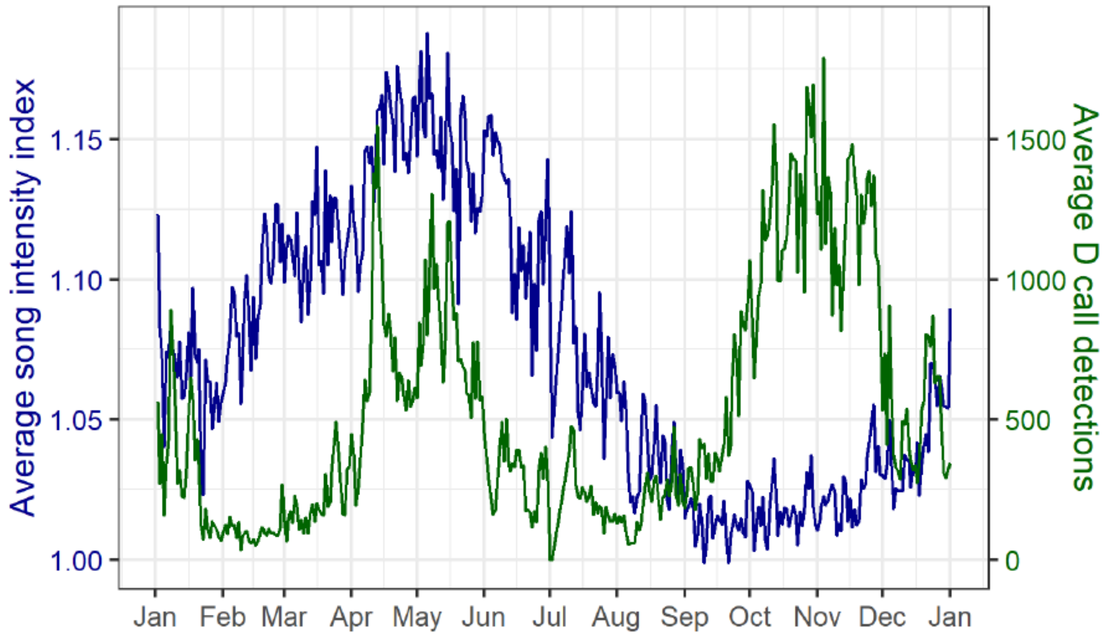


**Figure 3.12: Annual cycle of calling activity** [60]

[60] Adapted from Figure 3 in Barlow et al. (2023b). Average annual cycle in the song intensity index (dark blue) and D calls per day of the year, computed across all hydrophone locations and the entire recording period.

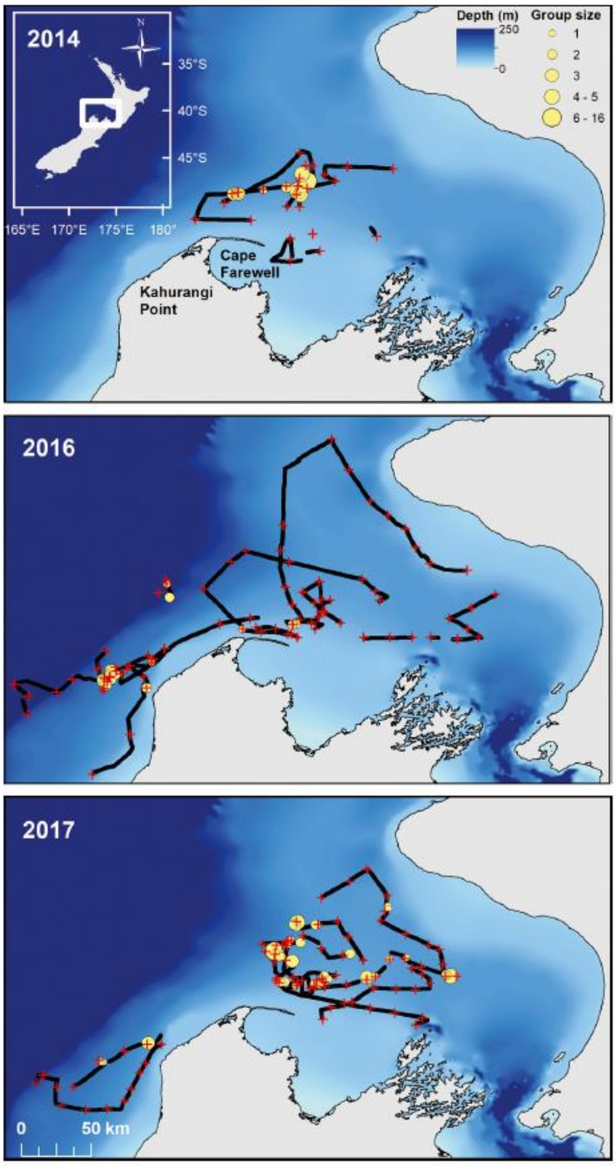


Figure 3.13: Survey effort in the STB (STB) region of New Zealand in each of the 3 study years. [61]

[61] Adapted from Figure 1 in Barlow et al. 2020. Black lines represent vessel tracklines during survey effort. Yellow circles represent blue whale sighting locations, scaled by number of blue whales recorded. CTD casts are shown as red crosses. Inset map of New Zealand in the 2014 panel indicates the location of the STB region within the white box.

### Blue Whales

There is a wealth of information (e.g., over 20 reports and published scientific papers[52]) available that provide relevant information about blue whales within the STB region. Some summaries of the key research from these sources includes:

> Barlow et al. [62] confirmed the almost year-round presence of blue whales in the STB, where foraging behaviour was frequently observed. Results (e.g., genetic, lack of photoidentification matches) suggest a high degree of isolation of the New Zealand population from other southern hemisphere blue whale populations. The researchers also estimated the within-year abundance of blue whales within the STB region at 166 (95% CIs = 75-367) plus an abundance estimate of 718 whales for all blue whales in New Zealand, although these estimates are likely to be underestimates and come with some qualifiers. Whales from the STB were also resighted in the Hauraki Gulf, Kaikoura, Westport, and Greymouth.

> Barlow et al.[53] confirmed the presence of three different blue whale populations: New Zealand, Antarctic and Australian within the STB from acoustic monitoring and almost year-round presence (Figure 3.11). The authors concluded that the STB region is the primary niche of the New Zealand population, a migratory corridor for the Antarctic population, and outside the typical range of the Australian population. The mean daily detection range for acoustic detections was estimated at 79.21 ± 19.09km for New Zealand blue whales, 147.57 ± 20.62km for Antarctic blue whales and 253.55 ± 116.60km for Australian blue whales.

> Barlow et al. [63] [64] confirmed strong correlations between environmental conditions, upwelling, krill distribution and blue whale presence. Barlow et al. (2020) included survey effort in the STB, including around the project area, in 2016 and 2017 (see Figure 3.13).

> Barlow & Torres[52] developed a blue whale distribution model based on environmental variables with a high degree of predictive performance. The model identified areas with

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[62] Barlow DR et al. (2018) Documentation of a New Zealand Blue Whale Population Based on Multiple Lines of Evidence. Endangered Species Research 36: 27–40. https://doi.org/10.3354/esr00891.

[63] Barlow DR et al. (2020) Links in the Trophic Chain: Modelling Functional Relationships Between in Situ Oceanography, Krill, and Blue Whale Distribution Under Different Oceanographic Regimes. Marine Ecology Progress Series 642: 207–25. https://doi.org/10.3354/meps13339.

[64] Barlow DR et al. (2021) Temporal and Spatial Lags Between Wind, Coastal Upwelling, and Blue Whale Occurrence. Scientific Reports 11(1): 6915–6915. https://doi.org/10.1038/s41598-021-86403-y.

a mean probability of blue whale presence. It shows that the proposed project location falls in an area of very low predicted blue whale presence (see Figure 3.10).

> Torres et al.[63] confirmed the importance of surface feeding on krill by New Zealand blue whales. Blue whales were encountered where prey was relatively shallow and denser.

> Goetz et al. [65] satellite tagged two blue whales off Karamea. One travelled over 500km north before transmissions ceased after 6 days off the west coast of Auckland and the other transmitted for 47 days during which time it completely circumnavigated the South Island and then when into the STB. The results from this study show that blue whales spend time in areas outside the STB, though the amount of time is likely driven by the presence of upwelling conditions which varies from year to year.

> Warren et al. [66] [67] used acoustic monitoring in the STB to confirm the presence of pygmy and Antarctic blue whales in the region and the importance of the region to both species. Detection range for the acoustic recorder was estimated at between 35-50km within the STB region. The acoustic recorder was located approximately 75km from the project area.

***Summary***: Spatial distribution data and habitat suitability modelling confirms that the offshore part of the STB is an important area for blue whales[52] [47] [48]. These models also confirm that the north-eastern and inshore waters of the STB, including the project area, have a very low probability of presence (Figure 3.9, Figure 3.10, Appendix 3.6 and Appendix 3.7). These models also confirm that the proposed consent location is highly unlikely to be an area of any special biological significance to blue whales. These model results are also consistent with data from acoustic monitoring which demonstrates that blue whales are in the STB region almost year-round but generally offshore of the project area (Figure 3.11[53]). There is one blue whale sighting within 10km and only two within 30km of the proposed site with most sightings considerably further west (e.g., >40-50km) and offshore (Figure 3.9 and Appendix 3.6).

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65 Goetz KT et al. (2022) First Satellite-tracked Movements of Pygmy Blue Whales (Balaenoptera Musculus Brevicauda) in New Zealand Waters. Marine Mammal Science 38(2): 742–55. https://doi.org/10.1111/mms.12876.

66 Warren VE et al. (2021a) Marine Soundscape Variation Reveals Insights into Baleen Whales and Their Environment: a Case Study in Central New Zealand. Royal Society Open Science 8(3): 201503– 201503, https://doi.org/10.1098/rsos.201503.

67 Warren VE et al. (2021b) Passive Acoustic Monitoring Reveals Spatio- Temporal Distributions of Antarctic and Pygmy Blue Whales Around Central New Zealand. Frontiers in Marine Science 7: https://doi.org/10.3389/fmars.2020.575257.

**Hector's and Maui dolphins**

This section focuses on Māui dolphins but will also include some details of relevant Hector's dolphin data. There is considerable information about Hector's and Maui dolphins within the STB and wider region [68]. Some summaries of the key research from these sources includes:

- Derville et al.[46] used a model to predict habitat suitability for Māui dolphins. The model achieved good overlap with existing sighting and stranding data and identified a hotspot of high habitat suitability near Hawera in the inshore waters of the STB. It is important to note that while these data indicate that the area is deemed to be highly suitable for Māui dolphin, it doesn't provide any information on whether there are actually Māui dolphins there now. The authors also noted that some of the identified hotspots are outside of the presently known distribution of Māui dolphins and therefore these may be areas where dolphins were historically present prior to human impacts.
- Forney et al. [69] considers potential underwater noise impacts on Māui dolphins. They highlight the potential for displacement caused by anthropogenic noise to increase risks for Māui dolphins through animals moving out of protected into unprotected areas. This is not likely to be the case for the project area as it isn't considered to be a part of the normal range of Māui dolphins.
- Roberts et al. [70] undertook a spatial risk assessment of threats to Hector's and Māui dolphins. The estimated density of Māui dolphins within the project area was assessed as extremely low, while waters inshore of the consent area identified as very low densities. There was no formal assessment of potential impacts from seabed mining.
- Cooke et al. [71] undertook some individual-based population modelling based on genetic mark recapture data. A variety of modelling scenarios were considered which led to a continued decline in the population unless strong management action was taken.

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[68] Baker et al. (2019); Baker et al. (2016); Buckle et al. (2017); Constantine et al. (2021); Constantine (2019); Cooke et al. (2019); de Jager et al (2019); DOC (2023); DOC & FNZ (2021); Derville et al. (2016); FNZ (2022); FNZ & DOC (2020); Forney et al. (2017); Heimeier et al. (2018); MacKenzie et al. (2022); McPherson et al. (2019); Nelson & Radford (2019); Ogilvy et al. (2022); Roberts & Hendricks (2020); Roberts et al. (2019, 2021); Slooten & Dawson (2020a,b), Slooten (2020)

[69] Forney KA et al. (2017) Nowhere to Go: Noise Impact Assessments for Marine Mammal Populations with High Site Fidelity. Endangered Species Research 32: 391–413. https://doi.org/10.3354/esr00820.

[70] Roberts JO et al. (2019) Spatial Risk Assessment of Threats to Hector's and Māui Dolphins (Cephalorhynchus Hectori). Ministry for Primary Industries, Manatū Ahu Matua.

[71] Cooke JG et al. (2019) Population Dynamic Modelling of the Māui Dolphin Based on Genotype Capture-Recapture with Projections Involving Bycatch and Disease Risk. Fisheries New Zealand, Tini a Tangaroa.

- de Jager et al. [72] modelled the spatial distribution of Māui dolphins using an assumed and random distribution of dolphins sampled from the full potential range (i.e., known present range plus historic range). Results highlight that dolphins from the randomly allocated dolphin distribution were estimated to move well outside the present protected areas. In some model runs, when dolphins were randomly allocated to the waters inshore of the project area, the model suggested that these dolphins could move offshore and potentially enter the project area. However, based on our current understanding of Māui dolphin distribution, there is an extremely low likelihood of dolphins being inshore of the project area.
- Wright & Tregenza [73] provided a summary of acoustic monitoring of Māui dolphins along the west coast of Auckland. The preliminary data suggests some trends with diel (24-hour) and tidal patterns. Nelson & Radford (2019) also undertook acoustic monitoring of Māui dolphins at several sites around Taranaki including one site 2km off the Whanganui River mouth during 2016/17, which is approximately 55km east of the project area. There were no narrow-band high frequency detections (characteristic of Hector's and Māui dolphins) recorded during the 95-day monitoring period at Whanganui. The lack of detections is consistent with our understanding that Māui dolphins are very rare in the region.
- Slooten [74] and Slooten & Dawson [75] [76] [77] review the current management for the conservation of Māui and Hector's dolphins. There is little information specifically relevant to seabed mining other than to identify it as potential cumulative effect and to confirm that the Māui dolphin population cannot sustain any mortality without risking a catastrophic decline.

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72 de Jager M et al. (2019) Modelling the Spatial Dynamics of Māui Dolphins Using Individual-Based Models. Ecological Modelling 402: 59–65. https://doi.org/10.1016/j.ecolmodel.2019.04.009.

73 Wright AJ, Tregenza N (2019) CPOD Successful in Trial for Detecting Māui Dolphin Outside Harbours. New Zealand Journal of Marine and Freshwater Research 53(3): 451–459. https://doi.org/10.1080/00288330.2019.1619597.

74 Slooten E, (2020) Effectiveness of Current Protection for Māui Dolphin. The Journal of Cetacean Research and Management 21(1): 151–55, https://doi.org/10.47536/jcrm.v21i1.135.

75 Slooten E, Dawson SM (2020a). Critique of the Scientific Basis for Currently Proposed Protection Options for Hectors and Māui Dolphins. bioRxiv https://doi.org/10.1101/2020.05.15.098889.

76 Slooten E, Dawson SM (2020b) Updated Population Viability Analysis, Population Trends and PBRs for Hector's and Māui Dolphin. bioRxiv https://doi.org/10.1101/2020.03.25.008839.

77 Slooten E, Dawson SM (2021) Delays in Protecting a Small Endangered Cetacean: Lessons Learned for Science and Management." Frontiers in Marine Science 8: https://doi.org/10.3389/fmars.2021.606547.

> The Hector’s and Māui Dolphin Threat Management Plan 2020 was released in 2021 by DOC and Fisheries New Zealand (FNZ) [78]. The Plan extended the West Coast North Island Marine Mammal Sanctuary (the Sanctuary) south as far as Cook Strait in 2020 and prohibited all seabed mining within the Sanctuary. The Sanctuary now runs inshore and is contiguous with the project area. Other increased protections included the extension of a four nautical mile set net exclusion area south to Cook Strait.

> McPherson et al. [79] provide an indicative assessment of underwater sound propagation modelling used to illustrate potential noise exposure to Māui dolphins from seismic surveys and vessel traffic on West Coast North Island, New Zealand. The study demonstrates that traffic density north of the Taranaki region is relatively low within 12 nautical miles of the coast, while higher densities occur in the Taranaki and STB regions. However, the authors didn’t assess the modelled noise levels against potential Māui dolphin thresholds but commented that the noise levels could be high enough to cause disturbance in some areas.

> Constantine et al. [80] estimates the census abundance and effective population size of Māui dolphins as 54 (95% CI = 48-66) and 35 (95% CI = 21-67) respectively from genetic sampling of dolphins around and north of the North Taranaki Bight. They also suggest that the population is approximately stable. There were a few long-distance movements of identified individuals, but most movements were less than 10km confirming that Māui dolphins do not appear to generally travel large distance or have large home ranges.

> The FNZ (2022) Aquatic Environment and Biodiversity Annual Review 2021 provides a useful summary of Hector’s and Māui dolphin biology, ecology and (primarily fisheries) impacts.

> Ogilvy et al. [81] assessed the diet of Māui dolphins from stable isotope analysis. They confirm that the diet of Māui dolphins has significantly changed over time including with a strong effect from El Nino. There were no samples available from the STB so it is unknown if these data will be representative of any Māui potentially found in the STB

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78 https://www.doc.govt.nz/globalassets/documents/conservation/native-animals/marine-mammals/maui-tmp/hectors-and-maui-dolphinthreat- management-plan-2020.pdf.

79 McPherson C et al. (2019) Underwater Sound Propagation Modelling to Illustrate Potential Noise Exposure to Māui Dolphins from Seismic Surveys and Vessel Traffic on West Coast North Island, New Zealand.

80 Constantine R et al. (2021) Estimating the Abundance and Effective Population Size of Māui Dolphins (Cephalorhynchus hectori maui) in 2020-2021 using Microsatellite Genotypes, with Retrospective Matching to 2001. Creative Services Team, Department of Conservation.

81 Ogilvy C et al. (2022) Diet Variation in a Critically Endangered Marine Predator Revealed with Stable Isotope Analysis.” Royal Society Open Science 9(8): 220470–220470. https://doi.org/10.1098/rsos.220470.

***Summary***: Spatial, abundance and distribution data combined with habitat suitability modelling confirms that the offshore areas of the STB, including the project area, are highly unlikely to be suitable habitat for Māui dolphins, are areas where Māui dolphins will be found very rarely and, if they are present, are likely to be in very low numbers[46 70 72 47 48 82]. The available data also confirm that the proposed consent location is highly unlikely to be an area of any special biological significance to Māui dolphins.

### Southern right whales

Southern right whales are rare visitors to the STB region. Some summaries of the key research from these sources includes:

> There are spatial models of the nationwide distribution of southern right whales provided in Stephenson et al.[47 48] and Torres et al. [45], although the former offers little fine scale resolution within the STB and the latter is primarily offshore distributions. Both models confirm that southern right whales have low probability of occurrence within the STB.

> Carroll et al. [83] provides the first national abundance estimate for southern right whales of 2,169 (95% CI 1836-2563) although there are no regional estimates, including for the STB.

***Summary***: Southern right whales are rare visitors to the region but, if they are present, are likely to close to the shoreline and well inshore of the project area.

### Killer whales

Killer whales are also rare visitors to the STB region. Some summaries of the key research from these sources includes:

> Reeves et al. [84] confirms that there a minimum of three regional killer whale populations in the Australia region: New Zealand, North-west Australia and South-west Australia. These populations present moderate levels of genomic diversity, negligible levels of inbreeding, small effective population sizes, and low contemporary migration rates among them. Stephenson et al. (2020b) modelled the probability of occurrence of killer

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82 Stephenson F et al. (2021) Cetacean Conservation Planning in a Global Diversity Hotspot: Dealing with Uncertainty and Data Deficiencies. Ecosphere 12(7): https://doi.org/10.1002/ecs2.3633.

83 Carroll EL et al. (2013) Accounting for Female Reproductive Cycles in a Superpopulation Capture-Recapture Framework. Ecological Applications (23(7): 1677–90. https://doi.org/10.1890/12-1657.1

84 Reeves IM et al. (2022) Population genomic structure of killer whales (Orcinus orca) in Australian and New Zealand waters. Marine Mammal Science 38: 151-174.

whales with low probability of them being present in the STB and project area. These data are consistent with the idea that killer whales are rare visitors to the STB region.

***Summary***: Killer whales are rare visitors to the STB and, when encountered, are generally transiting through the region. There are no data to suggest that the project area is of any biological or ecological significance to killer whales.

### Common dolphins

Common dolphins are resident to the STB and are regularly reported within the STB. Some summaries of the key research from these sources includes:

> Common dolphins are the second most recorded species in the DOC database (Table 1)[43] within the STB with an apparent widespread distribution throughout the region. Stephenson et al.[48] modelled the probability of occurrence of common dolphins nationally including with a high probability of them being within the project area.

> Common dolphins are frequently captured in New Zealand trawl fisheries, particularly in the large-vessel jack mackerel target fishery off the North Island west coast [85], although within the STB, captures are normally considerably further offshore than the project area. There is no abundance estimate available for the STB although the population has high genetic diversity consistent with a large population size [86].

***Summary***: Common dolphins are resident within the STB and have been reported from within the project area. While there is nothing to suggest that dolphins are likely to be resident within the project area, they are clearly using it at times. Notwithstanding this finding, common dolphins are known to range very widely and therefore the project area is likely to only represent a small fraction of their total home range within the STB. Overall, it is unlikely that the project area is biologically significant to common dolphins.

### New Zealand Fur Seals

There is little data about New Zealand fur seals within the STB as they are generally considered to be vagrants to the region. The nearest breeding colony is likely to be Sugar Loaf Islands (Ngā Motu) Marine Protected Area near New Plymouth which is approximately 150km to the north of the project area. Fur seals are also known from around offshore STB oil platforms and vessels and can be found hauled out on offshore floating lines and

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[85] Abraham ER et al. (2021) Estimated Captures of New Zealand Fur Seal, Common Dolphin, and Turtles in New Zealand Commercial Fisheries, to 2017-18. Ministry for Primary Industries.

[86] Baker CS, Chilvers BL, Childerhouse S, Constantine R, Currey R, Mattlin R, van Helden A, Hitchmough R, Rolfe J (2016) Conservation status of New Zealand marine mammals, 2013. New Zealand Threat Classification Series 14. Department of Conservation, Wellington, New Zealand. 18 p.

structures. There were four sightings of fur seals within the project area during aerial surveys undertaken over a two-year period[44] confirming that fur seals do occur infrequently in the area.

***Summary***: Fur seals are found widely around offshore waters of the STB. While fur seals are likely to be found within the project area, they are only likely to be there occasionally and in low numbers. There is nothing to suggest that the project area represents a biologically significant area for fur seals, especially given their reasonably large home ranges.

#### Other marine mammal species

Table 1[43] identifies over 40 marine mammal species which have been recorded in the STB. Most of these species are classified as 'data deficient', 'least concern', 'naturally uncommon' or 'vagrant' under the NZ Threat Classification System and/or the IUCN criteria. For the purposes of this assessment, the IA has focused on the six species that have been summarised above as they are either known to be present within the project area, have a high threat status, and/or are of particular significance to local communities and tangata whenua.

### 3.3.4.3 General Conclusions

Based on a review of the available data, the following conclusions can be made:

> There is a considerable amount of relevant and robust scientific data available about marine mammals within the STB. In some areas, in particular spatial modelling and marine mammal distributions, there have been significant advances with individual species distribution models now available plus abundance estimates for some species. This material has provided useful insights into the distribution, ecology and behaviour of marine mammals within the region. Overall, this new information is consistent with the assessment that there is a low likelihood of marine mammals being present in the project area and there is nothing to suggest that the area is of any significance to any marine mammal species.

> Specifically, spatial, abundance and distribution data plus habitat suitability modelling confirms that the offshore areas of the STB, including the project area, are highly unlikely to be suitable habitat for Māui dolphins, are areas where Māui dolphins will be found very rarely and, if they are present, are likely to be in very low numbers. These same data confirm that the offshore, western part of the STB is an important area for blue whales and that the north-eastern and inshore waters of the STB, including the project area, have a very low probability of presence. Furthermore, the proposed consent location is highly unlikely to be an area of any special biological significance to blue whales.

- More generally, the new data confirms the STB as an important hotspot for marine mammal diversity within New Zealand, including as a feeding and breeding location. Overall, the modelled distribution of most marine mammal species is further offshore of the project area with some notable exceptions such as common dolphins. Most of the marine mammal species recorded within the STB, have also been reported in very low numbers, are classified as 'data deficient', 'least concern', 'naturally uncommon' or 'vagrant' under the NZ Threat Classification System and/or the IUCN criteria, and are mostly considered only rare visitors or vagrants to the region.
- While Māui dolphins and/or Hector's dolphins are found in very low numbers in the STB region, the operational area is at the margins of the southern-most recognised range for Māui dolphins. It appears very unlikely that Māui dolphins are present in the project area given that the majority of their distribution is considerably further north of this site (e.g. well northeast of New Plymouth).

### 3.3.5 Seabirds

NIWA was commissioned by TTR to assess the presence of seabirds and shorebirds in the STB. In 2023, NIWA [87] provided the most recent synthesis of this assessment, including a table of species [88] likely to occur in or adjacent to the STB, which has been reproduced here as Table 3.5.

The assessment identified that seabird species likely to be present in the STB are a mix of relatively coastal taxa, including little penguin, shags, gulls and terns (although all such taxa can occur in more offshore areas) and pelagic, offshore taxa including albatrosses, shearwaters and petrels. Based on the New Zealand Threat Classification System [89] (NZTCS), three seabird taxa classified as 'Threatened to Nationally Critical' are likely to occur in the STB (Antipodean albatross, Gibson's albatross and Salvin's albatross), and a further eight Threatened' taxa (either 'Nationally Endangered' or 'Nationally Vulnerable' are also likely to occur in the area (Table 3.5). Additionally, a further 24 taxa classified as one of four 'At Risk' categories, and two further taxa classified as 'Vulnerable', based on the

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87 Thompson, D., 2023. Expert evidence of David Thompson on behalf of Trans Tasman Resources Limited. https://www.epa.govt.nz/assets/FileAPI/proposal/EEZ000011/Evidence-Applicants-evidence/TTR-David-Thompson-evidence-statement.pdf

88 https://www.epa.govt.nz/assets/Uploads/Documents/Marine-Activities-EEZ/Activities/THOMPSON-Final-Table-1.pdf

89 Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., Michel, P. 2021. Department of Conservation. 'New Zealand Threat Classification Series 36. Conservation status of birds in Aotearoa New Zealand, 2021'

International Union for the Conservation of Nature 'Red List' classifications [90], could also occur in the STB (Table 3.5).

Additionally, the coastal environment bordering the STB supports a range of shorebirds that are unlikely to occur at sea. Table 3.5 also summarises shorebird taxa occurring along the coast of the STB, ranked according to their NZTCS conservation status classifications. Based on NZTCS classifications, two shorebird taxa classified as 'Threatened to Nationally Increasing' are likely to occur coastally, adjacent to the STB (wrybill and northern New Zealand dotterel). A further seven taxa classified as one of four 'At Risk' categories also occur in the STB coastal environment (Table 3.5).

The STB region 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.

**Table 3.6: Summary information on the conservation status and relative abundance of seabirds and shorebirds likely to occur in or adjacent to the STB [91].**

| Common Name | Scientific Name | New Zealand Conservation Status | IUCN Red List Classification | Relative Abundance |
|---|---|---|---|---|
| 1. Seabirds | | | | |
| Antipodean albatross | *Diomedea antipodensis antipodensis* | Threatened - Nationally Critical | Endangered | 4 |

90 http://www.iucnredlist.org/

91 Taxonomy and New Zealand conservation status classification follows Robertson et al. (2021). Taxa ranked according to New Zealand conservation status, and then alphabetically by scientific name. International Union for Conservation of Nature (IUCN) Red List classifications follow data at http://www.iucnredlist.org/ (accessed May 2023). Relative abundance scores reflect the New Zealand population size for each species, not an estimate of the population likely to occur within the STB region. Relative abundance scores follow Townsend et al. (2008), whereby a score of 1 = < 250 mature individuals (defined as an individual capable of reproduction and here calculated as double the best estimate of number of annual breeding pairs for each species), 2 = 250-1,000, 3 = 1,000-5,000, 4 = 5,000-20,000, 5 = 20,000-100,000 and 6 = > 100,000 mature individuals. Abundance scores are based on information available at http://nzbirdsonline.org.nz/ (accessed May 2023) and are provided for those species that breed in New Zealand.

| Common Name | Scientific Name | New Zealand Conservation Status | IUCN Red List Classification | Relative Abundance |
|---|---|---|---|---|
| Gibson's albatross | *Diomedea antipodensis gibsoni* | Threatened - Nationally Critical | Endangered | 4 |
| Salvin's albatross | *Thalassarche salvini* | Threatened - Nationally Critical | Vulnerable | 5 |
| Black-fronted tern | *Childonias albostriatus* | Threatened - Nationally Endangered | Endangered | 4 |
| Southern royal albatross | *Diomedea epomophora* | Threatened - Nationally Vulnerable | Vulnerable | 4 |
| Northern royal albatross | *Diomedea sanfordi* | Threatened - Nationally Vulnerable | Endangered | 4 |
| Caspian tern | *Hydroprogne caspia* | Threatened - Nationally Vulnerable | Least Concern | 3 |
| Light-mantled sooty albatross | *Phoebetria palpebrata* | Threatened - Nationally Vulnerable | Near Threatened | 4 |
| Hutton's shearwater | *Puffinus huttoni* | Threatened - Nationally Vulnerable | Endangered | 6 |
| Spotted shag | *Stictocarbo punctatus punctatus* | Threatened - Nationally Vulnerable | Least Concern | 5 |
| Grey-headed albatross | *Thalassarche chrysostoma* | Threatened - Nationally Vulnerable | Endangered | 4 |
| Little penguin | *Eudyptula minor* | At Risk - Declining | Least Concern | 4 |
| Black-billed gull | *Larus bulleri* | At Risk - Declining | Near Threatened | 5 |
| Red-billed gull | *Larus novaehollandiae scopulinus* | At Risk - Declining | Least Concern | 5 |
| Buller's shearwater | *Puffinus bulleri* | At Risk - Declining | Vulnerable | 6 |
| Sooty shearwater | *Puffinus griseus* | At Risk - Declining | Near Threatened | 6 |

| Common Name | Scientific Name | New Zealand Conservation Status | IUCN Red List Classification | Relative Abundance |
|---|---|---|---|---|
| White-fronted tern | *Sterna striata striata* | At Risk - Declining | Near Threatened | 5 |
| Southern Buller's albatross | *Thalassarche bulleri* | At Risk - Declining | Near Threatened | 4 |
| White-capped albatross | *Thalassarche cauta steadi* | At Risk - Declining | Near Threatened | 6 |
| Fairy prion | *Pachyptila turtur* | At Risk - Relict | Least Concern | 6 |
| Broad-billed prion | *Pachyptila vittata* | At Risk - Relict | Least Concern | 6 |
| White-faced storm petrel | *Pelagodroma marina maoriana* | At Risk - Relict | Least Concern | 6 |
| Northern diving petrel | *Pelecanoides urinatrix urinatrix* | At Risk - Relict | Least Concern | 6 |
| Black shag | *Phalacrocorax carbo novaehollandiae* | At Risk - Relict | Least Concern | 3 |
| Little shag | *Phalacrocorax melanoleucos brevirostris* | At Risk - Relict | Least Concern | 4 |
| Cook's petrel | *Pterodroma cookii* | At Risk - Relict | Vulnerable | 6 |
| Mottled petrel | *Pterodroma inexpectata* | At Risk - Relict | Near Threatened | 6 |
| Flesh-footed shearwater | *Puffinus carneipes* | At Risk - Relict | Near Threatened | 4 |
| Fluttering shearwater | *Puffinus gavia* | At Risk - Relict | Least Concern | 5 |
| Snares Cape petrel | *Daption capense australe* | At Risk to Naturally Uncommon | Least Concern | 4 |
| Little black shag | *Phalacrocorax sulcirostris* | At Risk - Naturally Uncommon | Least Concern | 3 |

| Common Name | Scientific Name | New Zealand Conservation Status | IUCN Red List Classification | Relative Abundance |
|---|---|---|---|---|
| Westland petrel | *Procellaria westlandica* | At Risk - Naturally Uncommon | Endangered | 3 |
| Campbell albatross | *Thalassarche impavida* | At Risk - Naturally Uncommon | Vulnerable | 5 |
| Northern giant petrel | *Macronectes halli* | At Risk - Recovering | Least Concern | 3 |
| Pied shag | *Phalacrocorax varius varius* | At Risk - Recovering | Least Concern | 3 |
| Cape petrel | *Daption capense capense* | Migrant | Least Concern | |
| Wandering albatross | *Diomedea exulans* | Migrant | Vulnerable | |
| Southern giant petrel | *Macronectes giganteus* | Migrant | Least Concern | |
| Arctic skua | *Stercorarius parasiticus* | Migrant | Least Concern | |
| Black-browed albatross | *Thalassarche melanophris* | Coloniser | Least Concern | 1 |
| Southern black-backed gull | *Larus dominicanus dominicanus* | Not Threatened | Least Concern | 6 |
| Australasian gannet | *Morus serrator* | Not Threatened | Least Concern | 5 |
| White-chinned petrel | *Procellaria aequinoctialis* | Not Threatened | Vulnerable | 6 |
| White-headed petrel | *Pterodroma lessonii* | Not Threatened | Least Concern | 6 |
| Grey-faced petrel | *Pterodroma macroptera gouldi* | Not Threatened | Least Concern | 6 |
| 2. Shorebirds | | | | |

| Common Name | Scientific Name | New Zealand Conservation Status | IUCN Red List Classification | Relative Abundance |
|---|---|---|---|---|
| Wrybill | *Anarhynchus frontalis* | Threatened - Nationally Increasing | Vulnerable | 3 |
| Northern New Zealand dotterel | *Charadrius obscurus aquilonius* | Threatened - Nationally Increasing | Least Concern | 3 |
| Lesser knot | *Calidris canutus rogersi* | At Risk - Declining | Near Threatened | |
| Banded dotterel | *Charadrius bicinctus bicinctus* | At Risk - Declining | Near Threatened | 4 |
| South Island pied oystercatcher | *Haematopus finschi* | At Risk - Declining | Least Concern | 5 |
| Eastern bar-tailed godwit | *Limosa lapponica baueri* | At Risk - Declining | Near Threatened | |
| Black-fronted dotterel | *Elseyornis melanops* | At Risk - Naturally Uncommon | Least Concern | 2 |
| Royal spoonbill | *Platalea regia* | At Risk - Naturally Uncommon | Least Concern | 2 |
| Variable oystercatcher | *Haematopus unicolor* | At Risk - Recovering | Least Concern | 3 |
| Turnstone | *Arenaria interpres* | Migrant | Least Concern | |
| Pacific golden plover | *Pluvialis fulva* | Migrant | Least Concern | |
| White-faced heron | *Egretta novaehollandiae* | Not Threatened | Least Concern | 3 |
| Pied stilt | *Himantopus himantopus leucocephalus* | Not Threatened | Least Concern | 4 |
| Spur-winged plover | *Vanellus miles novaehollandiae* | Not Threatened | Least Concern | 4 |

## 3.4 EXISTING INTERESTS - ACTIVITIES AND PARTIES

### 3.4.1 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 identify the potential existing interests in the project area or the vicinity, and—where relevant and feasible—the parties who have these 'existing interests'.

### 3.4.2 Recreation and Tourism

Rob Greenaway & Associates (RGA) was commissioned by TTR to identify recreation and tourism activities which occur in the surrounding environment that may be potentially affected by the project. [92] The assessment identified the coastal area between Hawera and Whanganui as being potentially affected by the project from a recreation and tourism perspective.

The assessment identifies that regionally important coastal marine recreation settings are based at the main public access areas and activity points at:

> Ohawe Beach;

[92] 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.

- Waihai Beach;
- The mouth of the Tangahoe River;
- The mouth of the Manawapou River;
- Pātea;
- Waipipi;
- Waiinu;
- Kai Iwi;
- Castlecliff;
- The fishing resource up to 20km 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 areas most frequented by recreational vessels occurring around New Plymouth and south of Waiinu Beach (refer to **Appendix 3.8** 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 recreational fishing due to its distance from the coastline of the STB.

With regard to tourism activity in the STB, the assessment concludes that these activities are largely limited to six beach camp sites and three fishing charter operations - two operating from Pātea 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 20km 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 Pātea.

#### 3.4.2.1 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:

- Character Fishing operations:
  - South Taranaki Fishing Charters;

  - > Fluffy Duck Charters Ltd; and
  - > Hy-Jinks Fishing Charters.
- > Recreational Boating and Fishing Clubs:
  - > Pātea 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.

### 3.4.3 Maritime and Navigation

Marico Marino NZ Limited (Marico) was commissioned by TTR to assess vessels movements in the STB and to assess the impact the project will have on commercial shipping vessels. [93]

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 3.7 below.

**Table 3.7: Total Numbers of Ship Stations in STB over 12 months**

| Vessel Type | Unique Stations | Percentage (%) |
|---|---|---|
| Anchor Handlers | 4 | 0.4 |
| Buoys / Navigational Markers | 6 | 0.6 |
| Dry Cargo Ships | 375 | 40.5 |

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

| Vessel Type | Unique Stations | Percentage (%) |
|---|---|---|
| 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 |

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 3.14 below.

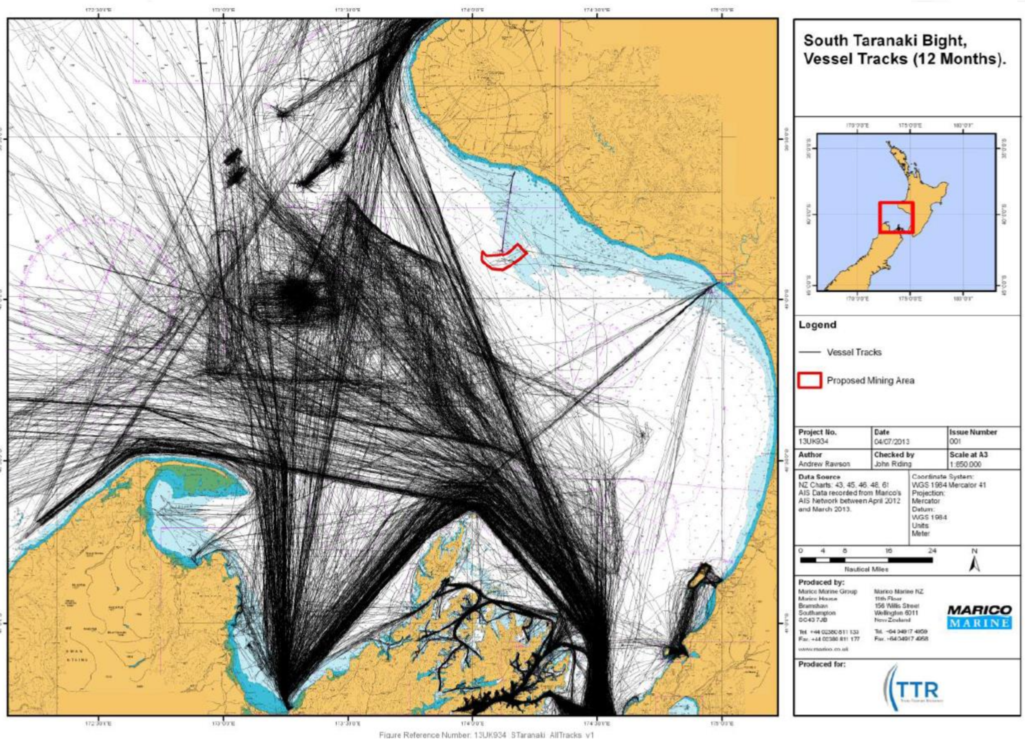


Figure 3.14: Marine Traffic through the STB over 12 months

The assessment concludes that the project area is well separated from the regular shipping routes and commercial fishing grounds.

As discussed above and in Section 5.13.6, 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.

### 3.4.4 Fishing

#### 3.4.4.1 Commercial Fishing

Fathom Consulting Ltd was commissioned by TTR to assess the commercial fisheries in the STB. [94] 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 period from 2006 to

94 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.

2015 [95]. This was subsequently updated by NIWA for the period October 2007 to September 2023 [96]. These three assessments are summarised below.

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 3.15 below). Despite the weather limitations, the area is considered to support a productive and diverse range of valuable inshore commercial fisheries.

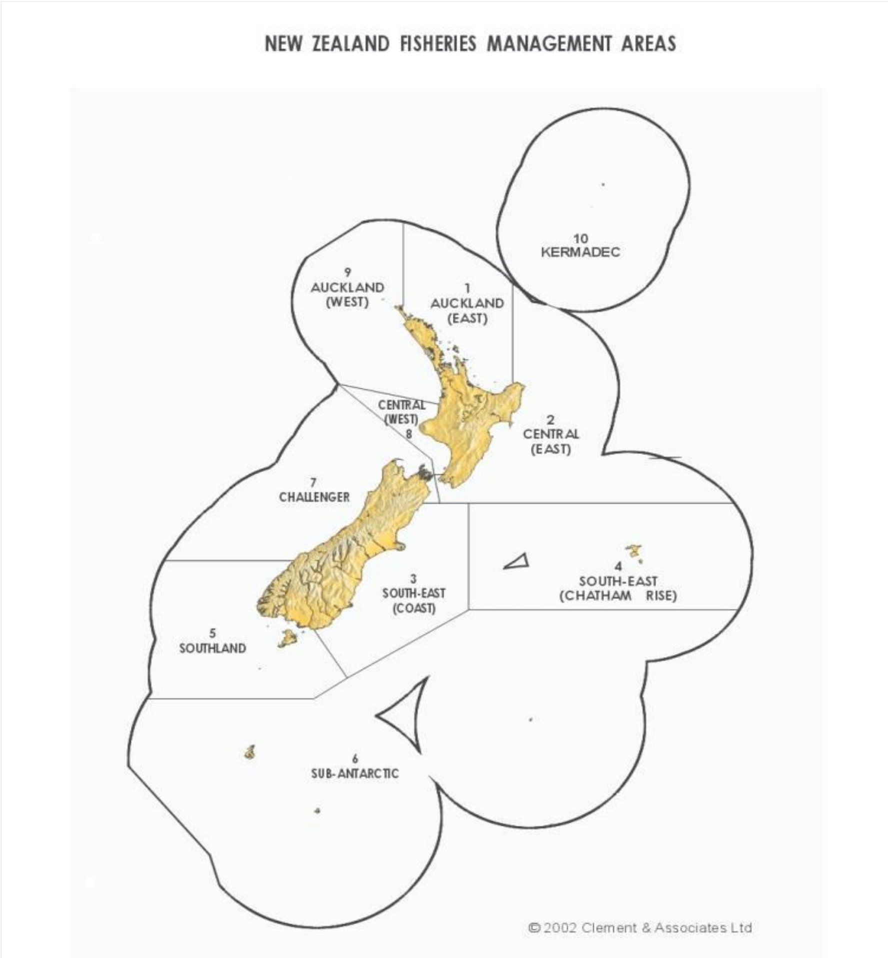


**Figure 3.15: New Zealand Fisheries Management Areas**

Some fishing methods are excluded from parts of the STB. In this regard, trawling by vessels larger than 46m was prohibited in 1986 from an area in the STB just outside the territorial sea

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

[96] MacDiarmid, A., MacGibbon, D., Anderson, O. (2024). South Taranaki Bight Fishing: 1 October 2007 - 30 September 2023. NIWA Client Report No: 2024053WN, 37 p.

boundary. Set-netting from the coast out to 2NMoffshore in the area from Pariokariwa Point to Hawera was prohibited in 2012 and extended in 2020 when new commercial and recreational set netting closures were put in place in the STB banning the use of set-nets within 4 nautical miles along the coast from Hawera southwards to Wellington. In addition, set-net closures were extended from 2 nautical miles to within 7 nautical miles offshore along the coast from Hawera northwards to the Waiwhakaiho River in north Taranaki.

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 most of the commercial fishing in the STB over the periods assessed by NIWA (2016 and 2024).

Across the entire time-period analysed by NIWA[96] from October 2007 to September 2023, commercial set-netting was the most common method of fishing in the areas inshore of the project area. In these areas school shark has been increasingly targeted over this period, while rig and other species have decreased in importance. Bottom trawling was the most common method in the project area and areas further offshore over the years assessed. In these areas the number of bottom trawl fishing events fluctuated from year to year but generally declined over the time-period and in recent years has been replaced by set-netting as the most common fishing method. At the start of the time series, red gurnard was the most commonly targeted species in the project area and adjacent waters areas, but in recent years this has been replaced by school shark. Closure of inshore areas in the STB to set-netting in 2020 most likely explains the decrease in targeting for rig and the increase in targeting for school shark as well as the recent increase in set-netting activities further offshore.

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 to March, while catch rates of trevally are highest in January to 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 well offshore in the central and western STB 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, school shark is caught year-round, but the highest catch rates occur in April and May.

NIWA[95] also identifies that rock lobster potting and crab potting were both common commercial fishing activities in the STB. 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 240km.

Quota ownership in both the trawl and set-net fisheries is dominated by Talley's and Sanford. Te Ohu Kaimoana Trustee is also a major quota owner on behalf of Māori, 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 near Hawera. The highest level of fishing effort is off the coastline between New Plymouth and Cape Egmont, in the western deep waters of the STB, and from Foxton southwards.

The project area has minimal overlap with the trawler fishing industry, which is mainly concentrated seaward of the 50m contour. In contrast, the project area is located in water depths of between 20 and 50m. NIWA[96] found that over the three fishing years from October 2020 to September 2023 the number of bottom trawls that overlapped with the project area totalled 0, 2 and 6 respectively.

#### 3.4.4.2 Existing Interest Parties to Commercial Fishing

The parties / representative bodies with 'existing interests' in commercial fishing activity within the project area or its vicinity 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 5.13.1.

#### 3.4.4.3 Recreational Fishing

Recreational fishing catch data collected occasionally from boat ramp surveys, fisher logbooks, ad hoc samples, and one-off surveys are available from Fisheries New Zealand through their rec data database. Although these data represent only a fraction of all recreational fishing activities and are recorded at a coarse spatial resolution relative to the proposed project area, they can provide an indication of the main methods used and species caught in the area. NIWA[95] summarised data for the Taranaki region obtained from Fisheries New Zealand for six adjacent reporting areas (Figure 3.16) along the Taranaki coast (OTK, HWR, PTE, WVL, WNG, RTN), disregarding older records (prior to 2005), to identify the main species caught and methods used.

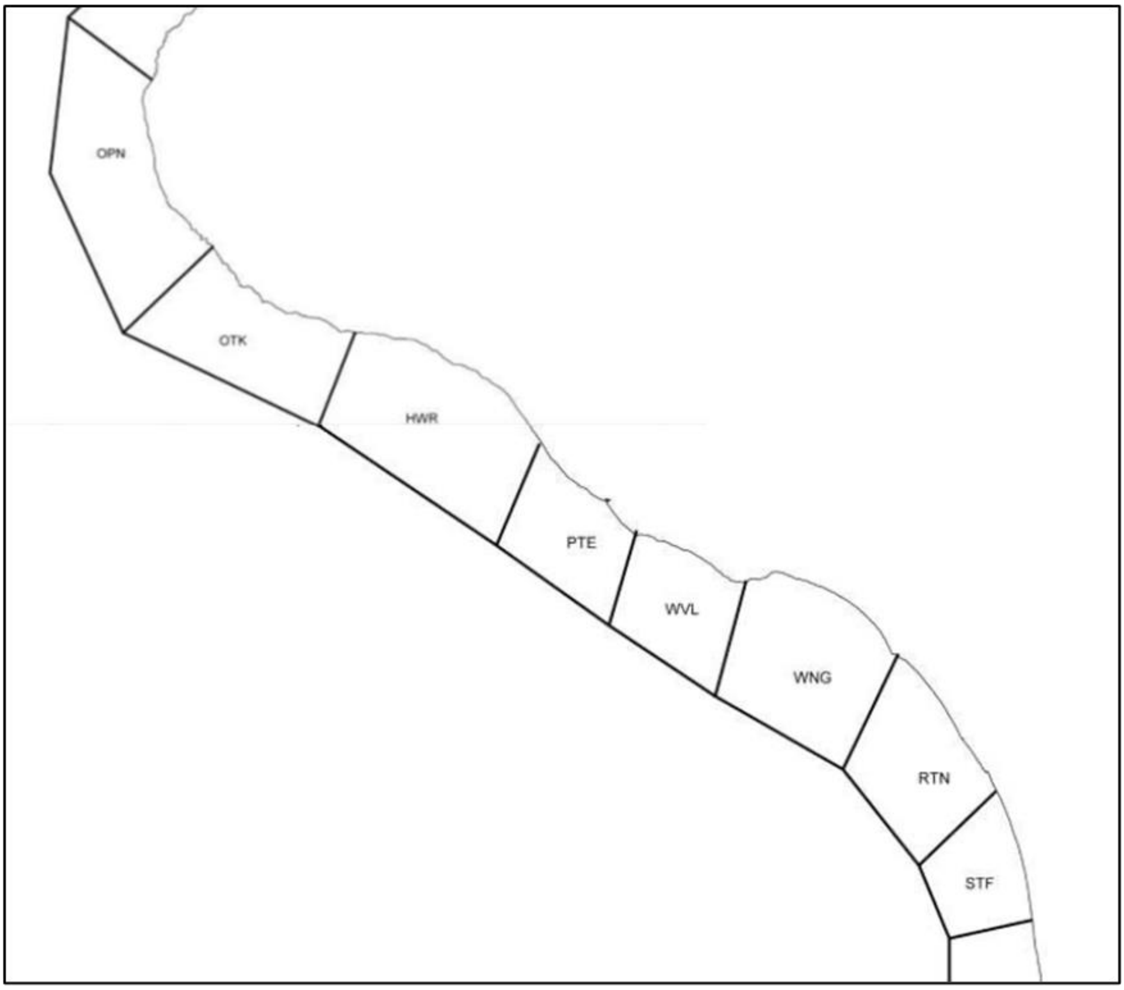


Figure 3.16: **Recreational fishing reporting areas used in the Fisheries New Zealand rec data database**

Since 2005, recreational fishing records from within all 6 reporting regions have amounted to 26,410 fish, mostly blue cod, snapper, and red gurnard which together comprised 74% of the catch. Kahawai, spiny dogfish, tarakihi and rig together formed another 18%, crayfish 1.3%, barracouta 1.1%, and school shark 0.8% with another 43 species together comprising the remaining 5% of recreational catch.

### 3.4.4.4 Customary fishing

Information on customary fishing was provided by FNZ (Fisheries New Zealand RepLog 15432) and summarised by NIWA[96]. This fishing is reported on a coarse spatial scale, with the relevant reporting area extending from New Plymouth in the north to Whanganui in the south, and available only for the period since 2006.

In the period between 2006 and 2023 about 45t of customary catch has been reported from this reporting region. Customary catch in this area and time-period has mainly comprised snapper (43.6%), pāua (30.1%), kina (10.9%), kingfish (7.6%), and rock lobster (4.7%). A further eight species or species groups were reported, each accounting for 1% or less of the total.

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. [97] On this basis, NIWA[39] 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 3.9**). 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 12NMfrom the coastline and therefore ~12NMfrom any coastal based customary fishing areas.

With regard to parties with 'existing interests', the parties with customary fisheries interests within or adjacent to the project area are the same parties identified in Table 3.8 and Section 3.4.10 below.

The mātauranga Māori and customary fisheries analysis [98] prepared by Te Tai Hauāuru Fisheries Forum identifies twenty-seven sites of customary importance to Māori for kaimoana. These, as well as the potential impacts and mitigation measures are discussed in further detail, in Section 5.13.1.3 below.

### 3.4.5 Aquaculture

There are no aquaculture activities undertaken within the project area, close to the project area, or anywhere within the STB.

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

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

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

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 100km 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. The Bay currently hosts longline mussel farming.

The potential effects of the project on the aquaculture industry at Admiralty Bay have been discussed in Section 5.13.3 and 5.13.4.

### 3.4.6 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 30km off the coast of Manaia. The production facility comprises an unmanned offshore platform, a 30km single three phase pipeline to shore and an onshore production station (refer to Figure 3.17 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 1.2km northwest of the project area.

Based on the above, Kupe JVP are considered a party who has an 'existing interest' in part of the project area and its vicinity.

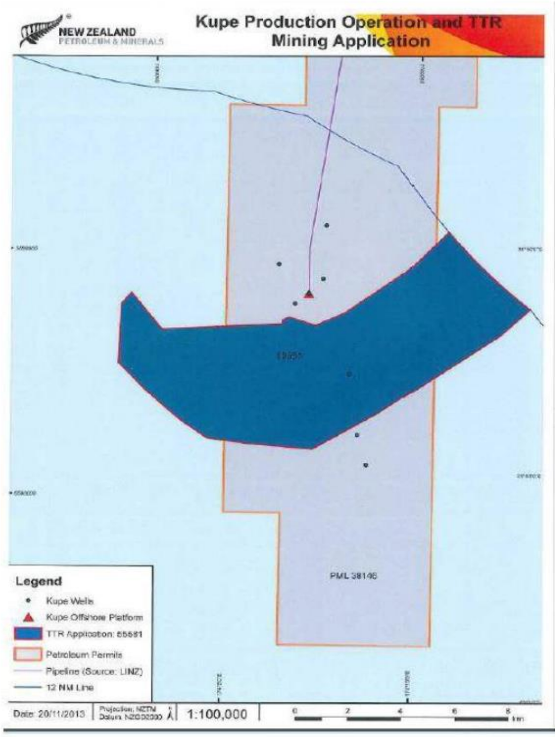


Figure 3.17: The extent of the Kupe Production area and project area

### 3.4.7 Existing Marine Consents

The EPA website lists six marine consents granted by the EPA under section 62 of the EEZ Act for activities in the STB. These are:

> 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.

> A marine consent granted to OMV New Zealand Limited on 29 July 2022 to discharge harmful substances Saraline 185V and natural gas condensate into the marine environment from the Māui Platform Alpha associated with drilling side-track development wells authorised by marine consent EEZ000010 (Decision number EEZ000015). This marine consent is due to expire in July 2027.

> A marine consent granted to OMV New Zealand Limited on 4 October 2018 to discharge trace amounts of harmful substances (offshore processing drainage) through the deck drains of Mobile Offshore Drilling Unit(s) (MODU(s)), to the sea, as part of the Exploration and Appraisal Drilling (EAD) Programme (Decision number EEZ100017). This marine consent will expire in December 2025.

- A marine consent granted to Ministry of Business, Innovation and Employment on 11 February 2022 to discharge harmful substances from mining activities (Decision EEZ100020). This marine consent will expire in December 2025.
- A marine consent granted to Beach Energy Limited on 29 March 2023 to discharge of harmful substances from mining activities and discharge harmful substances contained in drilling fluids (Decision EEZ100021). This marine consent will expire in December 2027.
- A marine consent granted to OMV New Zealand Limited on 13 February 2023 for the removal of mooring structures in the Māui field (Decision EEZ100022). This marine consent will expire in June 2050.

These all constitute existing interests in the vicinity of the project area.

### 3.4.8 Existing Resource Consents

Given its location, beyond the geographical area to which the Resource Management Act 1991 ("**the RMA**") applies, there are no existing resource consents in the project area. Further, there are no existing coastal permits for activities in the coastal marine area in the vicinity of the project area. Accordingly, there are not considered to be any existing interests relevant to the project arising from existing resource consents.

### 3.4.9 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 3.8 below.

Table 3.8: 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<br>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.<br>The project area is located approximately 12NMto east of the Ngāti Ruanui statutory acknowledgement area. |
| Te Kaahui o Rauru | Ngaa Rauru Kiitahi Claims Settlement Act 2005<br>Mandated iwi organisation Maori Fisheries Act 2004 | Ngaa Rauru has statutory acknowledgement over the coastal area, which extends west to the Pātea River.<br>The project area is located approximately 12NMto the east 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 | Deed of settlement signed August 2014 under the entity Te Atihaunui a Pāpārangi (Whanganui Iwi).<br>The Te Atihaunui a Pāpārangi rohe is approximately 45km southwest of the project area. |
| Te Runanga o Ngāti Apa Trust | Ngāti Apa (North Island) Claims Settlement Act 2004<br>Mandated iwi organisation Maori Fisheries Act 2004 | The Ngāti Apa statutory acknowledgement area is located approximately 50km to the southwest of the project area. |
| Ngāti Raukawa ki te Tonga Trust | Mandated iwi organisation Maori Fisheries Act 2004 | Deed of settlement signed June 2012 under the entity Raukawa. The Ngāti Raukawa ki te Tonga Trust rohe is approximately 70km southwest of the project area. |
| Te Ohu Tiaki o Rangitāne Te Ika a Māui Trust | Mandated iwi organisation Maori Fisheries Act 2004 | Deed of settlement signed November 2015 under the entity Rangitāne o Manawatu, mandated by Tanenuiarangi Manawatu Incorporated. The Rangitāne |

| Iwi Organisation | Legislation | Additional Comments |
|---|---|---|
| | | o Manawatu rohe is located over 70km southwest of the project area. |
| Ngā Hapū o Ngāruahine Iwi Inc. | Mandated iwi organisation Māori Fisheries Act 2004 | Deed of settlement signed August 2014 under the entity Te Korowai o Ngāruahine.<br>The project area is located approximately 12NMto the east 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 Māori Fisheries Act 2004 | Deed of settlement signed in September 2015 under the entity Te Kahui o Taranaki.<br>The southeastern boundary of the Taranaki Iwi area of interest is Ouri Stream.<br>The project area is located approximately 12NMto the east of the Taranaki Iwi area of interest. |

Due to the separation between the project area and the areas of interest and statutory acknowledgement areas (12Nm 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 effect of the project is discussed in Section 5.11 of this IA.

### 3.4.10 Settlement of Contemporary Claim under Treaty of Waitangi

All of the iwi organisations detailed in Table 3.8 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.

### 3.4.11 Protected Customary Right or Customary Marine Title

Regarding existing interests in respect to customary rights and customary marine titles which have been recognised under the Marine and Coastal Area (Takutai Moana) Act 2011

("**MCA Act**"), there are currently three applications lodged that are relevant to the project area being:

- Ngāruahine - for customary marine title to cover the immediate coastal area which borders their rohe. Taranaki Iwi Trust (which includes Ngāruahine), has applied separately for customary marine title, which includes an area defined as being on behalf of Ngāruahine, out to the CMA/EEZ boundary,; and
- Ngāti Ruanui - for customary title out to the CMA/EEZ boundary i.e., the 12 nautical mile limit which is also a boundary shared with the mining project area; and
- Ngā Rauru Kītahi - for customary title, but the claimed area, as shown by the map which accompanied their application, does not fully extend out to the CMA/EEZ boundary.

As no decision has been made on any of these applications, no formal protection/recognition has yet occurred, therefore, these are not 'existing' interests under part (f) of the EZZ Act definition, but may qualify as existing interests under part (a) of that EEZ Act definition. [99]

[99] [TTR SC decision at [154].

# 4. APPROVALS REQUIRED AND SOUGHT

## 4.1 FTA REQUIREMENTS

TTR is applying under the FTA for marine consents that would otherwise be applied for under the EEZ Act. As detailed in the following sections, the activities for which consents are sought are all discretionary activities under the EEZ Act.

Under section 36(2) of the EEZ Act, marine consents must be obtained before these activities can be undertaken. TTR could apply for consents for these activities under section 38 of the EEZ Act. Section 42(4)(k) of the FTA allows TTR to apply under the FTA for the same consents.

TTR is seeking a 35-year consent term which would normally apply under the EEZ Act with the actual extraction activity taking place over a 20-year period.

### 4.1.1 Marine Consents Required Under Section 20, EEZ Act

Section 20(2) of the EEZ Act lists activities that may not be 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.

Section 20(4) of the EEZ Act lists activities that may not be undertaken in the sea of the EEZ unless they are a permitted activity or authorised by a marine consent in accordance with the Act.

There are a number of activities involved in the recovery of VTM resource and related environmental monitoring that are listed within section 20(2) or (4), as detailed in Table 4.1 below. As the table shows, the activities in section 20(2) and (4) repeatedly capture the same activities but focus on different dimensions of those activities.

None of the listed activities are permitted, as they have not been described in any regulations as permitted activities in accordance with section 35 of the EEZ Act. All are classified as discretionary activities by default under section 36(1)(c) of the EEZ Act, i.e. in the absence of regulations classifying them.

Table 4.1: 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 | > The placement, movement and removal of the IMV anchor, |

| Section of the EEZ Act | Activity for which Marine Consent Required | Project Element |
|---|---|---|
| | demolition of a structure on or under the seabed. | including the anchor spread, on the seabed.<br>> The placement, movement and removal of the SBC on the seabed.<br>> The placement, movement and removal of the grade control drilling equipment on the seabed.<br>> The placement, movement and retrieval of moored environmental monitoring equipment on 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 SBC and by grade control drilling.<br>> 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, including the anchor spread.<br>> The disturbance of the seabed and subsoil associated with seabed material extraction via the SBC, through re-deposition of de-ored sediments, and from grade control drilling.<br>> The disturbance of the seabed and subsoil associated with the placement, deployment, retrieval and mooring of environmental monitoring equipment.<br>> 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. |

| Section of the EEZ Act | Activity for which Marine Consent Required | Project Element |
|---|---|---|
| | | > 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 as a result of the placement, movement and removal of the IMV anchor on the seabed.<br>> The disturbance and damage of the seabed as a result of seabed material extraction via the SBC, the re-deposition of de-ored sediments, and the grade control drilling.<br>> The disturbance and damage of the seabed as a result of the placement, deployment, retrieval and mooring of environmental monitoring equipment.<br>> The disturbance and damage of the seabed 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 to the seabed, and the associated placement, movement and removal of the IMV anchor on the seabed.<br>> The placement, movement and removal of the SBC in the water column above the seabed.<br>> The placement, movement and removal of the grade control drilling equipment in the water column above the seabed.<br>> 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 caused by the IMV and SBC during iron sand extraction activities. |

### 4.1.2 Marine Consents Required Under Sections 20B and 20C, EEZ Act

Sections 20B(1) and 20C(1) of the EEZ Act list discharges of harmful substances that may not be undertaken in the EEZ unless they are a permitted activity or authorised by a marine consent in accordance with the Act.

Sediments from mining activities are a 'harmful substance' for the purposes of the EEZ Act, by virtue of the definition in the EEZ Act, and regulation 4(d) of the EEZ Regs 2015. Discharges of harmful substances made as an integral part of, or as a direct result of, a mining activity are also defined as a 'mining discharge' under the EEZ Act.

Due to these definitions there are a number of discharges involved in the recovery process and related environmental monitoring that are listed within sections 20B(1) and 20C,(1) as detailed in Table 4.2 below.

These discharges are all discretionary activities, as they are discharges of sediment, which regulation 10 of the EEZ Regs 2015 classifies as discretionary.

Table 4.2: Marine Consent Requirements for Discharge

| Section of the EEZ Act | Activity for which Marine Discharge Consent Required | Project Element |
|---|---|---|
| s20B(1) | The discharge of a harmful substance from a structure into the sea or into or onto the seabed of the EEZ | > The release of seabed material (sediments) as a result of the seabed disturbance during grade control drilling activities;<br>> The release of disturbed seabed material (sediments) as a result of the seabed disturbance during the SBC extraction operations; and<br>> De-ored sediments and any associated contaminants |

| Section of the EEZ Act | Activity for which Marine Discharge Consent Required | Project Element |
|---|---|---|
| | | discharged back to the water column from the IMV.<br>> The release of disturbed seabed material (sediments) as a result of taking of sediment and benthic samples associated with environmental monitoring. |
| s20C(1) | The discharge of a harmful substance (if the discharge is a mining discharge) from a ship into the sea of the EEZ or into or onto the continental shelf | > All discharges from the IMV including de-ored sediments and any associated contaminants discharged back to the water column from the IMV. |

TTR has identified that there may also be some very low level residual contaminant discharges, in the form of synthetic biodegradable hydraulic fluid (TOTAL BIOHYDRAN TMP Hydraulic Oil or a similar product (refer to **Appendix 4.1** (Material Safety Data Sheet)) from the SBC and other operational equipment, during the recovery operations.

When considering the discharge of this material, as the biodegradable fluid is a synthetic material 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 synthetic and hydraulic oils are not identified in 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, nor does it require a marine discharge consent or a marine consent for that activity under the EEZ Act.

On this basis, any discharges of residual biodegradable hydraulic fluids from the SBC 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 4.1.3 below.

### 4.1.3 Activities not Regulated by the EEZ Act

In addition to the above, there are activities to be conducted as part of the project that are not regulated under the EEZ Act. Marine consent cannot be sought for these activities, but many are described in this IA as they are relevant to understanding the effects of the project as a whole, and (in some instances) the regulatory roles of other marine management regimes. This is consistent with the requirements to take into account the effects of activities that are not regulated under the EEZ Act (under section 59(2)(b)(i)) and the nature and effect of other marine management regimes (under section 59(2)(h)).

For the purpose of this application, the activities associated with the project that are not regulated under the EEZ Act include:

- 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 SBC 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; and
- Antifouling and biosecurity activities.

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 IA for a marine 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 5 of this IA.

# 5. ASSESSMENT OF EFFECTS

## 5.1 INTRODUCTION

This section of the IA identifies and evaluates the effects associated with the establishment and operation of the project. This covers:

> The regional and national benefits of the project;

> The effects of the regulated activities (as identified in sections 4.1.1 and 4.1.2 above) on the environment and on existing interests, which are required to be identified by clause 4, schedule 10 of the FTA and section 39(1)(d) of the EEZ Act; and

> The effects of the activities not regulated under the EEZ Act that are identified in section 4.1.3 above.

The effects assessments are informed by technical assessments and briefs of evidence (including those, where relevant, from the 2016 and 2024 EPA processes) which are attached separately in a supplementary technical package to this IA.

The effects assessment, including cumulative effects, are summarised and presented in the following sections:

> Economic effects;

> Sedimentation and optical water quality;

> Coastal processes;

> Ecology and primary productivity;

> Fished species;

> Seabirds;

> Marine mammals;

> Noise;

> Human health effects associated with the marine discharge activities;

> Visual, seascape and natural character;

> Air quality;

> Existing interests;

>> Other matters including, Environmental Monitoring Activities; Anchor Deployment and Positioning, Unplanned Oil / Fuel Spills; and Jack Up Developments.

When evaluating the effects of the project on benthic ecology and marine biota, many factors must be taken into account including the characteristics of the habitat or biota affected, the scale of the effect (including its spatial and temporal extent) and the extent and duration of any recovery or rehabilitation. 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.

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.

However, the project area and adjacent areas in the STB are one of the best studied shallow exposed shelf marine environments in New Zealand, with a wealth of studies generated by TTR that add to the body of existing information. 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 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.

Section 85(3) of the FTA requires decision-makers to consider adverse environmental effects in the context of their proportionality to a project's regional or national benefits. Part of the decision-making exercise for this application is, therefore, reconciling this project's localised, almost uniformly minimal adverse environmental effects, with its manifest regional and national economic significance.

The assessments summarised in this section of the IA support a conclusion that the project's potential adverse environmental impacts are transient and short-term and minor beyond the very local scale. Overall, the effects of the project are demonstrably not out of proportion with its significant regional and national benefits.

### 5.1.1 Assessment Process

The 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 5.1 below for classifications). The assessment also includes information on threshold levels, sensitivity of organisms to the potential effects and recovery times from the project.

Table 5.1: 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 total habitat area | Possibly detectable with 1-5% change in population size or community composition and no detectable impact on dynamics of specific populations | Rapid recovery would occur if activity stopped to 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 |

## 5.2 ECONOMIC EFFECTS

### 5.2.1 Introduction

NZIER (2025)[4] provides an economic impact analysis of the project for three study areas to 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.

### 5.2.2 Assessment Methodology

The NZIER 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 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.

### 5.2.3 Summary of Economic Effects

#### 5.2.3.1 Generated Economic Activity during Construction Phase

TTR estimates that 6% of its NZ$1 billion capital expenditure will be spent in New Zealand and the remaining spent offshore. The direct capital expenditure in New Zealand by the project will be approximately $55 million with 72% spent regionally, and about 18% locally. The New Zealand capital expenditure breakdown locally, regionally and nationally is set out in Table 5.2.

**Table 5.2: The Project's Capital Expenditure in New Zealand (NZ$M)**

| Industry | South Taranaki/ Whanganui | Taranaki Region/ Whanganui | New Zealand |
|---|---|---|---|
| Advertising, market research and management services | $0.12 | $3.73 | $15.55 |
| Air and space transport | 0 | $0.21 | $1.06 |
| Travel agency and tour arrangement services | 0 | $0.06 | $0.06 |
| Exploration and other mining support services | 0 | $1.16 | $1.16 |
| Construction services | 0 | $1.75 | $3.50 |
| Central government | 0 | $0 | $10.86 |
| Scientific, architectural and engineering services | $3.52 | $3.52 | $3.52 |
| Adult, community and other education | $6.23 | $6.23 | $6.23 |
| Fabricated metal product manufacturing | 0 | $9.34 | $9.34 |
| Transport equipment manufacturing | 0 | $3.76 | $3.76 |
| **Total** | **$9.87** | **$29.76** | **$55.04** |

Source: TTRL, NZIER estimates

TTRL forecast that NZ$55 million will be spent on capital for the initial setup of the Project. This expenditure results in a NZ$62 million increase in GDP and an additional 459 jobs (measured by headcount). The projected expenditure breakdown locally, regionally and nationally for the setup phase at a national level is set out in Table 5.3 below.

Table 5.3: Economic Impact of the Setup Phase at a National Level

| | Direct | Direct + Indirect | Direct + Indirect + induced |
|---|---|---|---|
| Output | $55.04 | $96.27 | $127.74 |
| GDP | $25.81 | $45.53 | $62.21 |
| Employment | 221.48 | 357.48 | 459.11 |

Source: NZIER

### 5.2.3.2 Generated Economic Activity (Operations)

TTR estimates that 72% of its annual operating expenditure will be spent in New Zealand and the remaining spent offshore. The annual direct expenditure in New Zealand by the project will be approximately $238 million with 98% spent regionally, and about 19% locally. The projected expenditure breakdown locally, regionally and nationally is set out in Table 5.4 below.

Table 5.4: Project Direct Operational Expenditure in New Zealand, Per Annum (NZ$M)

| Industry | South Taranaki/ Whanganui | Taranaki Region/ Whanganui | New Zealand |
|---|---|---|---|
| Exploration and other mining support services | $27.86 | $99.58 | $99.58 |
| Basic material wholesaling | 0 | $52.37 | $52.37 |
| Fabricated metal product manufacturing | $8.04 | $16.09 | $16.09 |
| Other transport | $0.83 | $23.78 | $23.78 |
| Scientific, architectural and technical services | $4.10 | $13.49 | $13.49 |
| Health and general insurance | 0 | $0.92 | $4.61 |
| Legal and accounting services | $3.08 | $15.41 | $15.41 |
| Advertising, market research and management services | $0 | $12.33 | $12.33 |
| **Total** | **$43.92** | **$233.97** | **$237.65** |

#### 5.2.3.3 Economic Impact Analysis

***National - New Zealand***

The analysis suggests that the project will generate NZ$265 million in GDP and employ 1,365 people (as measured by headcount) 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 5.5.

Table 5.5: Economic Impact of the Project at a National Level

| New Zealand | Direct | Direct + Indirect | Direct + Indirect + induced |
|---|---|---|---|
| Output | $238 | $444 | $568 |
| GDP | $104 | $200 | $265 |
| Employment (FTEs) | 359 | 965 | 1,365 |

The operations budget suggests that NZ$238 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$104 million in GDP and directly employ 359 people.

To put this into context, the New Zealand economy has an estimated GDP of $224,6396 billion and employs about 2.52 million people.

***Regional - Taranaki / Whanganui***

The project is expected to generate about NZ$222 million in GDP and employ 1.123 people (directly, indirectly + induced) 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 5.6.

Table 5.6: Economic Impact of the Project on the Regional Level (Taranaki / Whanganui)

| Taranaki / Whanganui | Direct | Direct + Indirect | Direct + Indirect + induced |
|---|---|---|---|
| Output ($m ) | $234 | $385 | $479 |
| GDP ($m ) | $102 | $171 | $222 |

| Taranaki / Whanganui | Direct | Direct + Indirect | Direct + Indirect + induced |
|---|---|---|---|
| Employment (FTE s) | 356 | 799 | 1,123 |

The operations budget indicates that NZ$234 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$102 million in GDP and directly employ 356 people.

To put this into context, the Taranaki / Whanganui economy has an estimated GDP of NZ$25.6 billion and employs about 74,400 people.

***Local - South Taranaki / Whanganui***

The project is expected to generate NZ$37 million in GDP and employ 224 people (directly, indirectly and induced) 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 5.7.

Table 5.7: Economic Impact of the Project on the Local Level (South Taranaki / Whanganui)

| South Taranaki / Whanganui | Direct | Direct + Indirect | Direct + Indirect + induced |
|---|---|---|---|
| Output ($m ) | 44 | 66 | 81 |
| GDP ($m ) | 19 | 29 | 37 |
| Employment (FTE s) | 103 | 170 | 224 |

The operations budget suggests that NZ$44 million is expected to be spent directly on activities and businesses based in South Taranaki / Whanganui. This expenditure is estimated to directly generate NZ$19 million in GDP and employ 103 people.

To put this into context, the South Taranaki / Whanganui economy has an estimated GDP of NZ$10.8 billion and employs about 32,000 people.

#### 5.2.3.4 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 prices of iron ore, $V_2O_5$ and $TiO_2$ or intermediate fuel oil (IFO) used to operate the vessels, specifically the IMV and FSO vessels. The price of iron ore, $V_2O_5$ and $TiO_2$ or IFO 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, which will continue for as long as the activities continue.

Price rises in the price of iron ore, $V_2O_5$ and $TiO_2$ 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 is between $36 million and $39 million in the Project's first seven years of extraction, increasing to about $54 million per annum thereafter. The project would contribute approximately NZ$854 million per annum to New Zealand exports.

In comparison, petroleum, minerals and coal royalties are about NZ$221 million of which minerals accounted for NZ$14 million (6.6%). With the Project in operation, TTR's royalty payment would increase minerals' contribution to total petroleum, minerals and coal royalties by 20 to 25 percent. This is based on only iron ore concentrate sales of 4.9 million tonnes per year and some 19,000 tonnes of vanadium from the VTM concentrate at metallurgical recovery rates of 77 percent. The estimates do not include sales from titanium, which has the potential to make a material contribution to the Project's future annual revenue stream.

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

***<u>Exports</u>***

Iron sands exports from the project of NZ$854 million per annum would place it in the top 12 items exported from New Zealand. Combined with iron and steel, the category would have exports of close to NZ$1.69 billion which would be about 2.6% of the total exports.

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.

***<u>Employment</u>***

The project will directly require 359 people (nationally) to operate the offshore vessels, and 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.

All of these roles will be New Zealand-based. About three-quarters of these will be based outside of the Taranaki region, while about 20% 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.

***Intermediate Fuel Oil Supply***

A third of the cost for the project is used for IFO380 (which falls under the HFO classification) used to operate the vessels, specifically the IMV and FSO vessels, with an estimated 7,000 tonnes required per month. TTR will source IFO through its supplier in New Plymouth, however, this is imported by a third party supplier in Singapore and therefore exposed to global price volatility and exchange rates. Over the last three years, the price of IFO380 fluctuated between US $349 per tonne and US $680 per tonne, with the average price in the December 2024 quarter being US $450 per tonne.  Sensitivity analysis indicates that the changes in these prices will have a small variability in royalty prices which are more sensitive to volatility in the iron ore price than to the exchange rate or the IFO price.

#### 5.2.3.5 Qualitative Impacts

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

***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 5.2.3.5 (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.

***Social Benefits***

A Social Impact Assessment [100] was completed to inform the application, the main findings on the potential social impact effects of the project are summarised below.

### Employment

The project is predicted to create approximately 300 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.

### 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.

### 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.

[100] Corydon Consultants Limited. Social Impact Assessment of Trans-Tasman Resources Ltd Iron Sand Mining Project – January 2016.

## 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 noting these conditions are provided on an Augier basis, 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 pre-commencement 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.

## 5.3 SEDIMENTATION AND OPTICAL WATER QUALITY EFFECTS

### 5.3.1 Introduction

It is inevitable that the recovery of iron sands from the project area will have some impacts on levels of suspended sediment and therefore on optical water quality near the seabed, and in the water column. Although the immediate environment (i.e. where the extraction and re-deposition operations are occurring) will be temporarily impacted, those effects are localised, and it is the spatial and temporal extent of the effects beyond the immediate environment that require a more detailed assessment.

### 5.3.2 Sedimentation and Sediment Plume Effects

#### 5.3.2.1 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. A sediment plume model was prepared by NIWA for TTR's initial application for marine consents in 2013.

A key work-stream identified for TTR's subsequent 2016 application was to gain more certainty over the way discharged de-ored sediment behaves in the near-field, 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 HRWs near-field analysis [101] were taken into account in the updated sediment plume modelling undertaken by NIWA in 2015 [102].

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[101] H.R. Wallingford, 2014. "Support to Trans-Tasman Resources – Independent review of plume modelling" DDM7316-RT001-R01-00. August 2014.

[102] Hadfield, M.G. and Macdonald, H.S. (2015). Sediment Plume Modelling, 117 p. https://www.epa.govt.nz/assets/FileAPI/proposal/EEZ000011/Applicants-proposal-documents/8e6049938f/NIWA-Sediment-Plume-Modelling-Report-Full-version.pdf

Subsequently, to understand the effect of uncertainties of input parameters on the model results, a "worst case scenario" was modelled [103]. Five uncertain parameters [104] such as the percentage of ultra fine materials released into the water column were set to a value within their error range but chosen to deliberately enhance the plume.

#### 5.3.2.2 Assessment Methodology

***Bench Testing of Sediment Samples***

HRW performed bench testing of sediment samples, which has 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.

HRW was supplied with three samples of sediment that was collected from below the seabed in the Sediment Modelled Domain ("**SMD**") shown in Figure 5.1. 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.

[103] Macdonald, H.S and Hadfield, M.G. (2017). South Taranaki Bight Sediment Plume Modelling Worst Case Scenario, 51 p. https://www.epa.govt.nz/assets/FileAPI/proposal/EEZ000011/Evidence/ac41266d7d/TTR-Appendix-to-HRW-Report.pdf

[104] See memo from Dr Dearnaley on 22nd February 2017 for a summary of parameters varied: https://www.epa.govt.nz/assets/FileAPI/proposal/EEZ000011/Evidence-Applicants-evidence/b877c5d2fb/TTR-Worst-case-parameterisation-for-source-term-for-use-in-sediment-plume-modelling.pdf

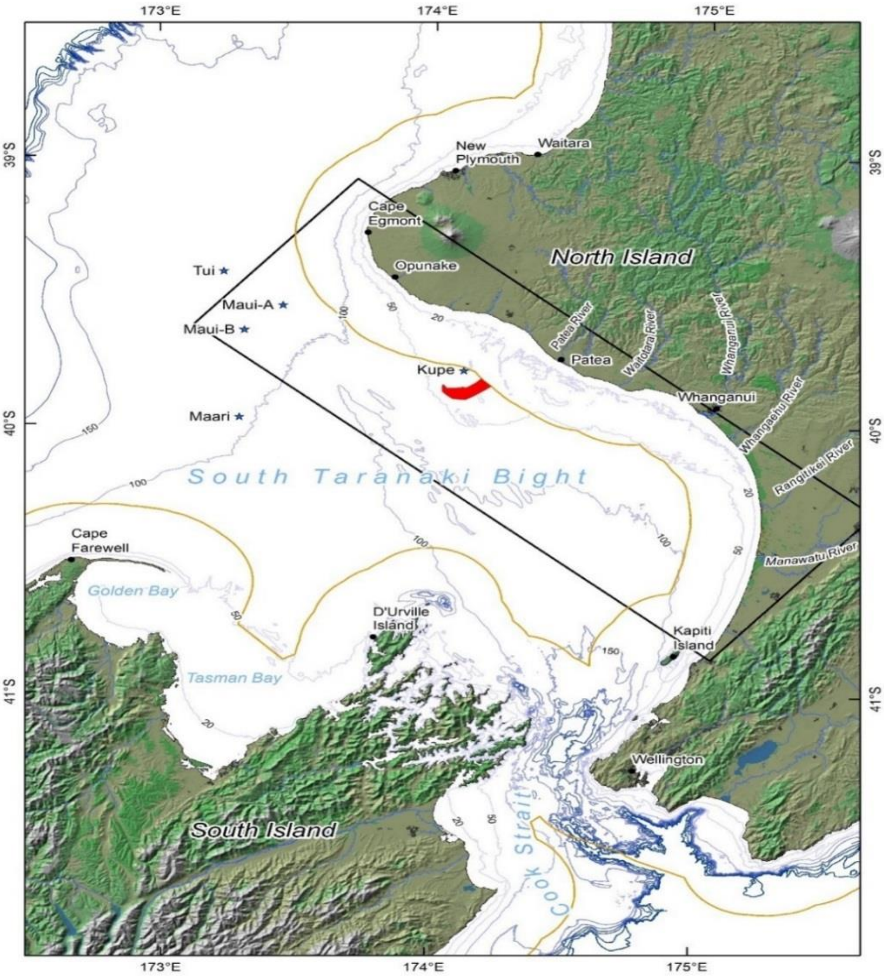


Figure 5.1: Approximate project area within the Sediment Modelled Domain.

***<u>Flocculation and Sediment Settling Rates</u>***

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 38µm falls rapidly to the seabed;

> Approximately 33% of fine fraction material less than 38µm falls at speeds of less than 0.2mm/s;

> Approximately 15% of fine fraction material less than 38μm falls at speeds of less than 0.1mm/s; and

> Approximately 0.5% of fine fraction material less than 38μm falls at speeds of less than 0.005mm/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 to 0.3Pa, rather than the 0.1Pa 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 was updated and re-run in 2015 to account for HRW's near-field findings. 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. [105] The model has been used to track and display sediments at concentrations that are frequently too small to be seen, detected or measured in the field. The model grid resolutions vary between the domains - 2km grids for the outer domains and 1km for the inner domains (with the option of using a 500m resolution). The 500m resolution is used to investigate the sensitivity of the model results to the grid resolution.

The model required the input of those parameters outlined below:

> Median grain size;

> Grain density;

> Porosity (of the seafloor sediment bed);

> Sediment class;

[105] 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 in terrain-following coordinates: Formulation and skill assessment of the Regional Ocean Modelling System"*. Journal of Computational Physics 227(7): 3595–3624.

- Background sediments (river and sea derived);
- Input rates;
- Proportion of background sediment sizes;
- Settling velocity (of sediments in the water column);
- Critical bed shear stress for erosion;
- Erosion rate parameter;
- Iron sand recovery derived sediments;
- Hydro cyclone overflow discharge; and
- De-ored sediment discharge.

The HRW assessment of near-field processes and plume around the discharge is based on most fine sediment fractions settling at 10mm/s 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 HRW's 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 in 2015 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 deepest edge ("**Location B**"). The analysis was based on the sediment being introduced over 1,000 days and the reporting has focused on the median ($50^{th}$ percentile, i.e. the suspended sediment concentration exceeded 50% of the time) and $99^{th}$ percentile (i.e. the suspended sediment concentration exceeded just 1% of the time). The area being considered was broken into three regions:

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

The majority of the discussion on the sedimentation effects assessment is based on effects that occur in the SMD, as shown in Figure 5.1. This SMD covers approximately half of the STB (approximately 13,300km$^2$) and covers the area where any potentially significant impacts from sediment discharged by the project could occur.

As part of the reconsideration of TTR's 2016 application, which is described in section 1 of this IA, NIWA reconsidered in 2023 whether the sediment dispersion model should be further updated.  It was concluded that the only available updates (being updated model code and atmospheric forcing) would not substantially alter the results presented in the previous assessments, as those results are driven by large scale oceanic currents and tides which updates would not substantially change.

#### 5.3.2.3 Findings on Sediment Plumes

The modelled background levels of suspended sediment concentration are shown in Appendices 5.1 and 5.2. By way of summary, the sediment plume is shown to predominantly travel in an east-southeast direction from its source. The suspended sediment concentration (SSC) resulting from mining operations is greatest within a few kilometres of the mining site and reaches 8.25mg/L at the surface and 45mg/L near the seafloor for the $99^{th}$ percentiles (where the 99th percentile represents the more extreme values). These values are larger than the surface background value (<10mg/L) and comparable for near bottom background values (<150mg/L). The magnitude of the plume reduces rapidly with distance from the mining location whilst the background sediment values increase. In the surface for the 99th percentile the plume reduces to 2.8mg/L 20km away from the source, and near the seafloor the value reduces to 6-7mg/L near Whanganui. These values are less than background sediment concentration in the surface (5mg/L at the mining site, increasing to >200mg/L at the coast) and bottom (200mg/L at the mining site, increasing to >1000mg/L near the coast).

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 20mg/L and the $99^{th}$ percentile is typically up to 100mg/L close to the coastline (with a maximum over 200mg/L close to major rivers) (refer to **Appendix 5.1**). The median concentrations at the seabed nearshore are over 100mg/L and $99^{th}$ percentile levels over 1,000mg/L (refer to **Appendix 5.2**).

Median background surface concentrations around the project site are typically 0.4mg/L closer to the shore and approximately 0.05mg/L in more offshore locations. Near-bottom suspended sediment concentrations are typically less than 1mg/L, with a $99^{th}$ percentile of less than 10mg/L. Levels of suspended sediments tend to be higher in winter 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 to 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 Appendix 5.3 respectively.

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

The net differences between 'background' and 'extraction plus background' at the locations 2kms, 8kms and 20kms away from the iron sand extraction location within the project area are:

> An increase at the 2km location in median suspended sediment concentrations from 0.4 to 1.5mg/L and an increase at the 99$^{th}$ percentile from 5.5 to 6.8mg/L;

> An increase at the 8km location in median suspended sediment concentrations from 0.5 to 1.3mg/L and an increase at the 99$^{th}$ percentile from 6.9 to 7.1mg/L; and

> An increase at the 20km location in median suspended sediment concentrations from 0.9 to 1.4mg/L and an increase at the 99$^{th}$ percentile from 10.5 to 10.8mg/L.

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 Figure 5.2 and Figure 5.3 respectively.

Figure 5.2 shows that suspended sediment concentration in the plume will be very low, with suspended sediment concentrations of 1.45mg/L around Location A. The top panel shows background SSC; middle panel shows mining-derived SSC; and bottom panel shows background plus mining-derived SSC. An open circle of 2km radius in the middle and bottom panels indicates the source location of the sediment plume.

The comparison of background, with background plus iron sand extraction activities concentrations, shows a slight movement offshore of the 1mg/L threshold of about 6km outwards over the Pātea Shoals. The ecological implications of such differences are discussed in Section 5.5 of this IA.

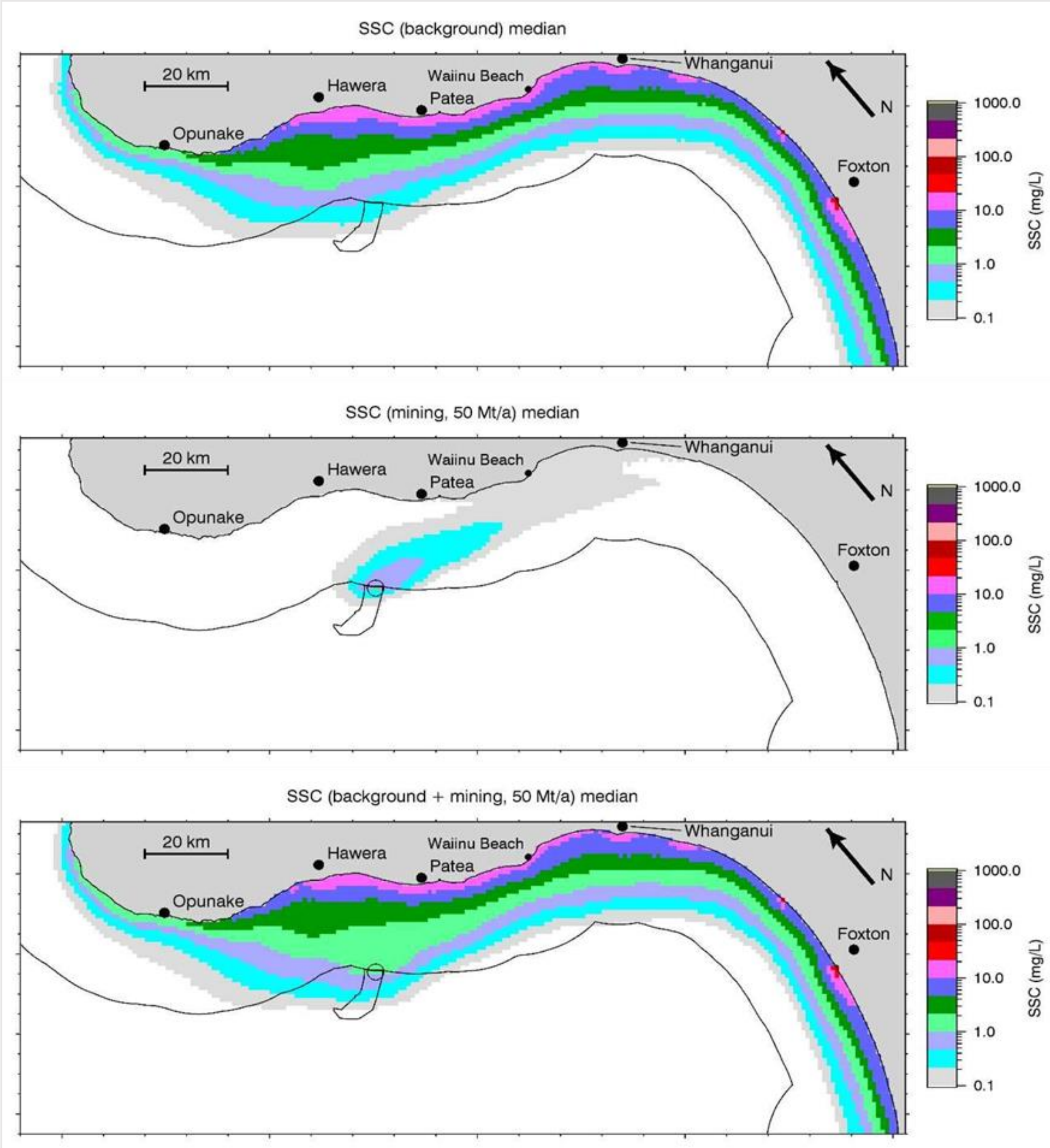


**Figure 5.2: Median near-surface concentration of suspended sediment from mining (50Mt/a) at source Location A.**

Figure 5.3 shows that median background suspended sediment concentrations in the near-bottom waters can be in excess of 200mg/L close to shore and 1,000mg/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 - 3km of the source.

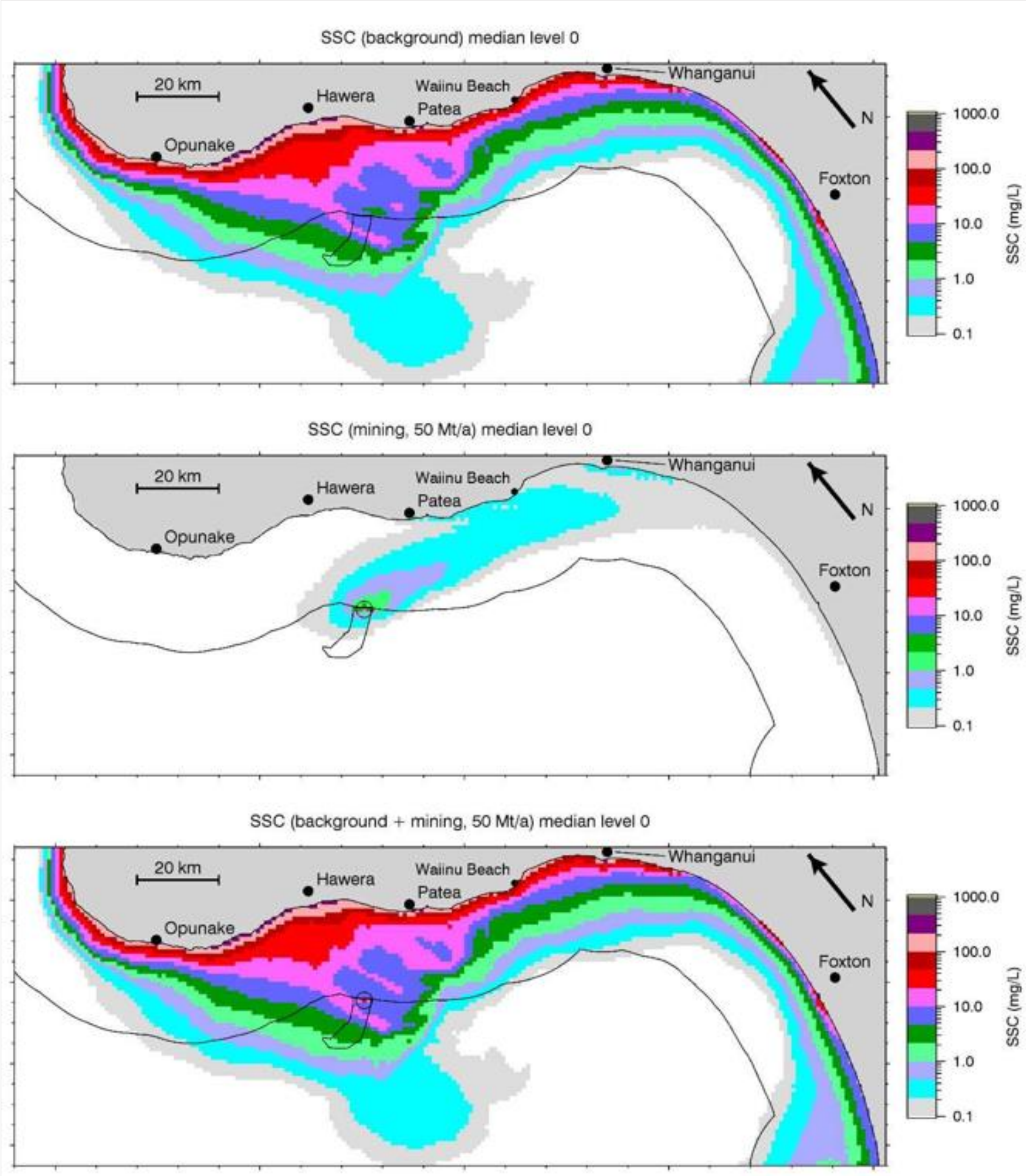


**Figure 5.3:** **Median near-bottom concentration of suspended sediment from mining (50Mt/a) at source Location A. Background SSC (top panel); mining-derived SSC (middle panel); and background plus mining-derived SSC (bottom panel).**

Although the modelling shows the sediment plume abutting the coast between Pātea and Foxton, concentrations are only 0.1 to 0.2mg/L. These levels are indistinguishable from background, naturally occurring levels.

The highest surface suspended sediment concentrations for Location A are 1.45mg/L (median) and 8.2mg/L (99th percentile) at the source, while 20km down current of the source the surface concentrations are predicted to be 0.35mg/L (median) and 2.8mg/L (99$^{th}$ 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.

TTR notes that the primary form of presentation of the results is via graphs with a logarithmic colour scale running from 0.1 to 1000mg/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 0.1mg/L, where background concentrations offshore are typically ~ 0.5mg/L or more, with the higher threshold of 0.3mg/L that was previously adopted resulted in 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.

#### 5.3.2.4 Sedimentation Effects as a Result of Re-deposition

The extent and thickness of sediments re-deposited onto the seafloor after their release into the water column as a result of the proposed mining operation is an important environmental consideration as thick layers of sediment have the potential to smother marine habitats.

NIWA modelled the levels of re-deposition of suspended sediments 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 1 to 2km 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 to 0.05mm over five days. Such levels are indistinguishable from what occurs naturally, and it is only at the source of the plume where ‘background plus extraction’ sediment deposition rates are distinguishable from 'background’ rates.

Erosion, dispersion and resettlement of sediments from the excavated pits are likely to be at very low rates, with rates of less than 0.01mm over two years up to 10km away from the pit area.

The worst-case modelling indicates slightly higher deposition from the mining plume. The deposition footprint, as with the original simulations, can be distinguished from the background only within a few kilometres of the source.

Overall, deposition rates of mining derived suspended sediments beyond the mining location will be insignificantly small relative to the naturally occurring background levels of sediment deposition in the SMD.

#### 5.3.2.5 Sediment Plume Model Uncertainties

Sediment plume models such as those used by NIWA have uncertainties and errors. However, these models can still be used to understand the effect of the mining sediment plume on the system if the effect of the uncertainties on the model results can be quantified and understand. There are two models that are coupled together and each of these models produce their own errors and uncertainties: (a) a circulation model that calculates where the currents move the sediment and (b) a sediment model that calculates movement of sediments in the water column (e.g., sediment sinking or being resuspended off the ocean bottom under certain conditions).

It is simple to assess the accuracy of the circulation model as the circulation can be directly measured. This assessment is presented in Figures 3.1 to 3.5 of Hadfield and Macdonald[102] and these show that the circulation model only has small errors. This comparison shows that the model is accurate enough to produce a reliable estimate of the movement of sediments as carried by the currents.

The sediment model can be split between the background sediments and the mining sediments.

**(a) Background Sediments**

The background sediments are assessed in Figures 4.1 to 4.13 of Hadfield and Macdonald[102]by comparing measured and remotely sensed estimates of background sediments with modelled background sediments. This shows that the model underestimates the background sediments in some regions and overestimates them in other regions. These over- and under- estimation errors are up to a factor of about 2 for inshore regions which is small compared to the variability in sediments. Background sediment concentrations increase with distance from the mining site to the coast as shown in Figures 4.7 to 4.9 of Hadfield and Macdonald[102]. There is a band of elevated concentrations near the coast with a width of 5 to 20km with sediment concentration of 2 to 60mg/L. The concentrations in the mining plume tend to be smaller by comparison and these concentrations become very small (at least a factor of 10 less) compared to background errors as the plume approaches the coast. When the concentrations in the mining plume are much less than the errors, the errors will not affect results which show that the mining plume is small compared to background. The model increasingly underestimates the background sediment concentrations with increasing distance offshore, probably due to a lack of sediments coming into the model domain through the boundaries. This error means that all background concentrations are derived only from resuspension and riverine inputs and has the effect of making the mining plume appear to have a greater impact compared to background sediments.

**(b) Mining Sediments**

It is harder to assess the model's representation of the mining plume as observations are not possible unless mining proceeds. A large uncertainty in the sediment model comes from the input parameters. To understand the effect of uncertainties of input parameters on the model results, a "worst case scenario" was performed. Five uncertain parameters such as the percentage of ultra fine materials released into the water column were set to a value within their error range but chosen to deliberately enhance the plume. The parameters used in the worst-case scenario were selected by the sediment expert working group associated with the 2017 hearing.

This worst case scenario differs from previous simulations as it uses a time-varying source term. The new source term assumes varying fines content in the material to be mined and also takes into account increased sediment release during mound building and an increase in sediment release during periods of high waves. The downtime for the mining operations has also been increased from 20% to 29% following new information on operational restrictions from TTR."[103].

The new source terms intermittently increase the amounts of fine sediments released into the water column at the mining site. The results from the worst-case scenario did not show a large difference from the original model runs. The best way to visualise the effects of the change in parameters on the mining plume is to compare Figures 5.8 to 5.12 and 5.25 to 5.29 from Hadfield and Macdonald[102] with Figures 3.16 to 3.19 and 3.24 to 3.27 of Macdonald and Hadfield[103]. In the worst-case scenario, the plume extends slightly further than the plume produced in Hadfield and Macdonald[102]. For example, the medium 1mg/L threshold moves 6km seawards from that produced in Hadfield and Macdonald[102]. There is also an increase in the concentration of the plume in some regions during infrequent events (99th percentile). See Macdonald and Hadfield [103] for a complete description of the differences between the worst-case scenario and the original plume produced in Hadfield and Macdonald [102].

Based on the analysis of uncertainties summarised above, the sediment plume model is considered to be fit for purpose, and provides a reliable basis for the assessment of effects of the sediment plume on the environment. [106]

#### 5.3.2.6 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 it is concluded that suspended sediment concentrations from the project will be moderate, near to the project area. 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.

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.

### 5.3.3 Optical Water Quality Effects

#### 5.3.3.1 Introduction

The optical effects of the project have been assessed in the Aquatic Environmental Sciences ("**AES**") assessment [107] which incorporates elements of the sediment plume modelling undertaken by NIWA. Subsequently, NIWA provided an updated assessment of optical water quality impacts [108] based on the worst-case sediment plume modelling[103].

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.

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[106] [Refer to Helen Macdonald statement of expert evidence, 19 May 2023 at [29]].

[107] Aquatic Environmental Sciences - Trans-Tasman Resources Ltd Consent Application: Ecological Assessments – January 2016

[108] Pinkerton, M. (2017). Optical effects of proposed ironsand mining in the South Taranaki Bight region - worst case update. NIWA Client Report No: 2017089WNrev1, 45 p.

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.

#### 5.3.3.2 Transects

To analyse the effects of the project on the optical water quality of the SMD, three descriptive transects were placed through the main axis of the sediment plume as shown in Figure 5.4. They can be described as follows:

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

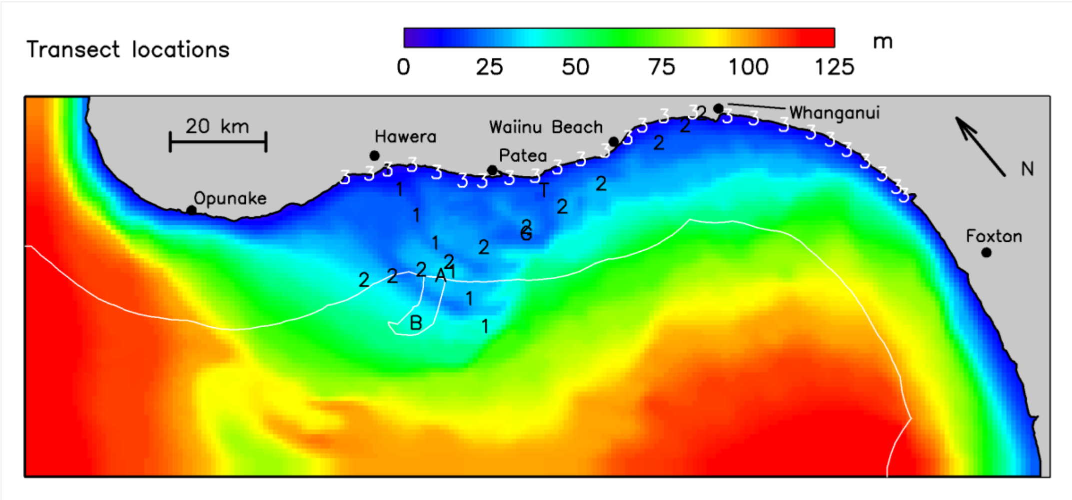


**Figure 5.4: Descriptive transects (1, 2 and 3) to show optical effects underlain by SMD bathymetry**

Note: A: Mining site (A) in plume modelling; B: Mining site (B) in plume modelling; G: Graham Bank; T: The Traps.

#### 5.3.3.3 Euphotic Zone Depth

The euphotic zone depth is the depth at which the downwelling irradiance has fallen to 1% of its surface value. A reduction in euphotic zone depth implies less light is available for primary production.

Overall, euphotic zone depths are greater in clear deeper water, further from the coast, and lesser over turbid shallower water and near the coast. This is a result of greater concentrations of suspended sediments, coloured dissolved organic matter and phytoplankton in shallower water.

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, the optical effect reduces as the distance from the extraction area increases.

The modelling shows that with mining at site A or B, the median euphotic zone depths along transects 1 (north-south) and 2 (east-west) are considerably shallower than in the background case. In contrast, the mining is predicted to have only a very small effect on euphotic zone depth for transect 3 (alongshore).

Figure 5.5 and Figure 5.6 show the results of the optical water quality modelling.

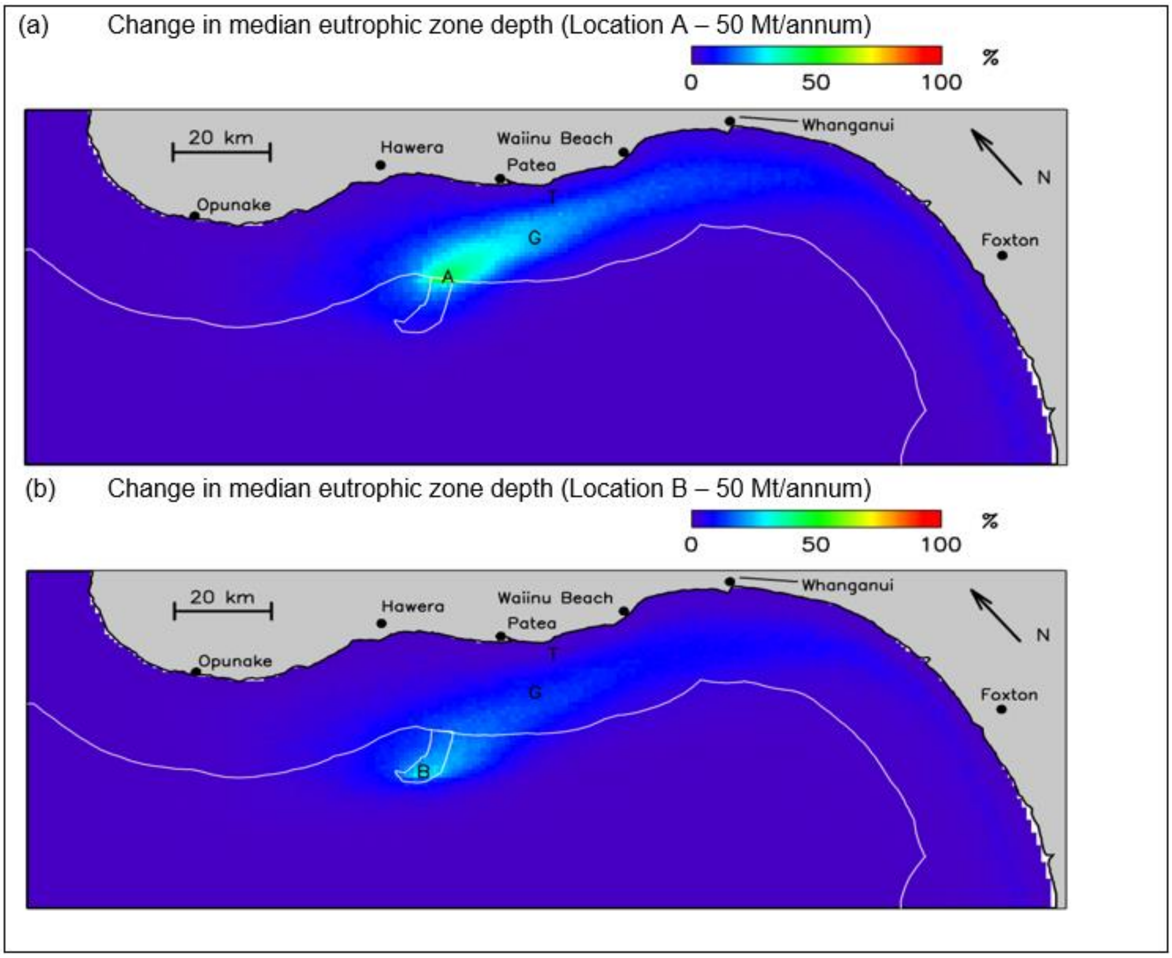


Figure 5.5: Modelled reduction in median euphotic zone depth (%) when mining at Location A (top panel) and Location B (bottom panel) using 2015 sediment transport model. G: Graham Bank; T: The Traps.

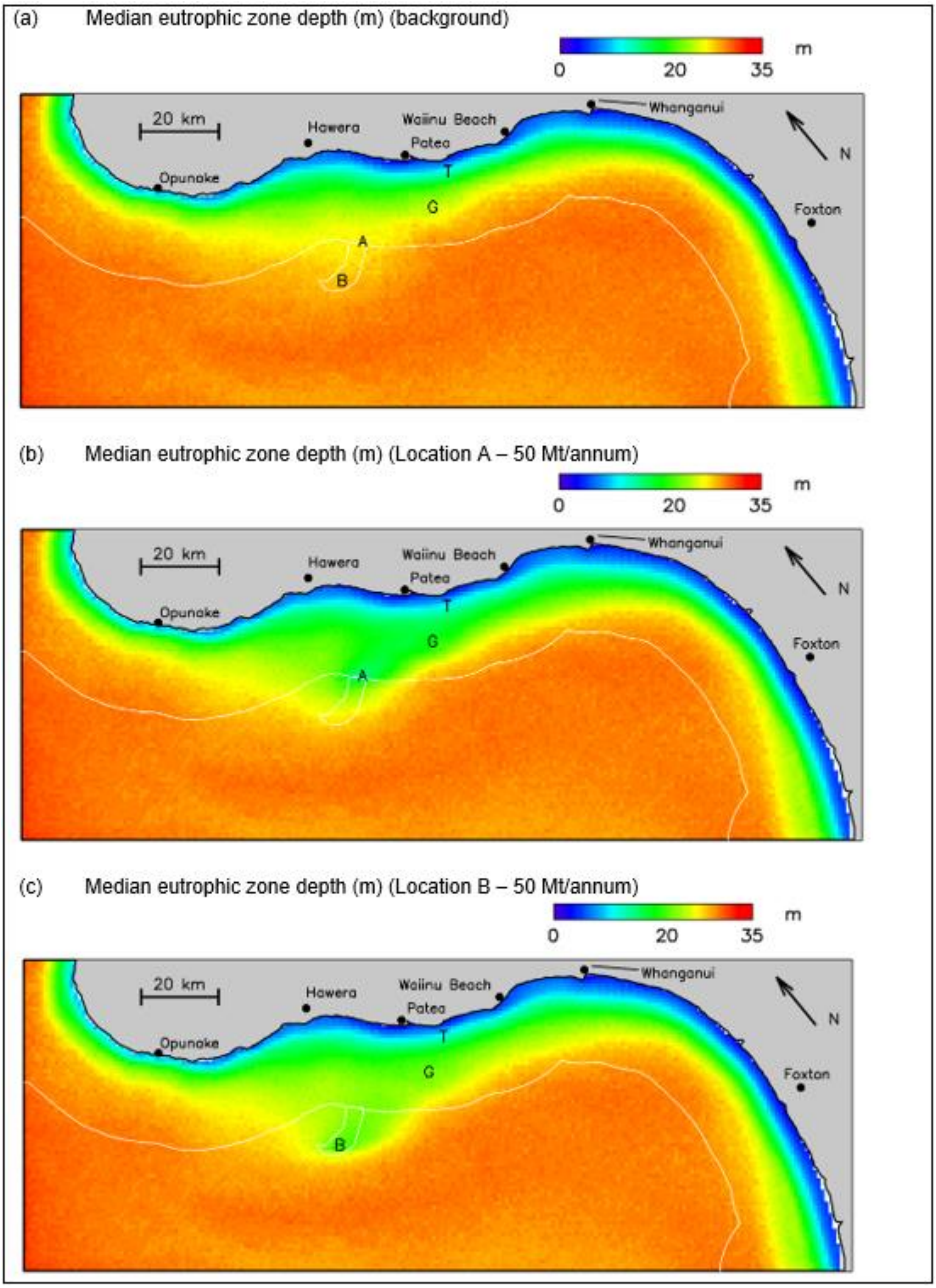


Figure 5.6: Modelled euphotic zone depth at Background Levels (top panel), mining at Location A plus background (middle panel), and mining at Location B plus background (bottom panel) using 2015 sediment transport model. G: Graham Bank; T: The Traps.

#### 5.3.3.4 Horizontal Visibility

Background horizontal visibility in the midwater tends to be low near the coast, with higher visibilities about 10km from the coast (first panel, Figure 5.8).

Median horizontal visibility in the midwater will change due to mining, consistent with changes to euphotic zone depth (Figure 5.7and Figure 5.8, second and third panels).

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.

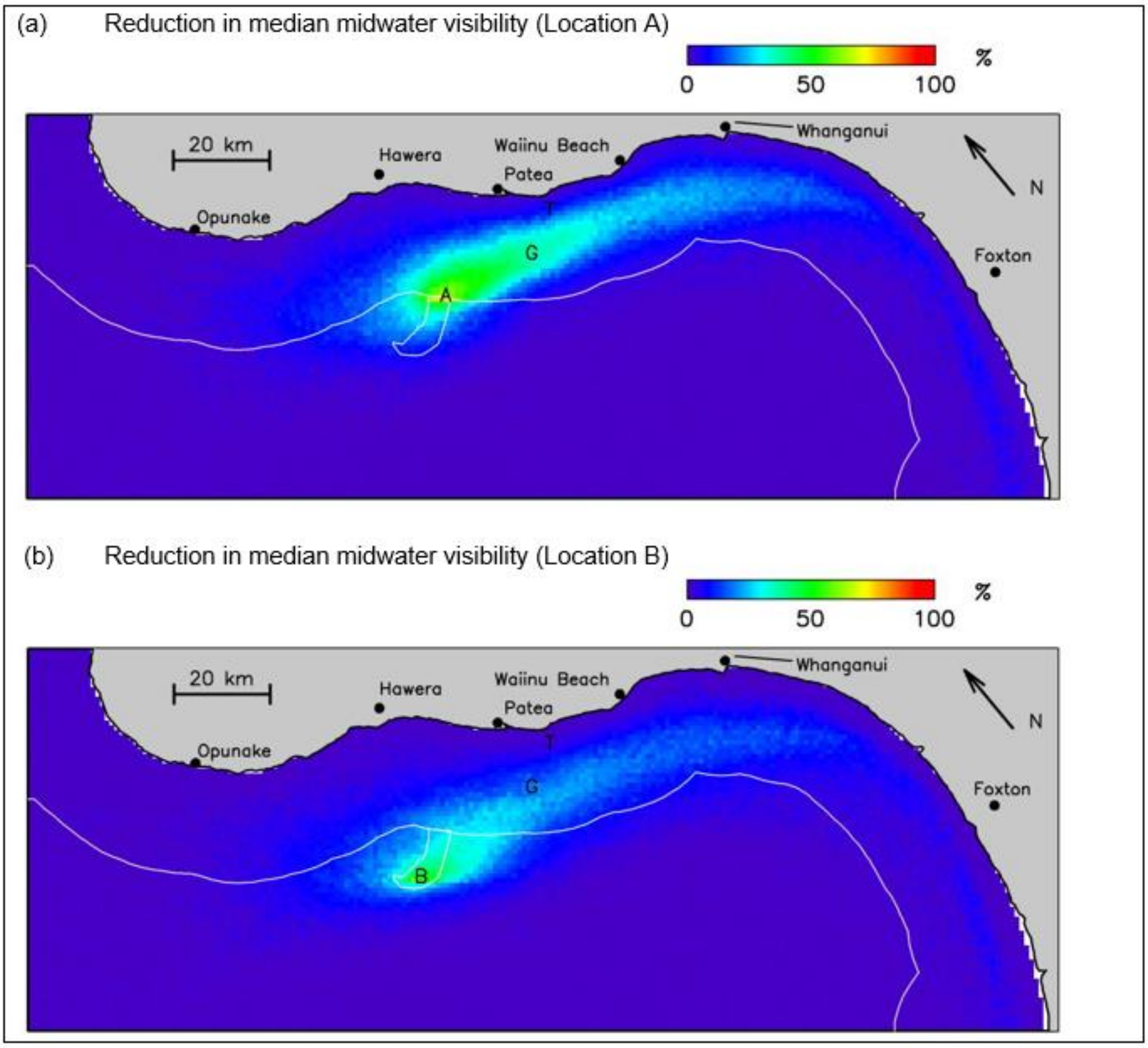


Figure 5.7: Modelled change in midwater horizontal visibility at Location A (top panel) and Location b (bottom panel). G: Graham Bank; T: The Traps.

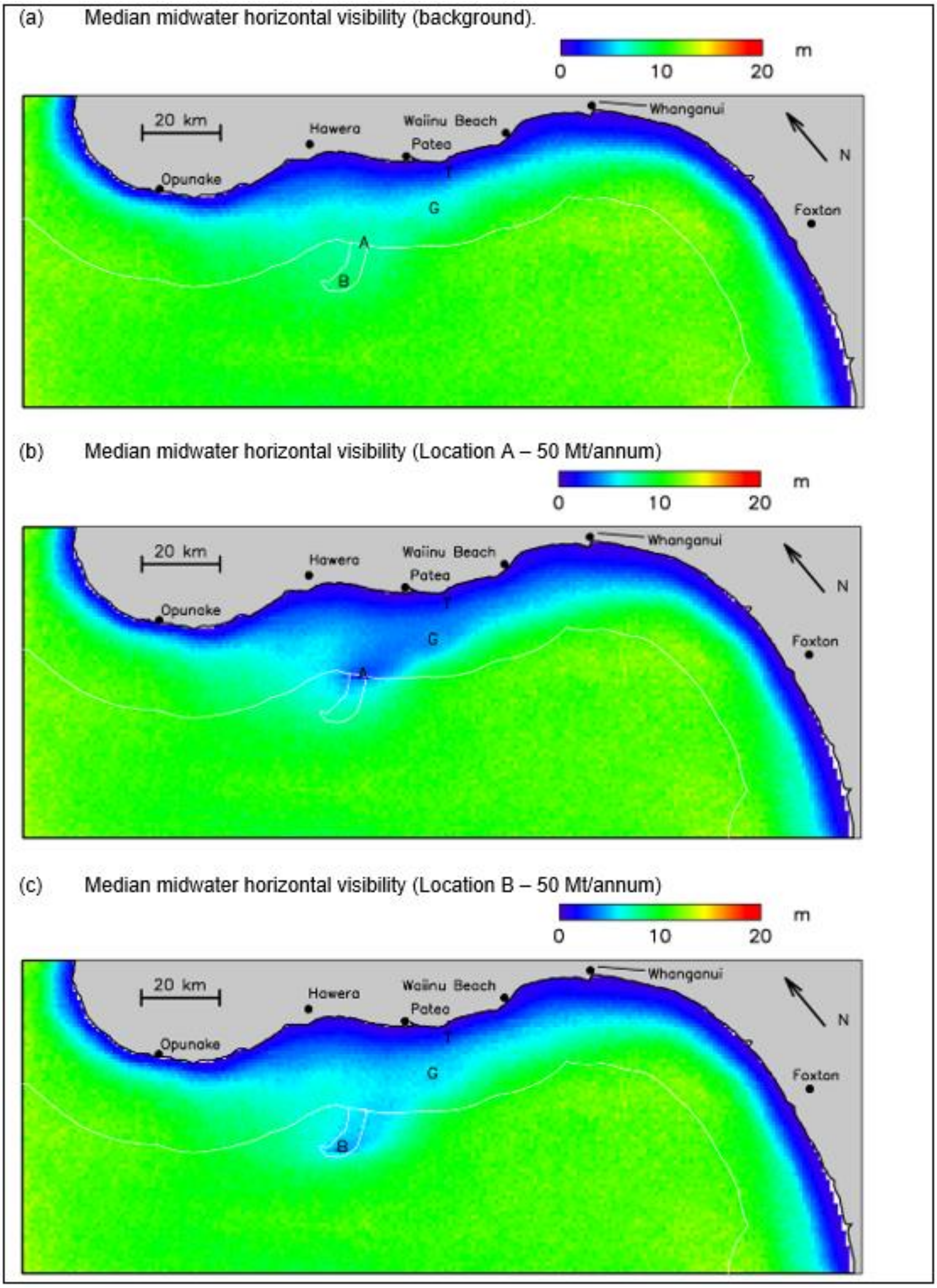


Figure 5.8: Modelled midwater horizontal visibility at Background Levels (top panel), mining at Location A plus background (middle panel), and mining at Location B plus background (bottom panel). G: Graham Bank; T: The Traps.

#### 5.3.3.5 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 to 15% when extraction activities occur at Location A, and by 3 to 5% as a result of activities at Location B. The number of 'good visibility days' [109] at the Traps that will be lost due to the iron sand extraction activities are predicted to be between 24 to 26 days per year as result of iron sand extraction activities at Location A and between 6 to 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 to 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 to 71 days per year and between 22 to 24 days per year as a result of activities at Location B - out of a total of 204 to 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.

[109] Defined as a horizontal visibility of more than 5 m.

#### 5.3.3.6 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 5.3** (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 5km 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 5.3 (2 to 4).

#### 5.3.3.7 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. [110]

With regard to the project, the changes to the intensity of light in the water column is calculated based on the optical modelling. **Appendix 5.4** shows the modelled change in the water column light intensity at Location A and B, while **Appendix 5.5** shows the modelled water column light. A summary of the modelling results is contained in Table 5.8 below.

**Table 5.8: 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.

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

Large reductions in light in the water column only occur very close to the location of extraction activities, with maximum reductions of 27 to 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 5.5 of this IA.

#### 5.3.3.8 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 5.9 below.

**Table 5.9: 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/m2/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 |
| 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 |

| Parameter | Measure | Background | Location A | Location B |
|---|---|---|---|---|
| | 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/m²/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 to 2% respectively.

The largest reductions are predicted to occur around the active extraction areas with maximum reductions of between 92 to 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 5.6 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.

#### 5.3.3.9 Worst case effects

The main conclusions of the worst case scenario on optical properties of the water column[108] are:

1. Predicted optical effects in the worst case simulations are qualitatively similar to those from Pinkerton & Gall[36] , but quantitatively greater. Averaged across the SMD, optical effects that are relevant to estimating effects on primary productivity were 44% greater in the new simulations than estimated using the models summarised in Pinkerton & Gall[36]. This considered effects of mining on mean light in the water column, mean light at the seabed, and the number of days per year when seabed light was greater than two ecologically relevant limits.
2. Average light in the water column averaged over the SMD is predicted to be reduced by only a small amount: 2.9%, mining at site A (up from 1.9%) and by 2.4%, mining at site B (up from 1.6%). Reductions in water column light are predicted to occur predominantly to the east of the mining site due to the sediment plume often moving in this direction.
3. The total amount of light received by the seabed in the SMD is predicted to reduce by 30%, mining at site A (up from 23%) and 21%, mining at site B (up from 15%), and this reduction will primarily affect the area east of the proposed mining area.
4. On average, optical effects of mining at 8 selected sites are 41% greater in the new simulations than estimated using the models summarised in Pinkerton & Gall[36]. This considers four optical effects: horizontal visibility (midwater, seabed), number of high visibility days per year (in midwater and at seabed), euphotic zone depth, and number of days per year with >1% light at the seabed. The predicted effects are 2.2 times greater due to mining at site A than mining at site B.

#### 5.3.3.10 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 extraction of iron sand and the resulting sediment plume is predicted to have insignificant effects on optical properties within 5km 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 with up to a 25% reduction (worst case 47%) within 20km down current of the extraction site. But reductions in light availability in the water column over

the entire SMD, when extraction is occurring at Location A, will average only 1.9% and worst case 2.9%, and , when extraction is occurring at Location B, will average only 1.6% with worst case 2.4%. These results are relevant to considering the effect of the proposed mining on primary productivity in the STB as a whole (see Section 5.5.3);

- 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% (worst case 30%) and 16% (worst case 21%) 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 zone depth will potentially be reduced by between 13 to 15% (worst case 19%) for extraction activities at Location A and 3 to 5% (worst case 7%) for extraction activities at Location B. The days that more than 1% light reaches the seabed will be reduced by 34 days (worst case 45 days), and 11 days (worst case 17 days) when mining at Locations A and B respectively (out of 141 days/yr); and
- At Graham Bank, the euphotic zone depth will be reduced by 37 to 38% (worst case 43%) and 16 to 17% (worst case 17%) for extraction activities at Locations A and B respectively, and the days that more than 1% of surface light reaches the seabed will reduce by 95 and 47 days (worst case 125 and 64 days) for extraction activities at Locations A and B respectively (out of 205 days/yr).

While there is potential for there to be a localised significant 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 5km of the coastline are predicted to be minimal and consistent with naturally occurring background optical water quality levels.

## 5.4 EFFECTS ON COASTAL PROCESSES

### 5.4.1 Shoreline Processes and Coastal Stability

#### 5.4.1.1 Introduction

NIWA[26] 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 assessment.

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.

#### 5.4.1.2 Assessment Methodology

To assess the shoreline processes and coastal stability, extensive field investigations that were conducted by NIWA over two years, including oceanographic measurements, and shoreline monitoring as outlined in Sections 3.2.3 and 3.2.4.

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.

#### 5.4.1.3 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.

> Modification of 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 add to the naturally occurring sedimentation on the seabed in the near-shore environment in the area of Pātea 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 insignificant and will not influence or contribute to the erosion of the already dynamic coastal environment. Therefore, the following conclusions regarding 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 to change as a result of the project.

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[24] during the EPA's evaluation of TTR's 2014 application, the project operation is predicted to have less than minor effects on 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.

#### 5.4.1.4 Management of Potential Effects on Shoreline Processes and Coastal Stability

Mitigation measures beyond the location of the project area, being far offshore, 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 TTR's 2016 marine consent application, the DMC concluded that the project area is not a significant source for sand transport to the beaches, and the project would not increase coastal erosion, [111] which were not matters challenged in any of the subsequent appeals. That is also in line with the findings of the DMC on TTR's 2014 application, that they did not consider that the project would have a significant effect on the physical environment. [112] TTR's proposed mitigation measures are therefore focussed on

[111] Para 229. [Add decision reference if necessary.]

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

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.

### 5.4.2 Wave and Surf Characteristics

#### 5.4.2.1 Introduction

TTR engaged NIWA to complete near-shore wave modelling considering the impacts of the project on wave characteristics[26] [21] and eCoast Marine Consulting and Research ("**eCoast**") was engaged to further investigate the impact of the project on surf breaks in the STB [113].

The deposition of de-ored sediments will fill the majority of the extracted areas and in some cases result in mounds. The assessments examined whether 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.

#### 5.4.2.2 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 to 9m mound at the southwest end of the operational area and a 9 to 10m 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, eCoast undertook the following:

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

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[113] 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.

- Determination of the range of wave and wind conditions that result in good surfable conditions at each site;
- Development of wave scenarios for modelling;
- Development of bathymetry scenarios for mounds and pits generated during mining and incorporation into existing bathymetry (undertaken by TTR / NIWA);
- Transformation modelling of the identified wave conditions using the existing and modified bathymetries for each case (undertaken by TTR / NIWA);
- Development of difference plots and analysis of wave parameters (height and direction) at each of the surfing breaks; and
- Assessment of impacts on surfing breaks.

#### 5.4.2.3 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 will form as a result of extracting iron sands.

Most of the hypothetical configurations tested produced local changes in wave height of up to 20 to 30 cm, or 7 to 12%. These were correlated with changes in mean wave period of less than 0.5 seconds for the worst case scenario (an 8 to 9m mound at the southwest end of the operational area and a 9 to 10m 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 5.9 below.

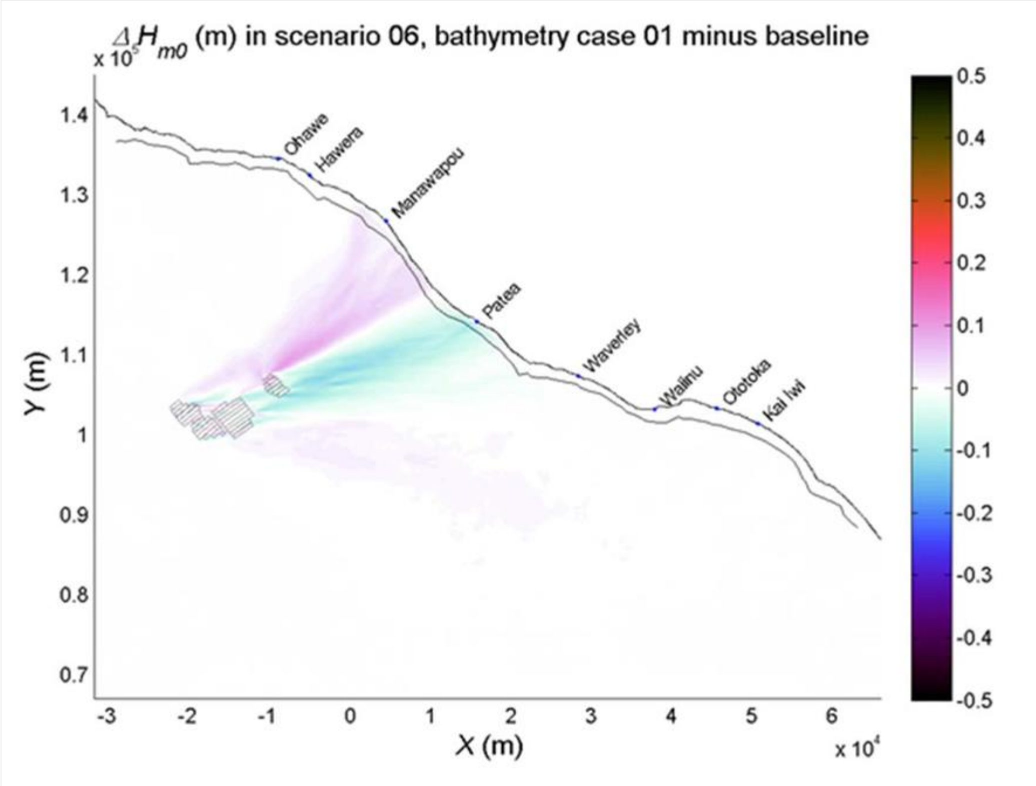


Figure 5.9: **Difference between significant wave height for case 1 and existing bathymetry, over the model domain, for environmental scenario 6 (2.4m high waves from the SW).**

Note: The locations of the extraction areas are marked in grey. Beaches surveyed in related studies are named. The 10m isobath (depth contour) is marked by a black line. Colours indicate the difference in significant wave height.

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

> Increases in wave height in the order of 100mm around the Manawapou River outlet.

> Decreases in wave height in the order of 100mm around Pātea.

> An increase in wave period of less than 0.5 seconds north of Pātea.

> A decrease in wave period of less than 0.1 seconds at Pātea.

Full results of all eight configurations are set out in Table 5.10 below. By way of summary changes in waves height at the 10m isobaths range from 0.8 to 8.6% or 4.1 to 11.3% across the full model domain. Changes in wave direction are 1 to 2 degrees, which is considered to be insignificant when compared with the variability in wave direction throughout the year.

Table 5.10: Maximum changes in significant wave height predicted for the eight bathymetry modification cases

| Extraction case | Full domain | Full domain | 10m isobath | 10m isobaths |
|---|---|---|---|---|
| | H max (m) | H max (%) | H max (m) | 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 15mm at Pātea and that other orientations produced changes in the order of 5 to 10mm 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 are 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) waves as they pass over the modified seabed. This in turn could then potentially impact on surfing breaks on the coast 22km or more inshore.

eCoast undertook extensive modelling of the wave environment and found that the principal changes in surf break characteristics arise from changes in the offshore wave climate. The modelling concluded that because the project area is located over 20km 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 5.10 below, which shows the predicted change in wave height for waves over 3m at the coast. This indicates that any changes to wave characteristics at the shoreline will be in the order of ±100mm. The potential impacts on wave heights are considered insignificant with respect to impacts on wave and surfing quality.

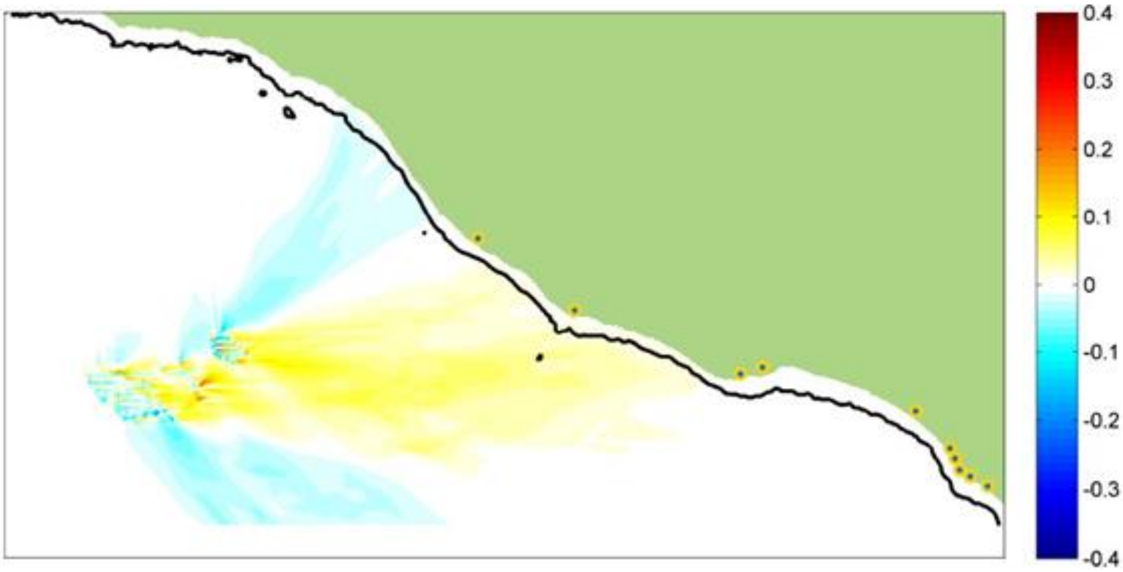


**Figure 5.10: Change in height of 3m waves from the WSW, 16 second period**

As with coastal processes, TTR's position on wave and surf characteristics, that any effects would be small and insignificant , was accepted by the DMC in their decision on TTR's 2016 marine consent application, [114] which were not matters challenged in any of the subsequent appeals. This is also in line with the findings of the DMC on TTR's 2014 application [115]

### 5.4.2.4 Natural Rehabilitation of Pits and Mounds

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 10m deep pit and a 9m high mound, at 35m water depth, it will take approximately 100 years for

[114] This is explicit in respect to waves, at Para 231, and implied in respect to surfing by the DMC's apparent acceptance of the evidence summarised at paras 752-756.

[115] TTR Marine Consent Decision. 15 June 2014. Para 506.

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.

## 5.5 BENTHIC ECOLOGY AND PRIMARY PRODUCTIVITY EFFECTS

### 5.5.1 Introduction

With regard to effects on benthic ecology and/or primary productivity, 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;

> 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;

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

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

The project related effects are discussed in further detail in the sections below and are based on the conclusions from AES[107] unless otherwise stated.

### 5.5.2 Effects on Benthic Ecology and Primary Productivity

#### 5.5.2.1 Physical Disturbance

With regard to disturbance, the area directly impacted by the project will be approximately 5km$^2$ per year, which is extracted in blocks of 900m x 600m (0.54km$^2$) which on average will 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 11m below the seabed, will be physically removed in totality.

The area of the STB that falls between 20 and 40m depth occupies an area of approximately 1,860km$^2$. 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 SBC 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.

#### 5.5.2.2 Suspended Sediment Effects

The effects of increases in suspended sediment and sedimentation are shown schematically in Figure 5.11 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.

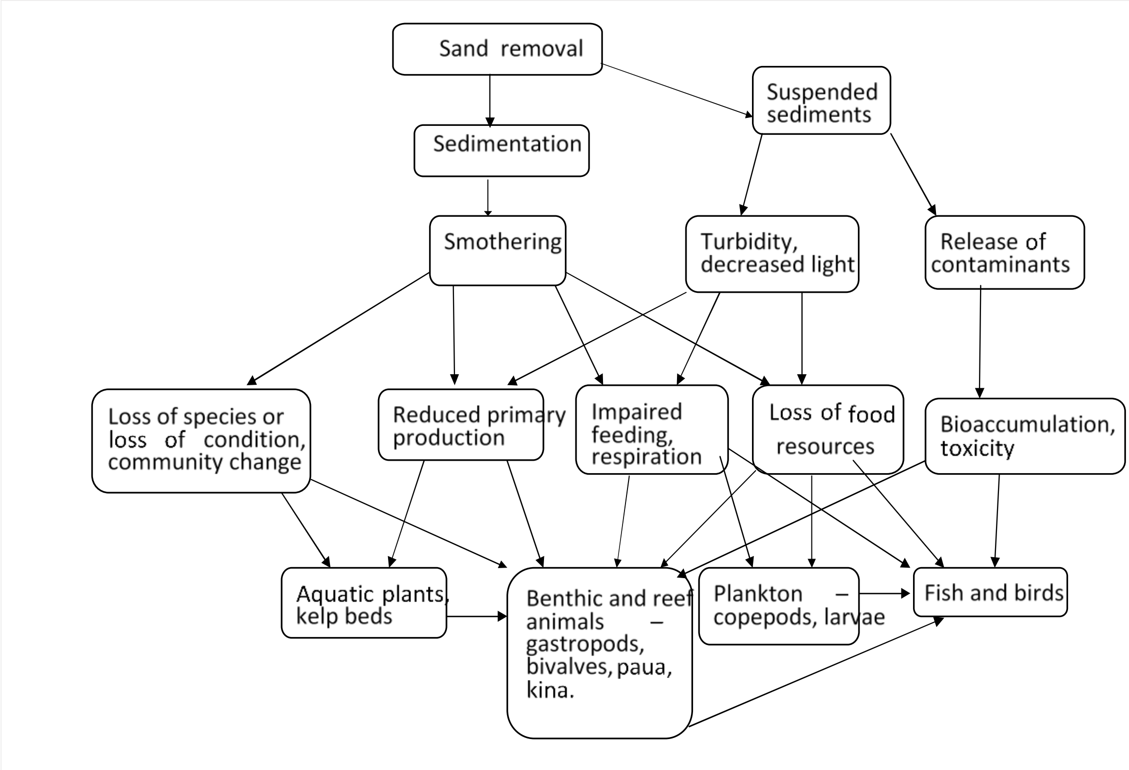


**Figure 5.11: Schematic diagram of effects of suspended and settled sediment**

AES[107] 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 to the southwest and southeast as well as organic matter that is produced from these sources, 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. [116] 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 TTR's first marine consent application in order to give greater certainty and address issues raised by the 2014 DMC. The following summary of effects is based largely on the AES[107] interpretation of the Cahoon et al.[116] findings unless otherwise referenced.

In relation to suspended sediment effects and sediment deposition (Section 5.5.3), it should also be noted that TTR's proposed conditions will require it to stop mining in any part of the proposed mining area if the finer material in the sands reaches an agreed threshold of 1.8% ultra-fines over the course of a week of mining operations. This is conservative as it is a lower percentage of ultra-fines that was used as the basis for the "worst case" scenarios in modelling the sediment dispersion.

#### 5.5.2.3 Indirect Effects Through Reduced Light

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 from the existing (background) situation when considered at the SMD or STB scale.

**Primary Production of Phytoplankton**

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.

**Primary Production of Macro Algae**

Macro-algae will be found wherever there is a hard substrate and sufficient light (0.1 to 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.

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[116] 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.

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 [117] 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.[116] 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 20km away. A recent study of the kelp *Ecklonia radiata*, common on rocky reefs in the STB, found that a >75% reduction in available light for a period of 15 days had a minor effect on kelp condition at temperatures up to 25$^{0}$C, becoming a problem only at 28$^{0}$C water temperature, an unlikely scenario for the STB.

**Primary Production of MPB**

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 to 35m contour and compromises much of the Pātea Shoals, particularly the eastern Pātea 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 10km 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

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

location, the prevailing wind and current conditions, as well as naturally high levels of suspended sediment entering the SMD from the rivers inshore.

AES[107] identifies benthic primary production 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 to 40m deep) sandy area, which is part of the Pātea 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.

**Summary**

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.[116] estimates that total primary production would be reduced over the SMD by 1.9% (range 1.6 to 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 to 1.7%) for Location B. Energy flow to the seabed averaged over the SMD would reduce by 5.8% (range 3.1 to 11.9%) for mining at Location A and 4.1% (range 2.3 to 8.3%) for mining at 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[107] identifies that these conclusions represent sound scientific assessments and lie within the bounds of reasonable probability. AES[107] 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.

#### 5.5.2.4 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 first consent application was considered, more information has been collected and a more robust assessment has been undertaken in AES[107], 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 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 Pātea and Hawera - support very abundant and diverse algae, invertebrate and fish communities, mostly close inshore;
- Biogenic habitat offshore:
  - Bivalve rubble characterised by large populations of the robust dog cockle, *Tucetona laticostata* at depths of 26 to 83.5m for live specimens and 44 to 69m for shell hash;
  - Bryozoan rubble at depths greater than 60m that support diverse benthic assemblages (bryozoan, sponges, ascidians etc, and
- Coralline red algae on shell rubble inshore and at the 40 to 50m contour.

AES[107] 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 southeast. The benthic habitat and communities in this eastern area and across the Pātea 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 southeast. The substrate also tended to get coarser to the east and southeast 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[107] 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[107] stated that studies by Hawkins et al. [118], Clarke & Wilbur [119] and Hewitt & Norkko [120], 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 400mg/L and development of oyster eggs was impacted at levels over 188mg/L and larvae at suspended sediment concentrations of 750mg/L. The greenshell mussel (*Perna canaliculus)* can adjust its filtering processes very effectively and will continue filtering even at levels of 1000mg/L[118]. Some species are more sensitive with condition of the horse mussel (*Atrina)* impacted by levels over 80mg/L [121]. Some deposit feeding polychaete worms, heart urchins and pipis show some effects if concentrations are over 80mg/L[120 122].

More recently the response of two New Zealand invertebrate species (a common cushion sponge *Crella incrustans* and large dog cockle *Tucetona laticostata*, which are both present within the STB) to elevated suspended sediments has been experimentally assessed as part of the Sustainable Seas National Science Challenge [123, 124]. Both had high survival rates, and

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[118] 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.

[119] 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).

[120] 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.

[121] 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.

[122] 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.

[123] Cummings, V.J., Beaumont, J., Mobilia, V., Bell, J.J., Tracey, D., Clark, M.R., Barr, N. (2020). Responses of a common New Zealand coastal sponge to elevated suspended sediments: indications of resilience. Marine Environmental Research, 155: 104886.

[124] https://www.sustainableseaschallenge.co.nz/tools-and-resources/sponges-and-suspended-sediment-on-the-south-coast/

no effect was observed on oxygen consumption following four weeks of exposure to SSCs of up to approximately 700mg/L. Although sediments had accumulated internally within *C. incrustans*, around a third of sponges had cleared these sediments two weeks after the elevated SSCs were removed.

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 60m. NIWA [125] suggested that concentrations of 100mg/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.

Most species in the STB, including some sensitive species can tolerate high levels of sedimentation (over 80mg/L) periodically. These limits are summarised in Table 5.11.

AES[107] notes that the 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 5.11: Suspended sediment concentration found to affect benthic invertebrates**

| Author | Species | Sediment Concentration* |
|---|---|---|
| Hewett et al. 2001 [126] | Cockle (*Autrovenus stutchburyi*) | 300-400mg/L |
| Hewett et al. 2001 | Pipi (*Paphies australis*) | 75mg/L |
| Nicholls et al. 2003 | Gastropod (*Zeacumantus lutulentus*) | >750mg/L |
| Hawkins et al. 1999 | Green lipped mussel (*Perna canaliculus*) | 1,000mg/L |
| Schwarz et al. 2006 [127] | Kelp (*Ecklonia radiata*) | 20mg/L |

125 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*.

126 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

127 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.

| Author | Species | Sediment Concentration* |
| --- | --- | --- |
| Schwarz et al. 2006 | Paua and kina larval mortality | 35mg/L |
| Schwarz et al. 2006 | Paua and kina | 18-74mg/L |

***Levels that had an impact on conditions/growth**

In the SMD the inshore region naturally experiences suspended sediment concentrations with Median background near-surface concentrations which reach over 20mg/L and the 99$^{th}$ percentile is typically up to 100mg/L close to the coastline (with a maximum over 200mg/L close to major rivers). The median concentrations at the seabed nearshore are over 100mg/L and 99$^{th}$ percentile levels over 1,000mg/L. Thus, the effects on the inshore biota would be expected to be indistinguishable from the effects of naturally occurring background suspended sediment concentrations.

Generally, the highest levels of suspended sediment concentrations in surface waters at the extraction site itself would be 1.45mg/L as a median and 8.2mg/L as the 99$^{th}$ percentile and less than 2.8mg/L at 20km downstream, thus effects, if they were to occur would be indistinguishable from natural variability beyond the immediate area of disturbance. Generally, near the seabed, suspended sediment concentrations would be up to a median of 1mg/L and 99$^{th}$ percentile of 5mg/L up to 20km away from the source and up to 14mg/L at the source itself.

In the worst case scenario[103], the sediment plume behaviour is similar to that of the previous runs, frequently extending to the east-southeast from the source location towards the coast at Whanganui. The highest values occur around the source; there is a region extending some 10km from the source with values between 0.5 and 1mg/L. Median values of SSC of 0.35mg/L extend about a few kilometres further away from the source than in the previous runs (about 20km). The extensive area that reaches the coast with median SSC above 0.1mg/L (light grey) also reaches a few kilometres further along the coast in the worst case simulation. However (as with the previous simulations) at the shore the modelled background concentrations exceed the mining-derived concentrations by approximately two orders of magnitude.

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 potentially 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 16mg/L) than "cleaner" sites (undetectable to 7mg/L) off the Whitianga Harbour by Schwarz et al. (2006). Using a range of natural concentrations Schwarz et al.[127]found a drop-off in mussel and oyster condition at suspended sediment concentrations over 26mg/L and sponges at over 15mg/L.

With regard to the project, even if very small suspended sediment concentrations in the plume reached the inshore region off Pātea 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 0.5m where the common kelp *Ecklonia radiata* occurs, were found to range from 3.4 to 150mg/L naturally (Schwarz et al. 2006).

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 60m 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.

NIWA[37] 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.

***<u>Summary - Effects of Suspended Sediments on Benthos</u>***

Direct effects of suspended sediment on these communities potentially include smothering, effects on feeding and other physiological processes, and indirect effects of changes to food availability, and larval supply. Most of the effects from the proposed iron sands extraction activities 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.

#### 5.5.2.5 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. Journal of Plankton Research [128] found concentrations of fine sediment above 20mg/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 North American Journal of Fisheries Management [129] finding fish eggs and larvae were only impacted if suspended sediment concentrations were over 500mg/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.

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[128] 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

[129] 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.

As discussed in Section 5.3.3.3, 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.

Overall, as concluded by AES[107], 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 at all, affected inconsequentially and populations would recover rapidly.

While the ecological effects on zooplankton and fish larvae resulting from the project are expected to be indistinguishable from natural variability, the proposed Pre-commencement Environmental Monitoring Plan ("**PCEMP**" in **Appendix 5.6**) and Environmental Monitoring and Management Plan ("**EMMP**" in **Appendix 5.7**) provide for ecological monitoring of zooplankton 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.

### 5.5.3 Ecological Effects from Sediment Deposition

Sedimentation impacts will be most prominent where the de-ored sediments are re-deposited in the mining lanes. 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 5.3, many taxa found in the inshore environment will be exposed to naturally high levels of sediment deposition, following river flood and regular storm events, while deeper water offshore is a general deposition zone for fine sediments originating from land based sources.

AES[107] 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 5.12 below). NIWA 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 to 10cm depending on the species and type of material deposited [130] [131].

**Table 5.12: Tolerance levels to sediment deposition**

| Author | Species | Sediment Deposition |
|---|---|---|
| Norkko et al. 2001 | Various benthic species | 3-7mm clay |
| Doorn-Groen 1998 [132] | Sessile animals including corals | 1.7mm/14 days |
| Norkko et al. 1999 | Shrimps and crabs | 9cm |
| Devinny & Volse 1978 | *Macrocystis* mortality of germlings (90%) | 10mg $cm^{-2}$ (~0.45mm Hepburn evidence) |
| Schiel et al. 2006 | Macro-algae germlings attachment | 2mm |

Some benthic taxa, such as the bivalves *Nucula* and *Macomona* and some polychaete worms, can survive and escape burial under at 20 to 30cm of sand while 50% of *Zethalia zelandica,* a small trochid wheel shell did not survive burial in 17cm of sand or 3.8cm of mud [133]. This demonstrates the difference in effects between sandy versus muddy depositions.

NIWA[130] found that the deposition of clay material has the greatest effect with experiments in the Auckland Region demonstrating that layers as thin as 3 to 7mm had some impact on macrofauna and rapid accumulations of 20mm can smother entire benthic communities. The material being re-deposited at the project area will primarily consist of fine sandy sediments with very little clay, further reducing the potential for smothering effects occurring.

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[130] 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.

[131] 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.

[132] Doorn-Groen, S.M. (2007). Environmental monitoring and management of reclamations works close to sensitive habitats. Terra et Aqua 108. 3-18 p.

[133] 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.

Cockles (tuangi), pipis and tuatua are important for recreational and cultural harvesting in coastal environments. AES[107] identifies that pipis are active burrowers and can be found buried in up to 100mm of sand and larger ones can even tolerate up to 400mm. More recently, Anderson et al. (2019) [134] found cockles able to resurface within days from beneath 2–25cm of sediment and are also resilient to daily (2cm) reburials. However, following disturbance to their natural orientation, inverted cockles were significantly impeded when buried under 5–10cm of sediment, with fewer adults resurfacing than sub-adults. The study concluded that cockle populations are likely to be resilient to native sediment deposition, unless physically disturbed. 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 9cm of deposition but cockles and other molluscs generally start responding at levels of 20 to 30mm, 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 [135]) and relatively heavy settlement (2mm) 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 to 7mm 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.

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[134] Anderson, T., Barrett, H., Morrisey, D. (2019). *Effects of sediment deposition on the New Zealand cockle, Austrovenus stutchburyi*. New Zealand Journal of Marine and Freshwater Research, 53: 363-376.

[135] 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.

Average sedimentation rates beneath the sediment plume are estimated to be 0.5 to 1mm/yr 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 into the mining pit, 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 (see Section 5.5.4 below). 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 5cm 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 Pātea Shoals.

#### 5.5.3.1 Larvae of species other than crayfish

For the soft sediment species occurring near the mining area or in the main part of the sediment 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 the PCEMP and EMMP (refer to Section 6 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 will be minimal on their larval and adult populations.

#### 5.5.3.2 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 into the mining pits on the seabed; and finer material that settles after being dispersed by the sediment plume. The predicted levels of sedimentation resulting from the sediment plume has been modelled over five and 365-day accumulation periods and indicate that under a worst case scenario the deposition footprint of mining-derived sediment is extensive but at very low values of 0.01 to 0.1mm per year (c.f.

the typical thickness of a human hair, which is 0.1mm) with small regions of deposition of 0.1 to 2mm within a few kilometres of the source location. The background plus mining sedimentation rate is distinguishable from the background only in a small region near the source and is negligible compared with known tolerance levels for benthic invertebrates and macro-algae.

### 5.5.4 Recovery from Suspended Sediments and Deposited Sediment

AES[107] 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[133]. 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.

Within those parts of the project area where no extraction is taking place, deposition will consist of predominantly sandy material, and recovery would be expected to be quicker because only a very thin layer (0.01–0.1mm per year) 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 those parts of the project area where extraction has occurred and de-ored 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 262,000m$^3$ of dredged material in the Hauraki Gulf found there was an initial increase in abundance and diversity of benthic communities then a decline [136]. 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 have shown that while communities associated with muds may

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[136] 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.

recover within months, communities in sand deposits are likely to be in a transitional stage and take up to two to 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.

In the Kaikoura canyon a diverse deepwater benthic population has shown remarkable recovery after being completely buried by the avalanche of sediments released by the 2016 Kaikōura earthquake [137, 138]. The results show that all fauna dramatically decreased immediately after the turbidity flow event, and by four years after the disturbance the benthic communities were similar to, but not yet the same as, the pre-event communities. Full recovery was modelled to take as little as 4.5 years or up to 12 years. In the warmer, shallower sandy waters of the STB where disturbance by storm events and land derived sediments is common, recovery of the sea floor community, once mining in the immediate area has stopped, should occur faster than in the deep, less frequently disturbed, waters of the Kaikōura Canyon.

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 on the community composition of infauna, 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.

NIWA[30] 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

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[137] Bigham KT, Rowden AA, Bowden DA, Leduc D, Pallentin A, Chin C, Mountjoy JJ, Nodder SD and Orpin AR (2023) Deep-sea benthic megafauna hotspot shows indication of resilience to impact from massive turbidity flow. Front. Mar. Sci. 10:1180334. doi: 10.3389/fmars.2023.1180334

[138] Katharine Bigham (2023). Resilience of deep-sea benthic communities to turbidity flows following the 2016 Kaikōura Earthquake. PhD thesis, Te Herenga Waka—Victoria University of Wellington. https://openaccess.wgtn.ac.nz/articles/thesis/Resilience_of_deepsea_benthic_communities_to_turbidity_flows_following_the_2016_Kaikoura_Earthquake/24646104

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 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.

The seafloor community offshore of the Pātea Banks (60m 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 slightly shallower waters around the margin of the Pātea Banks supports early successional stages (encrusting coralline algae, small encrusting invertebrates). These areas outside the project area will be little affected by the deposition of sediment from the sediment plume as the plume will predominantly orient in a southeast direction from the active mining location. Consequently, mining derived sediments will be deposited intermittently in these areas in a very thin layer (<0.02mm per year) that will in practice be impossible to detect in the field.

***<u>Summary - Recovery from Suspended Sediments and Sedimentation</u>***

The recovery of the benthic community as the iron sand extraction operations moves across the project area 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 in the project area and areas affected by the plume is dominated by short-lived, opportunistic and early successional stages but with small 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 but will be largely unaffected by the proposed iron sand extraction activities.

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.

### 5.5.5 Cumulative Ecological Effects of Suspended Sediments

The project has the potential to create elevated suspended sediment concentrations, above those which are presently occurring, immediately around the active operational area and in the down current sediment plume. The background suspended sediment concentrations result from resuspension of seafloor sediments by waves during storm events, river input of terrestrial sediments into the STB especially following high rainfall events, and bottom trawling and dredging that resuspend seafloor sediments. The impact assessments in the sections above take into account these present background sources of suspended sediments. Presently, there are no other activities within the STB area that will generate sediment plumes as a result of their ongoing operation and the potential for additional cumulative effects is low.

### 5.5.6 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[27].

As part of their assessment, AUT analysed sediments from the project area for their content of the acid volatile sulphides and simultaneously extracted trace metals to determine their concentrations 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 have been summarised below.

#### 5.5.6.1 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 are based. These findings have been summarised below.

#### 5.5.6.2 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 18m 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.

***<u>Trace Metals in Sediment Suspensions</u>***

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 [139] 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.

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, i.e. copper concentrations were highest in fine sands and lower in coarse sands. The average elutriate copper concentrations of as-received sediments 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

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[139] 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.

billion (“**ppb**”) 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.

A natural source of mercury is from volcanic and geothermal activity which usually emits gaseous mercury into the atmosphere and generally does not concentrate mercury 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. [140]

***<u>Effect of Grinding on the Dilute-Acid Soluble Metal Content of Enriched Iron Sand</u>***

A sample of magnetically enriched iron sand from the STB was ball milled to three average sizes, 276µm, 183µm and 23µm. TTR will be grinding sediment to a P80 of 120µm (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 193µm 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.

[140] Statement of Evidence of Matt Brown on Behalf of Trans-Tasman Resources, 15 February 2013, adaption of paragraph 59.

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.

***Bioaccumulation Effects of Mercury***

With regard to mercury, in his evidence presented on behalf of TTR in the hearing on the previous application [141], 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) [142] 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) [143] 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) [144] or, for methyl mercury, related to higher sediment organic*

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[141] Statement of Evidence in Chief of Dr Kay Vopel on behalf of Trans-Tasman Resources, 15 February 2013, Paragraphs 66-67.

[142] 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.

[143] 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.

[144] 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.

*matter content in the vicinity of offshore oil production platforms (Delaune et al. 2008)* [145]*."*

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 5.10 which focuses on copper and nickel.

#### 5.5.6.3 Summary

The AUT assessments outlined above were considered as part of the DMC's decision on TTR's previous application, in 2017. [146] The DMC's decision records that the issues of ecotoxicity were the subject of expert conferencing between three experts, and the experts agreed on every point. Key matters they agreed, which were accepted in the DMC's decision were:

- Concentrations of heavy metals may impact on the small area immediately near the extraction operations and for a small distance downstream;
- Dilution and mixing will rapidly dilute concentrations below trigger levels and will not impact on the nearshore environment;
- The level of metals would be negligible and the effects undetectable by the time the plume reaches the coast
- Pre-commencement and ongoing monitoring is recommended and will address any uncertainty

None of these matters were challenged on appeal, and TTR's proposed conditions (Attachment 1) incorporate all of the pre-commencement and ongoing monitoring requirements that were agreed between the experts and imposed by the previous DMC.

## 5.6 FISHED SPECIES

### 5.6.1 Introduction

TTR commissioned NIWA to undertake an assessment of the overlap of the proposed iron sand extraction activities in the STB with, and their potential effects on fish in the STB[37 39]. The overlap of mining operations and the sediment plume with fishing activities was updated

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[145] 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

[146] Paras 587-599 and 614-616.

by MacDiarmid et al. (2024). NIWA also undertook an assessment on the potential effects of light from project operations on fish [147].

The potential effects of the project on fished species have been identified as:

> Entrainment 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;

> Loss or changes in spawning areas

> Displacement from areas of disturbance by sediment plumes;

> Reduced prey abundance and prey detection; and

> Noise effects on some species.

These effects have been discussed in further detail below, although noise effects are discussed in Section 5.9 of this IA.

***Entrainment of Fish in Project Equipment***

NIWA[39] identifies that the majority of fish species will avoid becoming entrained in any operational machinery associated with the project, particularly the SBC, 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 SBC (up to 6m/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 fished species 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.

***Disturbance and Sedimentation Effects***

NIWA[39] 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

[147] Thompson, D. 2013. "Effect of ships lights on fish, squid, and seabirds". NIWA Client Report WLG2013-16. Updated November 2015.

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.

With regard to sediment effects on fish species, AUT [148] and NIWA [149] have identified that suspended sediment concentrations of 2mg/L and 3mg/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 AUT reported 35 to 40mg/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 500mg/L. As discussed in Section 5.3.2 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 median suspended sediment concentrations would be perceptible above natural background limits is within 2 to 3km of the source. In this regard, the median concentration of suspended sediments in surface waters at the source (Location A) will be 1.45mg/L and the 99$^{th}$ percentile concentration will be 8.2mg/L. At a location approximately 20km down current the median concentration in surface waters will be 0.35mg/L and a 99$^{th}$ percentile concentration being 2.8mg/L. Near the seabed the median suspended sediment concentrations at the source will be 14mg/L and the 99$^{th}$ percentile concentration 45mg/L, while at a location approximately 20km down current the median concentration will be 1mg/L and the 99$^{th}$ percentile concentration up to 5mg/L.

As previously noted in this IA 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 presently experienced by fish populations in the STB.

NIWA[37] used spatial information on the occurrence and foraging of different fish species, a suspended sediment concentration of 3mg/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 occupied by the different fish species found in

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148 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.

149 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.

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 3mg/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, NIWA[39] concludes that the overall effect on eagle rays 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.

***Spawning and Feeding***

While there is the potential for the sediment plume from the project to affect spawning sites, the project area and area potentially affected by the sediment plume are not identified as being important spawning areas or juvenile nurseries 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 presently encounter due to 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.

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 disruption to seafloor and water column feeding areas for fished species is not likely to be significant as the method for the extraction of iron sands from the seabed (being the successive extraction of segmented blocks from a total project area) allows for the re-colonisation of marine areas immediately after project operations cease in any one block.

***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 very small spatial scale of the IMV in the context of the STB.

### 5.6.2 Scale of impacts on fish species

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.

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.

Section 6 of this IA provides an overview of the proposed monitoring and management framework for the project. This includes discussion on the PCEMP 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 fish 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.

## 5.7 SEABIRDS

### 5.7.1 Introduction

NIWA[147] considered the potential effects of artificial lights from ships on fish, squid, and seabirds in the project area, while MacDiarmid 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 impacts of the mining operations and the sediment plume with fishing activities was updated in Thompson (2023) [150].

The following section provides a summary of matters relevant to seabirds in these reports.

### 5.7.2 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 schedule.

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. It is possible that seabird taxa could occur throughout the STB. This will be especially the case for species of albatross, petrel, shearwater and other small procellariform seabirds that range widely and occupy relatively large distributions. In contrast, some species, including gulls, terns, shags and little blue penguin, tend to frequent more coastal habitats, although gulls and terns can sometimes extend to more offshore areas and little blue penguin can forage relatively large distances from breeding colonies.

[150] Thompson D (2023) Expert evidence of Dr David Thompson on behalf of Trans Tasman Resources Limited. 19 May 2023

NIWA[37] selected five diverse species for a more in-depth assessment of scale, both of the area impacted from mining and of the areas these species are able to exploit when foraging - 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 species.

The Westland petrel is considered to be of high conservation value (and is listed as 'At Risk - Naturally Uncommon' under the NZTCS) 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 2mg/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 support 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 50km 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 lighting effects, it was agreed by experts as part of the joint conferencing for the 2015 marine consent that artificial nocturnal lighting was potentially the most significant effect for nocturnally-active seabirds due to the risk of attraction to and collision with vessels. [151] Deck lights and standard navigational lighting on the operational vessels, particularly the IMV, FSO vessel and AHT, have the potential to attract nocturnally active

[151] TTR Marine Consent Decision. 15 June 2014. Para 400.

seabirds. These lights may also attract squid and fish, which may in turn attract birds for feeding. However, it is considered that the relative 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 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.

Given that seabirds generally, and albatrosses and closely related species particularly, operate at relatively large scales (for example, when breeding, foraging trips of hundreds to thousands of kilometres are typical), it follows therefore that at the population level seabirds are able to exploit marine resources over relatively large areas, perhaps for the widest-ranging taxa in the order of Millions of square kilometres. Even for seabird species that tend to frequent coastal environments and that tend not to range as widely as the procellariform taxa (albatrosses and their allies), individuals will likely utilise in the order of thousands of square kilometres during the breeding season.

Considering the effects of the sediment plume and based on the worst-case modelling, the average spatial extent of surface and near-bottom median SSC above 2mg/L due to mining is 78.55km$^2$ [152]. This affected area is relatively small (a few percent) compared to the area an individual seabird could exploit, even less so when considered at a population level. Further, it should also be noted that the SSC of 2mg/L is a relatively low threshold, but the lowest SSC found to be avoided by pelagic fish [153] - it is possible that seabirds foraging in the water column could still forage successfully in water with this SSC level.

Whilst it is the case that detailed, fine-scale information about how seabirds utilise the PPA and wider STB, and how this utilisation varies temporally, is unavailable for most species, it is nevertheless and also the case, that sufficient information is available on the scale and magnitude of likely effects and on the scale at which seabirds interact with their environment to conclude that the impact on seabirds will be less than minor.

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152 MacDiarmid, A. (2017). Expert supplementary evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Limited, dated 1 May 2017.

153 MacDiarmid, A. (2023). Expert evidence of Dr Alison MacDiarmid on behalf of Trans Tasman Resources Limited, dated 19 May 2023.

### 5.7.3 Management of Potential Effects

Overall, it is considered that the project will result in indirect, negligible effect on seabirds within the STB.

Artificial nocturnal lighting emitted from operational vessels will increase the presence of artificial nocturnal light locally. 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;

> 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 and directed downwards 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 seabird species, and to ensure that there are no adverse effects on seabirds resulting from lighting, oil spills and the sediment plume. Further details on the development and implementation of this plan are 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 5.8** to this IA.

Section 6 of this IA provides an overview of the proposed monitoring and management framework for the project. This includes discussion on the PCEMP and the EMMP, both of which provide for specific monitoring of seabirds, that will further ensure that any effects associated with the project are appropriately monitored and managed throughout the proposed 35 year term of the consent.

Overall, it is considered that the potential effects of the project on seabirds 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.

## 5.8 MARINE MAMMALS

There has been a wealth of information that provides a robust assessment of the existing environment for marine mammals within the STB and the project area (see Section 3.3.4 of the IA), including data on species abundance, distribution, behaviour, and potential impacts. The available information confirms the STB as an important hotspot for marine mammal diversity within New Zealand, including as a feeding and breeding location for different species at different times. Notwithstanding this conclusion, the overall assessment is that there is a low likelihood of marine mammals being present in the proposed project area and there is nothing to suggest that the area is of any level of biological significance to any marine mammal species.

There have been several assessments of potential impacts from the proposed activity including most recently MacDiarmid et al.[37] which is supported and expanded upon by various reports and information provided to the 2016 and 2024 consent application processes.

Most consequential impacts between marine mammals and anthropogenic activities result from a direct overlap between the spatial location of activities and important habitats (i.e. feeding or nursing) and / or migration routes of the species [154]. There are a wide range of potential impacts on marine mammals from anthropogenic (human-made) activities.

Some species of whales or dolphins may be highly sensitive to any disturbance while other cetacean species may even be attracted to the activities (e.g. Todd et al.[154]). In addition, some individuals within a given population such as juveniles, old, diseased, or disoriented individuals may be more prone to disturbance or other impacts. Consequently, the operational activities employed, timing of activities and the behavioural state of an individual or group will also influence the probability of interactions occurring.

Based on what is known about marine mammals using the STB region and project area (see Section 3.3.4), the focal species for this assessment will be limited to three main groups: dolphins (i.e. Hector's, common, bottlenose, killer whales), seals (i.e. NZ fur seal) and whales (i.e. blue whales, southern right whales). While these three groups do not cover all the possible marine mammals that may occur within the area of activity, they represent either: (i) the species that occur in the area most commonly or (ii) that may occur in the area less commonly but have a threatened status. The consideration of potential impacts on these three broad groups is considered to broadly cover any potential impacts that may be possible on any of the other species that are not being directly addressed.

Based on the review by MacDiarmid et al.[37] and subsequent work presented, the potential effects of the project on marine mammals include:

[154] Todd VLG et al. (2015) A review of impacts of marine dredging activities on marine mammals. – ICES Journal of Marine Science, 72(2): 328-340. doi: 10.1093/icesjms/fsu187.

> 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 proposed project on marine mammals are discussed further in the sections below, with potential noise effects considered separately in Section 5.9 of this IA.

### 5.8.1 Whales

The expected range of blue whales based on the available data and spatial modelling indicated that these whales are generally found further offshore in the western and central parts of the STB, predominantly at depths of between 50-150m. There is no record of blue whales within the project area and only one record within 10km of the consent area (Table 3.5) providing good evidence that these whales are rarely, if ever, found within the project area. Further, MacDiarmid et al.[37] also concludes that they are unlikely to occur within the project area, which is thought to be at the edge of their feeding grounds. Further, in the unlikely event that whales were to be found in the area, it is highly likely that they would seek to avoid the specific areas within the project area where iron sand extraction activities are occurring due to exposure to higher than normal underwater noise levels and disturbance effects.

In addition, the extent of the area where SSC will be above 2mg/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 approximately 0.2% of the known foraging area of blue whales - excluding the shallower areas of the STB. MacDiarmid (2024) [155] concluded that effects from discharge of mining sediment on biota, including primary producers, invertebrates, fish and marine mammals, will not result in material harm. Furthermore, while the offshore STB is a well-documented and important feeding area for blue whales, it is only one such feeding area that blue whales utilise around New Zealand. This is based on satellite tracking data and also on resighting of individual blue whales from the STB in other places such as the Hauraki Gulf, Kaikoura, Westport, and Greymouth highlighting the large areas over which these whales' range (Childerhouse [156]). Given that only a very small fraction of blue whale

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[155] MacDiarmid A (2024) Expert rebuttal evidence of Dr Alison MacDiarmid on behalf of Trans Tasman Resources Limited. 23 January 2024.

[156] Childerhouse S (2024) Expert rebuttal evidence of Dr Simon John Childerhouse on behalf of Trans Tasman Resources Limited. 23 January 2024.

feeding habitat will be potentially affected, MacDiarmid et al.[37] concludes that any displacement or impacts on blue whale feeding would be negligible.

It is well understood that southern right whales prefer sheltered shallow coastal waters. No southern right whales have been observed within the project area, with the only rare sightings in the STB being to the north and well inshore of the project area. In addition, there are no coastal feeding areas identified for southern right whales anywhere in New Zealand with all known feeding grounds identified as being well offshore in the Southern Ocean. This confirms that even for the occasional southern right whale that comes into the STB, they are unlikely to be feeding and therefore any possible effect on their prey is likely to have little effect. Ching et al.[35] 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 considered to only be moderately favourable habitat. In addition, given that they are generally transient through the region rather than being resident (even for short periods), the short period of time during which they move through the STB means that any local effects on prey will be less than minor. 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 have any significant 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.

Overall, there is expected to be negligible effects on whales from the project's activities due to combination of factors, including:

> The project area represents a very small part of the whole home range and foraging area of whales and therefore, any potential effect on local prey is unlikely to have any overall effect on whales;

> Most species within the STB are generally found either further offshore (e.g., pilot whales, blue whales) or further inshore (e.g. right whales, killer whales) and so there is unlikely to be any significant overlap with the proposed activity;

> It is possible that there could be some short-term, local displacement of whales from the area immediately (e.g. 1 to 2km) around the proposed activity due to potential disturbance from underwater noise and/or localised sediment plumes but this effect is considered to be biologically insignificant given there are no resident whales within the

project area, the operation will constantly be moving slowly through the whole area and whales can easily move away and avoid the activity due to its slow speed; and

> Many of the marine mammal species found within the STB are transient and either simply passing through the region or are only around seasonally.

### 5.8.2 Dolphins

MacDiarmid et al.[37] identified that the majority of the STB is unsuitable habitat for Hector's dolphin, as well as the sub-species Maui dolphins - which is at a very high risk of extinction. These conclusions were supported by more recent spatial modelling and research including Stephenson et al.[48], Roberts et al.[70], and Derville et al.[46]. Hector's and Maui's dolphins generally prefer areas of low water clarity and are opportunistic feeders with a wide range of potential prey types. It is now well accepted that the present range of Maui dolphins is restricted to the West Coast of the North Island north of New Plymouth while the STB is considered to be a potentially important region for interchange between populations in the South Island and further north but with no resident dolphins. DOC do not have any monitoring programmes for Maui dolphins within the STB given that they are not expected to be there. Ching et al.[35] concludes that the proposed project is likely to have negligible effects on Hector's and Maui dolphins 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.

Common dolphins are found throughout the coastal waters of New Zealand. Spatial modelling as confirmed the STB as an important area for this species including that there is a high probability of them being within the project area (Stephenson et al.[48]). Common dolphins are known to target jack mackerel which is widely distributed in the STB and along the coastline. Given that there is unlikely to be any significant ecological effect on potential dolphin prey outside of the immediate area around the proposed activity, the risk of effects on prey are considered to be less than minor. 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.[35] concludes that any potential effects on the common dolphin population in the STB will be negligible.

Overall, there is expected to be negligible effects on dolphins from the project's activities due to a combination of factors, including:

> Hector's and Maui dolphins are not resident within the STB region or anywhere close to the project area which has been identified as an area of low habitat suitability for them. While they may occasionally use the STB to transit between areas north and south of the STB, they are unlikely to be present within the area.

- The project area represents a very small part of the whole home range and foraging area of common dolphins and therefore, any potential ecological effect on local prey is unlikely to have any significant biological effect on these dolphins;
- As for whales, it is possible that there could be some short-term, local displacement of common dolphins from the area immediately (e.g. 1 to 2km) around the proposed activity due to potential disturbance from underwater noise and/or localised sediment plumes but this effect is considered to be biologically insignificant given there are no resident dolphins within the project area, the operation will constantly be moving slowly through the whole area and dolphins can easily move away and avoid the activity due to its slow speed; and
- Most species within the STB are expected to be found either further offshore (e.g., common dolphins) or further inshore (e.g. Hector's and Maui dolphins when present) of the project area and so there is unlikely to be any significant overlap with the proposed activity.

### 5.8.3 Seals

New Zealand fur seals are found throughout New Zealand and have been increasing in numbers in recent years in many areas. They typically forage offshore at night along the edge of the continental shelf but can also forage inshore and on the shelf as well. Satellite tracking has shown that mean foraging trips are approximately 100km from breeding and haul out sites, meaning that the project area could be accessed from the nearest colonies (i.e., Stephens Island and Sugar Loaf Island). Cawthorn[44] confirmed the presence of fur seals with the project area during aerial surveys. Therefore, 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.[35] concludes that any potential effects on fur seals will be negligible.

Overall, there is expected to be negligible effects on New Zealand fur seals from the proposed activity due to a combination of factors, including:

- The project area represents a very small part of the whole home range and foraging area of fur seals and therefore, any potential effect on local prey is unlikely to have any overall effect on fur seals;
- While fur seals have been identified within the project area, there are no known haul outs for breeding colonies within 80km of the area which suggests that fur seal numbers within the area are likely to be low; and

- As for the other marine mammal species, it is possible that there could be some short-term, local displacement of fur seals from the area immediately (e.g. 1 to 2km) around the proposed activity due to potential disturbance from underwater noise and/or localised sediment plumes but this effect is considered to be biologically insignificant given there are no resident fur seals anywhere close to the project area, the operation will constantly be moving slowly through the whole area and fur seals can easily move away and avoid the activity due to its slow speed.

#### 5.8.3.1 Vessel Collision

There is always the potential for collisions between marine mammals and any vessels, including project related vessels. However, given that most of the vessels associated with the project (e.g., IMV, Trans-Shipment FSO, Bulk Carrier Export Vessel) will be either stationary or moving very slowly (i.e., less than 5 knots or 8 kph) while on site, the risk of vessel collision with marine mammals will be negligible. That is, at such slow speeds any marine mammals that may be in the area will be more than capable of swimming away from the vessels and avoiding collisions. During transit to and from the site, these vessels will travel at normal vessel speeds and therefore will represent no more risk to marine mammals than any other vessels transiting the region.

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.[37] 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.

While the risk of a collision is very low, any collision if it did occur, is only likely to result in minor injuries due to the very slow speed of the vessels involved. There is a negligible risk of any maiming or the death of marine mammals from such slow speed collisions.

Given these assessments, the risk to marine mammals from project related vessel collision is assessed as negligible. Notwithstanding the already negligible risk, TTR have proposed some additional mitigation actions to further reduce any residual risk (e.g., Marine Mammal Observers, Vessel transit protocols including watchkeeping for marine mammals) which are provided for in the proposed consent conditions.

## 5.9 NOISE EFFECTS

Underwater noise was identified as a potential risk for marine mammals from the proposed operation. This assessment was made on the basis of the likely type of underwater noise that will be generated by the activity and that it will be operating almost continuously for the period of the consent.

There has been an extensive body of research investigating the potential impacts of underwater noise from the proposed operation on marine mammals. [157] Humpheson [158], a specialist acoustician, provided highly comprehensive and analytical models of underwater noise from the proposed mining and associated operation to the 2017 hearing. This original research undertaken in 2017 was reviewed and updated in 2024 [159]. This research is consistent with international best practice underwater modelling and therefore still represents the best available data about the underwater noise from the proposed operation.

It is important to note that there are no available estimates for the specific underwater noise generated by this proposal as there is no comparable equipment operating anywhere in the world and, therefore, it is not possible to confirm the actual underwater noise from this project prior to it starting. However, it is possible to provide robust and appropriate estimates of the likely underwater noise levels from the activity based on similar operations overseas and expert opinion. Humpheson[158 159] used estimates available from the De Beers Marine seabed mining operation as underwater source levels for his modelling. These source levels still represent the best available information about the likely noise level of the proposed operation.

Humpheson[158 159] estimated the estimated Sound Exposure Levels (SEL; the total noise energy produced from a single noise event) at specific distances from the proposed operation including source noise combined from both the SBC unit and the IMV (the surface processing vessel). These data are presented in Table 5.13 below.

**Table 5.13: Revised Sound Exposure Levels (SEL) and Sound Pressure Level (SPL) estimated for differing exposure periods and distances from the underwater noise generated from the crawler unit and integrated mining vessel combined. Source: Humpheson (2017)**

| | | SEL dB re 1μPa$^2$.s | | | | |
|---|---|---|---|---|---|---|
| **Distance** | **SPL re 1μPa** | **10 sec** | **10 min** | **1 hr** | **3 hr** | **24 hr*** |

[157] For example: Hegley (2015), Childerhouse (2016) Childerhouse (2023, 2024), Humpheson (2017), Humpheson (2024), EPA (2017, 2024)

[158] Humpheson D (2017) Trans-Tasman Resources - Acoustic Modelling. Unpublished report to TTR.

[159] Humpheson D (2024) TTR - Weighted underwater sound exposure levels. Unpublished report to TTR. 23 January 2024. Appears as Appendix 1 in Childerhouse (2024b).

| | | SEL dB re 1µPa$^2$.s | | | | |
|---|---|---|---|---|---|---|
| 500 m | 135 | 145 | 163 | 167 | 170 | 184 |
| 1000 m | 130 | 140 | 157 | 162 | 165 | 179 |
| 1500 m | 129 | 139 | 156 | 161 | 164 | 178 |
| 2000 m | 128 | 138 | 155 | 160 | 163 | 177 |

There are no New Zealand national standards for assessing impacts of underwater noise levels (as there are for airborne noise) and therefore it is appropriate to apply relevant, international standards. In assessing potential impacts of underwater noise on marine mammals, one of the most widely used international standards (Table B) are specified in Southall et al. [160]. This assessment includes updated estimates of physiological effects on the hearing of marine mammals (i.e., Temporary Threshold Shift ("**TTS**") and Permanent Threshold Shift ("**PTS**")). These approaches also utilise marine mammal specific estimates of underwater noise (i.e., frequency weighted SELs) or m-weighted SELs) which represent international best practice as described in Southall et al. (2019). An assessment of the application of these underwater noise standards (Table B) against the estimated underwater noise levels estimated for the operation (Table A) was undertaken to assess potential impacts on marine mammals and are reported in Childerhouse[156]. The conclusions of this research with respect to potential PTS or TTS included:

> The comparison of the estimated underwater noise data (Table A) with the m-weighted thresholds for TTS and PTS provided in (Table B) indicate clearly that there is no risk of either TTS or PTS for any marine mammal species at 500m or further from the operation even if they spend 24 hours in the area;

> There has been no attempt to assess impacts within 500m around the operation as it is unrealistic to define a specific point source for the combined noise sources given all the noise sources are spread over a large area (e.g., the IMV and FSO are both greater than 300m in length, the SBC will be up to 45m below the IMV on the seafloor and the vessels are likely to be spaced significantly apart). Notwithstanding these results at 500m from

[160] Southall B L, Finneran J J, Reichmuth C, Nachtigall P E, Ketten D R, Bowles A E, Ellison W T, Nowacek D P, Tyack P L (2019). Marine Mammal Noise Exposure Criteria: Updated Scientific Recommendations for Residual Hearing Effects. Aquatic Mammals 2019, 45(2), 125-232, DOI 10.1578/AM.45.2.2019.125.

the operation, it is possible for TTS or PTS to potentially occur within 500m of the operation.

It is important to note that it is not essential to be able to predict the actual underwater noise levels of the operation as the proposed consent conditions (Condition 11) proffered sets the maximum allowable level of underwater noise from the operation. When implemented, the TTR's operation will be limited in the amount of noise it is allowed to make and therefore the maximum noise levels possible from the operation can be definitively known and these levels can be assessed robustly through quantitative modelling as has been done by Humpheson[159].

While the focus of the underwater noise assessment was primarily on investigating potential physiological effects (e.g. TTS and PTS), it is also important to consider other potential effects of underwater noise including potential behavioural effects. TTR applied a 120 dB threshold derived from Southall et al. [161] to investigate behavioural disturbance which represented the best available standard at that time. While the 120 dB standard has since been removed as the national US standard, no equivalent standard for the assessment for behavioural effects has been set. In the absence of any other specific standard, it is useful to still use the 120 dB as a guide for potential behavioural disturbance. It is also important to consider what is meant by behavioural effects - in this case the 120dB level has been set conservatively to try and capture any potential behavioural change including relatively small effects such as changes in vocalising rates, movement (e.g. direct, depth) and/or social interactions and cohesiveness[161]. While these behavioural changes are relatively low-level impacts and may not have any actual individual or population level biological effect, the use of the 120 dB level is a useful proxy for any general behavioural effects that might result from exposure to underwater noise from this activity.

Childerhouse[50] [156] assessed potential behavioural impacts on marine mammals from the proposed operation using the 120 dB level given this level still represents a useful general guide. Comparing the combined SPLs of the operation estimated with the 120 dB threshold for potential behavioural effects indicates that it is only Low Frequency cetaceans (e.g. blue whale, southern right whale) where a behavioural disturbance may occur out to a distance of 1,500m from the operation. This suggests that further than 1,500m from the operation, there is unlikely to be an impact on behaviour. There is no evidence of any behavioural disturbance likely for any of the other marine mammal species at 500m from the operation,

[161] Southall BL et al. (2007) Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals. 33: 411-522.

but it is possible that there could be at distances less than this noting the comment above about the difficulty is assessing noise levels within 500m of the operation.

The combined noise level estimated to be generated by the SBC unit and IMV combined is 177dB re 1µPa[158]. This level is significantly lower (i.e., 90% quieter) than the average noise level of 187dB re 1µPa for large vessels (i.e., 100-300m in length) measured in New Zealand and overseas (Pine et al. 2016). This suggests that the potential behavioural effects from this operation will be significantly less than we would expect to see from a large vessel noting that this operation is very slow moving compared with a faster moving large vessel.

Overall, for noise impacts on marine mammals to have an actual effect at the individual or population level, requires that there are marine mammals in the immediate area around the operation. While this is clearly possible given the importance of the wider STB area for marine mammals, there is nothing to suggest that the project area is of any significance to marine mammals and, in fact, the evidence suggests that the area has a low likelihood and low abundance of marine mammals being presence. This low level of marine mammal presence means that the likelihood of significant noise impacts on marine mammals is very low.

### 5.9.1 Management of Potential Effects on Noise

A Joint expert conferencing on noise effects was undertaken as part of the 2013 marine consent application by TTR [162]. 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.

Further, in setting a noise limit, the experts agreed it was important to consider not only the sound 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 SBC operating under representative full production conditions shall be measured nominally 10m below the sea surface at 300m, 500m, 750m and 1,000m 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*

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[162] EPA (2024) A joint statement of experts in the field of effects on marine mammals. 19 February 2024.

*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)."*

The above, though updated, is included as Condition 11 proffered by TTR as part of this application. In addition, proffered Condition 12 states that, "*The Consent Holder must design and construct the SBC and IMV to achieve, at full production, a total combined noise source level (measured in water), of not more than 177 dB re 1μPa RMS linear at one (1) metre*". These two conditions essentially set a maximum underwater noise level that the activity must adhere to during all operations. These conditions represent a highly conservative approach to protecting marine mammals and other marine fauna and is the most precautionary underwater noise level proposed for any consented marine activity in New Zealand to date.

TTR has also 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 (**Appendix 5.9**), which will seek to ensure any adverse noise effects are avoided to the extent practicable;

> The use of suitably trained observers to conduct pre-start observations over a 500m radius surrounding the IMV for at least 30 minutes to ensure no whales or dolphins are present; and

> Any start-up of the operational will be completed as a 'soft start'. That is, equipment shall be gradually increased in power over a minimum period of 20 minutes to reduce noise impacts on marine mammals.

TTR has included conditions of this nature in the proposed consent conditions provided as Attachment 1 of this IA.

## 5.10 HUMAN HEALTH EFFECTS OF THE MARINE DISCHARGE ACTIVITIES

### 5.10.1 Introduction

Regulation 35 of the EEZ Regs 2015 identifies that an IA for a marine consent for discharge, must be supported by an assessment of the health effects that may result from the discharge activities. This matches the requirements for a decision-maker to take into account the effects of the discharge on human health, under section 59(2A)(b).

Those statutory requirements differ from the requirements that apply to the non-discharge activities of the project (i.e. the activities regulated under section 20, as identified in section

4 of this IA). For the non-discharge activities section 59(2)(c) requires that the decision-maker takes into account the "effects on human health that may arise *from* effects on the environment". Excluding the discharge effects, there are not expected to be any environmental effects that could give rise to a human health effect given the environmental effects of the non-discharge activities will be localised and short-term while extraction is taking place.

The focus of this section is therefore on the human health effects that may result solely from the discharge activities.

TTR engaged Dr Francesca Kelly to assess the likelihood of risk to human health from contaminants. [163] Her assessment focuses 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 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 activities (i.e. the activities regulated by sections 20B and 20C) so are not discussed in this section, however they have been considered in Section 5.12 of this IA which looks specifically at the air discharges associated with the project.

There are no other anticipated adverse effects of the project on human health.

### 5.10.2 Human Health Effects of the Discharge Activities

#### 5.10.2.1 Contaminants Present within the Discharges

The only contaminants that will be present in the discharges associated with the disturbance of the seabed during grade control drilling, SBC operation and monitoring, are the naturally occurring trace metals within the seabed.

As noted in Section 5.5.6 of this IA, there is the potential for these naturally occurring trace metals (copper, zinc, etc) to be disturbed, excavated and redistributed over the seabed during project operations.

With regard to the de-ored sediments, the processing of the seabed material to remove the iron ore concentrate is done by magnetic grinding and filtering, as outlined in Section 2.3.3 of this IA. No chemicals are added or used in the processing, therefore the remaining de-ored sediments comprise only natural seabed materials with the iron ore concentrate

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163 Statement of Evidence in Chief of Dr Francesca Kelly on behalf of Trans-Tasman Resources Ltd. 15 February 2014.

removed. Thus, the only potential contaminant 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 12Nm from the coast. Further, there is the potential for the sediment plume from the extraction and discharge process to extend towards the coastline and inside the 12Nm mark.

As described in Section 5.5.6 of this IA the seabed materials contain detectable concentrations of copper and nickel, so Kelly's assessment is based on possible discharges containing those trace metals. 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 5.5.6.2, mercury has not been considered with regard to human health effects.

Kelly 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 [164] provides information about patterns of food type exposure in the New Zealand population.

Kelly 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 5.5.6.

164 http://foodsafety.govt.nz/policy-law/food-monitoring-programmes/total-diet-study/

## 5.11 VISUAL, SEASCAPE AND NATURAL CHARACTER EFFECTS

### 5.11.1 Introduction

Boffa Miskell (Boffa) identified the natural features and landscapes/seascapes of the project area and the STB with the potential to be affected by the project, and has assessed the project's effects on visual amenity, significant features, landscapes or seascapes, and natural character [165]. The findings of their report have been summarised below.

### 5.11.2 Assessment Methodology

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 (22.2km offshore) (Figure 5.12 and Figure 5.13 below); and
2) The centre of the project area (28km offshore) (Figure 5.14 and Figure 5.15 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. Two heights were used for the mapping to a nominal deck height of 15m, and a height of 55m to represent the highest point of the IMV (the top of a funnel). [166]

[165] Boffa Miskell – Visual Effects Report and Graphic Supplement – November 2015

[166] NB. At the time of Boffa's assessment the IMV was referred to as the FPSO.

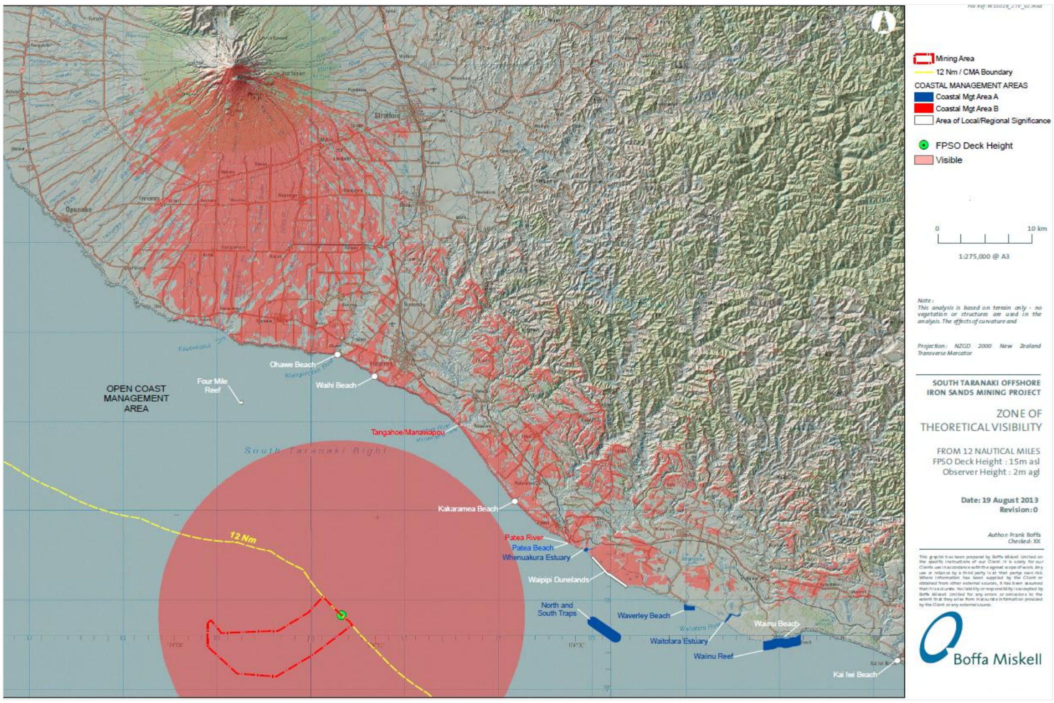


Figure 5.12: ZTV from 12Nm IMV Deck Height: 15m above sea level, Observer Height: 2m above ground level

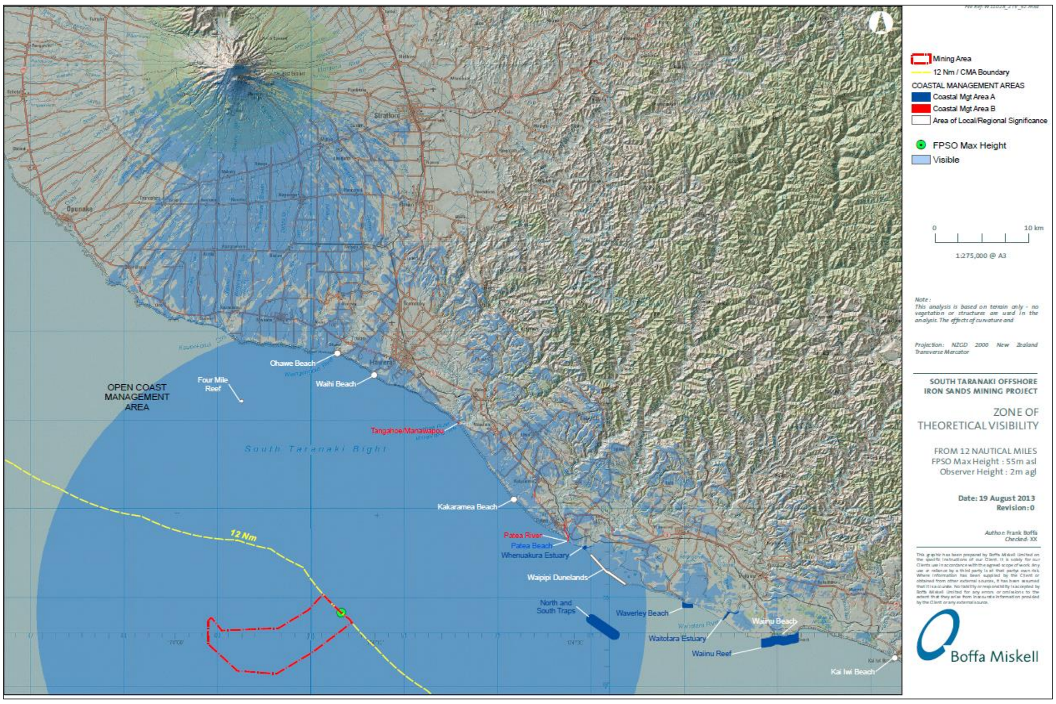


Figure 5.13: ZTV from 12Nm IMV Funnel Height: 55m above sea level, Observer Height: 2m above ground level

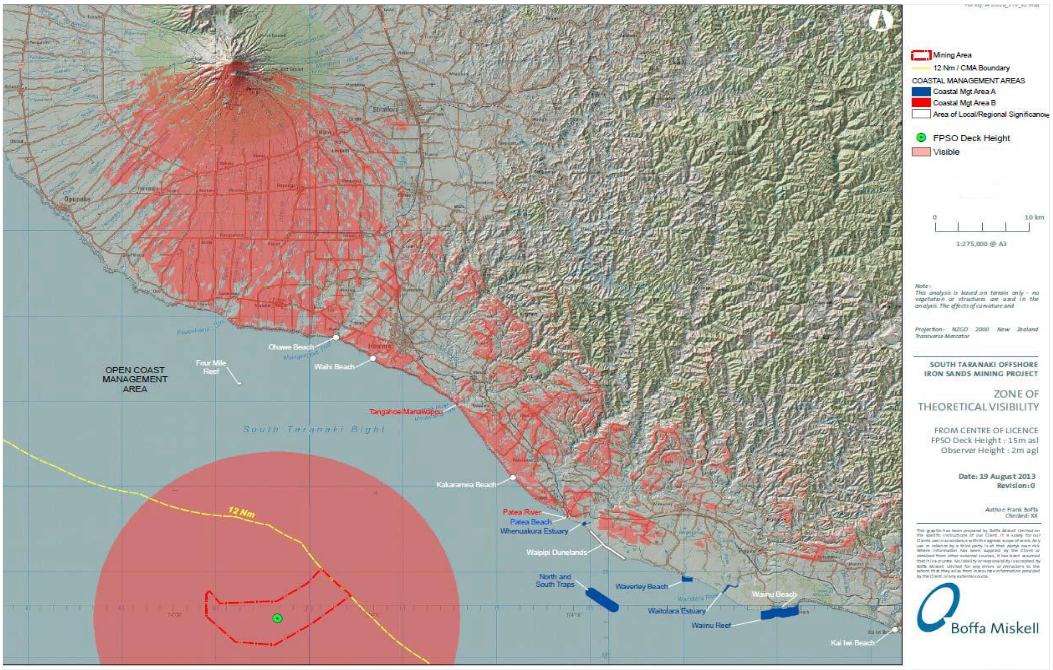


Figure 5.14: ZTV from centre of Application Area IMV Deck Height: 15m above sea level, Observer Height: 2m above ground level

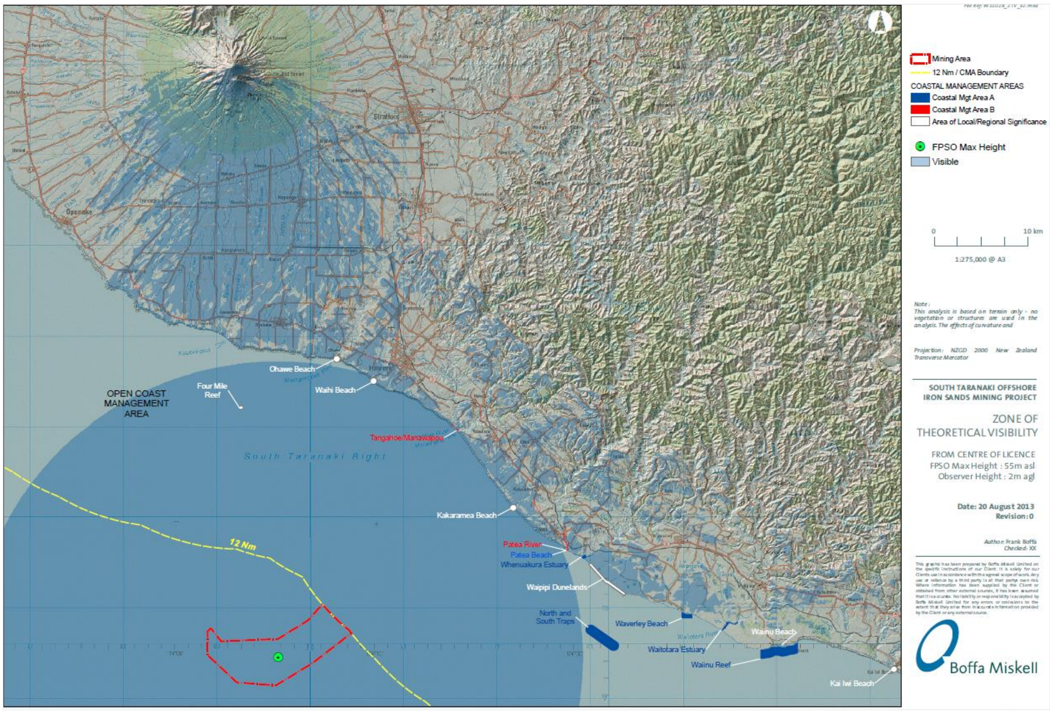


Figure 5.15: ZTV from centre of Application Area IMV Funnel Height: 55m above sea level, Observer Height: 2m above sea level

### 5.11.3 Summary of Potential Effects

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 to 15km 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. Despite the size of the IMV, and the presence of associated and smaller support vessels, which will in some cases be visible from the coastline for extended periods of time, the visual effect of 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 5.3, 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, so any effect on land-based viewpoints will be relatively insignificant.

Boffa[28] 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.

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 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, the assessment is that the significance of any visual cumulative effects will be no more than minor

With regard to natural landscape and features, Boffa considers that the offshore location of the project effectively avoids any direct effects on any areas that have outstanding natural features, landscapes or seascapes. Boffa assesses in particular the potential for effects on 5 outstanding features, taking into account the specific values that make them outstanding, and concludes in each case there will either be no effects on the outstanding values. 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.

Working within a defined project footprint, smaller than the total project area, and re-distributing de-ored sediments into already worked areas will further assist in avoiding and mitigating the potential for project related adverse effects on the natural landscape and feature values. Overall, Boffa 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. Where appropriate Boffa relied on the assessments of TTR's other consultants who have assessed specific marine-related biophysical matters that are integral to natural character. With the exception of the biophysical/geomorphological changes in the project area itself, such as the creation of pits and mounds from the extraction/deposition activity, Boffa assessed all effects on natural character as low. They found no adverse effects on natural character on inshore and nearshore coastal waters or the coastline, and concluded the significance of any natural character effects in the project area itself would depend on what mitigation measures are applied.

## 5.12 AIR QUALITY EFFECTS

### 5.12.1 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 [167], or reciprocating engines [168], located on the IMV.

### 5.12.2 Assessment Methodology

Discharges to air from the HFO gas turbines or reciprocating engines comprise combustion products. The air pollutants considered in T&T[168] 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[168] 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 concentrations of pollutants were predicted by using air dispersion modelling (the CALPUFF dispersion model) over a 52km x 40km grid (100m 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.

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[167] 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.

[168] 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.

### 5.12.3 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 5.14 below).

**Table 5.14: 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.<br><br>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 12Nm limit therefore, T&T [167] [168]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[167] [168] identify that the predicted ground level concentrations of all contaminants onshore are below the relevant health-based air assessment criteria. It is noted that 20µg/m³ is the

World Health Organisation 24-hour average guideline, which does not currently have any regulatory status in New Zealand.

### 5.12.4 Management of Potential Effects on Air Quality

To provide for the high $SO_2$ discharges, it is appropriate to include a condition to 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. This limit has been provided for in the proposed consent conditions provided as Attachment 1 of this IA and is volunteered on an Augier basis, given that this potential effect is not regulated.

## 5.13 EFFECTS ON EXISTING INTERESTS

### 5.13.1 Cultural Effects

#### 5.13.1.1 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 Supreme Court's guidance is that tikanga-based customary rights and interests are 'existing interests', and accordingly section 59(2)(a) requires effects on those interests to be taken into account. [169] The Supreme Court also held that these matters might be required to be taken into account under section 59(2)(l), as tikanga is "other applicable law" under that provision. TTR does not seek to, or need to, resolve which statutory requirement is the most relevant. Rather, TTR sets out to identify and address cultural values—to the extent that it can—so as to address the statutory requirements, whichever provision they arise from.

The assessments summarised in this section of the IA 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

[169] [Add cross-reference to relevant part of Statutory Framework section]

viewpoint of whakapapa with kaitiakitanga is an exercise of obligation, mana, of prestige, of hapū and iwi.

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*[170].

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.

#### 5.13.1.2 Cultural Values Assessment

There are three iwi whose rohe are closest to the project area. Those iwi, and the extent of their rohe along the STB coastline are:

> Ngāruahine (between the Waihi Stream near Hawera and the Taungatara Stream near Opunaki);

> Ngāti Ruanui (between the Whenuakura River near Patea and the Waingongoro River near Hawera); and

> Te Kaahui o Rauru (between the Patea and Whanganui rivers)

TTR recognises that Ngāti Ruanui holds mana whenua and mana moana in relation to the area closest to the project.

TTR has made extensive efforts to consult with all three iwi, and a detailed summary of that process is provided in Section 7 of this IA. TTR's attempts to engage with iwi prior to its 2016 application for marine consent were unsuccessful, which led TTR to engage Tahu Potiki, an independent cultural expert from the Ngāti Tahu and Ngāti Mamoe iwi, to prepare a Cultural Values Assessment ("**CVA**")[171] for the iwi groups who have a connection with the STB and the project area, with a focus on Ngāti Ruanui's cultural values. As identified in Section 7, TTR's further attempts to consult with Ngāti Ruanui during the EPA's assessment of TTR's

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170 Te Taihauāuru Iwi Forum Fisheries Plan 2012-2017, pp. 6

171 Cultural values Assessment and Analysis by Tahu Potiki. May 2016

2016 application, and its attempts to consult with Ngāti Ruanui prior to lodging the present application have been equally unsuccessful.

The CVA prepared by Mr Potiki 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 7 of this IA.

*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 which would allow 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 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 Pātea 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 of 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 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 sacred 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 the 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 Pātea 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 (in relation to TTR's previous marine consent applications) 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 5.13.1.3 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 with opportunities for Ngāti Ruanui to take a central role in this monitoring and communication. The CVA identifies that the measures proposed by TTR to address the actual and potential cultural effects of the project (identified in Section 5.13.1.4 below and as provided for in the Proposed Consent Conditions provided as Attachment 1 to this IA) 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.

#### 5.13.1.3 Te Tai Hauāuru 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 Māori matters affected by the project (refer to **Appendix 5.10**). 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.

Appendix 1 of the Forum Report identifies that a detailed work programme has been provided 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 an 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 Pātea* - 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.
- *Pātea 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 [172] 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.

**Table 5.15: Possible monitoring sites and species**

| Cultural Monitoring Sites | Indicators | Species/ Details |
|---|---|---|
| North and South Traps | Primary Production | Ecological integrity/ diversity/ abundance |
| The Rolling Grounds | Rig | Abundance and Health |

[172] Which TTR acknowledges is prohibited for marine discharge consents under s 64, EEZ Act.

| Cultural Monitoring Sites | Indicators | Species/ Details |
|---|---|---|
| Ototoka | Mussels | Abundance |
| Whanganui/ Kai Iwi | Gurnard/ Kahawai/ Tuna (eels) | Abundance (particularly the number of eels in glass eel migrations) |
| Waitotara to 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.
6. 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.
7. TTR should be required to invest in a financial bond to compensate for any negative impacts on customary fishing activities.

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 PCEMP 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.

#### 5.13.1.4 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 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 of indirectly 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 Hauāuru 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.

### 5.13.2 Commercial Fishing Effects

#### 5.13.2.1 Introduction

TTR commissioned NIWA[94 95 96] to assess the potential impacts of the project on fishing 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 7 and the assessment of the effects of the project on commercial fishing interests have been summarised below.

#### 5.13.2.2 Assessment Methodology

In preparing their report, NIWA[94] 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.

NIWA[96] looked at the catch and effort data from the MPI database "Wharehou" for fishing activities over the period from October 2007 to September 2023 within the proposed project area (PPA - the mining area), and the areas where the SSC resulting from the project related sediment plume will potentially be above the 2mg/L threshold (a conservative indicator for when fish may avoid an area, as discussed in Section 5.6.1 and below) 50% (median) and 1% (99th percentile) of the time for sand extraction activities at Mining Areas A and B (see Figure 5.16). Summaries (tables) were then made to determine the numbers of fishing events in each area by the various fishing methods and to identify the main target fish species.

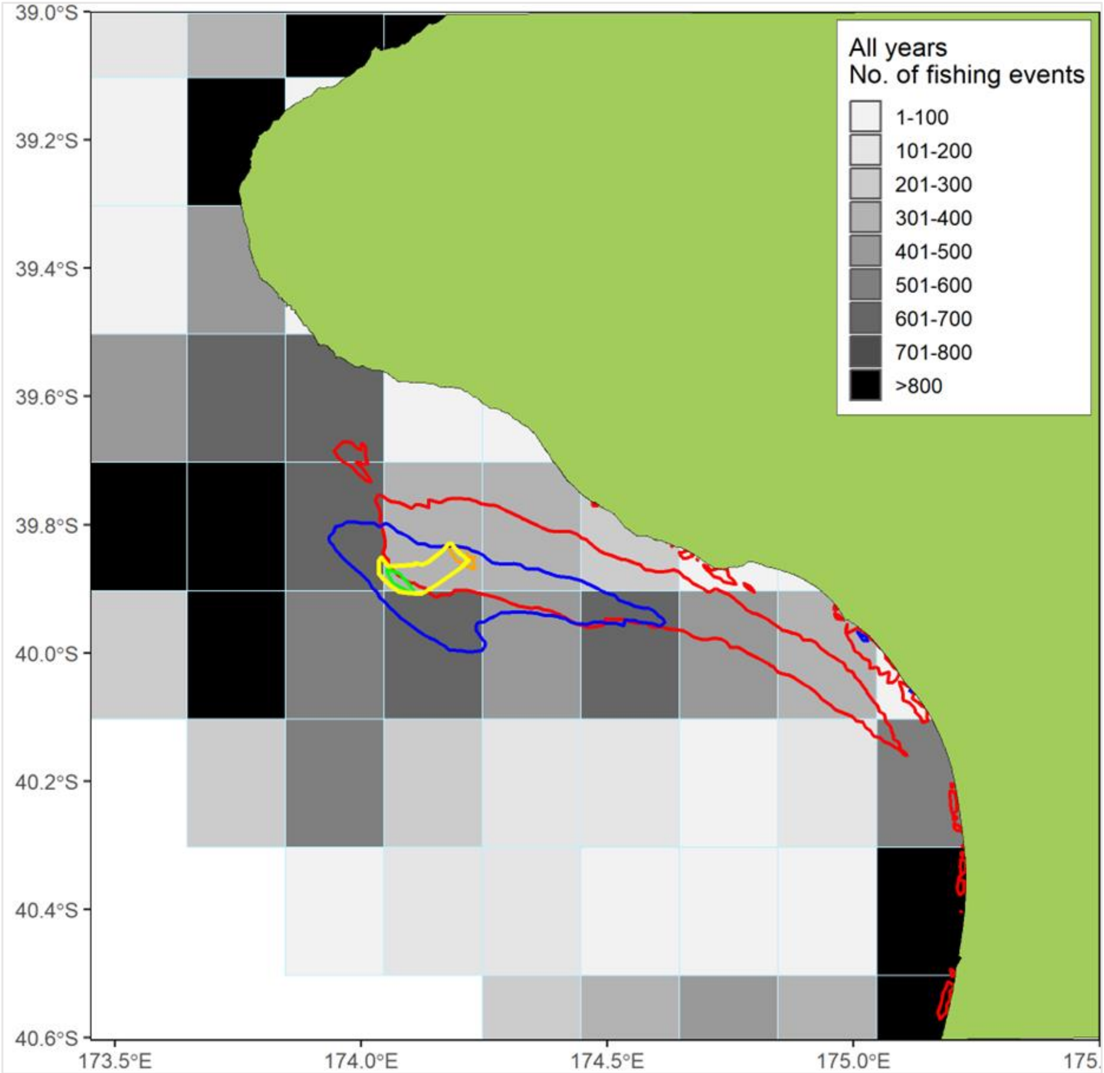


**Figure 5.16: The number of fishing events aggregated into 0.2 degree squares for FMA 8 for fishing years 2008–2023.**

Note: The PPA is shown in yellow, Mining A median SSC area in orange, Mining A 99th percentile SSC area in red, Mining B Median SSC area in green, and Mining B 99th percentile SSC area in blue.

#### 5.13.2.3 Summary of Potential Effects

***Species Abundance***

The abundance of fished species is potentially impacted by mining activities and suspended sediments in the sediment plume, as well as by noise and other vessel related effects.

Section 5.3 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 5.7.1, 2mg/L and 3mg/L are the lowest suspended sediment concentrations that are known to 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 35-40mg/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 at suspended sediment concentrations levels well in excess of 500mg/L.

Such levels of suspended sediments would not result from the proposed iron sand mining project, even when background suspended sediment concentration are included and right at the project's extraction and discharge source or near the seabed where background levels of suspended sediment are the highest.

***<u>Displacement of fishing effort from the project area</u>***

With regard to the proportion of fishing effort displaced by the project, Figure 5.16 (and further plots in NIWA[96] shows that over the fishing years 2008–2023 the highest level of overall commercial fishing effort in the STB occurred offshore in deeper water, reflecting the location of the mid-water trawl fishery for jack mackerel, and along the coast near Foxton. Fishing effort in the proposed project area and the Pātea Shoals generally was less intense over the period.

The NIWA[96] analysis indicated that there were 425 fishing events using a total of five separate fishing methods inside the PPA since 2007–08. Bottom trawling was the most important fishing method with 235 events for the time-period (55.2% of all events). The number of bottom trawl events has decreased over the last few years and there were none at all in 2021 and just two and six events in 2022 and 2023 respectively.

Set netting was the next most important method with 163 events for the time-period (38.3% of all events) and just 14 set netting events within the project area in 2023. Three other methods were used in the PPA for the time-period; bottom longline, hand line, and purse seine, but these were sporadic for all methods and did not occur in most years. Bottom longline was used in just five years (14 events), handlining in four years (eight events), and purse seining in two years (five events).

There were five main target species associated with fishing (all methods) in the PPA. School shark was targeted the most with 137 events (32.2%) followed by trevally with 109 events (25.6%), red gurnard with 103 events (24.2%), and rig with 37 events (8.7%). School shark was targeted every year and trevally, red gurnard, and rig in most years. Leather jackets were targeted in 19 events (4.5%) over four consecutive years from 2009 to 2012 but has not been targeted since. These five species account for over 95% of all events for the time-period.

The overall number of fishing events for all methods combined in the PPA has declined over time indicating likely minimal spatial displacement of commercial fishing 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 4km) 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.

***Mining A median SSC area***

NIWA[96] recorded 378 fishing events using a total of five separate fishing methods inside the Mining A median SSC area since 2007–08. Set netting was the most important fishing method with 244 events for the time-period (64.6 %). The number of set net events has decreased since 2016, but the method has been used every year for the time-period. Bottom trawling was the next most common method with 81 events for the time-period (21.4%). The number of events has decreased over time and there has been no bottom trawling at all in the last two years, likely as a result of restrictions put in place to protect Maui's dolphins. Handlining, bottom longlining, and cod potting have all occurred in the Mining A median SSC area but in much lower numbers (35, 17, and 1 event respectively). These methods have occurred in only a minority of years through the time-period and none in the most recent year (2023).

In this area school shark was targeted the most with 141 events (37.3%) followed by rig with 109 events (28.8%). Both of these species have been targeted in most years with fluctuating levels of effort. The next most targeted species was trevally with 47 events (12.4%) and was targeted commonly before 2015 after which targeting declined and has stopped altogether since 2020. Blue cod was targeted in 42 events (11.1%), but targeting didn't occur regularly until 2014, although there was none in the most recent year, 2023. Targeting of red gurnard has been sporadic through time, totalling 32 events (8.5%). Leather jacket was only targeted in five events across two years from 2012–2013 and blue warehou in two events in 2022.

Most of this area lies within the PPA and there will be some exclusion of fishing activities as described above and movement by fish to outside of this area to avoid suspended sediment concentrations above 2mg/L could occur.

***Mining A 99th percentile SSC area***

NIWA[96] found there were 1 227 fishing events using a total of eight unique fishing methods inside the Mining A 99th percentile SSC area since 2007–08. Set net was the most important fishing method with 814 events for the time-period (66.3 %). The number of set net events has fluctuated over time but declined overall. It is the only method to have been used in all years over the time-period. Bottom trawl was the next most common method with 205 events for the time-period (16.7%) and has declined over the time-period with none at all in 2023. Handlining was the next most common method with 88 events for the time-period (7.2%) and has been sporadic throughout the time-period with some years seeing no handlining at all. Bottom longlining was the fourth most common method with 84 events (6.8%) and occurring in most years through the time-period. Dredging did not occur until 2020 but has occurred every year since. While it only account for 1.7% of all fishing events for the entire time-period, in 2022 and 2023 it accounted for 20 and 12% of all events respectively, making it the second most important method in those years. The remaining methods, cod potting, purse seining, and rock lobster potting have only occurred rarely and none in the last three years.

NIWA[96] found there were six main target species associated with fishing (all methods) in the Mining A 99th percentile SSC area and a variety of other species. Rig and school shark were the two most common species targeted with 646 (52.6%) and 165 (13.4%) events respectively, which is consistent with the proportion of fishing events that used set net. The number of events that targeted rig has declined substantially over time whereas school shark (which was previously less important than rig) has fluctuated somewhat and increased noticeably in the last three years. Blue cod, trevally, and red gurnard were the next most important species being targeted by 139 (11.3%), 109 (8.9%), and 81 (6.6%) events respectively. Leather jackets were targeted in 37 events (3%) but only for a short period of six years from 2009 to 2014. These six species comprised almost 96% of all fishing events in the Mining A 99th percentile SSC area, with the remaining being comprised of a variety of other species.

Most of this area lies outside the PPA and will not be subject to exclusion of fishing activities. From time to time suspended sediment concentrations above 2mg/L will occur somewhere within this area and fish may move to adjacent areas of lower sediment concentration.

***Mining B Median SSC area***

NIWA[96] found there were 531 fishing events using a total of seven unique fishing methods inside the Mining B Median SSC area since 2007–08. Bottom trawling was the most important fishing method with 353 events for the time-period (66.5 %). The number of bottom trawl events has declined over time but has been used in each year for the time-period. Set net was the next most common method with 123 events for the time-period (23.2%). The number of set net events was relatively steady until decreasing to a low period from 2019 to 2021 but has since increased in 2022 and 2023 to its highest levels in the time-period. Bottom longlining was the next most important method with 30 events (5.6%) for the time-period, but its use has been sporadic through time with a number of years having no bottom longline effort in this area. Midwater trawling used on the bottom, purse seining, midwater trawling, and handlining have all been used but only occasionally and only accounted for between one and 14 fishing events (0.2–2.6%). The number of fishing events has fluctuated over the time-period but has overall been declining.

NIWA[96] found there were five main target species associated with fishing (all methods) in the Mining B Median SSC area. Red gurnard was targeted the most with 178 events (33.5%) followed by trevally with 132 events (24.9%). Red gurnard has been targeted in all years and trevally in all but two years, but both have had overall declining levels of effort over the time-period. The next most targeted species was school shark with 120 events (22.6%). The number of events targeting school shark was relatively steady until declining to the lowest levels from 2019–2021 and then increasing again to their highest levels for the time-period from 2022 and 2023. This follows the same general pattern for set net fishing events, which is the most common method for targeting school shark in the region. Leather jackets and jack mackerel were both targeted in 42 fishing events (7.9%) for the time-period, but leather jackets have not been targeted since 2013, whereas jack mackerel has been targeted in a handful of events in almost all years for the time-period. A variety of other species were targeted at various times throughout the time-period and comprised the remaining 3.2% of fishing events.

All of this area lies within the PPA and there will be some exclusion of fishing activities as described above and movement by fish to outside of this area to avoid suspended sediment concentrations above 2mg/L could occur.

***Mining B 99th percentile SSC area***

NIWA[96] found there were 889 fishing events using a total of six unique fishing methods inside the Mining B 99th percentile SSC area since 2007–08. Set netting was the most important fishing method with 527 events for the time-period (59.3 %). The number of set net events has fluctuated over time, appearing to have an overall declining pattern until 2021 then increasing somewhat in 2022 and 2023. Bottom trawling was the next most common method with 328 events for the time-period (36.9%), increasing in the first three years to a high of 41 events before declining thereafter with the last three years being the lowest in the time series. Bottom longlining, handlining, purse seining, and midwater trawling all occurred but in small numbers with between one and 19 events (0.1–2.1%) and sporadically. Across all methods there has been an overall decline in the number of fishing events.

NIWA[96] found there were five main target species associated with fishing (all methods) in the Mining B 99th percentile SSC area and a variety of other species. Rig was the most important species being targeted in 357 events (40.2%) but has declined in importance over time. School shark was the next most important target with 178 events (20.0%). The number of events targeting school shark increased from the beginning of the time-period before reaching a relatively steady period from 2011–2017 before declining markedly to a low in 2019–2020 and then increasing again to the highest levels in 2022 and 2023 during which time it was the most important target species in the Mining B 99th percentile SSC area. Trevally was the next most important species with 130 targeted events (14.6%). The number of events targeting trevally fluctuated over time but in the last three years, there have been no events at all targeting them. Red gurnard was the fourth most important target species with 128 targeted events (14.4%). After increasing to a maximum of 27 events in 2011 there has been an overall declining number of events targeting red gurnard since, with between just one and seven events each year since 2016. There were 60 fishing events (6.7%) targeting leather jackets for the time-period, but this was restricted to a short period between 2009 and 2013 after which there have been no events targeted at this species. These five species comprised 96% of all fishing events, with the remaining being targeted at a variety of other species.

Most of this area lies outside the PPA and will not be subject to exclusion of fishing activities. From time to time suspended sediment concentrations above 2mg/L will occur somewhere within this area and fish may move to adjacent areas of lower sediment concentration.

#### 5.13.2.4 Cray-Fishing

NIWA[96] 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 rock lobsters (greater than 1.5 kg) may move offshore to depths greater than 25m 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, NIWA[95] 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 5.13.2.7 below.

#### 5.13.2.5 Abundance of Commercial Fish Species

The effects of the project on the fish populations and mortality have been discussed in Section 5.6. NIWA[39] 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.

#### 5.13.2.6 Spatial Distribution

NIWA[39] 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. NIWA[95] 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.

#### 5.13.2.7 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 could potentially result in reef habitats 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 potentially affected is rock lobster and impacts could 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.

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 10m deep. The mobile surf zone environment is unlikely to be affected by sedimentation from the project.

The degree of impact on fished species 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 5.4), 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 and the sediments from the proposed mining operations do not significantly increase levels of suspended sediments over background levels near the coast. Therefore, the proposed mining operations are highly unlikely to have any effect on near shore populations of paua, rock lobsters or other fished species.

#### 5.13.2.8 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, SBC, 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.

TTR has commissioned both an independent review of the commercial fishery in the STB and undertaken 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.

#### 5.13.2.9 Commercial Fishing Exclusion - Cumulative Effects

Subsequent to approval from MNZ, as discussed in Section 5.13.2.8, TTR is proposing a limited safety buffer zone located around the IMV during project operations. This will occupy approximately 10km$^2$, 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 5.8 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 is low.

### 5.13.3 Aquaculture

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.

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.

Further to the impacts discussed above, 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 on aquaculture is included as Section 5.13.4 below.

### 5.13.4 Effects on Biosecurity

#### 5.13.4.1 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 in exports from the Marlborough aquaculture industry.

#### 5.13.4.2 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' [173].

Approximately 87% of New Zealand's 200 NIMS are likely to have been transported by vessel biofouling.

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.

#### 5.13.4.3 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***

[173] A recess in the hull that provides an intake reservoir from which piping systems draw raw sea water.

Vessels entering New Zealand waters are required to mitigate risks from ballast water, which has typically involved oceanic flushing of ballast water while vessels are in transit to New Zealand. While not completely effective, this has been accepted as best practice for ballast water management for more than 20 years.

As a result of ratification of The International Convention for the Control and Management of Ships' Ballast Water and Sediments, ballast water is now regulated by the Marine Protection Rules (Part 300: Ballast Water Management). These require on-board ballast water treatment ("**BWT**"), and the conditions proposed by TTR incorporate these requirements.

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 been provided for through the proposed consent conditions provided as Attachment 1 of this IA.

***<u>Vessel Biofouling</u>***

Biofouling on vessels arriving in New Zealand is managed by MPI under the Craft Risk Management Standard [174] ("**CRMS**"), which became mandatory in 2018. The CRMS requires that vessels arrive with a "clean hull" [175] 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.

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[174] Ministry for Primary Industries, 2014. *"Biofouling on Vessels Arriving to New Zealand – CRMS BIOFOUL"* 15 May 2014.

[175] 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"*.

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 will ensure that any potential biosecurity effects that may result from the project are negligible.

#### 5.13.4.4 Summary

Overall, provided the proposed measures are implemented and complied with, it is considered that any biosecurity effects related to the project will be negligible.

### 5.13.5 Recreation and Tourism Effects

#### 5.13.5.1 Introduction

As outlined in Section 3.4.2, RGA[92] identifies the recreational and tourism activities that occur in the STB, and has assessed how the project would affect tourism and recreational values and users.

RGA[92] bases this 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 5.3 and 5.4 respectively.

The potential impacts on the recreation and tourism activities within the STB are discussed below.

#### 5.13.5.2 Summary of Potential Effects

RGA[92] 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, Pātea, Waipipi, Waiunu, Kai Iwi and Castlecliff. Further, the STB recreational areas include the coastal fishing and cray-fishing resource extending approximately 20km offshore (at The Traps and Graham Bank). On the coast, the level of shellfish gathering is difficult to quantify, but RGA[92] considers it a locally important recreational activity.

The coastal and near coastal areas extending north from Pātea to Cape Egmont are relatively lightly fished in comparison to that south of Pātea and in the North Taranaki Bight. RGA[92] found that very little recreational fishing occurs more than 20km 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 Pātea.

RGA[92] concluded that the effects of the project on recreation and tourism interests are as follows:

- Effects due to changes in water clarity:
  - Minor in the inshore setting (where most recreational activity occurs) due to the very low scale of effect and high level of background suspended sediment;
  - Minor in the diving setting of the Traps due to persistent but small scale change in water clarity that will be most apparent when mining is in the eastern part of the project area (i.e. not for the full duration of mining);
  - Moderate in the diving setting of the Traps during the rare periods of extreme water clarity, with similar effects also likely at the less important diving setting on the Graham Bank; and

> Minor for all offshore surface recreation activities, due to the scale of the setting, the low level of activity, and the transient character of the experience.

> Minor effects due to changes to marine ecology.

> Minor effects, if any, on surfing or inshore recreation that relies on natural beach replenishment processes.

> Very Minor effects due to displacement from the exclusion zone around the active mining activity; and

> Very little potential for adverse effects on New Zealand's 'clean green' reputation.

#### 5.13.5.3 Management of Potential Effects on Recreation and Tourism

Due to the predominantly minor effects on recreation and tourism there was little consideration of effects, mitigation and management in RGA[92] and on this basis, there are limited conditions included in the proposed consent conditions that directly 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 PCEMP and EMMP for the project to assist in expanding the data source on recreational fishing within the STB.

In addition, the proposed conditions which indirectly relate include:

- The set discharge and sediment limit which indirectly contribute to ensuring water clarity effects are as predicted;
- The requirement of a complaints register to record any concerns for our users of the STB;
- The community relationship conditions which provide for community meetings and information sharing on the seabed material extraction activities and any monitoring results and/or actions, or other matters that may be of interest to the public.

### 5.13.6 Navigation and Commercial Shipping Effects

#### 5.13.6.1 Introduction

As identified in Section 3.4.3 Marico[93] undertook a comprehensive investigation of marine traffic movements and navigational safety within the STB.

R N Barlow and Associates Limited (Barlow) was engaged to further provide an assessment of the maritime and navigational impacts of the project [176].

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[93] and Barlow [177] reports.

#### 5.13.6.2 Assessment Methodology

In preparing its report, Marico[93] 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.

#### 5.13.6.3 Summary of Potential Effects

Both Marico[93] and Barlow [178] 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 [179] 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 67km$^2$ project area.

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[176] 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.

[177] 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.

[178] 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.

[179] 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.

Additionally, the project area is removed from regular marine traffic routes and activities, and Barlow [180] 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.

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.

#### 5.13.6.4 Management of Potential Effects

Given the low level of marine traffic through the project area, Barlow [181] 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.

[180] 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.

[181] 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.

Transfer of fuels at sea will be regulated under a "Produce Safety Case" to be approved by Maritime New Zealand in accordance with the Marine Protection Rules [182].

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 1m x 1m 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 12Nm 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.

### 5.13.7 Effects on Other Existing Interests

#### 5.13.7.1 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.  Their interests have been considered further through consultation with Origin Energy (the operators of the

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182 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

Kupe JVP field) as discussion in Section 7.2.13 of this IA and additional measures have been incorporated into the proposed consent conditions included as Attachment 1 of this IA.

#### 5.13.7.2 Existing Marine Consent Holders

As discussed in Section 3.4.8, 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 pre-commencement monitoring programme of two years, therefore they are not deemed to be affected by the project.

Further, Figure 5.17 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 (in the bottom right of Figure 5.17) and is in excess of 50km 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 5 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.

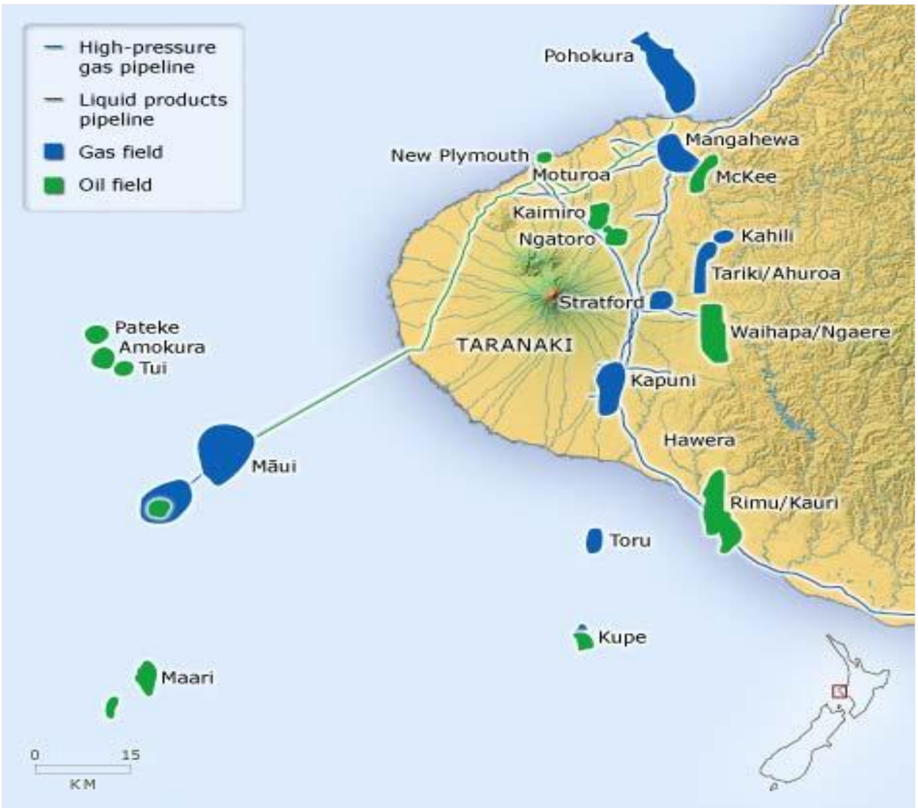


Figure 5.17: General indication of the Taranaki Region's oil and gas fields

#### 5.13.7.3 Settlement of a Contemporary Claim

As discussed in Section 3.4.10, 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 5.13.4 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 7) with Ngāti Koata.

## 5.14 OTHER CONSIDERATIONS

### 5.14.1 Environmental Monitoring Activities

#### 5.14.1.1 Introduction

TTR's application includes all the monitoring activities for which a marine consent or marine discharge consent is required (as identified in Section 4 of this IA).

As previously described in the IA, a draft 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 detail of the monitoring activities is described in Section 6 of this IA. Each monitoring activity and the potential effects of the activity are summarised below.

#### 5.14.1.2 Deployment of Moored Monitoring Equipment

As part of both the pre-commencement and environmental monitoring programme, the deployment of semi-permanent monitoring equipment will be required. Moorings that are placed within the CMA will go through the requisite consenting process with the Taranaki Regional Council ("**TRC**").

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' [183] will be issued for each mooring deployment.

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

[183] http://www.linz.govt.nz/sea/maritime-safety/notices-mariners

mooring components could be up to 100m in length and would typically consist of a 12mm double braid sinking rope.

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 to $4m^2$. It is initially proposed that two moorings for monitoring noise will be deployed in the EEZ resulting in a total disturbance of approximately 4 to $8m^2$ 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 to $8m^2$ 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 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.

#### 5.14.1.3 Vertical Profile Measurements

Vertical profile measurements will be collected from 19 sampling sites in the EEZ and in the CMA on a monthly basis during the PCEMP 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.

#### 5.14.1.4 Acoustic Surveys

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 from the IMV/SBC that the conditions specify (approximately 1 hour). The moored monitoring positions will check compliance at and beyond the identified 120dB contour.

#### 5.14.1.5 Water Sampling

Water samples will be collected from 19 sampling sites in the EEZ on a monthly basis during the PCEMP and on a fortnightly basis once iron sand extraction activities commence. Approximately 5L of water will be collected for both seabed and surface samples resulting in approximately 30L of water collected at each sample station. Not all 30L 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 570L 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.

#### 5.14.1.6 Zooplankton Sampling

Equipment will only be present in the water column for the period of time taken to deploy the sampling net to the required depth and to subsequently retrieve it. The sampling net will not make contact with the seabed. 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.

For those reasons, the effects of zooplankton sampling will be negligible.

#### 5.14.1.7 Epibenthic Surveys

The intention is to operate the drop camera and video tows 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, with no or negligible effects.

#### 5.14.1.8 Benthic Grab Sampling

The double Van-Veen has a maximum sample depth of 0.16m 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 0.2m$^2$ of seabed and will remove 0.02m$^3$ of substrate, and as each site is sampled in triplicate, this will represent a disturbance of 0.6m$^2$ and removal of 0.06m$^3$.

Using the proposed benthic sampling approach, in the first three years of monitoring there will be 19 sites within the EEZ. This equates to 11.4m$^2$ of seabed disturbed and 1.14m$^3$ 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 45.6m$^2$ and will remove 4.56m$^3$ 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 where extraction has recently occurred. Therefore, after the first three years, the increase in area of disturbance each year will be 1.8m$^2$ and 0.18m$^3$ 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 they will occur; whereby the 19 sampling sites are sparsely spaced over a total area of approximately 400km$^2$. 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.

#### 5.14.1.9 Bathymetry Surveys

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' [184] 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 these reasons any effects of MBES surveys on the marine environment are considered to be negligible.

### 5.14.2 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 90-110mm diameter, tensioned steel cables directly to the IMV. The anchors are moved during the course of the SBC 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.

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[184] http://www.doc.govt.nz/Documents/conservation/native-animals/marine-mammals/seismic-survey-code-of-conduct.pdf

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. As this anchoring will be short-term, marine consent would not be required under the EEZ act. Furthermore, 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.

### 5.14.3 Unplanned Oil Spill Events

#### 5.14.3.1 Introduction

TTR's application is not requesting consent under the FTA 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.

#### 5.14.3.2 Oil Spill Trajectory Modelling

As part of its 2014 application TTR engaged MetOcean Solutions Limited (MetOcean) to prepare an oil spill trajectory report [185] which used modelled data to predict the trajectory of varying sizes of spill events.

To inform MetOcean, 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

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[185] MetOcean Solutions Limited. *"Oil Spill Trajectory Modelling. TTR mining barge, New Zealand. Prepared for Trans-Tasman Resources."* January 2014.

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.

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 to 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 5.11 to 5.14).

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.

#### 5.14.3.3 Considerations of Effects and Mitigation

MetOcean concluded that potential oil spill effects would be of moderate to 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 20km 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 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.

### 5.14.4 Jack-Up Deployment 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. [186]

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.

#### 5.14.4.1 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.

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

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[186] OCEL, 2015. *"Implications of Loose Tailing Seabed Material on Future Jack-Up Deployment in the South Taranaki Bight"*.

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 400kPa, 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 6m.

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 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.

# 6. MANAGEMENT AND MONITORING FRAMEWORK

## 6.1 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 (Attachment 1). 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 PCEMP);
  - 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 PCEMP, based on the draft BEMP, that will guide the collection of further data about the existing environment to ensure that the information already available is supplemented by additional data covering the period immediately prior to commencement of mining. The pre-commencement data will also be used to refine and add to the SSC limits set by conditions;
- 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 PCEMP will be incorporated in the final version of the EMMP which is to be submitted to the EPA for certification;
- 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.

As part of the 2017 EPA application, 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 5.6 and 5.7 to this IA.

TTR 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. [187] The advice provided by AES[187] 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 PCEMP, 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 (Attachment 1), 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 in further detail in the sections below.

## 6.2 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 PCEMP 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 PCEMP;

[187] James, M.R., MacDiarmid, A., 2016. "Trans-Tasman Resource Ltd consent application: Ecological Monitoring" February 2016. 13 pp.

- Compare monitoring data against the background data to assist in determining if any of the project's activities have resulted in adverse effects that were not anticipated at the time of granting consent;
- Consider and make recommendations on the following:
  - The appropriateness of the SSC Limit values and the ISQG-High values; [188]
  - Potential Operational Responses that may be implemented based on the investigations into the causes of any breach of the SSC Limits or ISQG-High values;
  - The implementation of any Operational Responses;
  - The need for any new SSC Limit for any parameter or for any new ISQG-High values being monitored; and
  - Any revised SSC 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.

The TRG will meet annually during the PCEMP; 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

[188] These values are addressed in further detail in secton [ ] below.

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 PCEMP 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.

## 6.3 OPERATIONAL SEDIMENT PLUME MODEL

TTR will develop, maintain and utilise an project specific OSPM to assist with the management of project operations.

The OSPM is not a continuation of the sediment dispersion modelling that has already been completed. That modelling used a set of historic data to produce one long-term representation of past oceanographic influences on sediment behaviour. It was a hindcast model. By comparison, the OSPM will be a forecast model, running in real-time to produce many short-term predictions of individual events. It will enable TTR to predict whether the sediment discharged from the project at a given time may, as it disperses, result in SSC levels at down-current locations that exceed the SSC limits set by the proposed consent conditions. This is a critical tool to enable TTR to take operational decisions to ensure the discharge complies.

Also, once mining commences it will not be possible to directly measure ‘background’ SSC levels in locations receiving any mining-derived sediment, therefore, the OSPM is an essential tool for predicting background SSC levels, to ensure the contribution of mining-derived sediments to overall SSC levels is accurately assessed.

Water quality, sedimentation and oceanography data collected during the pre-commencement monitoring programme under the PCEMP will be important to validating and refining the OSPM 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 PCEMP 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 pre-commencement environmental monitoring period, for the first three years of extraction activities, and every two years thereafter.

## 6.4 PRE-COMMENCEMENT ENVIRONMENTAL MONITORING PLAN

### 6.4.1 Introduction

The pre-commencement environmental monitoring programme, undertaken in accordance with the certified PCEMP, 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 PCEMP will also serve to validate the OSPM and assist with refining the methodologies and environmental management thresholds proposed in the EMMP.

The proposal to undertake further environmental monitoring before commencing the mining activity does not signify that there is a shortfall in the existing information to support TTR's application. Rather, it reflects that the environment is dynamic, not static, and therefore the most accurate data on the characteristics of the existing environment will be data obtained in the period immediately prior to the commencement of mining. It also provides the necessary time to build, validate and calibrate the OSPM to ensure the OSPM is fit for purpose (which, as covered above, differs from the purposes of the sediment dispersion modelling that informs TTR's consent application).

### 6.4.2 Purpose and Scope of the PCEMP

The purpose of the PCEMP is to:

- Establish the most up-to-date pre-commencement environmental data that further identifies natural background levels in the STB, while also taking into account seasonal variations. This pre-commencement 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 SSC 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 PCEMP has been prepared to ensure that, as a minimum, a pre-commencement set of data is collected over a two-year period.

### 6.4.3 Monitoring Design and Methodology

The pre-commencement environmental monitoring programme 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 pre-commencement 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 pre-commencement monitoring programme are identified in Figures 6.1 to 6.5 below.

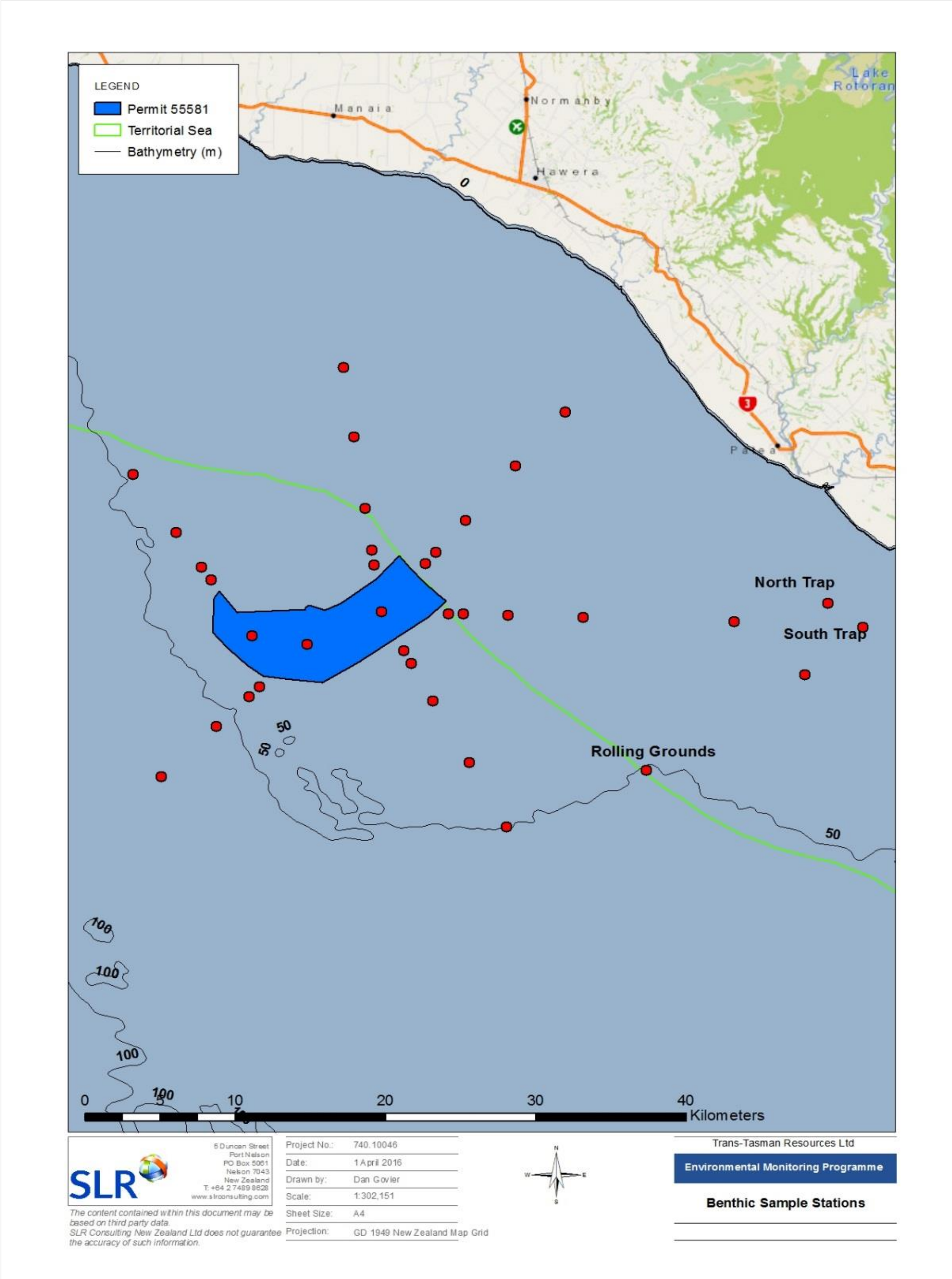


Figure 6.1: Location of benthic monitoring stations in relation to the Project Area.

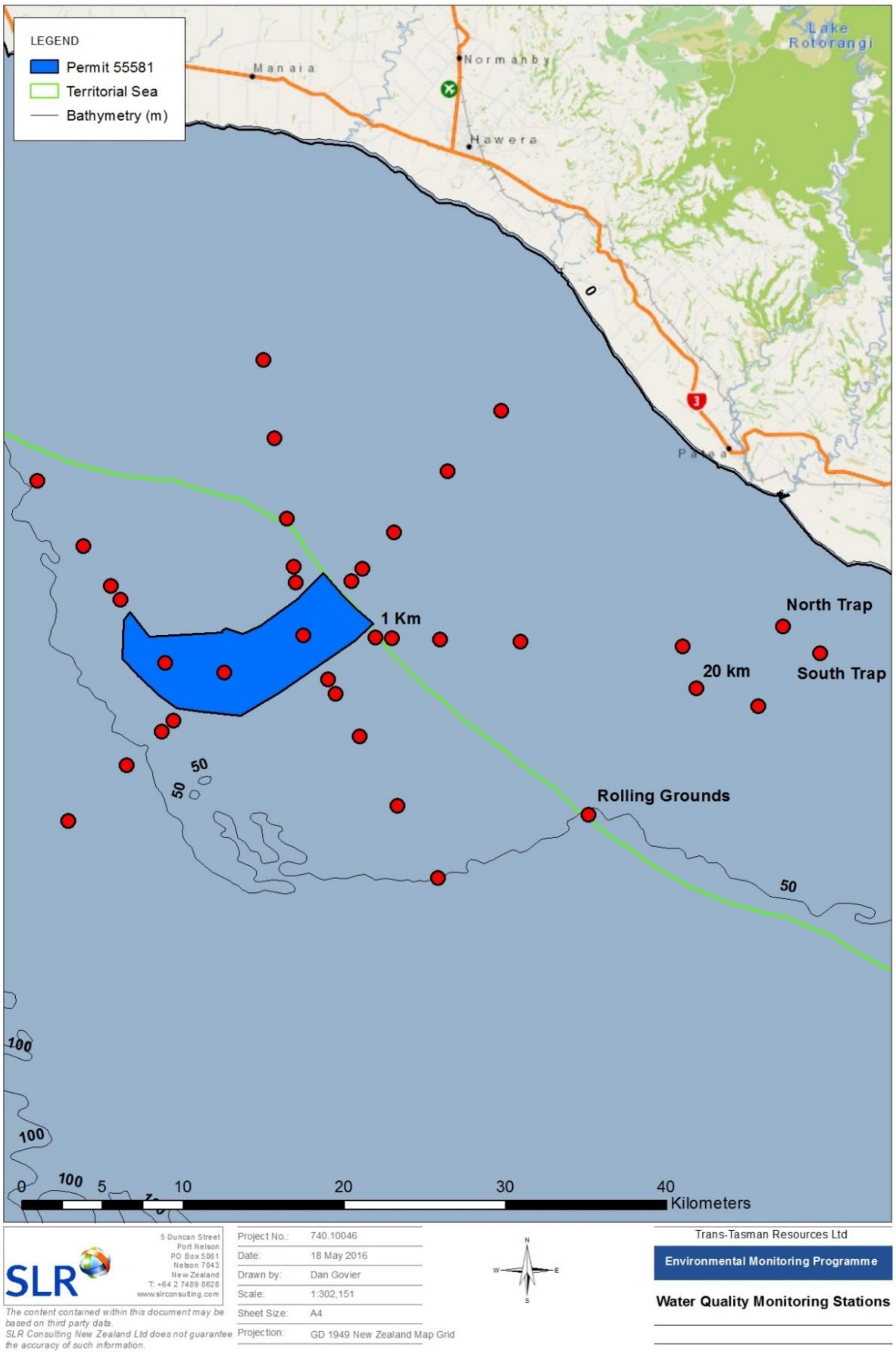


Figure 6.2: Location of water quality monitoring stations in relation to the Project Area.

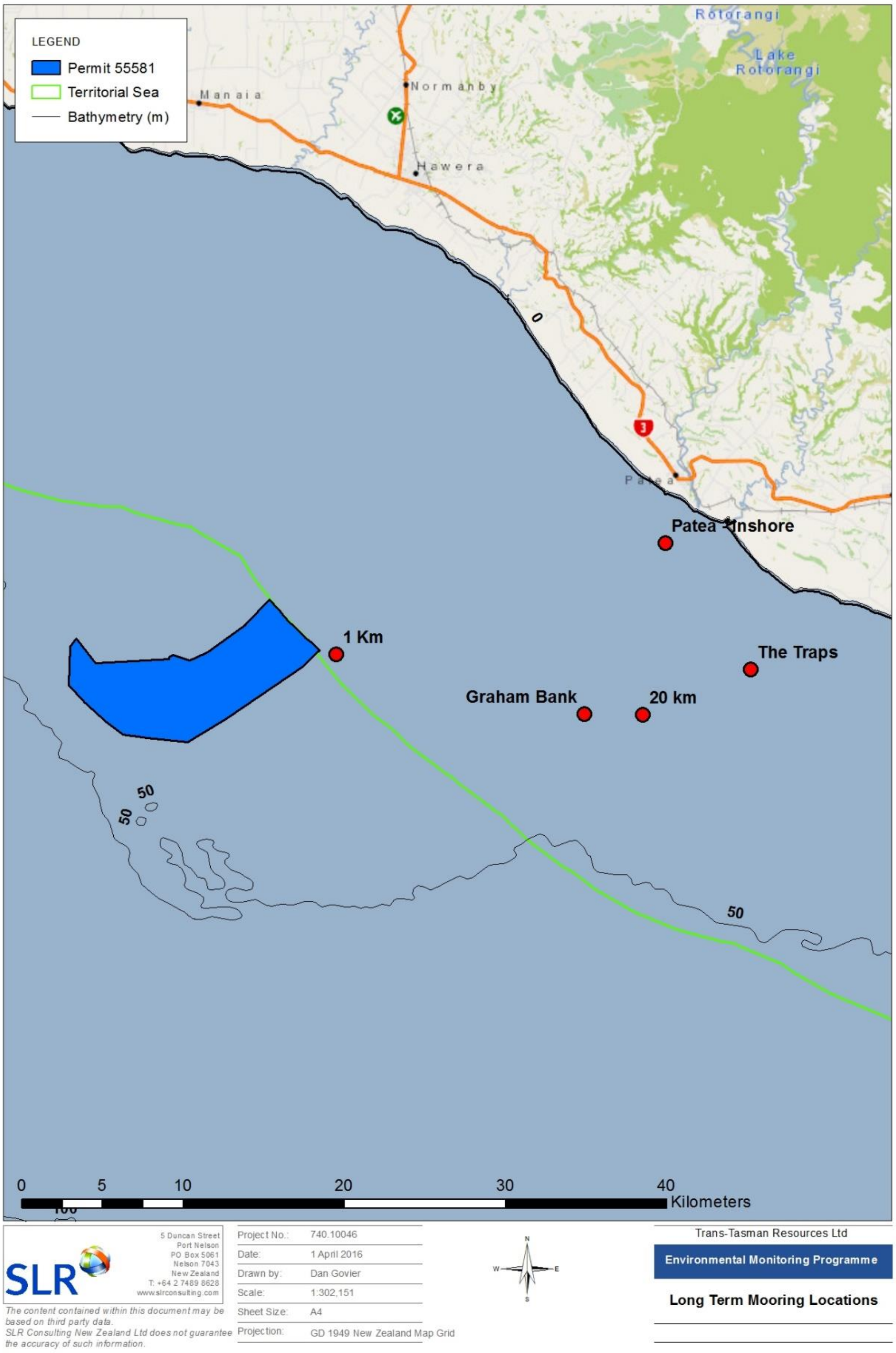


Figure 6.3: Location of fixed moorings in relation to the Project Area.

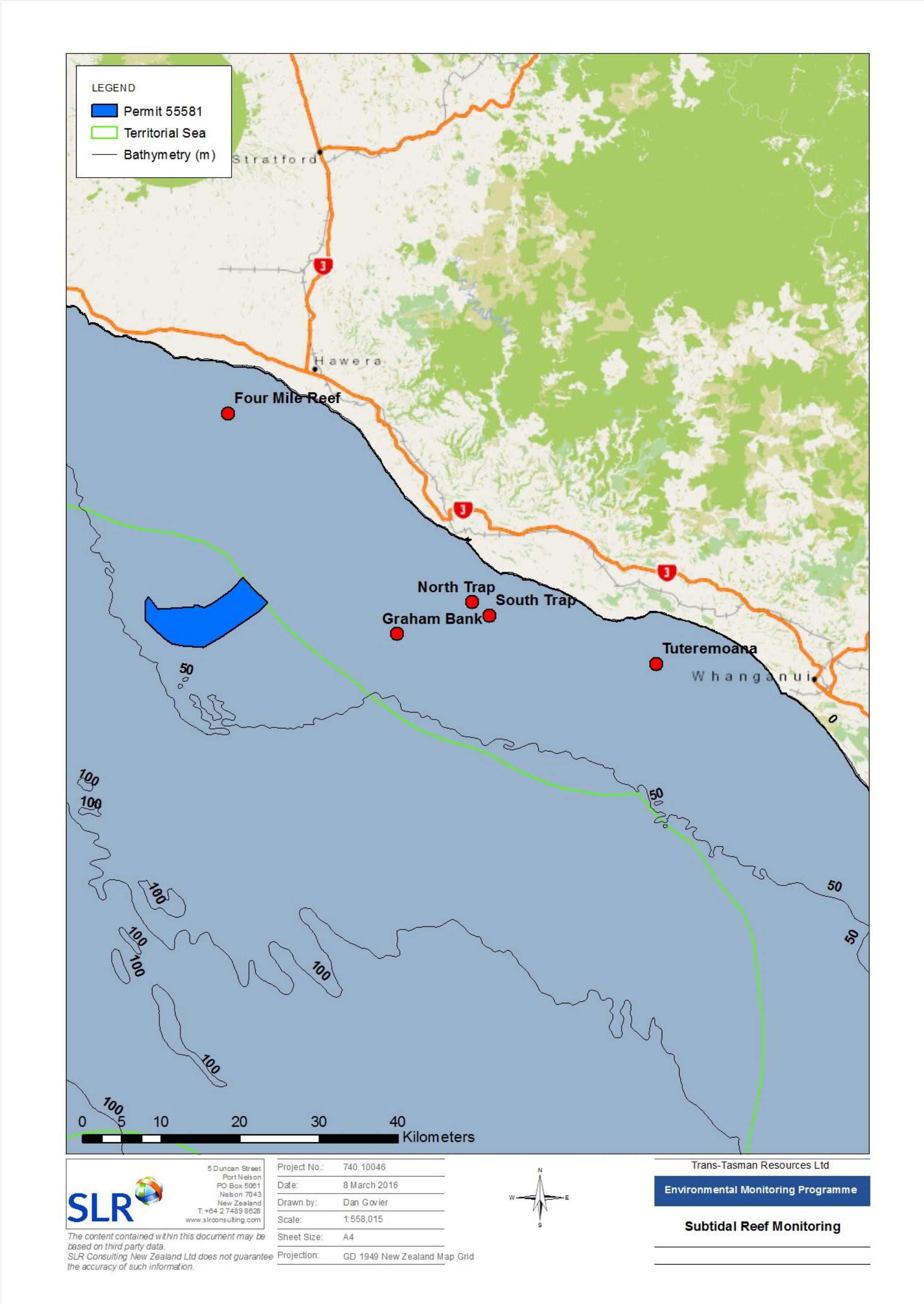


Figure 6.4: Location of subtidal monitoring sites in relation to the Project Area.


**Figure 6.5: Location of intertidal monitoring sites in relation to the Project Area.**

In addition to the 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 PCEMP. This design approach has been selected as it allows TTR to continue to undertake environmental monitoring when the extraction is occurring and facilitates a direct comparison between the pre-commencement and operational periods. The design means that sample locations are distributed at variable distances from the project area.

### 6.4.4 Monitoring Programmes

The PCEMP is made up of a number of separate monitoring programmes, with each programme addressing a separate environmental parameter. The objectives of each monitoring programme, along with a summary of the monitoring methodologies, is set out in Table 6.1 below.

**Table 6.1: Pre-commencement Monitoring Programmes: Objectives and methodologies provided for in the PCEMP.**

| Monitoring Programme | Objectives | Summary of Methods |
|---|---|---|
| Suspended sediment concentrations; Sediment quality including physio-chemical parameters; and heavy metals. | > Provide a further assessment of water quality in the STB for the period immediately prior to mining;<br>> Provide further measurements of suspended sediment concentrations in the STB for the period immediately prior to mining; and<br>> Provide data to inform other components of the monitoring programme, in particular the OSPM validation.. | > Deployed mooring;<br>> Turbidity;<br>> Photosynthetically Available Radiation ("PAR") logger;<br>> Temperature;<br>> Conductivity;<br>> Depth; and<br>> Gross sedimentation (settlement tubes). |
| Optical water quality | > 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.<br>> Provide high quality temporal and spatial resolution of the currents and turbidity characteristics of the STB to understand natural variability of these parameters.<br>> Obtain a time-series of in-situ suspended sediment concentrations, particle size | > Turbidity/moored sensors and profiles<br>> Sedimentation<br>> Currents measurements<br>> Waves/moored instruments<br>> Particle size and settling velocity/moored instruments and profiles |

| Monitoring Programme | Objectives | Summary of Methods |
|---|---|---|
| | distribution and settling velocity data along with current and wave measurements to allow determination of critical shear-stresses for re-suspension and settling. | |
| Oceanography | > Provide a further assessment of coastal processes and bathymetry in the STB for the period immediately prior to mining; and<br>> Provide data to inform the OSPM validation. | > Deployment of Acoustic Doppler Current Profilers ("**ADCP**") for measuring waves; and<br>> Deployment of Acoustic Wave and Current ("**AWAC**") instruments for measuring currents.<br>> Bathymetric surveys (including additional surveys prior to the commencement of mining). |
| Primary production | > Provide a further assessment of primary productivity in the STB for the period immediately prior to mining. | > Phytoplankton community composition, chlorophyll-a levels in the water column, micro-zooplankton community composition, chlorophyll-a in surficial sediments;<br>> Light availability - Photosynthetically Active Radiation logger; and<br>> Turbidity - Nephelometric Turbidity Unit ("**NTU**") logger. |
| Zooplankton | > Provide a further assessment of zooplankton (e.g. biomass, abundance and diversity) in the STB; and<br>> Provide a further assessment of water colour and clarity in the STB, both for the period immediately prior to mining | > Zooplankton diversity, abundance and distribution; and<br>> Surface water colour and clarity. |
| Subtidal and Intertidal Biology | > Provide a further assessment of infaunal and epifaunal communities (abundance and diversity) in the STB; and<br>> Provide a further assessment of sediment characteristics (sediment grain size, redox potential and pH) in the STB, for the period immediately prior to mining. | > Ecological benthic sampling programme;<br>> Abundance and diversity of infauna and epifauna;<br>> Sediment physico-chemical characteristics; |

| Monitoring Programme | Objectives | Summary of Methods |
|---|---|---|
| | > Provide a further assessment of subtidal and intertidal reef communities in the STB. | > Microphytobenthos;<br>> Intertidal and subtidal ecological surveys using both quantitative and qualitative methods;<br>> Drop camera photo-quadrats; and<br>> Diver surveys. |
| Marine mammals; and seabirds | > 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;<br>> Systematic observations;<br>> Aerial surveys; and<br>> Acoustic surveys. |
| Underwater noise | > Establish background underwater noise characteristics in the vicinity of the project area prior to the commencement of iron sand extraction activities; and<br>> Provide data to inform the Marine Mammal Monitoring Programme. | > Fixed-point underwater noise surveys.<br>> |
| Recreational fishing; seafood resources; and commercial fishing | > Provide a further assessment of recreational and commercial fishing and seafood resources (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 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.

### 6.4.5 Reporting

Each pre-commencement monitoring programme will have a unique reporting schedule as detailed in the respective monitoring programme sections. 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's head office 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 PCEMP 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 pre-commencement 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 pre-commencement 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.

### 6.4.6 Post Monitoring Process

The current draft PCEMP includes seven monitoring sites for background SSC percentiles which the project discharge activities were to be measured against. However, as a result of the 2017 EPA decision of TTR's application, this number has been increased to ten sites. These ten sites have been identified in Schedule 2 of the proposed consent conditions as set out in the table below.

**Table 6.2: Schedule 2 of the proposed consent conditions - Proposed background percentiles of surface and near-bottom suspended sediment concentration at the ten monitoring locations in the STB [189].**

| South Taranaki Bight Sites | Background Percentiles (SSC mg/L) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Surface | | | | Bottom | | | |
| | 25th | 50th | 80th | 95th | 25th | 50th | 80th | 95th |
| Rolling Grounds (WGS 1984: 39 57 22.58780 S, 174 22 29.90885 E) | TRG | TRG | 0.3 | 1.1 | TRG | TRG | 3.5 | 15.3 |
| Graham Bank (WGS 1984: 39 53 16.22020 S, 174 24 40.68384 E) | TRG | TRG | 1.7 | 4.5 | TRG | TRG | 32.8 | 84 |
| Source A to Whanganui 1 km (WGS 1984: 39 51 22.41692 S, 174 13 46.13207 E) | TRG | TRG | 1.1 | 2.7 | TRG | TRG | 16.9 | 44.2 |
| Source A to Whanganui 20 km (WGS 1984: 39 53 14.34932 S, 174 27 08.62846 E) | TRG | TRG | 2.3 | 5.9 | TRG | TRG | 29 | 76.6 |
| South Traps (WGS 1984: 39 51 53.21010 S, 174 32 48.75387 E) | TRG | TRG | 6.3 | 11.1 | TRG | TRG | 37.7 | 97.4 |
| North Traps (WGS 1984: 39 51 02.22374 S, 174 31 10.63364 E) | TRG | TRG | 7.2 | 12.4 | TRG | TRG | 46.5 | 115 |
| Tūteremoana (WGS 1984: 39 55 00.03802 S, 174 47 41.29085 E) | TRG | TRG | 8.5 | 13.6 | TRG | TRG | 23.7 | 62.5 |
| The Crack 1 (WGS 1984: 39 49 12.00 S, 174 15 00.00 E) provisional | TRG | TRG | TRG | TRG | TRG | TRG | TRG | TRG |
| The Crack 2 (WGS 1984: 39 51 00.00 S, 174 18 00.00 E) provisional | TRG | TRG | TRG | TRG | TRG | TRG | TRG | TRG |
| The "Project Reef" (location to be set by TRG) | TRG | TRG | TRG | TRG | TRG | TRG | TRG | TRG |

Regarding the background percentile SSC Limits for the project, expressed as the 25th, 50th, 80th and 95th percentile SSC limits, the seven original sites had identified SSC limits at the 80th and 95th percentile presented in Schedule 2. These limits were established from data extracted from the predictive sediment plume models (refer to Section 5.3.2 of this IA). However, as these additional sites and percentile limits are in response to requests following the completion of the predictive modelling previous undertaken, the 25th and 50th percentiles of all ten sites and the 25th, 50th, 80th and 95th percentile SSC Limits for the three additional site (The Crack 1 and 2, and Project Reef) will be established following the completion of the pre-commencement monitoring.

[189] Schedule 2 of the Proposed Consent Conditions

In accordance with Schedule 3 of the proposed consent conditions, the pre-commencement data collected and the outputs from the OPSM, will be used to establish the numerical values for each of the SSC Limits percentiles.

Notwithstanding, for those SSC Limits already identified in the proposed consent conditions, Schedule 3 also provides the process to review the numerical values against the identified values in Schedule 2. If the values are not consistent, then the new values will replace the values presently set out in Schedule 2 of the proposed conditions.

For clarification, the process is not reviewing the SSC Limits themselves, but simply validating the numeric values attached to each percentile SSC Limits. Validation will occur by statistically comparing the modelled and actual measured values to provide a measure of the OPSM 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).

The review and establishment of the numerical values must be undertaken by suitably qualified and experienced person(s) and submitted to the TRG for review and , in accordance with the proposed consent conditions (Condition 51), following the review / establishment process, the EPA must certify the change of values in Schedule 2. This will not require a change or variation of consent conditions but the conditions identify that the updated numerical values will supersede the numerical values of the SSC Limits in Schedule 2 for the purpose of the consents.

Once the numerical values for each SSC Limit have been reviewed and/or established, then updated and certified, they will be incorporated into the final EMMP (discussed below), which will then be submitted to the EPA for certification at least one month prior to the commencement of any extraction activities.

## 6.5 ENVIRONMENTAL MONITORING AND MANAGEMENT PLAN

### 6.5.1 Overview of the EMMP

The EMMP is a continuation of the BEMP/PCEMP. 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 extraction activities commence.

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;

- Stating 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 monitoring project related effects as they occur;
- Details of data analysis and processing for all parameters being monitored; and
- Reporting methods and frequency for all parameters being monitored.
- Identification of the operational responses to be undertaken if SSC Limits or water quality limits are reached;

To achieve these purposes the EMMP establishes an Environmental Management Strategy ("**EMS**") and a suite of environmental monitoring programmes, which are summarised below.

Acknowledging a draft has been provided, the final EMMP, to be provided for certification to the EPA prior to commencement of any extraction activities, will be prepared to align with the proposed consent conditions provided as Attachment 1 of this IA. For the most part, the requirements of the conditions have been incorporated into the relevant sections of the draft EMMP however, there will be further refinements after the completion of the PCEMP and prior to the commencement of the extraction activities. Hence the requirement for lodgement to the EPA for certification.

### 6.5.2 Environmental Management Strategy

The EMS 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;

> Identify, in accordance with the proposed consent conditions including Schedule 2, the 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 6.6 below.

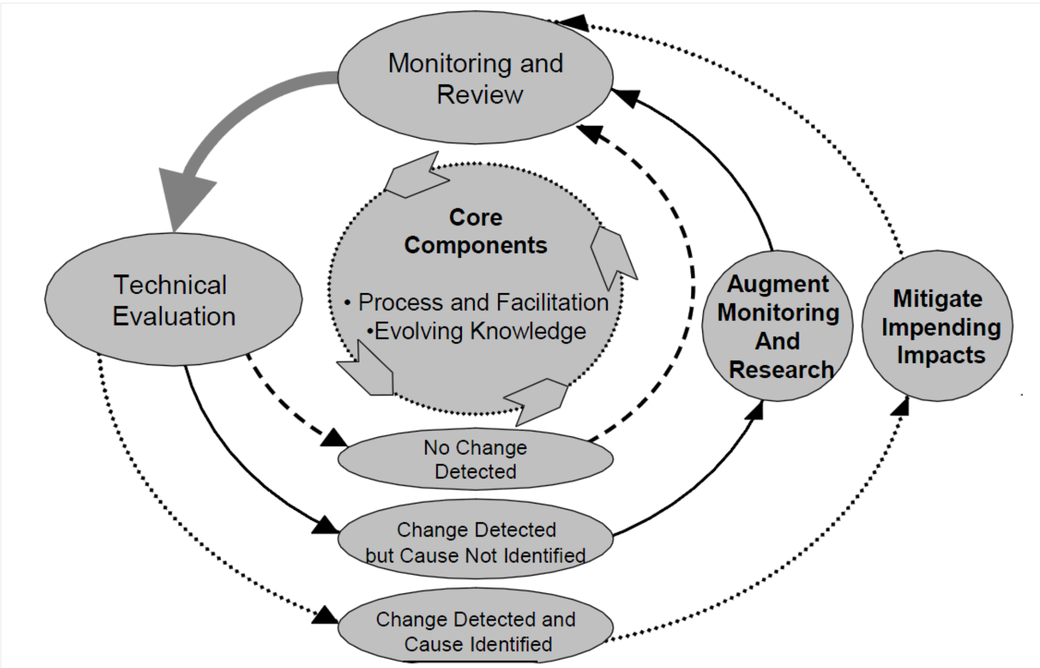


**Figure 6.6: Conceptual Environmental Management Framework.**

### 6.5.2.1 Monitoring Programme Overview

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 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 final PCEMP, shown in Figures 6.1 to 6.5 above.

The monitoring programme will cover 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. The final form of the monitoring programme will also reflect the findings and recommendations from the final PCEMP.

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 final 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.

### 6.5.3 Environmental Limits

As set out in Section 6.4.6 above, the final EMMP with incorporate environmental performance thresholds into the monitoring of suspended sediment concentrations in the STB. These are provided for in Schedule 2 of the proposed consent conditions and expressed as the percentile SSC limits as well as ISQG-High values (Condition 6).

The thresholds are linked to specific monitoring locations within the STB, which will be verified and established following the completion of the two years of pre-commencement monitoring undertaken as required under the PCEMP (as discussed in Section 6.4.6 above). The full range of sites will be included in the final EMMP to be submitted.

The thresholds are expressed as the $25^{th}$, $50^{th}$, $80^{th}$ and $95^{th}$ percentile SSC limits with the 95th percentile being a fixed limit (Condition 5.a) and the 25th, 50th and 80th percentiles (Condition 5.c). which allows variation of up to 10%, as determined over any twelve (12) month period. If these limits are exceeded, as determined by monitoring and the OPSM, then extraction activities must cease until TTR can demonstrate compliance with those limits again to the satisfaction of the EPA. Table 6.2 above identifies the ten locations and the proposed percentile SSC limits currently established.

Further to the SSC thresholds, 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. Schedule 6 of the proposed conditions identifies metals relevant to the project.

In the event that they occur, exceedance of the limits will prompt a management response from TTR to ensure that any potential adverse effects are avoided, remedied or mitigated if exceeded.

#### 6.5.3.1 Performance Limit Exceedance

If there are exceedances of the limits at the monitoring sites (Scedule2) and/or the ISQG-High values, 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.

#### 6.5.3.2 Operational Responses

Operational / management options that TTR may implement in the event that the limits are exceeded 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 6.7 below illustrates the approach TTR will implement if any exceedance of the SSC Limits set out in the proposed conditions occurs as determined through the environmental monitoring programme.

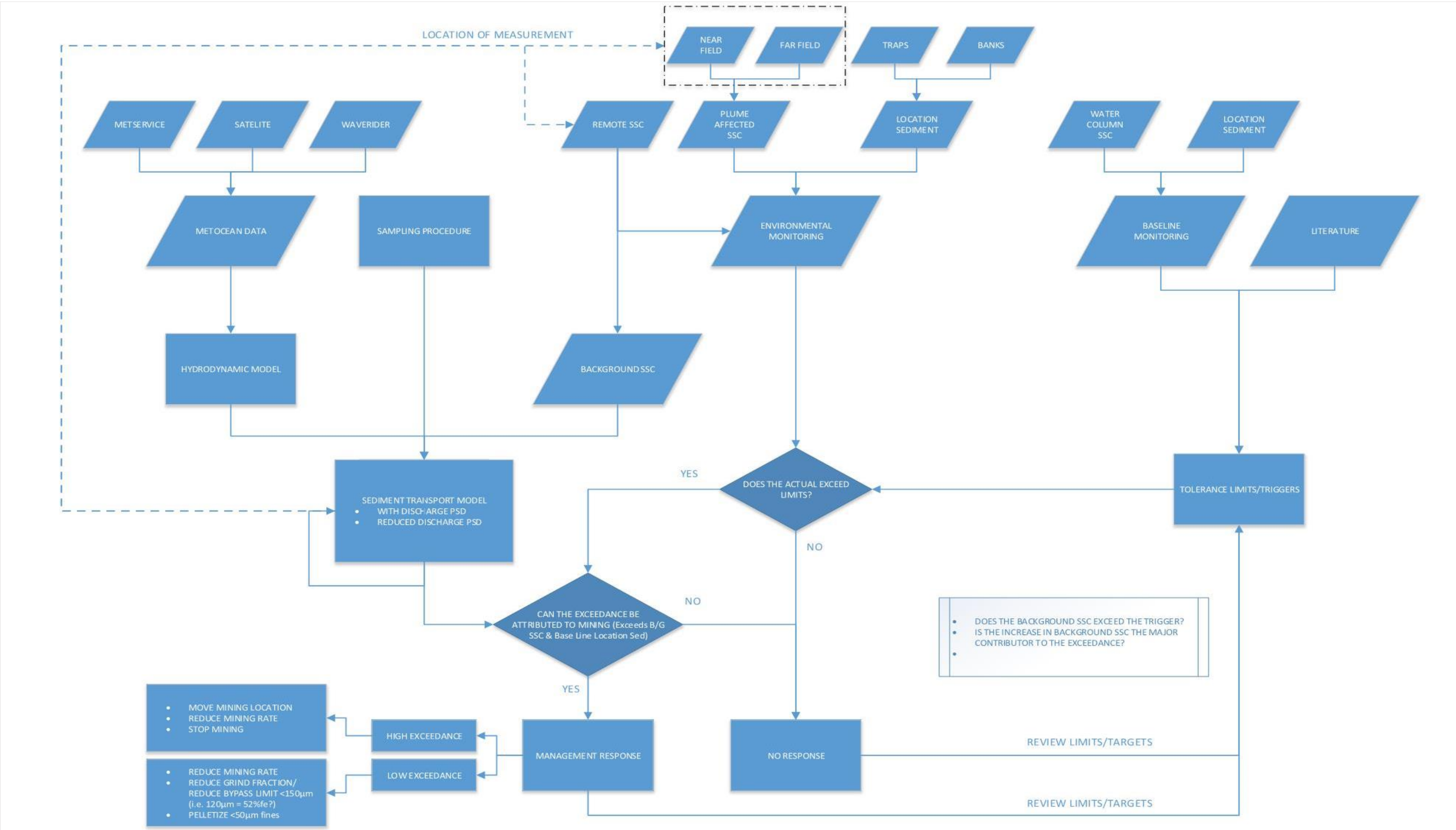


Figure 6.7: TTR's environmental management approach for SSC in relation to Response and Compliance Limits.

### 6.5.4 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 PCEMP will be carried over to the final 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.

### 6.5.5 Reporting

Each monitoring programme will have its own reporting schedule as detailed in the respective monitoring programme sections, and as summarised in the table below.

**Table 6.3: Reporting schedule for the environmental monitoring programmes in the EMMP.**

| Report | Of Relevance to: | | | | | | | | | | | Reporting timeframe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water Quality & | 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 |

| Report | Of Relevance to: | | | | | | | | | | | Reporting timeframe |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OSPM Validation Report | | ✓ | | | | | | | | | | Due within 40 working days of the completion of the pre-commencement 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 pre-commencement programme completion |
| SSC 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 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 (being the Annual Monitoring Report identified in the table above);
- 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.

The annual report will be provided to the EPA and the Kupe Operator within three (3) months of the completion of each twelve (12) month monitoring period..

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 and the Kupe Operator within two (2) months of each quarter ending (being 31 March, 30 June, 30 September and 31 December) for the duration of the seabed material extraction activities authorised by these consents.

## 6.6 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:

- Seabirds Effects Mitigation and Management Plan;
- Marine Mammal Management Plan;
- Collision (Loss of Position) Contingency Management Plan;
- Simultaneous Operations Plan; and
- Biosecurity 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 5 of this IA. The draft versions of the Marine Mammal Management Plan and the Seabirds Effects Mitigation and Management Plan have been provided as Appendix 5.9 and Appendix 5.8 respectively.

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.

### 6.7 POST–EXTRACTION MONITORING

Further to the pre-commencement and project related environmental monitoring, TTR is proposing to undertake post-extraction monitoring. The purpose of this monitoring is to identify at that the biological environment within the project area is on track to achieve recovery of the macroinfauna benthic community within 5 years following the completion of iron sand extraction activities. Recovery is defined (proposed condition 8) as having occurred when the macroinfauna communities at a specified location are within 15% of the average pre-mining total abundance, biomass and species richness, but taking into account natural variation; or when the annual monitoring results for that area indicate that that such recovery is on track to be achieved.

The monitoring of this recovery will be provided for through the implementation of a Post-Extraction Monitoring Plan ("**PEMP**") and will extend for a period of five 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;

> 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 five 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.

As provided for in the proposed conditions (Condition 8), where the annual monitoring shows that recovery is not on track to be achieved, then TTR must provide a report to the EPA that:

a) highlights the results of monitoring at the location that show that recovery is not on track to be achieved; and
b) includes analysis by a suitably qualified and experienced benthic ecology expert of:
   i. possible reasons why recovery is not on track to be achieved; and
   ii. potential measures to enhance recovery; and
c) explains how the Consent Holder will ensure that recovery of the macroinfauna benthic community will occur no later than five (5) years following completion of all seabed material extraction within 2km of the location where extraction first occurred.

This information would feed back into the PEMP reporting requirements.

## 6.8 PROPOSED CONSENT CONDITIONS

Schedule 10, clause 7 of the FTA state that:

> *Sections 63 to 67 of the EEZ Act apply with any necessary modifications as if the references to a marine consent authority in those sections were references to the panel.*

Section 83 of the FTA also states:

> *When exercising a discretion to set a condition under this Act, the panel must not set a condition that is more onerous than necessary to address the reason for which it is set in accordance with the provision of this Act that confers the discretion.*

Regarding the EEZ Act, 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 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.

The proposed consent conditions are provided for as Attachment 1 to this IA.

## 6.9 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, to be provided as requirements of the proposed conditions, 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.

# 7. CONSULTATION UNDERTAKEN

Subpart 2 section 29(1)(a) of the FTA requires the authorised person for the project to consult with the parties listed in section 11 of the FTA before lodging a substantive application. These include:

*(a) the relevant local authorities; and*

*(b) any relevant iwi authorities, hapū, and Treaty settlement entities, including—*

*(i) iwi authorities and groups that represent hapū that are parties to relevant Mana Whakahono ā Rohe or joint management agreements; and*

*(ii) the tangata whenua of any area within the project area that is a taiāpure-local fishery, a mātaitai reserve, or an area that is subject to bylaws or regulations made under Part 9 of the Fisheries Act 1996; and*

*(c) any relevant applicant groups with applications for customary marine title under the Marine and Coastal Area (Takutai Moana) Act 2011; and*

*(d) ngā hapū o Ngāti Porou, if the project area is within or adjacent to, or the project would directly affect, ngā rohe moana o ngā hapū o Ngāti Porou; and*

*(e) the relevant administering agencies; and*

*(f) if the proposed approvals for the project are to include an approval described in section 42(4)(f) (land exchange), the holder of an interest in the land that is to be exchanged by the Crown.*

Schedule 10, clause 4(b) of the FTA requires an IA is prepared for marine consent in accordance with section 39 of the EEZ Act. 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)(g) 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.

In accordance with section 29(1)(a) and Schedule 10, clause 4(b) of the FTA, this section provides details of the consultation and engagement undertaken by TTR with relevant administering authorities, iwi and other stakeholders, and those with existing interests likely to be adversely affected by the project.

Dedicated and open consultation has been undertaken for the VTM Project as part of the previous application process. The below sub-sections outline TTR's consultation process and summarises the outcomes of this consultation.

## 7.1 TTR'S CONSULTATION PROCESS OVERVIEW

A cornerstone to TTR's consultation strategy has been 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 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.

### 7.1.1 Initial Contact with Stakeholders

TTR facilitated a visit for interested stakeholders to De Beers Marine (Pty) Ltd ("**DBM**") in Cape Town, South Africa in 2015. 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. [190] 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 7.1** respectively.

### 7.1.2 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.

### 7.1.3 Formal Engagement for Previous Application Process

Informed by the initial 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.

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[190] Richardson, K (2007). "A perspective of marine mining within De Beers" SAIMM Conference, Hydrotransport 17, 7–11 May 2007.

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 7.2** 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.

### 7.1.4 FTA Pre-lodgement Consultation

Recognising the extensive consultation undertaken as part of the previous application process, to address Schedule 10, clause 4(b) and section 29(1)(a) of the FTA requirements, TTR sent letters to the parties listed in section 11 of the FTA as per the table below which:

- Confirmed that TTR, as a Schedule 2 Listed Project under the FTA, was to apply for marine consent for the Taranaki VTM project under the FTA.
- Identified that the FTA application will be for the same mining activity as TTR's previous application to the EPA, which commenced in 2016 and was withdrawn in 2024 with the same methodology, monitoring approach (including pre-commencement and post-completion monitoring), operational controls, management and reporting measures and on-going engagement and that these commitments would be included in the proposed consent conditions proposed as part of the FTA application.
- Provided an acknowledgement of the party / organisation's previous position on the application and confirmation that this position would be recorded in the FTA application; and
- Provided an opportunity meet with TTR in the event that the party / organisation wished to provide further statements, or if their position is different from that which has previously been articulated.

Table 7.1: Parties consulted as per section 11 of the FTA

| Party / Organisation |
|---|
| **s11(a) - relevant local authorities - local authority whose region or district is adjacent to the site where the relevant activity would be undertaken** |
| Taranaki Regional Council |
| South Taranaki District Council |
| **s11(b) relevant iwi authorities, hapū, and Treaty settlement entities** |
| Te Kāhui o Taranaki Trust - Represents Taranaki Iwi: as the "iwi authority" for the purposes of the RMA; as the Post-Treaty settlement governance entity for Taranaki Iwi Claims Settlement Act 2016; and on the Te Tai Hauāuru Fisheries Iwi Forum. |
| Te Korowai o Ngāruahine Trust - Represents Ngāruahine: as the "iwi authority" for the purposes of the RMA; and as the Post-Treaty settlement governance entity for Ngāruahine Claims Settlement Act 2016. |
| Te Rūnanga o Ngāti Ruanui Trust - Represents Ngāti Ruanui: as the "iwi authority" for the purposes of the RMA; as the Post-Treaty settlement governance entity for Ngāti Ruanui Claims Settlement Act 2003; and on the Te Tai Hauāuru Fisheries Iwi Forum. |
| Te Kaahui o Rauru - Represents Ngā Rauru Kītahi: as the "iwi authority" for the purposes of the RMA; as the Post-Treaty settlement governance entity for Ngaa Rauru Kiitahi Claims Settlement Act 2005; and on the Te Tai Hauāuru Fisheries Iwi Forum. |
| Rangitāwhi as a hapū of Ngāti Ruanui and Ngā Rauru Kītahi (as identified on the Te Puni Kokiri website) |
| Kairākau as a hapū of Ngā Rauru Kītahi (as identified on the Te Puni Kokiri website) |
| Ngāti Hine as a hapū of Ngāti Ruanui and Ngā Rauru Kītahi (as identified on the Te Puni Kokiri website) |
| Manaia as a hapū of Ngā Rauru Kītahi (as identified on the Te Puni Kokiri website) |
| Ngāti Hinewaiata as a hapū of Ngā Rauru Kītahi (as identified on the Te Puni Kokiri website) |
| Pokorokoro as a hapū of Ngā Rauru Kītahi (as identified on the Te Puni Kokiri website) |
| **s11(b)(i) - iwi authorities and groups that represent hapū that are parties to relevant Mana Whakahono ā Rohe or joint management agreements** |
| Not applicable as approvals are not being sought under the RMA. |

| |
|---|
| **s11(b)(ii) - tangata whenua of any area within the project area that is a taiāpure-local fishery, a mātaitai reserve, or an area that is subject to bylaws or regulations made under Part 9 of the Fisheries Act 1996** |
| Not applicable as there are no taiāpure or mātaitai reserves identified by MPI for the project area or the immediately adjacent CMA. |
| **s11(c) - relevant applicant groups with applications for customary marine title under the Marine and Coastal Area (Takutai Moana) Act 2011** |
| Ngā Hapu o Ngaruahine - MACAA Application # MAC-01-10-017 - common marine and coastal area between the Taungatara and Waihi Rivers |
| Ngaa Rauru Kiitahi - MACAA Application # MAC-01-10-005 to common marine and coastal area between Whenuakura River (north) and Whanganui River (South) |
| Taranaki Iwi - MACAA Application # MAC-01-10-013 to common marine and coastal area between north of Waitara (north) to Hawera (south) |
| Te Rūnanga o Ngāti Ruanui Trust - MACAA Application # MAC-01-10-019 common marine and coastal area between Waingongo River (north) to Whenuakura River (south) |
| **s11(d) - ngā hapū o Ngāti Porou** |
| Not applicable as the project is not 'within or adjacent to, or the project would directly affect, ngā rohe moana o ngā hapū o Ngāti Porou'. |
| **s11(e) - relevant administering agencies - means an administering agency for a specified Act that relates to an approval being sought in the substantive application** |
| The Ministry for the Environment as the 'administering agency' of the EEZ Act. |
| Environmental Protection Authority as the 'administering agency' of the EEZ Act. |
| ***s11(f) - approval described in section 42(4)(f) (land exchange), the holder of an interest in the land that is to be exchanged by the Crown*** |
| Not applicable as the project does not involve a land exchange. |

### 7.1.5 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 5.

Ongoing consultation has been occurring with the majority of the existing interest parties throughout the course of the previous application process leading up to the FTA application process and the outcomes have been further summarised in Section 5.4 below.

## 7.2 CONSULTATION OUTCOMES

### 7.2.1 Introduction

TTR's general principles for consultation with relevant administering authorities, iwi and other stakeholders, and those with existing interests 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 part of the previous application 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.

> As part of the FTA pre-lodgement application process, TTR re-engaged with relevant administering authorities, iwi and other stakeholders.

At the time of the of lodgement of the FTA application, the responses received (refer **Appendix 7.3**) from the contacted parties and organisations included only confirmation of receipt of the VTM project updates and/or confirmation of existing positions on the VTM project. There were no requests to re-engage on the VTM project application.

Considering that TTR has received no responses which indicate a change in the positions of those consulted, the consultation outcomes from the previous application process remain relevant. The sub-sections below provide a detailed overview of the consultation undertaken with relevant administering authorities, iwi and other stakeholders, and those with existing interests.

### 7.2.2 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 5.11.2). 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 practices, 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 practices;
- 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 its 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 applications, as described in Section 5.11.2 of this IA, TTR engaged Mr Tahu Potiki to provide a CVA of the project area with a specific focus on Ngāti Ruanui.

### 7.2.3 Te Tai Hauāuru 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 5.11.3 of this IA.

### 7.2.4 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 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.

### 7.2.5 Nga Rauru Kiitahi

TTR met with the CEO and Chair of Nga Rauru informally to discuss the status of the new marine 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 have 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.

### 7.2.6 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.

### 7.2.7 Admiralty Bay / Aquaculture Parties

As discussed in Section 3.12.4.3, 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 3.12.11. 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 5.4.7 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 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 5.4.14.

### 7.2.8 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.

### 7.2.9 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 PCEMP and EMMP discussed in Section 7.

### 7.2.10 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.

#### 7.2.11 South Taranaki District Council

Consultation was undertaken with representatives from South Taranaki District Council (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 pre-commencement environmental monitoring, undertaken in accordance with the conditions of these consents.*
>
> *The information shall be made available through a website maintained by the Consent Holder for the duration of these consents.*
>
> *The Consent Holder must advise the EPA of the website address within five (5) working days of it going live.*

> *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 must be held six (6) monthly (during the months of February and July of each year) for the first five (5) years of the seabed material extraction activities and annually at all other times.*
>
> *At least twenty (20) working days prior to the date of any community meeting, notice must be placed on the Consent Holder's website (Condition 81) and by way of advertisements in the regional newspapers, including the Taranaki Daily News, the South Taranaki Star and the Wanganui Chronicle, and on local radio stations. Notice must include the date, time and location of the meeting and contact details of the meeting facilitator.*
>
> *The Consent Holder must keep a record of the details of each community meeting, including details of the notification mechanisms used for each meeting. A copy of these records must be provided to the EPA upon request.*

> *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.*
>
> *The Consent Holder must keep records of the annual contributions and provide a copy of these to the EPA upon request.*

> *Within twelve (12) months of the commencement of the construction of the IMV associated with the activities, the Consent Holder must 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 must consult with the Hawera business community, local iwi, South Taranaki District Council and Accredited Education providers to ensure that the purpose of the training facility is being met. The Consent Holder must keep records of the consultation required by this condition and provide a copy of these to the EPA upon request.*

With regard to the above conditions, if the marine 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.

### 7.2.12 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 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 building a robust working relationship with the Whanganui District Council, local iwi and other local key stakeholder groups moving forward.

### 7.2.13 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.

### 7.2.14 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 3.12, 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 PCEMP 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.

### 7.2.15 Recreation and Tourism Operators

Consultation was undertaken with representatives from the various recreation and tourism operators that have been identified Section 3.12.2 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.

# 8. STATUTORY ASSESSMENT

## 8.1 INTRODUCTION

This section of the IA identifies and addresses all relevant parts of the statutory framework for assessing and determining the applications. All relevant parts of the framework are identified in section 8.2 and applied to the present application in sections 8.3.

The statutory framework is set out in the FTA and the FTA requirements assessed in **Appendix 8.1**. The FTA provisions make specific reference to some of the provisions in the EEZ Act.

However, unlike TTR's previous applications, the present applications are not made under the EEZ Act, and the only EEZ Act provisions that apply are those that are incorporated into the decision-making framework by explicit references in the FTA.

In this way, the FTA establishes a materially different framework than exists for applications made under the EEZ Act. Key differences (all of which are addressed in greater detail below) include:

> Under the FTA framework, the project's significant regional and national benefits must be given greater weight than all other considerations.

> Under the FTA framework there are no environmental bottom lines.

> The FTA framework only allows for an application to be declined for a very limited number of reasons (none of which is triggered here).

## 8.2 THE FRAMEWORK

The decision-making framework for the present application (being for marine consents under the FTA) is as follows. [191] The panel:

> Must consider the application and any advice, report, comment or other information received; [192]

> Must take into account the following matters, giving the greatest weight to the first matter: [193]

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[191] NB. This excludes aspects of the statutory provisions that do not apply:, Schedule 10, Clause 6(c) does not apply as there are no policy statements yet issued under the EEZ Act, and EEZ Act, s 62(1A) does not apply as it relates only to dumping or the abandonment of submarine pipelines.

[192] FTA, s 81(2)(a).

[193] FTA, s 81(2)(b) and Schedule 10, cl 6.

- The purpose of the FTA (section 7);
- The purpose of the EEZ Act (section 10);
- The international obligations provision of the EEZ Act (section 11);
- The decision-making criteria in the EEZ Act (subsection 59-60);
- Some of the information principles in the EEZ Act (section 61(1)(b) and (c)) ;
- The adequacy of the information (under section 62(2) of the EEZ Act); and
- The condition-making provisions of the EEZ Act (subsection 63-67);

> Must comply with the Treaty provision of the FTA (section 82);

> Must comply with the condition-making provision of the FTA (section 83)

> May impose conditions relating to Treaty settlements and recognised customary rights under the FTA (section 84); and

> May decline approval only in accordance with section 85 of the FTA

"Taking into account" any factor means the factor must be weighed alongside all other factors but does not dictate what weight it must be given in that assessment. It may be given considerable, moderate, little or even no weight at all depending on the circumstances. [194] However, the framework requires that whatever weight is given to any of the factors invoked from the EEZ Act, including the purpose of the EEZ Act itself, such factors are all subordinate to the purpose of the FTA.

### 8.2.1 Purpose of the FTA

Section 7 of the FTA states:

> *"The purpose of this Act is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits".*

This purpose might be achieved, in a limited procedural sense, by the FTA providing a more efficient process for obtaining approvals for development projects. Arguably, in a substantive sense the purpose can only be achieved if that process results in approvals being granted. Delivery of projects with significant regional or national benefits will not be facilitated if approvals for such projects are declined.

However, the terms of clause 6 of schedule 10 do not require the FTA purpose to be achieved (it is to be "taken into account"), and the specific (albeit limited) grounds on which

194 *Bleakley v Environmental Risk Management Authority* [2001] 3 NZLR 213 at [72].

a fast-track approval may be declined [195] provide a clear indication that the purpose provision is not intended to compel the granting of approval in all cases. Rather, the proper role of the purpose of the FTA—for FTA panels deciding substantive applications—is made clear by the requirement in clause 6 to give the greatest weight, out of all considerations, to the purpose of the FTA.

This means that if the project will have significant regional or national benefits, then facilitating the delivery of the project must be given greater weight than any competing considerations under clause 6. In practice, this means that if one, or even many, of the other matters to be taken into account under paragraphs (b)-(d) of clause 6 count against the grant of approval, then whatever weight is given to that matter or those matters cannot be greater than the weight given to the purpose of the FTA. Whether that may, in all the circumstances, result in a decision to decline approval will depend on the application of the specific and limited tests set out in section 85 of the FTA.

### 8.2.2 Purpose of the EEZ Act

Section 10 states:

*(1) "The purpose of this Act is –*

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

*(b) in relation to the exclusive economic zone, the continental shelf, and the waters above the continental shelf beyond the outer limits of the exclusive economic zone, to protect the environment from pollution by regulating or prohibiting the discharge of harmful substances and the dumping or incineration of waste or other matter"*

*(2) "In this Act, **sustainable management** means managing the use, development, and protection of natural resources in a way, or at a rate, that enables people to provide for their economic well-being while:*

*(a) sustaining the potential of natural resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*

*(b) safeguarding the life-supporting capacity of the environment; and*

(c) *avoiding, remedying, or mitigating any adverse effects of activities on the environment."*

*(3) In order to achieve the purpose, decision-makers must—*

*(a) take into account the decision-making criteria specified in relation to particular decisions; and*

*(b) apply the information principles to the development of regulations under section 27, 29A, 29B or 29E and the consideration of applications for marine consent.*

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195 See discussion of section 85 in Section 8.2.11of this IA.

There are two related definitions in the EEZ Act:

> “Natural resources” is defined 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.”*

> “Environment” is defined as:

*“The natural environment, including ecosystems and their constituent parts and all natural resources of New Zealand:*

(a) *the exclusive economic zone:*

(b) *the continental shelf:*

(c) *the waters beyond the exclusive economic zone and above and beyond the continental shelf.”*

As stated above, for the present application section 10 of the EEZ Act only needs to be taken into account, not achieved.

Section 10(3) is therefore inapplicable, as it is directed at the achievement of the EEZ Act purpose, which is not a requirement of the FTA framework. Despite this, almost every consideration under s 10(3) is in any event triggered under the FTA: clause 6(d) of Schedule 10 requires the FTA panel to take into account all of the same decision-making criteria as s 10(3)(a) [196] and almost all of the same information principles as s 10(3)(b). [197] Section 10(1)(b) states that one of the purposes of the EEZ Act is to protect the environment from pollution by regulating or prohibiting the discharge of harmful substances.

In its decision regarding TTR’s 2016 application, the Supreme Court held that section 10(1)(b) is a “bottom line” for discharge applications under the EEZ Act: it must be satisfied or else the balancing exercise required by section 59 of the EEZ Act cannot be undertaken. [198] It held that the bottom line in section 10(1)(b) is not protection from all harm, but only from “material harm”, [199] and that determining materiality requires consideration of a variety of factors, such as:

(a) The flora, fauna and natural characteristics of the area of sea and seabed affected;

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196 Namely the decision-making criteria in ss 59-60 of the EEZ Act.

197 The only information principle that is not applicable being s 61(1)(a), i.e. the obligation to make full use of powers to request information, obtain advice and commissioner reviews and reports.

198 At [245], [250] and [261] per Glazebrook J, [292] per Williams J and [305] per Winkelmann CJ.

199 At [252] per Glazebrook J, [292] per Williams J and [308] per Winkelmann CJ.

(b) The volume of the sediment that is discharged;

(c) The time for which the effect will last; and

(d) The size of the the seabed or volume of water affected.

Such factors, it said, demonstrate that there are qualitative, quantitative, temporal and spatial aspects to materiality that all have to be weighed. [200]

It also held that protection from material harm might be achieved through the imposition of conditions that mean:

> material harm will be avoided, or

> any harm will be mitigated to that it is no longer material, or

> any harm will be remedied within a reasonable timeframe so that, taking into account the whole period harm subsists, overall the harm is not material. [201]

For the present application, the Supreme Court's guidance is relevant for assessing whether the proposed discharges will result in material harm of the marine environment, and what role conditions perform in avoiding, mitigating or remedying any harm. However, the requirement to protect the environment from material harm from pollution does not operate as a "bottom line" for the present application. [202] The present application is made under FTA, the provisions of which only require section 10(1)(b) of the EEZ Act to be "taken into account". Any factor that is only required to be "taken into account" cannot constitute an environmental bottom line.

Further, there is no need to resolve any apparent disagreement between the majority judges of the Supreme Court about the role of economics in the assessment of material harm, as the FTA requires that economic benefits are given greater weight in the assessment than any part of the assessment against section 10(1)(b) of the EEZ Act.

It is also significant that effects that s 10(1)(a) seeks to avoid, remedy or mitigate in order to promote sustainable management are effects on the environment, not effects on "existing interests". Thus, the purpose provisions of the EEZ Act draw a distinction between effects on the environment and effects on existing interests. As addressed below, that distinction is maintained throughout the decision-making criteria in ss 59 and 60 of the EEZ Act.

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[200] At [255] per Glazebrook J, [293] per Williams J and [310] per Winkelmann CJ.

[201] At [261] per Glazebrook J, [292] per Williams J and [319] per Winkelmann CJ.

[202] See Section 8.3.17 of this IA.

### 8.2.3 Section 11, EEZ Act (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)."*

The meaning of this provision was addressed in the Supreme Court's decision on TTR's 2016 application. In common with the High Court and Court of Appeal, the Supreme Court followed the principles summarised by McGrath J in Helu v Immigration and Protection Tribunal. He said: [203]

> *[143] Parliament takes differing approaches to the implementation of international obligations. It sometimes gives them effect by incorporating their exact terms into New Zealand law. At other times, it enacts legislation, with the purpose of giving effect to such obligations using language which differs from the terms of substance of the international text. In such cases, the legislative purpose is that decision-makers will apply the New Zealand statute rather than the international text. Resort may still be had to the international instrument to clarify the meaning of the statute under the long-established presumption of statutory interpretation that so far as its wording permits, legislation should be read in a manner consistent with New Zealand's international obligations. But the international text may not be used to contradict or avoid applying the terms of the domestic legislation.*
>
> *[144] … [If] Parliament has provided that a decision-maker is to have regard to specific considerations drawn from international obligations, the legislation must be applied in its terms, although they may be clarified by reference to the international instrument.*

This guidance is relevant to the present FTA application. Parliament has not provided, in the EEZ Act, that regard must be had to specific considerations drawn from international obligations. Rather, section 11 sends a clear signal that the Act itself is intended to implement New Zealand's obligations under the relevant instruments. [204] Further, that intention is not replicated in the FTA, which sends an equally clear signal that Parliament is

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[203] *Helu v Immigration and Protection Tribunal* [2016] NZLR 298.

[204] *Trans-Tasman Resources Limited v Taranaki-Whanganui Conservation Board* [2020] NZCA 86 at [39], upheld on appeal.

not relying on the FTA to implement New Zealand's obligations under those same instruments.

### 8.2.4 Sections 59-60, EEZ Act (Decision-making Criteria)

Sections 59 and 60 of the EEZ Act set out the decision-making criteria under the Act.

The applicable parts of section 59 state:

> *(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) If the application relates to section 20 activity...a marine consent authority 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 (other than EEZ policy statements); and*
>
> *(l) any other applicable law (other than EEZ policy statements); and*
>
> *(m) any other matter the marine consent authority considers relevant and reasonably necessary to determine the application.*
>
> *(2A) If the application is for a marine discharge consent, the EPA must take into account—*
>
> *(a) the matters described in subsection (2), except paragraph (c); and*

*the effects on human health of the discharge of harmful substances if consent is granted....*

*(3) The marine consent authority 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 under this Part and received relation to the application; and*
*(c) any advice received from the Māori Advisory Committee....*

*(5) Despite subsection (3), the marine consent authority must not have regard to—....*

*(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 marine consent authority —*
*(a) before the date of the hearing, if there is one; or*
*(b) if there is no hearing, before the EPA decides the application."*

There is no hierarchy between the matters listed in subsection (2). As these are simply all matters to be taken into account, what weight each matter is given will depend on the circumstances.

In its decision regarding TTR's 2016 application, the Supreme Court held that tikanga-based customary rights and interests are "existing interests" under s 59(2)(a), [205] and tikanga could be "applicable law" under s 59(2)(l). [206] It also found the EPA's 2017 decision failed to effectively grapple with the true effect of TTR's proposal for iwi parties. [207] In relation to s 59(2)(a) it said the EPA needed to indicate an understanding of the nature and extent of the relevant interests, both physical and spiritual, and identify the relevant principles of kaitiakitanga that iwi parties said applied. It then needed to explain why those existing interests were outweighed by other s 59 factors or sufficiently accommodated in other ways. [208] In relation to s 59(2)(l) it said a decision-maker would look at the tikanga itself and

[205] At [154] per William Young and Ellen France JJ, [237] per Glazebrook J, [296] per Williams J and [332] per Winkelmann CJ.

[206] At [172] per William Young and Ellen France JJ, [237] per Glazebrook J, [296] per Williams J and [332] per Winkelmann CJ

[207] At [160] per William Young and Ellen France JJ, [237] per Glazebrook J, [296] per Williams J and [332] per Winkelmann CJ.

[208] At [161] per William Young and Ellen France JJ, [237] per Glazebrook J, [296] per Williams J and [332] per Winkelmann CJ

consider what it might say about the rights or interests of customary "owners" or of the resources itself. [209]

Most of that guidance remains potentially relevant to the present application: tikanga-based customary rights and interests must be taken into account under s 59(2)(a) and tikanga can be considered applicable law under s 59(2)(l). The extent of the FTA Panel's consideration of such matters will depend on what information is received (noting that an FTA Panel is not subject to the same duties as the EPA to exercise information-gathering powers under s 61(1)(a) of the EEZ Act)

There are two further features of the FTA framework that refine these aspects of assessment. First, an assessment under the FTA must give greater weight to the purpose of the FTA than to any s 59 considerations such as effects on existing interests or any other applicable law. Second, an effect on tikanga-based customary rights and interests, or an an inconsistency with tikanga, cannot be a basis for declining approval under the FTA unless that effect or inconsistency is out of proportion to the project's regional or national benefits, even after taking into account conditions. [210]

Section 59(2)(h) of the EEZ Act requires a marine consent authority to take into account the "nature and effect of other marine management regimes". Section 7 of the EEZ Act defines "marine management regimes" in a non-exhaustive way.

The exent of this obligation was considered by the Supreme Court specifically in relation to the argument that the EPA's 2017 decision had failed to meet these requirements in relation to the RMA and the New Zealand Coastal Policy Statement 2010.

The Supreme Court held that the EPA was not required to "apply" other marine management regimes, nor "consider the minutiae of each particular regime"; [211] but did have to consider the key features of each regime—their "objectives" and "the outcomes sought to be achieved"—and consider whether the project would produce effects inconsistent with such outcomes. [212]

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209 At [172] per William Young and Ellen France JJ, [237] per Glazebrook J, [296] per Williams J and [332] per Winkelmann CJ

210 FTA, s 85(3). See Section 8.2.11 of this IA.

211 At [179] per William Young and Ellen France JJ, [280] per Glazebrook J, [298] per Williams J and [331] per Winkelmann CJ.

212 At [181] per William Young and Ellen France JJ, [280] per Glazebrook J, [298] per Williams J and [331] per Winkelmann CJ.

For the present application, those findings provide relevant guidance about the level of scrutiny that s 59(2)(h) requires regarding "other marine management regimes".

The Supreme Court also reiterated that the outcomes sought by policy 13(1)(a) of the NZCPS are expressed as environmental bottom lines, [213] and held that the EPA would have identified this if it had correctly applied s 59(2)(h). The bottom-line nature of the policy would also have precluded the EPA from finding that inconsistency with the policy could be outweighed by other s 59 considerations. [214]

Those elements of the Supreme Court's decision are not relevant to the present application. The FTA framework makes clear that none of the decision-making criteria from the EEZ Act may operate as a bottom line in the context of a substantive application under the FTA—which limits both s 10(1)(b) and any provisions of another marine management regime. [215] At most, the requirement to take acocunt of the nature and effect of another marine management regime might lead an FTA Panel (depending on the available evidence) to identify an objective or outcome of that regime with which a proposal might be inconsistent. But such inconsistency alone cannot be a basis for declining approval. [216]

Section 60 of the EEZ Act states:

> *"In considering the effects of an activity on existing interests under section 59(2)(a), the [marine consent 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."*

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[213] At [185] per William Young and Ellen France JJ, [280] per Glazebrook J, [298] per Williams J and [331] per Winkelmann CJ.

[214] At [280] per Glazebrook J, [298] per Williams J, and [331] per Winkelmann CJ.

[215] NB. The majority judgments applied policy 13(1)(a) as a bottom line not merely because it used the language of such "bottom lines" (it was, after all, only a matter required to be "taken into account" under s 59(2)) but because of its strong commonality with the bottom line that the Court considered was created by s 10(1)(b). It was this "synergy"(at [280] per Glazebrook J) or "lockstep" (at [298] per Williams J) between the two regimes that led the Court to the view that the application's inconsistency with one would inevitably mean it was inconsistent also with the other.

[216] See Section 8.2.6 of this IA addressing the exclusivity of the grounds for declining approvals under section 81 and 85 of the FTA.

### 8.2.5 Section 61, EEZ Act (Information Principles)

Section 61 of the EEZ Act states:

> *(1) When considering an application for a marine consent, a marine consent 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 marine consent authority must favour caution and environmental protection.*
>
> *(3) If favouring caution and environmental protection means that an activity is likely to be refused, the marine consent authority must first consider whether taking an adaptive management approach would allow the activity to be undertaken.*
>
> *(4) Subsection (3) does not*
>
> *(a) apply to an application for—*
>
> *(i) a marine dumping consent; or*
>
> *(ii) a marine discharge consent; or*
>
> *(iii) a marine consent in relation to an activity referred to in section 20(2)(ba); or*
>
> (b) *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."*

The FTA framework excludes the application of s 61(1)(a). This lessens the obligations of an FTA Panel (compared with a marine consent authority deciding an application under the EEZ Act).

In its decision regarding TTR's 2016 application, the Supreme Court considered the meaning of s 61(2). It held that the information available in TTR's 2016 application in relation to marine mammals, seabirds and sediment was uncertain in a variety of ways, and that granting consent in those circumstances, and in the absence of further explanation by the EPA, amounted to a failure on the part of the EPA to favour caution and environmental protection.[217]

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[217] At [118]-[131] per William Young and Ellen France JJ, [274] per Glazebrook J, [294] per Williams J and [328] per Winkelmann CJ.

For the present application, the Supreme Court's findings on those matters are of limited relevance. Those findings were a specific response to the factual findings in the EPA's 2017 decision, which in turn were based on the evidence available in 2017. The FTA Panel detemining the present application is required to assess for itself whether there is uncertainty in the information, and must do so based on the evidence now available. That evidence has been revised and supplemented since 2017, particularly in response to the uncertainties concerning marine mammals, seabirds and sediment.

Further, under the FTA framework favouring caution and environmental protection can only be a matter to be taken into account—it cannot be a basis for declining consents. [218]

### 8.2.6 Section 62(2), EEZ Act (Power to Decline)

Section 62(2) of the EEZ Act states:

> *"(2) To avoid doubt, the marine consent authority may refuse an application for a consent if it considers that it does not have adequate information to determine the application."*

This provision is required to be taken into account, as stated in clause 6(d) of Schedule 10 of the FTA.

This creates some tension with sections 81 and 85 of the FTA. Section 81(2)(f) states that an FTA Panel may decline approval "only in accordance with section 85". Section 85 specifies potential reasons for which an approval "must" and "may" be declined — but none of those potential reasons is that the FTA Panel considers it does not have adequate information to determine the application.

The statutory requirement to only "take into account" section 62(2) of the EEZ Act, compared with the more directive requirements of sections 81 and 85 (which must be implemented, not merely weighed alongside other considerations), creates some doubt whether Parliament intended the reference to section 62(2) to operate as a further potential ground for refusing an application. However, it is hard to see what purpose the cross-reference to section 62(2) serves, if it merely enables an FTA Panel to consider whether it has adequate information, but does not enable the Panel to decline approval if it determines that the information is inadequate. The approach that seems to accord the most with the intention of the provisions as a whole is that the cross-reference to section 62(2) should be read as adding to the list in s 85 one additional ground for an FTA Panel to potentially decline an approval, namely inadequate information.

[218] See section below in relation to ss 81(2)(f) and 85.

### 8.2.7 Sections 63-67, EEZ Act (conditions)

Section 63 of the EEZ Act authorises the imposition of conditions. It states:

> *(1) A marine consent 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.*
>
> *(2) The conditions that the marine consent authority 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, if section 64 applies, together amount or contribute to an adaptive management approach.*
>
> *(3) However, the marine consent authority 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 marine consent authority 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 at Work Act 2015.*

Section 64 of the EEZ Act defines (non-exhaustively) what is an "adaptive management approach", but does not permit such an approach to be applied to marine discharge consents.

In relation to TTR's 2016 application, the Supreme Court considered whether the conditions imposed by the EPA applied an adaptive management approach. It upheld the findings of the Court of Appeal that the conditions did not apply adaptive management because they did not envisage any adjustment of the consent envelope, i.e. no scaling back of the authorised mining activities or any adjustment of the effects permitted under the consent. Rather, they contemplated TTR adjusting the way it carries out the operation to ensure it remains within the consent envelope, which both the Court of Appeal and Supreme Court held did not amount to adaptive management. [219]

The Supreme Court's guidance is relevant to the present application, as the relevant conditions proposed by TTR (i.e. those prescribing monitoring and management plans deigned to provide for operational responses if the requirements of consent are not met) are materially the same as those the Court considered. Therefore no adaptive management is proposed.

Section 65 covers bonds. It states:

*(1) A bond required under section 63(2)(a)(i) may be given for the performance of any 1 or more conditions of a marine consent that a marine consent authority considers appropriate and may continue after the expiry of the consent to secure the ongoing performance of conditions relating to long-term effects, including—*

*(a) a condition relating to the alteration, demolition, or removal of structures:*

*(b) a condition relating to remedial, restoration, or maintenance work:*

*(c) a condition providing for ongoing monitoring of long-term effects.*

*(2) A condition of a consent that describes the terms of the bond may—*

*(a) require that the bond be given before the consent is exercised or at any other time:*

*(b) provide that the liability of the holder of the consent be not limited to the amount of the bond:*

*(c) require the bond to be given to secure performance of conditions of the consent, including conditions relating to any adverse effects on the environment or existing interests that become apparent during or after the expiry of the consent:*

*(d) require the holder of the consent to provide such security as the marine consent authority thinks fit for the performance of any condition of the bond:*

*(e) require the holder of the consent to provide a guarantor (acceptable to the marine consent authority) to bind itself to pay for the carrying out of a condition in the event of a default by the holder or the occurrence of an adverse environmental effect requiring remedy:*

*(f) provide that the bond may be varied, cancelled, or renewed at any time by agreement between the holder and the marine consent authority.*

*(3) If the marine consent authority considers that an adverse effect may continue or arise at any time after the expiration of a marine consent, the marine consent authority may require that a bond continue for a specified period that the marine consent authority thinks fit."*

Section 66 addresses monitoring. It states:

[219] At [199]-[213] per William Young and Ellen France JJ, [281]-[284] per Glazebrook J, [299] per Willams J and [332] per Winkelmann CJ.

(1) *A condition imposed under section 63(2)(a)(iii) may require the consent holder to do 1 or more of the following:*

(a) *make and record measurements:*

(b) *take and supply samples:*

(c) *carry out analyses, surveys, investigations, inspections, or other specified tests:*

(d) *carry out the procedures in paragraphs (a) to (c) in a specified manner:*

(e) *provide information to the EPA or a person specified by the EPA at a specified time or times:*

(f) *provide information to the EPA or a person specified by the EPA in a specified manner:*

(g) *comply with the condition at the consent holder's expense.*

(2) *This section does not limit section 63(2)(a)(iii)."*

Section 67 addresses observers. It states:

(1) *A condition imposed under section 63(2)(a)(iv) that requires the holder of a consent to appoint an observer must specify in detail the observer's duties in relation to the activity.*

(2) *The consent holder may appoint a person to be an observer only if the person is approved by the EPA for that purpose.*

(3) *The EPA must approve a person to be an observer in relation to a consent if—*

(a) *the person has the appropriate training, skill, and experience to perform the duties; and*

(b) *the EPA is satisfied that the person is able to perform the duties independently of the consent holder."*

### 8.2.8 Sections 82, FTA (Treaty Settlements and related obligations)

Section 81(2)(c) of the FTA states an FTA Panel must comply with section 82, if applicable. Section 82 states:

(1) *This section applies if a Treaty settlement, the Marine and Coastal Area (Takutai Moana) Act 2011, or the Ngā Rohe Moana o Ngā Hapū o Ngāti Porou Act 2019 is relevant to an approval.*

(2) *If the settlement or Act provides for the consideration of any document, the panel must give the document the same or equivalent effect through the panel's decision making as it would have under any relevant specified Act.*

(3) *The panel must also consider whether granting the approval would comply with section 7.*

(4) *In this section, document—*

(a) *means any document, arrangement, or other matter; and*

(b) *includes any statutory planning document amended as a result of the settlement or Act referred to in subsection (1)."*

Section 7 states:

(1) *All persons performing and exercising functions, powers, and duties under this Act must act in a manner that is consistent with—*

*(a) the obligations arising under existing Treaty settlements; and*
*(b) customary rights recognised under—*
*(i) the Marine and Coastal Area (Takutai Moana) Act 2011:*
*(ii) the Ngā Rohe Moana o Ngā Hapū o Ngāti Porou Act 2019.*

*(2) To avoid doubt, subsection (1) does not apply to a court or a person exercising a judicial power or performing a judicial function or duty.*

*(3) In this section, existing Treaty settlements means Treaty settlements that exist at the time the relevant function, power, or duty is performed or exercised (rather than only those that exist at the commencement of this Act)."*

### 8.2.9 Section 83, FTA (Conditions no more onerous than necessary)

Section 81(2)(d) of the FTA states that an FTA Panel must comply with section 83 in setting conditions. Section 83 states:

> *"When exercising a discretion to set a condition under this Act, the panel must not set a condition that is more onerous than necessary to address the reason for which it is set in accordance with the provision of this Act that confers the discretion."*

This limitation on the discretionary authority of an FTA Panel applies to all aspects of condition-making pursuant to ss 63-67 of the EEZ Act and ss 82 and 84 of the FTA.

### 8.2.10 Section 84, FTA (Conditions relating to Treaty settlements and customary rights)

Section 81(2)(e) of the FTA states an FTA Panel may impose conditions under section 84. Section 84 states:

*(1) For the purposes of section 7, the panel may set conditions to recognise or protect a relevant Treaty settlement and any obligations arising under the Marine and Coastal Area (Takutai Moana) Act 2011 or the Ngā Rohe Moana o Ngā Hapū o Ngāti Porou Act 2019.*

*(2) This section applies in addition to, and does not limit, any other powers to set conditions under this Act."*

### 8.2.11 Section 85, FTA (Declining Approvals)

Section 81(2)(f) of the FTA states an FTA Panel "may decline an approval only in accordance with section 85". The relevant parts of section 85 state:

*(1) The panel must decline an approval if 1 or more of the following apply:*
*(a) the approval is for an ineligible activity:*
(b) *the panel considers that granting the approval would breach section 7:.....*

*(3) A panel may decline an approval if, in complying with section 81(2), the panel forms the view that—*
*(a) there are 1 or more adverse impacts in relation to the approval sought; and*
*(b) those adverse impacts are sufficiently significant to be out of proportion to the project's regional or national benefits that the panel has considered under section 81(4), even after taking into account—*
*(i) any conditions that the panel may set in relation to those adverse impacts; and*
*(ii) any conditions or modifications that the applicant may agree to or propose to avoid, remedy, mitigate, offset, or compensate for those adverse impacts.*

> (4) *To avoid doubt, a panel may not form the view that an adverse impact meets the threshold in subsection (3)(b) solely on the basis that the adverse impact is inconsistent with or contrary to a provision of a specified Act or any other document that a panel must take into account or otherwise consider in complying with section 81(2).*
>
> (5) *In subsections (3) and (4), adverse impact means any matter considered by the panel in complying with section 81(2) that weighs against granting the approval.*

The term "ineligible activity" is defined in section 5 of the FTA. It is not applicable here, as the application is not for an activity that section 5 defines as ineligible.

The proportionality test in subsection (3) demonstrates that even a project that will have significant adverse impacts may be approved, if those impacts are proportionate to the project's benefits. In simple terms, if the project's benefits are significant, then a significant adverse impact may not be out of proportion to those benefits. This type of comparison will in some circumstances be difficult to undertake, as regional or national benefits will typically be quantifiable, while some adverse impacts may not. However, proportionality is not an exact measure. However the relativities are assessed, the test must be applied in a manner consistent with the explicit direction in clause 6 of Schedule 10, to give greater weight to the purpose of the FTA than to all other considerations.

Relevant to sub-section (4), the FTA framework precludes the application of any "environmental bottom lines", as addressed above. [220] Thus, for an FTA application, the requirements of section 10(1)(b) of the EEZ Act (to avoid material harm from pollution), [221] or policy 13(1)(a) of the NZCPS (to avoid adverse effects on natural character) [222] do not apply as bottom lines. Section 85(4) goes further. It states that inconsistency with such provisions cannot provide a basis, on its own, for finding that the threshold in s 85(3)(b) is met. In other words, the significance of any adverse impact, or its proportionality to a project's benefits—which are the key matters required to be assessed under s 85(3)(b)—must be determined by evaluating more than its inconsistency with s 10(2)(b) or policy 13(1)(a). Inconsistency with such provisions is not, on its own, a basis for finding that the impact is significant, or that the impact is out of proportion to a project's benefits.

See also the discussion above regarding section 62(2) of the EEZ Act, which should be regarded as an additional potential basis for declining an approval (in the event that an FTA Panel finds there is inadequate information to determine the relevant application).

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[220] See Section 8.2.4 of this IA.

[221] As interpreted by the Supreme Court, see Sections 8.2.11 and 8.3.17 of this IA.

[222] See Section 8.2.4 of this IA.

## 8.3 APPLYING THE STATUTORY FRAMEWORK

Section 8.2 above identifies all of the relevant components of the statutory framework. This section addresses how those components apply to the specifics of the present applications.

The components of the statutory framework are addressed in the most logical sequence, beginning with the detailed matters of assessment described in ss 59-60 of the EEZ Act, before addressing the principles of decision-making, and the higher-order purposes of the FTA framework.

### 8.3.1 Sections 59(2)(a) and (b), EEZ Act – Effects on the Environment and Existing Interests

The effects of the project on the environment and existing interests are addressed comprehensively in Section 5 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 5 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 recovery of marine organisms to occur within a short timeframe;
- Any potential effects on fish, seabirds and marine mammals will be localised and predominantly contained within the project area, and will not result in material harm;
- 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 5 are:

> For the most part, 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 is located within an area of the STB where there are few existing interests. The primary existing interest is commercial fishing. 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 66km$^2$, the actual working area per year will be much smaller at approximately 5km$^2$. At any given time, existing interests will only be excluded from the locations presently being mined, a small safety area around the mining vessel and any safety area around related vessels. 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 5 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"*. These activities have been identified in Section 4.1.3 of this IA, and their effects have been taken into consideration in section 5.14. In summary, other than unplanned 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.

For further discussion on tikanga-based customary rights and interests, see Section 8.3.10 below.

### 8.3.2 Section 59(2)(d), EEZ Act – Protection of Biological Diversity and Integrity of Marine Species, Ecosystems, and Processes

The effects as they relate to these matters have been assessed in detail in Section 5 of this IA. The assessment of effects supports a conclusion 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.

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 material. 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.

### 8.3.3 Section 59(2)(e), EEZ Act – Protection of Rare and Vulnerable Ecosystems and the Habitats of Threatened Species

As identified in Section 3.4 of this IA, there are no 'rare and vulnerable ecosystems' within the project area. Additional bathymetric surveys prior to the commencement of mining will also ensure that there are no undiscovered reef systems within proximity to the project area. Project design and the proposed consent conditions will ensure that any effects on rare and vulnerable ecosystems are avoided, remedied or mitigated, in particular by conditions that rigorously limit and control the discharge of mining sediment.

With regard to the habitats of threatened species, Section 3.7 of this IA identifies that 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, may be present at times within the project area. However, for reasons addressed in Section 3.7 it is highly unlikely to be suitable habitat for Maui's dolphins, it is not of any identifiable significance as a habitat for Maui's dolphins or Blue Whales, and they have a very low probability of presence. Section 5.8 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.

#### 8.3.4 Section 59(2)(f), EEZ Act – The Economic Benefit to New Zealand of allowing the Application

Section 5.2 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$100/tonne, is between $36 million and $39 million in the Project's first seven years of extraction, increasing to about $54 million per annum thereafter;

> The contribution of approximately NZ$854 million per annum to New Zealand exports;

> The project will directly require over 173 people to operate the the IMV and FSO vessels and over 50 staff in support services; and

- The project is expected to generate about NZ$265 million in GDP and employ 1,365 people (directly and indirectly) in the New Zealand economy each year for the duration of the project. 799 of those will be employed in the Taranaki/Whanganui regions.

It is considered that the project will have an economic benefit on a local, regional and national scale if the consents are granted.

### 8.3.5 Section 59(2)(g), EEZ Act – The Efficient Use and Development of Natural Resources

TTR has invested significant time and financial resources into assessing the feasibility of iron sand extraction in the STB. This investigation has identified that there is a world-class natural resource of iron ore, vanadium and titanium present that can be extracted in an efficient manner.

The mining will be preceded by grade control drilling that enables extraction to be planned so as to remove only the seabed material containing VTM deposits. The depth of extraction will be continuously adjusted to target the deposits, and the processing onboard the IMV will separate the minerals from other seabed material so that all de-ored material can be returned immediately to the seabed. These practices will maximise efficiency, while also allowing for benthic ecosystems to recover in the shortest possible time.

There is projected long-term international demand for iron ore, vanadium and titanium, and in the absence of the Project the inferred mineral resource of 3.2 billion tonnes will be unutilised. The Project will place New Zealand as a significant global producer, and potentially the third-largest vanadium producer in the world (and the largest in the western world).

It is therefore considered that the project provides for the efficient use and development of natural resources.

### 8.3.6 Section 59(2)(h), EEZ Act – The Nature and Effect of Other Marine Management Regimes

Applying the definition from section 7 of the EEZ Act, it is considered that the marine management regimes (**MMR**s) whose nature and effect is to be taken into account for TTR's applications are:

- Biosecurity Act 1993;
- Continental Shelf Act 1964;
- Crown Minerals Act 1991;
- Fisheries Act 1996;

- Hazardous Substances and New Organisms Act 1996;
- Health and Safety at Work Act 2015;
- Heritage New Zealand Pouhere Taonga Act 2014;
- Marine and Coastal Area (Takutai Moana) Act 2011;
- Marine Mammals Protection Act 1978;
- Marine Reserves Act 1971;
- Maritime Transport Act 1994;
- Resource Management Act 1991;
- Submarine Cables and Pipelines Protection Act 1996; and
- Wildlife Act 1953.

As addressed above in section 8.2.4 of this IA, the FTA Panel does not need to consider the minutiae of other MMRs. It needs to take into account their key features, and whether granting TTR's applications would be somehow inconsistent with the outcomes the other regimes are seeking to achieve. Notably, if such inconsistency were to exist, that would need to be factored into the Panel's assessment, but would not on its own be a basis to decline consents.

The potential for inconsistency only arises in relation to MMRs that do not directly apply to TTR's activity (e.g. the Resource Management Act 1991, which does not apply beyond the coastal marine area). All MMRs that apply directly to TTR's activity (such as the navigation regime under the Maritime Transport Act 1994) will continue to apply on their own statutory terms, irrespective of whether marine consents are granted — so any grant of resource consents cannot produce outcomes that are somehow inconsistent with those MMRs.

Further, TTR has been careful to plan and design the Project to ensure it will be able to meet all applicable MMR requirements — and, where appropriate, provision has been made for some of these matters in TTR's proposed conditions.

Also, legislation does not generally have extra-territorial effect unless that is expressly stated or necessarily implied. However, vessels associated with the Project are "devices" (and when moored are "installations") within the meaning of s 7 of the Continental Shelf Act 1964. Section 7 states that for the purposes of all Acts (whether passed before or after the Continental Shelf Act), every act or omission which takes place on, under or about any installation or device used on or above the continental shelf in connection with the exploitation of its natural resources shall be deemed to take place in New Zealand.

#### 8.3.6.1 Biosecurity Act 1993

The Biosecurity Act provides a framework for border controls aimed at preventing unwanted organisms from entering the country, for establishing surveillance to detect organisms once they have arrived, and for the control and eradication of pests once they have become established.

The Act was amended in 2012 by adding Part 8A, which extends the application of the Act directly to the EEZ. TTR's proposed marine consents cannot be inconsistent with the nature and effect of Part 8A: it applies irrespective of any marine consents TTR obtains.

The Act addresses the risks associated with biofouling. [223] Biofouling refers to marine plants and animals that are attached to submerged surfaces at sea. It is one of the key mechanisms that enable transport of non-indigenous species by vessels and other craft or equipment, and is therefore a vector for the entry or spread of pests and unwanted organisms. A Craft Risk Management Standard (**CRMS**) issued under s 24G of the Biosecurity Act [224] specifically seeks to manage the biosecurity risks associated with biofouling.

Biosecurity risks are addressed in Section 5.13.4 of this IA, which identifies the procedures and management measures that will ensure any biosecurity risks related to the Project will be negligible. This includes conditions that will require, among other things, a Biosecurity Management Plan (**BMP**) to be prepared by TTR in consultation with the Ministry for Primary Industries, which is to be certified by the EPA and updated as needed to reflect the most up-to-date standards.

TTR has consulted with MPI on biosecurity matters, and will continue to engage with MPI on such matters during the course of the Project, which is provided for in the BMP requirements.

#### 8.3.6.2 Continental Shelf Act 1964

The Continental Shelf Act vests in the Crown all rights that are exercisable by New Zealand with respect to the continental shelf and its natural resources, for the purpose of exploring the shelf and exploiting those resources.

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[223] The other specific vector for potential biosecurity risks associated with the Project is ballast water, which is now managed under the Maritime Transport Act 1994, and addressed below in relation to that Act.

[224] Craft Risk Management Standard: Biofouling on Vessels Arriving to New Zealand (Ministry for Primary Industries, 15 November 2018).

Until 2013 the Act provided for the granting of licences for prospecting and mining on the continental shelf, including the imposition of conditions on any licences. It was amended in 2013 so as to make mining activities for minerals in the seabed or subsoil of the continental shelf (other than petroleum) subject to the licensing regime of the Crown Minerals Act 1991.

TTR formerly held a license for mineral prospecting under the Continental Shelf Act, which expired in 2014. TTRL now holds a mining permit, which includes the Project area, under the Crown Minerals Act. [225]

Granting marine consents cannot be inconsistent with the licensing aspects of the Continental Shelf Act.

The Continental Shelf Act also provides for the making of regulations to establish safety zones around installations or devices in, on or above the continental shelf. The only relevant safety zone is the Kupe Safety Zone (effectively, a 500m exclusion zone in all directions from the outer edge of the Kupe platform), established pursuant to the Continental Shelf (Kupe Wellhead Platform Safety Zone) Regulations 2006. The Project will fully comply with that safety zone.

#### 8.3.6.3 Crown Minerals Act 1991

The purpose of the Crown Minerals Act is to promote prospecting for, exploration for, and mining of Crown owned minerals (both terrestrially and in the marine environment) for the benefit of New Zealand. To this end the Act provides for:

> Efficient allocation of rights to prospect for, explore for, and mine Crown owned minerals;
> The effective management and regulation of the exercise of those rights;
> The carrying out, in accordance with good industry practice, of activities in respect of those rights; and
> A fair financial return to the Crown for its minerals.

A key tenet of the Crown Minerals regime is that the government does not wish to undertake prospecting, exploring or mining activities itself, and wants those activities to be undertaken by others. [226] A key objective for the granting of mining permits is to ensure that the exercise of the permit will economically deplete the relevant resource to the maximum extent

[225] Refer Section 1.3 of this IA.

[226] Minerals Programme for Minerals (Excluding Petroleum) 2013, cl 1.3(3).

possible in accordance with good industry practice. 227 Good industry practice is defined in the Crown Minerals Act to exclude any aspect of the activity regulated under environmental legislation. [228]

Thus, the Crown Minerals Act does not seek to manage the environmental effects of prospecting, exploration or mining operations. Its focus is on developing and using mineral resources in the most efficient way, not sustainable management.

Accordingly the Crown Minerals Act imposes no general obligation or responsibility on permit holders to avoid, remedy or mitigate the effects of their activities on the environment or existing interests when carrying out a mining permit; and MBIE, as the regulator responsible for the administration of the Crown Minerals regime, does not consider environmental effects when fulfilling its role under the Act.

For these reasons, a grant of marine consents to TTR for the Project could not be inconsistent with the nature and effect of the Crown Minerals Act.

#### 8.3.6.4 Fisheries Act 1996

The purpose of the Fisheries Act is to provide for the utilisation of fisheries resources while ensuring sustainability. [229] Ensuring sustainability is defined as:

> Maintaining the potential of fisheries resources to meet the reasonably foreseeable needs of future generations; and

> Avoiding, remedying or mitigating any adverse effects of fishing on the aquatic environment.

The Act applies to all New Zealand fisheries waters which includes the territorial sea and all waters in the EEZ.

The Act establishes a framework for managing customary, commercial and recreational fishing, administered by the Ministry for Primary Industries.

The impacts of the Project on customary, commercial and recreational fishing are addressed in Sections 5.13.1, 5.13.2 and 5.13.5 respectively. Regardless of the perspective applied (fish avoidance of mining sediment plume, effects on possible fish nursery area, commercial catch reduction, displacement due to buffer around mining activity, overall

[227] Above n 191, clause 10.1(3)(c).

[228] Crown Minerals Act, section 2(1).

[229] Fisheries Act 1996, section 8.

effect on abundance or health of commercial fisheries) the impacts range from negligible to insignificantly small.

It is therefore considered that the grant of marine consents to TTR cannot be inconsistent with the nature and effect of the Fisheries Act. With the exception of aquaculture, the Fisheries Act does not purport to facilitate exclusive occupation of New Zealand Fisheries waters, and to the extent that the Project may have any effect on fisheries it is sufficiently small to be consistent with the Fisheries Act objective of ensuring sustainability.

Further, to protect the only aquaculture interests that may be potentially affected by the Project—namely those in Admiralty Bay, where Project vessels may shelter during storm events—TTR has proposed conditions including prohibiting the discharge of ballast water.

Provided the proposed conditions are adopted, it is considered that the Project will not have any effects on customary, commercial or recreational fishing that are inconsistent with the outcomes sought by the Fisheries Act.

#### 8.3.6.5 Health and Safety at Work Act 2015

The Health and Safety at Work Act 2015 applies by default in the territorial sea, it applies to New Zealand ships wherever they may be, [230] and it applies to workplaces (including ships) where mining activity regulated by the EEZ Act is carried out. [231] It places a primary duty of care on persons conducting a business or undertaking (**PCBU**s) to ensure the health and safety of workers, so far as is reasonably practicable. [232] Its main purpose [233] is to provide for a balanced framework to secure the health and safety of workers and workplaces by:

- Protecting workers against harm by eliminating risks;
- Providing for fair and effective workplace representation, consultation, co-operation and resolution of issues about health and safety;
- Encouraging unions and employer organisations to take a constructive role promoting improvements and assisting PCBUs and workers to achieve a healthier and safer working environment;
- Promoting the provision of advice, information, education and training;
- Securing compliance through effective and appropriate measures;

[230] Health and Safety at Work Act 2015, section 10.

[231] Section 11.

[232] Section 36.

[233] Section 3.

- Ensuring appropriate scrutiny and review of actions by those with functions or powers under HSWA; and
- Providing a framework for continuous improvement and progressively higher standards for work health and safety.

Both Maritime NZ and WorkSafe hold responsibilities under HSWA in the marine environment. Health and safety on ships is a matter for which Maritime NZ is responsible, while health and safety on installations is a matter for which WorkSafe is responsible. The IMV may at times be treated as an installation (e.g. when fixed for mining extraction activity) and at other times a vessel (e.g. when manoeuvring between mining blocks). When TTR's last application was heard by the EPA in 2017, Maritime NZ confirmed the two agencies would work together to co-ordinate this without duplication.

The regime for managing health and safety at work also now covers the role of managing risks posed by hazardous substances in workplaces, under the Health and Safety at Work (Hazardous Substances) Regulations. 234 This includes rules to comply with the hazard classifications of relevant substances, for the management of risks to workers.

The granting of marine consents would not exempt or in any way preclude TTR from complying in full with all applicable HSWA requirements. It is therefore considered that the granting of marine consents cannot be inconsistent with the nature and effect of that regime. 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 8.2** of this IA. Additionally, TTR's Health and Safety, and Environment and Community policies are appended as **Appendices 8.3** and **8.4** to this IA.

#### 8.3.6.6 Hazardous Substances and New Organisms Act 1996

The purpose of the Hazardous Substances and New Organisms Act is to protect the environment, and the health and safety of people and communities, by preventing or managing the adverse effects of hazardous substances and new organisms. 235 This is largely implemented by the EPA, while workplace requirements are administered by WorkSafe under the health and safety regime.

Every hazardous substance imported into, or manufactured in, New Zealand needs to have an approval under the HSNO Act. Once approved, hazardous substances must be used in accordance with controls set by EPA Notices, group standards or individual hazardous

[234] Which came into force after the last DMC Decision, largely on 1 December 2017.

[235] Hazardous Substances and New Organisms Act 1996, section 4.

substances approvals. Broadly speaking, controls govern all relevant aspects of the lifecycle of a hazardous substance according to its hazard classification.

The only substances associated with the Project that are anticipated to fall under HSNO Act jurisdiction are:

> Fuels (heavy fuel oil and diesel);

> Chemicals involved in the production of the desalinated water that will be used as a medium to transfer iron ore from the IMV to the FSO.

The grant of marine consents would not lessen in any way the requirements of the HSNO Act from applying in full to relevant aspects of the Project. In this way, granting consents cannot give rise to any inconsistency with the nature and effect of the HSNO Act.

#### 8.3.6.7 Heritage New Zealand Pouhere Taonga Act 2014

The purpose of the Heritage New Zealand Pouhere Taonga Act 2014 is to promote the identification, protection, preservation and conservation of the historical and cultural heritage of New Zealand.[236] To this end it:

> Provides for the New Zealand Heritage List, a list comprising historic places, historic areas, wāhi tapu, wāhi tapu areas and wāhi tupuna, as a means for recognising heritage values;

> Prohibits the modification or destruction of an archaeological site unless an authority is obtained from Heritage New Zealand Pouhere Taonga; and

> Includes sanctions for breaches of the HNZPTA.

The Act defines an archaeological site as any place that was associated with human activity that occurred before 1900 or that is the site of a wreck of any vessel where the wreck occurred before 1900; or that provides or may provide evidence relating to the history of New Zealand.

No archaeological sites are known to be present within the Project Area. The potential for shipwrecks is low, but cannot be discounted entirely.[237] If a pre-1900 shipwreck and debris should be discovered during mining operations, it would be necessary for TTR to obtain an archaeological authority before carrying out any further work that might affect the site.

[236] Heritage New Zealand Pouhere Taonga Act 2014, s 3.

[237] Report 23 Trans-Tasman Resources South Taranaki Bight Offshore Iron Sand Project: Archaeological Assessment, December 2015.

Provision has been made for this in the proposed conditions. [238]

For all these reasons, the grant of marine consents for the Project would not be inconsistent with the nature and effect of the HNZPTA.

#### 8.3.6.8 Marine and Coastal Area (Takutai Moana) Act 2011

The Marine and Coastal Area (Takutai Moana) Act 2011 applies to the marine and coastal area, and not to the EEZ. The purpose of the Act is to:

> Establish a durable scheme to ensure the protection of legitimate interests of all New Zealanders in the marine and coastal area of New Zealand; and

> Recognise the mana tuku iho exercised in the marine and coastal area by iwi, hapū and whānau as tangata whenua;

> Provide for the exercise of customary interests in the common marine and coastal area; and

> Acknowledge te Tiriti o Waitangi.

To that end, key features of the Act are:

> It creates a common space in the marine and coastal area (the CMCA) that cannot be owned by anyone and therefore cannot be sold.

> It provides legal recognition and protection of customary interests in the CMCA, through protected customary rights (PCRs) and customary marine title (CMT).

> It provides that local authorities are prohibited from granting a resource consent for an activity that will, or is likely to, have more than minor adverse effects on the exercise of a PCR (with some exceptions) unless the PCR group gives its approval.

> It provides that the rights conferred by CMT include the right to give or decline permission for activities being carried out under a resource consent in a CMT area (with some exceptions) and the right of CMT groups to create a planning document.

> It provides that the exercise of rights associated with CMT and PCR cannot limit or affect:

  > Resource consents in place at the commencement of the Act;

  > Any activities that can be lawfully undertaken without resource consent or other authorisation;

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[238] Conditions 19-23.

    - Resource consents for emergency activities;
    - Future coastal permits to allow existing aquaculture activities to continue on the same site; and
    - In the case of CMT, activities in the national and regional interest such as certain future infrastructure and regional council research and monitoring.
- It creates two pathways for establishing legal recognition of PCR and CMT: in the High Court or via a recognition agreement directly with the Crown.
- It provides for public rights of free access, fishing and navigation to coexist with CMT, except in wāhi tapu areas.

As yet, no relevant rights claimed under the Act have been determined.

The Supreme Court has held that the Act is not the source of customary interests, but provides a mechanism for their recognition. [239] To the extent that customary interests exist and are not yet recognised under the Act processes, they may qualify as "existing interests" under s 59(2)(a). [240] Alternatively, the tikanga from which they derive may be considered directly under s 59(2)(l) as "other applicable law". [241]

It is considered that granting marine consents for the Project would not be inconsistent with the outcomes sought by the Act.

#### 8.3.6.9 Marine Mammals Protection Act 1978

The Marine Mammals Protection Act applies within and beyond New Zealand's territorial limits. It applies to the EEZ, and to any act or omission on any New Zealand ship wherever that may be, and to any act or omission by a New Zealand citizen wherever that person may be. [242]

The Act provides for the conservation, protection and management of marine mammals and is administered by the Department of Conservation.

A permit is required under the Act for anyone to "take" a marine mammal, which includes actions that harm, harass, injure and attract marine mammals.

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[239] 2016 Decision on TTR at [154].

[240] 2016 Decision on TTR at [154].

[241] 2016 Decision on TTR at [172] and [296]-[297].

[242] Marine Mammals Protection Act 1978, section 1(3).

The Act provides for the establishment of marine mammal sanctuaries within which activities known to harm particular marine mammal species can be restricted. It also provides for conservation management strategies to establish objectives for the integrated management of marine mammals, [243] and conservation management plans to establish objectives for the management of marine mammal sanctuaries. [244]

There is one marine mammal sanctuary within the vicinity of the Project, being the West Coast North Island sanctuary to protect Hector's dolphin. [245] This sanctuary was enlarged in 2020 246 so that it includes the full length of the coastal marine area in the STB. [247] It prohibits all seabed mining within the sanctuary, with an exemption for existing permits under the Crown Minerals Act. [248] Notably, the sanctuary was deliberately limited to the coastal marine area. It could have extended into the EEZ as other sanctuaries do, [249] if the intention had been for the prohibition to apply in the EEZ.

As part of the same exercise that enlarged the sanctuary, the Department of Conservation revised the Threat Management Plan for Hector's and Māui dolphin (TMP). [250] The TMP states that the objective for human-induced non-fishing threats is to, "ensure that adverse effects on the dolphins from other human-induced threats are avoided or minimised", and that this objective may be met through the Marine Mammals Protection Act and the EEZ Act (among others). [251]

The potential impacts of the Project on marine mammals are addressed in Sections 5.8 and 5.9 of this IA, which concludes that noise effects will be very low, and all other potential effect will be negligible. This supports a conclusion that the grant of marine consents cannot be inconsistent with the key features of the Marine Mammals Protection Act as outlined above.

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[243] Section 3C.

[244] Section 3D.

[245] Established under the Marine Mammals Protection (West Coast North Island Sanctuary) Notice 2008.

[246] Under the Marine Mammals Protection (West Coast North Island Sanctuary) Amendment Notice 2020.

[247] For a map of the enlarged sanctuary, refer to the Notice, above, at Schedule 2.

[248] Above n 55, clause 6.

[249] For example, the Clifford & Cloudy Bay Marine Mammal Sanctuary or Banks Peninsula Marine Mammal Sanctuary, the latter of which extends to 20 nautical miles offshore.

[250] Hector's and Māui Dolphin Threat Management Plan 2020.

[251] Objective 4.

#### 8.3.6.10 Marine Reserves Act 1971

The Marine Reserves Act is 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. [252]

The main aim of a marine reserve is to create an area free from alterations to marine habitats and life, providing a useful comparison for scientists to study.

There are 44 marine reserves in New Zealand's territorial waters, all managed by the Department of Conservation.

Of these, two are in the Taranaki region, being Parininihi and Tapuae Marine Reserves. The latter is located in an area between New Plymouth and Oakura, and the former is in an area north of Pukearuhe. They are outside the STB and a long way to the north of the Project site. There is no identifiable effect the Project could have on either of these reserves, and on that basis granting consents to TTR would not be inconsistent with the nature and effect of the Marine Reserves Act.

#### 8.3.6.11 Maritime Transport Act 1994

The Maritime Transport Act stipulates broad principles of maritime law relevant to maritime safety and protection of the marine environment. It applies within the EEZ, directly to TTR's proposed activity.

The detailed standards and procedures for marine safety and marine protection are contained in Maritime Rules and Marine Protection Rules, made by the Minister of Transport.

The Maritime Rules correspond to key international conventions relevant to navigational safety. The Rules address maritime safety in respect of:

- Design and construction of vessels, including ongoing maintenance of vessel structures;
- Ensuring the seafarers running a vessel are competent;
- Operational processes and procedures that are utilised to run the vessel on an ongoing basis;
- Specific rules on how to navigate a vessel and the related lights and signals used to identify the intentions of a vessel.

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[252] Marine Reserves Act 1971, section 3.

The Project's effects on maritime safety and navigation are expected to be no more than minor, as assessed in Section 5.13.6 of this IA.

The Marine Protection Rules, issued in "Parts", impose a wide range of requirements on vessels and offshore installations relevant to the Project, including:

> In relation to offshore installations, requirements in Part 131 to give effect to provisions of the International Convention for Prevention of Pollution from Ships 1973/78 and the International Convention on Oil Pollution Preparedness, Response and Cooperation 1990;

> In relation to vessels and installations,  requirements in Part 123A for International Oil Pollution Prevention Certificates;

> In relation to vessels and installations, requirements in Parts 130A and 131 for approved shipboard oil pollution emergency plans;

> In relation to vessels and installations, requirements in Part 102 for certificates of insurance;

> In relation to vessels and installations, requirements in Parts 170 and 131 for management of garbage

The Project's effects on these matters are assessed in Section 5.14.2 of this IA.

Ballast water is also now regulated under Part 19A of the Maritime Transport Act, and Marine Protection Rules Part 300.  The management of ballast water from vessels associated with the Project is addressed in Section 5.13.4 of this IA.

It is considered that the granting of marine consents would not exempt TTR from complying in full with all applicable maritime safety and protection requirements arising under the Maritime Transport Act, many of which are addressed to an appropriate extent in the proposed conditions of marine consent.  On this basis the grant of marine consents would not be inconsistent with the nature and effect of the Maritime Transport Act.

#### 8.3.6.12 Resource Management Act 1991

The purpose of the Resource Management Act (RMA) is to promote sustainable management, which balances the need to enable people and communities to use and develop natural resources while accounting for the needs of future generations, safeguarding life-supporting functions of the natural world and avoiding, remedying or mitigating adverse effects on the environment.

The RMA applies to all constituent parts of the natural and human-made terrestrial environment and the coastal marine area. It does not directly apply to any activities in the EEZ.

Under the RMA regime, the only MMR that is not a planning instrument is the 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. They do not, however, regulate discharges of mining sediment. As the only discharge from the Project that may potentially impact on the CMA is the discharge of mining sediment, there is no potential for inconsistency with the Resource Management (Marine Pollution) Regulations.

The jurisdictional boundaries of the TRC or the STDC are shown in Figure 8.1 below.

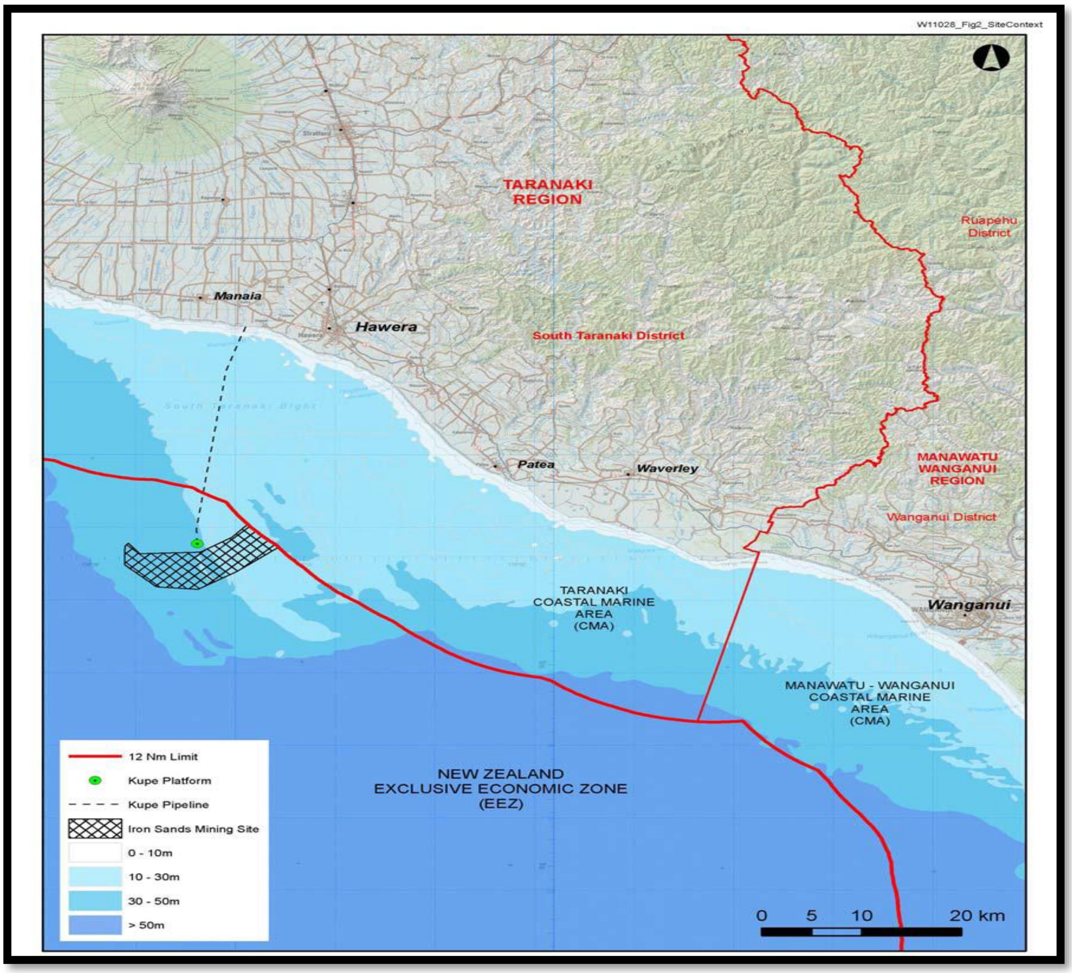


Figure 8.1: Site context and governance boundaries of the regional and district councils.

Some compliance monitoring is proposed to take place within CMA. The location of the permanent monitoring stations within the CMA will be within the jurisdictional waters of the Taranaki Region. Though the details (mooring configuration, surface buoy arrangement etc) have not been confirmed, TTR is aware that a coastal permit will be required for these activities, and one will be sought from the regional council as soon as the relevant details are confirmed.

The only other way in which the Project could potentially be inconsistent with the nature and effect of the RMA scheme is if the Project will create effects within the CMA that are inconsistent with the nature and effect of a relevant planning instrument. The nature and effect of all the RMA instruments of potential relevance is included in **Appendix 8.5** of this IA. Relying on the assessments in Appendix 8.4 it is considered that the Project, and the grant of marine consents for the project, is not inconsistent with the nature and effect of any of the relevant RMA instruments.

#### 8.3.6.13 Submarine Cables and Pipelines Protection Act 1996

The Submarine Cables and Pipelines Protection Act 1996 (SCPPA) governs the management of submarine cables (both electricity and communications) and gas and fuel pipelines. It is administered by the Ministry of Transport and provides for the protection of submarine cables and pipelines by allowing for the creation of cable protection areas. Within these protection areas it is an offence for a ship to anchor or to conduct most types of fishing.

There are 14 cable protection areas, six of which are in the STB:

- Area 8 Oaonui,
- Area 10 Maui A & B,
- Kupe Gas Project Protected Area,
- Maari Development Protected Area,
- Tui Area Development Protected Area, and
- Pohokara Protected Area

The SCPPA has no effect outside the protection areas, and the Project is outside any of the protection areas listed above. Accordingly granting consent to the Project would not be inconsistent with the nature and effect of this MMR.

#### 8.3.6.14 Wildlife Act 1953

All wildlife to which the Act applies is declared to be absolutely protected throughout New Zealand and New Zealand fisheries waters. 253 There are a limited number of marine species to which this applies, listed in schedule 7A of the Act. Notable exclusions are whales, dolphins, seals and sea lions, which are protected under the Marine Mammals Protection Act 1978.

For absolutely protected species it is an offence to catch, hunt or kill it; buy, sell or possess it; hold it in captivity; release it or export it; unless a permit is obtained from the Department of Conservation.

The only way in which the Project could conceivably trigger the above requirements is if an animal that is one of the identified absolutely protected species was present in the mining area and became entrained in the extraction process. The survey work undertaken by TTR has not identified any of the protected marine species within the Project Area, so the probability of this is considered to be extremely low.

However, if it were to occur, that would not be inconsistent with the nature and effect of the Wildlife Act, provided it is unintentional and incidental, all reasonable steps have been taken to avoid the occurrence, and the incident is reported (as those elements collectively are a defence to the prohibition).

The Act also enables wildlife sanctuaries, wildlife refuges and wildlife management reserves to be established. There are around 20 of these in New Zealand, but none within any area proximate to the Project.

For the above reasons, it is considered that the grant for marine consents would not be inconsistent with the nature and effect of the Wildlife Act.

### 8.3.7 Section 59(2)(i), EEZ Act – Best Practice in Relation to an Industry or Activity

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.

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[253] Wildlife Act 1953, section 3.

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 [254] - 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.

***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 Vessel***

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254 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

The AHV 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 AHV 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 marine 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.

### 8.3.8 Section 59(2)(j), EEZ Act – The Extent to Which Imposing Conditions Might Avoid, Remedy, or Mitigate the Adverse Effects of the Activity

The conclusions of the assessment of effects in Section 5 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 7 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.

### 8.3.9 Section 59(2)(k), EEZ Act – Relevant Regulations

There are two relevant regulations to be taken into account, 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 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, undertaking and providing 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 due to the high number of drill operations, notification cannot be guaranteed to be provided 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 4.1 above.

The EEZ Regs 2015 are addressed in Sections 4.1.2, where it is concluded that under the regulations that the mining discharges associated with the project are discretionary activities and therefore, requires marine consents under the EEZ Act.

TTR does not consider any other regulations relevant for consideration in regard to the project.

### 8.3.10 Section 59(2)(l), EEZ Act – Any Other Applicable Law

As addressed above in Section 8.2.4 tikanga-based customary rights and interests may be ‘existing interests’ under section 59(2)(a), and tikanga ‘applicable law’ under section 59(2)(l).

Section 5.13.1 sets out at length the measures taken by TTR to understand the tikanga that might be relevant to the Project, to the extent that such an assessment is possible in circumstances where those with the relevant mana moana have been persistently unwilling to engage. TTR is mindful of the Supreme Court’s findings that the EPA’s 2017 decision failed to effectively grapple with the true effect of TTR’s project for iwi parties; and considers that the extent to which those matters may be addressed by an FTA Panel, will depend heavily on what additional information such Panel receives from iwi regarding the relevant tikanga.

Pending any provision of additional information of that sort, TTR relies on the assessments outlined in Section 5.13.1, including the specific conditions proposed to address cultural values, as an appropriate response to tikanga as other applicable law.

Further, the context in which tikanga arises for this application is not the same as it was in 2017. Tikanga is a matter to be taken into account, but in the assessment of TTR’s application under the FTA greater weight is required to be given to the regional and national benefits of the Project.

### 8.3.11 Section 59(2)(m), EEZ Act – Any Other Matter Relevant and Reasonably Necessary to Determine the Application

In January 2025, MBIE released its Minerals Strategy which outlines guiding principles and outcomes for development of a robust minerals sector in NZ by prioritising extraction of critical minerals. Vanadium, the co-product of iron sands is identified as a critical mineral the MBIE Critical Minerals List for New Zealand with both domestic and international demand. The Minerals Strategy focusses on environmentally responsible extraction and export of minerals, specifically those critical for clean energy transition such as vanadium for use in VRFBs (refer Section 2.2 of this IA).

Overall, the sustainable recovery method for vanadium recommended in the Metallurgic Review report and potential high recovery rates (peaking at 79 %) will provide economic viability and environmental stewardship aligning with the principles and outcomes of the Minerals Strategy.

### 8.3.12 Sections 59(2A), EEZ Act – Effects on Human Health

For marine discharge consents, s 59(2A) applies, requiring the decision-maker to take into account the effects of the discharge on human health. For all other marine consents, s 59(2)(c) applies, requiring the decision-maker to take into account the effects on human health that may arise from effects on the environment.

As the application is for both marine consents and marine discharge consents, both types of effects on human health have been considered in Section 5.10 of this IA.

There are not considered to be any human health effects of either sort arising from the Project. For human health effects that may arise from effects on the environment, this is because as environmental effects are expected to be localised and short-term. For human health effects from the discharge itself, this is because the de-ored sediments will not contain any contaminants or other materials added into the natural material prior to discharge, and all naturally occurring trace metals are expected to occur at concentrations below levels that have any consequences for human health.

### 8.3.13 Section 61(1)(b), EEZ Act — Best Available Information

TTR considers that the information submitted in this IA and accompanying materials constitutes the best available information, being the information that, in the particular circumstances, is available without unreasonable cost, effort, or time. In fact, the cost, effort and time expended compiling the information is hard to overstate. TTR began extensive planning and investigations to support its Project prior to its first application to the EPA in 2013. It revised, updated and substantially expanded that information to support its second application to the EPA in 2016. It revised and updated the information further, to support a reconsideration of that application in 2023—24; and the sum total of all that investigative work, research and assessments has now been reviewed and updated as reflected in this IA.

The requirement to use the best available information does not mean that there can be no uncertainty, as section 61(1)(c) explicitly makes provision for decision-making even where information includes uncertainty or inadequacy.

Further, the proposal for pre-commencement monitoring does not signify that there is some shortfall that makes the information less than the 'best available'. As covered in Section 6.4 of this IA, pre-commencement monitoring must be undertaken as close to the commencement of the mining activity as possible, to capture statistically robust data for compliance monitoring purposes.

It is considered that the large volume of information already obtained amounts to the 'best available' and provides more than an ample basis on which to decide the applications.

### 8.3.14 Section 61(1)(c), EEZ Act — Uncertainty

TTR acknowledges that despite the vast quantity of information that has been gathered in support of these applications, the information on some topics is in some respects 'uncertain', in a technical or scientific sense. That is not unusual for a project of this type or scale and in this location.

For example, there is an inherent uncertainty that arises out of the necessity to rely on models to represent complex and dynamic natural systems in the STB. The size of the relevant marine space, and the complexity and variability of the natural processes influencing that space, make modelling a necessary part of the assessments. It is, for instance, impossible to measure all existing suspended sediment in the relevant area at any one time, let alone measure its behaviour over time in three dimensions under the influence of currents, tides, waves, wind and so on. Developing a robust understanding of such matters has therefore relied by necessity on a combination of measurements and modelling.

### 8.3.15 Section 62, EEZ Act — Favouring Caution and Environmental Protection

Given the inherent uncertainties in the information to support the applications, the requirement to favour caution and environmental protection under section 62 of the EEZ Act is triggered. However, for these applications, made under the FTA, this requirement is only a matter to be taken into account, and not one of the limited specified grounds on which a consents could be declined.

As addressed in Section 6 of this IA, TTR proposes a comprehensive monitoring and management framework which is incorporated into the proposed consent conditions (Attachment 1). The monitoring and management framework, and the strict limits set by conditions, exemplify an approach that favours caution and environmental protection. The framework and conditions consist of transparent, robust and enforceable measures that will impose:

> firm limits on those key aspects of the mining activity that have potential to impact on the natural environment( such as the discharge limits in condition 4, or the noise limits in conditions 11 and 12);

> monitoring and reporting obligations to ensure there is continuous and independently-verifiable evaluation of compliance across all relevant parameters; and

> a management plan approach that provides for operational responses to address any issues that arise.

### 8.3.16 Section 10(1)(a), EEZ Act — Sustainable Management

Granting the marine consents, subject to the proposed conditions, will promote the sustainable management of the natural resources of the EEZ as defined in the EEZ Act. It will enable a world-class mineral resource to be used at a controlled rate that will deliver substantial national, regional and local economic benefits, as addressed in Section 5.2 of this IA. As addressed in Sections 5.3-5.9 and 5.11 of this IA, the Project will give rise to some adverse effects on the environment, predominantly within the Project Area and in close proximity, but potential effects have been avoided through design, or are otherwise proposed to be remedied or mitigated as appropriate. Further, the Project will safeguard the life-supporting capacity of the environment and sustain the potential of natural resources to meet the reasonably foreseeable needs of future generations.

### 8.3.17 Section 10(1)(b), EEZ Act — No material harm from pollution

In accordance with the guidance of the Supreme Court, the effects of the mining discharge on the natural environment have all been assessed in section 5 of this IA, taking into account the requisite qualitative, quantitative, temporal and spatial dimensions. While avoidance of material harm from pollution does not apply to this application as an environmental bottom line, it is nevertheless considered that with robust controls and management (as proposed) the Project will in fact avoid material harm, and satisfy section 10(1)(b) of the EEZ Act.

### 8.3.18 Sections 82, FTA — Treaty settlements and related obligations

Section 82 applies if a Treaty settlement, the Marine and Coastal Area (Takutai Moana) Act 2011 (**MACA Act**) or the Ngā Rohe Moana o Ngā Hapū o Ngāti Porou Act 2019 is relevant to an approval.

The Ngā Rohe Moana o Ngā Hapū o Ngāti Porou Act 2019 is not relevant to the Project Area. Further the Project Area is located beyond any of the areas that are subject to claims under the MACA Act. TTR acknowledges some effects of the Project will be experienced beyond the Project Area, and potentially within areas that are subject to claims under MACA Act. TTR also acknowledges the Supreme Court's guidance that customary rights or interests claimed, but not yet decided, under the MACA Act may amount to existing interests depending on the circumstances. The extent to which such matters may arise here will depend on the information that the decision-maker receives, and Section 8.3.10 above addresses these matters under the broader framework of tikanga as "other applicable law".

Turning to Treaty Settlements, section 82 only applies if a Settlement is "relevant to an approval".

There are three Treaty Settlements which relate to the geographic area of land adjacent to the Project Area, as addressed below:

***Ngāti Ruanui***

TTR understands the outer boundary of this Settlement is the mean high water springs mark.

There is also a Statutory Acknowledgement of the association of Ngāti Ruanui with Te Moananui A Kupe O Ngaati Ruanui (Coastal Area). [255]

***Ngā Rauru Kiītahi***

TTR understands the outer boundary of this Settlement is the mean high water springs mark.

There is also a Statutory Acknowledgement of the association of Ngā Rauru Kiitahi with the Coastal Marine Area adjoining the Area of Interest. [256]

***Ngāruahine***

[255] Ngāti Ruanui Deed of Settlement Part 5 Summary of Redress (i)(ii)

[256] Ngā Rauru Kiitahi Deed of Settlement 6.3.3 Cultural Redress, Statutory Acknowledgement in relation to certain areas (d)(ii).

TTR understands the outer boundary of this Settlement is the mean high water springs mark.

The Settlement acknowledges the role of Ngāruahine as kaitiaki over the coastal marine area adjacent to their area of interest. [257]

The Deed of Settlement provides of a kaitiaki plan to be based on Ngāruahine values and principles in relation to natural resources within the kaitiaki area, designed to give presence and visibility to Ngāruahine's relationship with natural resources within their rohe. [258]

This Kaitiaki Plan has been developed, and sets out the long-term outcomes that Ngāruahine expects to enable kaitiakitanga, including "shared decision making with the consent authority. [259] The Kaitiaki Plan seeks that a Cultural Impact Assessment be prepared by the relevant Hapū as a requirement for an Assessment of Environmental effects undertaken for activities in the EEZ. [260]

The kaitiaki plan does not grant or create rights under the Marine and Coastal Area (Takutai Moana) Act 2011. [261]

The kaitiaki plan may be had regard to by the government department when exercising powers and functions.

TTR has considered the Treaty Settlement documents, and has not identified any suggestion that they are relevant to the Project Area, due to its significant distance from the land.

The focus in all the Treaty Settlement documents is on whenua, rohe, and, occasionally, the Coastal Marine Area. None of the history points to any relevance of the marine area to any of the iwi.

The statutory acknowledgements of kaitiaki (in the case of Ngāruahine) and statutory acknowledgement (in the case of Ngaa Rauru Kiitahi and Ngaa Rauru) indicate, by their very presence, that the Coastal Marine Area is not considered part of the area of the Treaty Settlement extents.

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[257] Ngāruahine Deed of Settlement clause 5.21 Kaitiaki area.

[258] Ngāruahine Deed of Settlement clause 5.23, reference to settlement legislation, see Ngāruahine Claims Settlement Act 2016 subpart 5 – Kaitiaki Plan

[259] Ngāruahine Kaitiaki Plan 2021 page 23, available here: https://issuu.com/ngaruahine/docs/te_uru_taiao_o_ngaruahine?fr=xKAE9_zU1NQ

[260] Ibid, page 44.

[261] Ngāruahine Deed of Settlement clause 5.25.

On this basis it is considered that section 82 does not apply. The related role of section 7 of the FTA is addressed below in Section 8.3.20.

### 8.3.19 Sections 83 and 84, FTA and 63-67, EEZ Act — Conditions

TTR has prepared a set of proposed consent conditions (refer to Attachment 1 of this IA), designed to comprehensively manage the Project alongside the related monitoring and management framework, as address in Section 6 of this IA.

TTR considers that the implementation of the proposed consent conditions will ensure that any project related effects will be appropriately managed, consistent with the requirement of section 10(2)(c) of the EEZ Act of *"avoiding, remedying, or mitigating any adverse effects of activities on the environment."* and in turn assisting in meeting the overall "*sustainable management"* and 'avoidance of material harm' purposes of the EEZ Act (as addressed above in Sections 8.3.16 and 8.3.17)

When drafting the proposed consent conditions, TTR has had regard to subsections 63-67 of the EEZ Act and subsections 83-84 of the FTA, as addressed in Section 8.2 of this IA.

In its decision regarding TTR's 2016 application, the Supreme Court was critical of conditions imposed by the EPA requiring that there be no adverse effects "at a population level" on marine mammals or on seabirds. The Court held this amounted to a failure to favour caution and environmental protection, given the EPA had found the information regarding marine mammals and seabirds to be so uncertain. [262]

The Supreme Court's findings on this particular issue are of limited relevance, as TTR is no longer seeking conditions requiring no adverse effects "at a population level". Following the Supreme Court's decision TTR obtained additional guidance from seabird and marine mammal experts about the use of "population level" conditions.[43] [150] Those experts support the removal of references to "population levels" from the relevant conditions, and for the present application that is what is proposed. [263] This also accords with the requirement in s 83 of the FTA that conditons should be no more onerous than is necessary.

The Supreme Court was also critical that the conditions imposed on TTR's previous application placed reliance on pre-commencement monitoring, which the Supreme Court

[262] At [129]-[130] per William Young and Ellen France JJ, [274] per Glazebrook J, [294] per Williams J and [328] per Winkelmann CJ.

[263] See attached conditions in Appendix 1.

said was an improper attempt to fill an information deficit, and would deprive the public of the right to be heard, by postponing relevant work until after the grant of consent. [264]

As addressed in Section 8.3.13 above, TTR is not reliant on pre-commencement monitoring to fill an information deficit. There is ample information on which to base a consent decision, without further monitoring. The purpose of the pre-commencement monitoring is to supplement that existing information with additional data obtained in the period immediately before mining commences, to ensure the most up-to-date information is captured prior to mining, to guide compliance and operational measures. [265]

In relation to TTR's 2016 application, the Supreme Court was also critical of the EPA's failure to require a bond, or otherwise explain why a bond was not required. [266] A bond is not considered to be necessary in relation to the performance of any conditions during the operational period of extraction, as during that period the EPA has the ability to take compliance action in respect of any performance failure, including the ability to require extraction to cease. That is a far more effective form of protection than any bond.

Further, if any unforeseen risks were to arise during the operational period of extraction, then these would consistute unplanned events, which would be covered by TTR's proposed insurance.

As for the period following the cessation of mining, the only remaining activities would be de-commissioning and post-extraction monitoring. The de-commissioning for this activity is neither complext nor costly, as the activity relies on structures and vessels which are affixed (if at all) by anchoring. The benthic environment is expected to recover naturally within 5 years, and the proposed conditions require this to be actively monitored and reported to the EPA, including a requirement to identify any potential measures to assist recovery if necessary. [267] Further, the conditions require benthic-recovery monitoring during the extraction activity (to take place in the initial area of extraction once mining in that area has been completed), to supplement the current assessments of recovery time. [268] On this basis, the only post-extraction risk that requires to be managed is the risk that natural recovery

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[264] At [275]-[278] per Glazebrook J, [295] per Williams J and [329] per Winkelmann CJ.

[265] See also 2024 rebuttal evidence from David Thomson, Simon Childerhouse, Alison McDiarmid (supplementary technical package)

[266] At [214]-[221] per William Young and Ellen France JJ, [285]-[286] per Glazebrook J, [299] per Williams J and [332] per Winkelmann CJ.

[267] Condition 8 of Attachment 1.

[268] Condition 57 of Attachment 1.

processes require enhancement. This would constitute an unplanned event during the exercise of consent, and would therefore be covered by TTR's proposed insurance.

For these reasons, and in keeping with s 83 of the FTA, it is considered that a condition requiring a bond is unnecessary.

As provided for under section 73 of the EEZ Act, TTR is requesting the marine consents be granted for the maximum allowable duration, being 35 years.

Section 73 requires the decision-maker, when determining duration, to:

> Comply with sections 59 and 61; and

> Take into account the duration sought by the applicant; and

> Take into account the duration of any other legislative authorisations granted or required for the activity.

Sections 59 and 61 are addressed in 8.3.1-8.3.12 and 8.3.13-8.3.14. 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.

Other authorisations that should be taken into account when determining duration are:

> 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 expired on 18 December 2017.

Having regard to all these requirements, the additional requirement in section 83 of the FTA that conditions should be no more onerous than is necessary, and the facilitative purpose of the FTA, TTR considers that the 35 year duration of the marine consent and marine discharge consents is appropriate.

### 8.3.20 Sections 62(2), EEZ Act and 85, FTA — Power to decline

The grounds on which TTR's application could potentially be declined are extremely limited. The only grounds of potential relevance are:

> If granting approval would breach s 7 of the FTA in relation to Treaty settlements and customary rights;

> If the decision-maker determines that it has inadequate information under s 62(2) of the EEZ Act; or

> If the Project's adverse impacts are sufficiently significant to be out of proportion to its regional or national benefits

***Section 7, FTA – Treaty Settlements and Customary Rights***

The relevant parts of section 7 require all persons performing and exercising functions, powers and duties under the FTA to act in a manner consistent with the

> obligations arising under existing treaty settlements, and

> customary rights recognised under the MACA Act

For the reasons outlined in Section 8.3.18 above, it is not considered that there are any relevant obligations arising under existing Treaty settlements, nor any customary rights yet recognised under the MACA Act (noting that effects on customary rights claimed but not yet recognised under the MACA Act may nevertheless be a relevant consideration under section 59(2)(a) of the EEZ Act). Further, it appears from section 7(2) that the obligations in section 7 may in any event not apply to an FTA Panel, on the basis that the members of such a Panel are exercising a quasi-judicial function in determining a marine consent application.

***Section 62(2), EEZ Act – inadequate information***

The meaning of section 62(2) of the EEZ Act is addressed in Section 8.2.6 above.

TTR considers the scale and quality of the information supporting the application is far more than adequate to enable a decision-maker to consider and weigh all relevant matters. Since TTR's first application in 2013, an objectively large volume of material has been amassed to ensure every relevant dimension of the Project can be assessed. The TTR Project has been subject to exhaustive studies of relevant environmental factors by independent and international experts. It is also noted that in 2017 environmental experts retained by the EPA supported the grant of consent as did the Department of Conservation.

***Section 85(3), FTA - Proportionality***

Section 85(3) requires the decision-maker to consider proportionality if a project will give rise to one or more adverse impacts. TTR's Project will give rise to one or more adverse impacts, as has been addressed in Section 5 of this IA.

The decision-maker is required to take into account the conditions that may be set in relation to the adverse impacts, and as addressed in Section 6 of this IA, TTR is proposing a comprehensive suite of conditions and a supporting framework of monitoring and management plans.

The proportionality assessment invoked by section 85(3) differs from the weighting that is required under clause 6 of Schedule 10. The latter requires decision-makers to apply a weighting when considering the range of relevant topics, i.e. to give the greatest weight to the Project's facilitation of regional and national benefits. This ensures that regardless of the relativities between benefits and any adverse impacts, the benefits will predominate in the assessment. The proportionality assessment in section 85(3) does not call for a similar predominance to be applied to the benefits: the test under this section does not require that the regional and national benefits be given greater weight. Rather it requires an 'unweighted' assessment, in which the adverse impacts are considered, the regional and national benefits are considered, and an assessment is made whether the significance of the impacts is out of proportion to those benefits.

Proportionality is an exacting but imprecise measure. For two things to be 'in proportion' does not require them to be equivalent — the test is more contextual than that.

However, in the particular circumstances of this application, it is considered that applying the proportionality test will not be difficult. The adverse impacts of the project are mostly localised to the Project Area and not permanent. The impacts that may be experienced further from the Project Area have been thoroughly assessed, and on the basis of those assessments (as addressed in Section 5 of this IA) and the comprehensive suite of conditions to manage those impacts (as addressed in section 6 of this IA), effects beyond the Project Area are not considered to give rise to any material harm to the environment. Conversely, the Project is expected to generate substantial economic benefits whether that is viewed at a regional or national scale. Those benefits (as addressed in Section 5.1 of this IA) are so large that it is in fact the benefits that are out of proportion (i.e. far exceed) the adverse impacts of the Project.

#### 8.3.21 Section 3, FTA — Facilitating the delivery of significant regional or national benefits

The significant regional and national benefits of the project have been assessed by NZIER, as outlined in Section 5.2 of this IA. Granting the marine consents will enable TTR to realise those significant regional and national benefits, and will be consistent with the purpose of the FTA. Conversely, a decision to decline the marine consents would preclude any benefits from being delivered, contrary to the FTA's purpose.

### 8.4 CONCLUSION

This section of the IA has identified and applied all relevant parts of the statutory framework applicable to the marine consents TTR is seeking.

In particular, all potential adverse effects on the natural environment and existing interests have been assessed, as required by s 59(2)(a) and (b) of the EEZ Act.

The outcomes of those assessments (and every other assessment required under s 59(2)) have in turn been considered against the information principles of the EEZ Act. The necessity of reliance on modelling for certain aspects means the assessments include some uncertainty, but this is to be expected for a project of this scale and location, and does not reduce the reliability of the information. The effects of uncertainty have guided TTR's approach to monitoring and management, and the associated suite of comprehensive conditions. This appropriately favours caution and environmental protection (as a matter to be taken into account in the overall assessment).

The statutory framework requires consents to be granted unless one of the very limited grounds for declining consent is triggered. None of those grounds is triggered here:

> There is ample information on which to decide the applications,

> Granting consent will not be inconsistent with any Treaty settlement obligations or relevant customary rights, and

> The national and regional benefits of the Project far outweigh the adverse impacts that the Project may have.

Those adverse impacts have in any event been assessed as being predominantly localised to the Project Area, where careful Project design and management will ensure they are minimised and short-lived; and any effects beyond the Project Area will range from minor to negligible.

In reliance on these assessments, it is considered that granting consent to the Project will be consistent with both purposes of the EEZ Act (sustainable management and the avoidance of material harm from pollution), and will uphold the purpose of the FTA by facilitating the delivery of a project with considerable regional and national benefits.

# 9. CONCLUDING STATEMENT

TTR has lodged an application with the EPA to undertake iron sand recovery activities within approximately a 66km$^2$ area of the STB for a period of 35 years. This application follows a similar marine consent application lodged in 2016 by TTR with the EPA.

The actual and potential effects associated with the project have been considered in accordance with requirements of the EEZ Act and the FTA. 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 pre-commencement 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 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.

The decision-making framework that applies under clause 6 of Schedule 10 (Approvals relating to EEZ Act), decision makers must take into account, and must give the greatest weight to, the purpose of the FTA, followed by the purpose of the EEZ Act and then the relevant decision making criteria specified under the EEZ Act.

With regard to the statutory framework which the application falls within, it is considered that the project strongly aligns with the purpose of the FTA and is not inconsistent with the relevant aspects of the EEZ Act and the other relevant legislations.

Overall, this IA and supporting documentation canvasses the scope of the considerations that the FTA requires to be undertaken. The application material demonstrates that the project:

- Will not cause any significant adverse effects, and will manage other effects to an appropriate level as provided for through the proposed consent conditions;
- Is not inconsistent with the relevant aspects of the EEZ Act; and
- Is significant at the regional and national levels that foregoing the project would result in a potential significant adverse local, regional and national level primarily in direct and indirect economic benefits.

On this basis, approval of the project is consistent with, and would give effect to, the purpose of the FTA. Therefore, 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.