TARANAKI VTM PROJECT
PRE-FEASIBILITY STUDY
OFFSHORE IRON SANDS PROJECT

Issued: 25 March 2025

Disclaimer

This updated Pre-Feasibility Study (PFS) has been prepared by Siecap NZ in collaboration with Trans-Tasman Resources Ltd and Manuka Resources Ltd to provide the technical and economic feasibility of the Taranaki VTM Offshore Project. The information presented is based on data, assumptions, and methodologies considered reasonable at the time of preparation.

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Glossary of Terms

AHT	Anchor-Handling Tug
AHV	Anchor Handling Vessel
ASX	Australian Securities Exchange
BFS	Bankable Feasibility Study
BML	Below Mud Line
Capex	Capital Expenditure
CD	Constant Density
CMA	Crown`s Minerals Act 1991
CMS	Cleaner Magnetic Separation
DEME	Dredging, Environmental and Marine Engineering Limited
DTM	Decision to Mine
DTR/DTC	Davis Tube Recovery
DTW	Davis Tube Wash
EEZ Act	Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
EPA	Environmental Protection Agency
EMV	Environmental Monitoring Vessel
FTA Act	Fast Track Approvals Act 2024
FMP	Flow Moisture Point
FOOS	First Ore on Ship
IMV	Integrated Mining Vessel, Processing, Storage and Offloading Vessel
FSO	Floating Storage and Offloading Vessel
GSV	Geological Drill and Survey Vessel
HAZOP	Hazard and Operability Study
IFO	Heavy Fuel Oil
HPF	Hyperbaric Pressure Filter
IMS	Intermediate Magnetic Separation
IMS	Intermediate Magnetic Separators
IMV	Integrated Mining Vessel
IFO	Intermediate Fuel Oil
ITP	Inspection and Test Plan
JORC	Joint Ore Reserves Committee Code 2012
LARS	Launch and Recovery System (for SBC)
LIMS	Low Intensity Magnetic Separator
MIMS	Medium Intensity Magnetic Separator
MCC	Motor Control Centre
Nm	Nautical Mile
NPV	Net Present Value
NZDS	New Zealand Diving and Salvage Limited
OGV	Ocean Going Vessel
Opex	Operating Expenditure
PFD	Process Flow Diagram

PFS	Pre-Feasibility Study
PID	Piping and Instrumentation Diagram
PSD	Particle Size Distribution
QEMSCAN	Quantitative Evaluation of Minerals by Scanning Electron Microscopy
RAS	Replenishment at Sea
RFQ	Request for Quotation
RMA	Resource Management Act 1991
RMS	Rougher Magnetic Separation
RO	Reverse Osmosis
ROM	Run Of Mine
RORO	Roll on Roll Off
SAL	Single Anchor Leg
SBC	Seabed Crawler
SOLAS	Safety of Life at Sea
SONAR	Sound Navigation and Ranging
SOP	Standard Operating Procedures
TSHD	Trailer Suction Hopper Dredge
TTR	Trans-Tasman Resources Limited
VTM	Vanadiferous Titanomagnetite
VTS	Vertical Transport System (ROM Hoses to SMTSBC)
WBS	Work Breakdown Structure
STB	South Taranaki Bight
STS	Slurry Transport System
SSC	Suspended Sand Concentration

1 EXECUTIVE SUMMARY

Trans-Tasman Resources Limited's (TTR) Taranaki VTM Project plans to extract vanadiferous titanomagnetite (VTM) iron sands resource from the seabed off the South Taranaki Bight (STB). The Project will produce iron ore concentrate for export containing critical minerals, vanadium and titanium.

The Taranaki VTM Project has potential to contribute to the New Government's stated aim to double the mining sector's export value to more than $3 billion over the next 10 years to 2035.

The 3.2 billion tonne (Bt) Taranaki VTM iron sands project is located in New Zealand's Exclusive Economic Zone (EEZ), between 22km and 36km off the coast of the STB, in waters ranging between 20 to 50 metres deep, in a region with existing oil and gas infrastructure.

TTR proposes to utilise an integrated mining processing vessel (IMV) and seabed crawler system of proven design to extract approximately 50 million tonnes (Mt) of seabed iron sands a year. The recovered iron sand will be processed by magnetitic separation to produce around 10% (4.9Mt) high grade VTM concentrate for export a year. The residual 45Mt of de-ored iron sand tailings will be continuously returned to the seabed in a controlled manner being redeposited into the area previously mined. The proposed mining method is a low-impact, mechanical, chemical-free process, extracting on average only the top 5 metres of seabed sediment within a tightly controlled 0.3km² dredging zone. The return of iron sand tailings to the seabed creates a minimal sediment plume of 0.5 to 1.5mg/L suspended sediment concentration (SSC) in the ocean and, by comparison, well below safe drinking water limits of 5mg/L SSC.

With regard to environmental safeguards, protection and impact independent experts conclude the TTR's project area in the STB is now regarded as one of the best studied shallow shelf marine environments in Aotearoa New Zealand with a wealth of studies generated by TTR that add to a body of existing scientific knowledge. The information is the best available and mining, subject to the proposed conditions, will avoid material harm, favours caution and environmental protection and the effects of the proposed mining operations and resulting sedimentation (plume) will have no adverse ecological effects on biota in the STB, including on marine mammals.

The mineral recovery process will have no material adverse impact on marine mammals, whales, dolphins, fish, reefs, coastal areas beaches or food gathering (kaimoana seafood). The seabed is continuously rehabilitated, with full recolonisation occurring in under two years. The environmental effects are managed by a comprehensive set of Environmental Protection Authority (EPA) approved 109 operating conditions and detailed management plans, ensures sustainable resource use, high environmental accountability and safeguards and protection from any permanent adverse effects.

With regards to carbon intensity, the proposed TTR extraction and recovery of iron ore concentrate from STB's iron sand deposits places TTR in the bottom quartile of CO^2 emitters for iron ore producers globally, with an estimated 62kg CO^2/t of VTM compared to an international average of 125 to 250kg CO^2/t iron ore concentrate.

TTR, now a subsidiary of Australian Securities Exchange listed Manuka Resources Limited (ASX:MKR), has reported 3.2 billion tonne (Bt) JORC Indicated and Inferred Mineral Resources of VTM grading 10.17% Fe_2O_3, 1.03% TiO_2 and 0.05% V_2O_5 in the Cook, Kupe and Tasman deposits offshore from Pātea in the STB. 1,881Mt of the reported VTM iron sand deposit is within TTR's granted Mineral Mining Permit MMP55581, outside the 12Nm limit, within New Zealand's

Exclusive Economic Zone (EEZ), Pilot plant processing and Davis Tube Recovery (DTR) of the magnetic fraction shows the resource produces concentrate grades of around 56% to 57% Fe, 8.4% TiO_2 and 0.50% V_2O_5.

The 3.2Bt VTM Indicated and Inferred mineral resource contains 1.6Mt vanadium pentoxide ranking the deposit as one of the larger drilled vanadium deposits globally.

The Pre-feasibility Study (PFS) is based on extracting and processing approximately 1Bt of VTM iron sands over 20 years from the reported resource within MMP55581 in the EEZ. The Company has defined and reported additional VTM mineral resources of 2.2Bt within MMP55581 and MEP54068 in the STB. At the proposed extraction rates these additional VTM resources, subject to future permitting and environmental approvals, could add a further 40 years of VTM processing and concentrate exports to the life of the project.

TTR plans to extract 50Mt of titanomagnetite ore and produce circa 4.9Mt of VTM iron ore concentrate per annum, which will be processed aboard an Integrated Mining Vessel (IMV). The iron ore concentrate from the IMV will then be transferred to floating storage and offloading (FSO) vessels for transhipment in a slurry form, where it will be dewatered and stored, ready for transfer to bulk carrier vessels for shipping to overseas markets. This is a common transshipment model used by several bulk commodity projects globally.

These vessels will be supported by a mid-sized Anchor Handling Tug (AHT) that will assist with the provisioning of the vessels, transfer of equipment, connecting the IMV to the FSO during transhipment, the berthing of the FSO to the conventional bulk cargo vessels, and IMV anchor and mooring relocation. The AHT will also provide refueling assistance. An environmental monitoring and research vessel (EMV) and a geotechnical drilling and grade control survey vessel (GSV) will undertake monitoring, testing and survey support activities for the Project.

TTR envisages contracting a third-party company for bunker fuel supply, which will have a facility in New Plymouth employing approximately six people.

TTR will directly employ over 300 employees in Taranaki comprising 180 crew to operate both the IMV and FSO vessels and a further 50 plus staff in supporting engineering, environmental monitoring and fuel bunkering roles. There will also be 35 general administration staff for the day-to-day operation of the Project. TTR plans to establish its New Zealand head office in New Plymouth, which will add 35 marketing and corporate management roles.

Indirectly the Project will generate 1,125 new skilled jobs in mining, services, logistics and support in the Taranaki region.

The technical and financial evaluation of the project as defined above and detailed in this PFS concludes that the project is economically viable and robust, and that further project development is justified.

The current set of VTM concentrate production and financial assumptions, delivers a project post-tax Net Present Value (NPV) of US$1.26 billion (NZ$2.2B) at a 10% discount rate, based on a discounted cash flow model. TTR is currently working with its technology providers to improve these assumptions and take new higher productivity assumptions as the basis of design for the Bankable Feasibility Study (BFS).

The project is potentially highly profitable with a modelled discounted capital payback (based on NPV) in approximately seven years with an initial project life of 20 years based on the reported mineral resource within MMP55581.

The discounted cash flow financial analysis of the project yields the following:

- Annual VTM concentrate production of 4.9Mt
- Project capital cost of US$602.2 million (NZ$1B);
- Operating costs are estimated at approximately US$27.20 tonne (NZ$47/t) (rounded, excluding freight costs);
- At current commodity prices generate annual contrate exports of earnings of US$495 million (NZ$854M);
- Total revenue estimated at US$9.9 billion (NZ$17B) (rounded) over the 20-year life of the project;
- Total direct operating costs (including overheads but excluding marketing costs, royalties and freight costs) are estimated at US$2.67 billion (NZ$4.61B) (rounded) over the 20-year. life of the project;
- EBITDA estimated at US$6.23 billion (NZ$10.78B) rounded) over the 20-year life of the project; and
- Net Profit after Tax estimated at US$3.70 billion (NZ$6.40B) (rounded) over the 20-year life of the project.

The financial outcomes detailed above reflect the results of the implementation of a single IMV production and processing vessel together and the sale of titanomagnetite concentrate and the separable recovered vanadium pentoxide.

The project solution detailed within this PFS has the potential, in the future, to be scaled by adding additional integrated vessels and revenue credits for the contained titanium dioxide in the concentrates.

The PFS results are based on existing resource estimates, broker consensus, mid-point iron ore pricing (Section 15) and market conditions and consequently, market fluctuations, varied logistics or production costs or recovery rates may render the results of past and future project studies uneconomic and may ultimately result in a future study being very different.

2 INTRODUCTION

This release of the 2025 Pre-Feasibility Study (PFS) builds on the foundation laid in Revision 2, released in July 2014, with significant advancements across multiple project areas. The latest updates reflect years of dedicated work, discoveries, and refined strategies to enhance both project viability and sustainability. Key updates include the following:

- Cutting-edge process and engineering advancements developed and defined between 2014 and 2017, shaping a stronger foundation for innovation and efficiency.
- **Vanadium Recovery Circuit Integration**:

  Incorporating a separable vanadium pentoxide (V_2O_5) recovery circuit, informed by comprehensive testwork conducted by TTR between 2018 and 2023. This addition metal recovery enhances resource efficiency and economic potential.
- **Environmental Management Alignment:**

  Incorporating the environmental conditions and detailed management plans developed in collaboration with stakeholders and the Environmental Protection Authority (EPA). These conditions and management plans were formalised during the approval of marine and discharge consents in August 2017, ensuring regulatory compliance and environmental stewardship.
- **Mineral Resource Definition**

  Incorporating the latest JORC Mineral Resource Statement block model and mineral estimation for iron, vanadium and titanium metals completed and reported on 1 March 2023.
- **Mine Plan**

  The mine plan has been refined to incorporate changes in mining scheduling, extraction methodologies, and sequencing of mineral resources within MMP55581 located in the EEZ.
- **Market Study Update:**

  Revisiting and updating the marketing study to reflect current market dynamics, demand trends, and strategic opportunities for iron ore concentrates and including metal credits for vanadium and potentially, in the future, titanium.
- **Revised Capex and Opex Estimates:**

  Updating capital and operating expenditure estimates to incorporate the latest cost structures, industry benchmarks, and project specifications.
- **Financial Model Refresh:**

  Enhancing the Discounted Cash Flow (DCF) financial model with updated inputs to provide a clearer, more accurate picture of the project's economic performance and outlook.

This revised PFS delivers a more robust and forward-looking analysis, positioning the project for informed decision-making and future success. The PFS presents a viable approach for extracting and processing iron ore deposits within TTRs tenements located off the west coast of New Zealand's North Island. It reflects advancements in resource estimation, project planning, environmental management, monitoring and operating conditions, financial modeling, and market analysis.

The exploration summary includes an updated review of drilling data, while the mineral resource definition has been revised to incorporate the latest mineral resource block model and JORC Mineral Resource Statement of March 2023. Metallurgical testwork has also been updated with the most recent reviews, providing an improved understanding of vanadium and titanium metal recoveries and value-added ore processing characteristics. The mine plan has been refined to incorporate changes in mining scheduling, extraction methodologies, and sequencing. Updates to the process plant include the integration of the DRA report findings.

Environmental considerations have been revised to reflect the latest regulatory conditions, legislative changes, and permitting timeframes. The environmental studies, permitting, and social impact assessment section now includes the latest full set of EPA approved marine and discharge consent conditions and detailed set of management and operating plans, along with an updated timeline for the approvals and consenting processes.

The capital costs for the project have been updated to reflect the impact of various external and market-driven factors. Adjustments were made based on the origin of key project elements, taking into account differences in labor costs, material availability, and regional economic conditions. Market fluctuations, including changes in commodity prices and currency exchange rates, were incorporated to provide a more accurate cost baseline. Inflation adjustments were applied in line with the latest industry indices to capture the rising (or in some cases, falling) costs of materials and services, particularly in sectors such as ship construction, mining process equipment and industrial equipment procurement. Supply chain challenges, including delays and increased freight costs, have been factored into the revised estimates, given their significant influence on lead times and overall project expenditure. As a result, the project schedule and financial analysis have been recalibrated to align with these cost revisions, ensuring that contingency allowances and risk assessments are updated to reflect current market conditions and potential future scenarios.

Market studies have been revised, with updates to iron ore concentrate pricing forecasts, marketing strategy, and long-term demand expectations, including the role of new market opportunities and credits for the vanadium metal recoveries. The iron ore price assessment has been updated, with revised projections reflected in key figures and market analysis tables.

The financial evaluation section includes updates to vanadium and titanium market assessments, revised operating cost estimates, and an updated DCF model, ensuring alignment with current economic assumptions. The risk assessment has also been reviewed, with revised risk considerations and an updated basic schedule.

Finally, outdated reports have been removed from the appendices, and revised CVs have been incorporated. Updates to the TTR PFS reflects the most up-to-date information available. This revision provides a comprehensive foundation for progressing the project Bankable Feasibility Study (BFS) towards Decision to Mine (DCM), financing and development, ensuring alignment with industry best practices, financial expectations, and regulatory frameworks.

2.1 Purpose of the Report

In August 2022, Manuka Resources Limited (Manuka), an Australian Securities Exchange (ASX) listed company, entered into a binding terms sheet to acquire New Zealand registered TTR. The acquisition by Manuka aimed to diversify Manuka's portfolio by adding TTR's VTM iron sands project in New Zealand to its assets. Following the acquisition, TTR became a wholly-owned subsidiary of Manuka, with TTR's directors, joining Manuka's board. The acquisition was completed in November 2022, marking a significant expansion for Manuka into the New Zealand mining sector.

This updated PFS reflects the latest commercial, technical, permitting, environmental and natural resource project approval changes since the earlier release. This revised version incorporates new data and insights, ensuring a more accurate and comprehensive evaluation of the project's feasibility. The updates highlight adjustments in project scope, cost estimates, technical methodologies, and environmental considerations, permitting and project consenting regime, providing stakeholders with a clearer understanding of the project's current status and future economic performance and outlook.

TTR conducted an in-depth assessment of extraction technologies. This structured evaluation led to the selection of the IHC crawler technology, successfully employed by De Beers Marine SA off the coast of Namibia, as the preferred extraction method. The mine plan has since been refined to incorporate updates in mining scheduling, extraction methodologies, and sequencing of the reported mineral resources within MMP55581 in the EEZ.

The PFS integrates the latest mineral resource block model and 2023 mineral resource estimation, along with updated metallurgical testwork to enhance the understanding of ore processing characteristics. Environmental considerations have been revised to align with the 2017 EPA approved marine and discharge consents, current regulatory conditions, legislative changes, and permitting timeframes.

Financial updates account for market fluctuations, inflation, and supply chain challenges affecting key components such as ship construction, mining equipment, and procurement. The project schedule and financial analysis have been adjusted accordingly, with an updated DCF model and the revised risk assessment.

This PFS has been prepared in accordance with the Australasian Code for Reporting of Exploration Results, Mineral Resources, and Ore Reserves (JORC Code, 2012 Edition) and complies with ASX Listing Rules and the regulatory guidelines of the Australian Securities and Investments Commission (ASIC).

2.2 Sources of Information

Where relevant, the information and sources for the 2014 PFS have been retained. Appendix 19.1 of the document outlines the areas where information has been updated to reflect the updated developments from the previous 2014 PFS version. The sources for the information that are contained within this report have been provided by equipment designers and manufacturers, as well as internationally recognised independent consulting and local engineering companies engaged by TTR.

A full listing of the principal sources of information used in both this version and previous versions of the PFS report is available and a summary of the sources is provided below:

- Amdel-Bureau Veritas Australia – Metallurgical laboratory testwork;
- NIWA – Environmental Impact Assessment;
- Mitchell Daysh – Environmental Planning Approvals, Operating Conditions and Management Plans;
- Beca – Engineering Design and Verification Services;
- Canadian Shipping Lines (CSL) – Trans-Shipping Proposal;
- Fugro – Aeromagnetic Survey;
- Golders Associates – Previous Mineral Resource Statements, Geology and QA/QC JORC Seabed Drilling Technology and Sample Compliance;
- Siecap NZ Ltd – Mineral Resource Estimation, Metallurgical Testwork and Technical Overview;
- IHC Merwede – Mining Technology Design Support;
- MTI – Dredging and Tailings Management;
- Sea Transport – Naval Architects - Engineering Design and Verification Services;
- Seabulk – Transhipment, Warehousing and Dewatering;
- Tennant Metals Pty. Ltd. – Marketing Report;
- Transfield Worley – Risk Management and Cost Controlling;
- Upstream Technologies SA (previously De Beers Marine SA and Ignite);
  - Operational Advice and Support
  - Design Review and Recommendations:
  - In-depth Analysis and Feedback
    - The IMV Crawler System;
    - Launch and Recovery System (LARS);
    - Mooring and Dynamic Positioning Systems; and
    - BFS Work Program, Scheduling and Execution.
- DRA – Process Plant Design;
- Vuyk Rotterdam – Naval Architects; and
- AMS – American Bureau of Shipping Marine Classification.

TTR has made all reasonable efforts to verify and establish the completeness, accuracy and authenticity of the information provided and where appropriate identify potential risks or uncertainties that would affect either technical or economic models. Refer to Section 19 of this PFS.

2.3 Qualification and Experience

For this study, which crosses several technological areas including mineral exploration and resource reporting, subsea engineering, vessel mooring systems and mineral ore beneficiation, subject matter experts and experienced qualified professionals from various consultants have been integrated to form the study team.

2.4 Key Findings

The following key findings have been identified; these findings are subject to the stated risks and assumptions detailed in Section 16 and 3.14 respectively:

- The proposed integrated mining methodology and technical aspects of the project are technically sound and appropriate for the project;
- The Project capital (Capex) and operational (Opex) cost estimates (within +/-30% accuracy) are based on appropriate and reasonable assumptions;
- It is reasonable to expect that the proposed mining method is suitable for the geological characteristics of the VTM mineral resource (as reported by TTR 1 March 2023);
- It is reasonable to expect that the stated metallurgical yields can be achieved using the proposed mining method and process (Siecap Report: Recovery of Vanadium from Taranaki VTM Project February 2025);
- It is reasonable to expect that if implemented, the proposed mining method has the capability of mining 39Mtpa of sediment (dry basis) (50Mtpa wet basis);
- It is reasonable to assume that if expected yields are achieved, the proposed processing facility is expected to produce 4.9Mtpa of iron ore VTM concentrate, taking into account mining losses and dilutions;
- The basic schedule covering further studies and development of the project as outlined is reasonable;
- Results of the metallurgical testwork undertaken by Amdel Bureau Veritas appear to be reasonable and have been prepared using appropriate techniques and in accordance with applicable industry standards; and
- For the base case of approximately 4.9Mtpa production of VTM concentrate grading 56% to 57% Fe, 8.4% TiO_2 and 0.50% V_2O_5 the estimated NPV is US$1.263 billion for a Capex of US$602 million. The projected average Opex FOB cash cost over the first 20 years is estimated at approximately US$27.20t tonne of concentrate.

3 PROJECT SUMMARY

3.1 Project Description

Incorporated in September 2007 New Zealand registered company Trans-Tasman Resources (TTR) was established to explore, assess and uncover the potential of the offshore titanomagnetite iron ore deposits along the west coast of the North Island of New Zealand. TTR's ambition is to provide a reliable supply of low-cost iron ore concentrate, containing valuable vanadium and titanium metal credits, and build mutually beneficial strategic long-term partnerships with mineral processing facilities and steel manufacturers. TTR is committed to conducting all its activities in a safe and environmentally sustainable manner and to proactively engage with existing interests, local and regional authorities, iwi groups and local communities on all relevant economic, environmental, cultural and social issues.

The aim of this PFS is to present the proposed operational process, along with an economic evaluation of the selected ore recovery and mineral processing techniques and methods, to achieve the following objectives.

- **Run-of-Mine Extraction:** The offshore iron ore will be extracted from the identified and reported mineral resources using efficient and environmentally responsible mining techniques.
- **Concentrate Washing and Logistics**: The VTM concentrate will be processed and beneficiated on a dedicated Integrated Mining Vessel (IMV), washed in fresh water to a Floating and Storage Offloading Vessel (FSO), dewatered and transferred to bulk Capesize vessels at sea for export to a third-party processing plant for further treatment and final metal recoveries.
- **Ore Beneficiation:** The extracted VTM ore grading 10.17% Fe_2O_3, 1.03% TiO_2 and 0.05% V_2O_5 will undergo a mineral beneficiation process to increase the iron content, producing a VTM concentrate with an iron grade of 56-57% Fe with vanadium grade of 0.5% V_2O_5 and titanium of 8.4% TiO_2.
- **Vanadium Extraction:** At the processing plant, advanced metallurgical methods will be applied to extract the recoverable vanadium from the VTM concentrate.
- **Iron Ore for Steelmaking:** The remaining iron ore, after vanadium extraction, will be delivered to a steelmaking facility where it will serve as feedstock for blast furnace operations.
- **Market Shipment:** A VTM concentrate suitable for international markets will be prepared and shipped to global customers.
- **Capital Cost Estimate**: A capital expenditure (Capex) estimate with an accuracy level of ±30%.

This study provides a comprehensive overview of the entire value chain including engineering and environmental management solutions, mineral extraction and beneficiation to product shipment and export, value-added processing and economic feasibility.

3.2 Option Overview

In the previous revision of the PFS (Revision 2, 2014), several mining system options were thoroughly reviewed and evaluated. Initially, a simple dredging option was commissioned during the early stages of the study. However, a subsequent workshop held with IHC in the Netherlands explored a broader range of options to identify the most suitable and sustainable solution for TTR's operations. The options assessed included integrated crawler systems, trailer suction hopper dredges (TSHD), drill ship recovery (Drill), roll-on/roll-off (Ro-Ro) systems, and point suction dredges (PSD). These systems were evaluated based on key performance indicators such as resource optimization and mining efficiency, operational ocean depth (20m to 50m), capacity, flexibility, logistical complexity and tailings dispersal management and marine environmental impact.

The structured decision analysis revealed that the Drill, Ro-Ro, and PSD systems were not viable options due to limitations in efficiency, flexibility, and environmental performance. The results identified two promising candidates: the TSHD, as detailed in the initial PFS report, and the integrated mining vessel and crawler system (IMV) similar to the proven and operating design used by De Beers Marine of South Africa now for over 30 years.

While the TSHD demonstrated scalability, it posed significant challenges regarding tailings dispersal. Its operation could create large sediment plumes due to limited control over tailings return. In contrast, the IMV crawler system, with its precise and (based on grade control drilling) targeted extraction process able to avoid zones of high (>2%) silt, and controlled return of the de-ored sediments (tailings) to the seafloor, minimises plume generation. By employing a tailings pipe and pressure diffuser to around 4m above the seabed, the system will return sediment to the seabed in a controlled manner, reducing the suspended sediment impact in the surrounding water column.

Based on these findings, it was clear that utilising proven IMV seabed crawler technology offered the lowest project risk along with the most effective and environmentally responsible mining solution, particularly given its superior tailings management capabilities.

The seabed crawler will be remotely operated from a surface support vessel and equipped with advanced acoustic navigation and imaging systems to ensure precise, systematic extraction along pre-defined grade controlled lanes. It will pump the unconsolidated surface sediment to the IMV vessel for processing and beneficiation. The high-precision nature of the crawler's operation ensures comprehensive coverage of the target area, able to avoid areas of high silt loads, eliminating the need for re-mining and enhancing overall efficiency. The mining vessel will employ a dynamic positioning system with multiple anchors to maintain accurate placement during ore extraction and redeposition of tailings onto the seafloor, ensuring safe and effective operations across the designated mining zones.

3.3 Project Geology

Titanomagnetite iron sand forms Quaternary[1] onshore beach and dune deposits and offshore marine deposits along approximately 480 kilometres of coastline from Kaipara Harbour in the north, south to Wanganui on the west coast of the North Island, New Zealand. The onshore deposits include the present beach and dune sand, and older coastal sand deposits that have been preserved by uplift due to faulting and/or lowering of sea level.

The titanomagnetite mineral is sourced from the Quaternary volcanic rocks of western Mount Taranaki and the volcanic rocks of the Taupo Volcanic Zone, transported to the coast by rivers, along the coast by shallow marine longshore currents, and subsequently concentrated by wave, wind and tidal action into beach and dune lag deposits.

From the interpretation of the exploration information, the geological model of the offshore iron sand deposits can be represented as areas, consisting of remnant coastal beach and dune lag deposits that were constructed, in the same geological process as the current onshore dune deposits, at a time of lower sea levels of around 30m to 50m during the last glaciation from around 15,000 to 9,000 years ago. These paleo-dune features were part of an ancient river system in which dunes formed contemporaneously at the mouth of the river(s) and the coastline. The rivers are locally controlled by active faulting with the iron sands within the river channels and dunes partially reworked by currents and longshore drift then inundated and reworked by the rising and transgressing seas over the last 7 to 8,000 years.

3.4 Exploration Summary

TTR have undertaken extensive exploration activities within its tenement areas, and in particular within the proposed mining area within MMP55581. Exploration activities have included, high resolution aeromagnetic surveys, high resolution 2D seismic surveys, multi beam sonar bathymetry surveys, ROV video surveys of seafloor, multiple programs of shallow and deep drilling, bulk metallurgical sampling and pilot plant processing. From these exploration and processing activities TTR has been able to report a JORC Mineral Resource Statement using drilling methods that have been independently technically verified to enable representative sampling at depth of the seabed titanomagnetite resource.

[1] The **Quaternary Period** is the most recent of the three periods of the Cenozoic Era in the geologic time scale, and spans from 2.588 ± 0.005 million years ago to the present. This relatively short period is characterized by a series of glaciations.

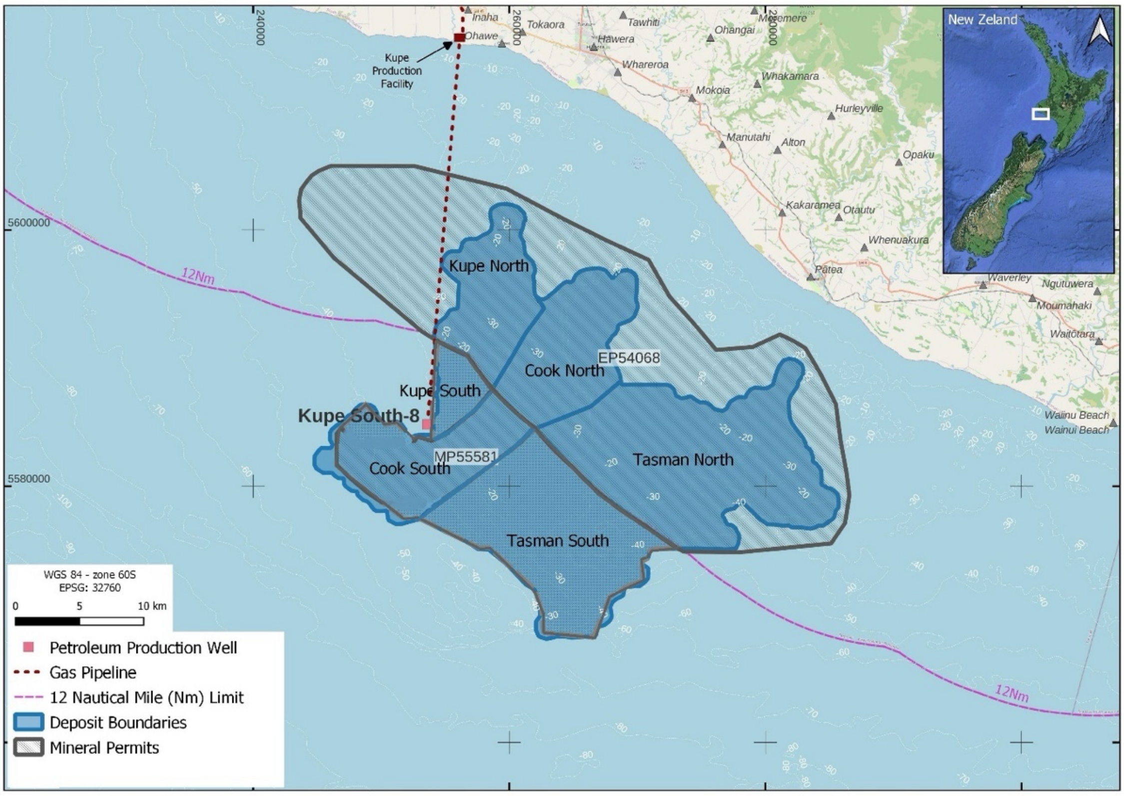

Figure 1 Location of the TTR VTM Project (Resource Blocks and Mineral Permits)

3.5 Mineral Resource Definition

On 1 March 2023 TTR reported the mineral resource estimates for its Taranaki VTM[2] iron sand project located in the STB off the west coast of the North Island, New Zealand (Figure 1)

The 3.2Bt Indicated and Inferred mineral resource of 10.17% Fe_2O_3, 1.03% TiO_2 and 0.05% V_2O_5 contains 1.6Mt vanadium pentoxide ranking the deposit as one of the larger drilled vanadium deposits globally.

Three contiguous resource deposits, the Cook, Kupe and Tasman VTM deposits that make up the Taranaki VTM project, are separately reported. The mineral resource and Davis Tube Recovery (DTR) concentrate estimates reported, based on all available assay data as of 1 January 2015, include iron oxide and iron (Fe_2O_3 & Fe), titanium dioxide (TiO_2) and vanadium pentoxide (V_2O_5) mineral resource estimates.

The mineral resource estimates for Cook, Kupe and Tasman deposits, have been reported separately for each of the North Blocks inside the 12Nm limit within Mineral Exploration Permit MEP54068 [Resource Management Act (RMA) approval area] and the South Blocks outside the 12Nm limit within Mineral Mining Permit MMP55581 [Exclusive Economic Zone (EEZ) approval area].

The mineral resource estimates are prepared and classified in accordance with the 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore

[2] Vanadiferous titanomagnetite ($Fe_{2.74}Ti_{0.24}V_{0.02}O_4$).

Reserves (JORC Code 2012).

The 2023 Taranaki VTM Mineral Resource Statement is presented in Appendix 19.16.

Summary

The Taranaki VTM iron sand project has a total reported combined Indicated and Inferred mineral resource of 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 (Figure 1; Table 1).

The reported mineral resource estimate for the contiguous Cook, Kupe and Tasman North deposit Blocks has an Indicated and Inferred mineral resource of 1,275Mt @ 10.44% Fe_2O_3, 1.05% TiO_2 and 0.05% V_2O_5 inside the 12Nm limit (within MEP54068) and 1.881Bt @ 9.99% Fe_2O_3, 1.01% TiO_2 and 0.05% V_2O_5 for the South Blocks, including the initial mining area, outside the 12Nm limit (within MMP55581).

A DTR and Concentrate Grade estimation has been reported for the Cook North and South Blocks and the Kupe North and South Blocks using a 3.5% DTR cut-off grade (Table 1).

The mineral resource estimate for the Cook North and 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.

The mineral resource estimate for the Kupe North and South Blocks reports a combined Indicated and Inferred recoverable mineral resource of 688.5Mt @ 10.80% Fe_2O_3, 1.12% TiO_2 and 0.05% V_2O_5 generating 46.1Mt concentrate at a grade of 56.82% Fe, 8.38% TiO_2 and 0.51% V_2O_5 at a 3.5% DTR cut-off grade.

Additional Taranaki VTM mineral resource estimates for the Tasman North and South Blocks have been reported using a 7.5% Fe_2O_3 (head) cut-off grade. At this cut-off grade the Tasman North and South Blocks have a combined Indicated and Inferred mineral resource of 1,279.6Mt @ 8.91% Fe_2O_3, 0.88% TiO_2 and 0.05% V_2O_5 at a 7.5% Fe_2O_3 cut-off grade.

Taranaki VTM Resource Estimates Summary									
	Indicated and Inferred Mineral Resources					DTR Concentrate			
MEP54068 Inside 12Nm (RMA)	**Cut-Off Grade**	**Mt**	**Fe_2O_3%**	**TiO_2%**	**V_2O_5%**	**Mt**	**Fe%**	**TiO_2%**	**V_2O_5%**
Cook North Block	3.5% DTR*	274	11.90	1.19	0.06	21	57.19	8.12	0.52
Kupe North Block	3.5% DTR*	417	11.48	1.21	0.06	31	57.07	8.35	0.51
Tasman North Block	7.5% Fe_2O_3	585	9.02	0.88	0.04				
Total VTM Resource (RMA)		**1,275**	**10.44**	**1.05**	**0.05**				
MMP55581 Outside 12Nm (EEZ)									
Cook South Block	3.5% DTR*	914	10.95	1.12	0.05	63	55.84	8.45	0.50
Kupe South Block	3.5% DTR*	272	9.76	0.98	0.05	16	56.33	8.43	0.50
Tasman South Block	7.5% Fe_2O_3	695	8.81	0.89	0.04				
Total VTM Resource (EEZ)		**1,881**	**9.99**	**1.01**	**0.05**				
Taranaki VTM Resource Total		**3,157**	**10.17**	**1.03**	**0.05**				

DTR is Davis Tube Recovery of the magnetic fraction of the sample

Table 1 JORC Reported Mineral Resource, Concentrate Tonnage and Grades

The JORC classification of Indicated and Inferred resource categories for the reported 1.881Bt VTM resource for the Cook, Kupe and Tasman South Blocks, outside the 12Nm limit within MMP55581, are presented in Table 2. The 1.881Bt resource comprises 1,418Mt, or 75%, Indicated and 463Mt, or 25%, Inferred resource categories.

Taranaki VTM Resource Classification MMP55581						
	Indicated and Inferred Mineral Resources					
VTM Deposit MMP55581	Cut-Off Grade	Mt Ind	Mt Inf	Mt Total	% Ind	% Inf
Cook South Block	3.5% DTR*	864.9	49.6	914.4	95%	5%
Kupe South Block	3.5% DTR*	238.2	33.6	271.8	88%	12%
Tasman South Block	7.5% Fe2O3	315.0	380.1	695.1	45%	55%
Total VTM Resource		**1,418**	**463**	**1,881**	**75%**	**25%**

Table 2 MMP55581 JORC Reported Indicated and Inferred Mineral Resources

3.6 Metallurgical Testwork

TTR has reported JORC mineral resource estimates for its VTM iron sand project located in the South Taranaki Bight of combined Indicated and Inferred mineral resource of 3.2Bt @ 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 containing 1.6Mt of vanadium pentoxide (V_2O_5)[3].

Vanadium is present as a co-product in the TTR VTM concentrate resource and would be a substantial source of the metal, or its compound, from future processing. The TTR Siecap metallurgical study[4] summarised the laboratory-scale metallurgical test-work and process flow sheet development to recover iron, vanadium and titanium metals. A one (1) tonne per hour (tph) pilot plant, and a preliminary economic and environmental assessment to evaluate scalability, efficiency, and sustainability of the metal recoveries is proposed to be complete as part of the final definitive BFS. The testwork completed since 2018 has been very encouraging and demonstrates pathways to capturing these critical metals as a separate product stream using conventional technology.

The metallurgical testwork was conducted in two phases:

Stage 1 – Preliminary testwork

Stage 2 – Pilot plant testwork

Stage 3 – Vanadium and titanium recovery testwork

The purpose of stage 1 and 2 testwork was to investigate the viability of upgrading the ore using conventional mineral sands processing methods and technology to determine the base parameters required for the design of the metallurgical process flow sheet. The purpose of the testwork was to design a process flow sheet that is capable of producing a saleable iron ore concentrate whilst maximising recovery of the valuable titanomagnetite component in the primary ore resource.

Initial testwork in Stages 1 and 2 focused on gravity separation as is commonly used at many existing mineral and iron sands operations. This initial testwork proved that this approach was not viable and steered the process flow sheet design towards conventional magnetite processing which is based primarily on magnetic separation.

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[3] Manuka Resources Limited ASX Announcement 1 March 2023

[4] Metallurgical Review: Recovery of Vanadium from Taranaki VTM Project New Zealand; TTR and SieCap Consultants 4 February 2025

In 2023 TTR commenced Stage 3 testwork and commissioned metallurgical testwork into advanced mineral processing techniques to optimise the extraction and separation of vanadium and titanium from TTR STB sourced titanomagnetite VTM iron sands concentrate.

Testwork conducted by the University of Canterbury and Callaghan Innovation confirmed the viability of sodium salt roasting-water leaching process for the sustainable recovery of vanadium from the VTM concentrate. The sodium salt – water leaching process not only achieved high recovery rates of vanadium (77%) but also exemplified a model that balanced economic viability with environmental stewardship. This dual focus ensured that vanadium extraction aligned with TTR's sustainable development goals.

Vanadium and titanium are listed as critical minerals in MBIE's report "A Critical Minerals List for New Zealand" released on 31 January 2025 by the Minister for Resources. Also released by the Minister on 31 January 2025 MBIE's report "A Minerals Strategy to 2040 for New Zealand" identified vanadium and titanium bearing iron sands in the South Taranaki Bight as a growth minerals development opportunity to contribute to doubling New Zealand's mineral exports to NZ$3B by 2035.

Vanadium is a strategic mineral vital for strengthening steel, use in rebar, construction and structural steel, aerospace, and renewable energy technologies and now the emerging demand for utility storage vanadium redox[5] flow batteries (+50Mw VRFBs) used for large-scale energy storage. Titanium is widely used in spacecraft, paints, paper, plastics, white goods, alloys, satellites, electronics, medical implants, building products and solar storage.

Global demand continues to outpace supply, emphasizing vanadium and titanium's critical role in decarbonization and energy resilience resulting in their inclusion on several countries, critical metals lists including the EU, UK, USA, Canada and Australia's.

The recent testwork and subsequent study concluded that the salt roasting and water leaching process holds significant promise for extracting vanadium from TTR's iron sands especially when operating conditions were carefully optimised. Achieving a remarkable 77% vanadium recovery rate under laboratory conditions underscored the process's viability.

Siecap NZ Ltd's 2025 Metallurgical Review: Recovery of Vanadium from Taranaki VTM Project New Zealand is presented in Appendix 19.17.

3.7 Operational Description

3.7.1 Integrated System

The selected integrated solution is based on a single IMV that will contain the seabed crawler mining system (SBC), the mineral processing, beneficiation and tailings deposition mechanisms and a single Floating Storage and Offloading Vessel (FSO) that will transship and dewater the concentrate from the IMV onto standard commercial Capesize bulk vessels for export and delivery to mineral processor end users.

[5] Redox batteries are fire safe and present minimal safety risks compared to solid state batteries

Figure 2 TTR Taranaki VTM Project IMV

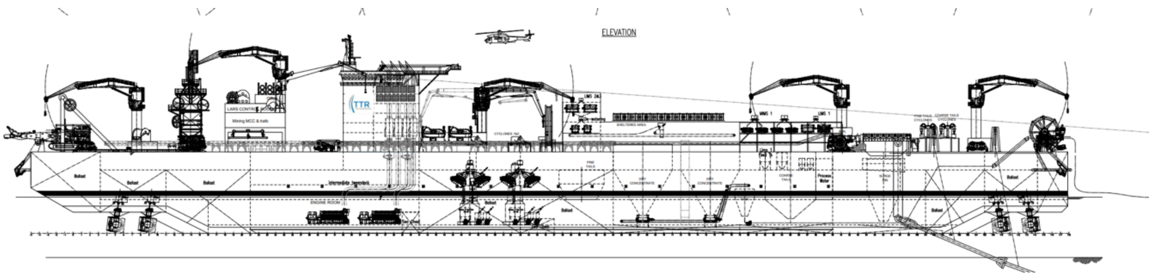


Figure 3 TTR Taranaki VTM Project IMV Elevation Plan

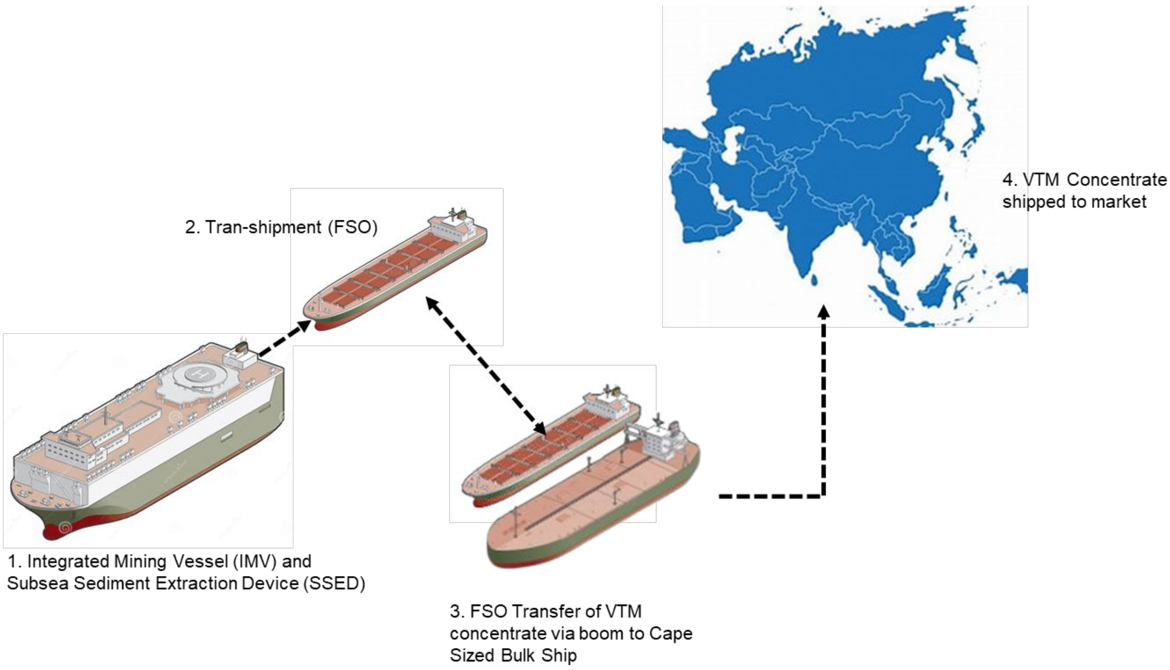


Figure 4 TTR Taranaki VTM Project - Operations

3.7.2 Seabed Mineral Resource Recovery

A mobile seabed crawler (SBC) was selected as the preferred sediment extraction technology to be integrated into the IMV. This proven and tested technology is very similar to the De Beers Marine extraction equipment operated offshore Namibia now for over 30 years.

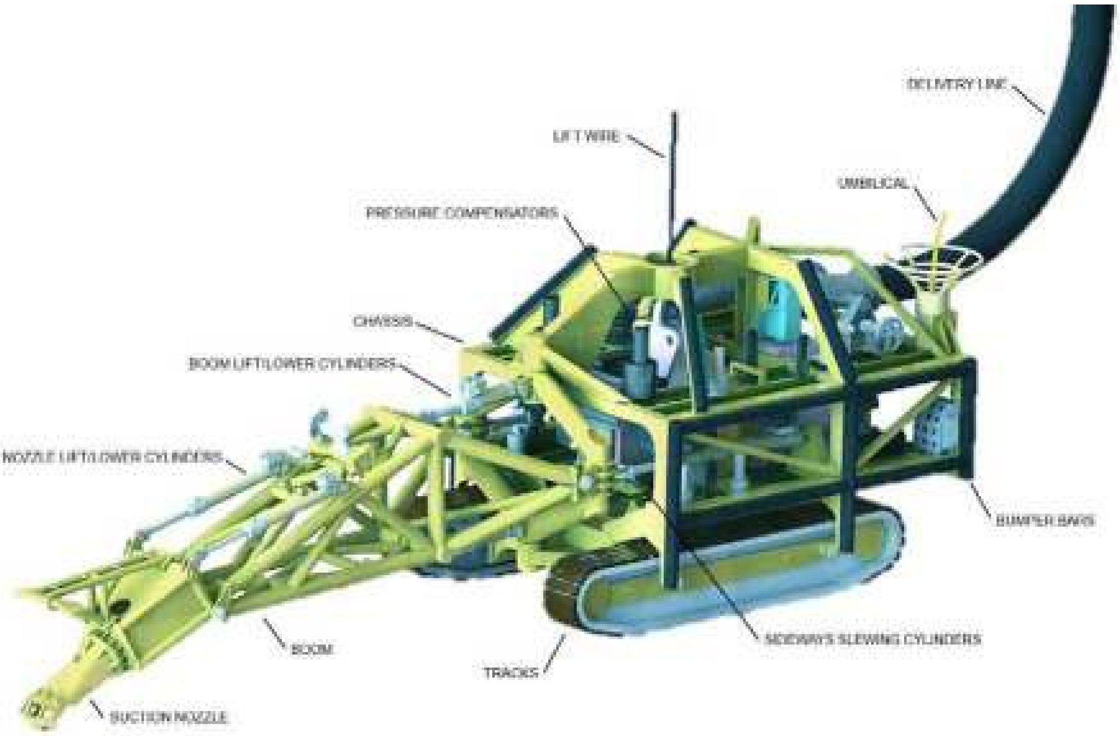


Figure 5 Seabed Crawler Technology (SBC)

During extraction operations the SBC is lowered onto the seabed by the launch and recovery system (LARS), together with the discharge hose and umbilical. Around 2-3 sections of the discharge hose will be floating on the water allowing for flexibility in the movement of the subsea device.

To accommodate the deposition of the tailings into an already depleted area, because of the location of the tailings deposition pipe on the bow of the vessel, the length of each extraction run will be a function of the vessel length, e.g. 300 metres. At the end of each run the SBC will turn 180° and work the adjacent run, see Figure 4 below. The total width of the planned run of the SBC boom is 10 metre wide allowing for a 1 metre overlap on both sides of the run to minimize spill (losses).

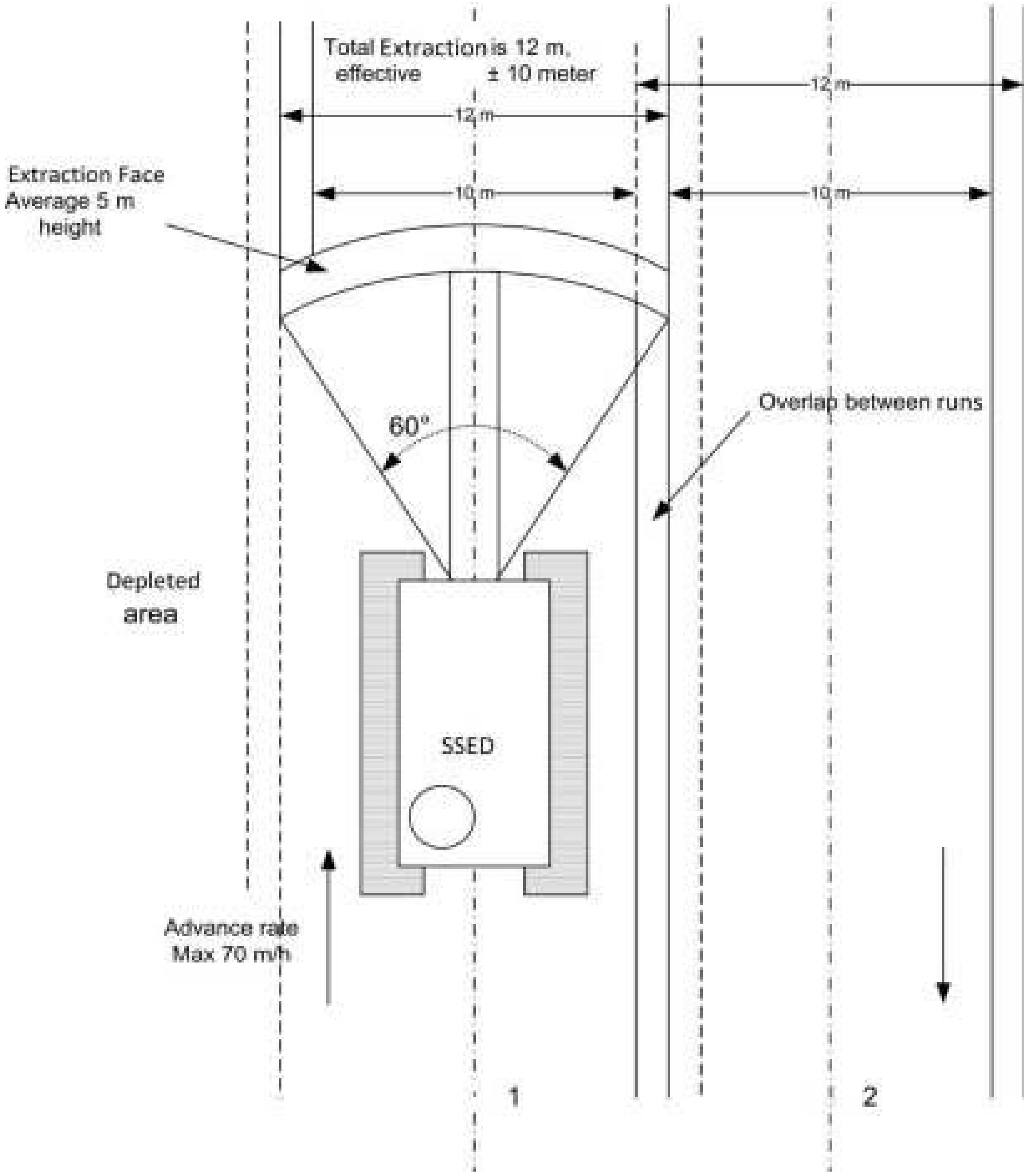


Figure 6 Typical SBC Extraction Run

The IMV will typically follow the SBC at the advance rate of 40 metres an hour. A 300m x 300m block will typically be depleted in around 10 days, and the mooring system will normally span a 900m x 300m area, see Figure 5, allowing a period of 30 days between each mooring move.

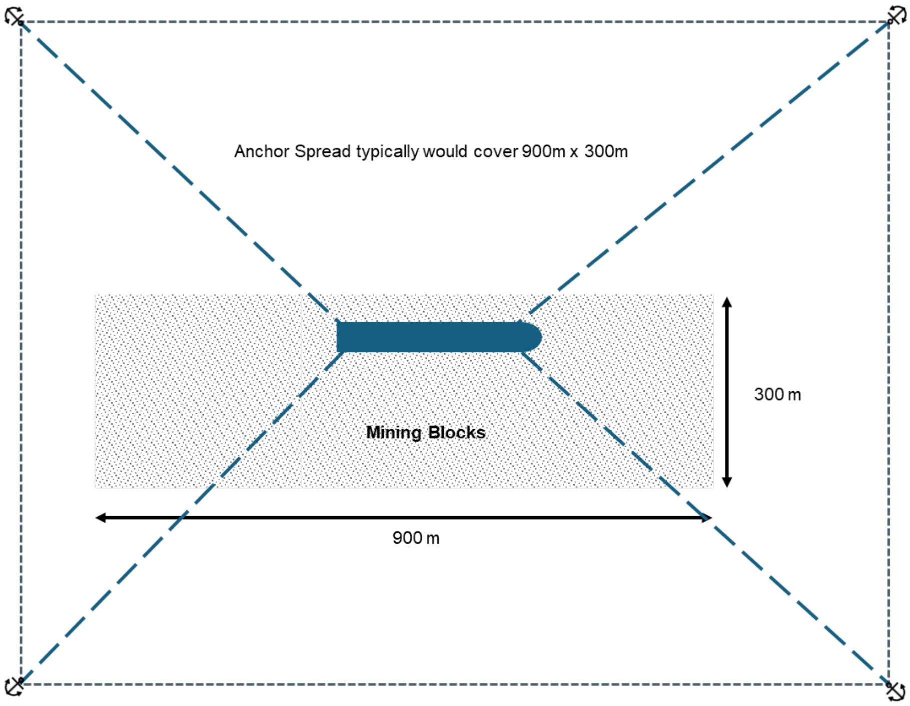


Figure 7 IMV Mooring Layout

3.7.3 Metallurgical Processing Module

The metallurgical test work programs demonstrated that the TTR VTM Project mineral resources can be beneficiated using conventional classification, i.e. magnetic separation followed by grinding and a final magnetic separation to produce a 56-57%Fe product (typically 75µm) with mass yields in the order of 10%.

A summary of the proposed processing facility is detailed in the Process Flow Diagram detailed in Section 7 of this report and is broadly described as follows:

- Extracted sediment will be delivered to the IMV via an 800mm ID rubber hose connected to the SBC. The pump will allow the transport of the sediment slurry at a rate of 8,000 tonnes per hour resulting in a slurry velocity in the hose of around 6.5m/s. The suction velocities directly at the nozzle entry will typically be around 1.5 to 2m/s and will decrease rapidly as the distance increases from the nozzle face. The estimated intake velocities 1m away from the nozzle will be a maximum of 0.5m/s. The run of mine (ROM), ore will be directed into a boil box from where it will be directed into two intermediate distribution sumps. Process water will then be added to reduce the slurry density to approximately 31.5% solids by weight before the slurry is fed to 10 trommel screens at main deck level. The screen aperture will be 4mm such that the effective screen size of the ROM will be ~2mm. Spray water on the screens will reduce the slurry density further to approximately 30% solids. The screen undersize is fed under gravity to 10 water agitated storage tanks directly below the screen area. The oversize will be fed via a chute to the tailings handling area.
- The -2mm ore will then be pumped from the agitated storage tanks to the first stages of magnetic separation. The purpose of the rougher magnetic separation (RMS) will be to capture both the liberated and locked magnetic particles whilst rejecting the majority of the gangue[4].

- Grinding – The feed to the first stage (~1,420t/h) will be ground to a P80 of nominally 130μm, requiring a grinding installed energy of 3.5kWh/t[6]. It is envisaged that the first stage grinding duty will be accomplished using 2 x 3,000HP Vertimills® in parallel.
- Intermediate Magnetic Separation (IMS) – The IMS section will comprise of 12 units arranged into two clusters of six separators each. Approximately 30% of the IMS feed will be rejected to tailings. The IMS concentrate will be gravity fed to the second stage grind feed tanks and the tailings will be gravity fed via a chute to the tailings handling area.
- Cleaner Magnetic Separation – The cleaner magnetic separation (CMS) section will consist of eight triple drum co-current magnetic separators at an intensity of 950 gauss, arranged in two clusters of four each. The CMS concentrate will then be gravity fed to a set of dewatering drum magnets to reduce the concentrate moisture to ~10%.
- Final Concentrate Handling – The dewatered concentrate will be stored in two hoppers. The hoppers were sized for a buffer capacity of 40h or approximately 32,000t. This will allow enough time for the FSO to sail a distance of maximum 70 nautical miles to a sheltered area (if required by weather conditions), offload its entire load of 60,000t concentrate and return to the IMV. Once the FSO is on station, it will connect to the IMV via a floating slurry line.
- On-board the IMV dewatered concentrate will be extracted from the bottom of the storage hoppers onto a conveyor belt. It will be elevated to the top of a constant density (CD) agitator tank with a sandwich conveyor. In the CD tank the concentrate will be slurried with fresh water from the desalination plant (from two intermediate freshwater tanks) to form a 50% by solids slurry. Fresh water is required to wash the concentrate, i.e., to reduce the chloride (salt) level of the product. The slurry will then be pumped to the FSO and filtered to a low moisture content of less than 6.5% using four hyperbaric pressure filters on the FSO.
- During offloading of concentrate the process plant will continue to operate to produce the balance of the 60,000t FSO cargo. Offloading to the FSO therefore will occur at double the production rate of the process plant (~1,600t/h).
- Tailings Handling – In order to minimise the environmental impact of the tailings, it will be dewatered before disposal via a set of hydro-cyclones. The coarse and fine tailings will be dewatered separately to approximately 75 to 80% solids before being discharged under gravity via the tailings deposition pipe. The deposition pipe will be controlled using sonar such that the discharge occurs at a constant height 4m from the seabed. The tailings wastewater will be discharged via a second pipe along the tailing's deposition pipe slightly higher than the solids discharge.

[6] Taken from the DRA March 2014 Process Review Report

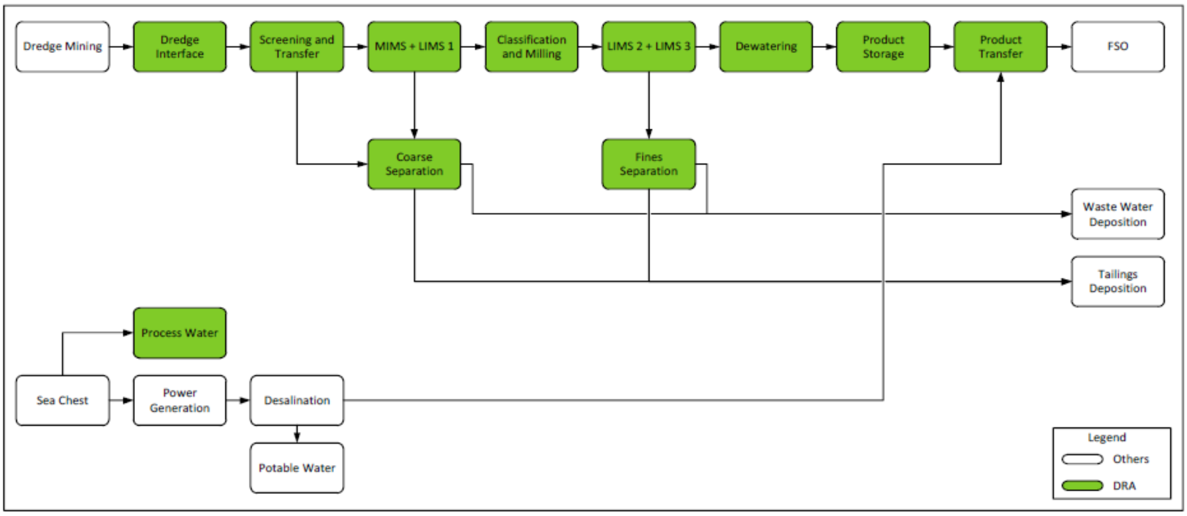


Figure 8 Mineral Recovery and Process Description

3.8 Auxiliary Services

3.8.1 Power Generation

The Project has specified on the IMV four (4) Siemens SGT-500 gas turbine generator sets for a total installed power capability of 80MW.

The SGT-500 set was selected because of its multi-fuel capability on a range of gas and liquid fuels specifically that of Intermediate Fuel Oil (IFO).

The units also have:

- The ability to accept a wide range of load application / rejection;
- The ability to accept a 6MW step load increase in a single step;
- The ability to shed load from 11MW to zero in a single step;
- The ability to shed load from full load to 2MW in a single step;
- The ability for on-line turbine washing;
- Low NOx emissions – 350ppmv without water injection, 50ppmv with water injection;
- Low noise emissions – 85dB(A) @ 1m;
- Low lube oil consumption; and
- Low footprint and weight.

Figure 9 FPSO Example

This vessel is shown above in Figure 7. is a typical oil and gas FPSO (Floating Production, Storage and Offloading) vessel. The power on board is provided by two SGT-500 gas turbines.

The SGT-500 is regarded in industry as a lightweight, high-efficiency, heavy-duty industrial gas turbine. Its special design features are high reliability and fuel flexibility. It is also designed for a single lift, which makes the unit suitable for all offshore applications.

The modular, compact design of the units also facilitates onsite modular exchange. (Source: Siemens Westinghouse)

The power generation component for the TTR project is detailed further in Section 8.1 of this report.

3.8.2 Sea Water Desalination

The project has specified 10 separate containerised Reverse Osmosis plants, each with a production capacity of three thousand (3,000) cubic metres per day.

Splitting the plant up in this way reduces risk as in the case of a breakdown in one plant, nine others are still available. It is also advantageous from a maintenance downtime perspective: with only 10% capacity offline at any one time, production is hardly interrupted for scheduled servicing. Spare parts are common across all plants, further reducing costs of stocking critical parts and components.

This aspect of the project is detailed further in section 8.2 of this report.

3.9 Environmental Regimes and Permitting Status

The Taranaki VTM project has undergone extensive environmental investigations and permitting processes. In 2017, TTR were granted marine and marine discharge consents by EPA Decision Making Committee (DMC) under New Zealand's Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ Act).

The EPA's decision was appealed to the High Court by environmental advocacy groups, some fishing interests and iwi representatives. The court process and outcomes, that subsequently included appeals to the Court of Appeal (CoA) and Supreme Court (SC), on points of law are summarised in Section 13.5 of this PFS.

Finally, the Supreme Court's decision, issued in September 2021, provided new guidance on the correct application of provisions in the EEZ Act by the DMC.

The Supreme Court judgment held that the DMC had made some errors of law in granting the consents. The SC referred the consents back to the DMC for reconsideration in light of the SC decision. The Court judgment stated, "Given the complex and evolving nature of the issues involved, it would not be appropriate to deny TTR the opportunity to have the application(s) reconsidered" and "TTR should be able to remedy matters if it can."

Importantly, the SC judgment provided a summary of the legal deficiencies of the original consent grants and the legal framework to address these when the grants are reconsidered by the reconvened DMC.

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

In anticipation of the NZ government's new Fast Track Approvals process, TTR withdrew its application for reconsideration by the reconvened DMC at the end of March 2024.

Between March and December 2024, the New Zealand Government developed the Fast Track Approvals Act 2024 (FTA Act), the purpose of which is to improve the delivery of projects with significant economic benefits. The FTA Act became law on 23 December 2024 and provides a streamlined process for such projects, with bespoke legal tests that give more weight to regional and national economic benefits than under the EEZ Act. At TTR's request, the New Zealand Government has listed TTR's project in the FTA Schedule 2[7], which means the project has already been approved to apply for final consents under the FTA process. This enables TTR to make an application for the project without first having to obtain additional ministerial support. TTR is now preparing its FTA application, which will reflect the new FTA legal tests.

TTR's EPA approved comprehensive set of consent operating conditions and detailed management plans mandate at least two years of baseline pre-mining commencement environmental monitoring and data collection, continuous operational monitoring over the 20 years of mining and five years of post-production environmental monitoring and review to address any unforeseen adverse impacts. TTR remains responsible for demonstrating ongoing compliance with these conditions to the regulator, the EPA, with oversight from independent technical reference groups including regional authorities, commercial fishing, oil and gas, iwi fishing forum representatives and cultural advisory panels to ensure environmentally responsible operations and stakeholder involvement throughout the project's lifespan.

3.9.1 Environmental Impact Assessment

For a detailed analysis of the updated Environmental Impact Assessment (EIA), including the most recent findings on sediment plume dynamics, marine ecology, and other key environmental factors, please refer to Appendix 19.21. This appendix contains the

[7] https://www.manukaresources.com.au/site/pdf/e2c94ac0-59d0-469d-a14d-fc1ce85ababb/TTR-Taranaki-VTM-Project-included-in-new-FastTrack-Approvals-Act-in-NZ.pdf

comprehensive assessment prepared by the National Institute of Water and Atmospheric Research (NIWA), which incorporates new data, updated modelling scenarios, and insights relevant to the ongoing environmental monitoring and environmental management strategies for the project. The information presented provides critical context for understanding the potential environmental impacts and the measures implemented to mitigate these risks.

3.10 Capital Costs

Capital costs (Capex) were estimated by TTR supported by various technical consultants and equipment providers. The Capex estimates are detailed in section 14.1 of this PFS and should be considered to be ±30% order of accuracy current at the first quarter of 2025.

The capital costs for the project have been updated to reflect the impact of various external and market-driven factors. Adjustments were made based on the origin of key project elements, considering differences in labor costs, material availability, and regional economic conditions. Market fluctuations, including changes in commodity prices and currency exchange rates, were incorporated to provide a more accurate cost baseline. Inflation adjustments were applied in line with the latest industry indices to capture the rising costs of materials and services, particularly in sectors such as ship construction, mining process equipment, and industrial equipment procurement. Supply chain challenges, including delays and increased freight costs, have been factored into the revised estimates, given their significant influence on lead times and overall project expenditure. As a result, the project schedule and financial analysis have been recalibrated to align with these cost revisions, ensuring that contingency allowances and risk assessments are updated to reflect current market conditions and potential future scenarios.

The total project Capex is estimated at US$602.183 million (NZ$1 billion). This figure encompasses a wide range of cost elements including project management, consultancy efforts (both BFS and execution), travel and accommodation, and extensive procurement activities. The procurement segment alone covers major components such as the IMV hull and superstructure, piping, machinery, the SBC, a geotechnical drilling and grade control survey vessel (GSV) and a variety of specialized equipment and installation costs. Each element has been meticulously evaluated to ensure that the overall estimate reflects both the scale and complexity of the project.

A critical aspect of any Capex estimate is the inclusion of a contingency reserve to address uncertainties and mitigate potential risks. The contingency, for this Capex estimate amounts to US$84.4 million (NZ$120M) or 14% of the total Capex.

The updated Capex estimate now also includes an allocation of NZ$2 million for the establishment of a dedicated employee training facility in Hāwera, aimed at enhancing workforce competency and supporting operational excellence. This facility will provide specialized training programs tailored to the project's manning needs, ensuring compliance with industry standards and best practices. Additionally, a NZ$3.9 million allowance has been incorporated for the acquisition of a suitable environmental monitoring and research vessel (EMV) I, monitoring equipment and technology and the necessary port infrastructure. This investment underscores the project's commitment to environmental stewardship, enabling continuous monitoring of marine ecosystems and ensuring adherence to regulatory requirements. These additions strengthen the project's long-term sustainability and operational resilience while aligning with best practices in environmental and workforce development.

Opportunities to reduce TTR's capital outlay through contracting with third parties to provide key elements of the project include potentially the project water supply and power infrastructure and auxiliary services. These will be evaluated during the BFS phase.

The following key assumptions have been made in regard to the capital cost:

- Contracted concentrate transfer and marine support operations;
- Owner run of mining, mineral processing, concentrate dewatering and environmental compliance and monitoring;
- Contracted vanadium recovery operations;
- A capital allowance has been made for an on-shore pilot vanadium recovery plant;
- Outside of the above, no capital allowance has been made for on-shore facilities as these are assumed to be covered by the respective entities providing services to the project at an operating cost; and
- The processing plant capital estimate has been based on suitable equipment sized from preliminary metallurgical test-work and flow sheet development. The processing plant is also based on a modularised construction strategy allowing (where practical) assembly and testing off site with reduced on-site construction effort and risk.

3.11 Operational Costs

Operating costs (Opex) have been estimated on the basis that all primary mining operations will be carried out by TTR. All transfer and support operations will be contracted out to third parties. The Opex estimates are detailed in section 14.2 of this PFS and should also be considered to be ±30% order of accuracy current at the first quarter of 2025.

The detailed Opex framework provides an in-depth analysis of the operational costs, amounting to US$27.20 (NZ$47.00) per tonne of VTM concentrate. This cost structure not only highlights the complexity and scale of the offshore mining operation but also identifies key cost drivers and opportunities for improving efficiency. Each component of the operation contributes uniquely to the overall expenditure, reflecting the logistical and technical demands of offshore mining while underscoring strategic areas for cost optimisation.

3.12 Project Schedule

It is estimated that the project duration will be 24 to 30 months from project Decision to Mine (DTM). The major key elements of the project schedule are shown in the table below:

Task Name
Project Management
Project Management and Control
Project Operations

Maritime Operations & Licensing
Project Artefacts/Documents
Basis of Design (Early Confirmation)
BFS Report
Decision to Mine
Execution
Procurement
FSO Supply
AHT Supply
IMV - Hull/Plant
Mining ROM
Process Plant
Power generation
Desalination
HDF - Concentrate Onloading
Construction
IMV - Hull/Plant
IMV Integration
Handover

Table 3 Project Schedule

3.13 Financial Analysis

The evaluation of the TTR Offshore Taranaki VTM Project was completed using discounted cash flow analysis (DCF) with a discount rate of 10%.

The base-case key economic outcomes were:

- A NPV estimate of US$1.263 billion (NZ$2.185B);
- Total operating costs of approximately US$27.20 (NZ$47.00) per tonne (excluding freight costs) of VTM concentrate product grading 57% Fe. 0.5% V_2O_5 and 8.4% TiO_2 delivered free on board (FOB); and

- Capital discounted payback of approximately 7 years based on 40% equity and 60% debt model.

The financial outcomes from the studies of the Project are shown below under Section 15.

3.14 Pre-Feasibility Assumptions

In the frame of this Preliminary Feasibility Study, the following main assumptions have been made in order to determine the most appropriate offshore scheme with regards to the logistical aspects.

- All equipment cost estimate accuracy is +/-30%;
- The FSO sizing has been based on a 60,000 tonne “Panamax” sized vessel;
- Flow-sheet has been compiled from laboratory test data and shall be confirmed further testing in the BFS phase;
- Assumed that the target specification for residual moisture of the final product is minimum 9%, to be confirmed by filtration test and FMP (Flow Moisture Point) for transportation of the iron concentrate;
- Preliminary grinding test results have to be confirmed by additional tests especially for the closed-circuit mill control (future consideration) and Vertimill® designs; and

3.15 Forward Work Programme

There are several areas that will require additional focus during the next phase (BFS) of the Project. These works are summarised below:

3.15.1 Bulk Concentrate Testwork

A larger representative bulk sample in the order of 1,500kg VTM concentrate is required to undertake additional testworks to confirm process equipment and PFDs and evaluate the concentrate product’s sintering and pelletizing properties.

A total of approximately 20t bulk sample is currently available for further testwork. Supervised trials will be conducted on the pilot plant with sample analysis carried out in local laboratories and in Australia. The following testwork is planned for the BFS phase.

3.15.2 Minerals Processing Testwork

In addition to the minor recommendations contained within each of the PFS verification reports the following activities will be included within the next phase of metallurgical testwork.

- Confirmation of optimum grind size for each grinding stage;
- Grinding circuit optimization – The potential for reduction of the grinding duty by closing the grinding circuit and having material at the target product size bypass the grinding will be investigated. This will include both laboratory sighter testwork and pilot plant trials. The impact on product grades will be closely monitored. Also included under this program will be further grindability testwork in order to provide accurate data for grinding mill sizing and Project power consumption;

- Once the grinding and magnetic separation circuits are optimised, the balance of the bulk samples will be processed according to the final flow sheet. The final concentrate produced will be provided to potential customers for sintering pot testwork;
- Magnetic separation circuit optimisation: The potential to reduce the number of MIMS units will be investigated. The impact on overall Fe recovery, Mag Fe recovery and product grade will be closely monitored;
- A mathematical concentrate grade from the Davis Tube Recovery (DTR) on each sample should be done and then compared to the DTR of the sample and also compare this with actual pilot run results; and
- A continuous pilot run with representative ore and a pilot plant configuration similar to the proposed flowsheet will be scheduled, including the use of sea water that will be used throughout the process plant.

In order to optimise the current metallurgical flowsheet TTR will:

- Evaluate options to determine if it will be viable to install separation equipment on the LIMS 1 concentrate to remove the target size material in the feed to the first grinding stage and similarly on LIMS 2 concentrate. This could have a positive impact on the grinding circuit by removing feed tonnage to the mills;
- Investigate different separation options for the removal of the +2mm fraction;
- Materials handling testwork- Samples will be collected at various stages of the pilot flow sheet for materials handling testwork (TUNRA testwork), including hydraulic conveying testing (slurry parameters), and material flow property and related tests. This work is needed to determine the key slurry parameters such as settling velocity, yield stress and viscosity. Wear rate of slurry pipeline materials will also be determined. The material flow properties of the final concentrate at the moisture level stored on the IMV as well as the FSO will be tested to provide critical data for bin and conveyor design. The transportable moisture limit will also be determined;
- Sea water trial – All pilot plant testwork to date has been carried out using potable water. A trial will be conducted to compare the pilot plant operation with sea water as opposed to freshwater to determine the extent of the influence of sea water on the process:
- Determine the dilution method, factor and effect of the process water (e.g. sea water);
- Develop a water management strategy that includes possible recycling of the filtrate from the FSO system helping in the dilution of the high total dissolved solids (TDS) and other elements in the concentrator plant; and
- In addition to the testwork above, a continuous 1tph pilot plant run will be considered in order to de-risk the final process flow sheet. Additional bulk samples will be required for a continuous run. This material could potentially be collected during tests to determine the free-flowing properties of the in-situ ore.

4 GEOLOGY

4.1 Geological Setting

New Zealand lies in the southwest of the Pacific Ocean astride a distinct belt of volcanic and earthquake activity that surrounds the Pacific Ocean. This is the Pacific Mobile Belt or "Ring of Fire" and the activity results from the structure of the Earth's crust. New Zealand straddles the boundary between the Pacific and Indian-Australian plates. To the north of New Zealand and beneath the eastern North Island, the thin, dense, Pacific plate moves down beneath the thicker, lighter Indian-Australian plate in a process known as subduction; within the South Island the plate margin is marked by the Alpine Fault and here the plates rub past each other horizontally; while south of New Zealand the Indian-Australian plate is forced below the Pacific plate. Plate movement results in volcanic activity in the North Island and in earthquakes that are felt throughout the country.

To understand New Zealand’s current geological setting and geographical features the past is the key to appreciating how this occurred and how the land and sea have diverged greatly during the geological past. The present-day shape of New Zealand is well recognised, however millions of years ago the relative positions of land and sea were quite different. Some hundreds of millions of years ago a super-continent (Gondwanaland), which included the present-day continents of South America, Africa, Australia, India, and Antarctica, existed in the southern hemisphere surrounded by sea.

The New Zealand area was situated on the edge of Gondwanaland. Since that time, movements from within the Earth have caused continents to break away from one another and move to their present positions - a process which is still continuing. The original super-continent was not stationary; it too responded to forces from within the Earth so that it was in different positions with respect to the Earth's poles at different times. Thus, at various times the fossil record and the rocks may show evidence of cold, temperate, or tropical climate.

The very oldest sedimentary rocks in New Zealand were deposited in basins lying offshore from the landmass of Gondwanaland. Subsequently the sediments were disrupted by tectonic movements and pushed up to form land that eventually became parts of Australia, Antarctica, and New Zealand. Later, an extensive series of depositional troughs developed offshore, which collected sediment eroded from adjacent continents for nearly two hundred million years. Here the "greywacke" rocks that now make up the main ranges of New Zealand were formed. This era came to a close about 110-120 million years ago when tectonic plate movements uplifted the sediments to form new land. A period of quiescence followed when erosion reduced much of the mountainous land to a low-lying, almost level plain. It was during this time that the split between Australia and New Zealand occurred.

As the land was reduced in height, low-lying swampy areas developed, which are now the sites of major coalfields. Eventually the sea started to cover the land, firstly depositing sediments in marginal basins, and later over most of the New Zealand area. Then, about 15 million years ago, the mainly quiet period ended, and New Zealand once again experienced tectonic activity, mountain building and widespread volcanic activity. In more recent geological times, the effects of rises and falls of sea level, due to alternating glaciations and warmer intervals, were superimposed on the tectonic events.

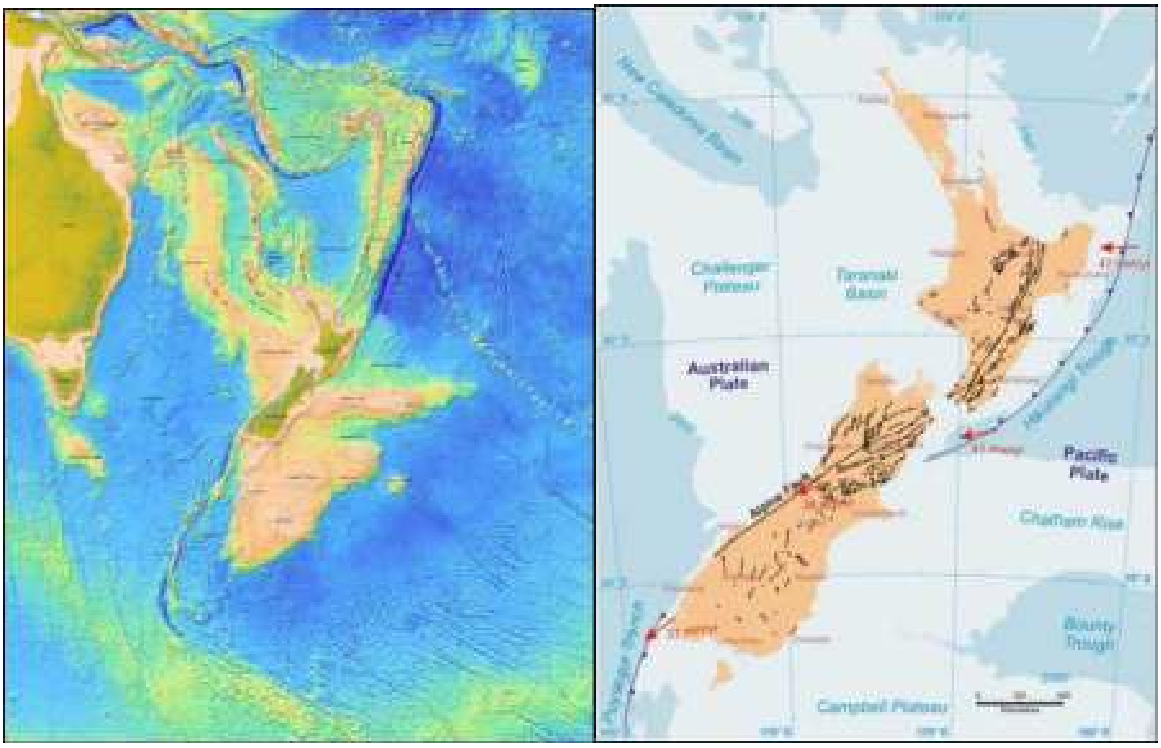


Figure 10 New Zealand's Continental Shelf and Tectonic Setting

4.1.1 Iron Sands Deposits

The nature, extent and provenance of New Zealand's onshore iron sand deposits have been well researched and investigated. Titanomagnetite iron sand forms Quaternary onshore beach and dune deposits and offshore marine deposits along approximately 480km of coastline from Kaipara Harbour in the north, south to Wanganui on the west coast of the North Island. The onshore deposits include the present beach and dune sand, and older coastal sand deposits that have been preserved by uplift due to faulting and/or lowering of sea level. This is evident with black sand beaches and dune systems along this coastline. The deposits have been well defined and in recent years attention has been given to the nature and extent of the offshore iron sand resource potential.

4.1.2 Source of Iron Sands

The liberated titanomagnetite mineral contained in iron sand deposits has been eroded from the Quaternary andesitic volcanic rocks of western Taranaki and, to a lesser degree from the rhyolitic volcanic rocks of the Taupo Volcanic Zone, transported to the coast by rivers, along the coast by shallow-marine longshore currents, and subsequently concentrated by wave, wind and tidal action into beach and dune lag deposits. Laurent (2000) investigated the dispersal and origin of the iron sands along the North Island's western coast using petrographic techniques. Shallow core samples were taken from multiple locations along the western coast in which the key tracer minerals analysed were titanomagnetite, orthopyroxene5, clinopyroxene, horneblende6 and volcanic lithics. It was ascertained that the main provenance was from the Taranaki volcanics, with the Taupo Volcanic Zone, providing a secondary input. A limited amount of material contributed also from localized, generally older volcanic outcrops and sediments. From the south to the north of Mt Taranaki, the primary variation was reflected by a decrease in the abundance of rock fragments, and an increase in the abundance of titanomagnetite, clinopyroxene and horneblende minerals. Winnowing of individual minerals was noted to happen over a short distance with a fining of grain size north and south of the primary source

Figure 11 Mt Taranaki volcano, viewed from the South Taranaki Bight, Looking North

The New Zealand offshore occurrence of iron sand has been known since the early 1960's, but estimates of the mineral resource are poorly constrained and to date remain unexploited. Scientific investigations have obtained a general understanding of the concentration and distribution of the offshore iron sand, through surface sampling. In 1980 Dr Lionel Carter presented iron sand concentration maps that show sediments containing >5% iron sand which are spatially restricted to the inner and middle shelves off Auckland, Taranaki and Whanganui. Elsewhere the iron sand concentrations are low, with the sediments concentrated under littoral (coastal) conditions that existed on the continental shelf during the Holocene transgression.

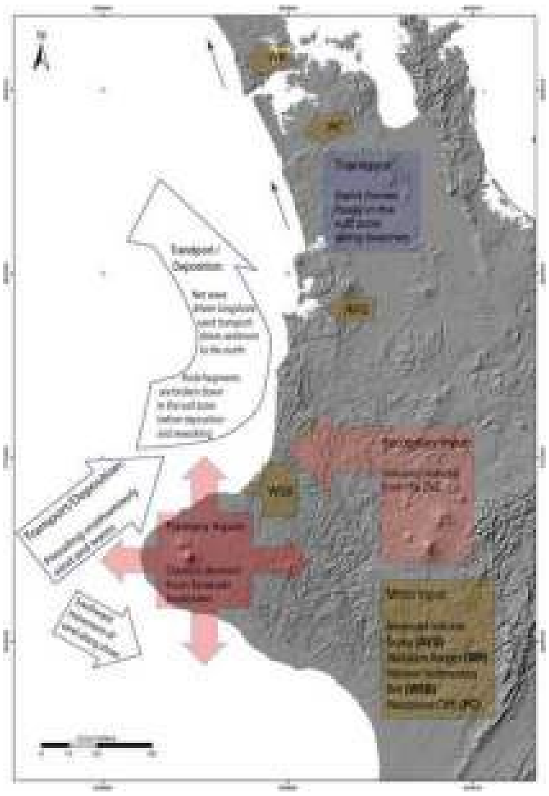


Figure 12 The Provenance and Dispersal Iron Sands off the North Island (Laurent, 2000)

4.1.3 Iron Sand Distribution

The highest reported surficial marine iron sand concentrations are typically associated with the inner shelf, shore-connected, Holocene muddy sand wedge that tapers seaward. This wedge offlaps onto an older gravelly sand unit, which is interpreted as a coarse-grained transgressive lag deposit that ranges in thickness from about 2 to 5m. The coarse grain sediments were deposited during the last marine transgression as the shoreface connected wave abrasion zone swept landwards during rising sea levels. This unit has not been covered everywhere by Holocene sediment but is subject to sediment reworking under the present wave climate. The shore connected sand wedge has accumulated largely since the stabilisation of post glacial sea level some 7,000 years ago. This unit is strongly influenced by waves and currents in the present littoral zone. Dr Alan Orpin and others describes, in a paper titled “Resource evaluation, exploration and current prospecting interests of west coast iron sands, North Island, New Zealand” the Whanganui Bight area as an area where active faults have created localized sea floor deformation and synsedimentary coarse grained post glacial infill of up to 20m thick. Generally, the distribution of the subsurface iron sands along the west coast of New Zealand is defined and their distribution and concentration influenced by a number of factors, such as current and littoral conditions, bathymetric relief and distance from the primary source.

4.1.4 Geological Model of Iron Sand Concentration within TTR Mining Area

Initial exploration targets were defined by concentrating on the higher magnetic anomaly areas and establishing the *in-situ* Fe grades through shallow and deep drilling. Drilling to date over the entire permit area has shown that the occurrence of higher grade (with an average 10% Fe head grade) iron sand to be patchy, and that a significant part of the permit area is generally covered by a “blanket” of lower grade sediment. This blanket is a combination of reworked titanomagnetite and Holocene marine sands and muds. However, within areas of the mining area there are occurrences of iron sand which have higher concentrations from the sea floor to depths of up to 11 metres.

From the interpretation of the exploration information, the geological model can be represented as an area, consisting of remnant coastal dunes that were constructed, in the same geological process as the current onshore dune deposits, at a time of lower sea levels of around 30m to 50m during the last glaciation from around 15,000 to 9,000 years ago. These paleo-dune features are part of an ancient river system in which dunes formed contemporaneous at the mouth of the river(s) and the coastline. The rivers are locally controlled by active faulting with the iron sands within the river channels and dunes partially reworked by currents and longshore drift inundated and reworked by the rising and transgressing seas over the last 7 to 8,000 years. Figure 11 shows a schematic of how the offshore high-grade deposits formed and subsequently were preserved and reworked.

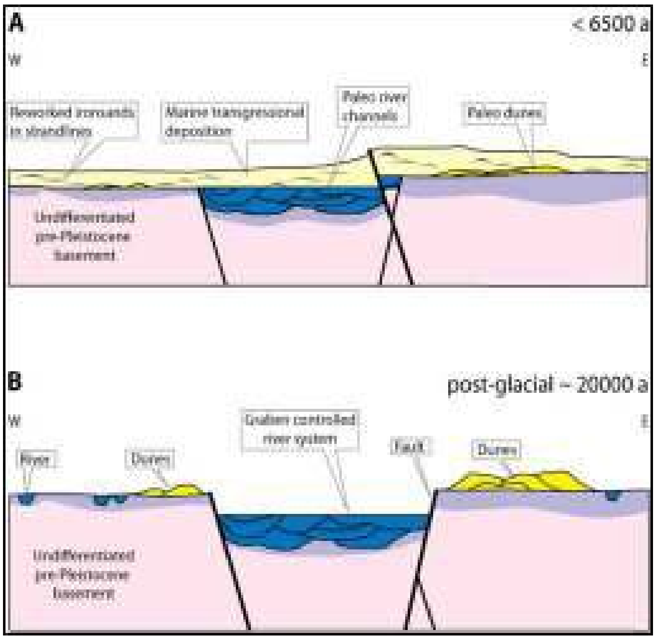


Figure 13 Geological Model Offshore Iron Sand Mineral Resource within Mining Area

Figure 14 The STB Coastline with Iron Sand Concentrate at River / Stream Mouth

4.2 Tenements

Trans-Tasman Resources have held a number of offshore mineral tenements along the western coast of the North Island, both within the South Taranaki Bight and to the north offshore Waikato. TTR were granted an offshore Continental Shelf Licence in 2014. Since the original PFS, TTR have undertaken strategic rationalisation of its permit holdings and currently has two offshore mineral permits, Mineral Mining Permit MMP55581 covering 24,257 hectares (242.57km^2) outside the 12Nm limit in the EEZ and Mineral Exploration Permit MEP54068 covering 63,504 hectares (635.04km^2) inside the 12Nm limit within the Coastal Management Area (CMA).

New Zealand approvals for the Prospecting, Exploration and Mining of Crown owned minerals resources is administered by New Zealand Petroleum and Minerals, (division of Ministry of Business, Innovation and Employment or MBIE). TTR's mineral rights are assessed and granted under the Crown Minerals Act 1991.

In January 2025, the New Zealand Government released its Minerals Strategy to 2040, in which it outlines the guiding principles and outcomes for the development of critical minerals. As a critical mineral, TTR's development of the vanadiferous titanomagnetite iron sands concentrate meets the current New Zealand Government Minerals Strategy, of ensuring a stable and secure supply of vanadium, for which the New Zealand Government have identified as crucial for supporting infrastructure development and advancing energy storage technologies, particularly as New Zealand transitions to cleaner, more sustainable energy sources.

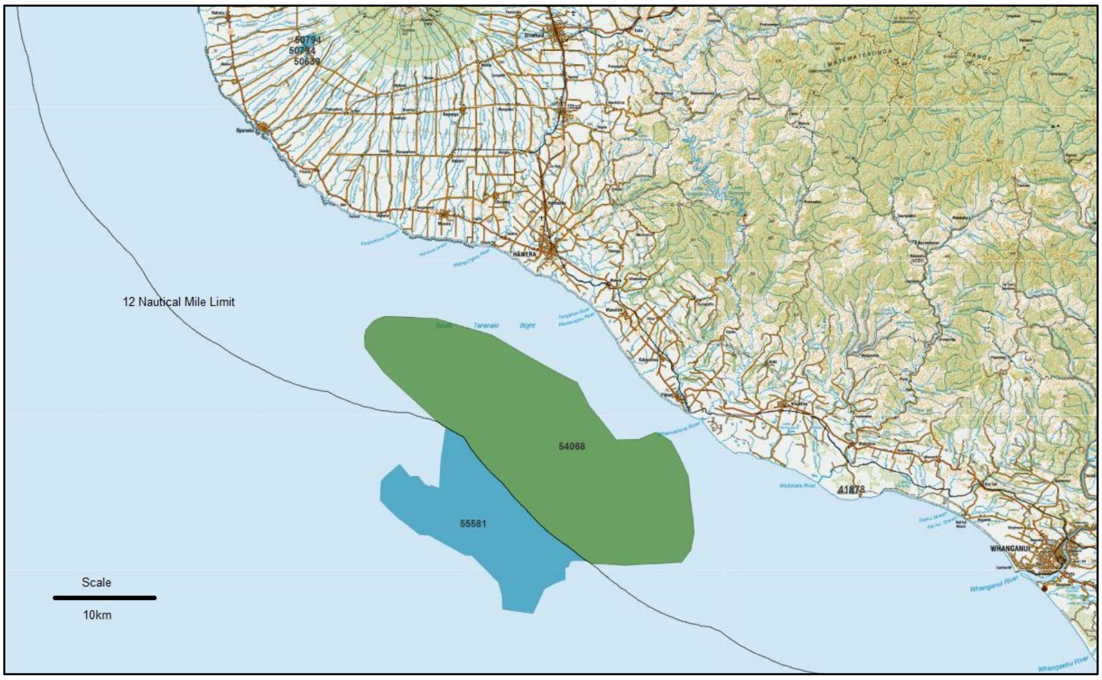


Figure 15 Location of TTRs Mining and Exploration Permits

Table 23 below lists the details held for the two permits held by TTR. Full license permit documents for MMP55581 and MEP54068 are presented in Appendix 19.15. An overview of New Zealand's regulatory regime is included within Section 13 of this report.

Number:	55581	54068
Commodity:	Minerals	Minerals
Type:	Mining Permit	Exploration Permit
Owners:	Trans-Tasman Resources Ltd	Trans-Tasman Resources Ltd
Location:	Taranaki	Taranaki
Operation Name:	Offshore Taranaki	
Status:	Granted	Granted
Granted:	2/05/2014	19/12/2012
Duration:	20 years	13 years
Expires:	1/05/2034	18/12/2025
Area:	24257 Ha	63503.647 Ha

Table 4 TTR Permit Details from New Zealand Petroleum and Minerals (NZ Government)

4.3 Mineral Resource Exploration

4.3.1 Airborne Magnetic Survey

Fugro Airborne Services were commissioned by TTR to undertake an extensive airborne magnetic survey. From this survey, over 55,000-line kilometres of aerial magnetic data was acquired. Fugro Airborne Geo-services then undertook filtering and interpretation of this data to target sub-surface sampling locations.

The aeromagnetic data clearly shows paleo-geomorphological features, such as channel, river mouth, beach dune deposits and possibly river deltas. From this data it is modelled that during the period of low sea levels, ancient river channel and river mouth systems were the locality for iron sand concentration. Further concentration occurred in this setting through longshore drift and tidal action, with dunes placed and potentially sorted through aeolian accumulation. With the marine transgression, the encroaching surf zone would have partially destroyed these dune systems. Eventually silt, sand and reworked iron sand were deposited on these features. The sub surface iron sands located further offshore are those of discrete locations that coincide with the paleo shorelines (during periods of stand still circa 7k yBP and 9K yBP) and the migration of the shoreline, due to marine transgression to the current sea level.

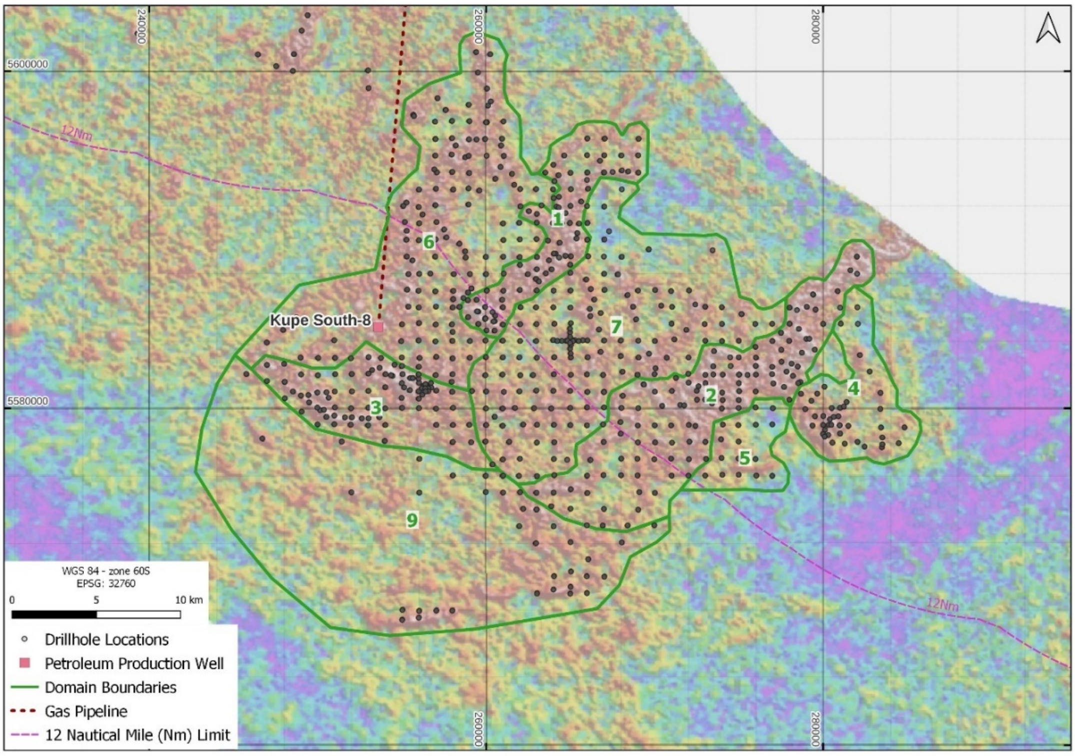


Figure 16 Airbourne Magnetic Anomalies Over the Taranaki VTM Project Area

4.3.2 Drilling

Early in the company's life, TTR investigated different drilling and sampling methods for seabed drilling. Globally nothing was considered to be a cost-effective drilling technology that could meet all of TTR requirements. TTR began a long and innovative process of design, construction and development of proprietary drilling technology. With the input from an experienced offshore drilling contractor, TTR now has the technology to rapidly obtain cost- effective and representative samples at depth. This has enabled a JORC resource to be defined within TTR's permits.

Two different submersible rigs have been developed to obtain the sample, a shallow system (<9 m drill string) and a deep drilling system (up to 42 m) with their applications depending on the number of holes required, water depth, and desired target depth. Both drilling rigs have a purpose-built LARS (Launch and Recovery System) to ensure safe launching and retrieval of the rig.

4.3.3 Shallow Drilling

The shallow drilling rig is controlled remotely from a vessel using a system of electric and hydraulics. The shallow drill system utilises a passive (non-mechanical cutting drill head)

Reverse Circulation (RC) drilling is the preferred method of recovering representative samples from below the sea floor. Samples are taken as composites over 1 metre intervals.

A hydraulic ram is used to control the descent of the drill string 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 does not require diver support it can be deployed in water depths of up to 60m (with the ability to go deeper if necessary). This is a single pass drilling system, so the maximum penetration depth is 11m below the sea floor.

The drill works using a triple tube system, with high pressure water, up to 500psi, pumped down the outer tube, which jets out of the end disturbing the sand and creating slurry. High pressure air between up to 220psi (350cfm) is pumped down the second tube, which in turn creates a venturi effect. The venturi lifts the slurry up the center tube and into a cyclone diffuser on the deck of the vessel, where it is collected in marked poly-weave bags.

The driller watches the drill penetrating the sea floor and directs the crew collecting the sample when to change bags (as each meter mark passes by).

This rig is extremely fast and cost-effective on a shallow resource, consistently drilling up to 8 holes to 9m depth in a 12-hour day. The rig also provides an effective bulk-sampling tool (<3 tonnes), having the capacity to collect several tonnes in a matter of hours.

Figure 17 TTR 11m Shallow Rig on Display at the Sample Warehouse

Figure 18 Launching of the Shallow Drilling Rig, 2011 Drilling Programme

4.3.4 Deep Drilling

As with the shallow drilling, the deep drilling rig has also been built as a Reverse Circulation (RC) drill. RC is the preferred drilling method, as this method can be carried out more effectively and potentially quicker than other drilling methods.

The deep drilling rig, developed in 2012, uses a combination of compressed air, drill fluid injection, rotation and downward pressure to retrieve slurry of sample from below mud line (BML). The bottom hole assembly (BHA) is a tri-cone roller bit, which allows penetration through alternating layers of sediment. The slurry sample travels from the rig to a cyclone diffuser on the vessel, via a return sample hose. The depth BML is monitored by the diver and the expert driller on the vessel with samples taken at 1 metre intervals.

The drilling is physically controlled by a diver on the drill platform who is directed by an expert drill supervisor located on the vessel, watching and communicating with them through standard SSBA communication equipment. Drilling is limited to dive time, which can be increased if decompression chambers are used.

Figure 19 Deep Drilling Rig on the PMG Pride During the 2013 Deep Drilling Programme

The deep drill rig was developed and deployed with the ability to drill up to 42m. This rig is diver operated on the sea floor. The rig uses a similar system to a land-based RC drilling rig carrying six removable drill rods in a carousel.

The deep drill rig and divers are connected to the service vessel by umbilical. The drill rig compressor and pump are on the service vessel and all samples are returned by bull hose to a cyclone on the deck. The system includes full video contact between the sea floor rig and the boat. Divers also have video and audio contact with the surface crew. Drilling is monitored by a drill supervisor on the service vessel.

4.3.5 SPT Drilling

In March 2013, TTR undertook geotechnical drilling in the Cook North area to determine the insitu geotechnical characteristics of the seabed material, at depth. This was required to determine the dredging effort required to extract the seabed sediment. TTR engaged OCEL Consultants Limited and NZDS to provide a reliable SPT N value to assist with the crawler design and breach testing. The investigation and report determined that the seabed material was considered dense to very dense, and that cutting action would be required with the SBC design. The report is appended to this PFS.

Figure 20 Deep Drill Rig on PMG Pride During the 2013 Drilling Programme

Figure 21 Collection of Drill Samples from Deep Drilling

Figure 22 Diver Preparing for Deep Drilling

4.3.6 2D Seismic Survey

TTR sought to gain better understanding of the geometry and geology of the sedimentary wedge within which iron sand-rich deposits occur. This sediment wedge overlies the massive siltstone/bioclastic, limestone and pebble sandstone unit of the Whenakura Group (locally called *papa* or basement). The basal contact of the sedimentary wedge with this massive mud/siltstone is a critical contact and was believed to be a strong reflector which would allow TTR to determine the true thickness of the sand wedge, allowing a more definitive volumetric assessment of any potential resource.

Two surveys have taken place, the first in August 2011 on NIWA's 14 m catamaran, RV *Ikatere*. This boomer study consisted of 20 seismic profiles, cumulating to total length of approximately 140-line kilometres, acquired over 28 hours of survey time. The water depth across the survey area ranged between ~30 to 55m. The data acquisition for the second seismic survey was completed on the 28th of February 2013, for an additional 20 lines at a total of approximately 140-line kilometres.

For both surveys the seismic source was a 300 Joule Applied Acoustics AA201 Boomer plate mounted on a CAT200 catamaran. For completeness, two receiver arrays were used: a Geoeel digital streamer and a Benthos analogue streamer. The Geoeel consists of 16 channels with a 1.5625m group interval, and 2 hydrophones per group. The horizontal offset between source and the Geoeel first channel was set to 10m. The Benthos 15/10S single-channel array was towed 4 to 5m directly behind the boomer source. The Benthos array consists of 8 hydrophones with a 300mm spacing connected in series.

Seismic processing was undertaken using Globe Claritas software. The processing routine included trace editing, quality control, source-receiver geometry setting, de- convolution, de-spiking, swell and band-pass filtering, staking, and post-stack de- convolution

The data was not tide corrected. Tide correction is usually only required when true depth below the sea surface is needed and was not required for this pilot study.

Swell filters were applied to all profiles following a protocol developed in house, as follows:

- Reflector was digitised on screen. Overall, the seismic surveys have successfully demonstrated the potential of high-resolution boomer seismic to provide valuable geological information, such as the sub-sea floor geometry of sedimentary units and the spatial extent of deposits;
- A 1-D time-series filter was applied using a window of 35–55 traces (equivalent to 25-40m filter length) to the digitised sea floor function. Different filter lengths were tested; and
- The residual function generated was applied as a static shift to each trace.

In some cases, swell corrections were applied twice when deemed necessary. Rare spikes and extremely high amplitude, low-frequency noise, in seemingly random places of the time section, required the application of a de-spiking algorithm to all shots. This is common practice and proved efficient. The final processed data were saved in standard SEG-Y format, with the trace relative position expressed as shop-peg in position 17-20 in the 240 bytes trace.

Processing was extremely beneficial to the quality of the seismic sections. The raw data are dominated by a very high frequency content that masks some useful signal indicative of geological reflectors. Although the processed data did not show better penetration, the overall resolution, coherence and clarity of the seismic profiles vastly improved after processing, as can be seen in the Figure 21.

On some profiles, the processing resolved seismic horizons below the primary multiple. The first 5-8ms immediately below the sea floor are often masked by the seismic-source signature, evident as a very-high amplitude and low frequency sea-bottom reflector. A ghost reflection also occurred within the first 10m.

Penetration (resolution at depth) and resolution of geological reflectors is usually very good down to the primary sea floor multiple, i.e. approximately 40ms below sea floor for most lines (which equates to approximately 30-35m).

Typically, seismic resolution of coherent reflection is often masked by the apparition of the very strong primary sea floor multiple within the first 40ms below the sea bottom reflection, depending on the water depth. However, for the current survey some lines (107, 117, and 118) yielded better resolution below the primary multiple, which indicates that strong coherent reflectors immediately below the primary multiple can be resolved with the present acquisition/processing settings. Some of these deeper reflectors could be geologically useful.

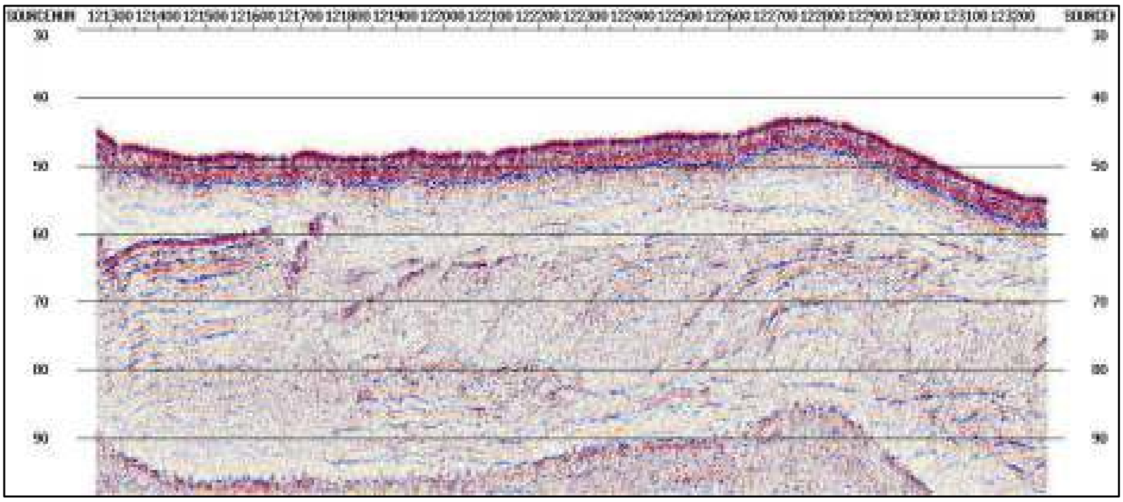


Figure 23 Processed Seismic Line Showing Sub-surface Infilling of a Paleochannel

4.4 Mineral Resource Estimation

Golder Associates Pty Ltd (Golder) was initially commissioned by TTR (TTR) to assist with the development of TTR's Taranaki VTM project in New Zealand in 2009. In 2010 an *in-situ* maiden resource of 1,040Mt at 8.40% Fe_2O_3 was defined. Since the in-situ maiden resource TTR has released five resource estimation updates, which reflected the ongoing drilling, advancements of the drilling technology and pilot plant processing and sample analysis used to define and update the mineral resource block model.

TTR's Taranaki VTM Project Mineral Resource Statement dated 1 March 2023is presented in Appendix 19.16 which details the latest updated mineral resource estimate and includes drilling results, QAQC and statistical analysis of the drill data reported. The main update to the original sample analysis and data set is the addition of Davis Tube Recovery results and concentrate assays for the proposed mining blocks.

Golder Associates undertook the independent analysis of TTRs drilling technology, sample collection and sample analysis procedures, to ensure that TTR can report in accordance with the JORC Code 2012. Golder provided practical experience in all aspects of ongoing design, planning of the TTR mineral exploration and mineral resource estimation, from which it was able to build its working resource block model.

4.4.1 Analytical Reporting

The TTR resource is a vanadiferous titanomagnetite ($Fe_{2.74}Ti_{0.24}V_{0.02}O_4$) iron sand deposit. Titanomagnetite is $Fe^{2+}(Fe^{3+},Ti)_2O_4$ pure magnetite is Fe_3O_4. The analysis process reduces all compounds to oxides and reports these. For head samples standard analyses return iron results as Fe_2O_3 (hematite), Fe is calculated from the stoichiometric ratios of Fe to O in the Fe_2O_3. For Davis Tube Concentrate sample analysis iron grades are reported as Fe.

TTR has estimated and reported the Fe_2O_3 content for the head grades and Fe for the DTC grades of the deposit based on the analytical results.

In historical documentation TTR have reported TiFe. The TiFe (Titanomagnetite) content of the deposit can be back calculated from the Fe_2O_3 content based on the assumptions and stoichiometric formula.

4.4.2 Site Visits

Representatives from Golder Associates visited the TTR project from 28 to 31 January 2010 and in July 2011. The purpose of the visits was to review the project status, drilling technology and sample recovery, audit the analytical laboratory and review the pilot plant operation.

In 2012 Stephen Godfrey and James Farrell (Associate, Senior Geologist) visited the TTR Wellington office and Porirua warehouse from 24 to 27 July.

4.4.3 Drilling

TTR has undertaken a number of offshore sampling programs using the services of New Zealand Diving and Salvage (NZDS). The programs have included sediment grab sampling, resource drilling (using the 5, 9 and 11m drilling rigs), bulk sampling and geotechnical drilling. Preliminary investigation commonly involved lowering a magnet to the sea floor to identify the presence of magnetic minerals. Within the Permit areas the return of magnetic sands from this process is almost ubiquitous. These grab samples, however, are non-representative of the deposit and so they have not been used in any analyses or estimations.

In partnership with NZDS, TTR developed a drill sampling system capable of sampling the first 5 to 6 metres of the seabed. The initial drill rig was diver operated on the sea floor. The drilling employs a passive triple tube reverse circulation system. In December 2010 the system was upgraded enabling it to be hydraulically controlled from the surface with diver support if necessary. In September 2011 the system was further upgraded and can now drill to a maximum depth of 9 metres, and in 2014 extending drill capabilities to 11 metres. The drilling rig is transported to the drill site by service vessel and lowered to the sea floor.

The original system was diver operated and restricted to operating in less than 25m of water. Below this depth decompression is required for the diver to return to the surface. The service vessels do not carry decompression chambers. The upgraded system can operate in deeper water, with the deepest hole to date at 65m water depth.

The original diver supported 6m system was used to drill the first 148 holes. A further 364 holes have been drilled with the diver-less system. The remaining drill holes in 2011 were drilled with the upgraded 9m system.

In 2012 a new rig was developed and deployed with the ability to drill up to 42m. This rig is diver operated on the sea floor. The rig uses a similar system to a land-based RC drilling rig carrying six removable drill rods in a carousel. Six holes have been drilled with this system.

The drill rig and divers are connected to the service vessel by umbilical. The drill rig compressor and pump are on the service vessel and all samples are returned by bull hose to a cyclone on the deck. The system includes full video contact between the sea floor rig and the boat. Divers also have video and audio contact with the surface crew. Drilling is monitored by a drill supervisor on the service vessel.

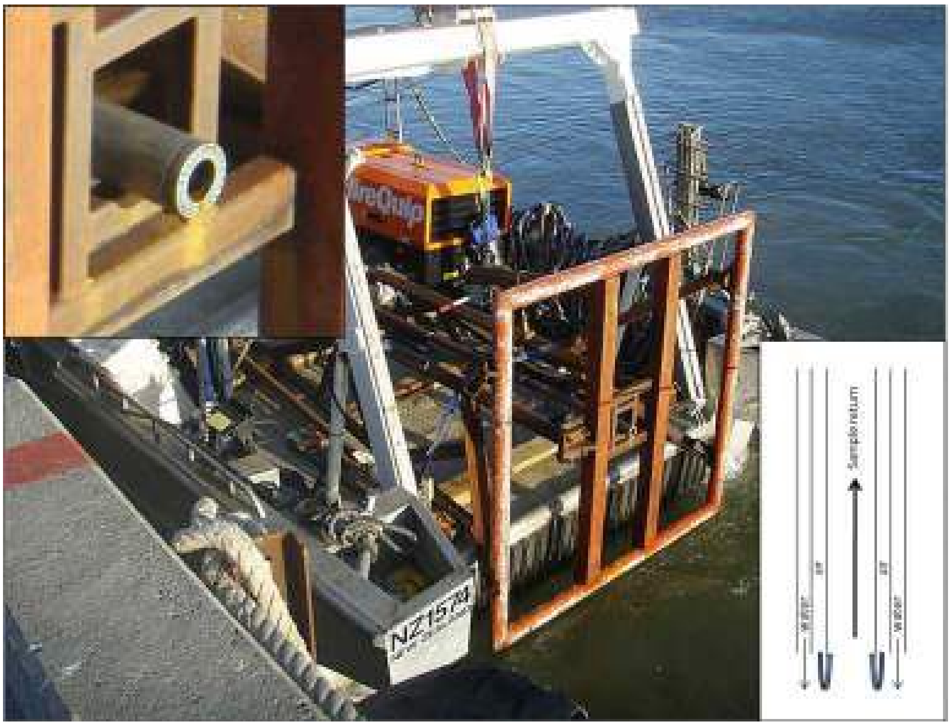


Figure 24 Drill Rig on The Shoman. Inset - Bit Detail and Circulation Diagram

Figure 25 Cyclone and Sample Collection

The complete drilling and sampling system has been constructed by NZDS. In order to ensure the effectiveness of the drill system and the veracity of the samples, in 2010 a Golder representative spent a day on the service vessel the *Shoman* and observed the drilling of three holes in the Graham Banks area.

The drill system uses a 75.75mm OD bit and 75mm OD pipe (approximately NQ). The drill used a single rod with a 6m stroke. On the sea floor the diver releases the drill rod which penetrates under its own weight with most of the work being done by the hydraulic cutting action of the bit. Water is pumped down the outer tube and air down the inner tube with angled jets creating both a cutting and venturi-type effect to raise the sample. Drilling through sand is quite smooth and effective. If the drill encounters shell beds penetration may be physically stopped. Originally, a blast of air was used to get through shell beds however, this resulted in abnormally large samples as the blast created a cavity which then collapsed.

Golder advised that these air blast samples should be flagged in the database and not used for any resource analysis work. The system later employed a hand operated winch and now uses a hydraulic system to exert down force on the drill rod to assist in penetrating shell beds.

The returned samples were collected from the base of a cyclonic separator. The size of the samples is normally consistent with the size of hole being drilled. When the downward progress of the drill is stopped the system returns clean water to the cyclone indicating there is no contamination from material inflow and that the drill is returning only material from the drill hole.

The drill system will have some issues with larger particles not returning in the system as there is no cutting bit to break them up. These larger particles make up a very small proportion of the material being sampled and should not have a significant impact on the resource. The envisaged dredging/processing system that would mine a deposit like this would screen out anything larger than 2 mm, so any contained mineralisation has no material impact on the resource.

The Spectrachem laboratory was visited in 2010 and 2012. The sample processing and analysis system was inspected during both visits, with the 2012 visit focusing on the DTR samples. In both instances the laboratory was observed by Golder to be performing as expected.

Figure 26 Mobilisation of the Deep Drill Rig

4.4.4 Sampling

Samples are bagged, labelled clearly and stored on deck until the return to harbour. A preliminary log of the samples is made while at sea and a magnetic susceptibility reading taken.

All samples are temporarily stored in Wanganui Port before being transported to the TTR Porirua warehouse. At the warehouse the samples are dried and split into eight. One split is sent for chemical analysis and another for geological logging. A field magnetic susceptibility reading is taken from chemical analysis sample. The remaining splits are re- bagged and stored.

Chemical analysis (head sample) is sent to Spectrachem for XRF analysis and returns the analysed suite to TTR. For the 2010-2011 drilling the drill samples were logged by the National Institute of Water and Atmospheric Research (NIWA). Subsequently, all drill samples have been logged by TTR geologists.

The laboratory screens the sample to remove all material greater than 2mm in diameter and records the percent recovery. This material is predominantly shells and pebbles and is regarded as barren. The laboratory analysis is performed on the sub-2 mm material. The final model results need to take this into account. The model estimates the full volume and tonnes of the deposit so the estimated grades need to be diluted by the recovery.

In 2012 selected samples were sent for Davis Tube Recovery (DTR) Analysis. The selected samples were from existing and any new drill holes in the proposed mining area. DTR analysis determines the magnetically recoverable portion of the sample by passing the sample through a high intensity magnetic field. The recovery is sensitive to the equipment set-up including particle size and magnetic intensity. The overall set-up is designed to emulate the eventual processing plant recovery but is at a laboratory scale. Some scale up factor may eventually be required in estimating an ore reserve. The recovered magnetic concentrate undergoes XRF analysis and returns the analyte suite as listed in the resource estimation tables. Note that the concentrate iron analysis returns Fe and the head analysis Fe_2O_3.

Figure 27 Davis Tube Device

4.4.5 Pilot Plant

As part of the resource validation process the metallurgical pilot plant was observed operating during Golder's 2012 site visit. The pilot plant, a scaled down version of the anticipated final processing plant, was located at the TTR Porirua warehouse. Multiple bulk samples have been collected from the proposed mining area for the pilot plant testwork. The samples were obtained using the exploration drill rig. The pilot plant screens the sample at +20mm then +2mm with the sub-2mm fraction going through a first pass Medium Intensity Magnetic Separation (MIMS) and Low Intensity Magnetic Separation (LIMS).

The recovered concentrate is ground by ball mill to 53µm (P80) and run through LIMS three times producing a final concentrate. JORC Code 2012 in defining a Mineral Resource requires that "there are reasonable prospects for eventual economic extraction". The successful production of concentrate by the TTR pilot plant demonstrates that it is possible to recover titanomagnetite from the TTR South Taranaki Bight iron sand deposits.

Golder was provided with comprehensive GIS data set and the geological drill hole database. Topographic and bathymetric data was extracted from the GIS data set along with miscellaneous geographical information, e.g. coastlines, rivers and place names. The GIS data set also included magnetic geophysical imagery. TTR also provided documentation for their drilling, sampling and database procedures.

4.4.6 Drilling for Mineral Resource Estimation

On 1 March 2023, TTR updated its mineral resource statement and released it to the ASX including a maiden vanadium resource. The updated resource estimated was based 689 drill holes, with the analysis of 4,237 head samples, 1716 Davis Tube Recovery (DTR) and Davis Tube Concentrate (DTC) analysis. The diagram below illustrates the locations of the drill holes used in the resource estimate.

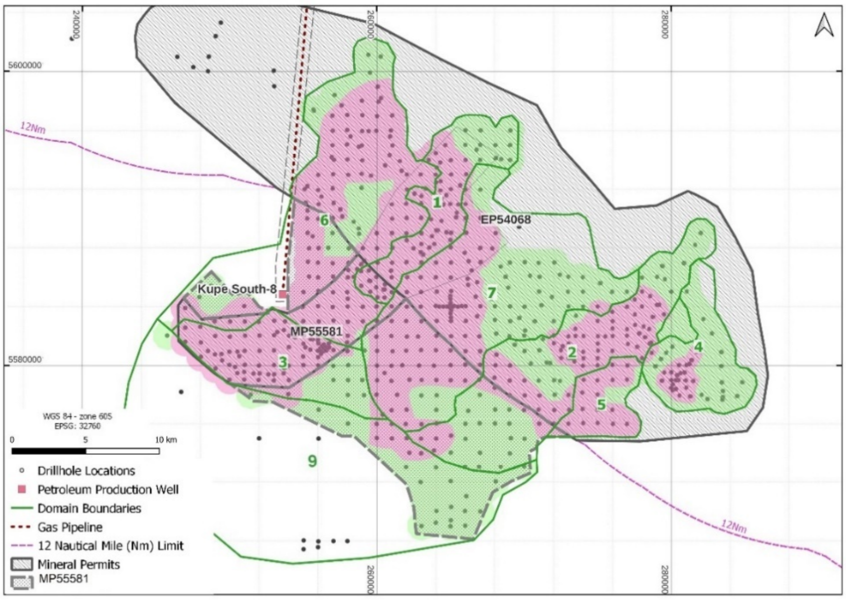


Figure 28 Drilling Locations - TTRs VTM Iron Sand Deposit

The 2023 resource estimate updated the naming convention for the TTR resource in the South Taranaki Bight. This was to reflect the updated mining permit area and reflect the boundary of the identified resource. Figure 26 shows Inferred (green area) and Indicate (pink area) resources.

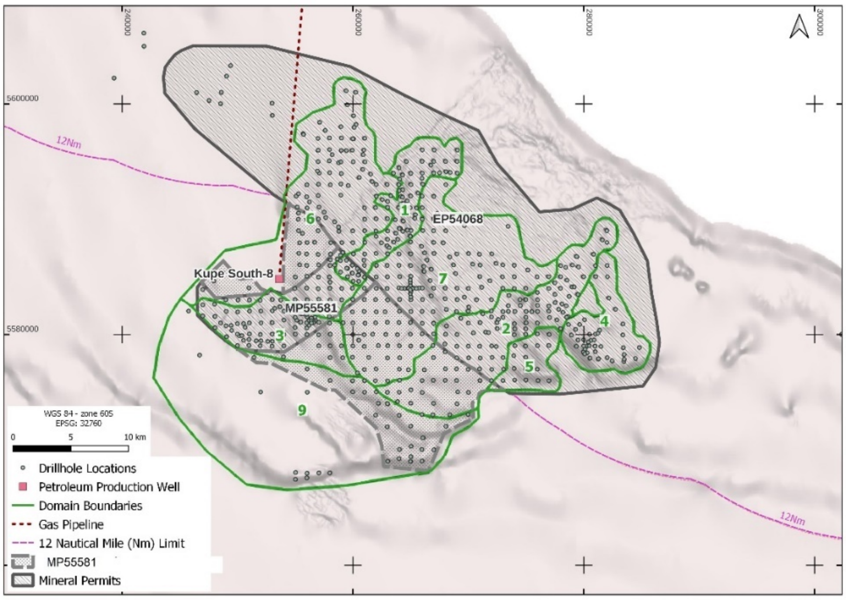


Figure 29 Domains Used in the 2023 Resource Estimation

Area	Drill Holes	Head Samples	DTR Samples
Cook North	121	1100	1000
Cook South	90	450	256
Kupe North	58	342	228
Kupe South	19	170	155
Tasman North and South	401	2175	77
Total	**689**	**4237**	**1716**

Table 5 Overview of the Drilling Used in the Mineral Resource Estimation Model

4.4.7 Density

Mineral Resource and Ore Reserves, although typically stated in terms of grade and tonnage, are estimated in terms of three parameters: grade, volume and density. Tonnes are the product of volume and density so for good estimation of the resource tonnes a reliable density value must be used for the deposit being evaluated. For a resource estimate the *in situ* dry bulk density is required to estimate the *in-situ* tonnage of the deposit. A detailed analysis of the available density data was undertaken previously by Golder in 2010. From this work the *in-situ* bulk density was defined using the Fe regression developed from the calculated theoretical bulk density corrected for measured results. The dry bulk density is calculated by the formula $((Fe_2O_3 *0.6994)+81.191)/51.064$ where Fe_2O_3 is 69.94% Fe.

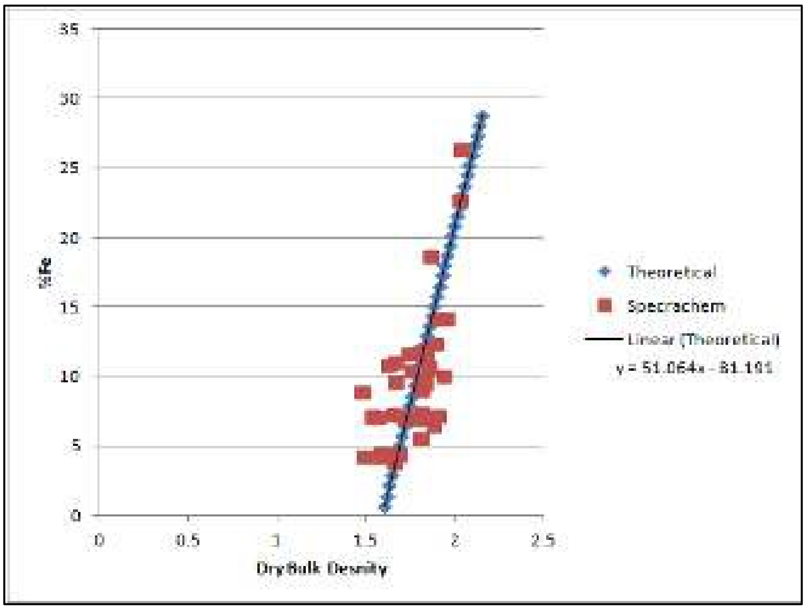


Figure 30 Dry Bulk Density Regression Against Fe

With consideration of the potential compaction of the sand and minerals other than quartz making up the non-magnetic portion of the sand Golder considers these bulk densities are likely to be slightly conservative. At the time of the PFS write up a review of the *in-situ* bulk density was undertaken. TTR believes that the *in-situ* bulk density used to estimate the mineral resource has potentially underestimated the bulk density by approximately 8% to 10%. This updated assumption on density will be assessed and if ascertained will be corrected and reported as part of the company completing the BFS and releasing a new JORC compliant Resource Statement and Ore Reserve.

4.4.8 Metallurgical Recovery

In the mineral sand industry, the mineralogy and quality can be secondary considerations to the recoverable percentage of heavy mineral. Magnetite and mineral sand deposits are commonly reported with a recovery. For deposits containing magnetically recoverable minerals DTR analysis provides this information. The recent DTR analysis by TTR now provides recoverable resource figures for the proposed mining area. The TTR pilot plant work provided plant recovery and efficiency figures.

4.5 Mineralisation

Iron sand deposits of New Zealand are comprised principally of silica sand with minor dark green clinopyroxene, black orthopyroxenes, hornblende and titanomagnetite (Orpin, 2010). In addition to the sands the samples commonly contain up to 15% shells and pebbles. Work to date has indicated that the only magnetic mineral present is titanomagnetite.

The mineralogy and chemical analysis suggest that most of the Fe content of the sands is in the vanadiferous titanomagnetite ($Fe_{2.74}Ti_{0.24}V_{0.02}O_4$). Plotting the FeO:Fe_2O_3:TiO_2 ratios identifies the mineral species as a titanium enriched magnetite.

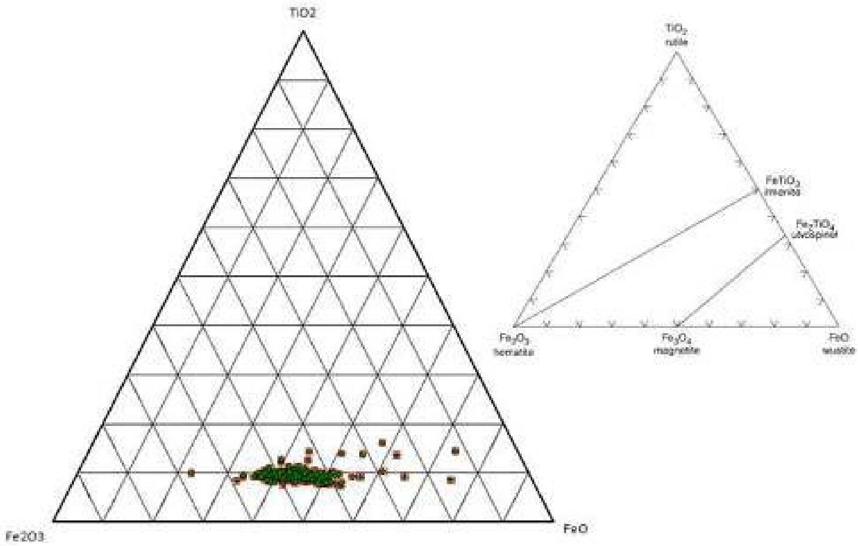


Figure 31 Fe_2O_3-FeO-TiO_2 Ternary Plot

4.5.1 Geological Model

The original geological model used to target drilling assumed higher grade VTM material would be intersected where the geophysics showed a higher magnetic response.

Statistical and visual analysis of the drill hole sample data showed that the samples were relatively consistent across most locations with only a small high-grade population. This conflicted with the anticipated result of getting higher Fe grade samples where the geophysical survey showed higher anomalous magnetic responses.

The geological model was revised to include a layer of overburden covering magnetic the features being observed in the geophysical survey imagery. A blanket of reworked sands explains the relatively consistent results from the shallow drilling.

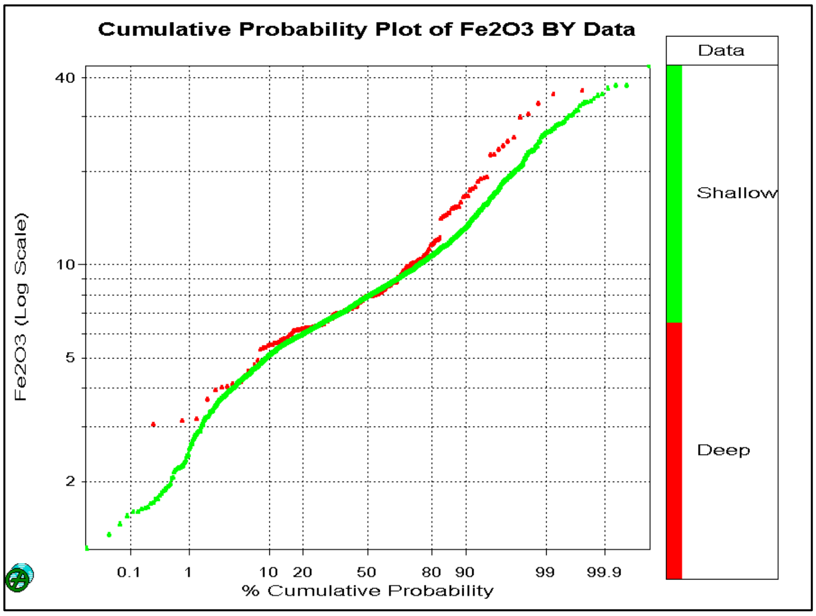


Figure 32 Fe_2O_3 - All Drill Holes

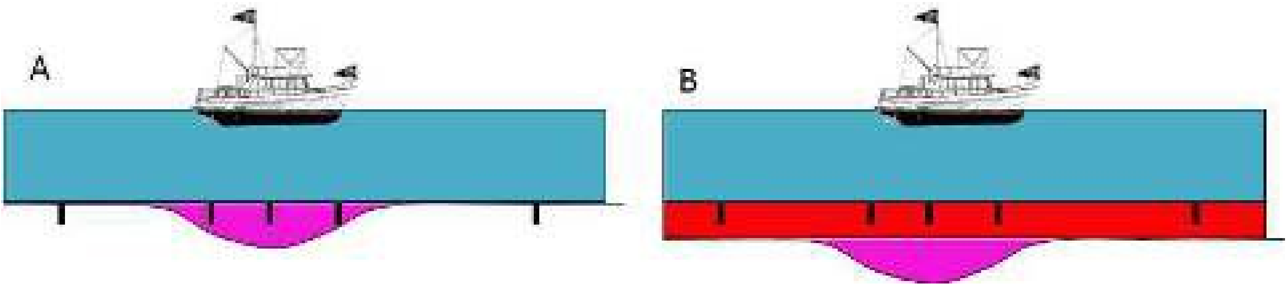


Figure 33 Geological Model

Statistical analysis also showed that the total population had an average grade in excess of that defined by TTR as the minimum grade required by the preliminary business model. This being the case a resource model was constructed to determine quantitatively the potential of the 'overburden'.

The deep drilling has shown the sands to be up to 30m thick, however, the limited dataset does not assist with the geological modelling.

4.5.2 Domains

The geological model has defined an overburden layer of sand which is different to the underlying geomorphological features. However, these overburden sands are reworked from the material making up these underlying features. Based on this, a series of broad domains were defined over the area sampled by the drilling. These are illustrated below. The old river channels are defined as fluvial zones, Graham Banks is defined as dunes and the linear features further offshore in Domain 9 are interpreted as slumps. The remaining northern areas are defined as deltas and Koitiata as paleo beaches.

The domains were further refined to limit the extent of the influence of any particular drill hole to approximately 1,000m horizontally. This was done in order to stop an unreasonable volume of material receiving an estimated grade in the block model. The 1,000m extrapolation is based on the drill spacing of 2,000m required for an Inferred Resource in this deposit.

The cumulative log probability plots for domains in Area 2 (the larger red box, in Figure 33) in the deposit and shows that there are statistical differences between the domains supporting the approach taken. Koitiata (Domain 8) is a single geographically separated from the Area 2 domains.

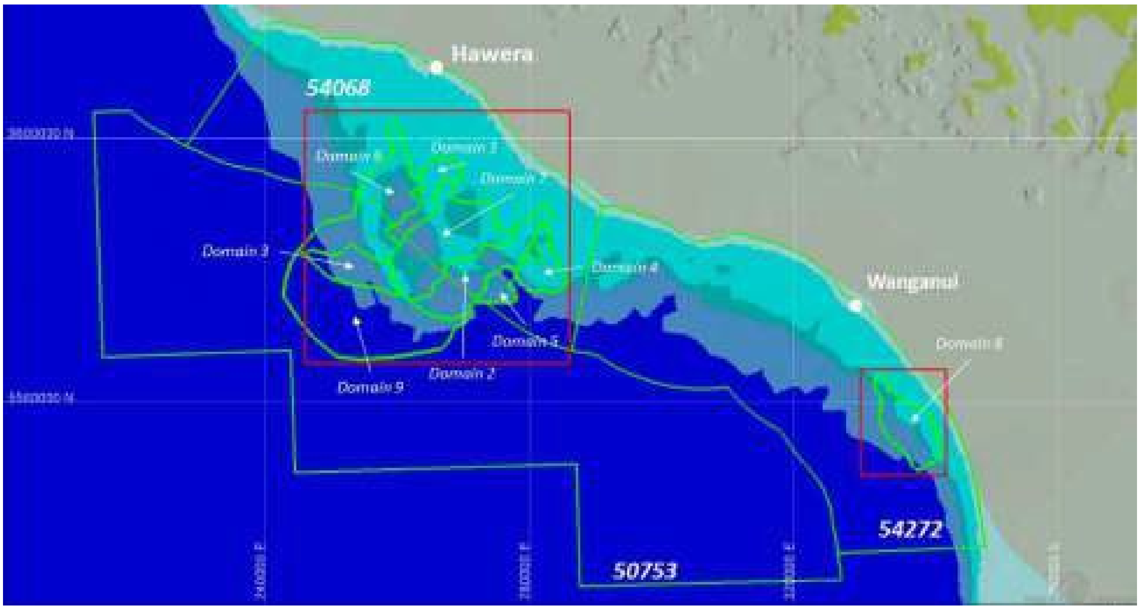


Figure 34 Resource Domains Defined by Golder Associates

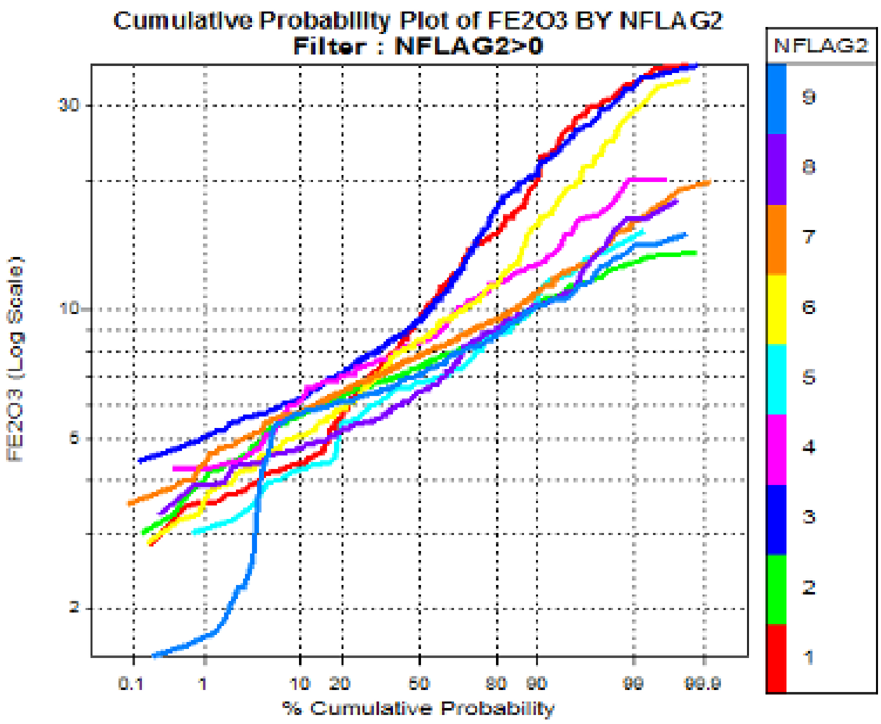


Figure 35 Cumulative Probability for Fe_2O_3 by Resource Domains

In addition to the geomorphological (spatial) domains, a mineralised zone was applied where all samples greater than or equal to 4% Fe_2O_3 were included in the mineralised zone. The break in the population at 4% can be seen in the above graph. To define the lower boundary of the mineralisation an intersection selection method was used to generate composites of the drill hole sample database using a 4% target with a maximum of 2m internal waste. As the proposed mining method of dredging will not be removing waste separately, overburden was blended into the selection. Multiple intersections were manually assessed to determine where to define the base of mineralisation by either incorporating the subgrade material or raising the base of mineralisation.

4.5.3 Resource Estimation

The TTR VTM offshore iron sand resource estimates are reported in accordance with the Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves (JORC, 2012). The latest 2023 mineral resource estimate was prepared by employees of Siecap NZ Ltd and Trans-Tasman Resources. The 2015 (updated by TTR and Golders) and 2023 resource estimation used MicroMine software, using the Golder Associates parameters for the basis of the modelling, i.e. base of mineralization, domains and cutoff grades.

The most significant difference between the previous models and reporting and 2023 models is the reporting of the vanadium and titanium resource estimates, the area extension of land for Mineral Mining Permit MMP55581 and the delineation and reporting of the Cook, Kupe and Tasman VTM deposits separately for each of the North Blocks inside the 12Nm limit within

Mineral Exploration Permit MEP54068 (RMA approval area) and the South Blocks outside the 12Nm limit within Mineral Mining Permit MMP55581 (EEZ approval area). The March 2023 Mineral Resource Statement is presented in Appendix 19.16.

The resource estimates were classified in accordance with JORC Code 2012 as Indicated and Inferred based on drill holes available as of 2015. The Indicated and Inferred mineral resources for the Cook, Kupe and Tasman north and south blocks are presented in Table 5.

Taranaki VTM Resource Classification						
	Indicated and Inferred Mineral Resources					
VTM Deposit	Cut-Off Grade	Mt Ind	Mt Inf	Mt Total	% Ind	% Inf
Cook North Block	3.5% DTR*	225.9	48.3	274.2	82%	18%
Cook South Block	3.5% DTR*	864.9	49.6	914.4	95%	5%
Kupe North Block	3.5% DTR*	134.4	282.3	416.7	32%	68%
Kupe South Block	3.5% DTR*	238.2	33.6	271.8	88%	12%
Tasman North Block	7.5% Fe_2O_3	294.9	289.6	584.5	50%	50%
Tasman South Block	7.5% Fe_2O_3	315.0	380.1	695.1	45%	55%
Total VTM Resource		**2,073**	**1,083**	**3,157**	66%	34%
Cook	3.5% DTR*	1,090.7	97.8	1,188.6	92%	8%
Kupe	3.5% DTR*	372.6	315.9	688.5	54%	46%
Tasman	7.5% Fe_2O_3	609.9	669.6	1,279.6	48%	52%
Taranaki VTM Resource Total		**2,073**	**1,083**	**3,157**	**66%**	**34%**

Table 6 Taranaki VTM Project Reported Indicated and Inferred Mineral Resources 2023

The JORC classification of Indicated and Inferred resource categories for the reported 1.881Bt VTM resource for the Cook, Kupe and Tasman South Blocks, outside the 12Nm limit within MMP55581, are presented in Section 3.5, Table 2. The 1.881Bt resource comprises 1,418Mt, or 75%, Indicated and 463Mt, or 25%, Inferred resource categories. The physical recovery has been applied to the models. Head grades and tonnages are for all materials less than 2mm in diameter. Concentrate grades are for the magnetically recoverable portion of the sample. Concentrate tonnage is calculated from the head tonnage and DTR.

The resource model has been reported at a 3.5% DTR cut-off grade where DTR analyses are available within the identified resource block areas. Outside this area a cut-off grade of 7.5% Fe_2O_3 has been used based on the statistical relationship between Fe_2O_3 and DTR.

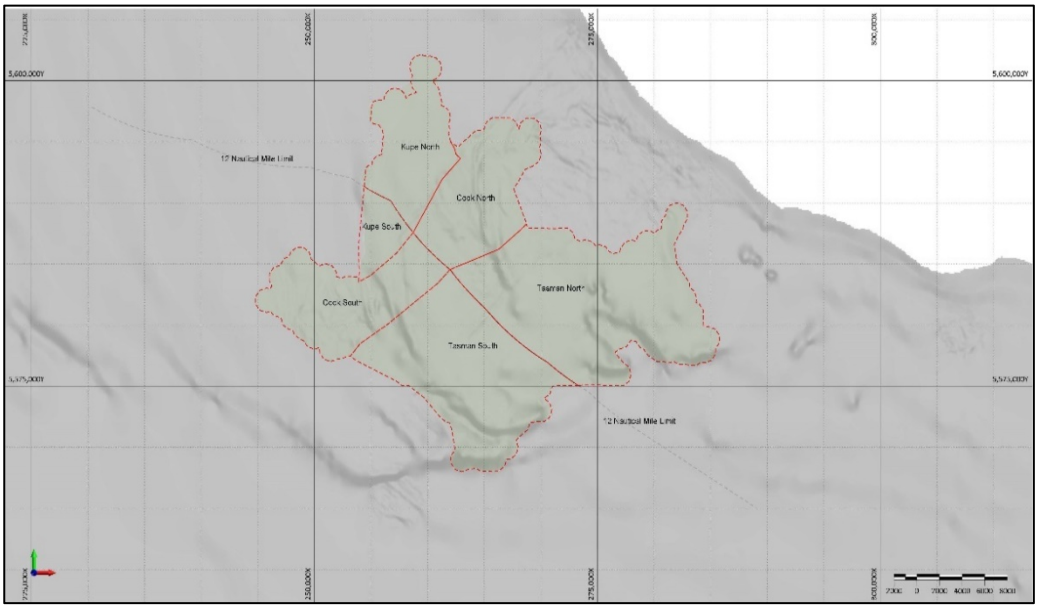


Figure 36 TTR 2023 - Mineral Resource Blocks

Taranaki VTM Resource Estimates Summary									
	Indicated and Inferred Mineral Resources					DTR Concentrate			
MEP54068 Inside 12Nm (RMA)	**Cut-Off Grade**	**Mt**	**Fe_2O_3%**	**TiO_2%**	**V_2O_5%**	**Mt**	**Fe%**	**TiO_2%**	**V_2O_5%**
Cook North Block	3.5% DTR*	274	11.90	1.19	0.06	21	57.19	8.12	0.52
Kupe North Block	3.5% DTR*	417	11.48	1.21	0.06	31	57.07	8.35	0.51
Tasman North Block	7.5% Fe_2O_3	585	9.02	0.88	0.04				
Total VTM Resource (RMA)		**1,275**	**10.44**	**1.05**	**0.05**				
MMP55581 Outside 12Nm (EEZ)									
Cook South Block	3.5% DTR*	914	10.95	1.12	0.05	63	55.84	8.45	0.50
Kupe South Block	3.5% DTR*	272	9.76	0.98	0.05	16	56.33	8.43	0.50
Tasman South Block	7.5% Fe_2O_3	695	8.81	0.89	0.04				
Total VTM Resource (EEZ)		**1,881**	**9.99**	**1.01**	**0.05**				
Taranaki VTM Resource Total		**3,157**	**10.17**	**1.03**	**0.05**				

Table 7 Reported Mineral Resource and Concentrate Tonnage and Grades

5 MINE PLAN

In 2014, Golder Associates conducted a high level mining scheduling review for TTR, which resulted in a maiden ore reserves statement, and has provided a basis for the PFS and ongoing mining evaluation of the TTR resource.

5.1 Updated Basis for Mine Planning

The 2014 mine plan study by Golders was confined to the resource defined under Mining Permit 55581 and Exploration Permit 54086. At the time of this study MMP55581 covered an area of 65.8 square kilometres, outside the 12Nm limit. In 2022, New Zealand Petroleum and Minerals granted TTR an extension of land, expanding MMP55581 to its current area of 242.57 square kilometres. Given this expansion, along with an increase in the mineral resource estimation (TTR, 2023) and updated modifying factors, the mine plan will need to be revised as part of the Bankable Feasibility Study (BFS). However, for the purpose of this Pre-Feasibility Study (PFS), the mining schedule relates to the originally granted area of MMP55581, and the modifying factors that were taken into consideration, at that time.

We do not expect any material change to any modifying factor when assessing the increased mining resource during the BFS phase.

5.2 SBC Mining Area

When delineating the mining area, several factors were taken into consideration:

- Fe head grade %;
- Bulk density;
- Davis Tube Recovery:
- Metallurgy;
- Depth of mineralization;
- Mining method;
- Water depth;
- Regulatory consideration;
- Meteorological and ocean conditions;
- Mining Permit area for MMP55581 (Note Mining Permit area and contained reported mineral resource has increased from the 2014 PFS);
- Tailings disposal, environmental effects; and
- Mine scheduling considerations.

5.3 Mine Blocks Overview

This section of the PFS evaluates two potential extraction methods:

1. Trailing Suction Hopper Dredge (TSHD).
2. Seabed Crawler (SBC) with an integrated mining vessel (IMV).

The report compares both methods, assessing their technical feasibility, mining efficiency, and suitability for offshore iron sand extraction. It ensures that the selected approach aligns with operational and environmental considerations. The findings confirmed that the VTM mineral resource can be converted to an Ore Reserve which the development of an extraction schedule.

The nature of the resource dictated how to effectively extract the iron sand resource, with TTR initially identifying two options that were considered technically feasible. The mining method options reviewed included a TSHD (Trailer Suction Hopper Dredge) or a sea floor crawler or SBC (Subsea Sediment Extraction Device), similar to that used offshore in Namibia for marine diamond mining. The methods have been reviewed and described within this study, but in terms of the effect the two mining methods have on the overall area and the mining blocks, this is considered minimal.

The mining blocks were defined by the resource block model with iron sand concentration varying in thickness from two to ten metres below the ocean floor. Two scenarios were considered when an external party provided the Ore Reserves Statement, one the TSHD option the other is the sea floor crawler.

In review of the two mining methods, the only major difference of the mining blocks is that of the orientation of the Christina Block. The orientation of the mining blocks takes into consideration prevailing environmental constraints such as current and wind direction.

For the dredging option, two large trailing suctions hopper dredges (TSHD) would extract the material from the sea floor to fill the hopper on the dredge. This material will then be transported to the Floating Production Storage and Offloading Vessel (IMV), where it will be processed. Based on current estimates, each dredge will have an annual throughput capacity of 30-35 Mtpa. The dredging option, with two dredges scheduled, indicates annual tonnage movements of 60-69 Mtpa of *in-situ* material with annual concentrate production of 3.7-7.4 Mtpa. The resources in the mining area are depleted in approximately 10 years.

For this PFS TTR has abandoned the dredging option and will develop the proven low environmental impact Seabed Crawler and integrated IMV production and processing option.

For the Seabed Crawler (SBC) option, the crawler will be located on the sea floor, connected to an IMV (Integrated Mining Vessel) via an umbilical delivery tube. A winching system and dynamic positioning system will be used to locate the IMV relative to the crawler which will be mining 300m × 300 m blocks to the base of the mineralisation, in a predetermined sequence. Based on current estimates, a remote crawler unit will have an annual throughput capacity of up to 50Mtpa of VTM ore.

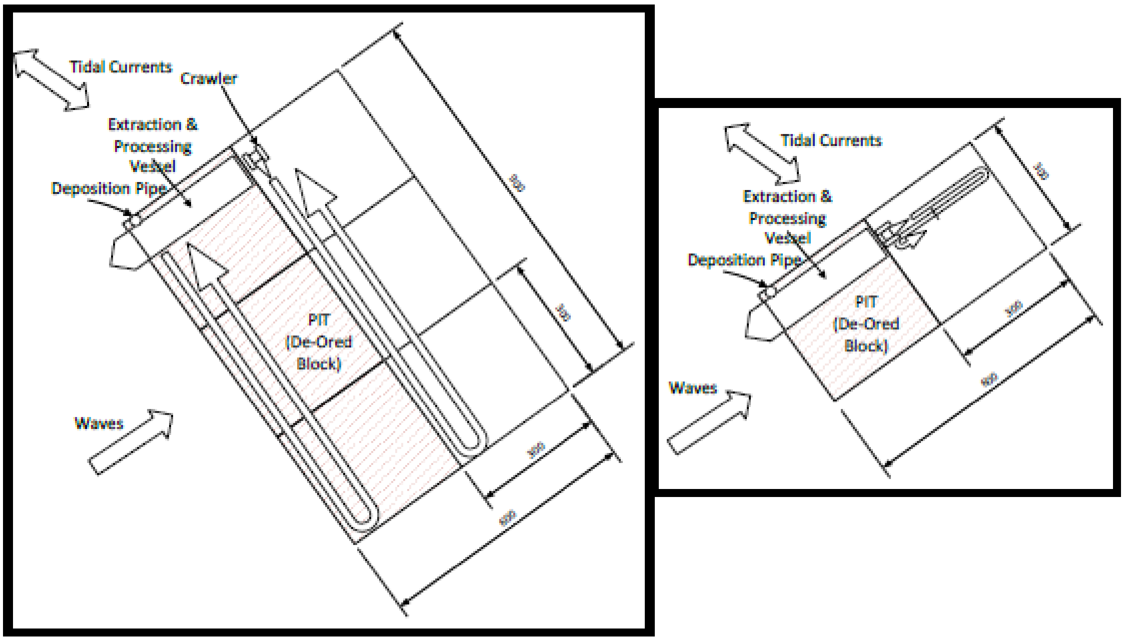


Figure 37 IMV and SBC Movements Over Mine Blocks

The SBC crawler option indicates annual tonnage movements of up to 50Mtpa of material with annual concentrate production of up to 5Mtpa. A ten-year mining schedule was originally developed; however, the updated 2023 Mineral Resource model highlights additional resources now available for mining by the crawler within MMP55581 for up to 20 years at the planned rate of extraction.

Concentration production in both scenarios varies with the feed grade and feed recovery factor. The IMV plant will be required to cope with these variations.

The extent of the resource within the mining area is shallow but widely dispersed. Areas between the higher-grade resources are retained within the mining area to ensure continuity between the areas for the purpose of maintaining this area as a single Mining Permit and potentially enabling lower grade sediment (below current cut-off grade) to be mined in the future.

5.4 Mine Plan - Schedule

The Golder Associates report was undertaken to develop a mining schedule over the defined mining area using the 2013 TTR resource block model. From this mining model, extraction schedules were generated, utilising assumptions (modifying factors) as well as key inputs to derive yearly run of mining and grades. Note these grades are based on DTR sampling.

Golder assessed the resource using two different mining methods, a trailing suction hopper dredge (TSHD) or a remote crawler system. The report had been used to determine the preferred mining method. Golder modelled the mineralised zone from two to ten metres below the ocean floor. For this scheduling study, the regularised block model has been “flattened” by adjusting the model block centers to equate to the depth of the block centre below the ocean floor.

5.5 Dredging

To minimise the dredging of the lower grade Fe material, higher grade areas in the proposed mining area were defined to target an average plant head-feed grade of 10 to 11% Fe. This higher cutoff grade is based on the previous financial model and now with the metallurgical upgrade of obtaining vanadium, and potentially titanium, credits this mine plan will need to be updated and defined in the BFS.

5.6 SBC - Seabed Crawler Operation

For the remote seabed crawler (SBC) option, it is assumed that both of the waste fractions will be pumped from the IMV into the mined-out areas as part of the remote crawler and IMV operating sequence.

Initial information from De Beers Marine SA and Royal IHC from Rotterdam, designers, builders and operators of the SBC indicated that the integrated IMV system would potentially require a minimum operational of 20m depth of water.

Note that Golders analysis and the mine plan are based on employing existing technology. Subsequent TTR engineering studies identified the capacity to process up to 8,000tph with an annual throughput capacity of up to 50Mtpa, as discussed in Section 7, of this PFS.

5.7 Mining Blocks

For this study, a mining block model was created from the updated geological model. The SG field in the geological model is the calculated density of the -2 mm or plant head feed material. The +2 mm fraction was discarded and a recovery field recorded. For this study, the density of the +2 mm oversize material is assumed to be 1.5t/m^3. This mining model is a sub-blocked model with the same block model dimensions and variables as the resource block model.

5.8 Mining Model Regularisation

For this study, the mining model was regularised to a consistent block size of 250 m × 250 m × 1 m. Bench tonnages for the proposed mining areas were calculated by summing the blocks that have the block centroid within an area. Note Figure 36, below, shows the outline of these regularised blocks, which were constrained due to the Mining Permit boundary at the time of that study. Refer to Section 4.2 for an overview of the current TTR mineral tenements.

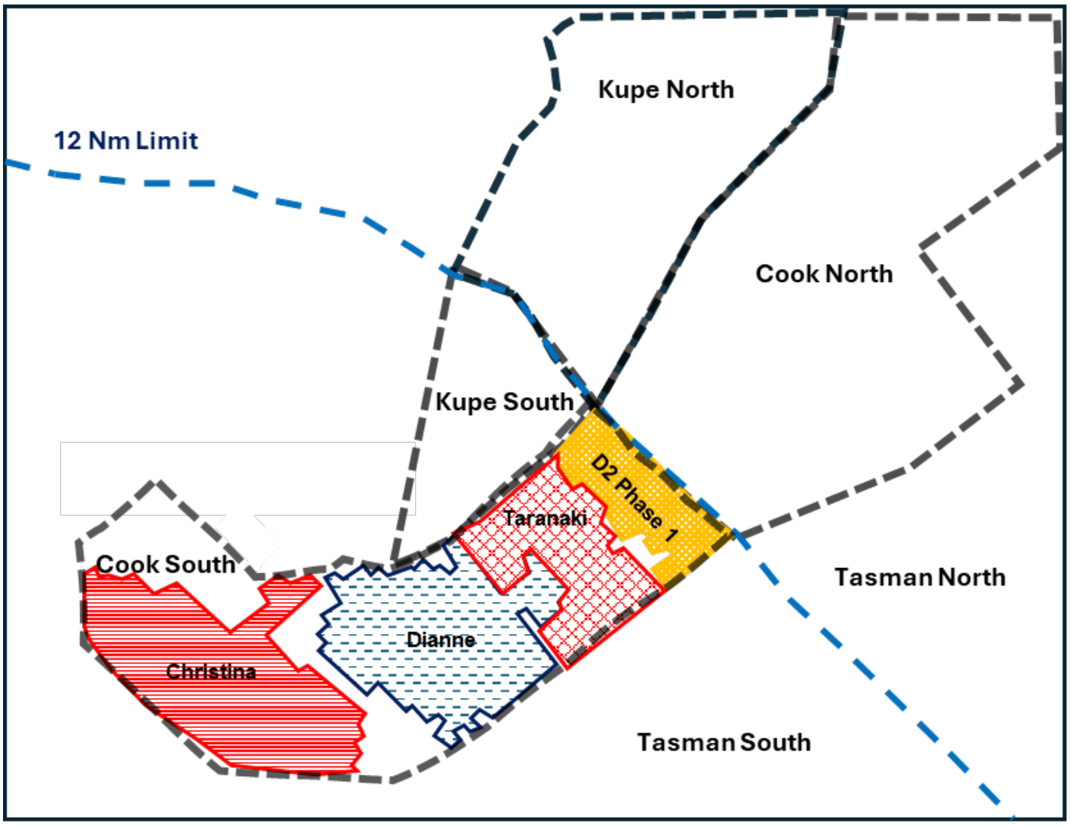


Figure 38 Defined Mining Areas and Mineral Resource Blocks MMP55581

5.9 The Effect of Model Regularisation

Regularising the model has reduced the total reported tonnages by 1.7% with only minimal changes to the modelled grades. These changes are considered to within acceptable limits.

5.10 Scheduling Block Model

It is assumed that the remote SBC crawler system will be used to mine the material below the gently sloping ocean floor.

For this scheduling study, the regularised block model has been “flattened” by adjusting the model block centers to equate to the depth of the block centre below the ocean floor.

A *depth* field was added to the mining model, and a java script (*rmg_block_depthbelsurf.java)* run to calculate the depth of the block centre below the ocean floor. The model blocks were exported to a csv file, manipulated by transferring the block *zcentre* field to a new field *b_centriod_z*. The *depth* field was then copied to the *zcentre* field. The modified csv file was imported into the scheduling model *north_acc_2013_250_flat.bmf.* This model has the same block dimensions and parameters as the regularised mining model.

This flattened scheduling model was used as the basis of the tonnages and grades for scheduling.

5.10.1 Grade and Tonnes Analysis

To define these higher-grade areas, a grade tonnage analysis of the blocks within the proposed mining area was done. The results, using DTR_Est grade as a cut-off are shown below.

DTR_Est	DTR_Est	Tonnes	Fe_2O_3	Fe
Cut-Off %	%	(Mt)	%	%
3	7.72	1103.6	11.81	8.26
4	8.51	928.6	12.61	8.82
5	9.65	723.4	13.69	9.57
6	10.84	563.7	14.81	10.36
7	11.76	465.9	15.66	10.95
8	12.73	380.2	16.54	11.57
9	13.48	323.1	17.27	12.08
10	14.38	263.9	18.09	12.65
11	15.33	211.9	19	13.29
12	16.45	164.3	20.07	14.04
13	17.5	130.1	20.96	14.66
14	18.31	108.3	21.72	15.19
15	19.4	84	22.71	15.88
16	20.64	63.6	23.67	16.55
17	21.56	52.1	24.62	17.22
18	22.17	45.3	25.16	17.6
19	23.14	35.5	25.97	18.16
20	24.06	28.6	27.01	18.89

Table 8 Grade Tonnage Report Based on DTR_Est Cut-Of

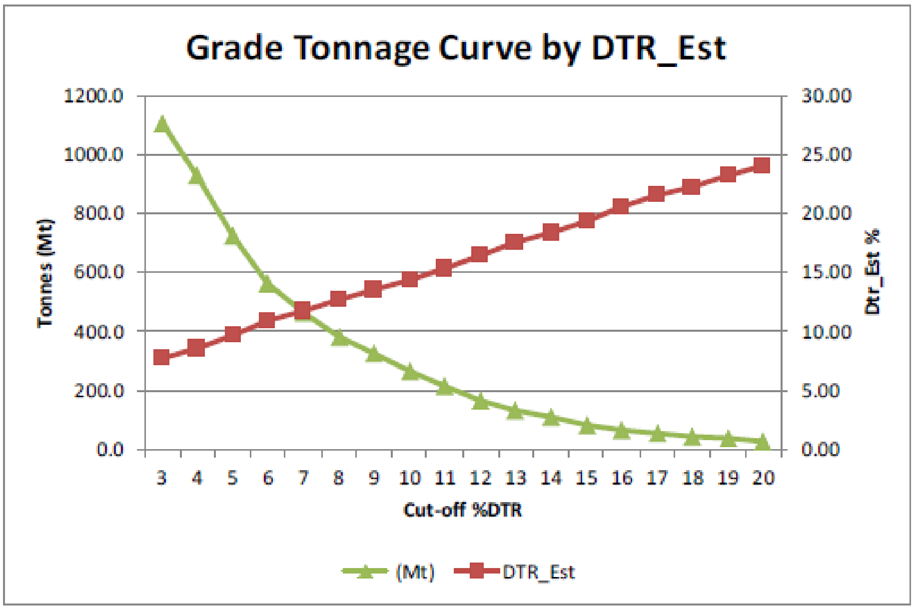


Figure 39 Grade Tonnage Curve - Based on DTR_Est%

This analysis indicates that a 7% DTR_Est grade cut-off would result in a plant head feed tonnage of 466Mt with an average grade of 10.95% Fe. However, it should be noted that the grade tonnage curve does show the best scenario as with any grade cut-off the curve assumes continuity of the concentration and every block is considered as equally available to be mined. That is why schedule planning was undertaken in this study to normalise the ROM grade and the tonnages expected within the mining blocks.

5.11 Integrated Mining Option (SBC and IMV)

For the integrated option, using a submerged seabed crawler, it is now proposed to have the SBC and the IMV both aligned along the SW - NE mining direction. The SBC will be located on the sea floor, connected to the IMV via an umbilical delivery tube. A winching system will be used to locate the IMV relative to the SBC which will be working 300m × 300m blocks in a predetermined sequence.

This alignment direction is parallel to the prevailing wind/wave direction (facing into the waves/wind) and perpendicular to the prevailing current direction.

5.12 Integrated Option (SBC) - Scheduling Blocks

The 7% DTR Est cut-off grade shell of the block model was used to define the blocks for the Crawler option. The dredging strip bench plans were utilised for D2 Phase 1, Taranaki, and Dianne but the Christina bench plans were rotated to align with the other areas and the prevailing wind/wave direction.

A bench height of one metre has been used but it is assumed that the crawler will operate at the base of the defined “ore body” and cut/dredge the full depth face (approximately 3 to 10 metres) during the scheduling sequence.

An *area2* field was added to the scheduling model north_acc_2013_250_flat.bmf. This field was coded with the area name and strip number.

5.13 SBC - Scheduling Parameters

Golder used the scheduling parameters for the SBC option which were provided by TTR following initial workshop discussions and meetings between TTR, Royal IHC (IHC) and DeBeers Marine SA the suppliers and operators of SBC type systems. Note these parameters were set at an early stage of the project feasibility, with subsequent analysis showing up to 50Mtpa as the mining extraction rate.

The original Golder scheduling assumptions were based on the 6,900tph crawler extraction rate. These assumptions, based on the updated SBC design, have now been upgraded to 8,000tph ore extraction rate:

1. Seabed Crawler throughput = 8,000tph
2. Annual operation hours = 6,326hrs
3. Calculated scheduling rate = 8,000tph × 6,326hrs pa = 50.0Mtpa.
4. Based on 72% SBC and IMV production utilisation rate and 28% downtime for servicing, weather events and breakdowns.

5.14 SBC Assumptions and Scheduling Parameters

For this scheduling scenario, it was assumed:

- TTR will utilise the SBC and IMV mineral extraction, processing and production technology SBC capable of achieving the above production rates after the initial ramp up period;
- The first 3 years are scheduled in six-month periods, then annual scheduling periods;
- Recovery of the sediment < 2 mm is based on the modelled field “rec”;
- Fe% = Fe_2O_3% × 0.6994;
- Mining recovery of *in situ* and feed tonnages = 100% (TTR request);
- Typical Process Recovery = 92%;
- Concentrate tonnage = Feed tonnage × DTR_EST% × Process Recovery;
- Indicated and Inferred resource classes have been used in the scheduling block tonnages and a Fe_2O_3 grade cut-off has not been applied;
- Each area is scheduled with strips being mined from the SE to the NW; and
- All areas can be accessed by the SBC crawler and IMV system.

5.15 High Level SBC Scheduling Results

The integrated SBC IMV scenario schedule assumes a ramp up period of six to twelve months with a single large plant.

A high level Mining Schedule based on the updated 2023 Mineral Resource estimation provides the basis for a 20 year mining life within MMP55581. The production average is based on producing 4.9M tonnes of concentrate per year with the averaged ROM and concentrate grade. The BFS will provide detailed scheduling on year by year basis, however the tables demonstrate that there is a mineral resource to establish a life of mine for at least 20 years.

The reducing rates in the final 3 to 4 years of the 20 year schedule will require further drilling to determine a DTR and DTC resource.

Table 9, shows that the overall mineral resource mining factor, required to min e for 20 years, with Table 10 shows the 20 life of mine resource availability.

Permit	Resource Block	Total Resource Mt	20 Year Minable Resource Mt	DTR Mt
MMMP55581	Cook South	914	686	63
	Kupe South	272	204	16
	Tasman South	695	146	**19***
	Total	**1,881**	**1,036**	**98**

Table 9 Summary: Available and Mineable Resources for 20 Year Mine Life

*Further drilling and DTR sampling are required to determine the Tasman Block DTR resource.

Year	ROM Mt	Resource Block	Resource Depletion Mt	Concentrate Mt	Ave DTC Fe % Concentrate Grade
1	50	Cook South	636	4.9	55.84
2	50	Cook South	586	4.9	55.84
3	50	Cook South	536	4.9	55.84
4	50	Cook South	486	4.9	55.84
5	50	Cook South	436	4.9	55.84
6	50	Cook South	386	4.9	55.84
7	50	Cook South	336	4.9	55.84
8	50	Cook South	286	4.9	55.84
9	50	Cook South	236	4.9	55.84
10	50	Cook South	186	4.9	55.84
11	50	Cook South	136	4.9	55.84
12	50	Cook South	86	4.9	55.84
13	50	Cook South/Kupe	240	4.9	55.90
14	50	Kupe	154	4.9	56.33
15	50	Kupe	104	4.9	56.33
16	50	Kupe	54	4.9	56.33
17	50	Kupe / Tasman	150	4.9	56.33
18	50	Tasman	100	4.9	TBC
19	50	Tasman	50	4.9	TBC
20	50	Tasman	0	4.9	TBC

Table 10 Twenty Year Mine Schedule. DTC = Davis Tube Concentrate

6 EXTRACTION METHODOLOGIES

Several extraction/mining methodologies have been assessed in both this and the previous versions of the PFS in order to evaluate the most practical and cost-effective solution given the stringent environmental conditions encountered in the proposed mining area as well as the large amount of sediment extracted from the seabed.

6.1 Seabed Crawler

The basis for this PFS concept is a mobile device with a submersible dredge pump and slewing boom configuration. The concept is based on many years of actual operational experience of the mining and dredge processes, and the designing of offshore mining/dredge systems, submerged pumps, dredge components and subsea tracked vehicles within the De Beers Marine SA group.

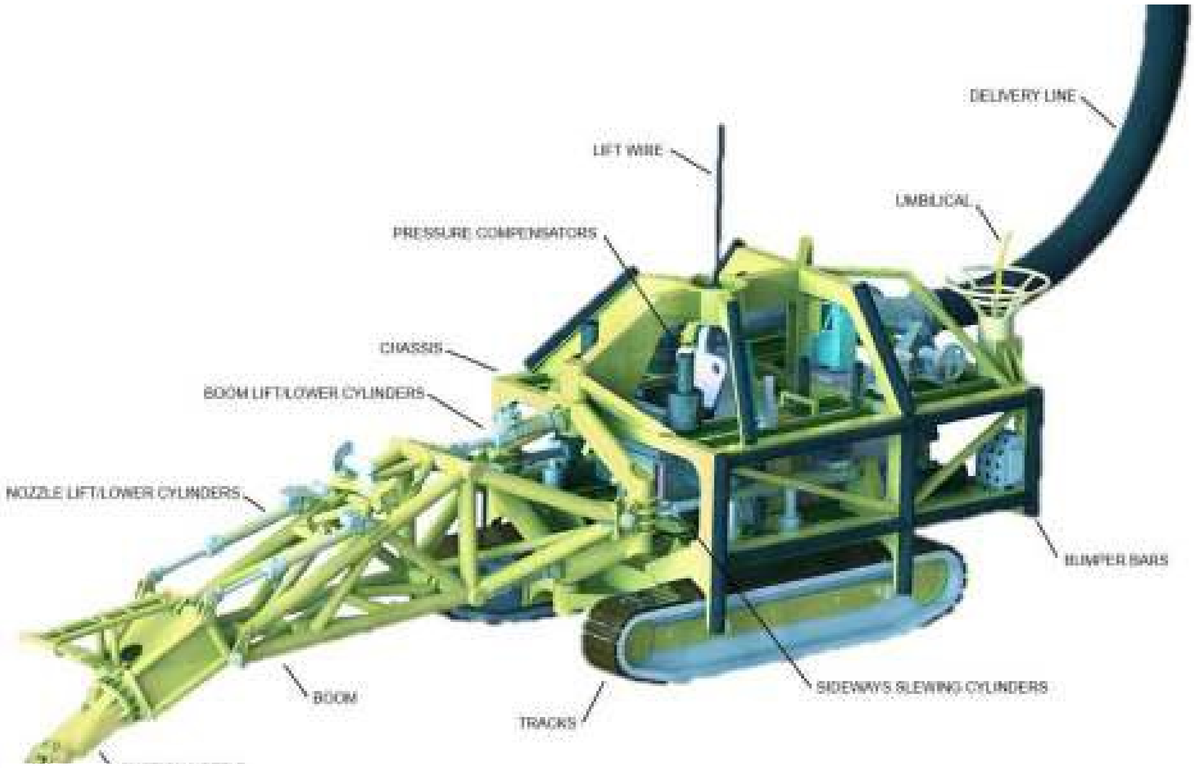


Figure 40 Seabed Crawler

After a rigorous selection process, TTR's concluded that the SBC or seabed crawler provided the best overall mining solution particularly because it facilitates an acceptable tailings management strategy.

The mining system has been defined at an 8,000 tonnes per hour nameplate capacity. The mining system consists of two crawlers, crawler launch and recovery system(s) (LARS), the electrical distribution system for the mining system, the mooring system and the de-ored sediment redeposition system. The weight of the crawler is currently estimated at 420 tonnes and will have a maximum rating of 70 metres water depth. The crawler will be fitted with a highly accurate acoustic seabed navigation and imaging system and will extract sediment by systematically advancing along a pre-determined 'lane'. The pump fitted on the crawler will allow the transport of the sediment slurry at a rate of 8,000 tonnes per hour resulting in a slurry velocity in the hose of around 6.5m/s. The suction velocities directly at the nozzle entry will typically be around 1.5 to 2m/s and will decrease rapidly as the distance increases from the nozzle face. The estimated intake velocities 1m away from the nozzle will be a maximum of 0.5m/s.

The crawler is designed for continuous operation with routine planned maintenance taking place once a week with at least one major maintenance shutdown biannually. Only one of the two crawlers will ever be in operation at any one time, conditions permitting.

The Launch and Recovery System (LARS) is the system that:

- Lifts the SBC off the Mining Vessel and lowers it onto the seabed during the launch phase; and then
- Lifts the SBC off the seabed and recovers it onto the IMV during the recovery phase. Refer to Section 9 of this document for detailed description of the IMV

During the operational scenario, the Seabed Crawler will be lowered onto the seabed and controlled remotely from the surface support vessel. The Seabed Crawler is fitted with highly accurate acoustic seabed navigation and imaging system, and extracts sediment by systematically advancing along a pre-determined 'lane'.

The SBC is the starting point of the extracted sediment slurry transport and comprises a suction head, pump system and a delivery line or STS. The suction head engages the seabed, fluidising the material and effecting the extraction. The slurry system is built up from standard and commonly used dredging equipment.

- Suction head Suction Line;
- Suction head (including jetwater nozzles if required);
- Pump System;
    - Dredge pump, and
    - Dredge pump electric motor.
- Slurry Transport System (STS).

6.1.1 SBC Slurry Transport System (STS)

The STS enables the transport of slurry from the SBC to the processing plant aboard the support vessel. The STS allows for quick deployment and retrieval as well as mining at variable mining depths.

The STS consists of the following components:

- The coupling between the sea floor mining tool and the first riser segment;
- A riser hose string consisting of individual riser hose segments; and
- A coupling between the riser and the plant connection.

The riser hose string consists of riser hose sections, with integrated floatation as required, and be stored on board the vessel through the use of a riser train handling system. The riser train consists of framed rollers, allowing the riser string to be stored on the vessel. The riser train includes several riser tensioners, used to launch and recover the riser string. The hose connects to the plant through the use of a ball joint connection, allowing for simple connection and disconnection during operations.

Figure 41 Riser Hose Handling

6.2 Sediment Breaching Test

In November 2013 MTI Holland B.V undertook breach testing of bulk samples taken from the TTR VTM project area. The testing was undertaken to evaluate the breaching behavior of iron sand sediment under different soil conditions. The study aimed to support the development of a crawler-based mining system by assessing breaching production under natural and active conditions, with and without water jets. Tests were conducted on both loose and dense iron sand of varying grades using a controlled tank setup. Key parameters measured included head wall velocity, porosity, permeability, and suction pipe velocity. The results showed that breaching production was highly dependent on porosity, with increased suction pipe velocity leading to slope instability and spillage. However, water jets improved breaching efficiency and stability. Additionally, a loose top layer accelerated the breaching process through an avalanche-like erosion effect, which was not yet included in theoretical models.

The study found discrepancies between theoretical predictions and experimental results, requiring correction factors in production calculations. Spillage was identified as a key challenge, with increased production speeds leading to material buildup behind the suction pipe, potentially obstructing operations. The report recommended further field characterization to refine porosity estimates, investigating erosion at greater breach heights (above 5 meters), and developing strategies to manage spillage. The findings from this testing provided crucial insights for optimising breaching production and improving the design of a crawler-based mining system.

Figure 42 Breach Tank Used in Testing Seabed Sediment

7 PROCESS PLANT

7.1 Metallurgy

7.1.1 Testwork Overview

The metallurgical testwork was conducted in three phases:

- Stage 1 – Preliminary testwork
- Stage 2 – Pilot plant testwork
- Stage 3 – Vanadium recovery testwork

The purpose of the testwork in stages 1 and 2 was to investigate the viability of upgrading the ore via conventional mineral sands and/or magnetite processing and to determine the base parameters required for the design of the process flow sheet. The ultimate objective of the testwork was to design a process flow sheet that is capable of producing a saleable iron ore concentrate whilst maximising recovery of the valuable component in the ore.

This testwork focused on gravity separation as is commonly practiced at mineral and iron sands operations. This testwork was largely unsuccessful and steered the process flow sheet design towards conventional magnetite processing based on magnetic separation. This report will focus on the testwork conducted on the pilot plant.

In 2023 TTR commenced stage 3 testwork and commissioned metallurgical testwork into advanced mineral processing techniques to optimise the extraction and separation of vanadium from New Zealand sourced vanadiferous-titanomagnetite (VTM) iron sands concentrate.

Testwork conducted by the University of Canterbury and Callaghan Innovation confirmed the viability of sodium salt roasting-water leaching process for the sustainable recovery of vanadium from the TTR VTM concentrate. The sodium salt – water leaching process not only achieved high recovery rates of vanadium (77% to 79%) but also exemplified a model that balanced economic viability with environmental stewardship. This dual focus ensured that vanadium extraction aligned with TTR's sustainable development goals.

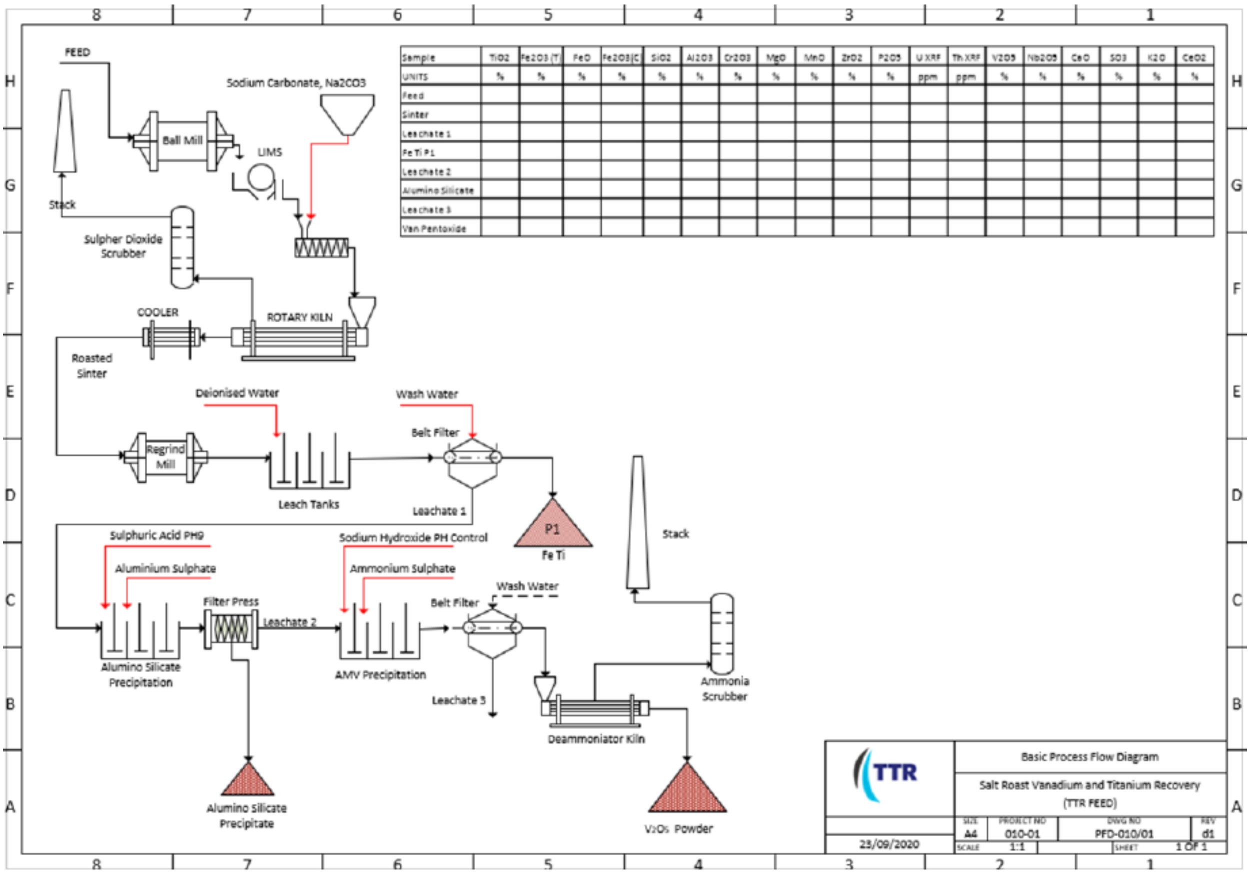


Figure 43 Vanadium and Titanium Recovery Flowsheet

7.2 Stage 1 and 2 Testwork – VTM Beneficiation

7.2.1 Ore Characterisation Qemscan

A composite head sample originating from the Xantia mining area was analysed by QEMSCAN (Quantitative Evaluation of Minerals by Scanning electron microscopy), an automated technique for quantitative mineralogical analysis of ores (Amdel report N3994QS11, 7th of April 2011). Qemscan identified the following minerals present in the ore:

Mineral	Description
Magnetite	Includes Magnetite and trace Hematite and Goethite
Rutile / Anatase	Includes Rutile / Anatase (>95% TiO2)
Ilmenite	Includes all TiO2 phases from Luecoxene to Ilmenite (50% TiO2 - 95% TiO2)
Titano-Hematite	Includes Titano-Hematite (50% TiO2 - 20% TiO2)
Titano-Magnetite	Includes Titano-Magentite (<20% TiO2)
Quartz	Includes Quartz
Calcite	Includes Calcite and CaCO3 from shell fragments
Feldspar	Includes K-Feldspar
Epidote	Includes Epidote
And/Sill/Kyan	Includes Al Silicate phase from the Andalusite/Sillimanite/Kyanite series
Tourmaline	Includes Tourmaline
Hornblende	Includes Hornblende
Pyroxene-En-Fs	Includes Pyroxene from the Enstatite/Ferrosilite series
Garnet	Includes Garnet phases, predominantly Almandine
Other Silicates	Includes all other silicate phases not listed above
Phosphates	Includes Apatite
Others	Includes all phases not listed above and occurring in trace form

Figure 44 Minerals Present as Identified by Qemscan

According to the QEMSCAN analysis, titanomagnetite is the dominant mineral in the -180 +106 µm size fraction. Silicate minerals hornblende and epidote are dominant in the -500 +180 µm size fraction. The QEMSCAN analysis has indicated that a high proportion (~36%) of the Fe is present in gangue minerals (epidote, tourmaline, hornblende and garnet). The recoverable Fe is contained mainly in titanomagnetite and magnetite with only minor quantities present as hematite.

	-1000/+250	-250/+180	-180/+125	-125/+90	-90/+0	Total
Magnetite	0.44	1.76	1.60	0.33	0.32	**4.44**
Rutile / Anatase	0.00	0.00	0.00	0.00	0.00	**0.00**
Ilmenite	0.00	0.03	0.00	0.00	0.00	**0.04**
Titano-Hematite	0.03	0.28	0.14	0.03	0.02	**0.51**
Titano-Magnetite	1.26	24.37	26.49	5.68	2.59	**60.39**
Epidote	0.28	1.94	0.22	0.01	0.01	**2.47**
Tourmaline	1.24	14.17	0.86	0.06	0.14	**16.47**
Hornblende	0.74	10.61	0.48	0.02	0.05	**11.90**
Garnet	0.36	2.62	0.24	0.03	0.03	**3.28**
Other Silicates	0.01	0.05	0.01	0.00	0.00	**0.06**
Others	0.19	0.19	0.03	0.00	0.01	**0.42**

Table 10. Deportment of Fe to Different Species

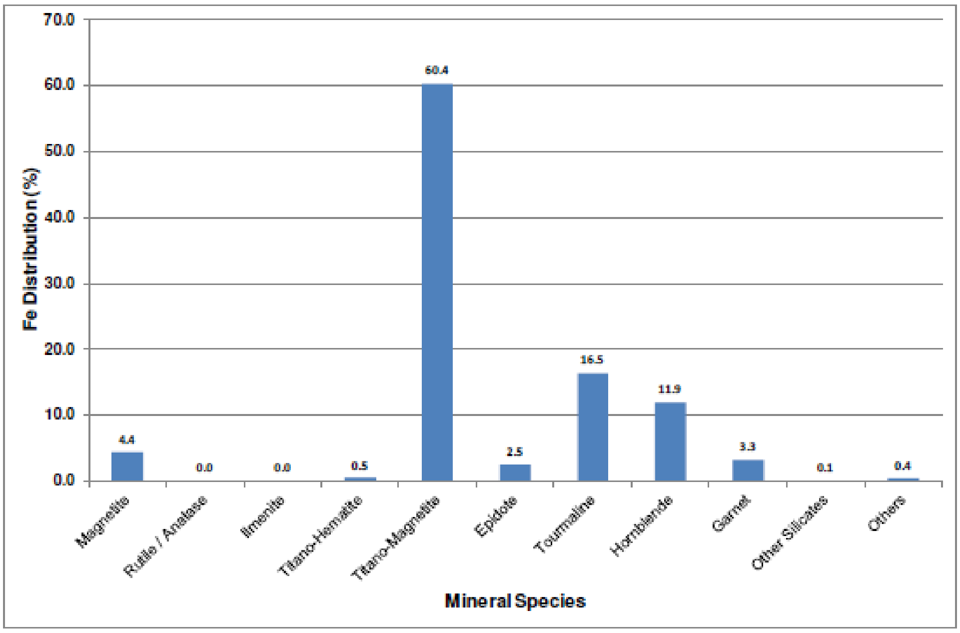


Figure 45 Deportment to Mineral Species

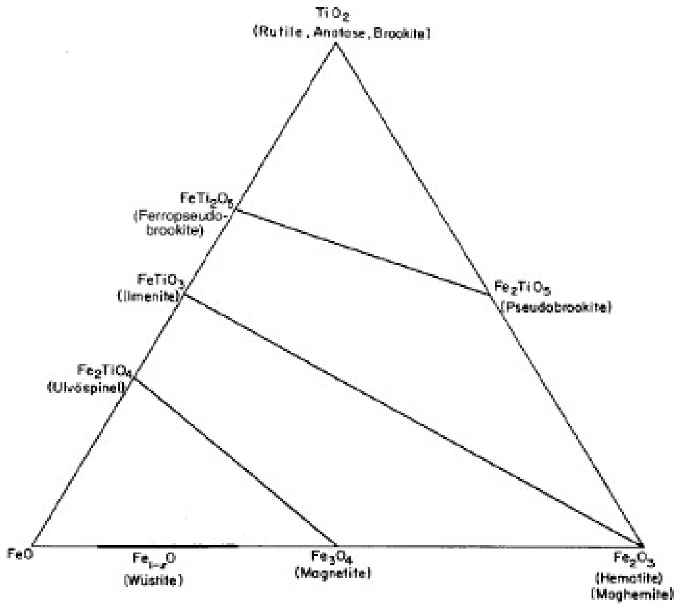


Figure 46 The FeO, Fe_2O_3, TiO_2 Ternary Phase Diagram

7.2.2 Davis Tube Recovery (DTR)

In 2012 a Davis tube testwork programme was launched to characterise the magnetic component of the ore and to quantify the maximum recoverable magnetic concentrate. In total, around 450 samples were tested. The DTR methodology that was developed had the specific aim of avoiding overgrinding of the sample which tends to lead to low concentrate grades and poor recoveries. All samples were stage pulverised and dry screened to avoid any oxidation of the sample during drying. The staged pulverisation typically produced a DTR feed with a P80 of 65 to 75µm. A magnetic field intensity of 3000 Gauss was used throughout.

The sample head Fe is plotted against the DTR weight recovery in Figures below. The DTR weight recovery quantifies the relative proportion of magnetic material in the sample which is equivalent to the maximum weight recovery that can be expected at a given Fe head grade.

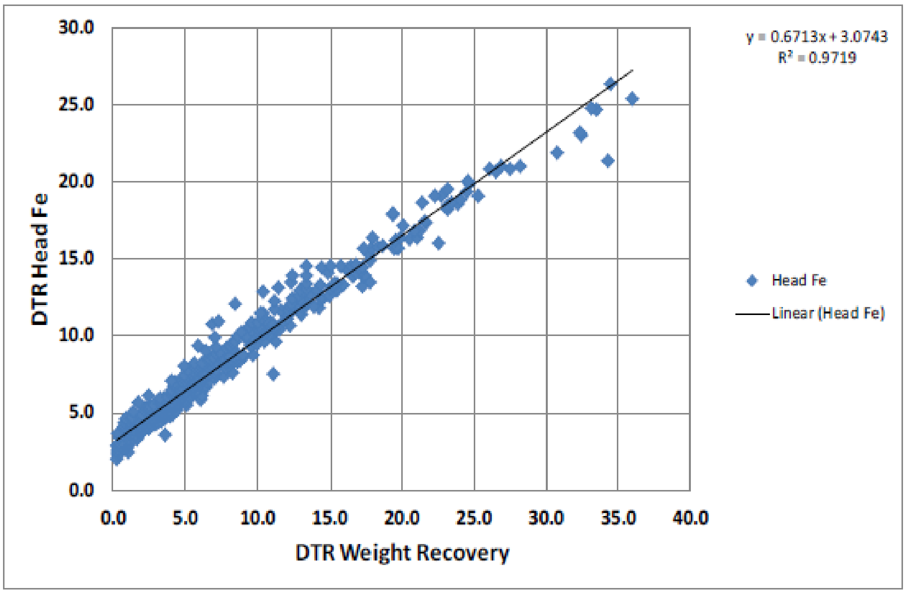


Figure 47 DTR Head Grade Fe vs Weight Recovered

The Fe recovery achieved with the Davis tube is plotted against Fe head grade in the Figure below. Although there is significant scatter in the data, the indication is that the Fe recovery drops below 40% from about 7% Fe. It also indicates that Fe recoveries ranging from 40 to 65% can be expected at a head grade of 10% Fe, with the average Fe recovery at 55%. No cut-off grade has been considered in this case.

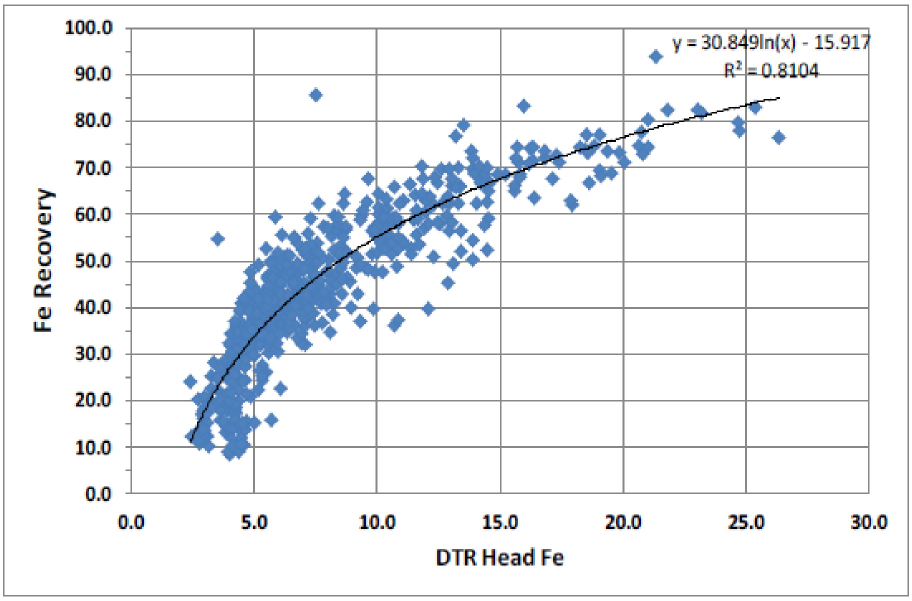


Figure 48 DTR Fe Recovery vs Fe Head Grade

The Fe – SiO2 relationship is depicted below. The Y-axis intercept is 60.7%, indicating the theoretical maximum Fe of the concentrate. The Fe content is substantially lower than that of pure magnetite (72.4% Fe) due to the displacement of Fe in the magnetite matrix by Ti, but also by Al and V.

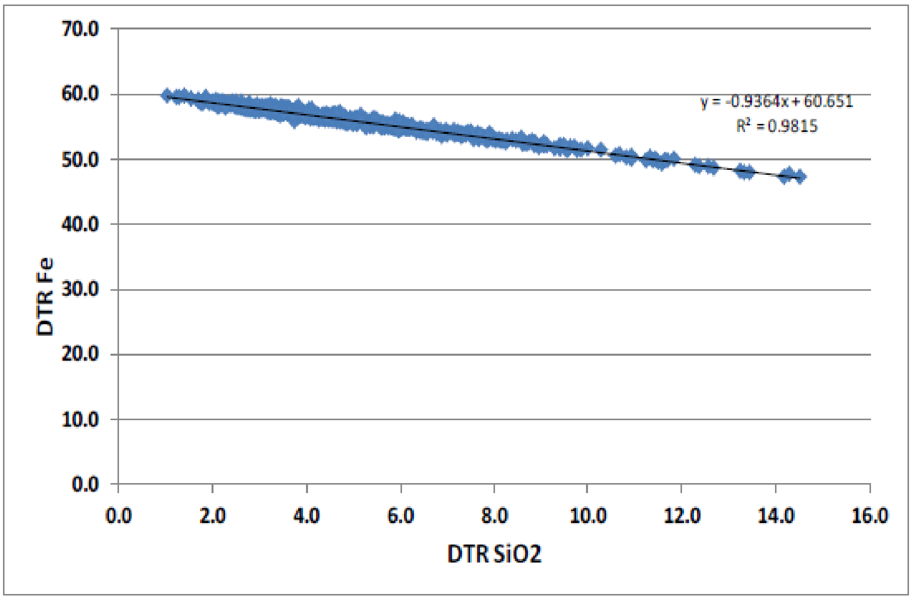


Figure 49 Fe -SiO_2 Relationship

The relationship between the DT Mag Fe (i.e. DT Concentrate Fe grade x DT Weight Recovery) and Head Fe is given in Figure 58 below, again illustrating the fact that a significant proportion of the Fe in the ore is non-magnetic and hence not recoverable.

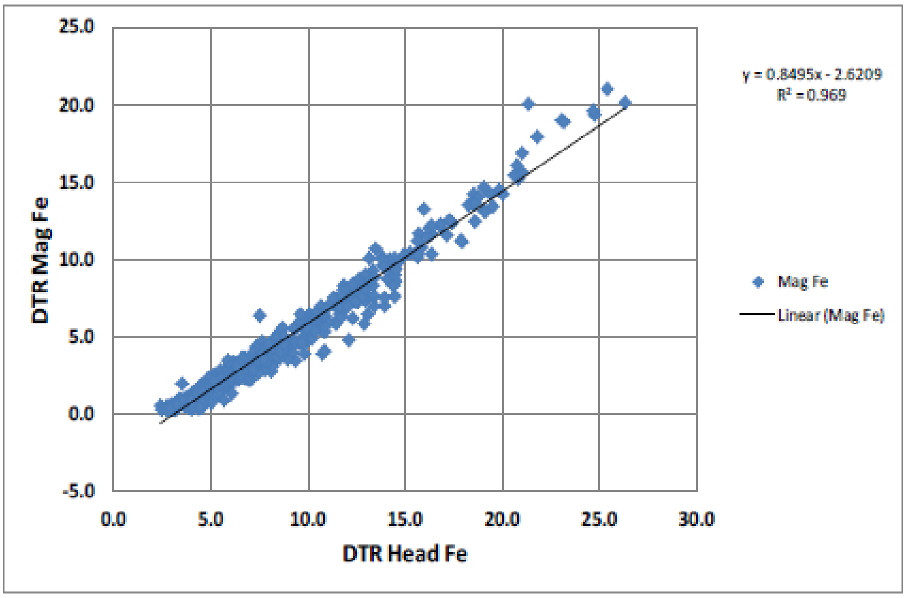


Figure 50 DTC Mag Fe vs DT Head Fe

7.2.3 Pilot Test Plant Work

In 2012 TTR pilot plant was constructed in New Zealand in order to test bulk sample from the initial mining areas and to develop a viable flow sheet for the recovery of the titanomagnetite from the run of mine (ROM) ore. The initial pilot plant flow sheet was set up as depicted in Figure 59.

After drying and removal of large pebbles and shells, the sample was homogenised in a tumble mixer and screened at 2mm. The material was then slurried in an agitator tank and subjected to medium intensity magnetic separation (MIMS) at 3,300G for a single pass followed by three passes through a low intensity magnetic separator (LIMS) at 1,250G. The primary LIMS concentrate was subsequently ground in a 500L ball mill using a mixture of 50 and 30mm ceramic balls. The aim grind size was 80% passing 53µm. Samples were periodically taken from the ball mill to collect data for grind establishment. The ground pre-concentrate was finally processed through a secondary LIMS for three passes at 1,050G. Grab samples of feed and product streams were taken and analysed at ALS Metallurgy in Perth. All feed and product streams were also weighed. All streams after the MIMS were weighed wet and the dry weights were determined by conducting moisture tests on the particular stream.

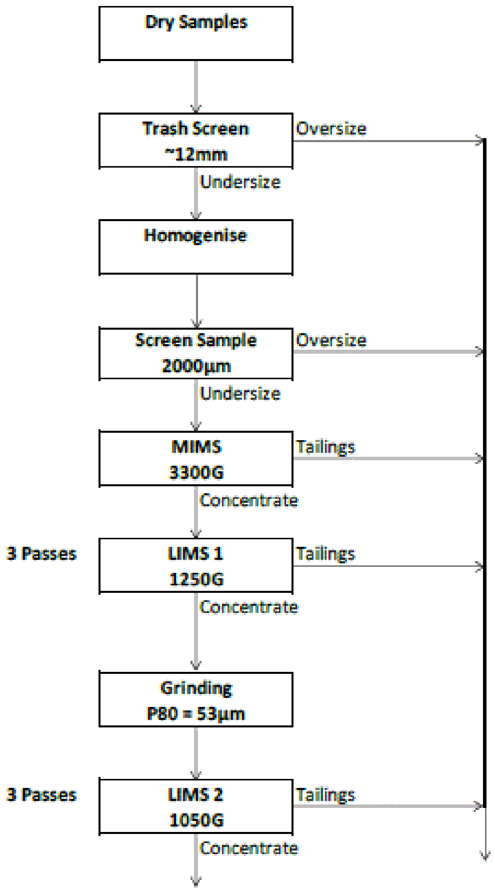


Figure 51 Initial Pilot Plant Flow Sheet Block Flow Diagram

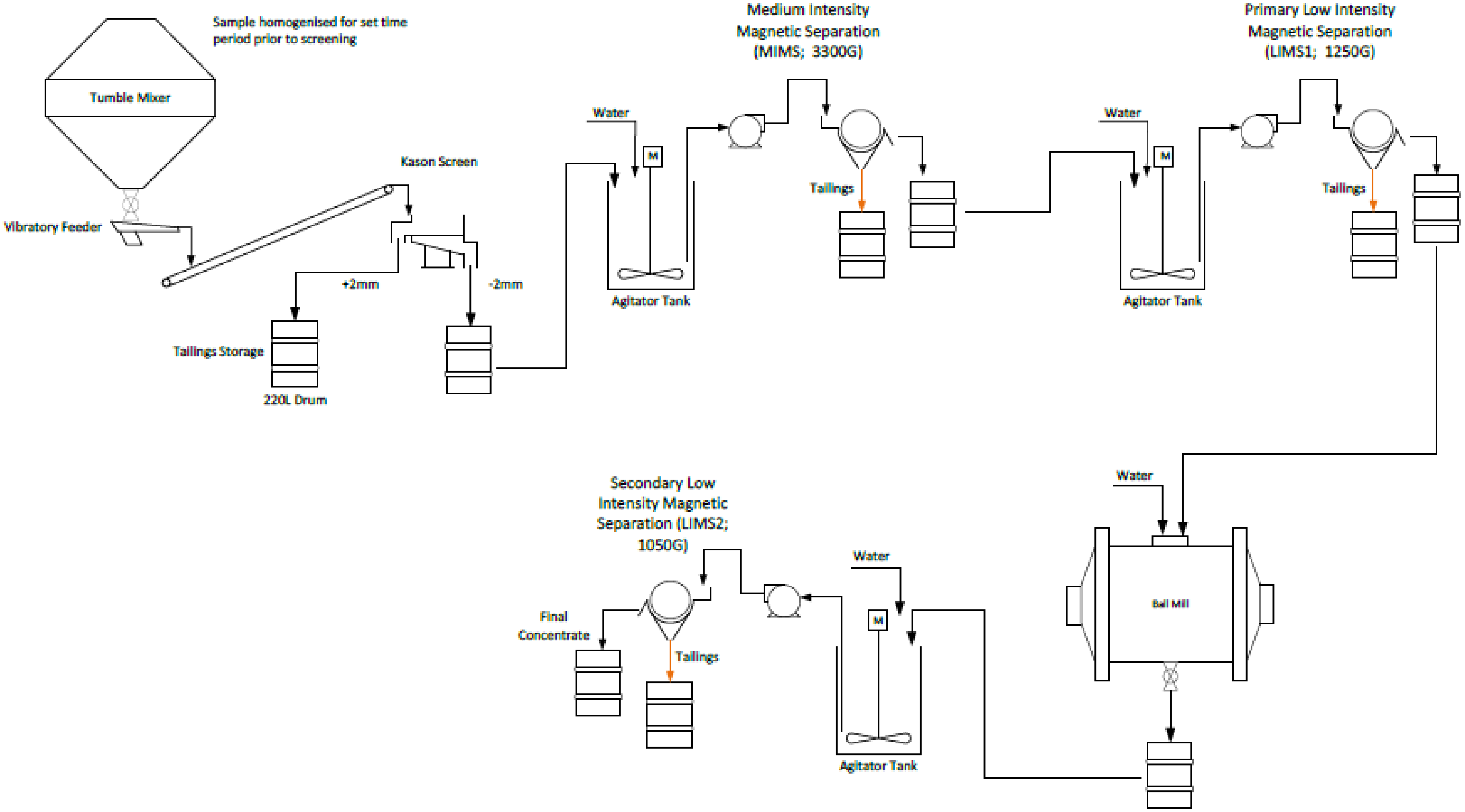


Figure 52 Pilot Plant Process Flow Diagram

Figure 53 Pilot Plant LIMS-1 Concentrate

Figure 54 Pilot Plant Ball Mill

After the first five runs, it became evident that there is an opportunity to discard a significant amount of tailings at a grind of approximately 150 µm. The pilot flow sheet was thus altered to introduce a two-stage grind with intermediate magnetic separation (refer Figure 63). For the second two stage grind run (Bulk 501), the field intensity on the MIMS was increased to 4300G in order to increase the initial Fe recovery on lower grade material.

The results from one sample, X039, were discarded due to operational problems during the run. Good magnetic Fe (Mag Fe) recoveries were obtained for all runs except Bulk 501. The reason for this is the low LIMS2 Fe recovery. It is not clear what the cause of this was. All the Davis tube wash (DTW) samples also returned relatively low Fe recoveries. However, it is clear that the flow sheet maximises both Fe recovery and final product grade. The recovery of magnetic Fe is evidenced by the MIMS/LIMS1 Fe recovery being constantly higher than the DT Fe recovery.

			Fe Recovery					
Sample ID	**Head Fe**	**Mag Fe**	**MIMS& LIMS1/1**	**LIMS2**	**LIMS3**	**O/All Fe Recovery**	**DT Fe Recovery**	**Mag Fe Recovery**
X450	7.8	3.5	48.6		83.4	43.3	45.0	96.3
X439	9.6	5.2	60.5		85.5	51.7	53.8	96.2
Bulk501	10.5	4.8	45.0	90.0	97.6	39.5	43.7	90.5
B456	13.9	8.9	66.3		92.7	61.6	62.7	98.3
X451Y	13.8	8.7	66.9	96.7	97.6	63.2	63.3	99.7
X438	21.1	16.4	76.9		91.2	71.9	74.4	96.7

Table 11 Pilot Plant Results – Fe Recoveries

	Weight Recovery			
Sample ID	MIMS& LIMS1	LIMS2	LIMS3	O/all
X450	12.0		46.0	5.7
X439	16.1		55.7	8.5
Bulk501	14.9	53.9	86.9	6.8
B456	20.4		64.0	12.9
X451Y	21.8	79.9	86.6	14.9
X438	34.9		68.8	23.4

Table 12 Pilot Plant Results – Weight Recoveries

	Fe Grade			
Sample ID	MIMS& LIMS1	LIMS2	LIMS3	LIMS2
X450	15.9	30.8		55.9
X439	18.8	34.2		56.3
Bulk501	14.3	29.7	49.4	56.9
B456	25.4	40.2		58.2
X451Y	26.1	40.9	51.8	57.8
X438	28.1	42.0		58.2

Table 13 Pilot Plant Results – Fe Grades

The pilot plant Fe recovery is plotted against mag Fe and DTR Fe recovery in Figure 64. It is clear that the pilot plant Fe recoveries fall well within the bounds predicted by the DTR work. Similarly, the pilot plant weight recoveries compared well with that achieved with the Davis tube.

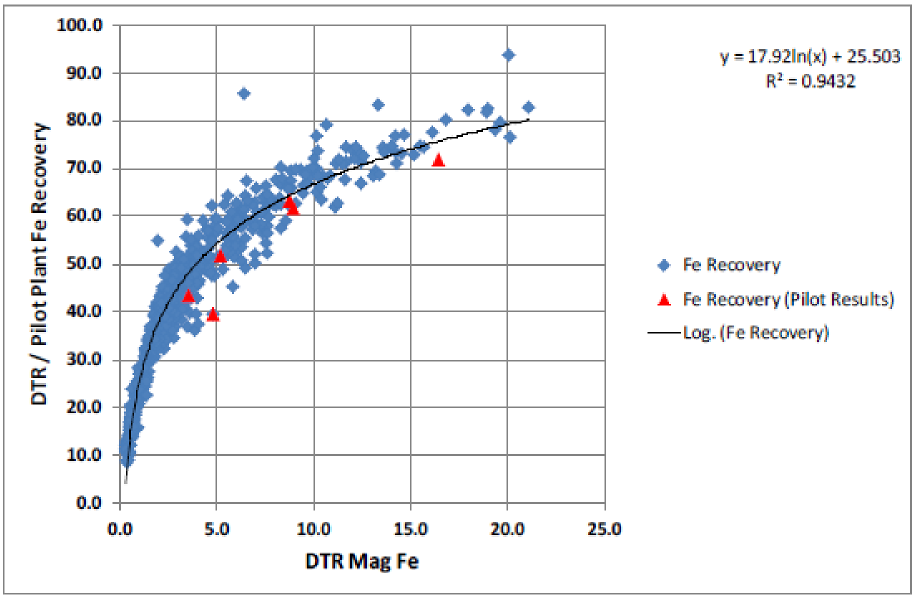


Figure 55 Pilot Plant and DTR Fe Recovery vs Mag Fe

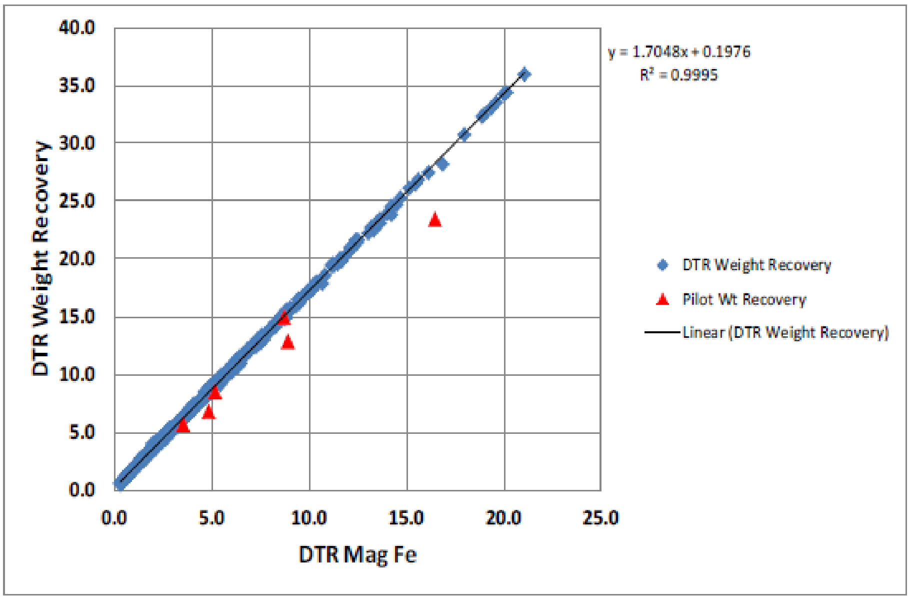


Figure 56 Pilot Plant and DTR Weight Recovery vs Mag Fe

7.2.4 Final Product Grade and Grind Determination

The Qemscan and other testwork have confirmed that the TTR iron sands are immature in respect of its liberation from associated gangue silicates. It is therefore necessary to grind the ore in order to achieve liberation, increase the product grade and maximise the Fe recovery. Initial grind establishment work on medium grade near shore material from the Xantia area indicated a liberation grind size of 53µm. However, this is deemed too fine a size from a marketing perspective. Grind establishment curves were generated for the pilot plant samples by taking samples at different stages during grinding in order to assist in determination of the optimum grind size. Each of these samples was subjected to Davis tube wash (DTW) at 3000G.

In Figure 66 the pilot plant Fe – SiO_2 relationship from DTW on grind samples is plotted showing a similar result compared to the DTR results from the drill samples. This would suggest that the final product SiO_2 must be reduced to less than 5% in order to have a Fe grade of more than 55%.

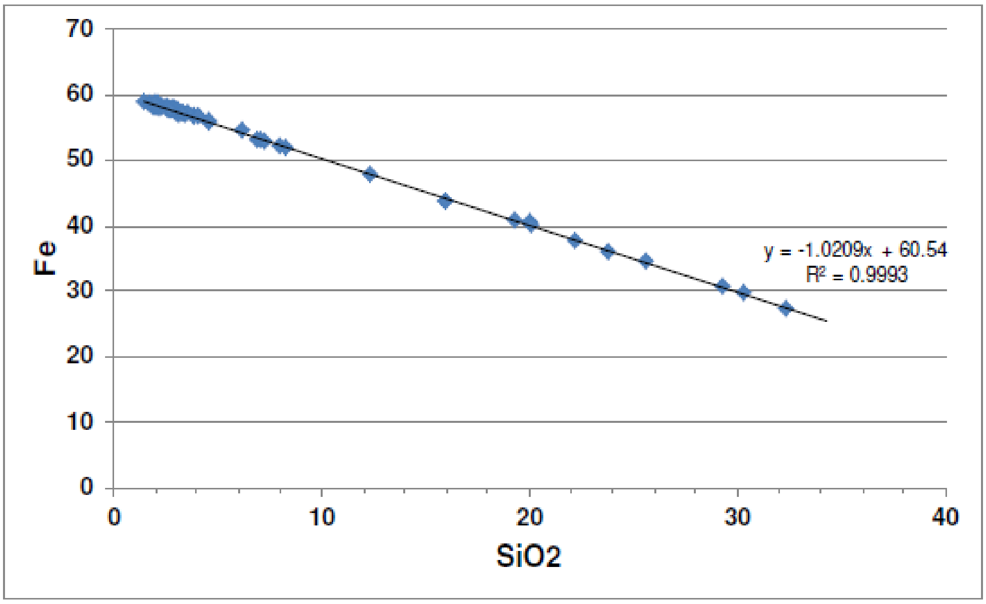


Figure 57 Pilot Plant DTW Results – Fe vs SiO_2

The pilot plant DTW data for Fe and P are plotted as a function of grind size and for samples ground to a P_{80} of 150 µm in Figure 67. The data sets were further split into low, medium and high grade according to head Fe. The low-grade data is most relevant as it best corresponds to the average ROM grade as determined by the mining schedule, i.e. 10.5% Fe. From the graph it can be seen that the low grade DTW Fe trend line intersects 55% Fe at a grind size (P_{80}) of 110 µm. However, the grade achieved with the LIMS will always be somewhat lower than that of the Davis tube.

An allowance of at least 1 to 2% Fe should be made in order to cater for plant inefficiency and product grade variation. With this in mind, the graph indicates a product specification of 55% could be guaranteed at a grind size of around 90µm and a specification of 56% Fe at 75 µm. A grind size of 90 µm corresponds to a product specification of 0.17% P maximum and 75µm to 0.16%P.

The final grind size will be confirmed during ongoing pilot testwork as well as negotiation with key product off-take customers. For the purpose of this Study, the plant grind circuit was designed for a grind size of 75µm.

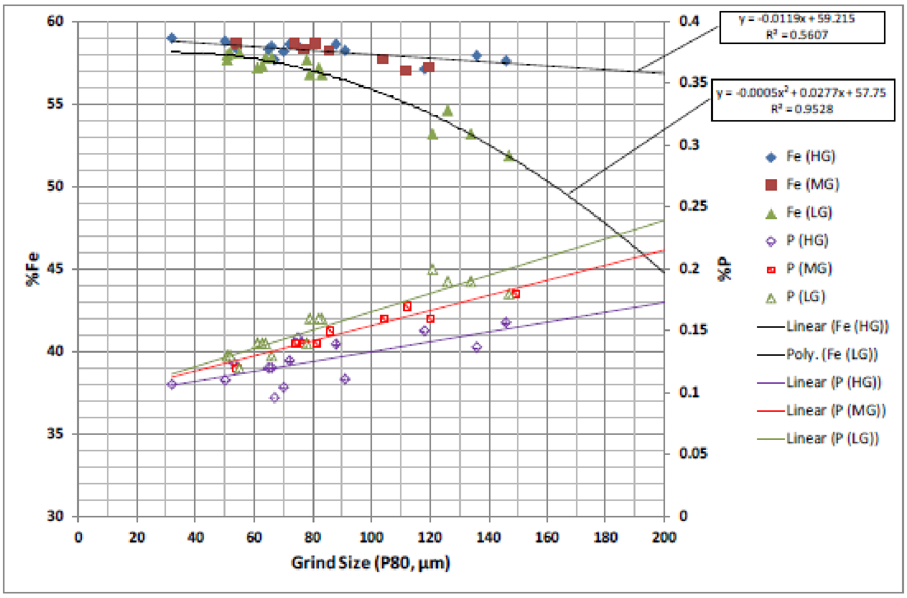


Figure 58 Pilot Plant DTW Results – Fe and P vs Grind Size

The proposed final product specification for a concentrate at a grind size (P_{80}) of 75 µm is given in 3, below.

Fe (min)	P (max)	SiO_2 (max)	Al_2O_3 (max)	TiO_2 (max)	V (min)	CaO (max)	S (max)	MgO (max)	K_2O (max)	Na_2O (max)	Zn (max)	Cl (max)
56.0	0.160	3.9	4.2	8.9	0.28	1.00	0.01	3.2	0.15	0.20	0.085	0.029

Table 14 Product Specification – 75µm Concentrate

7.2.5 Grindability Testwork

Under the DRA Process Review work A bulk sample from TTRs pilot plant was provided to Metso for conducting standard Jar Mill testwork data to assess the milling requirements to achieve the target grind and provide a Vertimill® sizing for the marine duty.

Several magnetic separation concentrates were progressively milled using the Levin- Method; which is effectively fine grinding in a standard Bond laboratory mill at known energy inputs. Milling tests were also conducted in laboratory scale UFG (ultrafine grinding) mills (Isa mill) on concentrates, and so a comparison between each technology and ball size effect can be made.

It has been possible to determine the grinding characteristics of the iron concentrate samples tested and therefore establish the probable milling performance of various milling options.

Levin Progressive Milling

The same breakage function was used throughout, and the grinding rates were manipulated to ascertain the best fit. From low energy grinding simulations show that there is a gradual improvement in milling rates with applied power.

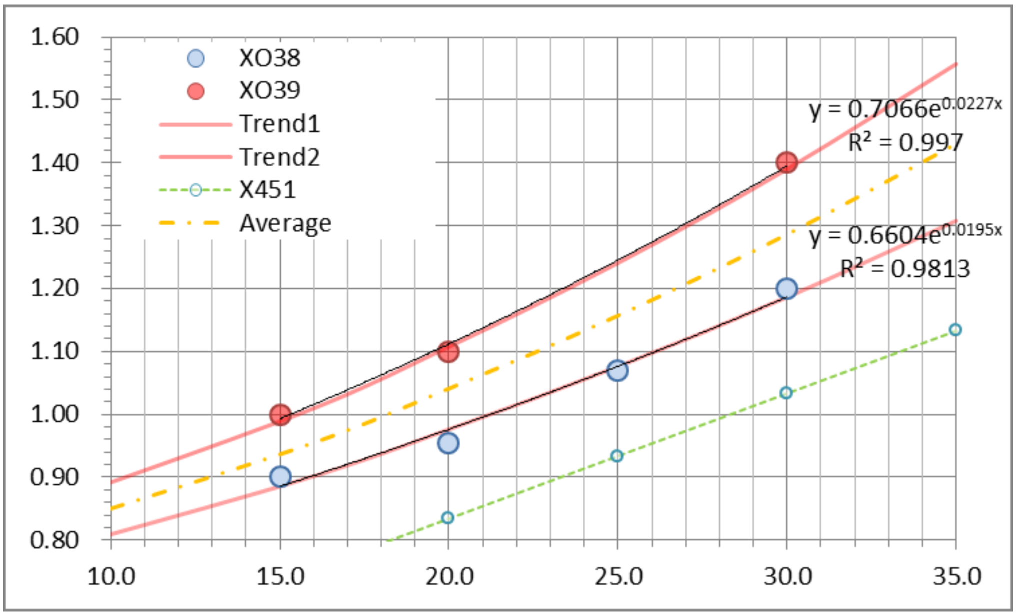


Figure 59 Levin Test – Typical Milling Rates with Applied Power

The testing undertaken by DRA / Metso showed that the breakage rates are less than conventional milling, despite improved particle breakdown, suggesting the smaller media size is more inefficient. Therefore, it was recommended that the use of Tower Mills be investigated. The grinding rates obtained were similar at low energies, 3.465*t/kWh* and were significantly higher than both Levin and IsaMills™, by *at least* a factor of two, and significantly more at the lower energy inputs. These results were subsequently used for simulating a full-scale mill.

Using the data from the Jar Mill test it was possible to estimate the performance of the full-scale unit, taking feed PSD and closed-circuit milling into consideration. The resultant simulations estimate that two VTM3000-WB units, in closed-circuit with two 33"Ø *gMax* or equivalent hydrocyclones, should cover the milling duty. However, it is strongly advised to consider a third standby unit, because the observed improvement in milling rates may not be fully realised with a seasoned charge on scale-up, and no derate factor has been used.

The estimated power requirement is between 3.3~3.5kWh/t.

7.3 Stage 3 Testwork – Vanadium Recovery

Laboratory testing was conducted by the University of Canterbury and Callaghan Innovation to validate the sodium salt roasting-water leaching process, optimise key parameters, and highlight areas for further testing and analysis associated with recovery from VTM.

In 2021, the University of Canterbury (UC) and Callaghan Innovation (CI) conducted lab-scale testing on the VTM concentrate sourced from three New Zealand locations, including TTR concentrate. The TTR sample and a second sample (Labelled as "PC" to maintain confidentiality, as its identification is restricted due to commercial sensitivity) shared nearly identical major oxide compositions, leading to comparable performance during testing. In contrast, the third sample exhibited a significantly different composition and performed notably worse in the testing program, highlighting the impact of ore variability on extraction efficiency.

The TTR and PC samples are iron sand concentrates while the VRC sample (Labelled as "VRC" to maintain confidentiality, as its identification is restricted due to commercial sensitivity) was a pyrometallurgical product i.e. vanadium enriched slag which understandably performed differently.

Sample	Name	Fe_2O_3	MnO	TiO_2	CaO	K_2O	P_2O_5	SiO_2	Al_2O_3	MgO	Na_2O	V_2O_5
1	TTR	82.90	0.68	8.60	0.74	0.09	0.29	2.42	3.79	3.09	0.11	0.57
2	PC	84.30	0.63	7.96	0.51	0.05	0.09	2.16	3.79	2.84	0.07	0.60
3	VRC	32.11	10.39	13.84	2.86	0.01	0.09	17.56	1.55	1.13	0.13	13.72

Table 15 Sample Major Oxide Compositions

The testing program explored the potential of the Salt Roasting and Water Leaching process, described in the previous section, the method favoured for its simplicity, established performance, and adaptability to local resources. The laboratory-scale testing evaluated and optimised the process for vanadium recovery from New Zealand iron sands.

The study evaluated roasting conditions, leaching solvents, and pre-treatment steps, and aimed to identify optimum operational parameters while addressing challenges such as byproduct management and environmental impacts.

The study concluded that the Salt Roasting and Water Leaching process holds significant promise for extracting vanadium from New Zealand's iron sands, especially when operating conditions were carefully optimised. Achieving a remarkable 77% vanadium recovery rate under laboratory conditions underscored the process's viability. However, challenges such as managing byproducts, addressing environmental impacts, and accommodating variations in sand composition were identified as hurdles to industrial-scale implementation. To advance this work, the study recommended future efforts focus on reducing wastewater and gas emissions, further enhancing the process's environmental sustainability, and conducting pilot-scale tests to confirm its commercial feasibility.

7.3.1 Experimental Procedure

The experimental procedure detailed in the report outlines the steps taken to evaluate the Salt Roasting and Water Leaching process for vanadium extraction from the iron sand samples. Key steps included the following.

Sample Preparation

- The samples were homogeneously mixed with sodium salts (e.g., sodium carbonate or chloride) using a ball mill for 60 minutes to ensure even distribution.

Roasting

- The prepared mixtures were roasted in a furnace equipped with temperature control to explore various roasting conditions, including temperature and duration; and
- After roasting, the samples were cooled to room temperature and ground to ensure uniformity.

Leaching

- The roasted materials were leached using distilled water or acidic solvents under controlled conditions; and
- Residual solids were separated using centrifugation and washed three times with distilled water to remove any remaining salts or impurities.

Analysis

- The composition of the roasted and leached samples was analysed using X-ray fluorescence (XRF) to determine metal content; and
- The leachate was further analysed using inductively coupled plasma mass spectrometry (ICP-MS) to quantify the vanadium and other elements extracted.

Process Optimisation

- Experiments were conducted to optimise pre-treatment, roasting, and leaching parameters. These included varying temperatures, roasting times, sodium salt compositions, and leaching solvents.

This methodical approach provided critical insights into the conditions that would maximise vanadium recovery, laying the foundation for further refinement and scalability of the process.

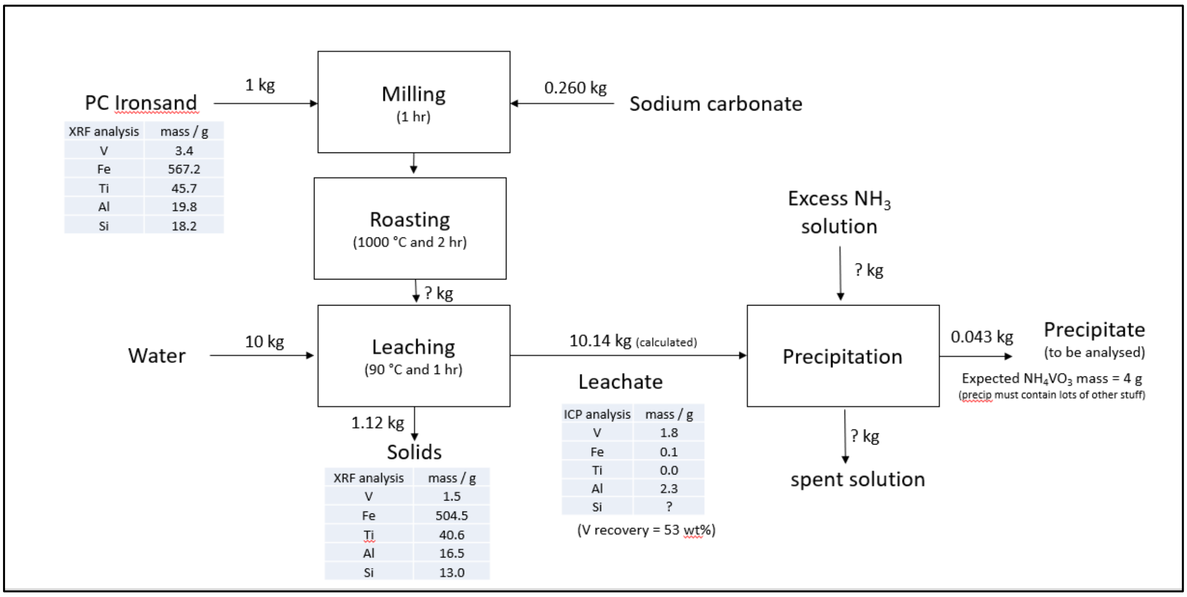


Figure 60 Mass Balance, University of Canterbury Laboratory Testing

7.3.2 Analysis of the Results

The third sample (VRC) was excluded from the Siecap conducted analysis due to its differing composition compared to the TTR and the second (PC) sample. While the TTR and PC samples shared similar major oxide compositions and demonstrated comparable performance, the VRC sample's distinct chemical makeup resulted in a vanadium recovery rate of only 9% under the baseline processing condition. As such, this analysis study focused on the two representative samples to provide meaningful insights into optimising vanadium extraction.

7.3.2.1 Average Vanadium Extraction Across Samples (Baseline Test)

The study evaluated vanadium recovery from the representative samples under identical baseline roasting and leaching conditions (roasting a 20g sample with 5g of sodium carbonate at 1000°C for 2 hours, followed by leaching at 90°C with distilled water for one hour). Under these baseline conditions, the results revealed varying levels of vanadium recovery.

On average, the baseline testing yielded a vanadium recovery rate of approximately 55% across the two representative sand samples.

7.3.2.2 Optimisation of Vanadium Extraction

The study then systematically investigated the effect of various parameters on vanadium extraction.

- Whilst the UC/Callaghan Innovation testwork references a coarse leach it does not elaborate on what defined the coarse leach. However, research papers detail the impact of a coarse leach on vanadium recovery and clearly defined the effect of the particle size distribution (PSD) i.e. D100 of 1000 µm and D90 of 25 µm, in which case the pulp density and pH were kept constant at 65 m/m% and 7.8, respectively. The results show that the best vanadium extraction was generally achieved when the coarser material (D100 of 1000 µm) was used as feed.
- Pre-treatment: Air roasting the sand prior to sodium salt roasting improved vanadium recovery from 55% to 65%.
- Roasting Conditions:
    - Temperature: Vanadium recovery increased with roasting temperature, peaking at 1000 °C.
    - Duration: Recovery improved with time, reaching a maximum of 56% after 4 hours. However, the difference in recovery between two and four hours was minimal, suggesting diminishing returns with extended roasting times.
    - Sodium Salts: Sodium carbonate and a mixture of 50 wt.% sodium chloride and 50 wt.% sodium carbonate both achieved comparable recovery rates.
- Leaching Conditions:
    - Time: The leaching duration had a marginal effect, with vanadium recovery stabilizing at 57% after two hours.
    - Solvent: Acidic solvents demonstrated superior performance compared to distilled water, achieving up to 65% vanadium extraction. However, the use of acidic solvents presents several adverse environmental impacts that must be carefully managed. Acidic solvents are inherently more reactive and, if not handled properly, can pose risks to soil and water quality through potential leakage or improper disposal. These solvents may produce hazardous by-products or residues, requiring robust waste management systems to prevent contamination of ecosystems.

7.3.2.3 Vanadium Extraction under Optimum Conditions

The detailed composition analysis showed efficient recovery of vanadium alongside other elements such as iron (Fe) and titanium (Ti). This demonstrates the effectiveness of an optimised process.

Combining optimal parameters (air roasting at 800 °C for 2 hours, sodium carbonate roasting at 1000 °C for 2 hours, and water leaching for two hours), on a coarse leached representative sample the testwork achieved an average vanadium recovery of 77%.

A slight increase in the vanadium recovery i.e. 79% was achieved using an acidic leach. The additional handling and storage protocols that are demanded by the use of acidic solvents would preclude its use in a full-size plant.

7.3.2.4 Challenges Identified

The process identified the following challenges.

- Formation of stable solid compounds during roasting, particularly with silicon (Si) and aluminium (Al), reducing vanadium availability;
- Generation of high-salinity ammonium-rich wastewater during vanadium precipitation, increasing treatment costs; and
- Emission of harmful kiln gases, requiring advanced gas scrubbing systems to minimise environmental impacts.

7.4 Process Overview

The TTR Taranaki VTM Project is designed to deliver 4.7 Mtpa titanomagnetite concentrate. The iron sands will be mined using two Seabed Crawlers, one operating and one standby. The ROM will be delivered to an IMV where it will be screened, magnetically separated and ground before final magnetic separation to produce a clean concentrate. All processing will be done wet using sea water throughout the process. The final concentrate will be dewatered to ~10% moisture and stored temporarily on the IMV before being slurried with fresh water from a reverse osmosis (RO) desalination plant. The slurry will be pumped to a floating storage and offloading vessel (FSO) where it will be dewatered and stored in the FSO holds. Once fully loaded, the FSO sails to a sheltered area (if required by prevailing weather conditions) where it offloads the cargo to an ore carrier, typically a Capesize vessel.

Tailings will be disposed in real time via a fall pipe extending forward off the port side of the IMV such that the tailings are deposited as far as possible from the face of mine. The tailings disposal fall pipe will be of similar design as a trailing suction hopper dredge drag arm. The tailings will first be dewatered via hydro cyclones with the wastewater disposed of separately along the tailings fall pipe.

7.4.1 Design Criteria

The design criteria for the process plant are listed in the table below. The reference key for the criteria is as follows:

1. Client supplied data.
2. Testwork data
3. Calculated
4. Design assumption

Item	Unit of Measure	Value	Ref	Comment
1. Overview				
ROM slurry density	vol.%	30	3	
Slurry volume mined	m3/h	11,348	3	
Solids density in situ	t/m^3	2.35	2	
ROM Feed	t/h (db)	8,000	3	
ROM Feed	t/a	48,002,734	5	
Product %Fe	%	56-57	2	
Process plant weight Recovery	%	9.6%	2	
Process plant weight Recovery	%	90.0%	2	
VTM Concentrate Production	t/h	765.0	3	
VTM Concentrate Production	t/a	4,590,261	3	Design to increase to 4.9Mtpa
2. Operating Schedule				
Annual operating days	d/y	365	4	
Daily operating hours	h/d	24	4	
Dry docking	d/y	12	4	56 days every 5 years for 15
Refuel	d/y	0	4	Refuelling will take place
Anchor spread	d/y	0	4	
Maintenance	d/y	26	4	
Days lost		38		Base case: Total 38 days lost (26 for maintenance), 12 days
IMV Availability	%	92%	3	
Mining efficiency	%	85%	4	
Weather uptime	%	90%	4	
	%	68.5%	3	

Total Operational Availability				
Operating time	h/y	6,000	3	
3. Ore Characteristics				
+2mm fraction	%	4.0	2	
-63µm fraction	%	0.6	4	
Concentrate SG	t/m^3	4.75	2	
Feed specific gravity	t/m^3	3.2	2	
Water Density	t/m^3	1.03	4	
Ore in situ density (wet)	t/m^3	2.35	4	
Ore in situ density (dry)	t/m^3	1.9	4	
Concentrate bulk density (dry)	t/m^3	2.36	4	
4.ROM Head Grade				
Fe	%	10.1	2	
SiO_2	%	48.9	2	
Al_2O_3	%	11.5	2	
TiO_2	%	1.4	2	
CaO	%	11.7	2	
MgO	%	6.0	2	
V	%	0.1	2	

Table 16 Project Design Criteria – Process Plant

7.4.2 Mass and Water Balance

The process plant mass and water balance were developed based on the design criteria and the pilot plant testwork results. The main inputs and outputs for the beneficiation plant are given below.

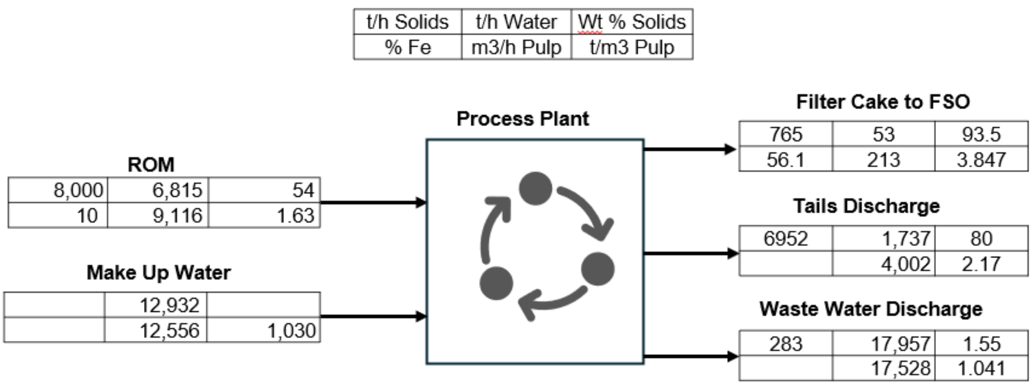


Figure 61 Process Plant High Level Mass and Water Balance

7.5 Process Description

7.5.1 Process Overview

In March 2014, DRA Global undertook a review of the process design for the TTR Taranaki VTM Project. DRA undertook the review while embedded into the TTR PFS design team to facilitate information and IP sharing. DRA's review identified a number of opportunities in terms of the installed power savings as well as alternate concepts and recommendations. These key findings and recommendations are.

- **Process Design Review**
  - Screening & Surge Tanks - The report recommends replacing trommel screens with double-deck vibrating screens to reduce footprint, mass, and power consumption.
  - Milling Circuit - The initial design proposed 4,500HP Vertimill®, but test results indicate 3,000HP Vertimill® may be sufficient.
  - Dewatering System - Recommended additional dewatering tests to ensure the target 10% moisture content is achieved in the final product.

- **Potential Power Savings**
  - Identified process modifications could lead to significant power savings (estimated at 10,250kW), including:
  - Using a pressure splitter instead of a boil box.
  - Optimising the coarse tailings disposal system to reduce pumping requirements.

- **Process Test-work Recommendations**
  - Additional pilot testwork is required, particularly for 7-10% Fe head grade samples, as this represents 60% of the resource.
  - Dewatering tests to confirm the effectiveness of the dewatering magnet.
  - Material flowability tests for product storage bins on the IMV.
  - Rheological testwork to optimise slurry pumping and flow characteristics.

- **Next Steps**
  - A dynamic simulation study is recommended to evaluate the IMV process plant availability and utilization.
  - Further layout optimization to integrate proposed changes.
  - Supply chain impact analysis to ensure smooth mining-to-processing-to-shipment flow.

The DRA revised process flow diagram for the beneficiation plant is provided in Figure 72.

7.5.2 ROM

ROM ore will be delivered to the IMV via an 800mm ID rubber hose connected to the SBC. The design rate of ROM delivery is 8,000t/h solids. The ROM ore will be directed into a boil box from where it is directed into two intermediate distribution sumps. Process water is added to reduce the slurry density to 31.5% solids by weight before the slurry is fed to 10 trommel screens at main deck level. The screen aperture will be 4mm such that the effective screen size of the ROM will be ~2mm. Spray water on the screens will reduce the slurry density further to 30% solids. The screen undersize is fed under gravity to ten water agitated storage tanks directly below the screen area. The oversize will be fed via a chute to the tailings handling area.

7.5.3 Screening and Surge Tanks

The TTR flowsheet allowed for 4 trommel screens to remove the oversize material (+3.5mm). This oversize material is then passed over a static screen, discharging the +25 mm material into a waste bin.

DRA reviewed the use of double deck vibrating screens. The primary deck would be to replace the duty of the static grizzly located on the boil box. The secondary deck would be to remove the +3.5mm material.

The advantages of using vibrating screens are:

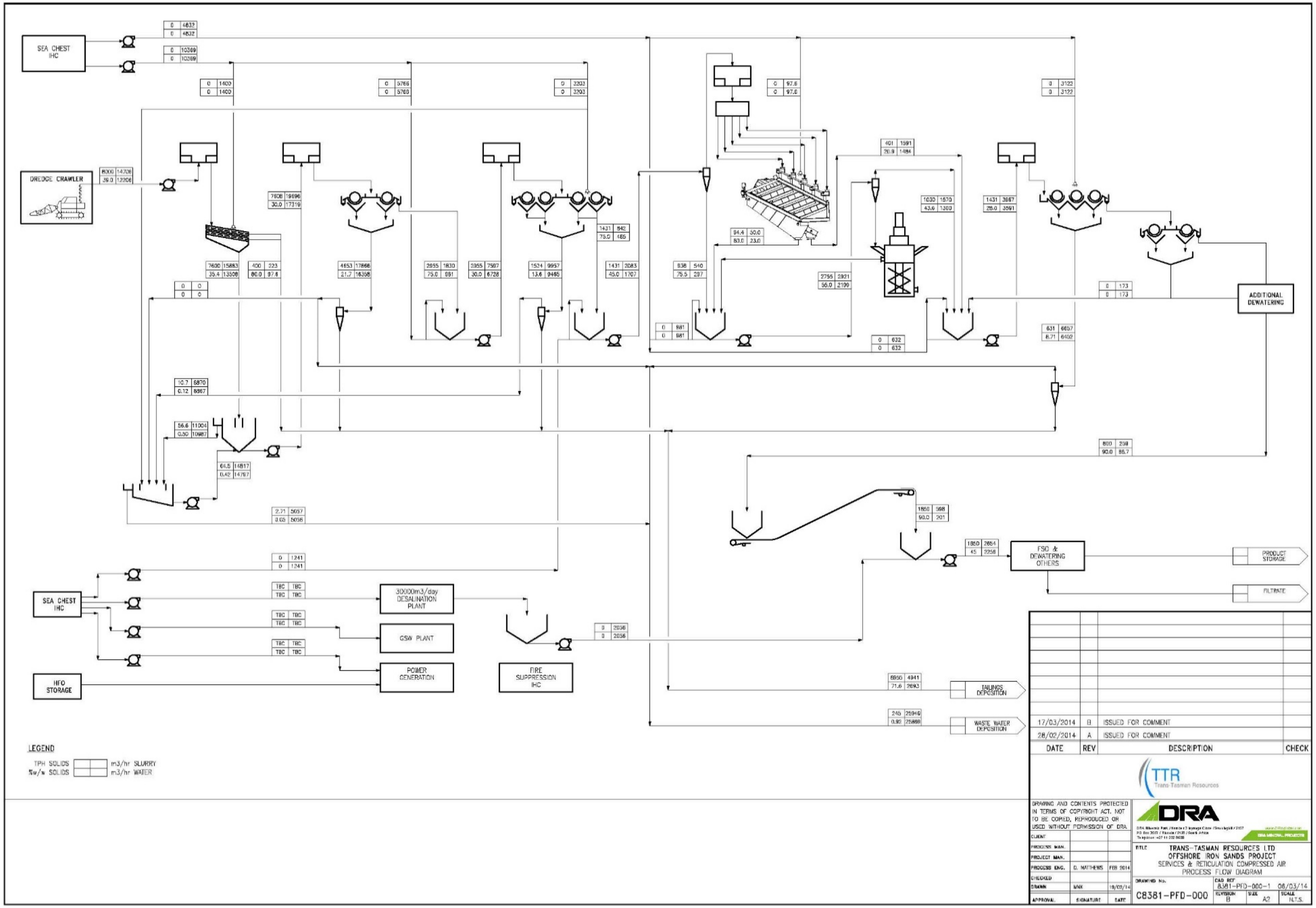
- reduced mass (30 tons per screen compared to 220 tons per trommel);
- reduced footprint;
- reduced Capex; and
- reduction in installed power.

The disadvantage of installing double deck vibrating screens are reduced operator visuals and maintenance access to the bottom deck. Due to the fine nature of the material and overflow entrainment, the overflow of the surge tanks directly to wastewater, which may result in a significant loss of Fe from the process. DRA recommended that a separate (motive water) tank be installed to capture the overflow from the surge tanks and reintroduce this water (and solids) into the surge tanks as motive / agitation water. It was also recommended that an elutriator type design be incorporated into the surge tanks to minimise the solids overflow to the motive water tank.

7.5.4 Rougher Magnetic Separation

The -2mm ore is pumped from the agitated storage tanks to the first stages of magnetic separation. The purpose of the rougher magnetic separation (RMS) is to capture both the liberated and locked magnetic particles whilst rejecting the majority of the gangue. This will be accomplished using single drum MIMS and double drum LIMS in series. The slurry is first pumped to the MIMS section located on the first level which will consist of 60 single drum units. The MIMS units will be split into ten clusters of six each, corresponding with the number of agitated storage tanks. The MIMS drums will have a magnetic field intensity of 4,500 G and consist of 3 m wide by 610mm dia. stainless steel drums

Figure 62 DRA Updated PFD



Due to the susceptibility of standard grade 304 stainless steel to pitting corrosion, grade 316 stainless steel was specified for the magnetic separator drums. The MIMS concentrate (approximately 41% of the feed) will be fed under gravity to the LIMS-1 feed tanks at main deck level. Process water will be added to reduce the concentrate slurry density from ~60 to 30% solids. The tailings will be gravity fed via a chute to the tailings handling area.

Figure 62 Magnetite Concentrate Exiting a Wet Drum Magnetic Separator

The MIMS concentrate will be pumped to the rougher LIMS distributors located on the second level. The rougher LIMS section will consist of 16 double drum units operating co-currently at an intensity of 1,250G. The units will be arranged in four clusters with four units each. Each unit has two 3.6m wide by 1.22m dia. drums in series. The weight recovery to concentrate is ~ 45%. Thus, in the RMS section, approximately 82% of the feed is rejected to tailings. The Fe upgrade ratio is 3.2. The RMS concentrate will gravitate to the first stage grind feed bins. Magnetite concentrate from LIMS units are typically at the required solids density required for grinding and no dewatering of the concentrate prior to grinding is required. The tailings will be gravity fed via a chute to the tailings handling area.

7.5.5 Milling

TTR reviewed various mill options and configurations, namely ball mills, ISA mills and Vertimill®. The comminution circuit proposed in the Rev 2 PFS had a two-stage grind with intermediate magnetic separation (IMS) to remove liberated gangue and reduce grinding energy in the second stage grind. Rev 2 also proposed grinding stages proposed M10,000 Isa Mills™ (Xstrata), because of its lightweight design and superior energy efficiency.

Following the DRA process review it was determined that two Metso Vertimill®, in parallel, provided the ability to complete the grinding circuit as a single pass grind. The post PFS process flowsheet had identified that two VTM 4500 mill were specified, however during the DRA review TTR completed special jar mill grindability testing with Metso, in South Africa. From these results DRA undertook a simulation and determined that two smaller VTM3000 units, in closed circuit could, could be utilised and meet the process design. It was noted that given the variability of the ore, additional detailed design would be required.

Description	Mill Specifications as per Basis of Design	Mill Specifications as per Mill Testwork
Mill Description	2 x VTM 4500	2 x VTM 3000
Installed Power	2 x 3 375kw	2 x 2 250kw

Table 17 DRA summary of the mill specifications

Figure 63 Metso Vertimill

7.5.6 LIMS 2 - Intermediate Magnetic Separation

The IMS LIMS units will be identical to the RMS LIMS units. Ground RMS concentrate will be diluted to 30% solids in the IMS feed tanks and pumped to the IMS section (LIMS-2) distributors on the second level. The IMS section will comprise 12 units arranged into two clusters of six separators each. Approximately 30% of the IMS feed is rejected to tailings. The IMS concentrate will be gravity fed to the second stage grind feed tanks. The tailings will be gravity fed via a chute to the tailings handling area.

7.5.7 LIMS 3 - Cleaner Magnetic Separation

The cleaner magnetic separation (CMS) section will consist of eight triple drum co- current magnetic separators at an intensity of 950G, arranged in two clusters of four each. Typical triple and double drum wet magnetic separators are shown in Figure 76. Ground IMS concentrate will be diluted to 30% solids in the CMS feed tanks and pumped to the CMS section (LIMS-3) distributors also located on the second level. The weight recovery to concentrate in the CMS section is expected to be 90% with the concentrate having a Fe grade of more than 56% Fe and SiO_2 less than 3.9%.

Figure 64 Triple and Double Drum Magnetic Separators

The CMS concentrate will be gravity fed to a set of dewatering drum magnets to reduce the concentrate moisture to ~10%. The purpose of these drums is to reduce the level of sea water in the concentrate to aid in reduction of final product chloride levels. Dewatered concentrate will be gravity fed into the concentrate storage hoppers directly below the CMS area. Water removed from the concentrate is recycled to the CMS feed tank.

7.5.8 Final Concentrate Handling

The dewatered concentrate will be stored in two hoppers. The hoppers were sized for a buffer capacity of 40h or approximately 32,000t. This will allow enough time for the FSO to sail a distance of maximum 70Nm to a sheltered area (if required by weather conditions), offload its entire load of 60,000 t concentrate and return to the IMV. Once the FSO is on station, it will connect to the IMV via a floating slurry line. Dewatered concentrate will be extracted periodically from the bottom of the storage hoppers onto a conveyor belt. It will be elevated to the top of a constant density (CD) agitator tank with a sandwich conveyor. In the CD tank the concentrate will be slurried with fresh water from the RO plant (from two intermediate freshwater tanks) to form a 50% solids slurry. Fresh water is required to wash the concentrate, i.e. to reduce the chloride level of the product. The slurry is subsequently pumped to the FSO and filtered to a low moisture content of less than 6.5% using four hyperbaric pressure filters.

Figure 65 Hyperbaric Pressure Filter

These units were chosen for their much smaller footprint relative to conventional filtration units, both from an operational and maintenance perspective. The residual moisture content attainable is also much lower than that of conventional filtration with the added benefit that the minimum moisture is transported to the final destination. The HPF units will operate at an elevated pressure of 6 bar. The filter cake is discharged from the units via a double gate valve system onto conveyors which will deposit the concentrate in the FSO holds. Filtrate from the FSO will be discharged below surface.

During offloading of concentrate the process plant will continue to operate to produce the balance of the 60,000t FSO cargo. Offloading to the FSO therefore will occur at double the production rate of the process plant (~1,600t/h).

7.5.9 Tailings Handling

No chemicals will be used anywhere in the beneficiation process. As a result, the tailings produced by the process plant will be inert. The only physical alteration of the ore is the size reduction during the grinding process. In order to minimise the environmental impact of the tailings in terms of plume formation, it will be dewatered before disposal via a set of hydro-cyclones (refer to Figure 78). Coarse tailings from the RMS area will be treated separately from fine tailings from the IMS and CMS areas. Water removed from the coarse tailings will be recycled to the process water tank at a rate of 15,000 t/h, thus accounting for approximately 52% of the process water requirement. Water from the fine tailings dewatering will contain too high level of suspended solids to be used as process water and will be discharged.

The coarse and fine tailings will be dewatered separately to approximately 75 to 80% solids before being discharged under gravity via the tailings deposition pipe. The deposition pipe will be controlled using sonar such that the discharge occurs at a constant height from the seabed. The tailings wastewater will be discharged via a second pipe along the tailings deposition pipe slightly higher than the solids discharge.

Figure 66 Hydrocyclone Cluster

8 AUXILLIARY SUPPORT SERVICES

8.1 Power Generation

For the purposes of the PFS study the project has specified four (4) Siemens SGT-500 gas turbine generator sets for a total installed power capability of 80MW.

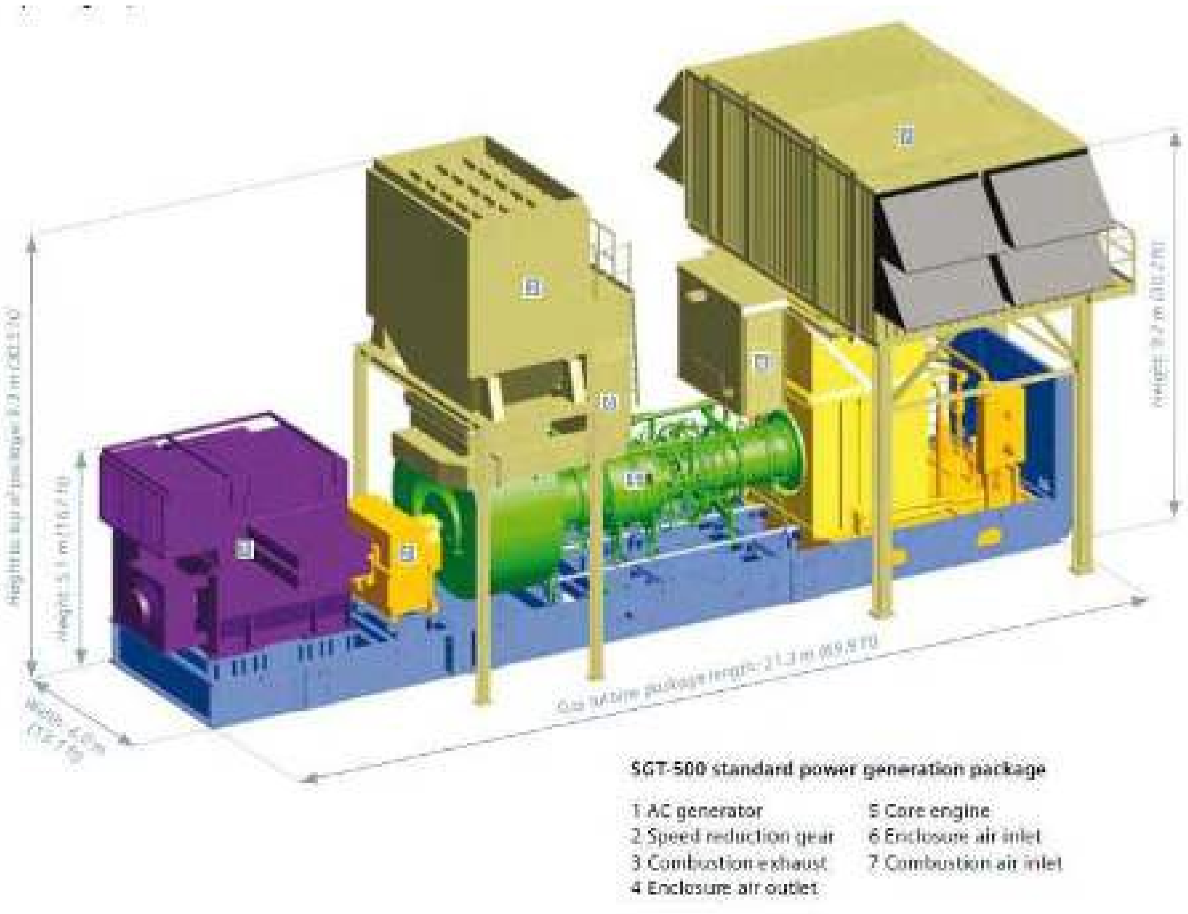


Figure 67 SGT-500 Power Generation Package

The SGT-500 is one of the few gas turbines which have the capability to operate on IFO, something normally associated with diesel engines. Siemens has shown that the SGT 500 can operate continuously on liquid fuels with viscosity corresponding to IF700 with no requirements for blending with diesel oil.

The project acknowledges that there is an opportunity to rationalise the power installation and add considerable value to the project. The feasibility phase value engineering exercise will investigate fitting the IMV with two turbines, along with four medium speed diesel generator sets giving the total installed power of around 80MW. The power generated will meet the ship's demand for energy, which includes the propulsion motors, mining, processing, desalination and low-voltage requirements for lighting and sockets.

Typical medium speed diesel engines for marine applications are rated from around 1MW in small vessels to 10MW in large vessels. Installations of four, six or eight engines are commonplace with 2MW to 7MW being a popular power range. The engines are invariably multi-cylinder units in either in-line or V configuration.

By implementing this dual concept, electric power will be provided by several synchronous alternating current generators operating in parallel. The generators will be connected to switchboards by way of circuit breakers that will allow the generators and loads such as thrusters, service transformers and motors to be connected and disconnected as required.

The advantages of this envisaged concept will include:

- ability to provide large amounts of power for activities other than propulsion;
- ease with which power can be distributed for auxiliary systems;
- modular designs allowing maintenance to continue during operations;
- flexibility in engine assignment; and
- good power plant efficiency.

8.1.1 BFS Power System Studies

Apart from the value engineering exercise, several other power related studies will be commissioned during the feasibility phase to support the design of the IMV power system including the following.

- **Short circuit calculations**: This study will be performed to verify the proposed switch gear will be able to withstand the force generated by the worst-case short circuit current. It will also be used to verify the circuit breakers are able to interrupt that level of fault current. When calculating the contribution to short circuit current it will be necessary to consider the contribution from all motors and certain types of drives in addition to the fault current delivered by the generators.
- **Protection co-ordination study**: This study will be performed to determine the various protection settings necessary to ensure that faults are isolated as close to source as possible.
- **Load balance**: This study will be performed to show the power consumed under various operating conditions, which may include dynamic positioning (DP), transit and harbour with variations for summer and winter operation if appropriate.
- **Harmonic analysis**: This study will be used to verify that levels of harmonic distortion fall within acceptable levels under all expected operating conditions. Excessively high levels of harmonic distortion have been known to cause equipment malfunction exceeding worst case failure design intent.
- **Transient stability study**: This study will be performed to verify the ability of the generators in the power system to maintain synchronism when subjected to a severe transient disturbance such as a fault, sudden loss of generating capacity or large load rejection. It will also be used to ensure that motors can restart and that generators can

restore voltage.

8.1.2 Distributed Control System

The IMV will be provided with a comprehensive vessel management system that will manage the functions of control, monitoring and alarm management of all machinery required to control the functions installed on the IMV including engine and propulsion auxiliary systems, fluid and cargo systems and other ancillary systems

8.1.3 Power Requirement Simulation Model

Due to the complex nature of the operating environment, TTR commissioned a simulation, (See Appendix 19.3), to examine the consequences of wave height, ROM grade variability, buffer sizes and maintenance shuts on the production rate and hence the instantaneous power consumption of the IMV.

A process mass balance model was constructed using the IDEAS modelling software to deliver modelling results for one year's operation at two production input rates of 6,700 tonnes per hour and 8,000 tonnes per hour respectively using actual historic variability in wave heights and observed variability of ROM ore grades based on site sampling surveys.

In addition to modelling the processing module, the model also accounted for:

- The power requirements of the IMV's DP system (DP), influenced by wave height;
- The production by reverse osmosis of desalinated water; and
- Routine fortnightly shuts of the plant for maintenance.

	Scenario 1	Scenario 2
	6700t/h ROM Solids	8000t/h ROM Solids
Real Time for Model	366.4 days	366.4 days
kWh/tonne (ROM)	8.8 kWh/tonne	8.4 kWh/tonne
Peak MW	82MW	82MW
ROM Average Feed Rate t/h	6300 t/h	6700 t/h

Table 18 TTR Power Simulation Results

8.2 Sea Water Desalination

As the processing circuit will be using sea water there is a requirement to provide a fresh water rinsing step into the process. At levels above 300 to 350ppm chlorides begin to pose challenges to steel mills. Chloride forms a white plume during the smelting process as halide formation with potassium (K) and sodium (Na) occurs. High levels of chloride fed into sinter plants can also act as catalysts for the formation of dioxins.

This rinsing requirement will be accomplished using desalinated sea water to transfer the ore in a slurry form from the IMV to FSO. This processing step will require the production of 30 000m^3 of fresh water per day.

The process of reverse osmosis is based on the fact that in all salt solutions an osmotic pressure arises whose magnitude is proportional to salt concentration. When a semi-permeable membrane is placed between two solutions of different concentrations and osmotic pressures, the difference in osmotic pressures will result in a flow of solvent (and a tiny part of the solute) through the membrane, from the less concentrated solution to the more concentrated one. In the process of reverse osmosis, the direction of the solvent flow is reversed by exerting external pressure, higher than the difference in osmotic pressures, on the more concentrated solution.

The typical reverse osmosis plant consists of a bundle of membranes placed in a pressure chamber, a high-pressure pump, a turbine for recovering energy from the high concentration brine which is discharged from the plant, and a system for the pre- treatment of the feed water and the product water.

In the TTR process the sea water will enter, via the sea chest, a pre-treatment system which will contains sand filters, micron filters and a system for chemical dosing. The purpose of this pre-treatment system will be to protect the membranes from fouling by dirt and biological deposits. The feed pump will generate sea water flow at pressures of 55– 80 bar through the membrane system. The discharged brine will be returned to the sea via the submerged tailings pipe. A secondary system used for periodical cleaning of the membranes is installed in each reverse osmosis plant.

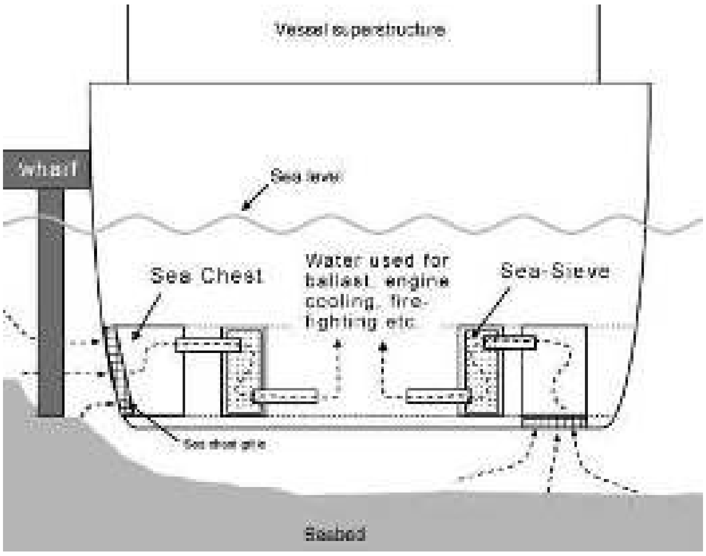


Figure 68 Vessel Sea Chest

The TTR project has specified 10 separate containerised Reverse Osmosis plants, each with a production capacity of 3000 cubic metres per day.

Modularising the plant in this way reduces risk, in the case of a breakdown in one plant, nine others are still available. It is also advantageous from a maintenance downtime perspective: with only 10% capacity offline at any one time, production is hardly interrupted for scheduled servicing. Spare parts are common across all plants, further reducing costs of stocking critical parts and components.

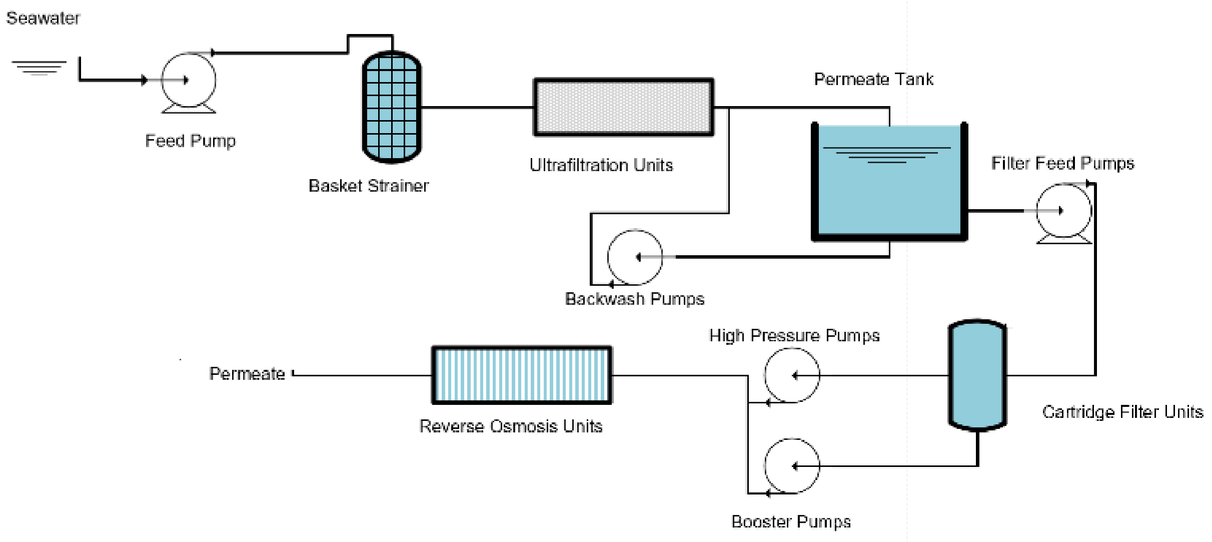


Figure 69 Typical Desalination Process

9 OFFSHORE FACILITIES & SHIPPING CYCLES

In order to fulfil the requirement for producing around 5Mtpa of concentrate, the integrated vessel solution requires several unique vessels to be permanently mobilised, each having a specific function.

9.1 Offshore Personnel levels

The personnel levels for the IMV have been developed based on the personnel arrangements on oil and gas FPSOs that have operated in the Taranaki Area. The crews of both vessels are employed under separate employment contracts, some collective and some individual. These contracts are a progression from the original IMV employment contracts developed for the ‘Whakaropai’ which was operated by Shell Todd Oil Services Limited in the Maui field from the mid 1990’s to the mid 2000’s.

9.1.1 Offshore Working Rosters

It is envisaged that TTR will employ the same 14-day on and 14-day off roster as per the current IMVs. This is a typical employment condition in the offshore oil and gas industry and results in two crews being engaged for each vessel.

Furthermore – the respective employment agreements will provide for six weeks annual leave and in order to meet the roster patterns a small number of relievers will be engaged to cover the disciplines when the core crew is taking these leave periods. The relievers are either sourced from onshore contractors or employed as casual permanent relievers.

9.1.2 Where Crew Reside Onshore

There are no employment restrictions as to where crew need to reside in New Zealand. As a natural result of Taranaki being the energy province of New Zealand, a number of crew will be sourced locally in Taranaki, whilst others from other New Zealand regions. For the ‘Umuroa’ the current figures are 54% Taranaki residents, elsewhere in 46% NZ, the ‘Raroa’ is similar.

9.1.3 Nationality of Crew

There are currently plans to incentivise the use of either New Zealand citizens or New Zealand residents as crew on all operational vessels.

9.2 IMV Offshore Operations

The IMV will be a large vessel designed to accommodate the extraction module at its rear, with the processing, operating and utility modules integrated above deck (Refer to Diagram 83). The vessel and its ancillary systems will be designed to support the interrupted extraction and processing up to a 4m significant wave height. When the captain of the vessel deems it necessary or when forecasts indicate conditions approaching that would exceed this wave height limit, the crawler will be lifted on deck and processing will be adjusted to accommodate this interruption and in extended periods of inclement weather even halted.

The vessel will be designed in accordance with the rules and regulations of ABS as a special purpose mining vessel for site- specific mining activities according to ABS classification rules and regulations with the Flag State for this vessel being New Zealand.

With regards to the design and construction of the IMV the following ABS rules and regulations will apply:

- ABS Rules for Building and Classing Offshore Support Vessels 2014;
- ABS Rules for Building and Classing Steel Vessels 2014;
- Code of Safety for Special Purpose Ships, 2008 adopted by IMO MSC 266(84);
- Rules for Building & Classing Mobile Offshore Drilling Units, 2014; and
- ABS Guide for the Classification Notation Thruster-Assisted Mooring (TAM, TAM (Manual)) for Mobile Mooring Systems, 2014.

The IMV is also required to comply with the following Rules and Regulations:

- IMO International Convention for the Safety of Life at Sea, 1974 (SOLAS), Consolidated Edition 2004 with latest amendments;
- IMO International Convention for the Prevention of Pollution from ship (MARPOL 73/78) with the latest amendments;
- IMO NOx regulations (MARPOL Annex VI);
- IMO International Convention on Load line 1966 including Protocol of 1988;
- IMO International Convention on Preventing Collisions at sea (COLREG 1972) including amendments of 1981 and 1987;
- IMO International Convention of Tonnage Measurement of ships 1969;
- Radio Rules of the International Telecommunication Convention, 1976 and 1979 incl. GMDSS;
- Global Maritime Distress and Safety (GMDSS) requirements for sea areas A1+A2+A3;
- International Labour Conference (ILO) Marine Labour Convention 2006; and
- International State and Port Security (ISPS).

The IMV will also be designed in compliance with the following international codes, standards and guidelines as far as applicable:

- 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 will comply with all the applicable Flag State marine rules and regulations.

Critical to the design of the mooring system is the specification of the maximum environmental conditions. TTR has used verified local Met Ocean data compiled over a period of two decades

To allow for potential future additional weight to be installed on-board the IMV, a 200,000tdw vessel has been considered for the mooring dynamic analysis in the rest of the study.

Figure 70 Integrated Mining Vessel (IMV)

9.2.1 IMV Mooring Analysis

As part of the IHC Crawler evaluation, a preliminary conceptual mooring study and dynamic analysis was performed on the IMV in order to confirm the ability of the proposed four- point mooring to cope with the environmental conditions. The loadings identified in the initial commissioned Principia mooring study, provided IHC with the baseline loading cases for the preliminary conceptual four-point mooring study.

The proposed mooring system will consist of a four-point mooring with an equal spread. The vessel will be able to operate in an anchor spread of 900m by 300m with a water depth of 20 to 65 metres. Refer to the appendix for the full report.

9.2.2 IMV Personnel Levels

The total personnel complement required for the IMV will be 139 personnel, this includes an allowance for relief during holiday periods. The detailed IMV personnel requirement is detailed in Appendix 19.5 of this document

9.3 FSO Offshore Operations

TTR commissioned CSL to provide a transhipment system consisting of a purpose-built self-unloading, trans- shipment vessel with a cargo capacity of 60,000 Mt. The loading system aboard the transhipment vessel consists of a dewatering plant and a mechanical, deck conveying system.

Product will be slurried with fresh water and pumped via floating hoses from the IMV to the transhipment vessel. The dewatering plant will consist of a number of hyperbaric disc filters. The machine consists of discs divided into segments, each of which is fitted with a ceramic filter. The water discharged from the hyperbaric filter on the vessel will not contain any “hard won” concentrate sediment particles. The hyperbaric disc filters on the FSO will make use of ceramic vacuum disc filters to dewater the iron sand slurry. The construction and operation principle of ceramic disc filters is similar to the conventional disc filters, but the difference is that the filter cloths are replaced by microporous ceramic segments with a pore diameter of 10µm. The verified analysis of the produced concentrate particle size distribution shows no particle below 20µm. The specified segments will provide a dewatered concentrate with a moisture content of less than 8%.

Once fully loaded, the transhipment vessel will sail to the area designated for “dry” transfer onto ocean going cargo vessels. The “dry” cargo discharge system on the proposed transhipment vessel is gravity based; a proven system widely used across CSL’s global fleet of vessels.

The dewatered iron ore flows through gravity feeder gates at the bottom of the transhipment vessel’s cargo holds, depositing cargo onto an inclining tunnel belt that will elevate the cargo to the main deck of the Transhipment Vessel. The cargo is then deposited onto two separate incline conveyors, each feeding a ship-loader located fore and aft. The ship-loaders can slew, luff and telescope and are capable of loading and trimming ocean going cargo vessels of up to 57m beam.

	FSO Specifications
Length (meters)	230
Width (meters)	32
Summer Draft (meters)	13
Air draft in ballast condition (meters)	34
Class and flag	IACS class society and flag to be determined.
Propulsion	• Main propulsion and rudder system designed for optimum maneuverability. • Powerful bow thrusters, allowing double-bank operation independent of tugs. • Further analysis required to determine maneuverability requirements during loading, including requirement for full Dynamic Positioning capability
Accommodations	25 people
Self-Unloading / Material Handling System	• Hopper shaped cargo holds lined with Ultra- high-molecular-weight polyethylene (UHMW) • Hydraulic mass flow gates • Gravity fed inclining conveyors • 2 x ship-loaders, each 4,000tph (peak 8,000tph; average 6,000tph)

Table 19 FSO Specification

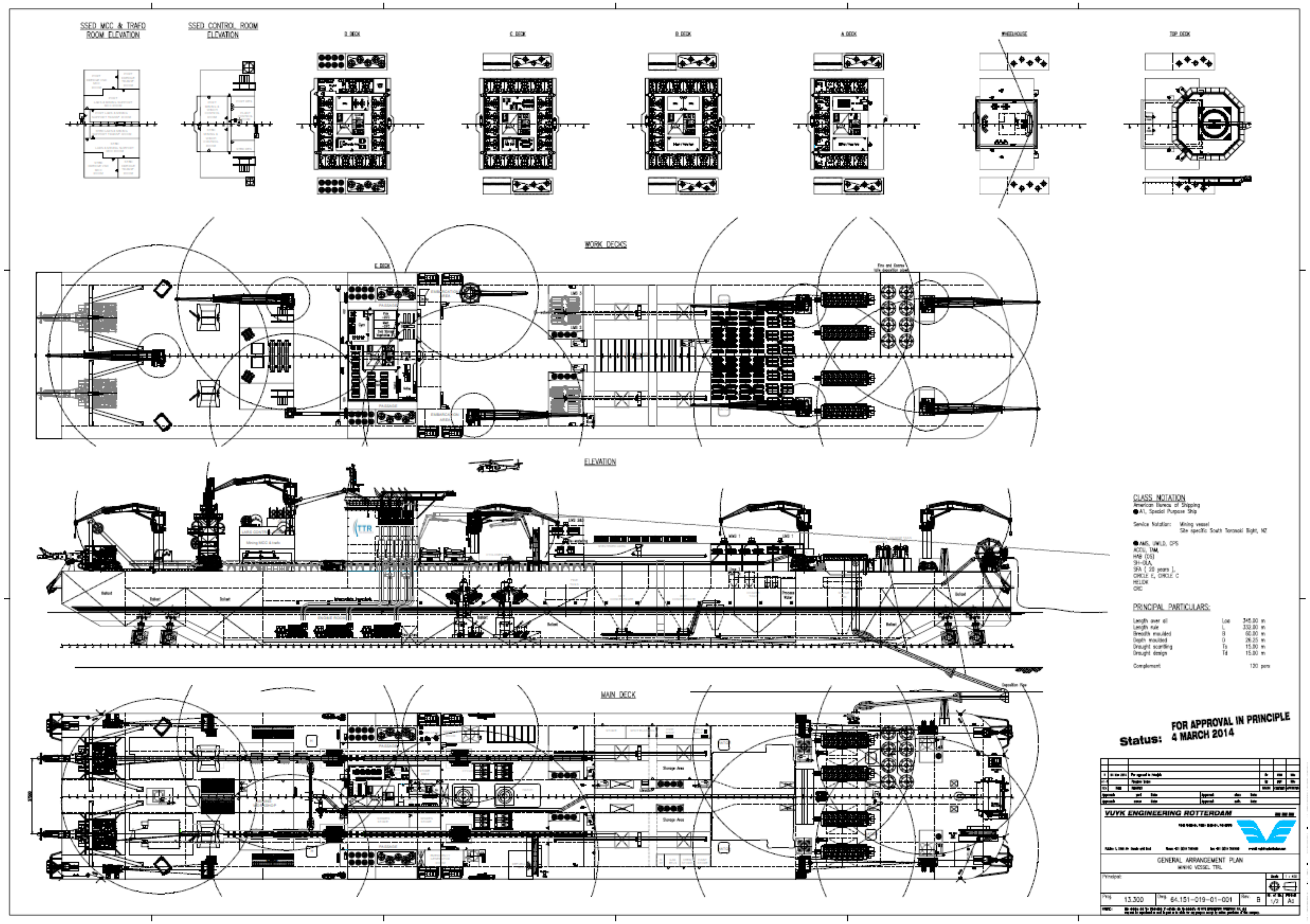


Figure 71 IMV General Arrangement

9.3.1 FSO Loading System

This loading system will consist of a dewatering plant and a mechanical deck conveying system.

The dewatering of the ore will be achieved by four hyperbaric filtration units each with a throughput of 450 tons/hr, providing a total dewatering capability of 1,800 tons/hr.

The slurried ore will be transferred from the IMV to the FSO through flexible hoses. Once the FSO is fully loaded with concentrate (60,000t), it can unmoor from the IMV and sail to an awaiting export Capesize vessel which will be located in a calm area off the South Island, approximately 70Nm from the mining location.

9.3.2 Cargo Vessel (Capesize) Loading system

The cargo discharge system on the proposed FSO will be gravity based and is wildly used across self-unloading bulk carriers and transhipment systems. The company approached during the completion of the PFS, i.e. CSL, had three gravity FSOs in operation and nine self-unloading bulk carriers under construction (or newly completed) utilizing the same core technology as the proposed TTR FSO.

9.3.3 Transhipment Cycle

The overall cycle duration of the Floating, Storage and Offloading vessel.

Activity	Time (h)
Total positioning time	5.0
Loading IMV to FSO	53.6
Average time for draft survey	0.2
Transit to Anchorage	5.8
Unload FSO (trans-shipping)	7.5
Shifting	0.5
Transit to IMV	5.8
Total time per FSO (hours)	**78.4**
Total time per FSO (days)	**3.3**

Table 20 FSO Shipping Cycle

The overall shipping cycle duration for the FSO is thus approximately 78.4 hours, putting the FSO on the critical path of the overall production cycle.

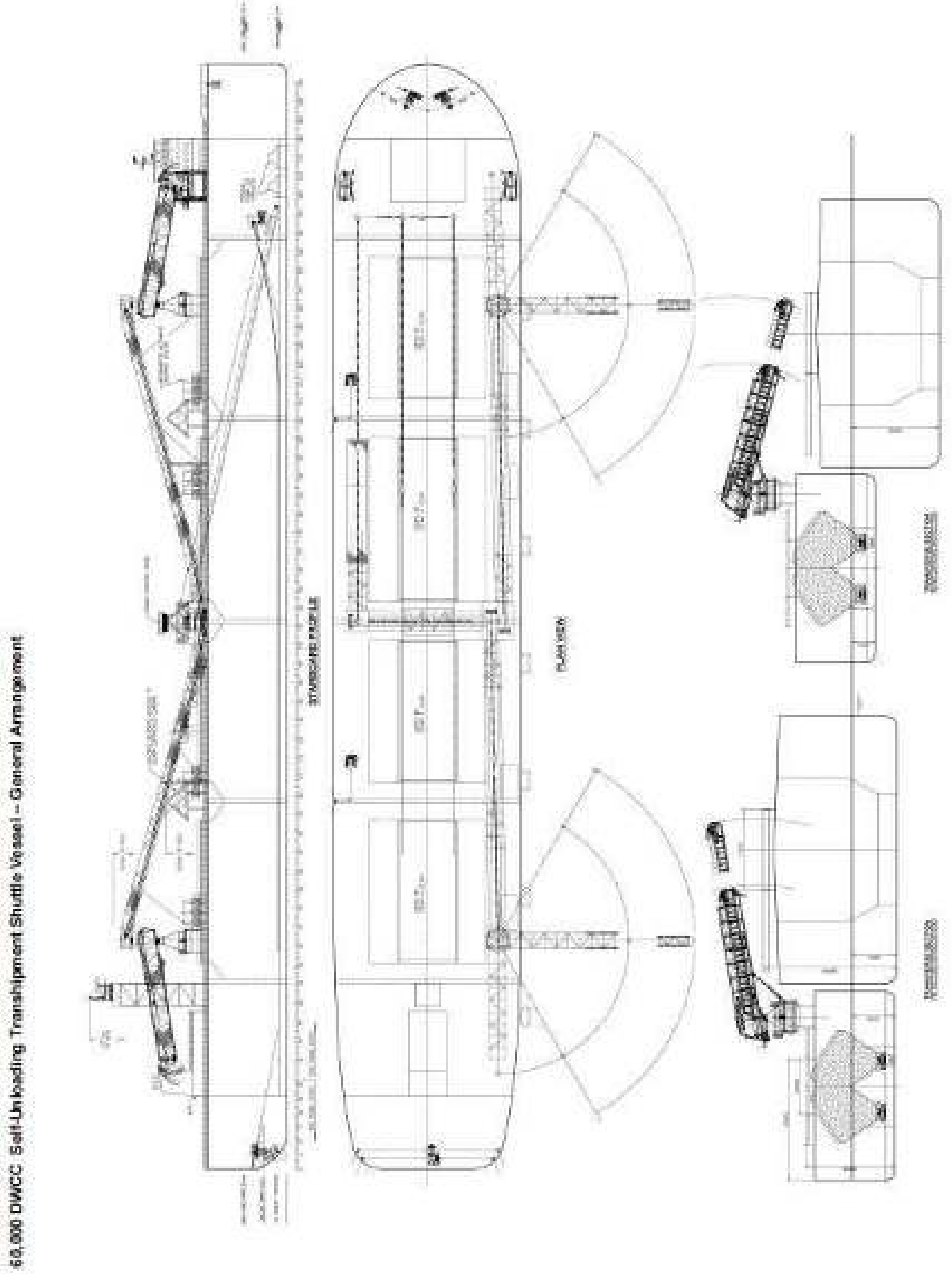


Figure 72 FSO General Arrangement

9.3.4 FSO Personnel Levels

The total personnel levels, including holiday relief, for the operation of the FSO will number 34 and will be sufficient to operate and maintain the filtration modules provided they are given the relevant training.

9.4 Operational Support

9.4.1 Anchor Handling Tug (AHT)

The TTR project has made provision for an 80te bollard pull Anchor Handling Tug (AHT) to assist with the provisioning of the IMV and FSO, assistance with the connection of floating hoses and anchor moving. The AHT will also provide refueling assistance and be equipped to assist in case of any fuel spillage and fire.

9.4.2 AHT Personnel Levels

The total personnel levels, including holiday relief, for the operation of the AHT will number 24.

9.4.3 Environmental Monitoring Vessel (EMV)

TTR has proposed deploying an Environmental Support Vessel (EMV) as a key component of its offshore iron sand extraction operations. The EMV would be dedicated to conducting comprehensive environmental testing and monitoring throughout the project's duration. Equipped with advanced oceanographic and environmental sensors, the vessel would collect real-time data on water quality, marine ecosystems, and sediment dispersion. This proactive approach ensures compliance with environmental monitoring requirements.

Continuous monitoring would allow for timely responses to any deviations from environmental performance expectations, minimizing risks to marine habitats. By integrating state-of-the-art monitoring technology with scientific oversight, TTR aims to uphold responsible resource development while maintaining the health of New Zealand's offshore environment.

9.5 Iron Concentrate Export to China

The final iron ore product will be exported to China by means of standard Capesize vessels, chartered by either TTR or their customers. The overall export cycle is detailed in the table below.

Activity	Duration (h)	Duration (d)
Load time 180kt	235.3	9.8
Sail to Qingdao (Cargo)	382	15.9
Unload	140	5.8
Sail to New Zealand	369	15.4
TOTAL	**1126.3**	**46.9**

Table 21 Capesize Vessel Shipping Cycle

10 OFFSHORE OPERATIONS

The integrated solution features a single IMV, that will contain the mining, processing and tailings deposition mechanisms, a single FSO that will trans-ship the concentrate from the IMV onto standard commercial bulk Capesize vessels for delivery to end users.

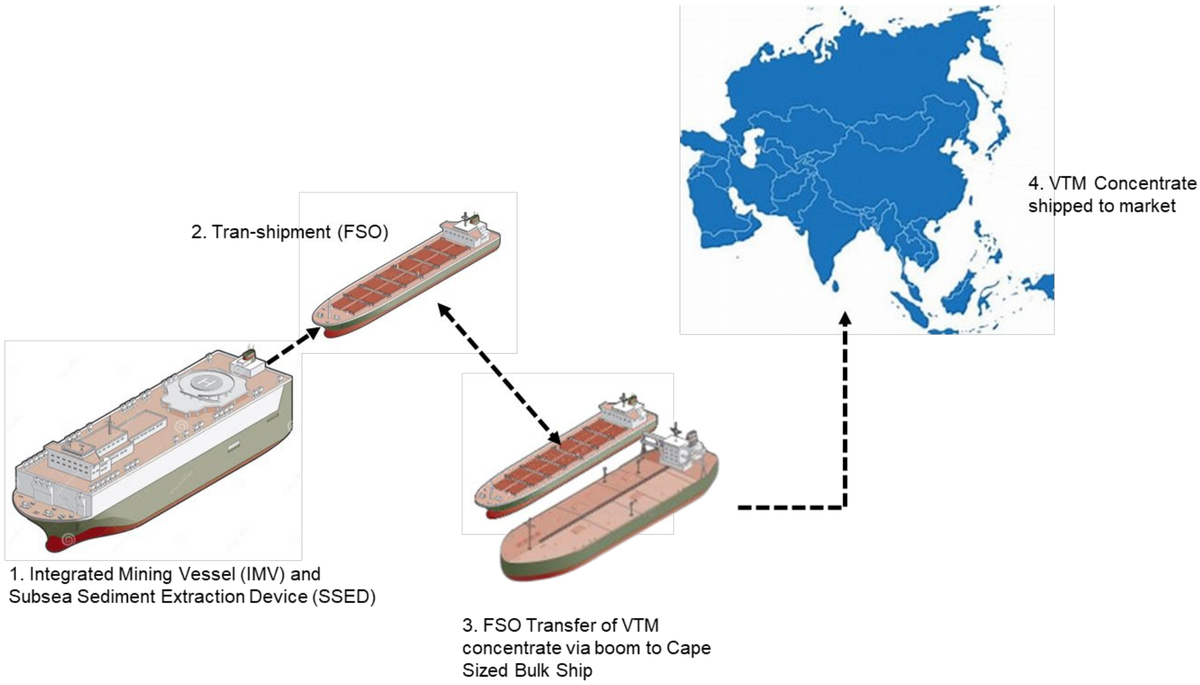


Figure 73 Offshore Operations

10.1 Anchor Relocation

A 300 x 300m mining block will typically be mined out in around five days, therefore a mining block selected 900 x 600m (anchor spread) would require requiring an anchor shift operation approximately every thirty days.

With the IMV in a DP assisted state, the AHT will move two (least loaded) adjacent anchors to their new position whilst the IMV remains over its existing mining area. Once the IMV has raised the mining crawler, moved over to the new mining area and lowered the crawler, the AHT will resume the relocation of the two remaining anchors.

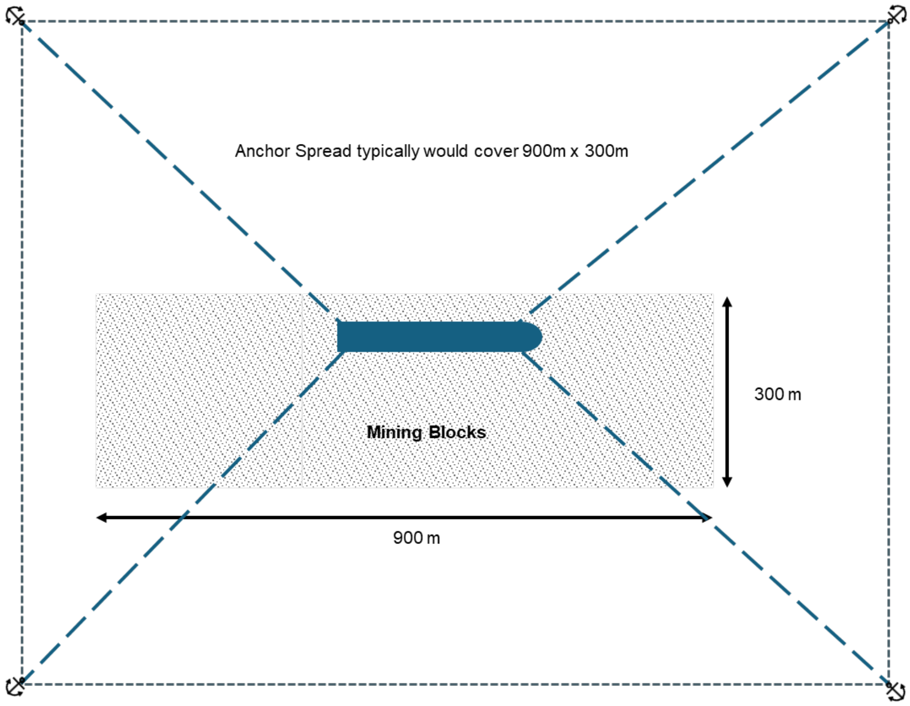


Figure 74 IMV Anchor Spread

10.2 Iron Ore Unloading

Once beneficiated the iron ore will be unloaded to a FSO used for storage and transfer to Capesize vessels for export.

This iron ore unloading operation will require the IMV to be equipped with a bow offloading system to be connected to the bow of the FSO by floating, flexible hoses.

The average distance required between the IMV and the FSO for safe unloading operations varies between 70m and 110m. The FSO will need to be equipped with some dynamic positioning capability in order to enhance operability and facilitate transfer operations whilst not disrupting mining operations.

The offloading system must offer the advantage of storing the flexible hoses on dedicated storage reels, in order to avoid leaving them at sea where they are subjected to waves and current which will induce wear, tear and fatigue damage of the lines.

10.3 CapeSize Vessels Loading

The transhipment from the FSO to the Capesize vessel will be performed by means of dedicated belt conveyors which will be installed below the FSO holds which slope has been modified in order to allow removal of the ore by gravity (no additional equipment required for ore transfer).

The iron ore will flow through gravity feeder gates at the bottom of the FSO cargo holds, depositing cargo onto an inclining tunnel belt that will elevate the cargo to the main deck of the vessel. The cargo will then be deposited onto two separate incline conveyors, each feeding a “ship- loader” located fore and aft. The ship-loaders can slew, luff and telescope and are capable of loading and trimming cargo vessels up to 57m across. No additional mechanical trimming will be required.

The distance between the two ship-loaders and the slewing capability will facilitate an optimized cargo vessel loading sequence with little or no shifting of the FSO along the cargo vessel.

The FSO will be fitted with an optimised mooring systems and an azimuth propulsion system, allowing for a higher degree of maneuverability, shorter cycle times and improved safety. This will also allow the FSO to operate without tug assistance.

Figure 75 Transhipment Shuttle Vessel CSL Whyalla Iron Ore in South Australia

Figure 76 Capesize Vessel Loading

10.4 Intermediate Fuel Oil (IFO) Supply & Transfer

Heavy Fuel Oil (IFO) is a broad term used to describe a range of residual fuels derived from crude oil refining, typically characterised by high viscosity and density. Within this category, different grades exist based on their specific properties and intended applications. One of the most common grades is Intermediate Fuel Oil (IFO) 380, which falls under the IFO classification.

The designation "IFO 380" refers to its maximum viscosity of 380 centistokes at 50°C, making it a widely used marine and industrial fuel. While IFO encompasses various formulations, IFO 380 is essentially a standardised variant within this group, sharing the same fundamental characteristics and applications as other heavy fuel oils. IFO 380 is still the standard grade of fuel for ocean going vessels and is readily available from Singapore. All of the operations on the IMV will be powered by generators using IFO 380, at full production this will consume around 7,500T of IFO 380 per month.

10.4.1 RAS (Replenishment at Sea)

The most efficient refueling system would be a RAS system. This is proven technology and used widely around the world, including all major Navies. Its biggest advantage is the ability for the IMV to continue operation during the fueling process.

The process would involve a tanker vessel sailing directly from the supply point to the TTR mining area and refueling would take place as shown below.

Figure 77 Typical Refueling Configuration

The jackstay wire rope is fastened to the receiving vessel above the refueling point, the fuel hose is then deployed and is guided to the reception manifolds, where the fuel probe self-locates and locks in place, once secure fuel can be transferred.

This system is capable of operating in up to 4m significant wave height[7].

10.4.2 Logistics

There is a large supply of IFO 380 available around the world with Singapore being the nearest large supply. During Summer, the supply and demand are relatively equal, during the Winter the requirement drops significantly and there is a surplus which needs to be exported. TTR would contract a company to provide a turnkey solution providing a consistent fuel supply per month directly to the operating vessels via a RAS or similar system.

11 HEALTH AND SAFETY

11.1 Summary

There are a number of Health & Safety (H&S) considerations when carrying out such a large offshore project, TTR will be requiring the companies who are supplying all of the equipment to provide relevant H&S guidelines for use. The information provided will be assessed against the best practice in industry and improved where possible to ensure TTR is providing the safest work environment available. Below are the high-level obligations TTR would have to cover when undertaking the mining operation:

11.2 Vessel Operations

All of the vessels involved in the mining operation will follow the International Safety Management Code (SOLAS) for vessel operations, Maritime Transport Act and Maritime NZ Marine Protection Rules. Each vessel will also have tailored H&S systems based on the unique normal day-to-day deck-based operations. There will be specialist operations which the vessels take part in which will need specific H&S guidelines developed for them as follows;

IMV:

- Deployment, connection & Emergency release of slurry hoses to FSO;
- Vessel proximity procedures (based on dynamic positioning capability);
- Safe sea state operating conditions;
- On deck crawler operations;
- Power plant operations;
- Crane operations;
- Anchoring operations; and
- Port Operations (handled by Pilot) – This will be specifically covered due to the size of the vessel.

Anchor Handling Tug (AHT):

All of the anchor handling operations will be dependent on the met ocean conditions

- Loading and unloading supplies to the IMV or FSO via deck cranes; and
- Moving the anchors of the IMV.

FSO:

- Deployment, connection & Emergency release of slurry hoses to FSO; and
- Loading between the FSO & Capesize export vessel.

11.3 Process

The process area will be treated in the same way as a high-level production plant onshore, with each piece of machinery assessed and assigned Standard Operating Procedures (SOPs) & maintenance schedules with hazards and work plans associated to each.

A HAZOP will be undertaken before commissioning.

11.4 Seabed Crawler (SBC)

The SBC or Seabed Crawler is an extremely large machine and will have similar H&S requirements around its handling as onshore mining equipment of the same size. Some of the unique requirements will be;

- Operating the Seabed Crawler on deck;
- Emergency lift procedures;
- Loss of vessel position;
- Umbilical tendering - steel wire lifting cable; slurry hose; high voltage power supply subsea & on deck; and
- Maintenance procedures on the Seabed Crawlers.

An advantage is that the crawler is mature technology which has established its use at sea, so previous experience of H&S procedures developed can be used and updated to exceed international expectations.

11.5 Power Generation

Due to the large amount of power being generated for the various processes on the vessel and the environment it is being used in, the H&S requirements will be of the highest standard and can be modelled on procedures used by onshore power plants.

The IMV will have an integrated power system which will control, monitor and regulate the power being sent to each piece of plant, this will allow TTR to automate the safety systems for faster and more efficient deployment. Specific attention will also be applied to:

- Security & treatment of on deck power cable;
- Integrity of areas where power is generated;
- Electrical isolation of plant & emergency stop of whole process;
- Monitoring of fumes & gases;
- Electrical safety plans;
- High voltage safety;
- Emergency power requirements; and
- Class protection of equipment established.

11.6 Fuel Handling & Transfer

The fuel being used on the project will be IFO 380, this fuel is not as refined as other fuels and is more toxic than refined fuel. Specific H&S risks are associated with this fuel necessitating a need to reduce the exposure to zero where possible. If exposure is necessary, then strict protective equipment would be specified and supplied.

Bunkering at sea is regulated under the Maritime Transport Act, Marine Protection Rules & MARPOL, the following H&S practices need to be followed;

- A safe and controlled surface transfer system – this system should have an automated mating coupling system;
- Transfer in daylight hours only;
- A safety management system documenting all procedures to take place to allow the safe transfer of fuel oil;
- Strict protocols in place for spill control; and
- The vessel transferring to have spill control and dispersants available and ready.

11.7 Personnel

Maintaining the health of all personnel working within this operation is paramount. The crew will be working on a rotation basis such as three weeks on, three weeks off, while they are on the vessel they will work every day on 12-hour shifts every day. TTR's H&S procedures will be similar to other manned production platforms such as the Raroa (existing New Zealand offshore FPSO. Some of the key H&S policies will be around.

- Physical health;
- Dealing with accidents and injuries;
- Promotion of a healthy lifestyle on board;
- Physical properties of fine iron sand and associated hazards;
- Mental Health;
- Fatigue;
- Isolated working environment;
- Adherence to strict procedures and practices;
- Active participation in promoting a safe work environment; and
- Providing proper training is provided in offshore survival; first aid and firefighting.

11.8 Helicopter Operations

These operations are some of the most dangerous and will have to be carried out regularly to transfer crews & emergency / specialist supplies. The safety precautions that need to be taken are very specific and require a number of trained specialists. Some of the considerations will be:

- Security;
- Communications;
- Cold water survival training;
- Weather parameters;
- Firefighting capability; and
- Rescue capability.

New Zealand has a major helicopter port based in New Plymouth which carries out a number of flights each day to New Zealand offshore installations. They have strict H&S standards and procedures which allow them to operate around and land on oil installations, these same standards will be applied to TTR's offshore operations, including adherence to Civil Aviation Rules, Safety Case methodology, Risk & impact assessments.

12 MARKET STUDIES AND CONTRACTS

12.1 Introduction

Siecap NZ undertook an update of the Market conditions and outlook, which was reviewed by independent commodities trader Tennant Metals Pty Ltd.

Tennant Metals have a comprehensive understanding of the global metals market, including miners, producers, smelters and refineries. Tennant Metals produced the 2014 PFS market study report for the PFS.

This Section of the PFS provides an analysis of the iron ore market, focusing on historical pricing structures, current market dynamics, and future price forecasts for 2025. It examines the evolution of iron ore pricing mechanisms, from the traditional benchmark system to the modern index-based structure, highlighting key influences such as Chinese steel demand, supply constraints, freight rates, and environmental policies.

A key aspect of this Section is the assessment of product variability and quality control, ensuring alignment with market specifications through a Total Quality Management Plan. The report also explores the strategic opportunities presented by co-products such as titanium and vanadium, particularly in jurisdictions where these minerals are classified as critical.

Additionally, this market study outlines recent price trends, including fluctuations observed in Q4 2024 and early 2025, and provides a forecast for the remainder of the year. It offers insights into the impact of global economic conditions, infrastructure spending, and the shift towards low-emission steel production on iron ore demand and pricing.

The findings and recommendations in this report aim to support strategic decision-making, optimize market positioning, and enhance commercial outcomes for stakeholders engaged in iron ore production and trade.

12.2 Product Specification

The TTR Iron sands has been identified as a material which can be mined and processed to produce a product of a quality that can be sold in the current market. The forecast mine life is 20 years plus at a production capacity of 4.9Mtpa.

Iron Ore	**VTM Iron Sand**
Type	**Concentrate**
Fe	56.70%
Fe^{3+}	66.70%
Fe^{2+}	33.30%
FeO	24.30%
Fe_2O_3	54.00%

SiO_2	3.40%
Al_2O_3	3.70%
CaO	0.94%
MgO	3.14%
Mn	0.53%
P	0.15%
S	0.01%
TiO_2	8.40%
V_2O_5	0.50%
Na_2O	0.15%
K_2O	0.12%
H_2O^+	0.00%
H_2O^-	6.50%
Total	99.40%
Ultrafines (for fines)	100.00%

Table 22 TTR's VTM Expected Typical Specification.

12.3 Product Variability Targets

It is anticipated that the product variability will be within the range required for the market. This is based on the assumption that a total quality management plan will be implemented with mining and scheduling. The operational focus will be aimed at maintaining all key parameters within the market contracted specifications between TTR and the customer.

12.4 Marketing Summary

12.4.1 Historical Pricing Structure of Iron Ore and its Evolution

Before 2009, the annual benchmark system was the primary mechanism for negotiating iron ore prices between major miners and steel producers, particularly in China, Japan, and South Korea. The system involved long-term contracts between the world's largest iron ore producer Vale, Rio Tinto, and BHP Billiton and major steelmakers, with Baosteel traditionally representing China's interests. Although this annual benchmark system was a mechanism developed between the world's three largest producers and their Asian customers, the pricing methodology was largely adopted by iron ore producers and their steel mill customers globally.

Additionally, initial pricing was straightforward, with payables based only on the iron ore content of the negotiated parcel less any penalty items. The range of those penalty items were quite detailed with clear contractual limits which once exceeded would reduce the total amount to be paid. It was however unusual for a seller to be entitled to additional credits in the event of the presence of a recoverable and valuable co-product like vanadium. This was in stark contrast to the base metals concentrate markets where additional credits were due and payable for those metals in existence above certain minimum amounts.

Following a shift from the yearly benchmark system in 2010, iron ore pricing in China transitioned to index-based mechanisms, significantly maturing over the past years, with the changes again being adopted broadly by producers and steel mills in the various geographical markets. The primary indices used in today's market include:

- Platts (S&P Global Commodity Insights)
    - IODEX 62% Fe CFR North China;
    - 63.5/63% Fe CFR North China;
    - 65% Fe CFR North China;
    - 58% Fe CFR North China; and
    - 52% Fe CFR North China (with max 4.0% Al content).
- The Steel Index (TSI) (Acquired by S&P Global Commodity Insights)
    - 62% Fe fines, 3.5% Al, CFR Tianjin port;
    - 58% Fe fines, 3.5% Al, CFR Tianjin port;
    - 62% Fe fines, 2% Al, CFR Qingdao port; and
    - 63.5/63% Fe fines, 3.5% Al, CFR Qingdao port.

Figure 78 Iron Ore 62% Fe, CFR China (TSI) – 7 February 2025

Today, iron ore contracts are primarily priced on a quarterly, monthly, or spot basis, with many deals based on average price settlements derived from Platts or TSI indices.

It is also important to note that the continued reference to Chinese ore preferences and pricing methodologies set out further in this summary, is due to their prevailing influence on global iron ore markets. (It is not the intention of TTR to specifically pursue a Chinese off-take relationship. The fact that both titanium and vanadium are listed as critical minerals in the USA, the EU, Canada, Australia and now New Zealand, provides offtake, marketing and strategic opportunities in numerous geographical locations).

12.4.2 Current Market Structure and Price Forecast – 2025

The iron ore pricing landscape in 2025 reflects a well-established index-based structure, with price fluctuations driven by Chinese steel demand, supply constraints, freight rates, and decarbonisation policies. It is now an accepted practice for parcels of iron ore with valuable co-products to receive either a direct credit (a direct and percentage based monetary payment for the attached co-product) or an implied credit (a higher payable than the prevailing percentage of iron ore contained) in price negotiations. With the shift towards lower-emission steel production, the demand for high-grade iron ore and magnetite is expected to remain strong, as will those ores with valuable co-products, while lower-grade ores may face discounts due to environmental concerns.

The role of futures trading continues to grow, adding complexity and flexibility to price negotiations.

12.4.3 Market Trends and Price Assessment

In this first quarter of 2025, iron ore prices have experienced volatility driven by global economic factors, shifts in Chinese steel demand, and supply constraints in major production regions such as Brazil and Australia.

- Q4 2024 Price Overview: Prices fluctuated between $115-$125 per dry metric tonne (dmt) CFR China (62% Fe fines) amid concerns over slowing steel demand and production curbs in China;
- January-February 2025: A slight price recovery was observed, reaching $130-$135/dmt CFR China, driven by;
    - Infrastructure spending increases in China post-stimulus measures;
    - Supply disruptions in Brazil due to seasonal heavy rains; and
    - Rising freight costs impacting CFR prices.
- Forecast for 2025:

- Analysts project an average price of $100/dmt[8] CFR China for 62% Fe fines throughout 2025, with potential downward pressure in Q3 due to global economic slowdowns.[9]
- High-grade ores (65% Fe) are expected to trade at a premium of $15-$20/dmt due to increased demand from low-emission steelmakers.

	Current (November 8)	2024 YTD	2020	2021	2022	2023	2024f	2025f	2026f	2027f	2028f
BMI	96	105	105	156	113	114	110	100	95	92	90
Bloomberg Consensus	na	na	na	na	na	na	109	95	90	88	90

Figure 79 BMI - Iron Ore Price Forecast (USD/Tonne) – 15 November 2024

12.4.4 Key Market Drivers in 2025

12.4.4.1 Chinese Steel Demand and Government Policy

- China remains the largest iron ore consumer, importing over 1 billion tonnes annually.
- The Chinese government continues its “Dual-Carbon policy, enforcing steel production cuts to reduce emissions.
- Demand for high-grade iron ore (65% Fe and above) and magnetite has increased due to decarbonisation initiatives and the increasing adoption of Direct Reduced Iron (DRI) processes.

12.4.4.2 Global Supply-Side Factors

- Brazil (Vale): Seasonal disruptions and logistics constraints have led to intermittent supply tightness.
- Australia (Rio Tinto, BHP, FMG): Expansion projects continue, but ESG concerns, and regulatory hurdles may impact future growth.
- New entrants: African projects (e.g., Simandou in Guinea) are expected to contribute to supply post-2025.

12.4.4.3 Freight and Logistics Impact on Pricing

- The cost of shipping iron ore from key exporters (Brazil and Australia) to China remains a significant factor in CFR pricing.

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[8] https://editorial.northernminergroup.com/wp-content/uploads/2024/11/BMI-Iron-Ore_-Price-Weakness-To-Continue-Into-2025-Upside-Contingent-On-Mainland-Chinese-Stimulus-15-Nov-2024.pdf

[9] https://www.nasdaq.com/articles/iron-ore-price-forecast-top-trends-iron-ore-2025

- Freight indices, particularly C3 (Brazil-China) and C5 (Australia-China), influence landed costs.

12.4.4.4 Futures Market and Hedging Strategies

- Dalian Commodity Exchange (DCE) and Singapore Exchange (SGX) iron ore futures play a pivotal role in price discovery and risk management.
- Increased hedging activity by steel mills and traders to mitigate price volatility.

12.5 Hematite and Magnetite - Iron Ore Pricing and Supply to China

12.5.1 Hematite vs Magnetite in the Iron Ore Market

Hematite (Fe_2O_3) and Magnetite (Fe_3O_4) are the two primary iron ore types used in steelmaking. While hematite dominates the global seaborne trade, magnetite has been gaining importance due to its energy efficiency, improved pelletising and sintering performance and lower impurities.

12.5.1.1 Hematite Ore Characteristics:

- Direct Shipping Ore (DSO).
- Lower processing costs but generally lower Fe content (58%-62%).
- Requires sintering before use in blast furnaces.

12.5.1.2 Magnetite Ore Characteristics:

- Requires beneficiation (crushing, grinding, magnetic separation)
- Higher Fe content post-processing (typically 65%-72% Fe).
- Lower impurities (phosphorus, sulphur and alumina).
- The reduction of magnetite to metallic iron is exothermic, meaning it releases heat, whereas hematite reduction is endothermic (absorbs heat).
- Suitable for pellet production and Direct Reduced Iron (DRI) steelmaking.

12.5.2 How Magnetite is Priced in China

Unlike hematite, which is mostly priced based on Platts IODEX (62% Fe) and TSI indices, magnetite pricing follows a different structure due to its beneficiation process and higher Fe content.

12.5.2.1 Magnetite Pricing Mechanisms

- Premium Pricing for Higher-Grade Ores.
    - Magnetite concentrates and pellets (65%-72% Fe) generally trade at a premium over the benchmark 62% Fe fines.

- The premium typically ranges from $15-$25/dmt above the Platts IODEX 62% Fe CFR China price.
- Platts 65% Fe index is used as a pricing benchmark for magnetite concentrates.

- Index Referencing.
  - Prices for magnetite concentrates (64%-67% Fe) are referenced to Platts 65% Fe fines CFR China.
  - Pellet prices are based on Platts Atlantic Pellet Premium or negotiated on long-term contracts.
- Discounts for Impurities.
  - If magnetite contains high sulphur (S) or phosphorus (P), discounts apply.
  - Some magnetite ores require further refining, leading to processing cost adjustments.

12.5.3 Market Positioning of Magnetite in China

China's Dual-Carbon policy (carbon peaking by 2030, neutrality by 2060) has increased demand for high-grade iron ores such as magnetite due to its lower energy requirements in steel production.

Magnetite is gaining prominence in China due to its higher Fe content, energy efficiency, and alignment with low-carbon steelmaking. Suppliers in New Zealand and Australia can leverage this demand by offering high-grade magnetite concentrates and pellets. Positioning magnetite as a premium, low-carbon alternative will be key to capturing future market opportunities in China's evolving steel industry.

12.5.3.1 Key Demand Drivers in China

- Energy Efficiency & Lower Emissions.
  - Magnetite is preferred for Direct Reduced Iron (DRI) and Electric Arc Furnace (EAF) steelmaking, which aligns with China's push toward low-emission steelmaking.
  - Using pellets made from magnetite reduces coke consumption and CO_2 emissions.
- Pelletisation for Low-Emissions Steel.
  - Magnetite is often processed into pellets, which are directly used in blast furnaces and DRI plants.
  - Pellet demand is rising as China restricts sintering activities to control pollution.
- Steel Mill Preferences.
  - Large steelmakers (Baosteel, China Baowu, HBIS) increasingly favour magnetite-based pellets and concentrates.

- Many integrated steel plants are modifying blast furnaces to accommodate high-grade magnetite-based feedstocks.

12.5.4 Supply Considerations for NZ and Australian Suppliers

12.5.4.1 Australia's Magnetite Position

- Australia holds significant magnetite reserves, with key projects in Western Australia (WA), South Australia (SA), and Tasmania.
- Major players include.
  - Fortescue Metals Group (FMG): Developing magnetite operations at Iron Bridge.
  - Grange Resources: One of Australia's largest magnetite producers (Savage River).
  - Gindalbie Metals/Karara Mining: A major supplier of magnetite concentrate to China.

12.5.4.2 New Zealand's Magnetite Potential

- NZ's iron sand deposits (e.g., Taranaki, Waikato) contain vanadiferous titanomagnetite ("VTM"), which is exported for steelmaking.
- Challenges: Historically higher titanium content has limited use in traditional blast furnaces, but advancements in processing technology, as well as the increasing value of vanadium has expanded the marketability of certain of these VTM ores.
- Opportunities: Vanadium is a relatively easily recovered metal with steel strengthening qualities, as well as grid storage battery applications. Current global supply of iron sands ores are sporadic in nature with varying grades and quantities. A single large scale VTM producer (annual production volumes of 3.0 – 5.0Mtpa) offering consistent supply and grades will be of significant interest to a number of steel mills in a range of geographical locations including Asia.

12.5.4.3 Recommended Strategy for NZ and Australian Suppliers

- Target High-Grade Magnetite Market.
  - Position NZ & Australian magnetite for DRI & EAF steelmaking in China.
  - Negotiate contracts with steel mills transitioning to low-carbon processes.
- Target Steel Mills in specific locations.
  - Both vanadium and titanium are deemed to be critical minerals in many major first world countries and regions with numerous producing steel mills of significant scale
  - Vanadium recovery generates a high value by-product within steel production.
- Leverage Pellet Demand.

- If feasible, invest in pelletising infrastructure to meet growing demand in China.
  - Engage with Chinese steel mills looking for low-impurity pellet feedstocks.
- Optimise Logistics and Freight.
  - CFR China contracts can be advantageous for securing buyers.
  - Freight cost analysis (C3 Brazil-China vs. C5 Australia-China) can help position magnetite competitively.

12.6 The Role of 58% Fe VTM in Iron Ore Pricing and Supply to China

12.6.1 VTM vs Hard Rock Magnetite and Hematite in the Iron Ore Market

Vanadiferous Titanomagnetite (Fe_3O_4 with vanadium and titanium content) is a distinct iron ore type that differs from traditional hematite (Fe_2O_3) and hard rock magnetite (Fe_3O_4). While hematite remains dominant in seaborne trade, both hard rock magnetite and vanadiferous titanomagnetite have been gaining importance due to beneficiation potential and specialised steel applications.

12.6.1.1 Hematite Ore

- Direct Shipping Ore (DSO), requiring minimal processing.
- Lower processing costs but typically 58%-62% Fe content.
- Requires sintering before use in blast furnaces.

12.6.1.2 Hard Rock Magnetite Ore

- Typically found in igneous and metamorphic rock formations, often requiring significant mining and crushing.
- High iron content (typically 60–70% Fe) but contains silica (SiO_2) and other gangue materials that require beneficiation.
- Common sources: Australia, Canada, Sweden, Brazil.
- Preferred for pelletisation and DRI (Direct Reduced Iron) processes.

12.6.1.3 Vanadiferous Titanomagnetite Ore (58% Fe)

- Derived from eroded volcanic rock and deposited in coastal or riverine environments.
- Lower iron content (~56–58% Fe) but naturally occurs in fine particles, reducing the need for extensive crushing.
- Contains titanium (TiO_2) and vanadium (V_2O_5), which impact processing but offer valuable by-products.
- Requires upgraded processing techniques due to titanium impurities.
- Can be used in specialty steel production and blended feeds for Chinese mills.

12.6.2 How 58% Fe Vanadiferous Titanomagnetite is Priced in China

VTMs (58% Fe) presents both challenges and opportunities in the Chinese iron ore market. While historical trades have been at a discount to standard hematite fines, its standard form, specialty steel applications, blending potential, and strategic positioning in the decarbonisation trend make it a viable export commodity.

12.6.2.1 Pricing Mechanisms for 58% VTMs

- Discounted Pricing Compared to Standard 62% Fe Fines.
  - VTMs (58%) historically have been priced at a discount of $5-$15/dmt (10-15% discount/dmt) relative to 62% Fe fines (Platts IODEX).
  - The underlying discount today depends on the titanium and vanadium content and low grade ores (52-54% Fe) can even trade at a premium to the 62% price depending on the contained percentages of vanadium pentoxide (V2O5) within the ore.
- Index Referencing with Adjustments.
  - Contracts reference Platts 58% Fe fines CFR China or Mysteel 58% Fe pricing indices.
  - Some trades apply penalty adjustments for TiO_2 content beyond 1.5%.
- Blended Pricing Structures.
  - Chinese steel mills blend low-grade titanomagnetite with higher Fe ores (e.g., Pilbara fines, Brazilian fines).
  - Prices are negotiated based on desired Fe yield post-blending.

12.6.2.2 Market Positioning of Vanadiferous Titanomagnetite in China

China's Dual-Carbon policy (carbon peaking by 2030, neutrality by 2060) influences iron ore preferences. Higher Fe ores are favoured, but titanomagnetite remains a viable option under specific conditions.

12.6.2.3 Key Demand Drivers in China for Vanadiferous Titanomagnetite

- Use in Specialty Steel Production.
  - Some mills utilise vanadium-rich titanomagnetite for high-strength steel applications, i.e. Panzhihua Iron and Steel (Pangang) Group, Xinjiang Da'an Special Steel Co., Ltd.
  - Demand is growing for low-alloy steels incorporating vanadium-enhanced

feedstocks[10].

- Blended Feed for Blast Furnaces.
  - Chinese mills blend vanadiferous titanomagnetite with hematite fines or Brazilian high-grade ores.
  - Helps optimise costs and furnace efficiency.

12.6.2.4 Supply Considerations for NZ and Australian Suppliers

- Australia's Titanomagnetite Position.
  - Australia has limited titanomagnetite reserves, but South Australia and Tasmania contain deposits with 58%-60% Fe content.
  - Major titanomagnetite players are focused on niche steel applications.
- New Zealand's Vanadiferous Titanomagnetite Potential.
  - New Zealand iron sands (e.g., Taranaki, Waikato) contain significant titanomagnetite resources.
  - Challenges: High titanium content can limit traditional blast furnace use but offers potential for value-added processing.

12.6.2.5 Recommended Strategy for NZ and Australian Suppliers

- Target Blended Market Opportunities.
  - Engage with Chinese steel mills seeking lower-cost blending feedstocks.
  - Establish supply partnerships for specialty vanadium-rich steel production.
- Enhance Processing and Beneficiation.
  - Explore upgraded beneficiation techniques to reduce TiO_2 content.
  - Consider developing low-cost pelletisation facilities to meet Chinese sinter plant requirements.
- Optimise Freight and Logistics for Cost-Effective Delivery.
  - CFR China contracts may improve competitiveness.
  - Utilise existing bulk export infrastructure to reduce shipping costs.

12.7 New Zealand's Critical Minerals List

New Zealand's Critical Minerals List, released in January 2025, identifies 37 minerals essential to the country's economy and technological development. Among these are vanadium and titanium, which play significant roles in various industries and particularly with regards to the

[10] https://www.spglobal.com/en

decarbonisation of both the steel and energy sectors.

12.7.1 Geopolitical Importance of Vanadium and Titanium.

Both vanadium and titanium are crucial for a range of applications, including aerospace, energy storage, and advanced manufacturing. Their strategic importance is further demonstrated by the fact that nations such as Australia, the United Kingdom, the United States, Canada, and the European Union also classify them as critical minerals, highlighting the role these elements play in national security, economic stability, and technological leadership.

In recent years, concerns over supply chain vulnerabilities have heightened the geopolitical significance of these minerals. China dominates global vanadium production, accounting for approximately 68% of output, while Russia contributes around 18%. Similarly, Russia is a major producer of titanium sponge, a material essential for aerospace manufacturing.

This concentration in just two countries presents supply risks, as geopolitical tensions or policy shifts could disrupt access. The worsening tariff disputes between the USA, Canada, Mexico, China, and the European Union are further exacerbating concerns over mineral security, as trade barriers and retaliatory tariffs threaten to increase costs and restrict the free flow of critical resources between key markets.

To mitigate these risks, countries are actively working to diversify their supply sources. Strategies include expanding domestic production, forming partnerships with allied nations, and investing in recycling and alternative materials research.

12.7.2 Geopolitical Importance of Vanadiferous Titanomagnetite

Despite the inclusion of vanadium and titanium on New Zealand’s Critical Minerals List, it is notable and disappointing that New Zealand’s iron sands were overlooked. Vanadiferous Titanomagnetite is a significant local resource containing viable quantities of vanadium and titanium, and its primary magnetite component could itself be considered a critical resource. With growing global concerns over supply chain vulnerabilities and geopolitical risks in mineral sourcing, the importance of iron and steel to the world economy cannot be overstated. Given the strategic value of domestic steel production and iron ore supply chains, the absence of New Zealand’s titanomagnetite from the critical minerals list represents a missed opportunity to strengthen economic resilience and develop a more self-sufficient and strategically positioned domestic resource base.

12.8 The Role of New Zealand Iron Sands in Green Steel Initiatives

12.8.1 Introduction

The steel industry is a major contributor to global carbon emissions, responsible for around 7% of CO_2 output. As demand grows for low-emissions alternatives, hydrogen-based direct reduction is emerging as a key solution. New Zealand’s VTM iron sands have strong potential to support this transition. With demonstrated compatibility with hydrogen reduction processes and opportunities for energy-efficient sintering, iron sands could play an important role in reducing the carbon footprint of steel production.

12.8.2 Green Steel

Green steel refers to steel produced with minimal or no carbon emissions, primarily through alternative reduction methods. The hydrogen-based direct reduced iron (DRI) process is a particularly promising approach, replacing traditional carbon-intensive methods with hydrogen, which emits only water vapour instead of CO_2. New Zealand's iron sands are well suited to this technology.

12.8.2.1 Hydrogen Reduction Potential

Research shows that New Zealand iron sands can be effectively reduced using hydrogen, making them compatible with emerging green steel technologies such as HYBRIT and MIDREX's hydrogen-based DR processes. Conventional blast furnaces struggle with titanomagnetite (TTM) iron sands due to their high titanium content, but shifting to hydrogen reduction could overcome these limitations and open up new pathways for sustainable steelmaking.

12.8.2.2 Pelletisation and Sintering Efficiency

For iron sands to be used in DR processes, the fine iron ore particles must be pelletised to improve their reducibility. Studies[11] have shown that iron sands pellets sintered at 1200°C achieve high compressive strength, making them suitable for direct reduction feedstock. ‘

12.8.3 Green Steel Market Opportunities

12.8.3.1 Supplying the Growing Green Steel Market

The global green steel market is projected to exceed NZ$145 billion by 2032, growing at an annual rate of nearly 21%. Countries such as Australia, Sweden, Germany, and Japan are investing heavily in hydrogen-based steel production, creating increasing demand for high-quality, direct reduction-compatible iron ores. New Zealand has an opportunity to position itself as a key supplier in this expanding market.

12.8.3.2 Partnering with Green Steel Innovators

New Zealand's iron sands industry could explore partnerships with firms leading the shift towards low-emissions steel production to secure supply agreements and collaborate on research and development.

[11] NZ Paper

12.8.3.3 Attracting Sustainable Investment

Governments worldwide are introducing policy measures to decarbonise heavy industries. The European Union's Carbon Border Adjustment Mechanism (CBAM) and the United States' clean hydrogen tax credits under the Inflation Reduction Act could create favourable conditions for green steel feedstocks. By aligning with these policies, New Zealand's iron sands industry could attract foreign investment and position itself as a sustainable supplier.

12.9 Marketing Risks

Given the forward-looking nature of market analysis, there are several risks highlighted below that are addressed under the broader project risk management protocols.

Marketing Related Risks	Description
Market downturn	The GFC of 2008/2009 was largely unpredicted by the broader market until it was "almost upon us", it is not possible to predict a re-occurrence of this type of global event in the future.
Project delay	Speed to market is a key factor in the success of obtaining long-term offtake agreements, should the project be delayed, these agreements will become more difficult for TTR to establish.
Pricing volatility	With price forecasts there is always a risk of incorrect prices (either high or low). Prices used by TTR in the evaluation of the project would be considered to be within the mid to upper range of the current range of estimates available.
Inaccurate sampling and analysis	Poor sampling techniques may result in lower revenue than anticipated.

Table 23 Marketing Related Risks

13 ENVIRONMENTAL REGIMES AND PERMITTING STATUS

13.1 Introduction

The previous revision of the prefeasibility study provided an overview of the broad environmental characteristics of Trans-Tasman Resources (TTR) area of interest within the South Taranaki Bight (STB). It highlighted the associated environmental risk factors and the extensive investigations undertaken by TTR to support the successful marine consent application. The updated Environmental Impact Statement is appended to this PFS (Appendix 19.21)

This revision of the PFS updates the environmental permitting status, emphasising the legal challenges encountered and the project's inclusion in New Zealand's Fast Track approvals process. The project's inclusion in the Fast Track approvals process signals its potential economic value and commitment to best practice environmental management. An overview of the

13.2 Marine Consent Approval

In August of 2017 TTR was granted marine consents and marine discharge consents under sections 62(1)(a) and 87F(1) of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ Act).

The consents permitted the extraction and processing of iron sand within the STB for 20 years. Under these consents, TTR was granted consent to extract up to 50 million tonnes of seabed material annually, with approximately 10% processed into 5Mt VTM concentrate for processing and export.

13.3 Environmental Impact Assessments

The marine consent process involved a comprehensive assessment of the potential environmental impacts of the proposed mining operation. The key areas evaluated included:

- Sediment Plume Dynamics - Assessment of the generation, dispersion, and optical impacts of sediment plumes, with modelling conducted under various scenarios to predict worst-case outcomes;
- Benthic Ecology - Studies indicated that benthic organisms within the mining site would be significantly impacted; however, natural recolonisation is expected over time;
- Marine Life - Evaluations of potential impacts on fish, shellfish, marine mammals, and seabirds, considering factors like noise, sediment dispersion, and food web interactions;
- Ecotoxicity and Biosecurity - Analysis of the potential bioaccumulation of heavy metals and the risks posed by marine biosecurity threats.; and
- Human and Environmental Health - Consideration of potential impacts on air and water quality and health risks to nearby coastal communities.

Refer to Appendix 19.21 for detailed environmental studies and findings in the Environmental Impact Assessment.

13.4 Regulatory Principals and Decision Framework

The EPA's decision-making Committee applied the EEZ Act's information principles, ensuring that the best available information was used to assess potential impacts. The decision-making process involved expert conferencing, public submissions, and independent technical reviews to evaluate the data provided. The Committee granted the consents, concluding that it had sufficient information to make a decision, and that granting consents, with appropriate conditions, would meet the EEZ Act's purpose.

13.5 Legal Challenges and Court Proceedings

The EPA's 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 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. 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 highest court in New Zealand's legal system. The Supreme Court's reasoning 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. The Supreme Court's decision, issued in September 2021, provided new guidance on the correct application of provisions in the EEZ Act.

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.

In anticipation of the Fast Track Approvals process, TTR withdrew its applications at the end of March 2024, bringing the reconsideration to an end.

13.6 Inclusion in the Fast Track Approvals Process

Between March and December 2024, the New Zealand Government developed the Fast Track Approvals Act 2024 (the FTA Act), the purpose of which is to improve the delivery of projects with significant economic benefits. The FTA Act provides a streamlined process for such projects, with bespoke legal tests that give more weight to regional and national economic benefits than under the EEZ Act. At TTR's request, the New Zealand Government has listed

TTR's project in Schedule 2 of the FTA Act, which means the project has already been approved to use the FTA process. This enables TTR to make an application for the project without first having to obtain additional ministerial support. TTR is preparing its application, which will reflect the new FTA legal tests.

13.7 Consent Conditions and Compliance Requirements

In August 2017, the Environmental Protection Authority (EPA) granted TTR a marine and marine discharge consents under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012, allowing the extraction of iron sand from the seabed in the South Taranaki Bight. Consent is subject to strict conditions ensuring environmental protection, stakeholder engagement, and ongoing monitoring. These are summarised below with the full set of conditions provided in Appendix 19.25.

13.7.1 Scope of the Consent

- Permits the extraction of up to 50 million tonnes of seabed material annually, with an operational limit of 8,000 tonnes per hour.
- Authorises the discharge of de-ored sediment back into the marine environment, subject to compliance with sediment dispersion limits.

13.7.2 Environmental and Operational Conditions

- Environmental Monitoring: Pre- and post-extraction assessments must be conducted to measure the impact on benthic ecosystems, water quality, and sediment dispersion.
- Noise and Marine Mammals: Underwater noise levels must comply with 120 dB re 1μPa limits to mitigate impacts on marine mammals. A soft start procedure must be followed before operations begin to ensure marine mammals are not in proximity.
- Benthic Recovery: Ongoing monitoring is required to assess the recovery of marine habitats post-extraction.
- Seabird and Marine Mammal Management: A management plan must be implemented to protect local marine biodiversity.

13.7.3 Reporting and Compliance

- Quarterly and Annual Reports: TTR must submit reports to the EPA, covering:
  - Extraction volumes.
  - Sediment plume modelling.
  - Environmental monitoring results.
  - Complaints received and remediation actions taken.

- Technical Review Group (TRG): An independent group will oversee the monitoring programme, review data, and provide recommendations on additional parameters that may need assessment.

13.7.4 Stakeholder and Community Benefit

Stakeholder Engagement and Community Benefit

- Tangata Whenua Consultation: Regular engagement with iwi representatives and integration of mātauranga Māori into monitoring and decision-making.
- Fishing Industry Coordination: TTR must hold six-monthly meetings with commercial fishing representatives to address concerns and coordinate activities.
- Community Fund: A $50,000 per annum fund (inflation-adjusted) is allocated for local community projects in South Taranaki.
- Training and Employment: A training facility in Hāwera will be established to develop local workforce skills in marine and process operations.

13.7.5 Risk Management and Compliance

- Biosecurity Measures: All vessels must comply with New Zealand's ballast water treatment regulations to prevent invasive species introduction.
- Oil Spill Contingency: Comprehensive oil spill response plans must be in place and reported to Maritime New Zealand.
- Kupe Oil and Gas Field Protection: A 500m exclusion zone around wellheads and a 1.5km protection zone around the Kupe Well Head Platform must be maintained to prevent conflicts with existing petroleum operations.

13.7.6 Review and Lapse Conditions

- The consent is valid for 10 years, with a requirement for continuous review to adapt to emerging environmental concerns.
- If operations do not commence within this period, the consent will lapse.

The EPA's approval of the TTR marine consent reflects a balanced approach between economic development and environmental stewardship. The strict monitoring, compliance, and engagement frameworks ensure the operation aligns with sustainable marine resource management principles.

13.8 Mineral Permit Regime

13.8.1 Legislation

Mining approvals required for TTR's project require mining permits under the Crown Minerals Act for extraction activities both within and beyond the 12Nm limit.

13.8.1.1 Mineral Permits under Crown Minerals Act 1991

TTR has been granted a mining permit (MMP55581) under section 25 and 29A of the Crown Mineral Act 1991, which covers the allocation of the Crown's mineral resources. The Mining Permit has been granted 20 years and is subject to a royalty regime and a set of work program conditions.

Permits are administered by NZ Petroleum and Minerals, a section of the Ministry of Business Innovation and Employment. In addition to the mining permit TTR also have an exploration permit 54068, which is situated within the 12Nm limit offshore, and is directly adjacent to, and contiguous with, MMP55581. Details of these permits are in Section 4.2 of this PFS document and are appended to this document (Appendix 19.15).

13.8.2 Section 59(2)(l) – Any Other Applicable Law

When considering both the marine consents and marine discharge consents, the EPA was required to take into account any other applicable laws that are relevant to the TTR application.

The following are the relevant statutes:

- Biosecurity Act;
- Continental Shelf Act;
- Crown Minerals Act;
- Fisheries Act 1996 ("**the Fisheries Act**");
- HSW Act;
- HSNO Act;
- *Heritage Act;*
- MCA Act;
- Marine Mammals Protection Act 1978;
- Marine Reserves Act 1971;
- Maritime Transport Act;
- RMA;
- Resource Management (Marine Pollution) Regulations 1998;
- Submarine Cable Act; and
- Wildlife Act 1953 ("Wildlife Act").

13.8.2.1 Biosecurity Act

The Biosecurity Act was enacted to reform the law relating to the exclusion, eradication, and effective management of pests and unwanted organisms. The 2012 reform also added Part 8A to the Biosecurity Act which extends the existing provisions to the EEZ. This was in response to increased economic activity in the EEZ.

Sections 24E to 24K of the Biosecurity Act deals with Craft Risk Management Standards and specifies requirements to be met for the effective management of risks that are associated with the entry of foreign craft into the EEZ and New Zealand territory.

All TTR project related vessels will be required to comply with the requirements of Part 3 – Importation of Risk Goods, including the Craft Risk Management Standards and Import Health Standards, and Part 4 – Surveillance and Prevention under the Biosecurity Act.

Further biosecurity risks associated with the project may potentially arise through the management of ballast waters and vessel biofouling associated with the operation of the vessels. As part of standard operational requirements, TTR will implement controls and procedures that identify how these risks are managed primarily through the requirement for vessels to comply with the requirements of the BMP.

Consent conditions can be imposed as part of any marine consent granted, requiring ballast water and hull biofouling to comply with the requirements of the Biosecurity Act and conventions guidelines for the management of ballast water and hull biofouling. The proposed consent conditions have included conditions of this nature.

TTR is committed to continue to engage with the Ministry of Primary Industries on matters of biosecurity under the Biosecurity Act during the course of the project and this has been provided for through the BMP requirements.

There are no Pest Management Strategies prepared under the Biosecurity Act that are relevant to the project. For completeness, it is noted Pest Management Strategies have been prepared by the TRC and the Horizons Regional Council; however, these pest management strategies relate to management of pests on land and are not relevant to the EEZ area to which the project relates.

It is considered that the project will comply with the provisions of the Biosecurity Act and any regulations made under that Act.

13.8.2.2 Continental Shelf Act

The Continental Shelf Act vests all rights that are exercisable in New Zealand with respect to the continental shelf and its natural resources (defined as mineral and other non-living resources of the seabed and subsoil of those submarine areas that extend beyond 12Nm to 200Nm, and in some areas to the outer edge of the continental margin (the extended continental shelf)) for the purpose of exploring the shelf and use those resources.

Prior to 24 May 2013, the Continental Shelf Act provided for the granting of licences for prospecting and mining on the continental shelf, including imposition of conditions on any licences granted. On 24 May 2013, the Continental Shelf Amendment Act 2013 inserted a new Section 5AA into the Continental Shelf Act which provided for matters related to the mining of minerals on the continental shelf.

Section 5AA specified that the Crown Minerals Act and any regulations made under that Act, as far as they are applicable and with any necessary modifications, apply to mining activities for minerals other than petroleum in the seabed or subsoil of the continental shelf. In effect, this meant that any new applications or subsequent mining licences would be processed under the Crown Minerals Act as if the Continental Shelf Licence was a prospecting or exploration permit under the Crown Minerals Act.

TTR held a Continental Shelf Licence (No. 50753) for minerals prospecting over 3,314 km^2 of the continental shelf under the Continental Shelf Act. The licence was granted and commenced on 17 December 2010 for a period of four years which expired on 16 December 2014.

On 26 July 2013, TTR applied for a new mining permit, that includes the project area for these consents, which is located within the area over which the now expired Continental Shelf Licence 50753 covered. As detailed in Section 4 of this PFS the mining permit (Mining Permit No. 55581) has since been granted under the Crown Minerals Act.

Further to the above, the Continental Shelf Act enables safety zones to be created to protect existing offshore installations. The project area borders the identified Kupe Safety Zone attached to the existing Kupe Natural Gas Platforms (refer to Figure 92) however, the project area does not impede this area.

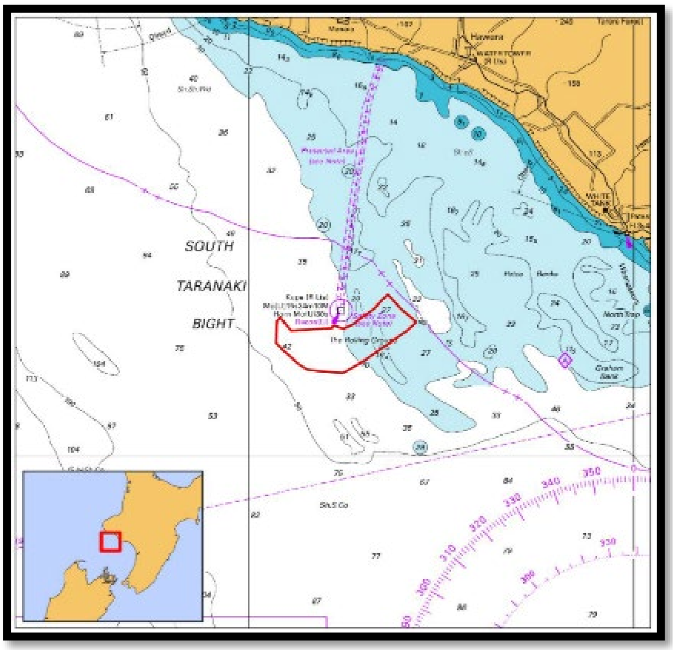


Figure 80 Kupe Safety Zone as Identified Under the Continental Shelf Act 1964

13.8.2.3 Crown Minerals Act

As identified above, following the May 2013 Continental Shelf Act amendment, the management of activities relating to prospecting, exploration and mining of Crown-owned mineral resources within the EEZ was transferred to the Crown Minerals Act. As such, approvals for the prospecting, exploration and mining of Crown-owned minerals resources are now administered by New Zealand Petroleum and Minerals, a branch of the Ministry of Business Innovation and Employment.

TTR's Crown Minerals Act tenements are located off the west coast of the North Island of New Zealand to the north and south of Cape Egmont, which the project area falls within. TTR was granted an Exploration Permit (No. 54068) for five years commencing on 17th December 2012, which expires on 18 December 2017. Also adjacent to the project area is Prospecting Licence 50753, which was granted to TTR on the 17th of December 2010 and expires on the 16th of December 2018. This licence was granted under the Continental Shelf Act.

The Crown Minerals Act sets out the reporting regulations for active Tier 1 mining permits. The purpose of the report is to ensure TTR operates in accordance with good industry practice and is tracking the resources and reserves in accordance with a recognised reporting code. TTR will be reporting to the Joint Ore Reserves Committee (2012) standard. Mine plans are also required to be submitted annually. This includes an outline of the extraction operations to occur for the following year along with an extraction schedule. These matters have been further provided for through the proposed consent conditions by way of an annual Operational Assessment Report.

13.8.2.4 Fisheries Act

The Fisheries Act establishes a framework for managing customary, recreation and commercial fishing, in New Zealand. The Fisheries Act is administered by the Ministry of Fisheries.

The Fisheries Act manages the allocation of rights to go fishing, the creation of taiapure (local customary fishery covering estuarine and littoral waters - Part IX) and mataitai areas (Maori customary fishing areas - section 186), and the recovery of costs from the commercial fishing industry.

TTR's project will occur in 'New Zealand fisheries waters' as defined in the Fisheries Act. The majority of the provisions of the Fisheries Act deal with quota management and access to fisheries under different fishery management regimes established in accordance with the provisions of the Fisheries Act.

Fishing interests are recognised by the EEZ Act as lawfully established existing activities which are 'existing interests'. These 'interests' need to be taken into account by the EPA when determining applications for marine consents and marine discharge consents, in accordance with section 59(2) of the EEZ Act.

Customary Fishing

The Maori Fisheries Act 2004 implements the agreements made under the Treaty of Waitangi (Fisheries Claims) Settlement Act 1992.

Measures include the establishment of a Kaimoana Monitoring Programme to provide ongoing information about the fish and shellfish stocks of relevance to Maori within the STB coastal areas. It is expected that this programme will provide valuable information to Maori and assist in the long-term management of the customary kaimoana stocks.

Recreational Fishing

The project area was found to be a very low use recreational setting, which may be used only rarely for recreational marine fishing due to being so far offshore. There is the potential for some minor and localised effects at the iron sand extraction sites due to the exclusive use of the extraction zone, turbidity effects and short-term effects on habitat in the recently mined seafloor. However, due to the distance offshore and the low recreational fishing activity, the public notification of working mining areas and the ability for recreational fishers to avoid any mining areas, there are unlikely to be any adverse effects on recreational fishing at a local, regional or national scale.

Commercial Fisheries

TTR has undertaken extensive consultation with the commercial fisheries representatives and the outcomes of this process resulted in the inclusion of consent conditions that provide for regular ongoing meetings between TTR and representatives of the commercial fishing industry. The purpose of the meeting is to establish and provide for a co-ordinated approach between the iron sand extraction activities and commercial fishing activities.

The consultation process also identified the value of Admiralty Bay to New Zealand's aquaculture sector. In order to protect the existing interests within this area TTR agreed to include conditions of consent that exceed current regulatory requirements and has voluntarily prohibited the discharge of any ballast water or other materials within Admiralty Bay as well as restricting use of the area to only sheltering during storm events other than in emergency situations.

The requirements to meet regularly with aquaculture interests and the restrictions on use of Admiralty Bay have been incorporated into the proposed consent conditions.

Provided the proposed consent conditions are adopted, it is considered that any effects on the existing interests of commercial fisheries will be avoided, remedied or mitigated.

13.8.2.5 HSW Act

Section 39(4) of the EEZ Act states:

"…any measures required by or under the Health and Safety in Employment Act 1992 that may have the effect of avoiding, remedying, or mitigating the adverse effects of the activity on the environment or existing interests."

It is noted that the HSW Act has superseded the Health and Safety in Employment Act 1992 which is referred to in section 39(4) of the EEZ Act. The HSW Act has implications on how TTR manages the project operations, but it does not have a direct impact on the effect of avoiding, remedying, or mitigating the adverse effects of the activity on the environment or existing interests.

Notwithstanding this, there are many operational health and safety considerations to be taken into account for the project and TTR has developed a comprehensive set of health and safety initiatives which will address the health and safety matters of the project.

Further to its initiatives and policies, TTR is liaising with MNZ and Worksafe New Zealand in respect of developing a suitable approach for the overarching health and safety management for the project. As part of this approach and prior to the commencement of any operations, TTR will be required to identify and evaluate all hazards that have the potential to cause major accidents and, subsequently, identify suitable control measures to address these hazards. However, to reiterate, these are not related to the effects of avoiding, remedying or mitigating the adverse effects of the activity on the environment or existing interests.

13.8.2.6 HSNO Act

The HSNO Act sets out controls on the use of hazardous substances and came into effect in two stages. Provisions relating to new organisms took effect in July 1998, and provisions relating to hazardous substances came into force on 2 July 2001. The HSNO Act is administered by the EPA.

In TTR's case the substances that fall under the HSNO Act jurisdiction are:

- IFO 380 and diesel; and
- Residual Clean-in-Place chemicals from reverse osmosis system

Storage and handling of IFO and diesel on all project related vessels will be managed to ensure compliance with requirements under the HSNO Act for the avoidance of unintended ignition and for the segregation of incompatible substances. Further, TTR will implement a Spill Contingency Management Plan to provide for any unplanned spill events that may occur.

All Clean-in-Place chemicals used in the reverse osmosis system will be collected and retained for onshore disposal by approved contractors.

Storage and handling of all potentially hazardous substances will be managed to ensure safe practices consistent with requirements under the HSW Act, and the HSNO Act.

13.8.2.7 Heritage Act

The *Heritage Act* prohibits the modification or destruction of an archaeological site unless an Archaeological Authority for the modification or destruction is obtained from Heritage New Zealand. This Authority is in addition to any resource consents required under the RMA for the modification or destruction of the heritage feature.

An archaeological site is defined in the Heritage Act as follows:

"any place in New Zealand, including any building or structure (or part of a building or structure), that—

(i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and

(ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; ...”

It is noted that the meaning of “archaeological site” refers to “a place in New Zealand,” including any place within the territorial limits of New Zealand, including the EEZ.

13.8.2.8 MCA Act

The MCA Act repealed the Foreshore and Seabed Act 2004 and restored any customary interests in the common marine and coastal area that has been extinguished by that Act. The CMCA extends from the line of mean high-water springs to the outer limits of the territorial sea but does not include land in the CMA already in private ownership or that held by the Crown as a conservation area, a national park or a reserve. No part of the project area is located within the territorial sea being an area not exceeding 12Nm from the low water mark of the coast.

The MCA Act also provides for the recognition and protection of protected customary rights. As a general rule, a consent authority must not grant a consent for an activity in a protected customary rights area if the activity has, or is likely to have, adverse effects that are more than minor on the exercise of a protected customary right.

The MCA Act also restores the right to Maori to seek customary marine title which recognises property rights of Maori that have continued since or before acquisition of Crown sovereignty to the present day. It also protects existing uses and rights, including navigation and fishing rights, and resource consents granted before the MCA Act commenced. It is important to note that the MCA Act does not affect Crown ownership of nationalised minerals.

In accordance with the EEZ Act, a ‘protected customary right’ or ‘customary marine titles’ as defined under the MCA Act are deemed as an ‘existing interest’ in the EEZ Act and shall be taken into account by the EPA when determining applications for marine consents and marine discharge consents, in accordance with section 59(2)(b) of the EEZ Act.

It is also noted that section 45(1) of the EEZ Act requires the EPA to serve a copy of any application for a marine consent on ‘customary marine title groups’ and ‘protected customary right groups’.

The MCA Act defines ‘customary marine title groups’ and ‘protected customary right groups’ as follows:

customary marine title group –

(a) means an applicant group to which a customary marine title order applies or with which n agreement is made and brought into effect; and

(b) includes a delegate or transferee of the group if the delegation or transfer is made accordance with tikanga.

protected customary right groups –

(a) means an applicant group to which a protected customary rights order applies or with which an agreement is made; and

(b) includes a delegate or transferee of the group if the delegation or transfer is made in accordance with tikanga.

At the time of writing there were no customary rights or customary marine titles, nor are there applications for titles, under the MCA Act relating to the project area. It is noted that Ngāruahine has lodged an application for customary title for the CMCA between the Taungatara and Waihi Rivers however, this area is outside the project area.

13.8.2.9 Marine Mammals Protection Act

The Marine Mammals Protection Act provides for the conservation, protection and management of marine mammals. The Marine Mammals Protection Act is administered by DOC and applies to the coastal marine environment's waters within the territorial sea and beyond the EEZ.

Under the Marine Mammals Protection Act, a permit from the Minister of Conservation is required for anyone to "hold" or "take" a marine mammal, whereby "take" is defined to include any actions that harm, harass, injure and attract a marine mammal.

Section 3(a) of the Marine Mammals Protection Act gives specific responsibility to DOC for the administration and management of marine mammals and marine mammal sanctuaries. Further, conservation management strategies establish objectives for the integrated management of marine mammals under the Marine Mammals Protection Act (section 3(c)). The purpose of these conservation management strategies is to establish objectives for management of marine mammal sanctuary(s) (section 3(d)).

The Minister of Conservation may also approve a 'population management plan' in respect of one or more species, being threatened species or other species of marine mammal (section 3(e)).

Section 22 deals with the Ministers powers to define, by notice in the Gazette, any place and declare it to be a marine mammal sanctuary. In defining and declaring a sanctuary, the Minister may specify the activities that may or may not be engaged in within the sanctuary and may impose restrictions in respect of the sanctuary.

There are currently six marine mammal sanctuaries in New Zealand including the West Coast North Island sanctuary, shown in Figure 93 below, which is the only sanctuary within the general vicinity of this project.

Marine Mammals Protection (West Coast North Island Sanctuary) Notice 2008

The issuing of this notice created a marine mammal sanctuary along the northern part of the west coast of the North Island. The explanatory note states that the notice "creates a marine mammal sanctuary along part of the west coast of the North Island, and restricts seismic surveys in the whole of the sanctuary and mining activities in part of the sanctuary. The sanctuary includes areas where Hector's dolphin are found."

The boundaries extend alongshore from Maunganui Bluff in Northland to Oakura Beach, Taranaki in the south. The sanctuary's offshore boundary extends from mean high-water springs to the 12Nm territorial sea limit. The total area of the sanctuary is approximately 1,200,086ha and covers 2,164km of coastline, as shown in Figure below.

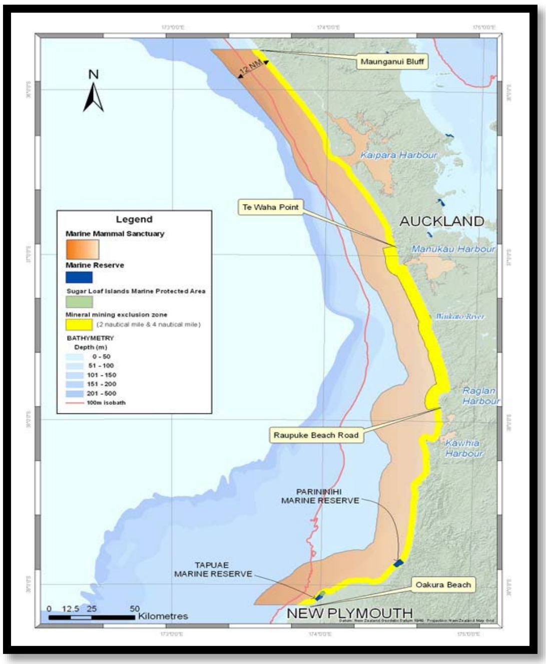


Figure 81 Boundaries of Marine Mammals Protection, West Coast North Island

Within the sanctuary boundaries there are restrictions on seabed mining activities and acoustic seismic survey work. The NZ Gazette notice for a marine mammal sanctuary specifies the areas in which these restrictions apply.

The project area is located approximately 100 km south of this sanctuary and is therefore not subject to any restrictions imposed within this area.

Other Mammal Effects

In summary, the potential key effects of the project are:

- Noise effects - it has been concluded that there is not expected to be a more than minor temporary alteration to the behaviour of marine mammals in the immediate vicinity of the extraction area. Further, given the low numbers of marine mammals observed in the area any effects of noise generated by extraction activities are expected to be no more than minor. Additionally, 'soft-start' and other operating procedures will be implemented to minimise the potential noise effects on marine mammals; and

- Risk of collision with operational vessels - it is concluded that overall, given the low vessel speeds during excavation, and the low number of operational vessels proposed in addition to those already using the STB, that the additional risk to any marine mammals that may be present in the project area is extremely low. Operational procedures will be implemented through management plans to further minimise the potential for any effects on mammals. These measures include observers and video recordings on each vessel, and the requirement of avoidance measures when mammals are encountered when the vessels are in motion.

TTR has included various mitigation measures and operational controls, including the provisions of a Marine Mammal Management Plan, in the proposed consent conditions for the project. These conditions are considered to further avoid, remedy or mitigate any potential adverse effects on marine mammals that occur as a result of the project. The proposed consent conditions as they relate to marine mammals have been prepared in consultation with, and generally accepted by, DOC through the pre-lodgement consultation process.

13.8.2.10 Marine Reserves Act

The Marine Reserves Act provides for the establishment of marine reserves over specified areas of the foreshore and territorial sea. Section 3(1) of the Act states “the provisions of this Act shall have effect for the purpose of preserving, as marine reserves for the scientific study of marine life, areas of New Zealand that contain underwater scenery, natural features, or marine life, of such distinctive quality, or so typical, or beautiful, or unique, that their continued preservation is in the national interest.”

Within marine reserves, a range of activities are prohibited including fishing, removal of material, dredging, discharging or dumping of any matter, construction or any other direct human disturbance.

There are two Marine Reserves in the Taranaki area, Parininihi and Tapuae Marine Reserves. Both are located to the north of project area:

(i) Parininihi Marine Reserve protects a 1,800ha portion of the subsea environments located in the southernmost reaches of the Taranaki Bight and protects an isolated offshore reef in the shadow of the White Cliffs/Parininihi. Within the reserve boundaries, all marine life, habitat, objects and structures are protected. The reserve is managed by a Joint Advisory Committee of Ngāti Tama Iwi and DOC; and

(ii) Tapuae Marine Reserve is located on the Taranaki coast close to New Plymouth. The 1,404 ha reserve adjoins the Sugar Loaf Island Marine Protected Area where a complexity of caves, canyons and crevices, boulder fields, mud and sand hosts a diverse and flourishing range of sea life.

The project-related activities will not take place within or in close proximity to either of these identified marine reserves, identified under the Marine Reserves Act.

13.8.2.11 Maritime Transport Act

The Maritime Transport Act and associated Marine Protection Rules previously regulated the discharge of harmful substances from ships or offshore installations, and the dumping of waste or other matter, beyond the territorial sea. However, as of 31 October 2015, as a result of the EEZ Act and the Maritime Transport Act amendments passed in 2013, there has been a transfer of responsibility for regulating these activities from MNZ to the EPA through the EEZ Act. Therefore, as of 31 October 2015, Part 200 (which previously provided for discharges) was revoked and Part 131 entered into force.

Further to the discharges, Part 131 of the Marine Protection Rules is relevant to the project.

Maritime New Zealand Marine Protection Rules, Part 131: Offshore Installation – Offshore Installations – Oil Spill Contingency Plans and Oil Pollution Prevention Certification

The purpose of Part 131 is to ensure that offshore installations operating in New Zealand continental waters and in the internal waters of New Zealand have marine oil spill contingency plans that will support an efficient and effective response to an oil spill.

Part 131 also ensures that certain pollution prevention equipment and arrangements on board installations meet international performance standards and in-service maintenance requirements.

Part 131, in conjunction with the EEZ Regs 2015, gives effect to the provisions of the MARPOL and the International Convention on Oil Pollution Preparedness, Response and Co-operation 1990 in respect of offshore installations.

Offshore installation is defined under Part 131 to include:

"(a) any artificial structure (including a floating structure that is not a ship) used or intended to be used in or on, or anchored or attached to, the seabed for the purpose of the exploration for, or the exploitation or associated processing of, any mineral, oil or gas.

The IMV is by this definition an "installation" because it is an "artificial structure …intended to be used in or on, or anchored or attached to, the seabed for the purpose of … the exploitation or associated processing of, any mineral, oil or gas".

Under Subpart A, 131.21, a person must not operate an offshore installation, in this case the IMV or other operational vessels, without the MNZ Director's written approval of an oil spill contingency plan containing the matters prescribed in Part 131 that are appropriate to the operation of that installation. Further, rules under Part 131 set out the process for approval, consultation, amendment etc. with regard to any such plans.

TTR is committed to preparing and implementing a Spill Contingency Management Plan for the project prepared in accordance with the requirements of Part 131, and in consultation with MNZ, and submitted for approval to the Director of MNZ. This has been further provided for through inclusion in the proposed consent conditions.

13.8.2.12 RMA

In accordance with section 59(2)(a) of the EEZ Act, the EPA is required to take into account effects that may occur outside of the EEZ - including areas that are within the jurisdiction of the RMA. Further section 59(2)(h) of the EEZ Act requires the EPA to take into account ‘the nature and effect’ of the RMA when considering marine consent and marine discharge consent applications.

The provisions of the RMA apply both on land and extend seaward to the outer limits of the CMA - being the extent of the 12Nm limit. The jurisdictional boundaries of the TRC or the STDC are shown in Figure 95 below.

The proposed compliance monitoring that is detailed within the BEMP and the EMMP will take place both within the EEZ and the CMA. The location of the permanent monitoring stations that will be placed within the CMA will be within the jurisdictional waters of the TRC. Even though the specific details have not been confirmed as to the mooring configuration and surface buoy arrangement, TTR is aware that a coastal permit (likely to be a discretionary occupational consent) will be required from the TRC prior to the BEMP commencing.

A resource consent application and supporting assessment of environmental effects will be submitted to the TRC for processing as soon as the relevant mooring and buoy details are confirmed. TTR note that the application for the placement of the moorings and surface buoys will be submitted in accordance with the relevant rules of ‘Regional Coastal Plan for Taranaki’ in adherence to the RMA 1991. No moorings will be placed within the CMA without prior resource consent approval.

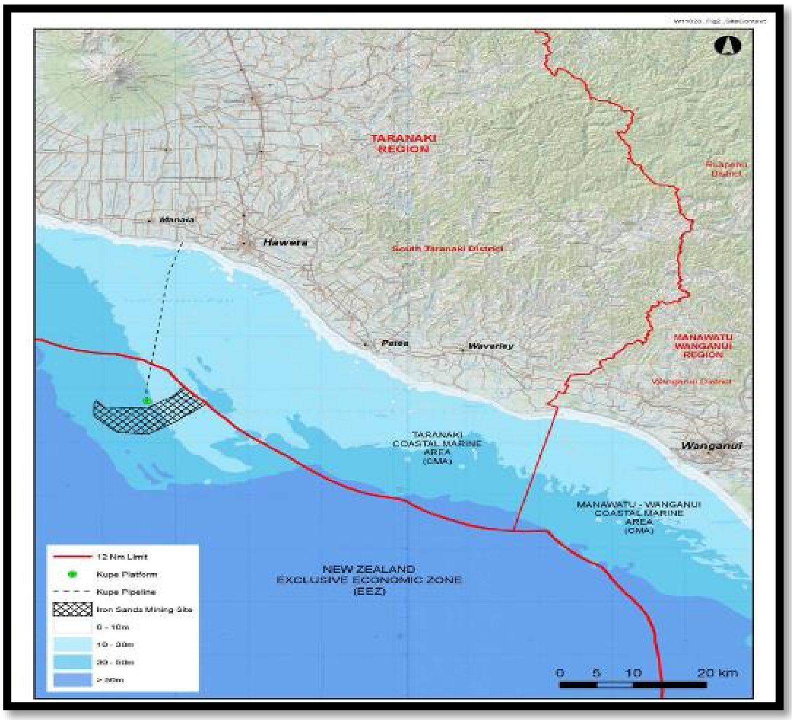


Figure 82 Site Context and Governance Boundaries of the Regional & District Councils

Purpose and Principles of the RMA

Section 5 of RMA sets out the purpose of the RMA, which is to “promote the sustainable management of natural and physical resources...”

The application of Section 5 of the RMA involves a ‘broad overall judgement approach’ as to whether an activity will promote the sustainable management of natural and physical resources. It is, however, noted that the definition of sustainable management does differ between the EEZ Act and the RMA, and the definition of the ‘environment’ in the EEZ Act is limited to the natural environment values.

Section 6 of the RMA states, in achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall “recognise and provide for…” the relevant matters of national importance. Consideration is given to relevant matters from section 6 of the RMA in Table 7.3 below.

Section 7 (Other matters) of the RMA, states in achieving the purpose of the RMA, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall “have particular regard to” specified relevant other matters.

13.8.2.13 New Zealand Coastal Policy Statement

The NZCPS is a national policy statement under the RMA and came into effect on 3 December 2010. The purpose of the NZCPS is to achieve the purpose of the RMA in relation to the coastal environment of New Zealand. The NZCPS is to be applied by persons exercising functions and powers under the RMA.

As previously identified, no part of the project area is located within the CMA. However, some potential effects arising from the project may occur in the CMA and wider coastal environment, as defined by Policy 1 of the NZCPS.

The NZCPS has only been assessed to the extent which the potential effects arising from the project operations can occur within the coastal environment and the CMA (as defined by the RMA).

Overall, it is concluded that the project is not inconsistent with the relevant provisions of the NZCPS.

13.8.2.14 Regional Policy Statement for Taranaki

The Regional Policy Statement for Taranaki (“**RPST**”) became operative on 1 January 2010.

The boundary of the Taranaki region extends to the seaward limit of the CMA adjoining the Taranaki region and does not include any of the project area.

The RPST identifies “High quality or high value areas of the coastal environment”. The coastal areas listed are identified in the Inventory of Coastal Areas of Local or Regional Significance in the Taranaki Region (2004). This inventory identifies important areas in the CMA and in adjacent land within the coastal environment.

The RPST also notes the coastal areas identified are not necessarily an exhaustive selection and on occasion, other parts of the coast may have natural, ecological or cultural values that are regarded as important to the region. The areas identified in the RPST that may experience potential effects arising from the project are as follows:

- Ohawe Beach;
- Waihi Beach;
- Manawapou-Tangahoe River Mouths and Cliff Tops;
- Kakaramea Beach;
- Patea Beach and River Mouth;
- Whenuakura Estuary;
- Waipipi Iron sands;
- Waverley Beach;
- Waiotara Estuary and Dunes;
- Waiinui Beach and Reef; and
- North and South Traps.

Further, the RPS states, “Taranaki is recognised nationally and internationally for its surfbreaks. Surfbreaks depend on the presence of a combination of suitable seabed shape, swell direction and power, swell corridors that allow swells to arrive at the surfbreak and wind direction and force. High quality or high value surfbreaks in Taranaki attract surfers from throughout New Zealand and overseas as well as locally. The surfbreaks have been identified using the Council’s inventory of Coastal Areas of Local or Regional Significance in the Taranaki Region (2004), the Surfing Guide (2004) published by Wavetrack and by consultation with local surfers.”

- Waiinui Reef; and
- The Point / Fences.

13.8.2.15 Regional Coastal Plan for Taranaki

The Regional Coastal Plan for Taranaki became operative on 1 October 1997 and applies to the CMA adjoining the Taranaki Region extending from mean high-water springs out to the 12Nm limit.

Management Areas for the CMA in Taranaki

The Plan identifies four coastal management areas for the CMA in Taranaki.

Areas of outstanding coastal value:

- Estuaries within the CMA that are permanently open to tidal movements;
- Port Taranaki being a highly modified environment; and
- The open coastline.

Areas where Amenity Values are of Regional importance

Policy 3.2 of the Regional Coastal Plan identifies areas where amenity values are determined to be of regional importance. The Regional Coastal Plan includes three areas that may be potentially affected by the project, as follows:

- Ohawe Beach;
- Waverley Beach; and
- Waiinu Beach.

Areas of Outstanding Coastal Value

Policy 4.1 of the Regional Coastal Plan identifies areas of outstanding coastal value that shall be managed in a way that gives priority to avoiding adverse effects on the outstanding coastal values of each area. There are five sites that may be potentially affected by the project as follows:

- Waitotara Estuary;
- Waiinu Reef;
- Waverley Beach;
- North and South Traps; and
- Whenuakura Estuary.

13.8.2.16 South Taranaki District Plan

The South Taranaki District Plan was made operative in December 2004. South Taranaki District Plan has jurisdiction over the South Taranaki District to the landward edge of the mean high water springs mark. STDC has no jurisdiction over the CMA.

The primary management technique used in the South Taranaki District Plan is zoning. Five zones cover the district, being Rural, Residential, Commercial, Industrial and Rural Industrial Zones.

Coastal Protection Areas

The South Taranaki District Plan identifies Coastal Protection Areas, being areas defined along the coastline by location, landscape and topography as part of the natural environment which is particularly susceptible to damage from the adverse effects of activities. These areas are also identified as being potentially most affected by coastal processes including erosion of the coastal cliffs.

TTR's project has no direct effect on the area or zones of jurisdiction of the South Taranaki District.

13.8.2.17 Wanganui District Plan

The Wanganui District Plan was made operative in 2004. The Wanganui District Plan covers the management of the land within the Wanganui District. The Wanganui District Plan has jurisdiction over the Whanganui District to the landward edge of the mean high water springs mark. Whanganui District Council has no jurisdiction over the CMA.

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.

Aside from those matters provided for under the EEZ Act, there will be no dumping of waste or discharge from vessels into the CMA, arising from the project.

13.8.2.18 Submarine Cable Act

The Submarine Cable Act governs the management of submarine cables (both electricity and communications) and gas and fuel pipelines. The Submarine Cable Act is administered by the Ministry of Transport and provides for the protection for submarine cables and pipelines by allowing for the creation of cable protection areas or cable protection zones. Within these cable protection zones, it is an offence for a ship to anchor or to conduct most types of fishing.

The Submarine Cable Act also lists offences against the Act, which include causing damage to submarine cables and pipelines.

The Ministry of Transport website records there are 11 cable protection areas (commonly known as Cable Protection Zones ("CPZ")) established around the country. The following CPZs are located in the STB:

- Area 8: Oaonui;
- Area 10: Maui A and B; and
- The Pohokura Protection Area (no number).

The project area is outside any of the CPZs identified above therefore, the project will not impact on the cable protection areas identified under the Submarine Cable Act.

14 CAPITAL AND OPERATING ESTIMATES

14.1 Capital Expenditure Estimate

The total project Capex is estimated at approximately US$602.183 million. This figure encompasses a wide range of cost elements including project management, consultancy efforts (both BFS and execution), travel and accommodation, and extensive procurement activities. The procurement segment alone covers major components such as the IMV hull and superstructure, piping, machinery, the SBC, a geological drilling and grade control survey vessel (GSV) and a variety of specialized equipment and installation costs. Each element has been meticulously evaluated to ensure that the overall estimate reflects both the scale and complexity of the project.

A critical aspect of any Capex estimate is the inclusion of a contingency reserve to address uncertainties and mitigate potential risks. The contingency, for this Capex estimate amounts to US$84.4 million or 14% of the total Capex.

The updated Capex estimate now also includes an allocation of NZ$2 million for the establishment of a dedicated employee and contractor Training facility in Hāwera, aimed at enhancing workforce competency and supporting operational excellence. This facility will provide specialised training programs tailored to the project's manning needs, ensuring compliance with industry standards and best practices. Additionally, a NZ$3.9 million allowance has been incorporated for the acquisition of a suitable environmental monitoring and research vessel (EMV), monitoring equipment and technology and the necessary port infrastructure. This investment underscores the project's commitment to environmental stewardship, enabling continuous monitoring of marine ecosystems and ensuring adherence to regulatory requirements. These additions strengthen the project's long-term sustainability and operational resilience while aligning with best practices in environmental and workforce development.

The estimate is composed of several major segments.

- Project Management
  - Consultancy Costs.
  - Travel & Accommodation.
  - Additional Set-Up Costs: A set-up expense for the TTR Charitable Trust is also included, reinforcing the administrative and preparatory elements of the project.
- BFS & Engineering/Design
  - BFS Components: Include resource definition, beneficiation, metallurgy, pilot plant development, permits, approvals, environmental initiatives, community engagement, and training facility setup. These items ensure that both operational readiness and regulatory compliance are thoroughly addressed.
  - Engineering and Design: Specifically related to the IMV, two estimates (Part A

and Part B) from Europe contribute to the design and integration of the offshore unit.

- **Procurement**

  The procurement section represents the bulk of the expenditure, covering:

  - IMV Elements - Costs for the hull, equipment, superstructure, piping, machinery, electrical systems, equipment fittings, firefighting, and navigation systems which will be predominantly sourced from China and integration in Singapore.
  - Two SBC units – Costs for pumps, crawler, controls and LARS systems.
  - Specialised Process Equipment - This includes items such as the Vertimill® units, with significant contributions from the USA, as well as equipment sourced from Europe.
  - Process Plant - This area covers equipment like pumps, dewatering systems, and screening equipment;
  - Power generation and desalination equipment sourced in Europe and US;
  - Installation, Norms, and Contractors Fees - These ensure proper assembly and commissioning; and
  - BFS, Project management and EMV vessel in New Zealand

- **Risk-Based Contingency**

14.1.1 Contributions by Source Country

The design and construction phase of the project is truly global, drawing on world-leading technology and best-in-class providers for both services and equipment. This international collaboration brings together a carefully selected network of experts who ensure every element of the project adheres to the highest standards. South African contributions are particularly noteworthy, with De Beers expertise in advanced seabed mining technologies setting a benchmark for innovation and efficiency. Complementing this, China's renowned shipbuilding industry delivers state-of-the-art vessel construction capabilities, while Singapore's specialised maritime systems integration services provide seamless coordination in complex offshore environments. Together, these global inputs exemplify the project's commitment to excellence and cutting-edge performance.

- **China (52%)**

  China is the dominant contributor, supplying the majority of procurement elements such as the hull, piping, machinery, electrical systems, and various process plant components. The extensive reliance on Chinese manufacturing and equipment procurement is a key driver of the overall Capex.

- **Europe (3%)**

  European contributions are evident in several areas:

- Engineering and design work, including parts of the IMV.

- **South Africa (16%)**

  South African contributions are evident in several areas:

  - Engineering and design work, including parts of the IMV and LARS; and
  - SBC design, components and controls.

- **USA (11%)**

  The USA contributes significantly with specialized processing equipment, most notably the Vertimill® units, which represents a major capital investment in the processing technology for the project.

- **Singapore (9%)**

  Singapore plays a crucial role in the vessel integration process. This is vital for the successful assembly and operational readiness of the IMV unit.

- **New Zealand (NZ) (6%)**

  New Zealand's input is focused on project management and BFS-related efforts. This includes consultancy, travel, and specialised local projects like the vanadium recovery pilot plant, BFS, permitting, and community/environmental initiatives and EMV.

- **International (3%)**

  A small fraction of the costs is attributed to international sources, primarily reflecting the risk-based contingency allocation and minor cross-border contributions.

- **Australia (0.1%)**

  Australia's overall contribution is limited to beneficiation and metallurgical testing during the BFS phase.

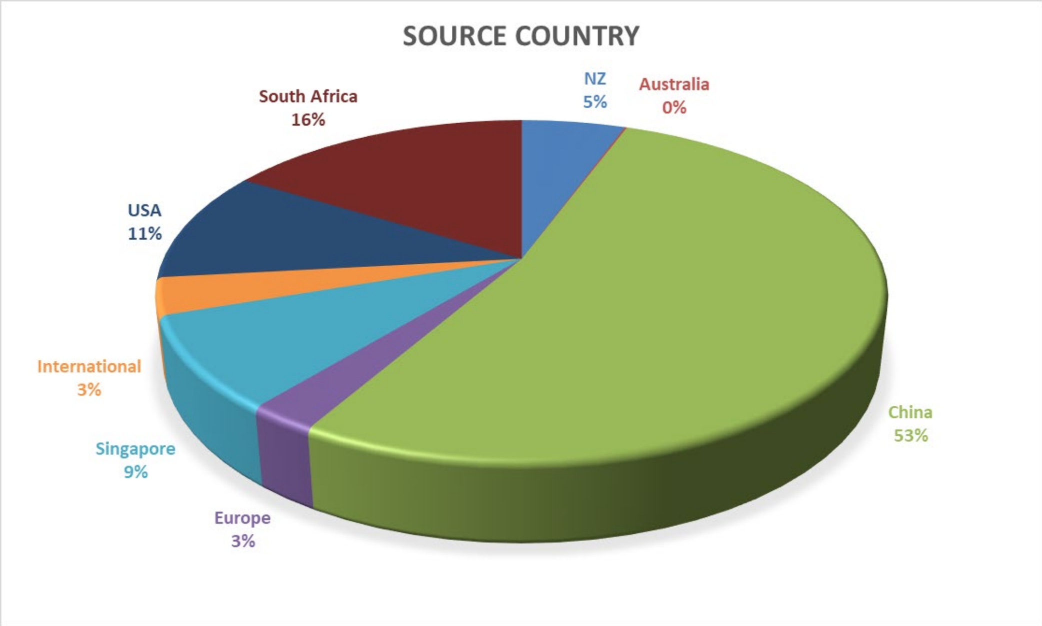


Figure 83 Project Element Source Country

14.1.2 Capital Estimate Revision Process

The capital cost estimates for the Taranaki VTM Project have been updated through a process that began with identifying the intended sources of each key project element. This involved a review to determine whether materials, equipment, and labour resources were to be sourced domestically or internationally, taking into account supplier locations, logistical pathways, and potential geopolitical impacts.

With the sourcing origins clearly defined, the next step was the application of relevant industrial and national price indices to adjust costs. The Producer Price Index (PPI) was employed to reflect changes in manufacturing and wholesale prices across various sectors, while the Consumer Price Index (CPI) was consulted to capture broader trends. Additionally, industry-specific indices were referenced, particularly for ship construction, mining process equipment, and industrial equipment procurement.

Incorporating market-driven factors was a critical part of the methodology. This process began with data collection from reputable industry reports, government publications, and economic research papers. Key factors considered included:

- Commodity Price Fluctuations - Historical and forecasted trends were analysed to anticipate changes in raw material costs.
- Currency Exchange Rates - Data from the Reserve Bank and financial institutions.
- Supply Chain Dynamics - Insights from logistics providers and recent case studies were used to estimate freight costs; and
- Labour Market Trends - National employment data and industry wage reports provided

insights into wage growth and productivity variations across regions.

Inflation adjustments were applied using the most up-to-date data available to ensure that material and service costs reflect current market conditions accurately. Supply chain challenges, including increased freight rates and extended delivery times, were integrated into the revised estimates to account for potential delays and cost overruns.

14.1.3 Capex Model

The project's capital expenditure (Capex) estimate was developed using "@Risk", a Monte Carlo simulation tool that models the uncertainties inherent in project costs. The process involved defining cost elements with probability distributions to reflect potential variability, informed by historical data, industry benchmarks, and expert input. Through multiple simulation iterations, "@Risk" generated a probability distribution for the total Capex, providing insights into the range of potential outcomes and highlighting key cost drivers.

As part of this process, the maximum Capex value was selected to determine an appropriate base contingency. This approach ensured a high level of confidence that the estimated Capex would be sufficient to cover expected variations.

In addition to this statistical contingency, a risk-based contingency was applied, derived from the project risk register. The risk register outlined identified project risks along with their likelihood and potential cost impacts, allowing for a contingency that accounted for both historical cost variability and project-specific risk factors. This combined approach provided a robust and defensible CAPEX estimate for the project.

14.1.4 Summary Scope of Work

Capital costs have been prepared based on the work breakdown structure (WBS) for the execution phase of the Project. Estimated costs have been broken down into the main areas of mining, processing and logistics.

The overall capital cost estimate includes the following scope:

- Project capital includes all development work;
- Processing plant for the screening and beneficiation of iron sands based on 8,000tph;
- Installed Power Generation of 80MW; and
- Sea Water Desalination capacity of 30,000 m^3/day.

The following items are excluded from the overall capital cost estimate:

- Working capital;
- Insurances; and
- Escalation.

14.1.5 Capital Estimate Basis

The capital cost estimate has been prepared based on the detailed project scope developed during the PFS.

Budget prices were received from pre-qualified OEM's/vendors for the major engineered/process equipment, namely the trommel screens, mills, magnetic separators, pumps, power generation units and the water desalination plant. These items currently represent approximately 58% of the total value.

The historical norms used in the estimates were based on industry standards within the defined scope. The project has endeavored to compile a reasonable level of basic engineering to facilitate the allocation of applicable norms, finalization of project scope and verify aspects of constructability and understanding of risk associated with the implementation of the works.

The value of "normed" works is approximately 21% of the total estimate value. The total Capex estimate comprises the following break-up:

- 5% Fixed Prices;
- 60% Budget prices;
- 21% Normed estimates; and
- 14% Provisional Prices.

The project management and engineering requirements have been quantified using a resource-based schedule, reflecting current industry standards and historical data for this type of project. Incidental and non-labour costs such as travel, third party consultants, etc. have been included on expected activities for the project.

The current overall contingency applied to the bottom line of the estimate (total base estimate excluding sunk costs) is 12%.

14.1.6 Normed Estimates

The normed estimates of the project were compiled using a Cost Ratio method, which relates directly to equipment cost. The Cost Ratio method is particularly suited to preparing Pre-Feasibility estimates, where there is not a lot of detail available with regards to associated equipment, facilities and services.

```
1.  Purchased equipment costs from references
    and on current index basis .......................$000,000
2.  Equipment installation
    (0.17 to 0.25 times Item 1).......................$000,000
3.  Piping,material and labour, excluding service
    piping (0.13 to 0.25 times Item 1)................$000,000
4.  Electrical,material and labour, excluding
    building lighting (0.13 to 0.25 times Item 1).....$000,000
5.  Instrumentation (0.03-0.12 times Item 1) .........$000,000
6.  Process buildings, including mechanical services
    and lighting (0.33 to 0.50 times Item 1) .........$000,000
7.  Auxiliary buildings,including mechanical services
    and lighting (0.07 to 0.15 times Item 1) .........$000,000
8.  Plant services,such as fresh water systems,sewers,
    compressed air etc.(0.07 to 0.15 times Item 1)....$000,000
9.  Site improvements, such as fences, roads,
    railroads etc.(0.03 to 0.18 times Item 1).........$000,000
10. Field expenses related to construction management
    (0.10 to 0.12 times Item 1) ......................$000,000
11. Project management including engineering and
    construction (0.30 to 0.33 times Item 1)..........$000,000

12. Fixed capital = (Sum of 1+2+3+4+5+6+7+8+9+10+11)..$000,000
      Costs
```

Figure 84 Historical Norms

Using this method to project an estimated capital cost required the following actions:

- The preparation and verification of plant flow-sheets involving all major items of equipment, for each of the options considered;
- The calculation of equipment sizes using knowledge of the estimated plant mass balance;
- The costing of individual equipment items; and
- The factoring of associated equipment and service costs to calculate the final estimated capital cost.

14.1.7 Range

The estimate for the TTR Project was developed in the usual manner using vendor quotations, contractor estimates and rates applied to a defined scope of work. Therefore, the cost risk of planned work includes the risks associated with scope definition, quantity take-offs and rate estimation (i.e., the basis of the estimate). For each item in the estimate, three-point range estimates consisting of the likely, the maximum pessimistic and minimum optimistic values were determined for each of these risk factors.

These ranges were determined by key project team members based on factors such as the stage of scope development, the source of rate information and the level of complexity associated with the estimated item and applied in the form of an accurate margin and contingency.

14.1.8 Accuracy

The accuracy margin applied to the base estimate is the amount by which an estimate is corrected to allow for inherent uncertainties brought about by the extent of analysis and design undertaken to quantify risk elements enabling costs to be determined to the prescribed level of accuracy.

Therefore, the level of accuracy margin applied depends on the nature of the information supplied to vendors or suppliers and the information received from these same vendors or suppliers.

As the level of detailed engineering increases, as does the cost to undertake the higher-level studies. Therefore, it is common for detailed engineering to be conducted within the full feasibility study after the project concepts have been fully optimised.

14.1.9 Contingency

Contingencies are the amounts of money allocated to the project to provide for uncertainties in project definition and technology, and risks associated with execution of the project. A quantitative risk analysis was used to determine the most likely project cost outcome and estimate accuracy.

14.1.10 Capital Benchmarks

No specific benchmarking of capital costs has been completed as part of the PFS study given that the process for determination of the capital costs used current market data as the basis of the project estimation. During the PFS study a number of processes have been adopted to assist in determining the optimum capital necessary for the project. From the outset of the PFS study it was expected to achieve a high level of front-end loading. Extensive consideration of execution planning, engineering definition, and understanding site-specific factors have been the basis of the work completed by the PFS study team. In the course of progressing the study a number of Value Improving Practices have been followed, including:

- Formal technology selection;
- Simulation modelling;
- Customised standards and specifications;
- Constructability reviews; and
- Risk assessments.

14.1.11 Verification

Due to the lack of detail engineering within the Pre-Feasibility stage, the verification of the accuracy of estimates and assumptions used in creating these estimates was regarded as essential to the potential success of the Project.

Experienced consultants in each of the different technology areas, namely mineral sands mining, concentration and beneficiation/comminution, were retained to independently evaluate the integrity of the specifications and assumptions.

14.1.12 Capex Cost Estimate

Based on the operational tools and equipment required to achieve a production target of 4.9Mtpa of final iron sands concentrate, the risk analysis estimates a Capex budget of US$602.183 million (circa NZ$1 billion).

PROJECT ELEMENT		CAPITAL ESTIMATE							ELEMENT TOTALS	PFS TOTAL
		IMV	FSO	AHT	ENVIRO MON	PM & ENG	UNCERTAINTY	RISK		
VESSEL	HULL	$ 42,221,692.89		$5,683,724.65	$1,900,000.00		$ 7,185,812.63	$ 4,222,169.29	$ 153,298,229.34	$ 61,213,399.47
	EQUIPMENT	$ 31,630,003.83					$ 3,163,000.38	$ 3,163,000.38		$ 37,956,004.60
	INTEGRATION	$ 45,107,354.39					$ 4,510,735.44	$ 4,510,735.44		$ 54,128,825.28
PROCESS	PROCESS PLANT	$163,393,883.51					$16,529,388.35	$ 3,940,880.48	$ 201,932,946.14	$183,864,152.33
	DEWATERING		$15,459,730.28				$ 1,545,973.03	$ 1,063,090.50		$ 18,068,793.81
MINING SYSTEMS	CRAWLERS/LARS ETC	$ 86,711,224.00				$ 5,621,583.47	$10,820,910.00	$ 8,799,470.00	$ 111,953,187.47	$111,953,187.47
AUXILLIARY	POWER GENERATION	$ 66,036,828.55					$ 6,603,682.86	$ 1,839,386.82	$ 100,575,468.37	$ 74,479,898.22
	DESALINATION	$ 21,929,050.54					$ 2,192,905.06	$ 1,973,614.54		$ 26,095,570.15
MANAGEMENT	PM&E	$ 23,287,615.97				$ 8,783,724.17	$ 1,164,380.80	$ 1,187,472.81	$ 34,423,193.75	$ 34,423,193.75
	Totals	$480,317,653.69	$15,459,730.28	$5,683,724.65	$1,900,000.00	$14,405,307.64	$53,716,788.55	$30,699,820.25	$ 602,183,025.07	**$602,183,025.07**
	% of Total	79.8%	2.6%	0.9%	0.3%	2.4%	8.9%	5.1%		100%

Table 24 CAPEX Breakdown

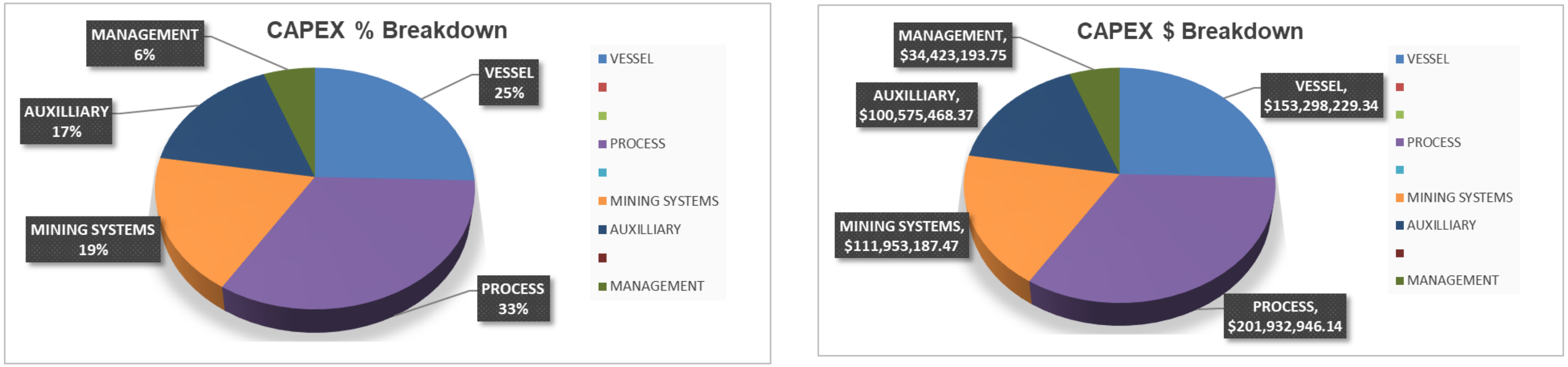


Figure 85 Capex Breakdown

14.1.13 Capex Analysis Results

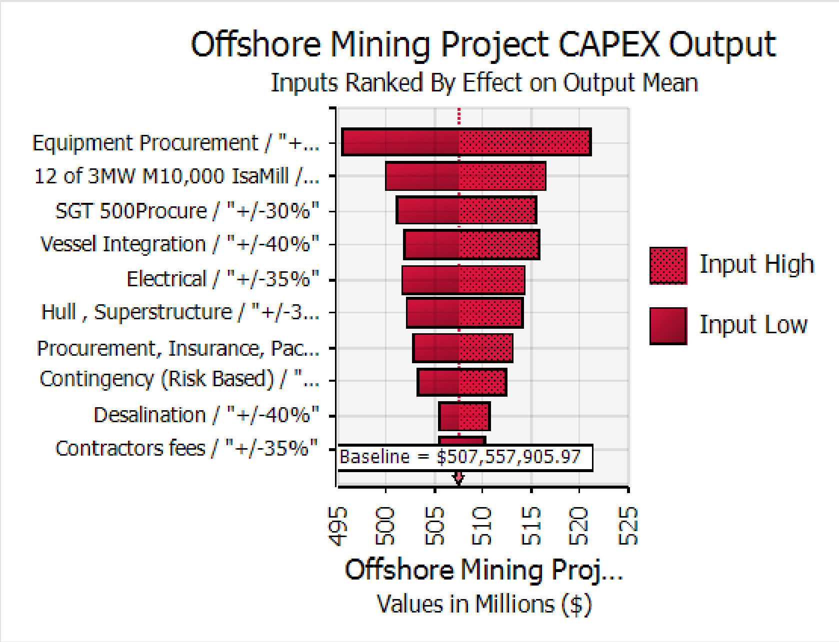


Figure 86 Capex Sensitivity Analysis

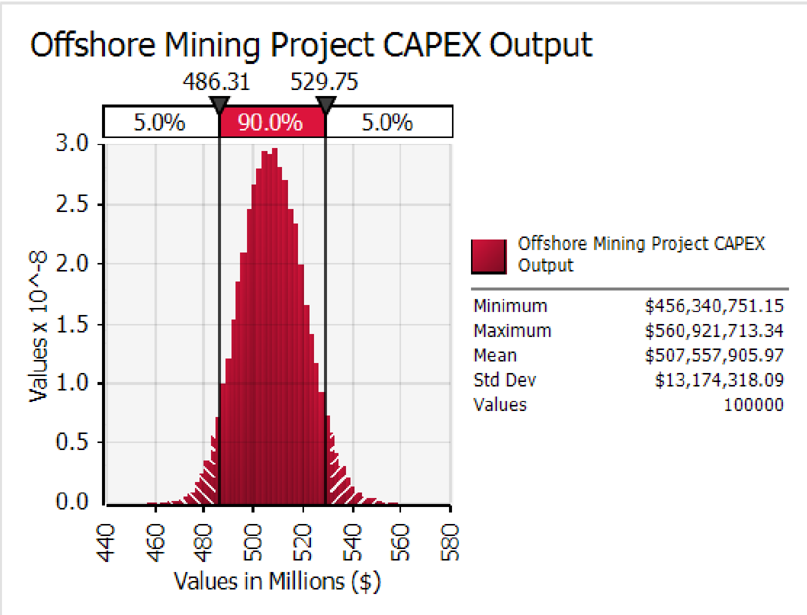


Figure 87 Capex Distribution

14.2 Operational Expenditure

The detailed Opex framework provides an in-depth analysis of the operational costs, amounting to US$27.20 (NZ$47.00) per tonne of concentrate. This cost structure not only highlights the complexity and scale of the offshore mining operation but also identifies key cost drivers and opportunities for improving efficiency. Each component of the operation contributes uniquely to the overall expenditure, reflecting the logistical and technical demands of offshore mining while underscoring strategic areas for cost optimisation.

The seabed crawler (SBC) with its impressive capacity of 8,000tph, exemplifies operational efficiency, contributing just US$1.29t of VTM concentrate to the total cost. This low unit cost is a testament to the crawler's robust design and high throughput capability. At the other end of the spectrum, the Integrated Mining Vessel (IMV) stands out as the most significant cost driver, accounting for US$15.34t of concentrate or over half of the total Opex. This high cost is primarily due to the vessel's multifaceted role, encompassing sediment extraction, mineral processing, and energy-intensive operations including 80MW power generation and seawater desalination. Notably fuel consumption, which is a critical factor in the IMV's operation, represents US$8.12t of concentrate, roughly 30% of the total Opex, underscoring the importance of efficient power generation and energy management.

The Floating Storage and Offloading (FSO) Vessel adds a further US$7.72t to the Opex, driven largely by leasing costs of US$7.00t. While the FSO provides essential storage and transshipment capabilities, its leasing arrangement introduces a fixed cost that scales directly with production. Ancillary services, including the Anchor Handling Tug (AHT) (US$1.85t) and the EMV vessel (US$1.00t), provide vital operational support, with the latter reflecting the project's commitment to ongoing environmental stewardship and strict regulatory compliance.

A deeper breakdown of Opex reveals further operational complexities. Labour costs account for US$6.27t of concentrate, reflecting the highly skilled workforce required to manage offshore operations. Repairs and maintenance costs total US$2.04t, essential for maintaining equipment reliability and minimising downtime. Insurance (US$0.57t) protects operational assets against marine and environmental risks, while miscellaneous expenses (US$2.20t) cover consumables, logistics, and unforeseen operational requirements. Importantly, the US$1.00t allocated for environmental monitoring and training not only ensures ongoing regulatory compliance but also enhances workforce capability, strengthening long-term operational resilience.

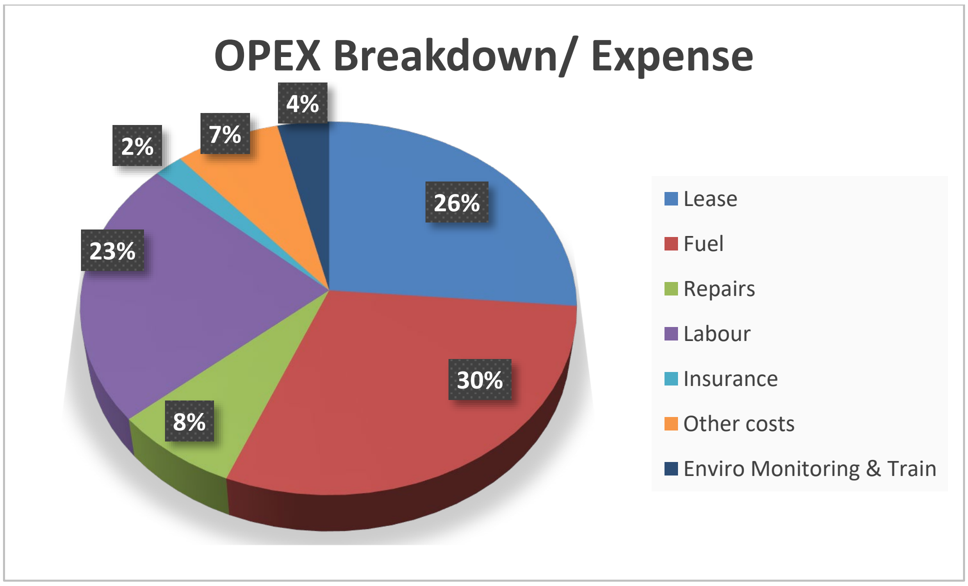


Figure 88 Opex Operational Breakdown

Summary Opex Costs	**US$t Concentrate**
8,000 tph Seabed Crawler	US$ 1.29
Integrated Mining Vessel	US$ 15.34
Floating Storage and Offloading Vessel	US$ 7.72
Ancillaries (AHT)	US$ 1.85
Environmental Monitoring Vessel	US$ 1.00
Total	**US$ 27.20**

Table 25 Opex Costs by Element

Summary Opex Costs	**US$t Concentrate**
Leasing Costs (FSO)	US$ 7.00
Fuel	US$ 8.12
Repairs & Maintenance	US$ 2.04
Labour	US$ 6.27
Insurance	US$ 0.57
Other Costs (Misc.)	US$ 2.20
Environ Monitoring & Training	US$ 1.00
Total	**US$ 27.20**

Table 26 Opex Costs by Area

14.2.1 Benchmarking Against Iron Sand Land Operations

When benchmarked against conventional iron sand land operations, which typically operate at approximately US$25.00-28t, the offshore operation's Opex of US$27.20t remains competitively positioned, particularly when considering the added complexities of marine-based mining. While land-based operations benefit from simpler logistics, lower fuel dependency, and reduced environmental monitoring costs, they also face significant challenges, such as land use constraints, regulatory pressures, and community engagement hurdles.

Land-based mining often contends with strict zoning laws, complex environmental regulations, and public opposition related to land disturbance and ecosystem impacts. Coastal and rural communities frequently raise concerns about the environmental footprint of large-scale mining operations, leading to time-consuming consent processes and potential operational delays. Additionally, engagement with Māori iwi and local stakeholders is essential in maintaining a social licence to operate, adding another layer of complexity to land-based projects.

Offshore mining offers several strategic advantages with access to higher-grade deposits, with minimal overburden removal, thus allowing for more consistent head grades and potentially higher metallurgical yields. Furthermore, the environmental footprint of seabed mining, when managed responsibly, can be more contained compared to the land disturbance associated with large-scale excavation, offering long-term sustainability benefits.

14.2.2 Closing the Cost Gap: Pathways to Greater Efficiency

Targeted initiatives aimed at reducing fuel consumption such as optimising power generation systems or integrating hybrid energy solutions could yield substantial savings. Similarly, increasing crawler and plant throughput would dilute fixed costs across higher production volumes, directly lowering the unit Opex.

Continuous refinement of the mining plan to minimise grade variability will further stabilise production rates and improve processing efficiency. Investment in advanced process control systems and real-time monitoring technologies could also enhance operational stability, reduce downtime, and improve overall cost management.

In the long term, the offshore model's flexibility and capacity for scaling production, combined with strategic efficiency improvements, offer cost advantages over land-based operations, positioning the project to remain competitive in the global iron sand market while aligning with New Zealand's environmental and regulatory standards.

15 FINANCIAL EVALUATION

This section summarises the financial and operating parameters of the TTR Taranaki VTM project for the first 10 years of operations, as well as the Capex and Opex with an accuracy of +/- 30% as defined in the scope of work set out in the pre-feasibility study.

15.1 Business Model

The business plan has been elaborated by TTR in the above section in particular with regard to the marketing approach in terms of pricing and sales. TTR and its various consultants have also collectively contributed to the necessary inputs in relation to the Capex and Opex estimates for the project for the purpose of economic evaluation.

There is a compelling technical and economic case for using VTM concentrates as a substitute for traditional iron ore, particularly when the valuable vanadium is recovered as a by-product.

The Taranaki VTM Project has significant upside scalability that can be deployed on a modularised basis following successful investment and deployment of its first production unit. TTR has a vast amount of resource potential (only 9% of its tenement has been explored to date) providing significant expansion opportunities to become a major, low-cost supplier of VTM iron ore concentrates.

15.2 Key Inputs and Assumptions

In performing financial evaluation of the project, the following assumptions have been considered for the base case scenario:

- Run-of-mine sediment mining tonnage and anticipated head grade based on proposed mine plan prepared by Golders Associates for first five years as follows and thereafter assuming average head grade of 9.5% based on average of year eight to ten;
- Metallurgical yield estimated based on analysis of results from samples tested through the pilot plant and Davis Tube Recovery results and adjusted by the Fe recovery of the pilot plant and then compared against the proposed mine plan;
- Product Fe grade of 57%;
- Production projected for 20-years, thereafter assuming same level of grade and yield on an ongoing basis with terminal value;
- Crawler cycle time of 260 net operating days or 6,326 hours (72% utilization rate);
- Crawler dredging capacity of 8,000tph throughput;
- IMV requires Dry Docking of 56 days every 5 years for the first 15 years, and every 3 years thereafter;
- IMV is powered by Intermediate Fuel Oil (IFO380) converted to power cost on kwh per ton of IFO used basis based on estimated conversion factor;
- Power usage based on estimated average power consumption from engineering modelling conducted during the pre-feasibility study (PFS);
- Estimated personnel required and estimated labour costs;

- Estimated repair and maintenance costs based on industry norms;
- Estimated insurance and other ancilliary support costs;
- Sales, general and admin costs as a dollar per ton of concentrate estimate;
- Marketing costs as a percentage of sales;
- Royalties based on higher of ad valorem or accounting profit basis;
- Sale price based on nominal 62% Fe CFR China benchmark price, adjusted for 57% Fe product grade discount, and thereafter applying sale discounts and/or adjustments as applicable;
- FSO on a fully outsourced basis, charged on a fixed cost plus a variable per ton charge;
- Estimated freight cost from New Zealand to China; and
- Estimation of other ancillary costs such as anchor support vessel, grade control drilling, community development, exploration, environmental research and monitoring, etc.

15.2.1 Key Inputs

15.2.1.1 Long-Term Consensus Iron Ore Price Forecast

The selection of $90/metric ton as the long-term iron ore price forecast is based on a balanced assessment of historical price trends, market fundamentals, expert forecasts, and industry dynamics.

The justification for this assumption is outlined below:

a) Alignment with Long-Term Market Forecasts

Industry analysts and market researchers, including Fitch Solutions, Australia's Office of the Chief Economist (OCE), and Macquarie, provide long-term iron ore price forecasts ranging from $70 to $100/metric ton for the period leading up to 2030. While some projections indicate a downward trend toward $70-$80/metric ton, others suggest prices could stabilize closer to $90-$100/metric ton due to supply constraints and cost inflation in mining operations. Selecting $90/metric ton represents a reasonable midpoint of these projections while maintaining a conservative yet realistic outlook.

b) Historical Price Trends and Market Cycles

Iron ore prices have historically fluctuated due to supply-demand imbalances, global economic cycles, and geopolitical factors. Over the past decade, prices have generally ranged between $80 and $120/metric ton, with occasional spikes and dips. The $90/metric ton assumption reflects a sustainable long-term average, accounting for both cyclical downturns and potential future upswings driven by supply constraints and infrastructure-driven demand.

c) Cost Support and Marginal Production Economics

The cost of production for major iron ore producers, such as Rio Tinto, BHP, and Vale, generally ranges between $40 and $55/metric ton, depending on location and grade.

While some low-cost mines in Australia and Brazil can operate profitably at lower prices, the marginal cost of production for higher-cost producers (e.g., in China, India, and West Africa) typically sits around $70-$90/metric ton. This suggests that prices are unlikely to fall below $90/metric ton for extended periods without prompting supply reductions, reinforcing the assumption of $90/metric ton as a sustainable long-term benchmark.

d) Structural Demand Drivers and Supply Constraints

China's Transition to Higher-Quality Steel Production: While China's steel demand may slow, its increasing preference for high-grade iron ore (to reduce emissions and improve efficiency) may support a price floor around $90/metric ton for high-quality ore.

Infrastructure and Decarbonization Investments: Demand from emerging markets, renewable energy projects, and infrastructure development in India, Southeast Asia, and Africa will offset some of the declines in China's steel consumption.

Supply-Side Challenges: Future supply risks, including regulatory constraints, environmental policies, and operational challenges in new mining regions (e.g., Simandou in Guinea), could lead to temporary shortages and price resilience above $90/metric ton.

e) Inflation and Currency Effects

Mining input costs, including labor, energy, and logistics, continue to rise due to global inflationary pressures and supply chain disruptions. A long-term price assumption of $90/metric ton accounts for the cost-push inflation effect, ensuring that the forecast remains economically viable in real terms.

15.2.1.2 Long-Term Forecast for IFO 380 CST Fuel Oil

a) Historical and Current Market Pricing Trends

As of early 2025, the price of IFO 380 CST in Singapore is approximately $499 per metric ton (bunkerindex.com).

Over the past decade, IFO 380 CST has experienced price fluctuations between $300 and $700 per metric ton, largely influenced by crude oil prices, supply-demand dynamics, and regulatory changes.

A $500 per metric ton long-term estimate aligns with historical average prices, providing a reasonable middle ground rather than an overly optimistic or pessimistic projection.

b) Regulatory and Market Influence on Long-Term Prices

The IMO 2020 sulfur cap significantly reduced demand for high-sulfur fuel oils, shifting demand toward low-sulfur alternatives. However, ships equipped with scrubbers still support a steady demand for IFO 380 CST.

Looking forward, while stricter environmental regulations could reduce demand, the availability of scrubber-equipped vessels and regional price arbitrage (e.g., Singapore vs. China's Zhoushan) ensures continued usage of IFO 380 CST.

The price of IFO 380 CST tends to correlate with global crude oil trends. If crude oil prices stabilise in the $70–$90 per barrel range over the long term, bunker fuel prices will likely remain within a proportionate range, supporting a $500 per metric ton assumption.

c) Inflation and Cost Adjustments in Long-Term Modeling

A $500 per metric ton assumption accounts for inflationary pressures on crude oil production and refining costs, ensuring that the forecast remains realistic over a 10-year horizon.

While some alternative fuels (e.g., LNG, biofuels) may gain market share, their high infrastructure investment requirements could delay mass adoption, maintaining stable demand for traditional fuels like IFO 380 CST.

15.2.1.3 Vanadium Pentoxide Price Long-Term Forecasts

a) Historical Price Trends and Market Stability

The 2024 average price of vanadium pentoxide (V_2O_5) was reported by the USGS at $5.45 per pound, down from $7.50 per pound in 2023. This suggests a stabilization of prices following recent fluctuations. Given that market corrections have occurred and recent price levels reflect equilibrium conditions, assuming the $5.45 price point for long-term forecasts is reasonable and aligns with historical price adjustments.

b) Supply and Demand Considerations

Vanadium supply is influenced by production from primary mining sources and as a byproduct of steel production. The global demand for vanadium, driven primarily by steel alloying and energy storage applications, remains steady. While demand for vanadium redox flow batteries (VRFBs) could increase in the long term, any significant price surge is likely to be met with supply-side responses. The $5.45 price reflects a balance between supply resilience and demand growth, making it a stable long-term assumption.

c) Cost Structure and Production Viability

Global production costs, particularly in China, Russia, and South Africa, suggest that a price floor of approximately $5.00 per pound supports sustainable mining and refining operations. A long-term price forecast at $5.45 ensures cost coverage for producers while maintaining competitive pricing for consumers, thereby avoiding significant supply shocks.

d) Inflation and Commodity Price Trends

While inflationary pressures could push nominal prices higher, the real price of vanadium pentoxide—adjusted for inflation—has remained relatively stable over time. Commodity price trends indicate that metals typically trade within long-term ranges unless structural supply or demand changes occur. A $5.45 price forecast incorporates reasonable expectations of inflation-adjusted stability.

15.2.1.4 Shipping Allowance for Transporting Iron Ore from the West Coast of New Zealand to China – US$ 10.00/metric ton

The selection of a $10 per metric ton shipping allowance for transporting iron ore from the West Coast of New Zealand to China is based on an analysis of historical and current freight rates, voyage distances, and prevailing market conditions. The key factors supporting this assumption are outlined below.

a) **Benchmarking Against Dry Bulk Freight Rates**

Iron ore is typically transported using Capesize or Panamax bulk carriers, depending on shipment volumes and port constraints. Historical freight rates for comparable routes provide a strong reference point:

- Australia to China (Pilbara–Qingdao): Shipping rates for Capesize vessels have ranged between NZD $9.60–$21.82 per metric ton, depending on market conditions.
- Brazil to China: Due to the significantly greater distance, rates are higher, typically around NZD $18.70 per metric ton.
- New Zealand to China: Given the shorter distance relative to Brazil but longer than Australian routes, a reasonable estimate falls between NZD $8–$12 per metric ton for Capesize shipments.

The $10/t assumption aligns with these rates while allowing for fluctuations.

b) **Voyage Distance and Fuel Costs**

The shipping distance from Westport, New Zealand, to Northern China (e.g., Qingdao) is approximately 4,800–5,400 nautical miles, placing it between the distances from Australia (approx. 3,000Nm) and Brazil (approx. 11,000Nm).

Given current marine fuel prices and bunker consumption for a Capesize vessel, the fuel cost component supports a $10/t rate estimate.

c) **Port and Handling Considerations**

New Zealand's West Coast ports have limited bulk export infrastructure, requiring additional handling costs or transshipment.

Loading rates and potential delays could affect final costs, but these are generally offset by the shorter shipping route compared to Brazil or South Africa.

d) **Market Volatility and Risk Allowance**

The dry bulk freight market is subject to fluctuations driven by factors such as fuel price variations, seasonal demand shifts, and geopolitical influences.

Baltic Dry Index trends reflect the volatility of bulk shipping rates.

The recent Capesize freight rates for iron ore transport from Australia to China have ranged from NZD $9.60 to $21.82 per metric tonne.

15.3 Economic Impact Assessment

TTR engaged New Zealand Institute of Economic Research (NZIER) to update the economic impact assessment of the Taranaki VTM Project. NZIER are an independent economic consultancy, who provide services to both the public and private sectors, and were commissioned to undertake the economic impact study, capturing the direct and the flow-on impacts of the Project's capital investment and 20-year operation in New Zealand on the local, regional and national economies.

15.3.1 Economic Impact Summary

The economic impact assessment report was modelled on the PFS capital (Capex) and operating expenditure (Opex) estimates to conduct its economic analysis. The NZIER economic impact assessment for TTR's Taranaki VTM Iron Sands Project highlights the project's significant contributions to the New Zealand economy, with a NZ$1 billion capital investment, approximately NZ$55 million will be spent within New Zealand, primarily on project setup, environmental initiatives, and infrastructure. This investment is expected to create 459 new jobs nationally, with 211 regional and 86 local jobs. Once operational, the project will inject NZ$238 million annually into the economy, generating 1,365 jobs nationwide, including 1,123 in the Taranaki and Whanganui region and 224 at the local level.

The project is estimated to earn NZ$854 million per year in export earnings, with NZ$658 million from iron ore and NZ$196 million from vanadium pentoxide. It will contribute NZ$36M to NZ$54M in annual royalties and NZ$91M to NZ$136M in corporate taxes to the New Zealand government. Sensitivity analysis indicates that iron ore prices significantly impact export earnings and royalties, while exchange rate fluctuations and fuel costs have less influence on the project's overall financial performance. Refer to Appendix 19.24 for the full report.

15.4 Project Discounted Cash Flow

STB Vanadium Titanomagnetite Iron Sands Project

20 YEAR LIFE OF MINE

High Level DCF | **x US$1,000,000** | **OPEX/US$t** | **27.20**

		US$M	Yr	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
NOTE: PRICE IS CURRENT SPOT PRICE		Conc m/t avg sales				4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
90.0	US$/t North China	*Revenue (FeX Earnings)*	*(58% disc to 62%CFR)*			380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6	380.6
13.7%	62% Fines Discount 57%Fe																								
5.45	US$/lb V_2O_5 less 50% costs	0.50%	0.77	50.00%		113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3	113.3
2,080.00	US$/$TiO_2$	8.50%	0.77	0%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.79	*Revenue/tonne US$/t*	*Total Revenue*				*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*	*493.9*
-	US$/t	V_2O_5 & TiO_2 Roast 50% revenue (cost 50% revenue row 10)				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
27.2	Fixed	Direct and GA costs avg	*(IFO $500/t US$75/bbl)*			133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3	133.3
10.0	US$/t	Freight				49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0
37.2	*Cost/tonne US$/t*	*Total Costs*				*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*	*182.3*
63.59	*EBITDA/tonne US$/t*	**EBITDA**				*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*	*311.6*
		Interest				17.5	15.4	13.1	10.7	8.2	5.6	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-
602.18		Depn / Amort (DA)	EOL 7yrs. SL Depn			86.0	86.0	86.0	86.0	86.0	86.0	86.0													
		Fe, V_2O_5 & TiO_2 Royaltie	2% AVR / 10% APR			20.8	21.0	21.2	21.5	21.7	22.0	22.3	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
		NPBT				*187.3*	*189.2*	*191.2*	*193.4*	*195.6*	*198.0*	*200.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*	*280.4*
28%		Tax	Corporate tax rate. No loss C/fwd			-	5.4	53.5	54.1	54.8	55.4	56.1	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5
		NPAT				*187.3*	*183.8*	*137.7*	*139.2*	*140.8*	*142.5*	*144.3*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*
		Cash Flows																							
		NIAT-DA				273.3	269.8	223.7	225.3	226.9	228.6	230.3	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9
602.18	Capex	Asset		125.0	477.2																				
		Financing Principal repayments			421.5	(43.0)	(45.1)	(47.4)	(49.8)	(52.3)	(54.9)	(57.6)	(60.5)	-	-	-	-	-	-	-	-	-	-	-	-
		CF	**1,204.3**	(125.0)	(55.7)	230.3	224.7	176.3	175.5	174.6	173.7	172.7	141.4	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9	201.9
		Disc % /yr		1.0	0.9	0.8	0.7	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
0.1	Discount factor excl inflation	**DCF**	1,263.0	*(119.2)*	*(48.2)*	*181.5*	*161.0*	*114.8*	*103.9*	*94.0*	*85.0*	*76.8*	*57.2*	*74.2*	*67.5*	*61.3*	*55.8*	*50.7*	*46.1*	*41.9*	*38.1*	*34.6*	*31.5*	*28.6*	*26.0*
		IRR	37.7%	*(125.0)*	*(477.2)*	*273.3*	*269.8*	*223.7*	*225.3*	*226.9*	*228.6*	*230.3*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*	*201.9*

Table 27 TTR's Discounted Cash Flow Model

16 RISK & UNCERTAINTIES

TTR commissioned Transfield Worley to specifically undertake a Marine Operations Risk Review on the proposed operations as outlined in the PFS. TTR undertook a HAZID workshop, to not only identified risks associated with the following operational activities, but to assist in any Marine approvals.

- Mining and processing;
- Marine vessel operations including those of the IMV, FSO, export vessel, anchor handling tugs, and replenishment vessel;
- Transfer operations from the IMV to FSO, FSO to export vessel, and fuel transfer;
- Biosecurity and operational discharges including sewage/garbage, de-ored sand and brine, brackish fresh water from the ore washing process, oil products, and other hazardous materials;
- Navigational impacts and maritime safety of the project including marine traffic and activities, proximity to other mining operations, other TTR operational vessel movements, and Automatic;
- Identification System issues;
- IMV (terminology updated to IMV) exclusion; and
- Anchor Handling.

The full report is appended to this PFS. In summary the following operational risk ratings were identified as follows:

Hazard Risk	Before Mitigation and Control Measures	After Mitigation and Control Measures
Extreme	15	0
High	14	3
Moderate	13	23
Low	5	21

Table 28 TTR Marine Operations HAZID Risk Ranking (Transfield Worley)

Project Risks

- The resource is located in an area that is subject to severe sea states, although these have been factored into the dynamic model there is a risk that down time due to inclement weather is higher than allowed;
- The mineable grade is based on an annual mining schedule, as more detailed schedules are applied loss and dilution factors will need to be applied;
- Assumptions on process plant iron units recovered prove to be overly aggressive;
- Capital estimates are based predominantly on supplier estimates, industry "norms" have been used to calculate fabrication and integration costs and hence there is a risk that our allowances have been aggressive;
- Operating costs have been built up using a combination of suppliers budget estimates,

estimated personnel numbers, estimates on consumables and industry “norms” for maintenance. There is a risk our estimates have been aggressive;

- Production estimates have been based on IHC estimates with caveats on further work to understand the “dig-ability” of the sands to be dredged. This was addressed in the IHC report on the dredging / breach testing;
- The crawler solution current operating model restricts its depth to c.25 m, hence shallow areas in the RMA zone cannot be mined requiring, if a crawler operating solution cannot be found higher mining costs will be incurred, this is not expected until after year five;
- The project does not get environmental approvals are appealed or the approvals are granted with conditions what make the Project uneconomic, refer to Section 13 of this PFS document;
- The Company is not in a position to make early commitments to long-lead procurement items with consequential delays to first commercial ore production;
- Mineable grades are materially worse than assumed;
- The Project is subjected to protest vessels that stop/slow operations;
- Assumptions on tailings are worse than allowed for and result in significant amounts of ROM dilution increasing unit costs;
- Assumptions on plume models and overall environmental effects are materially worse than allowed for requiring cost imposts to mitigate on the project that have not been allowed for;
- Revenue assumptions prove to be aggressive.
- Capital estimates prove to be conservative with significant savings identified and materialised through BFS and execution;
- Operating costs prove to be conservative with significant savings identified through BFS and executed through operations, a key driver of Opex will be IFO demand (linked to power demand) and IFO 380 price;
- Mining production rate proves to be conservative and is materially exceeded driving higher sales revenue and lowering unit costs;
- Mineable grades prove to be conservative and are exceeded driving higher revenue through higher sales and lower unit costs;
- Assumptions on process plant iron units recovered prove to be overly conservative;
- Revenue assumptions prove to be conservative;
- Schedule assumptions prove to be conservative allowing for an early start up of operations.
- Further testwork is required to determine the Process Flow Sheet for the optimal recovery of vanadium pentoxide, this relates to the marketing of the VTM Concentrate, and not the IMV processing.

16.1 Updated Risk

The TTR project has undergone a recent risk review, identifying several updated project risks that could impact its progress. Key updates include regulatory and environmental compliance challenges due to evolving legislation and heightened stakeholder scrutiny. Technical risks have also been revised, particularly concerning offshore extraction methodologies and sediment plume management, requiring further validation through modelling and independent assessments.

		INCREASING PROBABILITY				
		A Rare	**B** Unlikely	**C** Moderate	**D** Likely	**E** Almost Certain
INCREASING CONSEQUENCE	**0** None	0	0	0	0	0
	1 Slight	0	0	0	1	0
	2 Minor	0	0	2	4	3
	3 Moderate	1	1	2	15	5
	4 Major	0	0	2	3	2
	5 Catastrophic	0	2	2	4	1

Key:

Green	**Low**
Yellow	**Moderate**
Orange	**High**
Red	**Extreme**

Figure 89 TTR Updated Project Risks

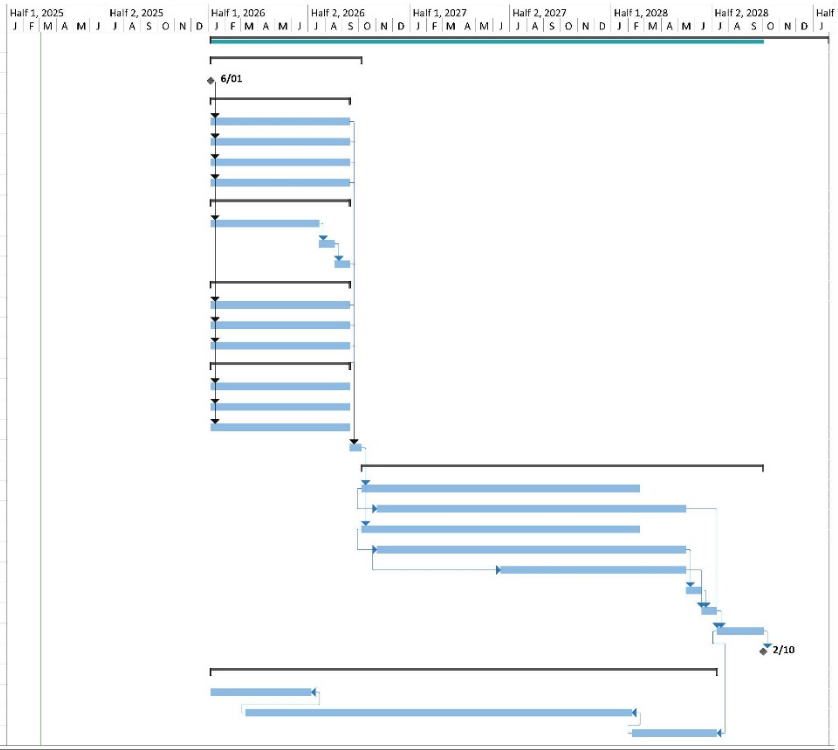
Issue	Risk Status	Description of Impact	Risk Category	Risk Reduction / Mitigation Plan	Current Priority
Information is deemed uncertain or inadequate, Marine Consent delayed or not granted	In Progress	inability to mine, impact on capital recovery timeframe	Environment	Consultation, Verification Process & Legal	Extreme
Tank overflow or pipe rupture	Identified	Vessel lists uncontrollably. Engine room and electrical switch room flooded, immobilising the vessel.	Safety	Water tight bulkheads installed. Layout, controls, supervision Provision of sumps and bilge systems	Extreme
Fire	Identified	Personal injury or equipment damage	Safety	Detailed design and materials selection Maintenance procedures, hot work permits	Extreme
Plant not suited to ROM variability	Identified	Short fall in annual production Long or short term deviation from specification	Financial	Good quantification of resources. Measurement/sampling detection on mining vessel Mill control/recirculation system Alternate market available for off-specification product Detailed design & review processes Equipment selection	Extreme
Inadequate BFS engineering / FEED	Identified	Cost overrun during construction. Plant does not perform as expected	Financial	PFD to be verified. Contracting strategy to be developed during BFS. FEED and operability reviews by experienced parties. Benchmark off other projects	Extreme
Rewetting of iron sand post the drying step making the product structurally unstable	Identified	Potential for liquefaction, formation of beaches causing hazard of capsizing	Safety	Design to remove (or manage) presence of free-water in cargo	Extreme
20yr on-water life requires insitu overhauls	Identified	Short fall in annual production due to extended outage periods	Financial	Detailed design to account for in-situ overhauls Streams and crossovers to be includes Maintenance procedures, equipment selection, spares holdings, proven technologies. Preventative maintenance , maintenance schedule - Commonality of spares/parts - Maintenance philosophy	Extreme
Get declined for Environmental Consent or restrictive operational conditions on consents i.e. smaller operation	In-Progress	Unable to progress with Project	Environment	Engage SME, Comprehensive Study & mitigation plans	Extreme
Third party will appeal positive Consent/License award	In-Progress	Delay to achieving Marine Consent	Environment	Consultation, Engaging Legal resources	Extreme
Uncontrolled movement of heavy loads on a moving vessel	Identified	Personal injury or equipment damage	Safety	Detailed design to consider maintenance requirements (e.g. crawl beams)	Extreme
High energy requirements on the vessel	Identified	Energy costs greater than anticipated	Financial	Detailed design to reduce power demand	Extreme
Price of iron ore drops significantly - project becomes uneconomic	Identified	Project is not viable	Financial	Robust margins/Allowances, ID Lower cost options CAPEX & OPEX	Extreme
Insufficient contingency allowance applied to budget pricing	Identified	Actual cost of procured items differs from estimate, because point of purchase is 12 months after BFS budget is set	Financial	Procurement Processes, RFQ, Verification Processes,	Extreme
Restricted access to NZ ports	Identified	Unable to address urgent break-fix	Performance	Berthing procedures, Vessel Design	Extreme
Power required is nominal, BFS estimate has insufficient allowance for power generation	Identified	Power Inadequate	Performance	Design Verification, Detailed modelling	Extreme
Increase in Shipping costs	Identified	Potential for significant Increase in FOB/CFR determinations	Financial	Early Notification, Mod of Shipping arrangements	Extreme
Cracking of hull caused by vibration	Identified	Vessel lists uncontrollably. Engine room and electrical switch room flooded, immobilising the vessel.	Safety	Detailed design to isolate vibrations, on going monitoring of equipment operation. Fatigue analysis in design phase	High

Table 29 Updated Risk Register, Highlighting the Highest Project Risks

17 BASIC SCHEDULE

The basic development schedule for the future stages of the TTR project is proposed in the schedule shown below:

ID	Task Name	Duration	Start
1	**Offshore Ironsands Project**	**40 mons**	**Tue 6/01/26**
2	**BFS**	**9.75 mons**	**Tue 6/01/26**
3	BFS Study Commences	0 mons	Tue 6/01/26
4	**Mining System Design**	**9 mons**	**Tue 6/01/26**
5	Crawler	9 mons	Tue 6/01/26
6	LARS	9 mons	Tue 6/01/26
7	Mooring	9 mons	Tue 6/01/26
8	**Mining Vessel Basic Design**	**36 wks**	**Tue 6/01/26**
9	**Process Plant Design**	**9 mons**	**Tue 6/01/26**
10	Detailed Design	7 mons	Tue 6/01/26
11	Market Enquiry	1 mon	Tue 21/07/26
12	Market Evaluation	1 mon	Tue 18/08/26
13	**Vessel Auxiliary Plant**	**9 mons**	**Tue 6/01/26**
14	Power Generation	9 mons	Tue 6/01/26
15	Desalination Plant	9 mons	Tue 6/01/26
16	**FSO**	9 mons	Tue 6/01/26
17	**Support Services**	**9 mons**	**Tue 6/01/26**
18	Support Vessels	9 mons	Tue 6/01/26
19	Helicopter	9 mons	Tue 6/01/26
20	Infrastructure	9 mons	Tue 6/01/26
21	**BFS Estimate**	3 wks	Tue 15/09/26
22	**Construction and Commissioning**	**26 mons**	**Tue 6/10/26**
23	FSO Detailed Design	18 mons	Tue 6/10/26
24	FSO Construction	20 mons	Tue 3/11/26
25	Mining Vessel Detailed Design	18 mons	Tue 6/10/26
26	Mining Vessel Construction	20 mons	Tue 3/11/26
27	Process Plant Installation	12 mons	Tue 15/06/27
28	Vessel Commissioning	1 mon	Tue 16/05/28
29	Process Plant Dry Commissioning	1 mon	Tue 13/06/28
30	Process Plant Wet Commissioning	3 mons	Tue 11/07/28
31	Project Complete	0 days	Mon 2/10/28
32	**Environmental**	**32.75 mon**	**Tue 6/01/26**
33	Preparation for Baseline Monitoring	6.5 mons	Tue 6/01/26
34	Enviornmental Baseline Monitoring Period	25 mons	Tue 10/03/26
35	EMMP Development	5.5 mons	Tue 8/02/28



Project: Full High Level Project Sch
Date: Tue 4/03/25

Task · Split · Milestone · Summary · Project Summary · External Tasks · External Milestone · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · Deadline · Progress · Manual Progress

Page 1

Figure 90 Basic Schedule of Detailed BFS Study

18 BANKABLE FEASIBILITY STUDY

A Bankable Feasibility Study (BFS) is one that will be suitable to enable TTR to negotiate project financing from typical lending sources. The bankable document will satisfactorily provide all the technical / economic information and auditing necessary for a banker (and the banker's independent engineer) to determine that the project risks are acceptable and that the project is indeed viable on a stand-alone project financing basis.

The scope of work for this phase will be to carry out detailed project definition and planning to produce a BFS. This will include:

- General arrangements & P&IDs;
- Lists of required mechanical & electrical equipment;
- Estimate +/- 10% and Schedule that meets TTR's business case; and
- Materials take off lists in support of Capital Cost Estimate.

From this point should the project meet the TTR's business case, and the "green light" is given to proceed, the project will then enter the Execution stage.

Completion of the BFS requires development of preliminary engineering drawings and other documentation. Equipment quotations will be solicited competitively, material take-offs will be prepared, and a direct field cost estimate supported in its entirety by competitive bids will be prepared.

18.1 BFS Strategy

There are two generic strategies that could be implemented to execute the TTR offshore project. The first strategy, i.e. "Project Management by Owners Team", will require that TTR assume full responsibility for the management and engineering of the project, forming a TTR led team that comprises hired or seconded individuals and engaged organisations, each retained for a distinct portion of work or responsibility.

The second strategy, "Project Co-ordination by the Owners' Team" approach is the preferred option, as it ensures strategic oversight while representing the shareholders' interests. By appointing a Project Management and Engineering company as the prime contractor, this model enables effective project execution, with the contractor managing sub-consultants, schedules, budgets, and deliverables, ensuring alignment with project objectives while minimising direct operational involvement by the owners' team.

18.1.1 Project Management by Owners Team

With this strategy, TTR will organise the study and assemble the final BFS report. Various tasks and specialized contributions to the report will be subcontracted to outside consultants and could include the following:

- Exploration drilling;
- Specialised geotechnical investigations;
- Environmental baseline studies and investigations;

- Continued metallurgical test-work; and
- Detailed engineering design and material take-offs.

TTR will co-ordinate all the geological assessments and modelling, mine design and planning, production scheduling, flow-sheet development and estimating of both capital and operating costs. The developed WBS will be used to define all the tasks required, and then a decision will be made as to which tasks could be carried out with internal resources.

These internal tasks could include geologists, mining engineers, mechanical, civil and electrical engineers, metallurgists, legal resources, and purchasing, construction and marketing experts.

A formal project will be developed, with the necessary internal people assigned responsibilities for budgets, deliverables and schedules.

All externally contracted parts of the study will have a very well-defined scope and definition of work, including the contractual basis for carrying out the work and the required dates for completion.

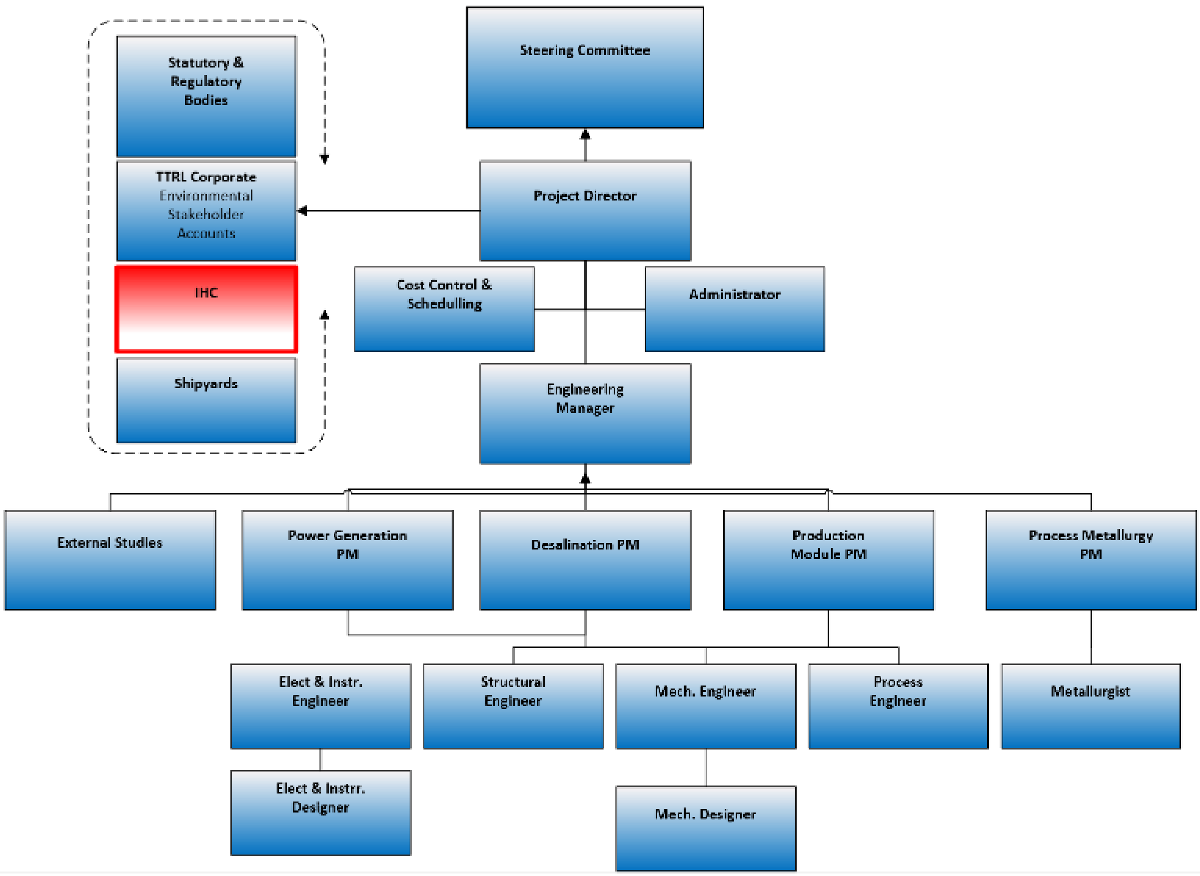


Figure 91 Organisation Chart: BFS Project Managed by Owners Team

18.1.2 Project Co-Ordination by the Owners Team

The second preferred strategy, "Project Co-ordination by the Owners' Team", involves establishing a lean but highly capable team representing the shareholders' interests. This team operates at a strategic oversight level, ensuring that project execution aligns with the shareholders' objectives while minimising direct involvement in day-to-day operations.

A key element of this approach is the appointment of a Project Management and Engineering company to act as the prime contractor, assuming responsibility for engaging and supervising all sub-consultants. This firm will manage the full project lifecycle, ensuring schedules, budgets, and deliverables remain on track while maintaining alignment with the project's overarching objectives.

18.1.3 Role of the Prime Contractor

Once engaged, the prime contractor will take ownership of the following critical responsibilities:

- Coordination of Sub-Consultants – Managing all engineering, operational, and regulatory sub-consultants to ensure an integrated and cohesive approach to project delivery.
- Final Bankable Feasibility Study (BFS) Report – Taking full responsibility for compiling and delivering the BFS, ensuring all technical, financial, and environmental aspects are robustly addressed.
- Schedule and Budget Adherence – Implementing rigorous project controls to monitor performance, mitigate risks, and ensure timely and cost-effective execution.
- Technical and Operational Oversight – Providing expert engineering input to optimise project design and execution, particularly in complex offshore environments.

This structured approach leverages the expertise of an experienced project management and engineering firm while allowing the owners' team to focus on high-level governance, risk management, and strategic decision-making.

18.1.4 Alignment with Upstream Technology

Given the nature of the project, appointing a prime contractor with proven expertise in offshore mining i.e. Upstream Technology (formerly De Beers Marine and Ignite), will be instrumental in driving project success. Upstream Technology, with its background in diamond offshore and land-based mining solutions, possesses the necessary technical and operational experience to oversee the execution of such a project.

The previous collaboration between TTR and Upstream Technology positioned Upstream as a leading advisory and operational partner, providing expertise in:

Engineering design input and operational strategies;

Integration of key offshore mining components, including the crawler system, mooring setup, and process equipment on a marine-based platform;

Ensuring regulatory and environmental compliance for operations in New Zealand's Exclusive Economic Zone (EEZ); and

By integrating Upstream Technology's global expertise in offshore mining solutions into the project structure, the prime contractor model ensures that best-in-class marine resource extraction techniques are adopted. This also aligns with TTR's strategic objective of resuming project development through the Fast Track approvals process, which underscores the need for an experienced and well-structured project execution framework.

18.1.5 Strategic Benefits of Project Co-Ordination

- Reduced Operational Risk – With a highly skilled prime contractor managing technical execution, the owners' team can focus on governance and shareholder interests.
- Improved Project Execution – Leveraging Upstream Technology's offshore mining expertise ensures efficient operations, integrating novel solutions to mitigate technical and environmental challenges.
- Enhanced Stakeholder Confidence – A structured governance model, combined with a globally recognised offshore engineering partner, strengthens the project's credibility with regulators, investors, and the broader industry.

By adopting a Project Co-ordination by the Owners' Team approach, supported by an experienced prime contractor such as Upstream Technology, the project benefits from world-class operational expertise while maintaining shareholder-driven oversight. This model ensures that all technical, financial, and environmental objectives are met, laying the foundation for a successful and sustainable offshore mineral extraction operation in New Zealand.

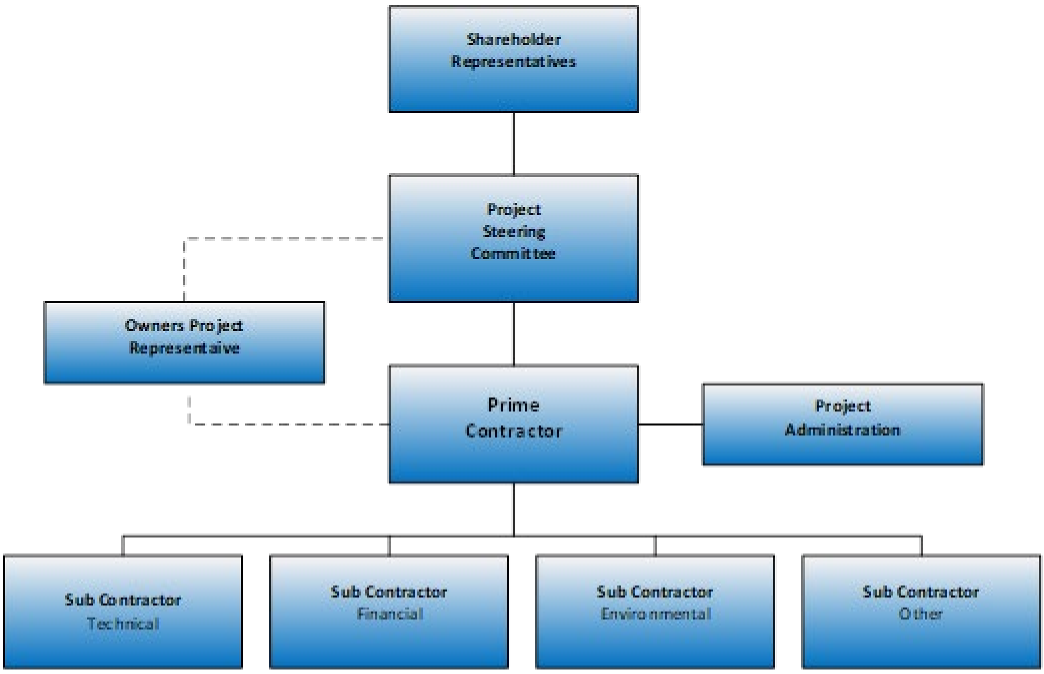


Figure 92 Organisation Chart: BFS Project Co-Ordination by Owners Team

18.2 BFS Capital Cost Estimate

18.2.1 BFS Contracting and Procurement Strategy

Choosing the right suppliers that can deliver value for money outcomes is the core principle underpinning TTR's strategy for the development of the BFS capital cost estimate of the

Offshore Iron sands Project. This means that TTR will need to be satisfied that the best possible outcome has been achieved taking into account all the relevant costs and benefits over the whole of the procurement/project cycle.

With regards to competitive costing processes for this project are, the procurement and contracting processes adopted will be designed to:

- Encourage competition to deliver the most favorable submission;
- Ensure that rules and procedures adopted do not limit competition by discriminating against any one supplier;
- Enable suppliers to develop reliable, informed and competitive proposals which assist in making informed decisions as to the preferred supplier; and
- Ensure contractual compliance.

The procurement of services and equipment for this project will require a number of strategies to be employed depending upon the nature and type of contract or purchase required. In identifying and managing the chosen strategy those directly involved in the process will be required to adhere to the following key requirements:

- Impartiality, whereby potential suppliers are treated equally and have the same opportunity to access information and advice;
- Consistency and transparency of process so that requests are evaluated in a systematic manner against explicitly predetermined evaluation criteria;
- Security and confidentiality of processes for receiving and managing supplier information to ensure the security and confidentiality of intellectual property and proprietary information;
- Identification and resolution of any actual or perceived conflict of interest prior to undertaking any tender evaluation; and
- Contractual compliance.

Adherence to the above behaviours will provide surety that TTR is undertaking procurement and contracting in a professional and transparent manner and consistent with contractual requirements.

18.2.2 Selection of TTR Preferred Suppliers

In general, competitive tenders will be sought with both local and international suppliers and manufacturers who will be given full, fair and reasonable opportunity where possible.

Where Sole Sourcing is proposed, a Sole Source Justification will be required to be submitted to the TTR Board for approval.

Recommended suppliers will be determined having assessed their submission on the basis of compliance with the contractual requirements of the tender, the below mentioned selection criteria and price.

The tender selection process will address the following:

- Health and Safety;

- Industrial relations policies and practices;
- Quality (AS/NZ ISO 9000.2000);
- Technical capabilities;
- Contractor capabilities;
- Available resources;
- Deadlines and timeframes;
- Key personnel;
- Environmental impacts;
- Commitment to local employment opportunities; and
- Local (New Zealand) content.

Preferred suppliers may also be asked to provide references for similar work undertaken so that these can be used to assess the capabilities of the company to meet the project deliverables.

Specific emphasis will be placed on contractor safety records, and recent and previous experience with a similar project. All selected suppliers will be required to demonstrate an understanding of the safety requirements, submitting an overview of their proposed management process for the safe implementation and management of the contract.

18.2.3 Risk Management

Prior to accepting any offer, TTR will conduct a risk analysis/due diligence to identify potential problems, the likelihood that these risks could occur and their consequences. As part of the risk management process a criticality assessment shall be completed to identify the level of mitigation required for the "purchase". Following this a specific risk management/mitigation strategy will be put in place.

Risk assessments will be carried out at regular intervals of the contracting process, not just in the initial procurement planning stage. This will assist in identifying and monitoring risk factors as they arise or change but also will assist in managing the total procurement and contracting risk.

18.2.4 Contracting and Procurement Legal Advice/Services

TTR retained counsel and lawyers will be engaged during the contract formation, tender assessment and contract negotiations stages to provide advice on contractual requirements, form of contract required and supplier conformance with the Terms and Conditions of the contract. They will also assist in ensuring that TTR fulfils its legal and contractual obligations in terms of the BFS tender process.

18.2.5 Contracting and Procurement Document Control

During the procurement and contracting process all documents (both electronic and hardcopy) will be collected and filed together, thereby providing a record of procurement activities and how they have been conducted. The records will facilitate an understanding of the reasons for the procurement, the process that was followed and all relevant decisions, including approvals and authorisations. The filing system has already been established by TTR for the purpose of this project.

A contracts/procurement control database will be maintained during the project life cycle to communicate status information for Contracts/Purchase Orders and other related packages. This will be controlled within the Document Control Management System.

Document Control is a centralised process, and a dedicated person will be charged to manage, collate and record all incoming and outgoing correspondence.

18.3 Value Engineering

As part of the BFS phase both internal and external reviews will be scheduled to assess all aspects of the project to ensure that process documents will be carried out, addressing materials of construction, surge and design safety factors, adherence to general philosophy, and completeness etc.

18.4 Detailed PFS Recommendations

Based on the findings of this 2025 updated Pre-Feasibility Study (PFS) for the Taranaki Vanadiferous Titanomagnetite (VTM) Project, the following recommendations are proposed to advance the project towards development and operational execution:

Project Development and Execution Strategy

- Establish a dedicated project team to oversee all aspects of BFS execution.
- Initiate detailed engineering studies as part of BFS to refine project specification and optimise capital allocation.
- Conduct a strategic review of project phasing to assess risk and provide mitigation measures.

Regulatory and Environmental Compliance

- Continue engagement with the Environmental Protection Authority (EPA) and relevant stakeholders to ensure full compliance with the Fast Track Approvals (FTA) process.
- Implement the updated Environmental Management Plan (EMP) to address sediment plume control, marine biodiversity monitoring, and community impact mitigation.
- Plan the two-year baseline environmental monitoring program prior to operational commencement, followed by continuous monitoring during the project lifecycle.

Mining and Processing Optimisation

- Confirm the suitability of the Integrated Mining Vessel (IMV) and Submerged Sediment Extraction Device (SBC) technology through additional engineering and third-party verification.
- Update the Mineral Ore Reserves and mining schedule
- Optimise the processing flow sheet to maximize vanadium and titanium recovery, ensuring alignment with industry best practices.
- Expand metallurgical testwork on the sodium salt roasting-water leaching process to improve vanadium recovery beyond the current laboratory results.

Infrastructure and Logistics Planning

- Finalise procurement strategies for critical infrastructure, including the IMV, Floating Storage and Offloading (FSO) vessel, and associated power generation systems.
- Develop strategic partnerships with shipping and logistics providers to streamline iron ore concentrate export operations.
- Evaluate potential cost reductions by outsourcing auxiliary services such as desalination, power supply, and fuel logistics to third-party providers.

Market Positioning and Commercial Strategy

- Conduct further market analysis to refine sales and offtake agreements, particularly with steel producers in China and other key markets.
- Explore opportunities for product differentiation by leveraging the project's contribution to green steel initiatives and critical mineral supply chains.
- Establish long-term agreements with vanadium and titanium buyers to ensure stable revenue streams and project viability.

Financial and Risk Management

- Update the financial model to incorporate new Capex and Opex estimates, adjusted for inflation and supply chain risks.
- Secure funding commitments for the BFS phase, with a focus on engaging strategic investors and government support mechanisms.
- Conduct scenario analysis on price fluctuations, operational costs, and regulatory changes to ensure financial resilience.

Workforce Development and Community Engagement

- Commence planning for a training facility in Hāwera to develop local workforce capabilities and support operational readiness.
- Strengthen community engagement initiatives to address cultural, social, and economic concerns, fostering positive relationships with local iwi and stakeholders.
- Implement a corporate social responsibility (CSR) strategy that aligns with regional development priorities and environmental sustainability goals

19 APPENDICES

No	Updated PFS No	Document	Source	Date	Updated PFS
1		PFS Rev 1	Technip	2012	Removed
2		CVs of Key Personnel	TTR	2013	Removed
3	19.1	Basis of Design	TTR	2013	Retained
4	19.2	Process Flow Diagram	TTR	2013	Retained
5	19.3	Simulation Model	BECA	2013	Retained
6	19.4	IMV GA Drawings	TTR	2013	Retained
7	19.5	IMV Personnel Assessment	TTR	2013	Retained
8	19.6	Maritime and Navigational Report	RN Barlow	2015	New
9	19.7	Mechanical Equipment List	CSL	2013	Retained
10		Process Plant GA	TTR	2013	Removed
11		Grinding Media Calcs/ Costs	TTR	2013	Removed
12		Marketing Report	Tennant Metals	2013	Removed
13	19.8	Crawler Viability Report	IHC Merwede	2013	Retained
14	19.9	Tailings Plume Assessment	HR Wallingford	2013	Retained
15		Dredging Concept Study	MTI	2011	Removed
16		South Taranaki Mineral Resource Report	Golder Associates	2012	Removed
17	19.10	Mining Schedules	Golder Associates	2013	Retained
18	19.11	Transhipment Study	Seabulk Systems	2010	Retained
19		Environmental Opinion	ASR	2010	Removed
20	19.12	Metallurgical Lab Testwork	Amdel Bureau Veritas	2011	Retained
21		Airbourne Magnetic Survey	Fugro	2010	Removed
22		FPSO Mooring Feasibility Study	Technip	2011	Removed
23	19.13	IHC Mooring Analysis	IHC Merwede	2014	New
23	19.14	ST 500 Gas Turbine Specifications	Siemens	2013	Retained
24	19.15	TTR Mineral Mining & Exploration Permits	NZPaM	2025	Updated
25	19.16	TTR Mineral Resource Statement 1 March 2023	TTR	2023	Updated
26	19. 17	Metallurgical Review: Recovery of Vanadium from Taranaki VTM Project	Siecap NZ	2025	New
27	19.18	Breach Testing Report	IHC Merwede	2014	New
28	19.19	SPT Drilling Report	OCEL Consultants Ltd	2013	New
29	19.20	Marine Operations Risk Review	Transfield Worley	2013	New
30	19.21	Updated Environmental Impact Assessment	NIWA / Mitchell Daysh	2025	New
31	19.22	TTR 2025 DCF Model	TTR	2025	New
32	19.23	Process Plant Review	DRA	2014	New
33	19.24	Economic Impact Study	NZIER	2025	New
34	19.25	EPA Approved Marine Consent Conditions 2017	EPA	2017	New

Table 30 List of Updated Documents Appended from Rev 2