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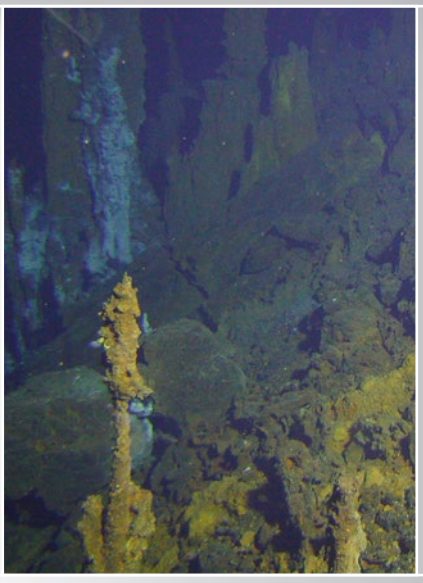


Preparation of Environmental Impact Assessments: General guidelines for offshore mining and drilling with particular reference to New Zealand

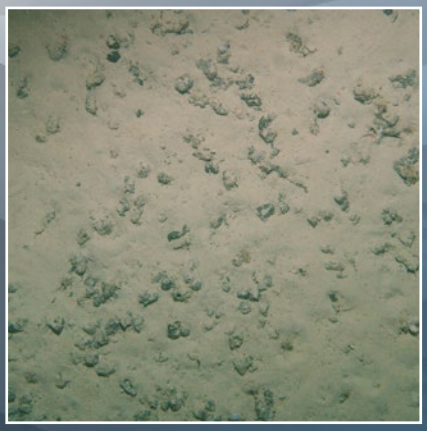
Malcolm R. Clark

Helen L. Rouse

Geoffroy Lamarche

Joanne I. Ellis

Chris W. Hickey



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For any information regarding this report please contact:

Malcolm Clark
+64-4-386 0523
malcolm.clark@niwa.co.nz

National Institute of Water & Atmospheric Research Ltd
301 Evans Bay Parade, Greta Point
Wellington 6021
Private Bag 14901, Kilbirnie
Wellington 6241
New Zealand

Phone +64-4-386 0300
Fax +64-7-856 0151

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Executive summary

Interest in offshore hydrocarbon and minerals exploration is growing rapidly as investors identify the potential economic returns from New Zealand's rich marine resources. The challenge for management agencies is how to facilitate development of these natural resources while ensuring environmental sustainability is not compromised. In 2012 the Ministry for Business, Innovation and Employment funded NIWA to lead a research project entitled "*Enabling management of offshore mining through improved understanding of environmental impacts*". This research programme aimed to develop, validate and implement science-based guidelines for effective environmental management of offshore mineral and hydrocarbon extraction, as well as address some critical gaps in our understanding of the environmental impacts of mining operations on New Zealand's marine estate.

The first research aim of the project included the development of a generic template for Environmental Impact Assessment (EIA), and guidelines for its use that could be used by any offshore mining or drilling company to guide the preparation of an assessment of the environmental impacts of the proposed operation. These were initially produced in 2014, but have been revised and updated for this guidance document that accompanies the generic EIA template for offshore mining and drilling activities. It is important to note that the template and guidance have been prepared in the joint context of New Zealand's Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (the EEZ Act) and the broader Pacific context where activities in 'The Area' are managed. An international need for a consistent approach to assessment of environmental impacts has been identified and addressed by the International Seabed Authority (ISA) and the Pacific Community (SPC) in their own developing EIA templates. The template and guidance presented here draws lessons from that international best practice but provides direct reference to New Zealand's own legislation.

The guidance is not intended to be exhaustive or prescriptive. Each resource and each location will have its own set of circumstances that are best described and assessed in a particular way. However, the document covers aspects that should be in every EIA, and provides general guidance to the content in each section of the template. It includes a background to the project and the purpose of this guidance document; outlines (and appends in full) the EIA template; provides general advice on how to prepare an EIA; and then details specific guidance on template sections. The report also contains a list of references cited in various sections to help the reader access important sources of information, a glossary of key terms and abbreviations, and a table containing useful websites for further information.

The document focusses on guidance for **environmental and ecological** assessment of impacts**.** The template includes sections and subsections on social, economic, and cultural issues, and in doing so follows the recent production of an EIA template by the ISA. These issues are often treated separately, and how that is addressed can be evaluated for each specific case. Their inclusion here attempts to progress the concept of a more integrated impacts assessment, even though provision of advice on them was beyond the scope of the existing study.

A related report covering the scientific research requirements for baseline surveys and monitoring programmes has been developed between NIWA and the SPC, and provides more specific detail than given in this higher-level document.

1 Introduction

New Zealand's marine estate contains extensive, largely untapped natural mineral, oil, and gas resources (Figure 1-1) that comprise a major source of potential wealth for New Zealand. However, the region also supports a unique and diverse biota that contributes important ecosystem services. The Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (EEZ Act) and the Crown Minerals Act 1991 (CM Act) provide the framework for environmentally sustainable exploration and exploitation of offshore oil, gas, and mineral resources, but there is currently no consistent process to evaluate the effects of these activities.

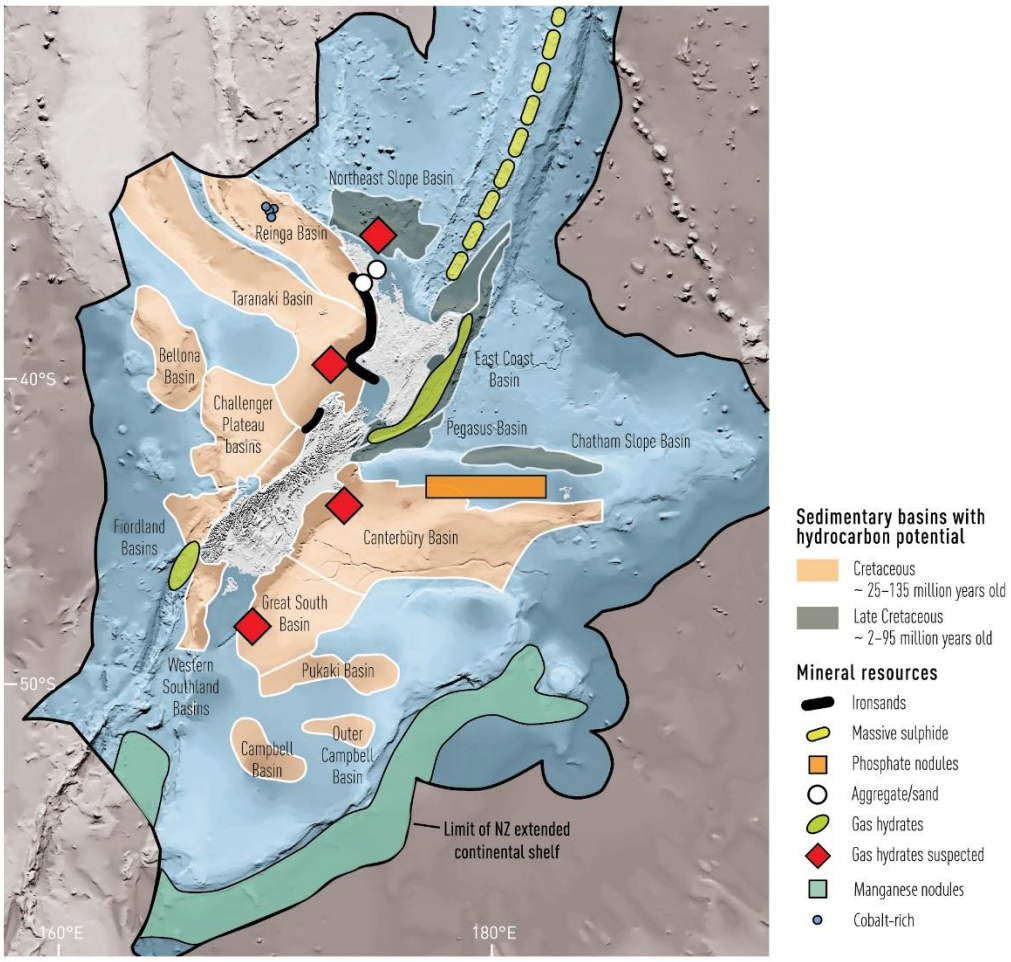

Figure 1-1: The New Zealand region, and distribution of hydrocarbon and mineral resources in the EEZ and ECS (source NIWA).

The EEZ Act requires an assessment of environmental impacts to accompany consent applications for exploration or exploitation of offshore hydrocarbon and mineral resources. There is an extensive international literature on environmental impact assessments, but there has been limited specific guidance about the content and format of EIAs in relation to the New Zealand legal framework and natural environment.

In this report we present a template and guidance for an Environmental Impact Assessment that can be used to assist assessments of proposed offshore hydrocarbon and mineral operations in New Zealand. The intention is for it to apply to both sectors, although we acknowledge some focus on the

deep-sea mineral resources, as they have few established EIA processes. Hence when the term "mining" is used, it applies more widely to extractive activities, including drilling operations.

The template and guidance are designed to support the EEZ Act in the New Zealand context, but also link to assessments in the broader Pacific Ocean where a template has been developed by the ISA to apply in areas beyond national jurisdiction ("the Area") (ISA 2012) and an adaptation of this for Pacific Island States (Swaddling 2016). We draw lessons from this international experience, but note that the specific terminology and requirements of the EEZ Act take precedence for activities within the New Zealand EEZ.

1.1 Project background

The NIWA-led project *Enabling management of offshore mining through improved understanding of environmental impacts* aimed to address these issues through three main research aims:

1. To develop science-based guidelines for management of offshore environmental impacts
2. To identify critical research needs to understand environmental impacts of offshore mining
3. To develop environmental baseline surveys and monitoring plans for exploration and exploitation

This Ministry of Business Employment and Innovation (MBIE) funded project started in 2012 and ran for four years. Because of the high level of demand from resource users for access to offshore mineral resources, and the very recent advent of legislation to manage the environmental effects of such activities, two immediate tasks for the project under research aim 1 were:

- To carry out a review of existing national and international environmental management frameworks, standards and guides (Ellis et al. 2014);
- To develop a generic template for Environmental Impact Assessment (EIA), and associated guidelines that can assist any offshore hydrocarbon or mining company wishing to undertake an assessment of the environmental impacts of the proposed operation, as well as help government agencies to review the assessment.

This report builds on a previous version of the template and guidance report (Clark et al. 2014), as well as incorporates comments and suggestions from several agencies, and aligns with developments in assessment advice for Pacific Island countries and the Area.

1.2 What is an Environmental Impact Assessment?

There are many definitions of an Environmental Impact Assessment or EIA. The International Association for Impact Assessment (IAIA) (Senécal et al. 1999) defines an environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made." Following on from this, the IAIA describes four key objectives of an EIA:

- To ensure that environmental considerations are explicitly addressed and incorporated into the development decision-making process;

- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals;
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and
- To promote development that is sustainable and optimizes resource use and management opportunities.

EIAs are required for a wide range of activities, including offshore mining activities. There is a wealth of international experience in these activities and reports carrying out EIAs. Ellis et al. (2014, 2017) provides a useful international background to EIAs for offshore mining and drilling activities, and other related environmental management tools such as risk assessments and environmental management plans (which we discuss further below in part 1.2.2). This guidance document takes lessons learned from this international experience and applies them for the New Zealand context.

1.2.1 New Zealand legislative context

In New Zealand, management of offshore mining falls under a number of pieces of legislation, but there are two key acts:

- The Crown Minerals Act 1991 manages the mineral resource, and the purpose of the Act (section 1A) is to promote prospecting for, exploration for, and mining of, Crown owned minerals for the benefit of New Zealand.
- The Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 manages the environmental effects of activities in the Exclusive Economic Zone (EEZ) and Extended Continental Shelf (ECS). The purpose of the EEZ Act (section 10) is to promote the sustainable management of the natural resources of the EEZ.

Many other articles of legislation may be relevant to offshore mining or drilling activities, including the Resource Management Act (RMA) 1991 (where activities overlap into the Coastal Marine Area up to 12 nautical miles (nm) offshore). Other relevant pieces of legislation, defined in the EEZ Act as 'marine management regimes', are listed in Appendix A.

Under the EEZ Act, requirements for EIAs are specified in section 39 (hereafter s39) where they are called Impact Assessments (IA). Strictly speaking, IAs are broader than EIAs, as they encompass aspects of risk assessment and environmental management plans, as well as non-environmental assessment components. However, the trend in the international literature is for EIAs to include elements of social, economic and cultural fields, and so the terms are somewhat interchangeable. We use EIA, as well as separate terms for environmental risk assessment (ERA) and environmental management planning (EMP), as this gives the guidance a wider international meaning (see 1.2.2). We provide a copy of s39 in full in Appendix B. In summary, an IA under the EEZ Act will need to include:

- Describe the proposed activity and the current state of the area where the proposed activity will be undertaken and its surrounds
- Identify people whose existing interests might be affected by the proposed activity, and describe any consultation with those parties (and attach written approval for the proposed activities where this has been given)

- Identify potential effects on both the environment and on existing interests (including cumulative effects and those in EEZ and ECS)
- Specify alternative locations or methods that would avoid remedy or mitigate any potential effects, as well as the measures intended to avoid, remedy or mitigate the potential adverse effects identified
- Contain enough detail that both corresponds to the scale and significance of the proposed activity on the environment and on existing interests and allows the Environmental Protection Authority and people whose interests may be affected to understand the nature of the proposed activity and its effects.

The term 'effects' is defined in the EEZ Act (see Glossary). The IA under the EEZ Act is equivalent to an Assessment of Environmental Effects (AEE) under the Resource Management Act (RMA).

1.2.2 International legislative context

The Law of the Sea Convention (LOSC) is the principal legislation governing environmental requirements associated with deep-sea mining. Under the LOSC, states are given rights to exploit resources of their continental shelf, as well as to seek rights from the International Seabed Authority to undertake or sponsor DSM activities within the Area. However, the LOSC (Article 192) also creates a general obligation for States to protect and preserve the marine environment from activities both within and outside areas of national jurisdiction. It also stipulates that State laws and regulations must be "no less effective than international rules, regulations and procedures". Obligations under international law in respect of DSM include applying the precautionary approach, employing best environmental practice, and conducting prior environmental impact assessment.

The "Mining Code" is a comprehensive set of rules, regulations and procedures based on the LOSC issued by the ISA to regulate prospecting, exploration and exploitation of marine minerals in the international seabed Area (defined as the seabed and subsoil beyond the limits of national jurisdiction). To date, the ISA has issued Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area (2000) which was later updated (2013); Regulations on Prospecting and Exploration for Polymetallic Sulphides in the Area (2010) and Regulations on Prospecting and Exploration for Cobalt-Rich Crusts (adopted 2012). These regulations include the forms necessary to apply for exploration rights as well as standard terms of exploration contracts (see https://www.isa.org.jm/mining-code). The ISAs Legal and Technical Commission has produced additional guidance for the assessment of the environmental impacts of exploration for polymetallic nodules (ISA 2013)) although environmental regulations related to exploitation have not yet been fully developed.

The international legislation, and recommendations for Pacific Island Countries and Territories, are well set out in a report produced as part of a major SPC-EU project on deep-sea minerals ("SPC-EU DSM project"): the "Pacific-ACP states regional legislative and regulatory framework for deep sea minerals exploration and exploitation" (SPC 2012). This has supported the development of national legislation by some countries. It recommends a specific EIA requirement in the legislation to identify potential adverse environmental (including social and economic) impacts and to develop tailored mitigation strategies. It recommends an 'Ecosystem Services' approach to evaluating impacts, as well as an effects-based or impact-specific approach (rather than an activity-specific approach). Assessment requirements would need to be relative to scale and effect; for example, requiring an EIA in some circumstances and no EIA in others. This report further suggested that regulations should

ensure the content of the EIA and the resulting statement must be sufficient to enable informed consideration of the actual or potential effect on the environment and other interests, such as social and human health conditions. Such an EIA could include:

- a description of the project including information on its site, design and size;
- an assessment of the likely effects and impacts of the project;
- an explanation as to how that assessment has been reached;
- details of any consultation undertaken;
- a description of the measures envisaged to avoid, reduce or remedy anticipated adverse effects;
- data required to identify and assess the main effects which the project is likely to have on the environment;
- an outline of the main alternatives studied by the operator (and the no-action option – for comparison) and an indication of the main reasons for the choice(s) made.

The SPC (2012) report also noted the LOSC requirement of States involved with DSM activities to ensure the employment of 'best environmental practice', which can be summarised as "the application of the most appropriate combination of environmental control measures and strategies" (adopting wording used in the 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic). It generally refers to widely accepted norms or customs of environmental and risk management. Since that report, work has been carried out collaboratively by SPC and NIWA and a report produced ("Pacific-ACP states regional scientific research guidelines for deep sea minerals") that provides information and recommendations for baseline and monitoring surveys associated with exploration and exploitation of deep-sea minerals (Swaddling et al. 2016).

There is a suite of additional relevant international legislation (see Appendix 4 of Swaddling 2016) that include the Madang Guidelines (SOPAC 1999) which relates specifically to deep-sea minerals, and includes general principles for environmental impact assessments. The 1992 Convention on Biological Diversity (CBD) aims to conserve biological diversity and species in natural surroundings, and to rehabilitate degraded ecosystems. It requires Convention Parties to protect in situ ecosystems and habitats within national jurisdiction areas, and to (i) identify and monitor impacts (Article 7); (ii) establish a system of marine protected areas (Article 8); (iii) conduct EIA (Article 14a); and promote consultation (Article 14c) regarding processes and activities that may adversely affect biodiversity.

1.2.3 Deep-sea minerals EIA templates

The ISA hosted a workshop in 2012 in Fiji that addressed issues around environmental management needs, and a sub-group at this meeting developed an EIA template (ISA 2012) which was based on the Environmental Impact Statement developed by Nautilus Minerals when applying for a mining licence for Seafloor Massive Sulphides in Papua New Guinea (Coffey/Nautilus 2008).

As mentioned above, this report was an important consideration in the structure of the template developed by NIWA for New Zealand use. The first draft of this template and the inclusion of guidance text to flesh out the expected content of each heading (Clark et al 2014), has been evaluated at a workshop of the SPC-EU DSM project, and was subsequently slightly modified.

The SPC-EU DSM project also further refined the ISA template, in its "Pacific-ACP states regional environmental management framework for deep sea minerals exploration and exploitation (Swaddling 2016). This template aligns closely with the updated NIWA template, and both were evaluated and partially blended at a workshop in 2016 ("Griffith Law School and the International Seabed Authority Workshop on environmental assessment and management for exploitation of minerals in the Area") (ISA 2017).

1.2.4 EIAs as part of a broader process

The EIA process is well developed in many terrestrial and coastal marine situations (e.g., Petts 1999, Glasson et al. 2012). Although it can be tailored to specific national legislation (e.g., US Department of Energy 2004, CEAA 2012), a number of operating principles have been defined by the IAIA (Senécal et al., 1999), which specify that an EIA process should provide for:

- Screening: to determine if an EIA is required
- Scoping: identify the issues and impacts for an EIA
- Examination of alternatives: look at several options to achieve project objectives
- Impact analysis: identify and predict effects of the proposal
- Mitigation and impact management: establish measures to manage impacts
- Evaluation of significance: what are the residual impacts?
- Preparation of report: document all the issues and measures
- Review of the assessment: whether the EIA meets the criteria (see section 1.2)
- Decision making: approve, reject, or modify proposal
- Follow-up: if approved, ensure compliance and monitoring of conditions and impacts.

EIA, environmental risk assessment (ERA) and environmental management plans (EMP) are closely linked, and all are relevant to a broader impact assessment under the EEZ Act. ERAs usually focus on ecological aspects, and are typically carried out to assess the risks of both natural hazards and human-induced effects on the wider environment. Hence, ERAs should be an integral part of the process, whereby they are used to screen and scope important causes of risk that will need further analysis (Suter 2006). One of the key tasks of an EIA is to describe the major impacts of any activity on the environment (in particular ecological systems), and provide information on their nature and extent as the basis for then developing plans to mitigate such impacts (the environmental management plan (EMP) process). Hence an ERA, either as a precursor to, or part of, the EIA highlights the main elements at risk from the activity, and identifies the key aspects that the EIA should focus on (Figure 1.2).

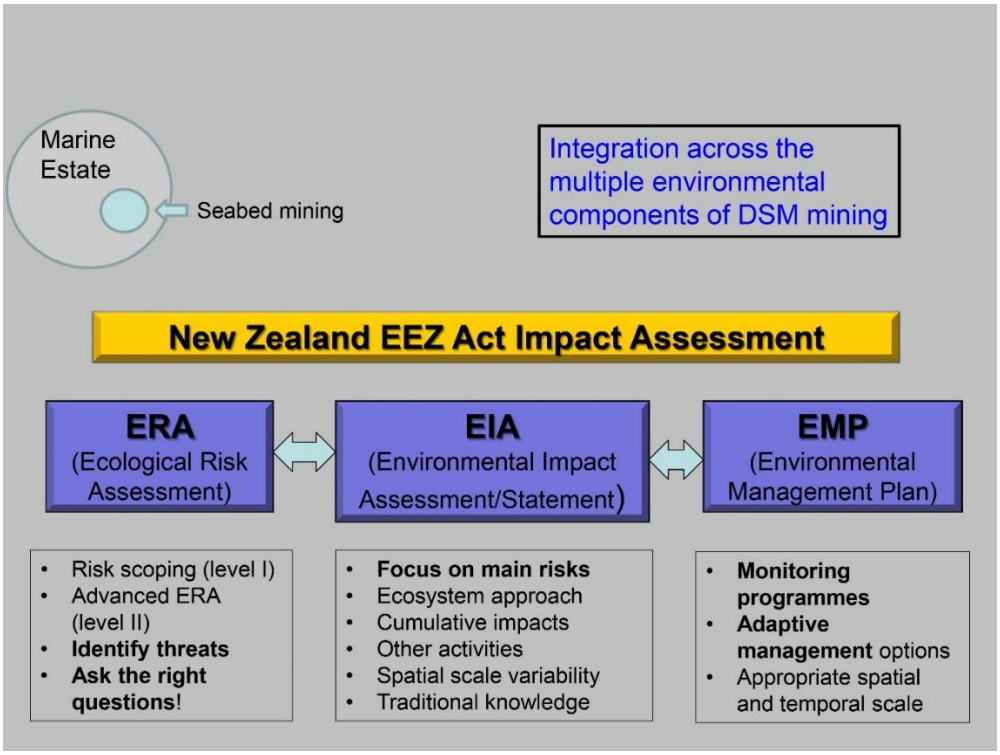

Figure 1-2: A schematic drawing of elements of an environmental management system, showing the relationship between ERA, EIA and EMP (based on Ellis et al. 2017).

An EIA is itself part of a larger scheme. Seabed mining is one of many activities that occur in the marine estate. Other uses, values, and processes will all impact on exploitation of any hydrocarbon or mineral resource, and so there is a wider context to consider. However, within a particular minerals or hydrocarbon operation, there should be a well-structured Environmental Mining Management System (EMMS) (Ellis et al. 2017). This includes the key elements of an ERA, which informs the EIA, in terms of focussing on the main risks. Part of the EIA involves identifying measures to reduce or mitigate impacts, and so there is feedback with risk assessment as the EIA develops. The EIA then enables a management plan to be formulated that covers the progression from exploration to exploitation, and includes detailed descriptions of how the operation is to be managed to ensure environmental objectives are met.

Specifically under the EEZ Act, an IA includes elements of all three stages outlined in Figure 1.2. The ERA acts firstly as a scoping stage to highlight the main elements at risk from the activity, and helps structure data collection during exploration that identifies and informs the key aspects that the EIA should focus on. A key task of the EIA is to describe the major impacts of an activity on the environment and provide information on their nature and extent as the basis for developing plans to mitigate such impacts. The EIA enables a management plan to be formulated that covers the progression from exploration to exploitation, and includes detailed descriptions of how the operation is to be managed to ensure environmental objectives are met. The EMP then monitors the scale of effects to ensure management objectives are met. This process is expanded on by Ellis et al. (2017) who advocate that such an environmental management framework is necessary for deep-sea mining. These linkages are more sequential in an ISA type of scheme than in an Impact Assessment (IA) under the EEZ Act, where in the latter the expectation is that elements of management planning are included rather than an EMP being developed subsequent to the EIA. Hence a reminder that when this document is used in applying for activities under the EEZ Act, that Act's terminology and specific

requirement take precedent-call the EIA an IA, and ensure it addresses the requirements of the EEZ Act.

Terminology can get very confusing in the EIA "space". An additional term (also see Glossary) that is frequently encountered is Environmental Impact Statement (EIS), which is used at times interchangeably with EIA. However, an EIS goes further than an EIA, and incorporates an overall assessment of the proposed project including the effects of proposed activities and any mitigation strategies.

In the context of this guidelines document, we use "EIA" terminology, with a focus on "environmental" components. However, the latter term is widely used to mean much more than just ecological conditions, and often includes human elements (and hence social, cultural and economic aspects). It is important to stress that in this report we focus primarily on the natural environment, although note where social, economic, and cultural aspects need to be developed as part of, or complementary to, the EIA.

1.3 How to use this document

The world of impact assessments is broad and potentially complex, and the scope of this research project provided some boundaries as to what topics to focus on. At a very broad level:

What this guidance is/contains:

- Generic to different resources and mining activities relating to offshore minerals and hydrocarbons
- Assessment of physical, chemical and biological impacts in particular
- Advice on activities that are generic across locations and resource types
- It has a scientifically technical focus to guide environmental research

What this guidance isn't/ doesn't contain:

- Detailed advice on how to do social, cultural or economic impact assessments
- Detailed advice on assessing the effects on existing interests
- Detailed advice on developing monitoring plans
- Advice on site specific issues
- The only advice to be found – there are plenty of alternate sources of info which we refer to where appropriate

1.3.1 How is the document structured?

This document contains the following sections:

- Introduction - a background to the project and the purpose of this guidance document
- The EIA template – outlines the high-level headings for the EIA template document
- General advice – on how to prepare an EIA
- Specific guidance on template sections.

The document also contains a list of references cited and a Glossary of key terms and abbreviations. Appendices A and B provide more detail regarding the EEZ Act requirements, the full EIA template is provided in Appendix C, Appendix D contains a bibliography of useful reading and websites, and Appendix E summarises key research aspects of monitoring surveys.

2 The template

We have prepared a generic EIA template, learning lessons from key international documents and guidance (e.g., US Department of Energy 2004), especially the structure developed by the ISA (2012), NIWA (Clark et al. 2014), Swaddling (2016), and ISA (2017) for minerals mining, but also the hydrocarbon examples of Petro-Canada (1997) and Husky Oil (2001), and making it relevant for the New Zealand legislative context discussed in the Introduction above. The latter includes consideration of advice on preparation of an AEE (MfE 2006) and an EIA for the Department of Conservation (DOC 2012). The full template is given in Appendix C, and the key headings provided here in Box 1

Box 1 – First level headings from the EIA template

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7. Description of the existing socio-economic environment

8. Assessment of impacts on the physico-chemical environment and proposed mitigation

9. Assessment of impacts on the biological environment and proposed mitigation

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11. Assessment of impacts on the socio-economic environment and proposed mitigation

12. Environmental management, monitoring and reporting

13. Consultation

14. Glossary

15. Study team

16. References

17. Appendices

3 General advice

This section of our guidance document is intended to provide generic advice on how to put together an EIA.

3.1 Writing style

The aim of your EIA is to help decision makers, as well as other affected or interested parties, fully understand the impacts of the proposed activity, both positive and negative. There is a wide-ranging audience for EIAs in New Zealand, from the public through scientists and regulatory authorities. Whoever is reading the EIA must be able to identify and understand the key information and messages in the assessment. There are some simple steps to help writing clearly that include:

- Making sure your document has a logical flow (our EIA template should help but amend it if you need to so that it works for your particular circumstances)
- Using plain English and defining any technical terminology that you use, adding a glossary if needed
- Including a 'key messages' introduction section in each chapter can help the reader see what is coming up; using a summary section at the end makes sure that major points are flagged again in the readers mind. This may seem like repetition but the summary section will generally be more detailed, and if you phrase things differently it should work to emphasise the key points on the readers' mind
- Making sure the details you provide are appropriate for the scale and significance of your proposed activity.

Other generic advice on good writing applies too, such as:

- Keep your sentences short and containing one key point
- Use paragraphs to separate topics
- Get a third person to review or edit the document.

Another key element of getting the important messages across is to achieve a balance between the amount of content that is in the main body of text, and that which is placed in appendices. There are no hard and fast rules about this, but the text should contain the **key** results and any information on methods that is important to know to have confidence in those results. The detail that is required by specialists who might review the EIA should be in appendices. Typically the EIA will be easier to digest if as much technical detail as possible is placed in appendices and the main text is a condensed version of the large amounts of supporting information and reports that may be required as appendices. Care must be taken not to oversimplify or misinterpret the technical details, which can be a real challenge in finding a balance between a concise summary for readability and providing sufficient detail for readers to understand conclusions. The relevant experts that contributed to the detailed studies in appendices should check the executive summary and key result sections to ensure their findings are accurately interpreted. The third person mentioned above, who ideally has not been intimately associated with the EIA formulation, should review it, and have as part of their brief whether too much information is in the text, or more is needed to justify and explain certain points.

These guidelines have been compiled to apply generally to an international EIA process, and we have used definitions and phrases in a certain way (see the glossary). Where an application in being made under the EEZ Act, it is very important to ensure the language and terminology used is consistent with the legislation.

3.2 EIA principles

It is important to bear in mind the objectives of an EIA (as covered under section 1.2), as well as check that the EIA meets a number of basic and operating principles (the latter in section 1.2.4). These have been defined by the IAIA (Senécal et al. 1999), and are important to ensure that the EIA is robust to review, and provides environmental managers with the required information. An EIA should be:

- Purposive: be informative for decision-making
- Rigorous: apply best practicable science
- Practical: result in useful information and outputs
- Relevant: provide useable information
- Cost-effective: achieve EIA objectives within acceptable resource and time limits
- Efficient: process should minimise cost burdens
- Focused: concentrate on significant issues
- Adaptive: adjustable to the specific situation but not compromise the process
- Participative: inform and involve interested and affected parties
- Interdisciplinary: involve multiple techniques and experts across a range of fields
- Credible: a professional process, subject to independent checks/verification
- Integrated: interrelationships of social, economic and biophysical aspects
- Transparent: an open and informative process
- Systematic: consider all relevant information and options

These are largely self-evident, but are included here so people preparing EIAs can evaluate whether the information provided under template headings meet these principles and criteria.

3.3 Understanding the decision-making process

It may help during drafting of the EIA to bear in mind the process that the decision makers will need to go through in considering your application. Section 59 of the EEZ Act outlines how an application will be considered and what the decision makers must take into account.

One of the information principles of the EEZ Act (s61) is that any uncertainty or inadequacy in the information is taken into account, along with a requirement to make decisions based on the best available information. Further, in the face of uncertain or inadequate information the decision maker must favour caution and environmental protection, and in doing so, the decision maker must first consider whether an adaptive management approach would allow the activity to go ahead.

Section 63 outlines the ability of the decision maker to impose conditions if it considers these are appropriate to deal with adverse effects. These conditions include bonds (further details in s65), insurance, monitoring (further details in s66), appointing an observer (further details in s67), and record-keeping, and it is noted that this may amount to an adaptive management approach.

Section 64 outlines how an adaptive management approach may be incorporated in granting a marine consent. Section 64(2) provides that an adaptive management approach includes:

- allowing an activity to commence on a small scale or for a short period so that its effects on the environment and existing interests can be monitored.
- any other approach that allows an activity to be undertaken so that its effects can be assessed and the activity discontinued, or continued with or without amendment, on the basis of those effects.

Section 64 goes on to explain that to incorporate an adaptive management approach into a marine consent the EPA may impose conditions whereby the activity is to be undertaken in stages, with a requirement for regular monitoring and reporting before the next stage of the activity may be undertaken or the activity continued for the next period. A stage is defined to say it may relate to the duration of the consent, the area over which the consent is granted, the scale or intensity of the activity, or the nature of the activity. Some advice on adaptive management is given here in section 3.10.

Consultation between the regulatory bodies and the applicant is a key issue in developing an EIA. Most agencies are willing to see a draft copy well in advance and can provide feedback on its general structure and content.

Given these decision making and information principles, we outline below some simple points about inadequate information, uncertainty, use of models, conditions, and adaptive management. This discussion is by no means exhaustive, and readers are also referred to recent decisions such as the one for Trans-Tasman Resources' (TTR) application to extract iron ore from the EEZ in the South Taranaki Bight[1] for early indications about the types of matters that may be considered by decision makers. As this document goes to press, information from a second application in 2016 is available on the EPA website.

3.4 Engagement

Consultation and engagement with stakeholders is an important consideration to keep in mind. Pre-lodgement engagement can be critical for a successful EIA, and should involve discussions with the EPA, other government agencies, existing interest stakeholders, tangata whenua and relevant local communities early in the process. The key to this is "engagement" and not just communication. A good engagement process should involve a two-way exchange of information, ideas, and comments which ultimately will improve the EIA itself, as well as satisfy the necessity of the wider community feeling informed and involved. It should be stressed that this process must start early on, and not be an afterthought to satisfy ticking the "consultation box".

It would be useful for applicants to provide a draft of the EIA to persons and organisations identified during the engagement phase as existing interests or potentially affected by the proposal. This can avoid unforeseen issues arising during the consenting process. This must allow sufficient time for

[1] http://www.epa.govt.nz/EEZ/trans_tasman/decision/Pages/default.aspx viewed 27 August 2014

review and modification of the draft EIA before submission, as once an EIA is lodged, there may be tight timeframes and limited opportunity for further modifications.

Associated with engagement, is the need for transparency of the process. This is ensured in the New Zealand process by all documents and submissions being made available on the Environmental Protection Authority (EPA) website. Commercially-sensitive information can be withheld, but most information related to environmental impacts and assessment can be made publically available. This was also the case in Papua New Guinea with the Nautilus EIS, and is something the ISA will need to address as contractors move in future from exploration to exploitation.

3.5 Completeness of information

The template and guidance in this document will help applicants to meet requirements for carrying out an adequate EIA. However, the EPA has prepared some advice on "best practice impact assessment" (EPA 2013), and this includes the following checklist for information that the assessment must have to comply with s 39 of the EEZ Act:

a) describe the activity for which consent is sought; and

b) describe the current state of the area where it is proposed that the activity will be undertaken and the environment surrounding the area; and

c) identify the effects of the activity on the environment and existing interests (including cumulative effects) and effects that may occur in New Zealand or in the sea above or beyond the continental shelf beyond the outer limits of the exclusive economic zone; and

d) identify persons whose existing interests are likely to be adversely affected by the activity; and

e) describe any consultation undertaken with persons described in paragraph (d) and specify those who have given written approval to the activity; and

f) include copies of any written approvals to the activity; and

g) specify any possible alternative locations for, or methods for undertaking, the activity that may avoid, remedy, or mitigate any adverse effects; and

h) specify the measures that the applicant intends to take to avoid, remedy, or mitigate the adverse effects identified.

A simple "completeness check" should be carried out to ensure that the EIA covers these elements. The amount of detail should correspond to the scale and significance of the effects.

An Impact Assessment (s39) should be in such detail as corresponds to the scale and significance of the effects that the activity may have on the environment and existing interests, as well as sufficient detail to enable the EPA and persons whose existing interests are or may be affected to understand the nature of the activity and its effects on the environment and existing interests. So it is not unreasonable to assume that an EIA will be inadequate if it doesn't contain sufficient detail that corresponds to the potential effects the activity will have, if it is missing any information required by s39, or if the EPA or a stakeholder with a potentially affected existing interest can't understand those effects. Recent decisions by the EPA in regard to Trans-Tasman Resources and Chatham Rock

Phosphate emphasise the importance of documenting uncertainty around information, as well as early and thorough engagement of stakeholders, particularly those with existing interests, to help in scoping and understanding the effects of the proposed activity.

3.6 Expressing uncertainty and confidence

There are many kinds of uncertainty, and even within the narrower range of scientific uncertainty there can be many sources. It can be helpful to define different types of uncertainty so that they can be better understood and managed. Uncertainties can be defined in several groups:

- Knowledge uncertainty arises where there is incomplete understanding of processes, interactions or system behaviours
- Unpredictability arises from chaotic (often random) components of complex systems or of human behaviour
- Structural uncertainty arises from inadequate models, ambiguous system boundaries, or over simplification or omission of processes from models
- Value uncertainty arises from missing or inaccurate data, inappropriate spatial or temporal resolution, or poorly known model parameters
- Uncertain interpretations, arise when values or terms are interpreted differently by different user groups.

These types of uncertainties may all be relevant to assessing whether something will happen, or what effect it may have if it does happen. Many of the techniques used in preparing an EIA, such as models used to make predictions of impacts (see section 3.6 below), will therefore have the potential for the 'answers' they produce to have associated uncertainty. Monitoring programme measurements and information may also have uncertainties due to precision of instruments used, or if new and less proven technologies are used.

Rouse & Norton (2010) proposed three broad steps in managing scientific uncertainty, which may be useful in this context:

1. identify sources of uncertainty
2. reduce uncertainty where possible
3. acknowledge and manage the residual (unavoidable) uncertainty.

Rouse and Norton (2010) state that generally scientists conduct the first two steps in the context of their disciplines using a variety of techniques. Acknowledging, stating and quantifying residual uncertainty is required, before managing it. This may be done in a number of ways, such as:

- Statistically – using statistics such as mean with a standard error, or a minimum-maximum range of estimates
- Probabilistically – estimating the likelihood of the predicted outcome happening.

3.7 General approaches to managing uncertainty

Managing residual uncertainty can be undertaken using general risk-management or adaptive management approaches (e.g., Rouse & Norton 2010; PCE 2003). In a New Zealand context, the best

practice approach to risk management would be to use the appropriate national standard (AS/NZS ISO 31000:2009) which requires risks to be identified, analysed, evaluated and ranked for management, as part of a process that includes ongoing communication with any stakeholders and monitoring and review of management actions and re-evaluation of risks as required. As stated in Rouse and Norton (2010), adaptive management (e.g., Holling 1978) has been loosely defined as 'management with a plan for learning' (Wintle 2007). Where there is uncertainty, adaptive management allows for a structured process to test competing hypotheses of system behaviour and the testing of alternative management actions (Gunderson & Light 2006), resulting in improved understanding and management of the resource (see also section 3.10).

Rouse and Norton (2010) highlighted how the RMA incorporates aspects of these approaches and thus provides a pathway to manage uncertainty. Some of these approaches are also reflected in the EEZ Act; as stated in Ellis et al. (2014), the EEZ Act is at least implicitly risk-based. For example, the definition of effect (s6) includes potential effects with potential high impact (i.e. likelihood and consequences are considered). In addition to the s61 and 39 requirements above, there is a reference to using adaptive management (s64) to allow staged approaches to activities whose environmental effects may be uncertain at the time of decision making. The use of bonds (s65) to insure adherence to conditions, particularly for ongoing effects, is also a risk-based provision that could be used to cover off some uncertainties, for example around adverse effects that become apparent during or after the expiry of the consent.

3.8 A comment on the use of models

In understanding the existing environments that you are proposing to work in, and particularly in predicting potential impacts of your activity on the environment (be it physical, biological, or social), you may need to use models. If you have used modelling in preparing your EIA, the report should include:

- A description of the model used (is it an off-the-shelf readily available model that meets industry standards or some purpose built one-off? Where has it been used before?)
- An outline of underlying assumptions in the model (and how these may influence the model outcomes)
- An outline of the key model input parameters, and their justification
- A description of how it has been tested, validated and/or calibrated; including "ground-truthing" and model sensitivity analyses
- A comment as to whether the model and/or its outputs have been independently peer reviewed
- Comments regarding the level of confidence in the model predictions (and the input data).

This list is by no means exhaustive, and you should provide whatever information is required to make sure the structure and workings of the model are clear, and all uncertainties are fully documented.

3.9 A comment on the provision of proposed conditions

The EEZ Act definition of an Impact Assessment does not include the provision of suggested monitoring regimes or consent conditions. However, bearing in mind the decision-making framework outlined above, it will be important to include mitigation and monitoring conditions as part of the EIA. We do not provide specific guidance on permitting topics, as they are complex, and specific to the nature of the resource and the mining operation characteristics at a certain location. There are existing guidelines for resource consent conditions under the RMA (Quality Planning Organisation 2013) which includes advice on aspects of management plans, and general issues of environmental standards and adverse impact assessment. A key aspect is addressing whether all the significant adverse effects that may result from the exercise of the consent can be effectively managed by consent conditions. This may involve an environmental management plan, or consent conditions that provide clear performance or environmental standards that are to be certified by an appropriately qualified and experienced person as being achieved. The guidance advises that under the RMA "Critical actual or potential adverse effects need to be identified, appropriately avoided, remedied or mitigated with conditions before a decision to grant is made and not left to be addressed via a future management plan". However, the applicant will have the best information about the proposed activity and the intended location, and hence can propose realistic conditions that ensure the identified potential impacts are avoided, remedied or mitigated. Any proposed conditions should be detailed and preferably SMART (Specific, Measurable, Achievable, Relevant and Time-bound). The EPA's 2014 TTR decision indicates that decision-makers will place significant weight on the conditions proposed with the application and EIA (paragraph 781), and that sufficient baseline survey work should have been undertaken prior to lodgement of an application to help increase the decision-makers certainty regarding assessments of effects (paragraphs 788, 831-837). Similarly, the EPA's 2015 decision on the CRP application reviewed the proposed conditions as an integral part of the decision-making process (e.g. paragraph xviii)[2].

Monitoring and reporting conditions are likely to be very specific to the nature of the resource, the site characteristics, and the requirements for what needs to be monitored in that particular situation. We do not provide detailed guidance in this document, but cover some general aspects under section 12 of the template.

3.10 A comment on adaptive management

Given the EEZ Act's stated approach to adaptive management, it makes sense that in preparing an EIA, thought should be given as to areas of the assessment that have uncertainties associated with them such that an adaptive management approach might be considered. Adaptive management is an established tool for managing environmental effects where there are uncertainties about the potential impacts of a proposed activity and is allowed for in the EEZ Act. We make some comments here and in section 4.15, as part of the EIA that deals with environmental management, monitoring and reporting.

Adaptive management is a widely-used term, but is often misinterpreted. It is flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood (National Research Council 2004). However, it is not a "trial and error" approach that involves doing something, seeing what happens, and then trying something else. It is a structured decision making process (Figure 3-1).

[2] Readers are referred to these EPA decisions for further detail, at http://www.epa.govt.nz/EEZ/Pages/default.aspx

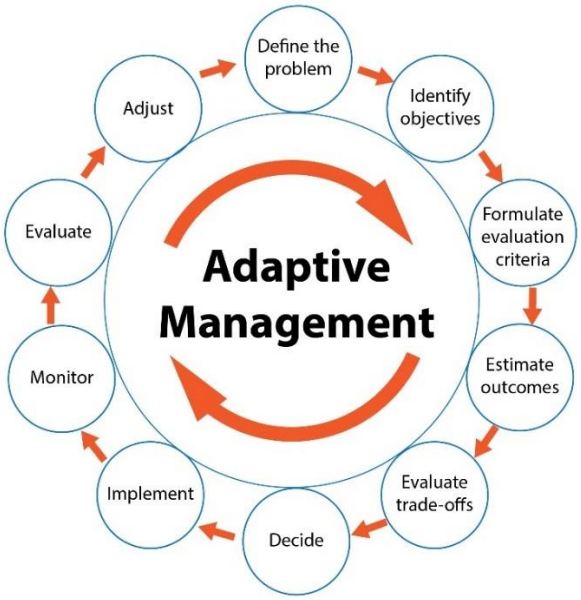

Figure 3-1: The Adaptive Management cycle (modified from Allen et al. 2011).

It is important to recognise that it is only one of a suite of available management tools, and should not be seen as a silver bullet to coping with uncertainty. It is best suited to situations where there is high uncertainty, but also high controllability of management factors and actions. There are two slightly different forms of adaptive management; Passive, where management accounts for anticipated changes in resource status, but is not designed for learning; and Active, where the approach anticipates the effects of management actions on learning. Whether either can be successful depends on a number of conditions ("problem-scoping key") that should be evaluated in proposing such management (Figure 3-2).

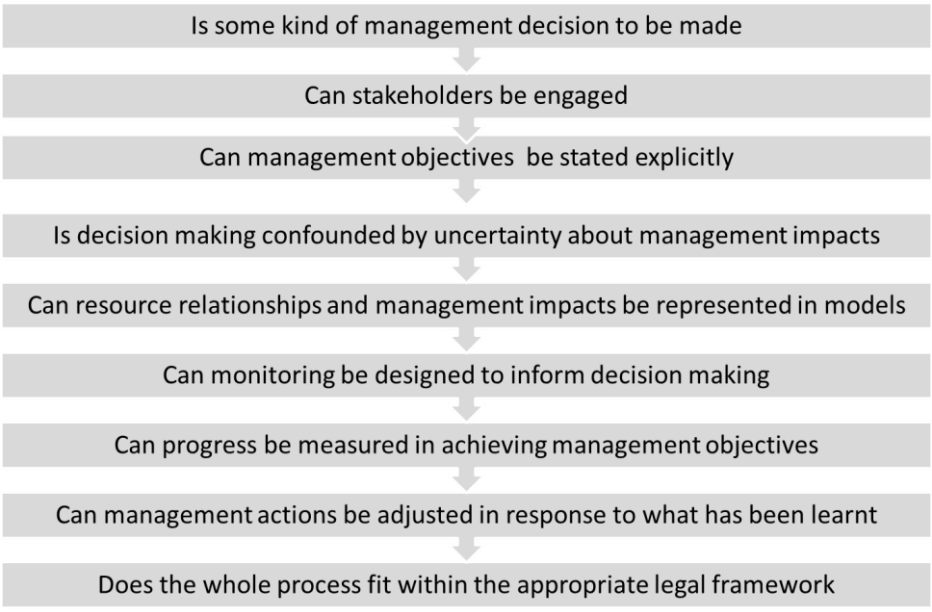

Figure 3-2: The adaptive management problem-scoping key: criteria to evaluate if the process is appropriate (based on Williams et al. 2009).

The scientific requirements behind adaptive management include having clear and measurable management objectives, and the ability to express and evaluate uncertainty through testable models. The latter involve a number of difficult issues to address adequately, including:

- Models need to include key components of the resource system, and quantify critical processes, natural change dynamics, fluctuating environmental conditions, and management inputs
- Models need to incorporate different ideas (alternative hypotheses) about how the system works and how it responds to management. A suite of models may be needed to capture key uncertainties
- Models should be calibrated or validated, so predictions are realistic

The decisions in 2015 by the EPA to decline consent for TTR to mine ironsands in the South Taranaki Bight and CRP to mine phosphate on the Chatham Rise throw light on how to interpret some of these aspects of the EEZ Act for managing uncertainty. One of the EEZ Act s64 definitions of adaptive management is the use of a staged approach (start small and expand). Both TTR and CRP Decision-Making Committees (DMCs) considered potential for a staged approach but in both cases, the applicants said this was not feasible due to investment certainty needed.

The DMCs for both applications quoted from the Supreme Court decision on Sustain Our Sounds v New Zealand King Salmon under the Resource Management Act (RMA) with regard to adaptive management[3], which outlined four factors to assess whether an adaptive management approach is appropriate (TTR decision paragraph 799, CRP decision paragraph 833). These include the extent of environmental risk, the importance of the activity, the degree of uncertainty, and the extent to which risk and uncertainty will be reduced by the adaptive management approach.

In addition, both DMCs considered a further aspect of the King Salmon decision (at TTR decision paragraph 803, CRP paragraph 834) with a further four factors to consider before endorsing an adaptive management approach: good baseline information about the receiving environment, appropriate indicators used as conditions, threshold set to trigger actions before the effect becomes overly damaging, and effects that might arise are able to be remedied before they become irreversible. While both decisions note there are differences between the RMA and the EEZ Act, they consider there is useful guidance from the 'King Salmon decision' in considering an adaptive management approach under the EEZ Act.

3.11 A comment on cumulative effects

Policy and regulatory requirements in many countries include that EIAs identify, analyse and evaluate cumulative effects. The EEZ Act is no different, with section 39 (1c) specifying an assessment must identify the effects of the activity on the environment and existing interests, including cumulative effects. The latter can arise over time, or in combination with other effects (section 6).

There are many stressors caused by anthropogenic activities that can affect the marine environment in a number of ways, and there is a very large body of literature dealing with this field of research (see Glasson et al. 2012, Solan & Whiteley 2016). Results of numerous studies indicate that interactions between stressors can be variable, and hard to predict (e.g., Crain et al. 2008, Darling & Cote 2008). Nevertheless, cumulative effects should be explored as much as possible given available

[3] https://www.courtsofnz.govt.nz/cases/sustain-our-sounds-incorporated-v-the-new-zealand-king-salmon-company-limited-ors

data, and should be thought about early on during the exploration phase so appropriate information can be collected.

The assessment of cumulative impacts in a deep-sea mining EIA needs to consider three key elements:

1. Multiple sources of impact (either different types of mining operation, or different sectors)
2. Additive or interactive processes (repetition leading to accumulation of impacts)
3. Different types of cumulative effects

These elements form the basis of six evaluation criteria (Smit & Spaling 1995):

- Temporal accumulation (consider duration and frequency of perturbation)
- Spatial accumulation (consider geographic scales, boundaries, directional patterns)
- Perturbation type (single, multiple, likely trigger for further effects)
- Processes of accumulation (consider cause and effect, what is additive versus interactive)
- Functional effects (causing changes in ecological processes or controlling properties)
- Structural effects (spatial changes in biological or physical composition)

Historically EIAs have not addressed cumulative impacts well, and have tended to be simply qualitative (Burris & Canter 1997). There are now many methods available to analyse cumulative effects, including expert group opinion, spatial analysis, network analysis, interactive matrix techniques, biogeographic pattern analysis, and ecological/ecosystem modelling (e.g., Smit & Spaling 1995). Ideally there would be sufficient data available to adopt an ecosystem approach, and evaluate the impacts of stressors on ecosystem services (Austin & White 2016). Full ecosystem modelling may be unrealistic, but mapping the extent of various stressors, and evaluating potential interactions on a spatial scale, is a good way to at the very least visualise the likely distribution of cumulative effects which can inform precautionary management (Ban et al. 2010). Ban et al. (2010) also provide a simple method for scoring cumulative impacts, and this can be a useful aid to help design robust monitoring programmes.

Cumulative effects should be separated in the EIA as a readily identifiable section that brings together the single impact descriptions in other sections of the template. Burris & Canter (1997) note that cumulative impacts should be considered for the same set of environmental factors that are analysed for both direct and indirect impacts. That ensures that significant impacts (which can be positive as well as negative) are not overlooked.

Interactions with commercial fisheries are a major aspect that must be covered. Together, mining and bottom trawling activities will have a larger benthic footprint than either by itself, and this needs to be evaluated against the spatial scale of community structure and function. Indirect effects, such as sedimentation plumes and deposition, are also common to both industries, and so need to be considered where the two are close together or overlap.

Climate change (warming waters, expanding Oxygen Minimum Zones, rising sea levels, increasing ocean acidification) may also be relevant, especially in areas where biological communities are predicted to be affected in the future (e.g., the distribution of deep-sea corals may change as ocean acidification will affect the depth of the aragonite saturation horizon). This may seem too long-term an effect, but if a prospective mining site is a feature or habitat that could be a future refuge for rare communities this needs to be considered (e.g., seamounts and corals, Tittensor et al. 2010).

Cumulative effects should also be evaluated at two different spatial and possibly temporal scales: within the scope of the proposed mining operation, which will cover the nature and extent of operations within the physical footprint of mining disturbance, as well as the larger area of potential indirect effects. This scale needs to pay particular attention to the duration and frequency of repetitive activities within the mining site. This was an important aspect of the CRP application, where the cumulative distribution of 15 years of sedimentation was required by the DMC to assess the additive component of the impact.

On a more regional scale, multiple mining operations, and various commercial and recreational/artisanal (if nearshore) fisheries will involve assessing multiple sources of impacts, as well as different types of effects. Displacement of fishing activities from mining blocks, wider environmental effects of mining on fish behaviour, and consumer concerns about seafood quality were considered in the CRP application process, but their significance was uncertain.

4 Specific guidance on template sections

This section works through each part of the EIA template in order, offering additional guidance or reference to other sources of information where relevant. The brief of the project, and expertise of the authors, is primarily bio-physical, and although there are template sections for describing the socio-economic environment and impacts in the template (sections 7 and 11) we offer little guidance beyond what is already contained in the template. Also, it is important to note that sections on existing onshore environment and potential impacts of the proposed activity on the onshore environment may need to vary to complement or replace an AEE completed under the RMA.

The EEZ Act requires that an IA is done with regard to the scale and significance of the proposed project. In this guidance we make suggestions for approximate length, but the overall length - or even if all sections of the EIA template are required – will need to be appropriate to the scale and significance of the proposal. Each part below contains the template text in a blue box, followed by general advice to help at that stage of the EIA.

Note that the detail within, and order of, some sections differs from that of the ISA and SPC templates. Nevertheless, the content of the guidance here is applicable across the various templates.

4.1 Executive summary

A summary of the content of the EIA, including:

- *description of the proposed activity/project and its objectives*
- *the main processing methods of the proposed operation*
- *key potential impacts (physico-chemical, biological, socio-economic)*
- *measures to avoid, remedy or mitigate environmental impacts*
- *end-use plans, including decommissioning*
- *consultation with stakeholders and interested parties.*

The Executive summary is intended to provide a concise overview of the EIA so that the decision makers for the application can form an initial view of the issues involved and also of the quality of the EIA. The five bulleted topics in the template should be covered in as succinct a way as possible. However, it is worth writing this section of the EIA with the intention that this summary could form a stand-alone document; it should contain sufficient detail to allow the reader to appreciate all of the key areas that need to be considered, even though they will need to read parts of the main document to understand the details of those decision points. The length of this section will be variable depending on the scale and significance of the proposed project, but is likely to be 8–10 pages.

4.2 Non-technical summary

A short and "plain language" summary for the public.

The non-technical summary is just as described– it is intended for a public audience. Use clear, jargon-free language to outline the proposal, summarise the potential effects, comment on proposed mitigation and any residual and/or cumulative effects, and any proposed monitoring. This should be no longer than about 5 pages and will provide the opportunity to condense the key points of the proposal into a concise statement that can be used for many purposes in consulting with various people about the proposed work. It can't be over-emphasised that clear communication is essential to help interested members of the public understand the proposed work and the extent of environmental assessment and mitigation. Good information exchange with all parties is an important part of the overall process.

4.3 Template Section 1: Introduction

1.1 Background

- *Introductory background to the application.*

1.2 The proposed activity/project

- *A description of the overall proposed mining or drilling activity*
- *Describe the area of the proposed activity*
- *Include an outline of previous consultation.*

1.3 This report

- *Scope of the Environmental Impact Assessment (EIA) – what is included, what is not based on earlier assessments or work. Link to other supporting documentation.*
- *The format (i.e. structure) of the EIA document – especially for larger projects where there is a lot of detail (in line with EEZ Act requirements for EIAs to be appropriate to scale and significance of the project).*

The purpose of the Introduction section is to set the scene for the EIA. It contains introductory background to the proposal, a summary of the proposed activity (with reference to more detail to come in Template Section 3 Project description, see 4.5 below), and outlines the EIA format so that readers understand where to look for certain information. We suggest that detailed technical reports are summarised within the EIA and the full reports appended, in which case the Introduction should make this clear.

This section should contain enough detail for a reader to form an overall impression of the proposed project and how it has developed, and understand how the EIA is structured. As this section mainly provides a 'roadmap' to more detailed material in the EIA, it should be relatively short (1-2 pages).

4.4 Template Section 2: Policy, legal and administrative context

This section provides information on relevant legislation, agreements or policies that are applicable to the proposed mining or drilling operation.

2.1 Applicable mining and environmental legislation, agreements and policies

- *Outline links to New Zealand's EEZ legislative context, including requirements for consultation*

2.2 Other applicable legislation, agreements and policies

- *Description of other legislation etc that does not necessarily apply specifically to seabed mining*
- *Consider other marine management regimes such as those as defined in s7 of the EEZ Act*

2.3 Relevant international and regional agreements

- *Include relevant international agreements (e.g., UNCLOS, CBD, IMO, SOLAS, MARPOL)*

2.4 Other standards, principles and guidelines

- *Reference any national, regional and international standards, management principles and guidelines not covered above, such as non-binding recommendations from the ISA.*

Make clear the extent of overlap into the Coastal Marine Area under the Resource Management Act 1991

This section of the EIA references the relevant contextual and legal frameworks under which the mining or drilling is proposed. This is relatively straight-forward, but at the same time it is important to make sure this section is clear and complete. The EIA should demonstrate that the applicant is aware of the key legislative requirements under the EEZ Act but also other relevant international requirements and other New Zealand marine management regimes. Most of these are outlined in section 7 of the EEZ Act but there are also some other acts (e.g. Sugar Loaf Islands Marine Protected Area Act 1991) to be aware of. This section should make it clear if any additional permits are required for the proposed project under these other legislative frameworks, and whether these have been applied for or granted.

In particular, if the proposed activity will overlap into the Coastal Marine Area or include onshore support activities managed under the RMA, the EIA will need to make this clear so that decision makers can consider how to handle the application, in line with sections 88-100 of the EEZ Act. Any relevant regional provisions (objectives or policies from regional policy statement or regional plans under the RMA) or territorial provisions (from district or city plans) to manage the coastal marine environment should be identified. These provisions should make it clear whether a consent is required for any activities that the proposed project will undertake within the Coastal Marine Area or onshore. This will include activities subject to restrictions under the RMA such as:

- The use of land (RMA s9)
- The use of the coastal marine area (s12)
- Certain uses of the beds of lakes and rivers (s13)

- Taking, using, damming or diverting water (s14)
- Discharges of contaminants to air, water or land (s15)
- Avoidance of unreasonable noise (s16).

If both EEZ Act and RMA consents are required, a joint application can be made in which case the EIA must include an assessment of effects that comply with both section 88(2)(b) of the RMA and section 39 of the EEZ Act. Guidance on preparing AEEs under the RMA can be found on Ministry for the Environment (e.g. http://www.mfe.govt.nz/publications/rma/aee-guide-aug06/index.html) and Quality Planning websites (http://www.qualityplanning.org.nz/index.php/consents).

Under the LOSC, all states are required to take appropriate steps to ensure that seabed exploration and exploitation activities under their jurisdiction or control are appropriately managed, in accordance with international standards and best practice. Compliance with the EEZ Act should meet most of these international standards, but we refer the reader to knowledge of a number of conventions and agreements to be aware of. These include (based on Swaddling 2016, Appendix 4): the United Nations Convention on the Law of the Sea, International Maritime Organization (IMO) conventions (e.g., MARPOL), The Madang Guidelines, ISA Mining Code, Nouméa Convention, London Convention, United Nations sustainable development goals, Rio declaration on the environment and development, Convention on Biological Diversity, United Nations Agenda 21, International Marine Minerals Society code for environmental management of marine mining, Convention on the Conservation of Migratory Species of Wild Animals (CMS), OSPAR Convention.

This section may be several pages in length and will obviously be longer where there is overlap with multiple regulatory regimes.

4.5 Template Section 3: Activity/Project description

3.1 Purpose and need of the proposed activity/project

- *Type of mineral or hydrocarbon resources*
- *Why the operation is proposed*
- *Background to the project, including aspects of the discovery of resources, development of techniques etc.*

3.2 Proposed project location

- *Coordinates of proposed project area*
- *Map and boundaries of footprint (total area, and certain phases, see 3.3.2)*
- *Include any closed/exclusion areas.*

3.3 Description of the proposed development

3.3.1 Project duration and phasing

- *Overall life of project*
- *Duration of different operational phases (timeline) from mobilisation to decommissioning*

- *Development timetable should be detailed, and perhaps outline here but include an appendix covering:*
  - *Pre-construction tasks*
  - *Construction schedule, staging of activities*
  - *Commissioning and operational schedules*
  - *Infrastructure development*
  - *Closure schedule.*

3.3.2 Proposed project scale

- *Spatial scale of the proposed operation, including how it is proposed to evolve through time.*
- *Include indicative rates of extraction, total extraction, depths of extraction (both below sea level and depth of seabed) overburden estimates, discharge rates etc.*

3.3.3 Mining or drilling methodologies

- *Proposed methods of extraction (dredging, coring, etc.).*
- *Describe technical specifications of equipment, including construction and operating standards for design of gear.*
- *Include details of the operation throughout the water column, from seabed to surface.*

3.3.4 Support equipment

- *Describes any equipment needed for support (e.g., tender, supply vessels, barges), includes handling of hazardous materials.*
- *Describe frequency of vessel movements for support, supply, barge removal etc.*

3.3.5 Proposed processing operation

- *Includes:*
  - *Commissioning*
  - *On-site operations (including how onsite operations will be powered)*
  - *Off-site operations*
  - *Transport of material off-site*
  - *Disposal of waste (including hazardous waste).*
  - *Decommissioning*
- *A schematic diagram should be included of the key components of the operation.*

3.3.6 Other alternatives considered

- *What other locations, methods etc. were considered, and rejected in favour of what is proposed.*

The Project Description section of the EIA template is fairly self-explanatory, with the headings of most sections or sub-sections clear as to their intent. The purpose and need is essentially background to the project, but sets the scene for why the extractive operation is needed. The project location should have a series of maps that demonstrate the regional location, as well as the more detailed locality. It will link in with a further description, and perhaps more detailed maps again, under part 3.3.2 which describe spatial and temporal changes in the sequence of activities.

A key aspect of this section is the description of mining methodologies. Most oil and gas operations utilise well known techniques, equipment and overall operating procedures, whereas mining of seabed minerals is new, and there is no standard methodology. Methodologies will vary with mineral type and depth. Where the technology is new or untested, this section needs to be very detailed, as it is fundamental to understanding what the impacts are likely to be. This should include the operation at the seafloor, as well as water column activities (e.g. riser pipe transfer) as well as the methods of disposal of processing water, fine sediment, and other by-products. If there are national or international "best practices" that are relevant, it is useful to include an assessment of how the proposed operation will align with them (see Appendices D and E).

Description of the overall timetable, from construction through to decommissioning and closure of operations, is important to scope the nature and extent of various environmental impacts. The description should include the major phases of the operation, as well as the milestone dates on which relevant tasks and activities are expected to be completed. Information on the development timetable provided under this section should clearly communicate the different phases in the development proposal. For reasons of clarity, a flow chart or Gantt chart should be used where appropriate.

Section 20 of the EEZ Act outlines restrictions on activities, and it is important that the project description includes a clear summary of what activities may require consent under this section. This refers to deployment of structures, pipelines and cables, as well as disturbance to the seafloor environment by removal or addition of material, and any activity that could have an adverse impact on marine species (including vibrations and explosions). A table is a useful way of displaying each of the restricted activities, and whether the project will affect any of the conditions. It also provides a clear signal to managers of the activities that will need to be addressed in the EIA for consent to be granted.

The final section covers alternative methodologies and locations, and it is essential to give an account of the pros and cons of methods and sites that were evaluated before deciding on undertaking the activity in this particular area, and the justification for use of the particular equipment and methodologies chosen. This is a legal requirement under the EEZ Act.

This section may be relatively long, as it will include some technical detail of equipment and mining methodologies, as well as a full account of the overall mining and drilling sequence. Some parts may be best suited as Appendices (especially those where there is a lot of technical detail that is not needed in the main text), but is important to describe fully the proposed operational plan.

4.6 Template Section 4: Description of the existing physico-chemical environment

4.1 Key messages

- *Overview of key content covered in this section (this is a box with up to 6 bullet points of the main aspects covered, or the main findings).*

4.2 Regional Overview

- *General regional context (includes map, covers wider area around proposed activity area).*
- *Include site-specific issues and characteristics, particularly sensitive environments.*
- *Reference to relevant technical data/previous studies will be required.*
- *The regional overview is a brief section, but provides the broader scale context for the more detailed site-specific description below.*

4.3 Meteorology and Air Quality

- *General overview of climatology e.g. wind directions and speeds, seasonal patterns, cyclones.*
- *Description of air quality, including chemical characteristics*

4.4 Geological setting

- *Describe the general geological landscape and topographic features of the site.*
- *Describe in detail the nature and extent of the resource (including aspects such as thickness, depth below seabed, horizontal extent for crusts or nodules).*

4.5 Physical oceanographic setting

- *Describe oceanographic aspects such as currents, waves, vertical stratification, sedimentation rates.*
- *Describe notable characteristics of the site, such as hydrothermal vents, seamounts, canyons.*
- *Detail is required on the regional setting as well as the specific site, and include changes with depth, and horizontal distance (near-field, far-field).*

4.6 Water quality

- *Describe water mass characteristics at the site at various depths, including salinity, nutrients, particle concentrations, temperature, geochemistry, chemical composition, dissolved gas profiles, etc.*

4.7 Seabed substrate characteristics

- *Substrate composition with special reference to sediment composition, sediment chemistry, nutrient characteristics, pore water profiles, and grain size.*

4.8 Natural hazards

- *Volcanism, seismic activity, tsunami etc.*

4.9 Noise and light

- *Ambient noise if any, influence of existing exploration and maritime activity.*

4.10 Gas and chemical emissions

- *Describe the level of gas and chemical emissions from both natural and anthropogenic activities, as well as those affecting seafloor or water column chemistry (e.g., acidity).*

4.11 Summary of existing physico-chemical environment

- *Bring together key findings e.g. any sensitive environments or highly valued areas.*
- *This will be up to a page, and more extensive than the Key messages in the first section.*

This section provides regional and site-specific information on the physical environmental conditions at the activity site(s). The term "physical environment" is generally interpreted here in the widest sense, and this section may be reasonably large. The section should not include however, biogenic habitat (corals) or structures directly related to living or dead biological matter – unless specifically mentioned. The aim is to provide a robust environmental assessment against which impacts will be assessed. As a general guideline, the level of detail should be commiserate with the scale and intensity of the proposed activity. It should provide ample information on material collected by the applicant specifically for the purpose of the document.

This section should be illustrated using maps, diagrams and photos. Particular attention should be made to using adequate spheroid and projections for the maps. The EPA as the primary decision maker does not recommend a particular projection for applications under the EEZ Act, but marine charts have traditionally been generated using Mercator projections, such as Mercator 41/WGS84 spheroid. This projection was submitted to EPSG (European Projection Survey Group) and accepted as EPSG code 3994. New Zealand Petroleum and Minerals traditionally uses the LINZ New Zealand Transverse Mercator (NZTM, EPSG code 2193) projection. LINZ recommends the NZCS2000 Lambert Conformal projection for spatial data. It is a confusing area, but the important point is that the projection should be appropriate for the particular location/site. If the site extends onshore or inside 12 nm then the Lambert projection should be used, but for general offshore use we recommend Mercator 41/WGS84. A number of web sites are listed in Appendix D which can help.

Notable physical characteristics at the site should be clearly identified in the relevant sub-sections. These can include sensitive physical environments, but not strictly biologically or ecologically sensitive environment (covered in part 4.11). Such physical environments include sites of hydrothermal venting, seamounts, areas of high surface productivity, carbonate concretions, pockmarks, sandwaves, and oceanic eddies.

A number of physical environment datasets, databases and data portals are available from New Zealand government and research organisations and should be used and referenced whenever necessary. Such platforms provide either metadata or specific and detailed data for the New Zealand region. The Department of Internal Affairs hosts the "all Government datasets online" portal, which provides a directory of publicly-available, non-personal, New Zealand government held datasets (https://data.govt.nz).

The New Zealand National Aquatic Biodiversity Information System (NABIS - http://www.nabis.govt.nz) also provides information on bathymetry, topography, and oceanography in the New Zealand region, as well as information on the distribution of marine species.

EcoConnect is an environmental forecasting and information service (http://ecoconnect.niwa.co.nz) that enables real time weather observations and forecasts at a specific site. The portal provides information and map generating tools for weather, sea state (wave and wind hindcast models); sea level (tides and storm surge); and climate analyses.

Reference can be made to international databases such as the Australian Ocean Data Network Portal (AODN - http://portal.aodn.org.au/aodn/) or ARGO Data set (http://www.usgodae.org/argo/argo.html and http://www.coriolis.eu.org/) for physical oceanography considerations.

Other databases of relevance to physical environment are provided in Appendix D.

Because distant natural events could have an impact, even minor, on the operations (see Template Section 8), it is recommended that any natural hazardous or catastrophic events that would have an impact on the operations be described in this section (e.g., distant tsunami, earthquakes).

Some template sections here, such as 4.3 - "Meteorology and Air Quality", 4.5 “Physical oceanographic setting” and 4.6- "Water quality" may require the inclusion of results from numerical models – whether developed purposefully to describe the existing environmental conditions, or readily available. If so, uncertainty and model protocols should be discussed (also see report section 3.7). Various characteristic and frequency statistics can be derived from such models: for example wind speed and direction, and wave conditions (such as height, mean and peak wave period, direction) (e.g., Tolman 2009; Tolman et al. 2002; Uppala et al. 2005).

The description of the geological setting in Template Section 4.4 should be reasonably detailed because of its direct relevance to the proposed exploration and exploitation of mineral and oil and gas resources. The reader should be able to understand the general nature, structure and dynamics of the seafloor and its processes at and near the proposed site/s. This will include description of the regional and local geology, geomorphology and tectonic environment. A brief geological history of the region is needed, including specific information on the origin of the relevant resources at the site. This section should synthesise, in plain language, the up-to-date knowledge available in the scientific literature. The literature should be referred to appropriately.

Seafloor information may be illustrated using bathymetry, backscatter, sediment or predictive maps at a scale relevant to the region and the site. An account of the sub-seafloor will usually require this information to be illustrated using seismic reflection data, with suitable scale, vertical exaggeration and labelling of key reflectors and events. Seismic sections should be presented with a clear interpretation. Indicative vertical scales in metres should be added on two-way travel time sections. Technical terms should be listed in the Glossary.

Template section 4.7 on sediment characteristics may include a variety of information. It will need to cover the results from actual sampling and cover the type of sediment, particle size distribution, chemical composition, pore water characteristics, and nutrient composition and levels. Existing “contaminant” presence should also be noted, such as naturally accumulated heavy metals and radioactive compounds.

The description of natural hazards in Section 4.8 should focus on the relevant hazards likely to affect the site, although also mention hazards that are unlikely to occur. The main natural geological hazards include, but are not necessarily limited to, active faults capable of generating earthquakes (Litchfield et al. 2013; Stirling et al. 2012), active submarine volcanic edifices (Carey et al. 2014), potential slope instabilities and landslides (Vanneste et al., 2013). Although tsunami usually have little to no impact on offshore structures they may be of relevance to coastal regions and ports and should be mentioned if such issues are of relevance. Probability of occurrences could be presented from published data (Stirling et al. 2012).

Information on noise and light should include both aerial and underwater ambient (or background) levels from natural and anthropogenic origin. The origins of the anthropogenic noise and light should be detailed if possible (ship traffic, timing, period of the year etc.). Noise levels are commonly expressed in decibels (dB), referred to a conventional reference value. Underwater, the reference is usually re. 1µPa at 1 m, and in the aerial environment the reference is usually re. 20µPa. Noise frequencies should be clearly indicated, and background noise should be measured or assessed at a wide range of frequencies.

This section does not need to present and discuss the measures that will be implemented to avoid, remedy or mitigate adverse impacts to the surrounding environment and existing interests. Mitigation measures should be addressed as appropriate in sections 8, 9, 10, and 11 of the EIA and there needs to be good cross referencing throughout the EIA so that a reader can easily see how an identified effect is to be avoided, remedied or mitigated.

4.7 Template Section 5: Description of the existing biological environment

- *This section is divided by depth regime for the site into a description of the various biological components and communities that are present or utilise the area.*
- *The format of this could be handled in many different ways. However, it is useful to structure it by depth as this reflects the likely division of impacts in the 3 main areas of the water column. It is the approach taken by the International Seabed Authority (2012).*

5.1 Key messages

- *Overview of key content covered in this section (this is a box with up to 6 bullet points of the main aspects covered, or the main findings).*

5.2 Regional Overview

- *General regional context*
- *Include site-specific issues and characteristics, particularly sensitive environments*
- *Existing conservation areas, protected species etc.*
- *Reference to relevant technical data/previous studies will be required*
- *The regional overview is a brief section, but provides the broader scale context for the more detailed site-specific description below.*

5.3 Biological communities

5.3.1 Surface

- *From the surface down to 200 m - this includes plankton (phytoplankton and zooplankton), surface/near surface fish such as tunas, also seabirds, turtles, marine mammals.*

5.3.2 Midwater

- *Open water from a depth of 200 m down to within 50 m of the seafloor and includes zooplankton, mesopelagic and bathypelagic fishes, deep-diving mammals.*

5.3.3 Seafloor

- *Benthic invertebrate and fish communities, including infauna to an appropriate depth of sediment, and demersal fish up to a distance of 50 m from the seafloor.*

5.3.4 Ecosystem/Community level description

- *Summary of ecosystem studies, where elements of the above components are integrated*

5.4 Summary of existing biological environment

- *Bring together key findings such as any sensitive environments or highly valued areas.*
- *This will be up to a page, and more extensive than the Key messages in section 5.1.*

The depth ranges given above apply to deep-sea resources. In shallow areas (e.g., ironsand deposits) the depth ranges to describe the surface-seabed characteristics would be different.

This section gives a detailed account of the state of information on biological communities. It starts with a general regional overview, which covers broad-scale characteristics such as biogeographic provinces, particular topographic features that may have a certain type of fauna (e.g., hydrothermal vent sites, seamounts, canyons), as well as any existing areas or species subject to management. Template section 5.2 is relatively high level, but sets the scene for a more in-depth description in section 5.3.

There are several recent biogeographical accounts that applicants may find useful, including global epipelagic (Spalding et al. 2012), mesopelagic (Sutton et al. 2017) and benthic (Watling et al. 2013) classifications. There are also a number of more regional or New Zealand accounts, including Rowden et al. (2005) for seamounts, Francis et al. (2002) for demersal fishes, and two recent generic environmental classifications of the EEZ, the Marine Environment Classification (MEC) (Snelder et al. 2006), and a Benthic Optimised MEC (Leathwick et al. 2012).

A comprehensive species list should be provided for the area. This can be compiled from a number of sources, including:

- a literature review to uncover all published records. A good place to start is the summary by Gordon et al. (2010) and the 3 volume series on New Zealand's biodiversity (Gordon, 2009, 2010, 2012).
- museum, university or research institute collection specimen records (e.g., National Fish Collection at Te Papa, NIWA Invertebrate Collection,)

- research databases available from national institutes (e.g., NIWA, Te Papa, Auckland Museum) or government agencies. The New Zealand National Aquatic Biodiversity Information System (NABIS - www.nabis.govt.nz) provides information on the distribution of marine species (in particular fishes) in the New Zealand region
- global biodiversity databases, available online (e.g. www.iobis.org, www.fishbase.org for invertebrates and fishes respectively).

There should also be notes provided on particular characteristics of the species, especially if they may be endemic (restricted in their distribution to just the site, resource substrate, or localised region) or known to be rare, threatened or endangered. The IUCN redlist of endangered species (www.iucnredlist.org) with additional data provided by national lists (Freeman et al., 2010 for New Zealand species) can then be linked with species lists from the area to know if they are present.

The description of species composition and abundance needs to include all size and age ranges of fauna, from microfauna and infaunal meiofauna (e.g., nematodes which are very important in soft sediment environments such as nodule habitat) through macrofauna to epifaunal megafauna. Life history stages also need to be considered, such as larval and juvenile stages with different ecological characteristics from adults.

Existing data (as well as new data collected during exploration activities) should be analysed to be more than a simple list of animals found, but indicate how species and faunal assemblages use habitats in the area. This needs to include use by different life history stages of fauna, such as spawning sites, nursery areas, feeding grounds etc. This can highlight key linkages between faunal groups and their environmental context. This should include multivariate analysis of community structure, at appropriate scales where there has been sample replication. This type of analysis should evaluate whether particular faunal communities are common or rare throughout the site of interest, as well as distributed outside the licence area. Faunal descriptions should include accounts of genetic diversity and trophic relationships, and an assessment of community function and their role in provision of ecosystem goods and services. This type of analysis needs to be planned during the exploration phases of the project to produce data that enable robust analyses to be carried out for the EIA. Useful sources of guidance are ISA reports on environmental guidelines for polymetallic nodules, and polymetallic sulphides and crusts (ISA 1999, 2007), as well as a recent report by SPC-NIWA (Swaddling et al. 2016).

Given the emphasis by many agencies on the ecosystem approach to management, it is important to consider wider community relationships where information exists (section 5.3.4). This enables assessments to move beyond community descriptions to incorporate potential changes in ecosystem function (e.g., Armstrong et al. 2012, Tuck et al. 2014, Thurber et al. 2015).

Community-level analyses may be carried out for different faunal groups under the three depth bands above. It is common to have multivariate grouping/clustering type analyses for benthic invertebrate fauna in particular. However, where analyses may span the depth-based habitats, they should be included in the ecosystem/community section. There should, at the least, be a description and assessment of information on trophic interactions and the linkages of both food energy, and contaminants, in the food chain. Emphasis might be placed on knowledge of trophic levels, the degree of interaction between benthic and pelagic communities, whether there are specialised predators that could be more vulnerable than generalists, and how complex the food web and species interactions are to give an idea of resilience of the system to disturbances. Scientific interests

may also look at going further and developing models to quantify the trophic structure, and energy flows through the ecosystem. There are a number of ecosystem models that could be considered, as data are collected during exploration phases. Such data can begin to support a trophic model structure that quantifies the transfer of organic material through a food web, such as that based on the widely used mass-balance Ecopath trophic model (Christensen and Walters, 2004). Modelling is likely to become a more common feature of EIAs, whereby mining-like perturbations to the system can be modelled and assessed (e.g., Chatham Rock Phosphate Ltd, 2014).

This description of the biological environment (and subsequent assessment of impacts in Template Section 9) can also be structured by "receptor" rather than by the depth range. This approach is based on the main biological groups, such as:

- Primary producers
  - Phytoplankton
  - Algae (if sufficiently shallow)
  - zooplankton
- Mesopelagic fauna
  - fish
  - squids
  - macrozooplankton
- Fish
  - assemblages
  - pelagic species
  - demersal species
- Marine mammals
  - cetaceans
  - pinnipeds
- Seabirds
- Other rare or endangered species
  - e.g., turtles
- Benthic invertebrates
  - Meiofauna, macrofauna, megafauna
  - Microbes and protists
  - Assemblages
- Ecosystem/Community level descriptions
- Sensitive habitats (as defined by the EPA in the EEZ Act regulations)

Sensitive Habitats warrant a separate heading, whether the structure is by depth zone (in this case template section 5.3.3 “Seafloor”, or by receptor. The EPA Permitted Activities Regulations (Schedule 6) define 13 sensitive habitat types, and provide indicative criteria and thresholds as to whether they are potentially sensitive:

- Stony coral thickets or reefs
- Xenophyophore beds
- Bryozoan thickets
- Calcareous tube worm thickets
- Chaetopteridae worm fields
- Seapen fields
- Rhodolith beds
- Sponge gardens
- Beds of large bivalve molluscs
- Macroalgae beds
- Brachiopods
- Deep-sea hydrothermal vents
- Methane or cold seeps.

Components of “Vulnerable Marine Ecosystems” (VME) should also be considered, as defined by the Food and Agriculture Organisation (FAO) (FAO 2009). Taxa that have been identified as VME indicators for the high seas region around New Zealand managed by the South Pacific Regional Fisheries Management Organisation are described by Parker et al. (2007).

The format of the biological description does not really matter, and should suit the particular area, resource, and the report authors’ preference for structure. However, the depth component should be retained in the description of the range of taxa, as that can then guide the evaluation of the sensitivity and vulnerability of fauna to different stages or parts of the extractive operation. Hence depth zone can be a sub-section structure under each of the faunal groups, or conversely the faunal groups become sub-sections of the depth zones.

4.8 Template Section 6: Description of the existing onshore environment

This section should describe the conditions of the area where onshore processing operations will be located, as well as any relevant environmental information on transit lanes/areas.

Although other legislation may apply onshore, there are advantages to having the entire operation and chain of processing and potential impacts covered in a single EIA.

The level of detail provided in this section will depend on the extent of onshore activities and any overlap with the RMA management regime to 12 nm offshore.

6.1 Key messages

- *Overview of key content covered in this section (this is a box with up to 6 bullet points of the main aspects covered, or the main findings).*

6.2 Overview

- *General context for the onshore area*
- *Include site specific issues and characteristics*
- *Existing conservation areas, protected species etc.*
- *Reference to relevant technical data/previous studies will be required*
- *The overview is a brief section, but provides the broader scale context for the more detailed site-specific description below.*

6.3 Physico-chemical environment

- *Land and any waterbodies that may be affected. Air quality issues.*

6.4 Biological environment

- *Terrestrial or aquatic communities in the area.*

6.5 Summary of existing onshore environment

- *Bring together key findings.*
- *This will be up to a page, and more extensive than the Key messages in section 6.1.*

The length and detail of this section, and the corresponding assessment of impacts (Template section 10, see 4.12 below), will obviously depend on the proposed activity. If the activity is in the middle of the EEZ, with no shore-based support activities, this section would either not be required or would be a very short statement to that effect. However, if there is either a potential cross-boundary impact and/or associated shore-based support activities this section will be required. It may also be a briefer description for operations beyond EEZs in the Area under the jurisdiction of the ISA.

As per the three introductory bullets to this topic in the template, this section should describe the conditions of the area where onshore processing operations will be located, as well as any relevant environmental information on transit lanes/areas. In Template Section 2 (the Policy, legal and

administrative context; see 4.4 above) your EIA will have outlined the extent of overlap into the Coastal Marine Area under the RMA management regime to 12 nm offshore, and any relevant regional or local management provisions. This would include an assessment of whether a resource consent under the RMA was required for the Coastal Marine Area or onshore activities, for which an assessment of environmental effects (AEE) would be required. Sections 88-100 of the EEZ Act outline the potential for joint applications if both EEZ Act marine consents and RMA resource consents are required. If this is the case, the EIA must include an assessment of effects that complies with section 88(2)(b) of the RMA and section 39 of the EEZ Act. It should be remembered that section 59 of the EEZ Act requires applicants to take into account the nature and effect of other marine management regimes, plus relevant regulations and any other applicable law.

Regardless of whether a joint application is made, there may be advantages to having the entire operation and chain of processing and potential impacts covered in a single EIA, and so this section allows for that. The level of detail provided will depend on the extent of onshore activities. Guidance for preparing an AEE under the RMA can be found elsewhere (e.g. www.mfe.govt.nz/publications/rma/ or www.qualityplanning.org.nz/index.php/consents), and the suggested headings provided here are just one way of organising this section and are not exhaustive.

An overview should provide general context for the onshore area, in particular identifying any site-specific issues and characteristics, such as existing conservation areas, or habitat for rare or protected species. Reference to any relevant technical data/previous studies will be helpful. The overview is a brief section, but provides the broader scale context for more detailed site-specific descriptions below.

In line with the EIA template as a whole, it will be useful to include physical, chemical and biological aspects in your assessment of the existing environment. The physico-chemical environment would include comment on any particular features of the land, water or air. The biological environment would include any terrestrial or freshwater aquatic ecosystems. It will be helpful to organise these sections to make it clear whether the planned activities will breach the relevant restrictions under RMA sections 9-16 (see 4.4 above) such as whether discharges to land, water or air may have potential impacts on physical, chemical or biological aspects of the environment (which would be discussed in Template Section 10 of the EIA).

In line with other sections establishing environmental baselines, this section should start with Key messages and end with a summary of key findings.

4.9 Template Section 7: Description of the existing socio-economic environment

7.1 Key messages

- *Overview of key content covered in this section.*

7.2 Existing Interests

7.2.1 Fisheries

- *If the project area occurs within an area used by fisheries, then this needs to be described here.*

7.2.2 Marine Traffic

- *This section describes the non-project related marine traffic occurring within the project area.*

7.2.3 Tourism

- *This section describes areas used by cruise-liners, game fishing, sightseeing, marine mammal watching, other tourism activities.*

7.2.4 Marine Scientific Research

- *Outline the current scientific research programmes that are taking place in the area.*

7.2.5 Conservation areas

- *Describe any Marine Protected Areas or Marine Reserves, Marine Mammal sanctuaries etc.*

7.2.6 Other

- *Other uses of the project area not related to fisheries, marine traffic, tourism, scientific research or conservation (e.g., recreational activities (sailing, diving), telecommunications cables, other hydrocarbon or mineral exploration or mining projects etc.).*

7.3 Cultural environment

- *Cultural significance of the proposed project area (including specific sites).*
- *Iwi authorities, customary marine title groups, customary rights groups who may be directly affected by the application*

7.4 Historic heritage

- *Historic significance of the proposed project area (e.g., shipwrecks).*

7.5 Socio-economic and socio-cultural aspects

- *Adjacent coastal communities' regional demographic and economies, including local port information if relevant.*
- *Emphasise existing coastal uses by communities that could be affected.*
- *Existing economic conditions and issues must be described*

7.6 Summary of existing socio-cultural environment

- *Bring together key findings e.g. any existing interests.*
- *This will be up to a page, and more extensive than the Key messages in section 7.1.*

This section of the EIA provides a detailed account of existing interests and values and the wider socio-economic environment. This baseline information is then used to assess economic and social impacts of the proposed development, which are reported in template section 11 of the EIA (see 4.13). Social impact assessment can be defined as an effort to assess or estimate, in advance, the social consequences that are likely to follow from a proposed activity (NOAA, 1994). The term

includes social, cultural and economic components, conditions and factors which interactively determine the state, condition, and quality of living conditions, employment, health and well-being of those people and communities affected directly or indirectly by the project.

When describing socio-economic and socio-cultural conditions, this section should focus on components that may be affected by the proposed activity. In addition to the interests and uses outlined below, relevant components often include:

- Population characteristics including the demographics of relevant groups and trends (including ethnicity and sensitive populations and groups); major economic activities; available work force, unemployment and underemployment; availability of housing, infrastructure and services (e.g. roads, education facilities); and seasonal migration patterns where relevant.
- People's relationships with the biophysical environment, including areas having economic, recreational, aesthetic, cultural or symbolic significance to specific people.
- Historical heritage of the area, especially any features that may be affected by the proposed activity.

Socio-economic assessments must determine existing interests that may be affected by the proposed project. The EEZ Act lists activities and rights that are considered existing interests. Within the New Zealand context, iwi authorities, customary marine title groups and protected customary rights groups that may be affected by the proposed project would need to be consulted so that these interests can be described (and effects then assessed for template section 11 of the EIA). This may require a cultural impact assessment to be undertaken. Existing interests that may be affected by a proposed marine activity can also include fisheries (commercial, recreational and customary (i.e., indigenous)), marine transport, tourism, scientific research, marine protected areas and other conservation areas, historic heritage, as well as adjacent coastal communities. Any other interests in or uses of the area, such as sailing or telecommunications cables, must also be identified.

Multiple use of offshore areas subject to minerals or hydrocarbon interest is most likely to involve fisheries. There is a large literature resource available for fisheries around New Zealand, and it can be a complex picture to unravel. In the first instance, applicants can learn a lot from NABIS (www.nabis.govt.nz) which can plot the distribution of many marine species, including all of New Zealand's commercial fishery species, as well as conservation areas and regions subject to fishing restrictions (such as Benthic Protection Areas). Annual stock assessment plenary reports published by the Ministry for Primary Industries (http://fs.fish.govt.nz/Page.aspx?pk=61&tk=212) are also a good resource to gain an understanding of the importance of commercial fisheries in the region.

There are a number of offshore areas that are protected from bottom trawling and dredging operations, under the Fisheries Act. There are also seasonal closures in some areas, as well as vessel size and fishing gear restrictions. These may have no direct bearing on potential mining or drilling operations, but need to be described within the area of interest. Of particular importance offshore are seamount closures (dating from 2001) (Brodie & Clark 2003) and Benthic Protection Areas (BPAs) declared in 2007 (Helson et al. 2010). The location of these is shown in Figure 4-1.

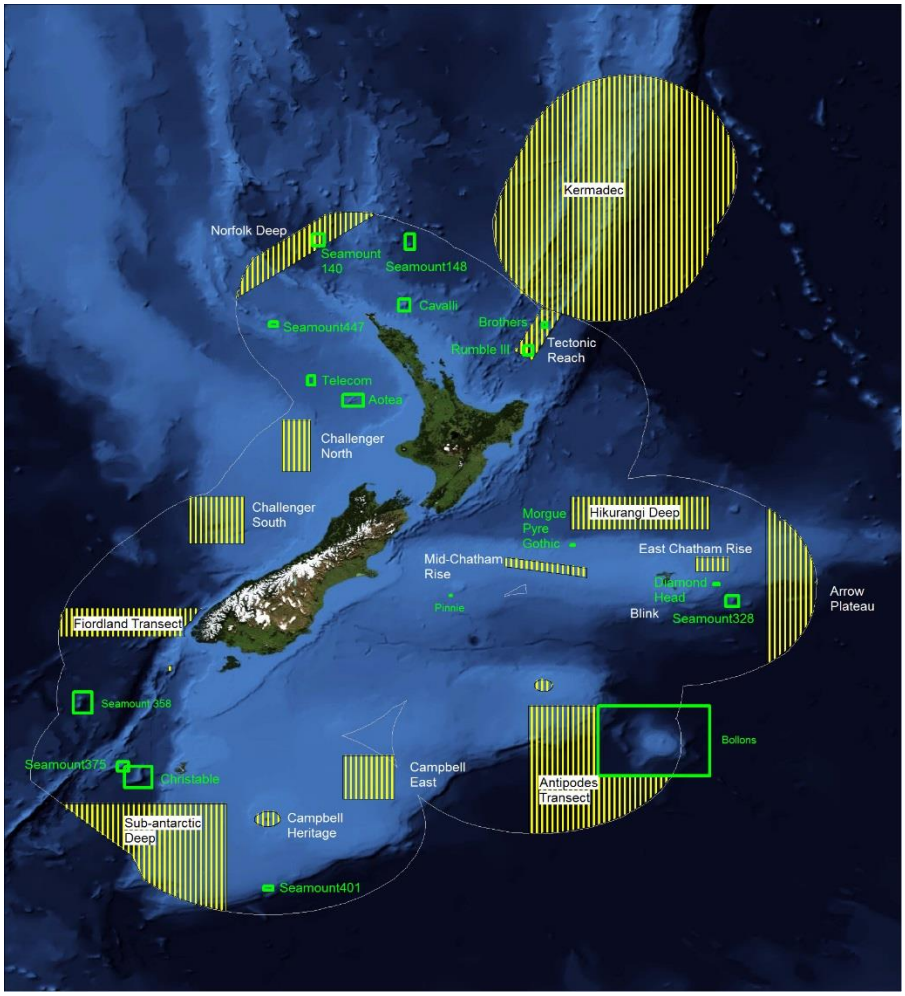

Figure 4-1: The New Zealand EEZ showing the location of Benthic Protection Areas (yellow striped) and seamount closures (green polygons), where no bottom trawling or dredging is permitted.

Marine Mammal Sanctuaries are also important conservation areas to be aware of. These are areas designed to protect marine mammals from harmful human impacts, particularly in vulnerable areas such as breeding grounds and on migratory routes. They occur off the Auckland Islands, Banks Peninsula, Catlins coast, Clifford and Cloudy Bay, Te Waewae Bay, and off the west coast of the North Island (see http://www.doc.govt.nz/nature/habitats/marine/other-marine-protection/).

Identification of, and working with, all potentially affected groups at the very beginning of planning for the proposed project is best practice. An overview should provide general context of the existing interests, and then give more detailed description of these interests, in particular identifying any site specific issues and characteristics, such as existing conservation areas, historic heritage sites or overlap of the project with key fisheries.

In line with other sections establishing environmental baselines, this section should start with key messages and end with a summary of key findings. The level of effort that is devoted to the description of the human environment should be commensurate with the size, cost, and degree of expected impacts of the proposed activity.

4.10 Template Section 8: Assessment of impacts on the physico-chemical environment and proposed mitigation

This section should provide a detailed description and evaluation of potential impacts of the operation to the physical environment components identified in section 4. This may need to consider effects that may happen during construction/development (pre-commissioning), operational, and decommissioning phases, as well as the potential for accidental events. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impacts; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

Note: This section (and section 9) will focus on aspects of greatest risks to the environment. Before an EIA is written, an environmental risk assessment (ERA) should be carried out which will evaluate the likelihood, scale, intensity and consequences of the mining or drilling operations having an impact on the physical, chemical and biological environment. This means the EIA can describe in greater detail the main impacts on the environment and not expand elements of minor risk. The methods and results of the ERA should be provided as an appendix to the EIA, or as a separate report.

8.1 Key messages

- *Overview of key content covered in this section.*

8.2 Identification of threats

- *Summarise the results of a previous ERA (undertaken as part of the initial scoping stage of the EIA process). This is expected to be a separate report, with only the summary provided here to highlight the major issues of concern.*
- *This ERA identifies the key parts of the project which have potential to impact the existing environment.*
- *The detail is in the associated ERA, and so this frees the EIA to focus on the main impacts, not have a lot of detailed description of minor effects.*

8.3 Meteorology and Air Quality

8.3.1 Potential impacts and issues to be addressed

8.3.2 Environmental management measures

8.3.3 Residual impacts

8.4 Geological setting

8.4.1 Potential impacts and issues to be addressed

8.4.2 Environmental management measures

8.4.3 Residual impacts

8.5 Physical oceanographic setting

8.5.1 Potential impacts and issues to be addressed

8.5.2 Environmental management measures

8.5.3 Residual impacts

8.6 Water quality

8.6.1 Potential impacts and issues to be addressed

8.6.2 Environmental management measures

8.6.3 Residual impacts

8.7 Seabed substrate characteristics

8.7.1 Potential impacts and issues to be addressed

8.7.2 Environmental management measures

8.7.3 Residual impacts

8.8 Natural hazards

8.8.1 Potential impacts and issues to be addressed

8.8.2 Environmental management measures

8.8.3 Residual impacts

8.9 Noise and light

8.9.1 Potential impacts and issues to be addressed

8.9.2 Environmental management measures

8.9.3 Residual impacts

8.10 Gas and chemical emissions

8.10.1 Potential impacts and issues to be addressed

8.10.2 Environmental management measures

8.10.3 Residual impacts

8.11 Vessel waste management

8.11.1 Potential impacts and issues to be addressed

8.11.2 Environmental management measures

8.11.3 Residual impacts

8.12 Cumulative impacts

The nature and extent of interactions should be considered. This is at both local, and regional scales.

8.13 Summary of residual effects

- *A table may be a useful summary format*

The aim here is to provide a description and evaluation of potential impacts of the mining or drilling operations on the physical environment components identified in Template Section 4 (see 4.8 above) from the activity described in Template Section 3 (see 4.6 above). It therefore links closely with Section 4 of the template, and uses a similar format to enable a reader to learn about the physical characteristics of the area, and directly relate them to the description of impacts. It emphasises the importance of a detailed description of methods under Section 3, as that enables an understanding of the source and nature of impacts caused directly by the operation.

The section should start with a revision of the methods, and a description of the source of impact. This typically comprises physical disturbance of the seabed, and an associated sediment plume that will disperse beyond the footprint of the direct mining or drilling operation. There is potential impact from leakage of material through riser pipes, or semi-enclosed collection methods (e.g., grab), as well as discharges of processing waters and fines after sorting on the surface platform (Figure 4-2).

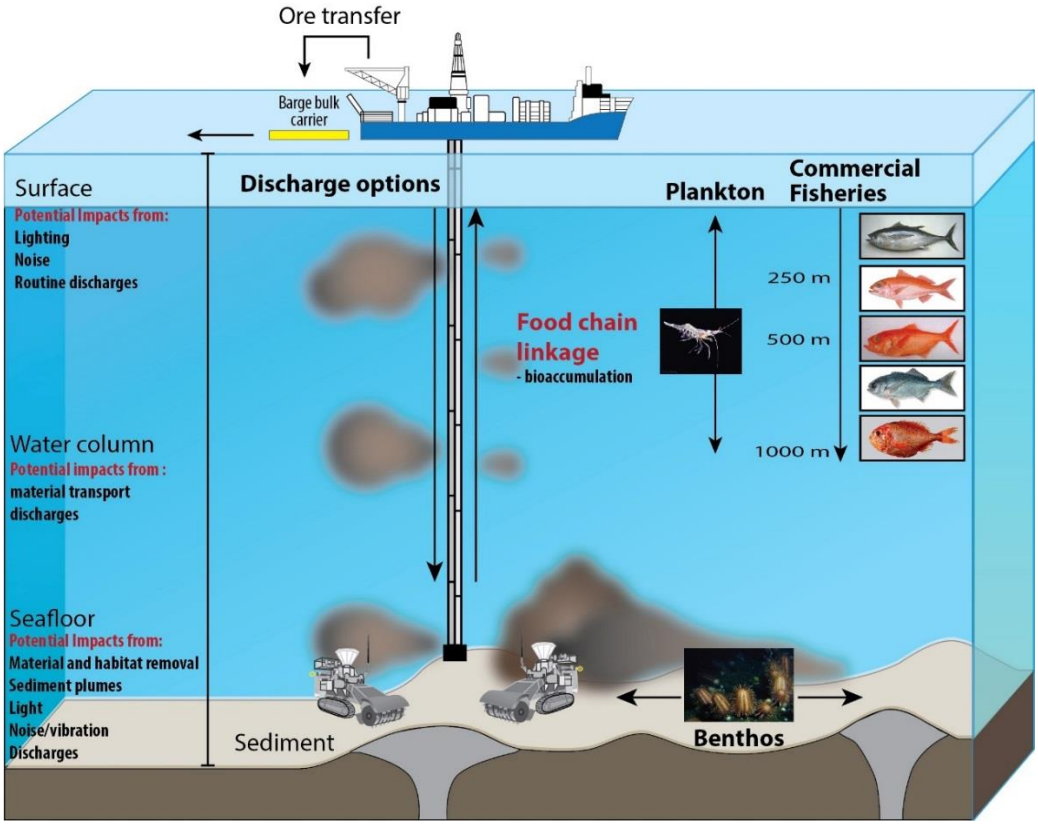

Figure 4-2: Schematic of deep-sea mining or drilling impacts. (from NIWA/IUCN)

The description of the potential physical impacts of the proposed activity can be divided into three types:

1. **Direct physical impact** of equipment and machineries on the seafloor, such as:

    - the removal or displacement of material,
    - the alteration of landforms (e.g., sandwaves, scours, pockmarks, mud volcanoes, carbonated concretions etc.), and other physical and chemical characteristics of the seafloor,
    - the radical changes or creation of small-scale topography (scarps, channels, pockmarks, mounds, etc.).

Alteration of habitat by installation of infrastructure (pipelines, platforms, anchors etc.) also needs to be considered

2. **Indirect physico-chemical impacts**.

    - Generation of sediment plumes. The formation of sediment plumes, their displacement and redeposition of sediment, and their potential impact on substrate composition and biology, is very complex and will generally require specific research including observations and numerical modelling.
    - The discharge or release of fluid or solid materials. This could be the result of drilling, dredging, transporting slurry to the surface, or rejection of unwanted residual products. This should address the contaminants of potential concern relating to the proposed operation. Estimates of volume rejected should be given. Changes in the water chemistry and assessment of potential ecotoxicity effects associated with extractive activity and potential discharges from support vessels or operational processes (e.g., drilling muds, antifouling release from structures) need to be estimated. This will require provision of data on background physico-chemical conditions and seasonal variability of these parameters. Such studies may need to be undertaken for the seabed and benthic environment as well as the water column.

3. **Surface effects**. Release of gas or solid particles in the atmosphere should be estimated. These may result from increases in natural emissions triggered by the activity or directly generated by equipment and machineries, usually onboard support and transport vessels. Generation of combusted exhaust gases (usually in the form of CO_2, CO, and NOx) potentially released to the atmosphere should be estimated.

The descriptions should consider effects that may happen during construction/development (pre-commissioning), operational (including maintenance), and decommissioning phases, as well as the potential for accidental events. The preferred approach in this template is that for each component there is a description of:

1. the nature and extent of any actual or potential impact, including cumulative impacts;
2. measures that will be taken to avoid, remedy or mitigate such impacts; and
3. what residual impacts will remain and the rationale for why these cannot be reduced.

This approach should also apply to sections 4.11, 4.12, and 4.13.

Although the details of the ERA should be provided in a separate report, a summary of risk information should be presented in the EIA (see discussion about this in section 4.11 below).

In evaluating the nature and extent of impacts, it is important to consider what type of activity is restricted under legislation. For these there must be a detailed account of impacts and mitigation options, as these will need specific EPA consent whereas permitted activities are already able to be undertaken (depending on their scale).

The impact of natural hazards is clearly different from any treatment of human-generated impacts. This part (8.8) could be divided in two parts:

- Any potential trigger of natural event directly or indirectly associated to the activity, i.e., is there any possibility that the activity would increase the likelihood of occurrence of an event (e.g., underwater landslide)?
- Any impacts of natural events – recurrent or rare - on the operation and infrastructures. Such events include extreme weather. However, some may originate from distant locations, well outside the EEZ, but with an impact, even minor, on the operations (distant tsunami, earthquakes). A management plan should be developed for such events.

This particular section may be fairly brief where the magnitude or frequency of any event is low. However, if potentially large or regular, then mitigation of impacts will be an important aspect to consider.

Where any noise and light effects resulting from the activity (e.g., vessels, ROVs, seafloor mining tools) are going to have a biological, rather than physical impact, cross-referencing between sections should enable the reader to link the cause and effect. Hence this section should relate to, and be closely integrated with, Template Section 9. Note potential adverse effects from noise and lights resulting from activities were identified in both TTR and CRP applications, and that conditions to avoid remedy and mitigate such impacts were proposed.

In line with other assessment of impact sections of the EIA, this section should start with Key messages and end with a Summary of key findings. The overall impact from the various sources need to be summarised to give an holistic view of the effects of the entire operation.

4.11 Template Section 9: Assessment of impacts on the biological environment and proposed mitigation

In this section, we provide a detailed description and evaluation of potential impacts of the mining or drilling operation to the biological environment components identified in section 5. This may need to consider effects that may happen during construction/development (pre-commissioning), operational, and decommissioning phases, as well as the potential for accidental events. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impacts; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

Note: This section (as for section 10) will focus on aspects of greatest risks to the environment. Before an EIA is written, an ecological risk assessment (ERA) should be carried out which will evaluate the likelihood and consequences of the operation having an impact on the biological environment. This means the EIA can describe in greater detail the main impacts on the physical and biological environment and not elements of minor risk. The methods and results of the ERA should be provided as an appendix to the EIA, or as a separate report.

9.1 Key messages

- Overview of key content covered in this section.

9.2 Identification of threats

- Summarise the results of a previous ERA. This is expected to be a separate report, with only the summary provided here to highlight the major issues of concern.
- This ERA identifies the key parts of the project which have potential to impact the existing environment.
- The detail is in the associated ERA, and so this frees the EIA to focus on the main impacts, not have a lot of detailed description of minor effects.
- Include the results of any test mining (if applicable) that is relevant to identifying impacts.

9.3 Biological environment

9.3.1 Surface

9.3.1.1 Potential impacts and issues to be addressed

9.3.1.2 Environmental management measures

9.3.1.3 Residual impacts

9.3.2 Midwater

9.3.2.1 Potential impacts and issues to be addressed

9.3.2.2 Environmental management measures

9.3.2.3 Residual impacts

9.3.3 Seafloor

9.3.3.1 Potential impacts and issues to be addressed

9.3.3.2 Environmental management measures

9.3.3.3 Residual impacts

9.3.4 Ecosystem/community level

9.3.4.1 Potential impacts and issues to be addressed

9.3.4.2 Environmental management measures

9.3.4.3 Residual impacts

9.3.5 Cumulative and cross-boundary effects

9.3.5.1 Potential impacts and issues to be addressed

9.3.5.2 Environmental management measures

9.3.5.3 Residual impacts

NOTE: As in section 5.3, this assessment of impacts can also be structured by "receptor" rather than by the depth range. The format does not matter, as long as the depth component is retained in the description of the range of taxa that need to be included.

9.4 Other issues

- Outline where there are other more general issues or overlap with other marine management regimes or regulations such as maritime safety, biosecurity, waste management etc.
- Aspects of existing conservation areas, management plans etc.

9.5 Summary of residual effects

- A table may be a useful summary format

This section links closely to Template Section 5 (see 4.7 above), in that the format is similar to enable a reader to learn about the biological communities and their characteristics in the area, and then directly relate the description of impacts to them. It emphasises the importance of a detailed 0description of methods under template section 3 (see 4.5 above), as that enables an understanding of the source and nature of impacts caused directly by the mining operation. This section should also link with the Ecological Risk Assessment that was performed as part of, or a separate exercise to, the preparation of this EIA. The ERA will have examined sources of impact in detail, and identified the main sources of risk, and their likely severity. ERAs, in the context of deep sea mining and drilling, have been reviewed by Ellis et al. (2014).

There are many approaches and methods to Ecological Risk Assessment (ERA). A realistic approach at the beginning of the exploration phase, given the amount of information available, is to conduct at least a Level 1 assessment in line with accepted New Zealand and Australian risk assessment standards (AS/NZS ISO 31000 2009). This assessment is based on knowledge of the activities likely to occur within the region, and their nature and extent. Likely environmental threats arising from these activities to the local habitats can be identified, and then evaluated for the likely level of risk. There are two common approaches to a Level 1 assessment: the likelihood – consequence risk assessment method (Fletcher 2005), and a more exposure-effects approach such as applied in a Scale-Intensity-

Consequence analysis (SICA, Hobday et al. 2007). These are both largely expert-opinion methods that involves convening a group of experts with knowledge of a range of biological aspects, who then progress through 3 main steps:

1. examination of sources of risk, their magnitudes, scales, frequencies and intensities;
2. assessment of the potential consequences of those risks; and
3. likelihood of a particular level of consequence occurring from the various activities.

Scores are given to the potential consequence of each identified activity that results in an assessment of the **relative** significance of the likely impact.

A likelihood-consequence analysis was carried out by MacDiarmid et al. (2012) to give managers an indication of what sort of activities were likely to cause most impact across a range of resource and mining operations. The results of this type of assessment are given for a New Zealand example in Table 4-1 (Table 4.8 in MacDiarmid et al. 2012).

Table 4-1: Example risk assessment. This is a subset of the activity-threat combinations that result in a relative score and hence enables a ranking of the impact of activities. From MacDiarmid et al. (2012).

Table 4-8: Expert Panel Assessment: Polymetalic crust mining. Levels of consequence, likelihood, risk and confidence associated with this activity in the EEZ and ECS. Activities are listed (a, b, c, etc) after each threat to which they contribute. The maximum possible level of environmental risk is 30. Extreme environmental risks are highlighted in red, high in yellow, and moderate in green. Low risk activities are not highlighted. *Threats managed under the Maritime Transport Act (1994). NA = not applicable as species assessed are all protected.

Expert Panel Assessment: Polymetalic crusts		Recovery period				Key species				Protected species				Ecosystem functional impact				Proportion of habitat affected			
Activity	**Threat**	Consequence	Likelihood	Risk	Confidence	Consequence	Likelihood	Risk	Confidence	Consequence	Likelihood	Risk	Confidence	Consequence	Likelihood	Risk	Confidence	Consequence	Likelihood	Risk	Confidence
Prospecting a) Surface flood lights and noise b) ROV and other imaging surveys c) Acoustic swath mapping d) Sub-bottom profiling using CHIRPS, boomers and sparkers e) Spot sampling using ROV, submersible, or rock dredge f) Survey vessel activities	*Seabird attraction, disturbance, collision (a)	1	6	6	2b	NA	NA	NA	NA	3	5	15	2b	0	6	0	2b	3	6	18	2b
	Acoustic impact from multi-beam echo sounders on marine mammals, reptiles, fish and invertebrates (c)	0	5	0	2a	0	6	0	2a	1	5	0	2a	0	6	0	2a	0	6	0	2a
	Acoustic impact of high resolution seismics on marine mammals, reptiles, fish and invertebrates (d)	1	6	6	2a	2	6	12	1c	2	6	12	2a	0	6	0	2b	2	6	12	2b
	*Ship strikes on marine mammals, fish, and reptiles (f)	3	6	18	2b	2	2	4	2b	2	2	4	1c	0	6	0	2b	0	6	0	2b
	Impact on benthos (b, e)	4	3	12	1c	1	4	4	2a	1	4	4	2a	2	5	10	1c	1	6	6	2a
Exploration g) Surface flood lights and noise h) Test extraction methods i) Bulk sampling j) Sediment plume k) Underwater noise l) Sub-bottom profiling using CHIRPS,	*Seabird attraction, disturbance, collision (g)	0	6	0	2b	NA	NA	NA	NA	2	5	10	2b	0	6	0	2b	0	6	0	2b
	Impact on benthos (h, i)	4	6	24	1c	2	4	8	2a	1	4	4	2a	2	5	10	2a	1	4	4	2b
	Acoustic impact on marine mammals, reptiles, fish and invertebrates (l, m)	1	6	6	2a	2	6	12	1c	2	6	12	2a	0	6	0	2b	2	6	12	2b
	Entanglement of megafauna (h, i)	3	5	15	2b	1	3	3	2b	1	3	3	2b	0	6	0	2b	0	6	0	2b

Where the nature of the resource, site, and technology specific characteristics are known, an exposure-effects approach may be more appropriate. The "likelihood" component of an assessment is then less relevant than assessing the nature and extent of impacts that will definitely occur.

The level 1 SICA analysis assesses the impact of each of 32 potential impact activities on 5 ecological components (target, bycatch and byproducts, Endangered, Threatened and Protected species, habitats, communities/ecosystem). Expert judgement classifies each on a 6-point scale from negligible to catastrophic. Activity/component combinations for which the risk score is greater than a certain level (moderate or above has been adopted in many cases) are taken through to level 2 analysis. There are 10 principal steps in a SICA analysis, which correspond to columns in a summary table:

1) Record the hazard identification score (absence, presence)
2) Score spatial scale of the activity
3) Score temporal scale of the activity
4) Choose the sub-component most likely to be affected by activity
5) Choose the most vulnerable unit of analysis for the component
6) Select the most appropriate operational objective
7) Score the intensity of the activity for that sub-component
8) Score the consequence resulting from the intensity for that subcomponent
9) Record confidence/uncertainty for the consequence scores
10) Document rationale for each of the above steps

The SICA method and tables described by Hobday et al. (2007) are designed for fisheries, and so need to be made more specific to a seabed mining or drilling operation, although the activity of bottom trawling covers many of the relevant impacts.

The results of this level 1 qualitative risk assessment should guide data collection during exploration activities, as a more quantitative assessment is likely to be required before progressing to a mining licence application stage. So a level 1 assessment identifies the main issues, and a level 2 assessment applies a more rigorous evaluation of risk to those factors/effects that are identified as high risk. In addition to a standard ecological set of conditions to be assessed, a chemical risk assessment process relative to water, sediment and tissue body-burden is an important component of the EIA.

As stated above, the method used for an ERA may vary, but any assessment should be transparent, and rank activities in such a way as to highlight those that have a high risk of causing an impact. These should be emphasised in the EIA. Even low risk activities are included, but do not need to be described in as much detail.

The details of the ERA should be provided in a separate report (as an appendix), but summary information presented in the EIA.

Impacts of the mining or drilling operations will be resource, site, and method dependent. There are many potential impacts, but some of the key effects on biological structure and function that this section should always consider include:

- **Potential surface impacts (0–200 m)**
  - increased vessel activities and potential pollution (from vessel discharges and wastes) of the surrounding area
  - reduction in primary production (e.g., through shading by discharges) (in shallow or clear deeper water this may affect macroalgae or microalgae on the seafloor)
  - stimulation of primary production by increased nutrient release (e.g., nitrogen, iron in discharges) in photic depths

- reduction in the availability of prey (through either changes in abundance, displacement, or visibility)effects (e.g. displacement) on surface/deep-diving mammals and birds, fish and mobile pelagic invertebrates(e.g., through changes in water composition and clarity or noise/lights)
- this includes vessel-based effects above the actual sea surface

- **Potential water column impacts (200–50 m above seafloor)**
  - plankton/mesopelagic fish mortality
  - toxic effects with metal and other contaminants (e.g., ammonia, sulphides, pH reduction) release
  - bioaccumulation of toxic metals though the midwater food chain
  - sediment plume effects through water column (e.g., visual clarity reduction for feeding)
  - potential oxygen depletion at depth
  - effects on deep-diving marine mammals
  - potential noise effects (direct avoidance, masking faunal communication, feeding disruption)
- **Potential benthic impacts (seafloor to 50 m above)**
  - direct physical impact of mining/sampling gear
  - smothering/burying of animals by sediment
  - clogging of suspension feeding structures
  - toxic effects with metal and other contaminants (e.g., ammonia, sulphides) release
  - loss of essential habitat (e.g., spawning/nursery, feeding grounds)
  - loss of other habitats and/or communities of particular biological importance

As in template section 5, this assessment of impacts can also be structured by “receptor” rather than by the depth range. With this approach, the description is based on the main biological groups:

- Primary producers
  - Phytoplankton

    Impacts and issues to be addressed

    Environmental management measures

    Residual impacts
  - Micro- and macro-algae

    Impacts and issues to be addressed

    Environmental management measures

    Residual impacts

- Zooplankton
    - Impacts and issues to be addressed
    - Environmental management measures
    - Residual impacts
- Mesopelagic fauna
    - Fish [Impacts, Management measures, Residual subheadings]
    - Squids [Impacts, Management measures, Residual subheadings]
    - Macrozooplankton [Impacts, Management measures, Residual subheadings]
- Fish [Impacts, Management measures, Residual subheadings]
    - assemblages
    - pelagic species
    - demersal species
- Marine mammals [Impacts, Management measures, Residual subheadings]
    - cetaceans
    - pinnipeds
- Seabirds [Impacts, Management measures, Residual subheadings]
- Other rare or endangered species [Impacts, Management measures, residual subheadings]
    - e.g., turtles
- Benthic invertebrates [Impacts, Management measures, Residual subheadings]
    - Microfauna, meiofauna, macrofauna, megafauna
    - Microbes and protists
    - Assemblages
- Sensitive habitats [Impacts, Management measures, Residual subheadings]

The Sensitive Habitats section is very important here. The EPA Permitted Activities Regulations (Schedule 6) define 13 sensitive habitat types (see Template Section 5), and provide indicative criteria and thresholds as to whether they are potentially sensitive:

The likelihood of encountering some of these habitats depends on the environment of the resource type being considered, yet even where it is highly unlikely to occur (e.g., seapen fields on a seamount with SMS potential) it is suggested that each habitat type is considered so that it is clear which habitats require detailed attention in the EIA.

The effects of noise/vibrations are poorly understood for many marine species. There are guidelines for assessing effects of sound on marine mammals (NMFS 2016), and for New Zealand the potential impact of noise on marine mammals from seismic reflection, and the required mitigating actions are addressed in the 2013 Code of conduct for minimising acoustic disturbance to marine mammals from seismic survey operations (New Zealand Department of Conservation), but data on thresholds of noise that cause physiological impacts (such as hearing damage, barotrauma, stress) on fishes are less developed (Popper & Hastings 2009, Hawkins et al. 2014). Natural sources of noise in the marine environment are important for sensing the environment, and for communication by animals. Behavioural responses include fish avoiding large approaching vessels; disruption of spawning sites in shallow coastal waters; and altered predator-prey detection responses (see review by Stanley & Jeffs 2016).

Masking of animal communication vocalisations may also be a serious and long lasting issue of mining operations rather than seismic operations which may only be used extensively during exploration phases. If the sound to be produced by the mining operation is known then effects on marine mammals and fish (such as blue whales and gurnard with documented vocalisations and sensitivities) can be modelled.

This section, with description of impacts, management measures, and residual impacts is clearly a critical one to enable the EPA and other management agencies to assess the nature and extent of impacts, what can be reduced by various operating measures, and what impacts remain that then need to be considered. When there are impacts that cannot be avoided, it is important to describe both the spatial and temporal extent of these.

Temporal considerations:

This should include an assessment of the relative impacts on different components of the ecosystem, as some will be affected more than others (e.g., sessile species versus mobile ones that have an ability to move), and whether this could lead to a change in the structure of the system, or any regime shift over time if mortality rates on key taxa are very high. The timing of impacts relative to important biological events (e.g., spawning, migration) needs to be assessed. There should also be consideration of the likely recovery potential of various faunal components of the ecosystem, and hence the duration of any disturbance effects.

Spatial considerations:

Ecological: A key component of any management plan will be how any damage to ecosystem structure or function can be conserved elsewhere. If residual effects are severe, then the broader impact of these on representative, abundant, or rare communities will need to be evaluated. The practicality and effectiveness of spatial management options will likely be a major aspect of how residual impacts can be managed. There are numerous types of spatial management areas that could be mentioned in this section, but they should be developed further in Template section 12, with much more detail in the subsequent Environmental Management Plan. Some options include:

- closed areas within the mining or drilling region to protect particularly rare or vulnerable communities
- preservation reference (or “control”) sites to enable monitoring of changes of representative faunal communities in mined versus non-mined areas of the region, and

- protected areas outside the affected region that replicate faunal communities within the mined area, and allow for conservation of the ecosystem structure of the broader area, and perhaps recolonisation of the impacted sites.

There is an extensive literature on the design of spatial management zones and Marine Protected Areas. Papers that give a good introduction to the concepts that need to be considered are Botsford et al. (2003), Crowder & Norse (2008), Ehler & Douvere (2009), and Wedding et al. (2013).

Operational. The process of seabed mining or drilling will of necessity require some consideration of mixing and dispersion associated with the return of seabed-derived contaminants in the water column at some height above the ocean floor. This continuous mining process will discharge wastes and generate a plume of sediment-laden material with associated chemical contaminants. The characteristics of this plume and its dispersion requires a consideration of the extent of mixing in the water column, where contaminant concentrations may be elevated.

The use of mathematical models is generally required to provide predictions of the mixing of discharges from the end of a pipe. A commonly used model is CORMIX developed by the US EPA for discharge simulations (Jirka et al. 1996), although more sophisticated models are available which provide predictions of concentrations in the near-field and far-field areas of the plume. The key information required from such models include the size of the plume and concentrations of contaminants with distance away from the discharge point.

Tiered assessment approaches covering a range of different methods at different scales are often employed for chemical contaminant assessment. These include elutriation testing and longer-term assessments relating to potential whole sediment toxicity. Guidance on these assessments are provided in various dredge disposal guidance documents from various jurisdictions (e.g., NZGSDW 1999, US EPA 1991) and see section 3.2 of Ellis et al. (2014).

EIA risk assessments for potential discharges from oil drilling operations (e.g., Husky Oil 2001) may differ from seabed mining. For these operations potential hazards include (i) chemicals discharged from surface operations; (ii) discharge of drilling muds; (iii) oil residues during exploration and production activities; and (iv) chemicals used to treat oil spillages (e.g., dispersants). While the likelihood of oil spillages may be considered low, the consequences of oil spillages may be very high because of threats to surface-dwelling species (e.g., birds, mammals) and wind-driven transport processes.

In line with other assessment of impact sections of the EIA, this section should start with Key messages and end with a Summary of key findings.

4.12 Template Section 10: Assessment of impacts on the onshore environment and proposed mitigation

In this section, provide a detailed description and evaluation of potential impacts of the mining or drilling operation to the onshore environment components identified in section 6. This may need to consider effects that may happen during construction/development (pre-commissioning), operational, and decommissioning phases, as well as the potential for accidents. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impacts; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

10.1 Key messages

- *Overview of key content covered in this section.*

10.2 Identification of threats

- *Summarise the results of a previous Ecological Risk Assessment. This is expected to be a separate report, with only the summary provided here to highlight the major issues of concern.*
- *This ERA identifies the key parts of the project which have potential to impact the existing environment.*
- *The detail is in the associated ERA, and so this frees the EIA to focus on the main impacts, not have a lot of detailed description of minor effects.*

10.3 Physico-chemical environment

10.3.1 Potential impacts and issues to be addressed

10.3.2 Environmental management measures

10.3.3 Residual impacts

10.4 Biological environment

10.4.1 Potential impacts and issues to be addressed

10.4.2 Environmental management measures

10.4.3 Residual impacts

10.5 Summary of residual effects

- *A table may be a useful summary format*
- *Potential cumulative effects should also be included.*

The aim of this section of the EIA is to provide a detailed description and evaluation of potential impacts of the operation to the onshore environment components identified in Template Section 6 (see 4.8 above). This will vary with national legislative requirements, and whether the activity is contained entirely within the EEZ or includes activities that span national or jurisdictional boundaries (e.g., High Seas/National waters, EEZ/Territorial Seas, EEZ Act/RMA). The overall length of this section will depend on the extent of cross-boundary and onshore activity.

We recommend that an ERA (see 4.12 above) is carried out to identify the key threats, which are summarised in this section of the EIA. The potential impacts of these threats on the existing onshore environment is then assessed, management measures explored, and any residual effects identified. As in Template Section 6 of the EIA (see 4.8 above), it may be useful to organise these sections according to the relevant restrictions under the RMA sections 9-16 (outlined in 4.4 above); e.g. discharges to land, water or air and potential impacts on physical and biological aspects of the environment. It is also important for these sections to make clear the expected time for the respective systems to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

In line with other assessment of impact sections of the EIA, this section should start with Key messages and end with a Summary of key findings.

4.13 Template Section 11: Assessment of impacts on the socio-economic environment and proposed mitigation

As per preceding sections, provide a detailed description and evaluation of potential impacts of the mining or drilling operation to the socio-economic components identified in section 7. This may need to consider effects that may happen during construction/development (pre-commissioning), operational, and decommissioning phases, as well as potential for accidental events. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impact; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

11.1 Key messages

- *Overview of key content covered in this section.*

11.2 Existing Uses

11.2.1 Fisheries

11.2.1.1 Potential impacts and issues to be addressed

11.2.1.2 Environmental management measures

11.2.1.3 Residual impacts

11.2.2 Marine Traffic

11.2.2.1 Potential impacts and issues to be addressed

11.2.2.2 Environmental management measures

11.2.2.3 Residual impacts

11.2.3 Tourism

11.2.3.1 Potential impacts and issues to be addressed

11.2.3.2 Environmental management measures

11.2.3.3 Residual impacts

11.2.4 Marine Scientific Research

11.2.4.1 Potential impacts and issues to be addressed

11.2.4.2 Environmental management measures

11.2.4.3 Residual impacts

11.2.5 Conservation Areas

11.2.5.1 Potential impacts and issues to be addressed

11.2.5.2 Environmental management measures

11.2.5.3 Residual impacts

11.2.6 Other

11.2.6.1 Potential impacts and issues to be addressed

11.2.6.2 Environmental management measures

11.2.6.3 Residual impacts

11.3 Cultural environment

11.3.1 Potential impacts and issues to be addressed

11.3.2 Environmental management measures

11.3.3 Residual impacts

11.4 Historic heritage

11.4.1 Potential impacts and issues to be addressed

11.4.2 Environmental management measures

11.4.3 Residual impacts

11.5 Socio-economic and socio-cultural aspects

11.5.1 Potential impacts and issues to be addressed

11.5.2 Environmental management measures

11.5.3 Residual impacts

11.6 Summary of residual effects

- *A table may be a useful summary format.*
- *Potential cumulative effects should also be included.*

The aim of this section of the EIA is to provide a detailed description and evaluation of potential impacts of the operation on the socio-economic environment, especially those components identified in Template Section 7 (see section 4.9 above). It relates primarily to other uses and the offshore marine environment rather than the onshore situation.

Socio-economic impact assessment can include consideration of the desirability of outcomes (from beneficial to adverse), the scale of effects (e.g. creation of jobs, estimates of risk of environmental impacts), extent of duration of impacts in time and space, intensity or severity of social impacts and an assessment of whether impacts are likely to be cumulative. It is important to consider the social equity or distribution of impacts across different populations, i.e. which groups are likely to be affected in which ways. In the case of proposed projects that involve controversy, attitudes and perceptions towards the proposed project are one of the variables that must be considered in determining the significance of impacts.

There are a number of steps that can help with constructing the likely nature and extent of potential impacts on existing interests. The steps identified below are recommended by NOAA (1994) and are still current as best practice for social impact assessments. Firstly, scoping and identification of the probable social impacts for each of the existing interests can be based on the consultation process or interviews. Consideration needs to be devoted to the impacts perceived by affected groups and communities. Principal methods can include public meetings, interviews, workshops, surveys, and reviews of the existing social science literature.

Secondly the likely and possible effects must be estimated. The probable social impacts can be formulated in terms of predicted conditions without the proposed activity (baseline projection, from template section 7); predicted conditions with the proposed activity; and predicted impacts, which can be interpreted as the differences between the future with and without the proposed activity.

After direct impacts have been estimated, the assessment should consider how affected people will respond in terms of attitude and actions. The assessment should also consider cumulative impacts which are those impacts which result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions.

Economic benefit should be described in terms of profit (net of costs) and new jobs created, including the location of those jobs and the persons to whom the profits will accrue. Indirect economic effects, i.e. additional jobs, revenue or economic activity in related or secondary sectors, should only be included if there is significant under-employment or under-capacity in relevant sectors of the economy, and these should be identified separately from direct employment and revenue from the proposed activity.

A social impact assessment not only forecasts impacts, it should identify means to mitigate adverse impacts. Mitigation includes avoiding the impact by not taking or modifying an action; minimising, rectifying, or reducing the impacts through the design or operation of the project; or compensating for the impact by providing substitute facilities or resources.

Cultural impact assessment

A Cultural Impact Assessment (CIA) is a report documenting Māori cultural values (including both iwi Māori and imi Moriori), interests and associations with an area or a resource, and the potential impacts of a proposed activity on these. CIAs are a tool to facilitate meaningful and effective participation of Māori in impact assessment. Some iwi/hapū use the terms 'Tangata Whenua Impact Assessment', or 'Tangata Whenua Effects Assessment', to describe the impact assessment process and report.

The content and structure of a CIA may differ between iwi/hapū groups and with the nature and scale of the proposed activity. However, a CIA generally includes:

- Information on the relevant cultural values associated with the site or area (noting that iwi/hapū may choose not to fully disclose information about some sites);
- The effects on those values, and the relationship of tangata whenua to them, as a result of the proposed activity; and
- Recommendations to avoid, remedy or mitigate adverse effects, including but not limited to recommended conditions of consent should the application be granted.

A CIA report will also include the methodology or description of the consultative processes used in preparing the report (site visit, hui, tangata whenua presentations, reviews of draft and sign off), as well as a brief overview of the relevant planning framework and iwi/hapū expectations for the process following the CIA.

The Quality Planning website provides further information on preparing CIA's (see www.qualityplanning.org.nz for further information), and the EPA website hosts a report by Repo Consultancy (2010), as well as general advice (see http://www.epa.govt.nz/EEZ/working_eez/Pages/engaging_with_maori.aspx). Additional resources include Te Puni Kōkiri which has developed a national web-based database that provides information on the iwi authorities within each region and district and the areas over which one or more iwi exercise kaitiakitanga.

In line with other assessment of impact sections of the EIA, this section should start with key messages and end with a summary of key findings.

4.14 Template Section 12: Environmental management, monitoring and reporting

Sufficient information should be provided to enable regulatory agencies to anticipate possible environmental management, monitoring and reporting requirements for an environmental permit. Information listed should reflect the proponent's environmental policy (Environment Management System (EMS)) during different stages in the project life, i.e. from construction to decommissioning and closure. Information detailed in this section should include, but not be limited to, the headings below:

12.1 Organizational structure and responsibilities

This section should show how the Contractor's environmental management team fits into its overall organizational structure. Responsibilities of key personnel should be outlined.

12.2 Environmental Management System (EMS)

Although a full EMS may not exist at the time the EIA is submitted, this section should outline the standards that will be considered and/or aligned with developing the EMS for the project.

12.3 Environmental Management Plan (EMP)

This differs in detail between what is needed at the time of the EIA for a New Zealand assessment, and the EMP subsequently needed under the ISA and SPC processes. Irrespective of position in the sequence, an EMP will be submitted as a separate document for approval prior to exploitation operations commencing. This section should provide an overview of what an EMP would entail. This section shall include, as a minimum, the following headings:

12.3.1 Mitigation and Management

This section should summarize the actions and commitments that have arisen from the impact minimisation and mitigation strategies. There may be different rehabilitation strategies and activities for operations during mining, and those for closure.

12.3.2 Monitoring plan

This section should summarize the monitoring plan approach and specific detail of the monitoring programme.

12.3.3 Closure plan

It is expected that a closure plan will be submitted as a separate document for the Regulatory Authority's approval. However, this section should provide an overview of what the closure plan will entail, including decommissioning, continued monitoring and rehabilitation measures, if applicable.

12.4 Reporting

12.4.1Monitoring

This section should outline how results of monitoring studies will be reported to the Regulatory Authority.

12.4.2 Incident Reporting

This section should outline how incidents will be reported.

Details about environmental management issues and procedures are often developed in international assessment processes beyond the EIA, at the stage of an Environmental Impact Statement (EIS), and an Environmental Management Plan (EMP). There is often considerable confusion about what goes where in various Assessment/Statement/Report formats. In this EIA template we have largely limited scope to the assessment of environmental impacts, although recent EPA decisions under the EEZ Act highlight the importance of including EMP and/or adaptive management plans in conjunction with the EIA to aid decision-makers. Hence this section of the template is an opportunity to highlight the main aspects of monitoring and reporting procedures that will be central to environmental management planning.

An EMP defines and describes the measures to prevent and/or minimise impacts identified in the EIA. It lays out procedures showing how the mining company manages the implementation of mitigation measures, how it will monitor their effectiveness, how it will act in response to the monitoring, and what reporting systems will be followed. There is a large body of literature available describing EMP structure and content, and most are generically similar despite application to different industries and resource types. General guideline documents that are useful include Auckland Council (2014) and Australian Department of the Environment (2014). Swaddling (2016) also gives a good overview of the EMP process, and suggests a number of sub-plans that include for each aspect covered measurable objectives, targets, frequency and timeframe, responsible personnel, measures of success, procedures for dealing with non-conformance, and corrective action. These sub-plans include:

- Environmental monitoring
- Training and awareness
- Water use management
- Materials handling and storage
- Leak and spillage management
- Waste management
- Dust management
- Noise management
- Decommissioning and closure
- Stakeholder engagement (internal and external communication)
- Socio-economic impacts management
- Emergency preparedness and response
- Occupational health and safety

Environmental monitoring is the main aspect of EMPs that concern us here, as monitoring programmes are critical to confirm that the effects of the proposed project are as predicted in

template sections 8, 9, 10, and 11. In the following we focus our discussion on monitoring for physical, chemical and biological effects.

The design of a monitoring programme will be based on results of an environmental baseline survey/s. Baseline studies must occur prior to submission of an EIA and before any operation can start. Data need to represent the undisturbed environment as much as possible, and hence need to be included in plans for the exploration phase from the outset. These data form the benchmark against which conditions during development and commencement of the project can be measured.

The nature and level of monitoring should be proportional to the expected or potential impact identified in the main body of the EIA, especially where the residual effects are large, or there is considerable uncertainty. Aspects to consider when evaluating monitoring priorities include whether an impact is persistent, toxic or noxious, can bio-accumulate, is radioactive, is widely spread (transboundary significance), could cause undesirable changes in ecosystems, is irreversible, or can interfere with other marine uses (e.g., fishing, food production) (OSPAR Convention 1992). The main components of the impact monitoring process are given in Figure 4-3.

Figure 4-3: Components of the environmental monitoring process (from Swaddling 2016).

There are two "categories" of monitoring

- Operational monitoring: including mining or drilling location and rate, volumes discharged, hazardous discharge events and quantity of mined material removed.
- Effects monitoring: including physical (e.g., clarity, sediment deposition), chemical (e.g., analytical suite of contaminants, zone of initial mixing for guideline comparisons, relevant water and sediment quality guidelines, bioaccumulation assessment) and biological monitoring (e.g., sentinel species, survey approaches).

The main aspects to be included, and parameters to be measured, for both baseline and monitoring survey programmes are described in the guidelines on scientific research developed by the SPC-EU DSM project and NIWA (Swaddling et al. 2016). This report covers survey design, sampling equipment, and "best scientific practices" for deep-sea sampling relevant to marine minerals. A summary table from that report on recommended scientific studies, their rationale, and methods, is reproduced as Appendix E, which provides a starting point for determining the studies that need to be conducted for monitoring changes over time and space.

Table 13.1 in the Nautilus EIS (Coffey Natural Systems/Nautilus Minerals, 2008) is a helpful reference, even though specific to Seafloor Massive Sulphide (SMS) resources. It covers several ecological aspects that should be considered, and summarises the proposed (or existing) baseline studies, as well as methods for validation and monitoring to ensure mitigation is appropriate. These aspects include:

- Geological processes (e.g., venting dynamics with SMS)
- Topography changes
- Plume formation over time from re-suspended sediment
- Sediment deposition effects
- Genetic structure of the population/s
- Faunal abundance changes
- Larval recruitment and settlement patterns
- Effects of lights, noise, vibration, etc.
- Animal recolonisation
- Recovery of trophic structure
- Concentration of contaminants in discharges.

Baseline studies

Baseline data collection, and short-term monitoring studies, are important aspects of prospecting and exploration activities, as they underpin the preparation of an EIA, prior to any application for a full mining permit. It is expected that some information will be available from an area before any exploration occurs, and desk-top studies will form the basis of initial scoping of the activity/project. However, available data will invariably be inadequate to describe and characterise the receiving environment of any likely mining site. Hence baseline surveys and targeted scientific studies will be needed to provide the pre-mining state of the environment, as well as some monitoring of conditions over time to understand temporal variability of some key environmental factors. Such studies will need to cover a wide range of research aspects (Figure 4-4).

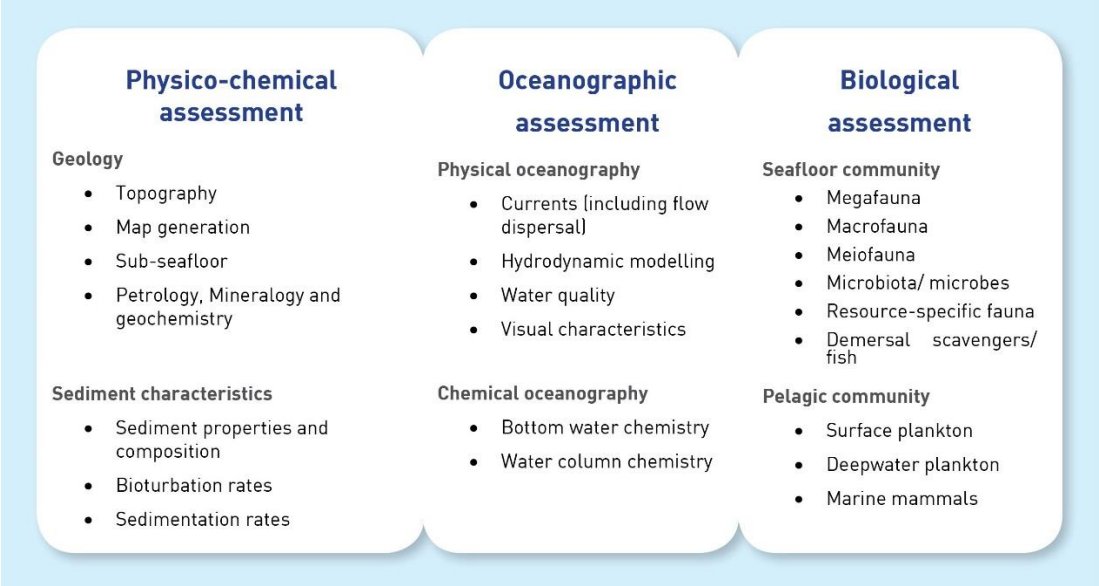

Figure 4-4: The types of scientific studies required for initial baseline (and subsequent monitoring) surveys. (from Swaddling et al. 2016)

Details are not repeated here, and we refer applicants to the detailed SPC-EU-NIWA report (Swaddling et al. 2016). In addition to that resource, the ISA has published two reports that describe and give some advice on the sorts of studies, type of data, and nature of sampling (physico-chemical and biological) required for both baseline measurements and ongoing monitoring. These cover manganese nodule (ISA 1999), seafloor massive sulphide, and cobalt-rich crust resources (ISA 2007). However, the type of information provided can apply much more generically to other mineral resources. Wherever appropriate, the recommendations from the ISA reports have been incorporated into Swaddling et al (2016).

Monitoring

Validation and monitoring studies should start as soon as possible after operations commence. They may be specified in consent conditions, although the level of detail may be left to the separate EMP. Monitoring studies are expected to be a combination of short-term validation studies that can confirm predicted project impacts (e.g., plume modelling versus empirical observations of sedimentation) and longer-term monitoring studies that provide regular updates on environmental conditions.

Monitoring is an integral part of any marine consent, and hence there should be a well thought out and justified explanation of what, how, and why monitoring is occurring. It is easy to put down a long list of environmental parameters that can be measured, but there are several key points to consider beyond this:

- describe why these particular variables are being assessed (i.e., what the information will tell the company and managers).
- explain how the parameters are measured. The metrics used for the particular variables must be reliable, and an indication of measurement accuracy and precision given.

- ensure that any measurements taken are done so in a standardised way, that equipment is adequate, and as comparable with other gear used for similar studies in the region (enabling some integration to benefit regional knowledge).

The purpose and content of a proposed Monitoring Plan should provide clear and specific statements of objectives and criteria for actions. It should not merely include monitoring for trends which are not linked to triggering thresholds for management responses. There must be an assessment of what level of change constitutes an adverse effect, when the expected limits of change as outlined in the EIA are exceeded. This must accompany some decision rules about what will then happen. It is inadequate to just monitor, and then think about what the changes mean afterwards. This should be discussed with the regulatory authority, as acceptable levels of environmental change as a consequence of the activity (environmental performance standards) will influence the type and level of monitoring, and the plan may be modified based on consent conditions assessed and imposed by managers.

Monitoring studies, including their rationale, and methodologies, are covered by Swaddling et al (2016). A major section of the report describes aspects of fundamental survey design, emphasising the need to have clear objectives, which then dictate aspects such as sampling scale, spatial design, sampling unit size, sample number, and sampling gear. Annex 4 then goes on to provide current best practice methodology for conducting this research.

The EEZ Act requires the EPA to consider an adaptive management approach to address lack of information, and hence a monitoring programme should ensure that an adaptive management concept is supported by appropriate data. Adaptive management can be a complicated area of science and management (see section 3.10), and it is important that in developing such an approach, and an associated monitoring programme, that there is consultation with the EPA to ascertain their detailed requirements about an acceptable level of environmental risk.

4.15 Template Section 13: Consultation

This describes the nature and extent of consultation with parties identified to have existing interests in the proposed project area, as well as relevant Iwi Māori and other stakeholders

This can be considered earlier in the document in some situations where knowledge of the extent of consultation is critical to progressing further. It may aid gaining confidence in the information to be provided in the body of the EIA.

13.1 Consultation methods

- *Describe how you have consulted with different groups.*

13.2 Existing interests

- *Identify any parties with potential existing interests in the area that may be impacted by the proposed activity.*

13.3 Tangata whenua

- *Any iwi, hapū, customary marine title group, and protected customary rights group that have been notified and consulted.*

- *This should include both iwi Māori and imi Moriori*

13.4 Other stakeholders

- *Include other stakeholders that have been consulted.*

13.5 Public consultation

- *Describe the goals and approach to methods and workshops that have occurred with the general public.*

13.6 Ongoing consultation plans

- *What further consultation with stakeholders is planned, or needed?*

Consultation involves talking with people who may be interested in, or affected by, a proposed activity. It is an opportunity to inform people about the proposed project and an invitation for those affected to contribute to the project design/issue identification and resolution process. Consultation needs to be done early in the process and as often as required. While consultation about resource consents is not mandatory under the RMA, it is good practice and can reduce costs and delays later in the process. Under the EEZ Act, applicants for a marine consent must describe any consultation undertaken with existing interests potentially affected by their proposed activity. Early and full consultation can identify and resolve issues and reduce affected parties' concerns and opposition to proposed projects.

Under RMA consultation requirements, applicants should:

- provide enough time and information to the consulted party so they can make intelligent and informed decisions
- provide enough time for the consulted party to participate and for their advice to be considered
- genuinely consider that advice, including keeping an open mind and having a willingness to change. The detail of a proposed project should not be pre-determined.

Consultation involves talking with parties including relevant iwi, hapū, customary marine title groups and other stakeholders. Section 4.9 of this guidance (EIA template section 7) provides guidance on identifying existing interests.

As well as describing the consultation methods, a summary of key findings and whether further consultation with stakeholders is required should be included in this section.

4.16 Template Section 14: Glossary

This section is self-explanatory. It includes:

- *Relevant terms are explained (e.g. terms under different legislation, technical terms).*
- *List of acronyms.*

If your EIA has introduced particular terms relevant to legislation or technical disciplines, a glossary should be included. This recognises the fact that different terms may mean different things to potential readers of the EIA (decision makers, technical consultants undertaking reviews, members of the public) and so a clear definition will be essential. It is also important to ensure, when your EIA is being edited before submission, that you have been consistent with your use of these terms. If a glossary is included, it may be useful to state that in the Introduction section where the EIA format is outlined (see 4.3).

4.17 Template Section 15: Study team

This comprises a list and description of the main people involved in the EIA, their areas of skill and technical expertise, and institute/consultancy/company affiliations.

Include a list and summary biography (1-2 paragraphs) for key people involved in the preparation of the EIA, including their qualifications, professional area of expertise and years of experience. This can allow the decision maker to have confidence in the EIA work. This may be especially important in EIAs for large, complex proposals, or proposals in sensitive areas. Full CVs could be made available on request.

4.18 Section 16: References

References are provided for:

- *Citations from the EIA.*
- *Technical reports, previous studies.*

Any evidence provided in the EIA from other sources should be clearly referenced, and this list at the end of the EIA document should state the full details of any documents cited in the text. This should include clear links (e.g. website urls with date of access) to where the cited references can be obtained, so that the decision makers can access this information readily.

4.19 Template Section 17: Appendices

Include technical reports carried out for parts of EIA (e.g., the ERA, other important studies such as sediment plume modelling, ecotoxicity research).

In preparing the EIA, thought should be given early on to the level of technical detail included in the main body of the EIA and what can be appended. We suggest that technical reports referred to throughout the EIA are appended, and summarised in the main body of the EIA. This approach will make the main EIA easier for decision makers to navigate and understand, but ensures appropriate technical detail is available where required. The appendices may therefore form many hundreds of pages for complex proposals.

5 Acknowledgements

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6 Glossary of abbreviations and terms

Adaptive management	An experimental approach to management, or structured “learning by doing”, based on developing dynamic models that attempt to make predictions or hypotheses about the impacts of alternative management policies. Management learning proceeds by systematic testing of models rather than by random trial and error.
AEE	Assessment of Environmental Effects
Benthic	Associated with the seafloor
Biotope	Both the abiotic and biotic elements of habitats. Usually applies to physical habitats and their associated faunal communities
Coastal Marine Area	As defined under the Resource Management Act 1991, the area between mean high water springs (HWMS) and 12 nm, managed by regional or unitary authorities.
Contaminant	Includes any substance (including gases, [odorous compounds,] liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat— (a)When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or (b)When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged (Resource Management Act)

Demersal	An animal that lives on or near the seafloor
DOC	NZ Department of Conservation
ECS	Extended Continental Shelf: this applies to the seabed and subsoil of submarine areas extending out to the continental margin-in many cases it extends further than the EEZ.
EEZ	Exclusive Economic Zone: this extends from the territorial sea (12 nautical miles) to 200 nautical miles off the coast and offshore islands of New Zealand.
EEZ Act	The Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
Effect	Under the EEZ Act, effect includes— (a) any positive or adverse effect; and (b) any temporary or permanent effect; and (c) any past, present, or future effect; and (d) any cumulative effect that arises over time or in combination with other effects; and (e) any potential effect of high probability; and (f) any potential effect of low probability that has a high potential impact. (2) Subsection (1)(a) to (d) apply regardless of the scale, intensity, duration, or frequency of the effect.
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
Elutriate	Process of elutriating fine particles and pore water from sediments
EMP	Environmental Management Plan
EMMS	Environmental Mining and Management System
EPA	New Zealand Environmental Protection Authority
Epifauna	(also called epibenthos) aquatic animals that live on the bottom substratum as opposed to within it, that is, the benthic fauna that live on top of the sediment surface at the seafloor
ERA	Environmental or Ecological Risk Assessment
Hapu	The most significant political unit in pre-European Māori society (clans or descent groups). Hapū ranged in size from one hundred to several hundred people, and consist of a number of whānau (extended families). Hapū controlled a defined portion of tribal territory, which may provide access to sea fisheries, shellfish beds, cultivations, forest resources, lakes, rivers and streams.
IA	Impact Assessment
IAIA	International Association for Impact Assessment
imi	The largest socio-political grouping in pre-European Moriori society

Impact	Equates to effect as defined in the EEZ Act (s6) as: 1(a) any positive or adverse effect; and (b) any temporary or permanent effect; and (c) any past, present, or future effect; and (d) any cumulative effect that arises over time or in combination with other effects; and (e) any potential effect of high probability; and (f) any potential effect of low probability that has a high potential impact. (2) Subsection (1)(a) to (d) apply regardless of the scale, intensity, duration, or frequency of the effect.
Infauna	Benthic organisms that live within the bottom substratum of a body of water, especially within the bottom-most oceanic sediments, rather than on its surface. Bacteria and microalgae may also live in the interstices of bottom sediments.
ISA	International Seabed Authority
Iwi	The largest socio-political grouping in pre-European Māori society (Tribe).
Hindcast	Is a way of testing a mathematical model. Known or closely estimated inputs for past events are entered into the model to see how well the output matches the known results. Hindcasting is also known as backtesting.
MBIE	New Zealand Ministry of Business Employment and Innovation
Macrofauna	Benthic or soil organisms which are retained on a 0.5mm sieve
Megafauna	Large animals of any particular region or time, generally >2 cm.
Meiofauna	Small benthic invertebrates that live in both marine and fresh water environments, loosely defined by their size, larger than microfauna but smaller than macrofauna, rather than a taxonomic grouping.
Mesofauna	Macroscopic soil invertebrate
Microfauna	Microscopic or very small animals
MfE	New Zealand Ministry for the Environment
nm	Nautical Miles = 1.852 km
Pelagic	Any body of water that is neither close to the bottom nor near the shore
Precautionary Approach	This is a management rule whereby if a threat of serious or irreversible damage to the environment exists, uncertainty or a lack of information should not delay management action, and that action should be 'precautionary' with the burden of proof on those proposing the activity
RMA	Resource Management Act 1991
SICA	Scale Intensity Consequence Analysis. A level 1 risk assessment method.
SEA	Strategic Environmental Assessment
SMS	Seafloor Massive Sulfide (also written as sulphide)

Territorial Sea	Limited within the 12 nm inshore
Toxicant	A chemical capable of producing an adverse response (effect) in a biological system, seriously injuring structure or function or producing death.

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Appendix A Other marine management regimes

EEZ Act section 7: Meaning of marine management regime

(1) In this Act, unless the context otherwise requires, marine management regime includes the regulations, rules, and policies made and the functions, duties, and powers conferred under an Act that applies to any one or more of the following:

(a) territorial sea:

(b) exclusive economic zone:

(c) continental shelf.

(2) The marine management regimes referred to in this section include those established under the following Acts:

(a) Biosecurity Act 1993:

(b) Continental Shelf Act 1964:

(c) Crown Minerals Act 1991:

(d) Defence Act 1990:

(e) Fiordland (Te Moana o Atawhenua) Marine Management Act 2005:

(f) Fisheries Act 1996:

(g) Hauraki Gulf Marine Park Act 2000:

(h) Marine and Coastal Area (Takutai Moana) Act 2011:

(i) Marine Mammals Protection Act 1978:

(j) Marine Reserves Act 1971:

(k) Maritime Transport Act 1994:

(l) Resource Management Act 1991:

(m) Submarine Cables and Pipelines Protection Act 1996:

(n) Wildlife Act 1953.

Appendix B EEZ Act section 39 Impact Assessment

(1) An impact assessment must—

(a) describe the activity for which consent is sought; and

(b) describe the current state of the area where it is proposed that the activity will be undertaken and the environment surrounding the area; and

(c) identify the effects of the activity on the environment and existing interests (including cumulative effects and effects that may occur in New Zealand or in the sea above or beyond the continental shelf beyond the outer limits of the exclusive economic zone; and

(d) identify persons whose existing interests are likely to be adversely affected by the activity; and

(e) describe any consultation undertaken with persons described in paragraph (d) and specify those who have given written approval to the activity; and

(f) include copies of any written approvals to the activity; and

(g) specify any possible alternative locations for, or methods for undertaking, the activity that may avoid, remedy, or mitigate any adverse effects; and

(h) specify the measures that the applicant intends to take to avoid, remedy, or mitigate the adverse effects identified.

(2) An impact assessment must contain the information required by subsection (1) in—

(a) such detail as corresponds to the scale and significance of the effects that the activity may have on the environment and existing interests; and

(b) sufficient detail to enable the Environmental Protection Authority and persons whose existing interests are or may be affected to understand the nature of the activity and its effects on the environment and existing interests.

(3) The impact assessment complies with subsection (1)(c) and (d) if the Environmental Protection Authority is satisfied that the applicant has made a reasonable effort to identify the matters described in those paragraphs.

(4) The measures that must be specified under subsection (1)(h) include any measures required by another marine management regime and 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.

Appendix C Environmental Impact Assessment template

Table of Contents

Executive Summary

A summary of the content of the EIA, including:

- description of the proposed activity/project and its objectives
- the main processing methods of the proposed operation
- key potential impacts (physico-chemical, biological, socio-economic including existing interests)
- measures to avoid, remedy, or mitigate environmental impacts
- end-use plans, including decommissioning
- consultation with stakeholders and interested parties.

Non-technical Summary

A short and "plain language" summary for the public.

1. Introduction

1.1 Background

- Introductory background to the application.

1.2 The proposed activity/project

- A description of the overall proposed mining or drilling activity
- Describe the area of the proposed activity
- Include an outline of previous consultation.

1.3 This report

- Scope of the Environmental Impact Assessment (EIA) – what is included, what is not based on earlier assessments or work. Link to other supporting documentation.
- The format (i.e., structure) of the EIA document – especially for larger projects where there is a lot of detail (in line with EEZ Act requirements for EIAs to be appropriate to scale and significance of the project).

2. Policy, legal and administrative context

This section provides information on relevant legislation, agreements or policies that are applicable to the proposed mining or drilling operation.

2.1 Applicable mining and environmental legislation, agreements and policies

- Outline links to New Zealand's EEZ legislative context, including requirements for consultation

2.2 Other applicable legislation, agreements and policies

- Description of other legislation etc that does not necessarily apply specifically to seabed mining
- Consider other marine management regimes such as those as defined in s7 of the EEZ Act

2.3 Relevant international and regional agreements

- Include relevant international agreements (e.g., UNCLOS, CBD, IMO, SOLAS, MARPOL)

2.4 Other standards, principles and guidelines

- Reference any national, regional and international standards, management principles and guidelines not covered above, such as non-binding recommendations from the ISA.

Make clear the extent of overlap into the Coastal Marine Area under the Resource Management Act 1991.

3. Activity/Project description

3.1 Purpose and need of the proposed activity/project

- Type of mineral or hydrocarbon resources
- Why the operation is proposed
- Background to the project, including aspects of the discovery of resources, development of techniques etc.

3.2 Proposed project location

- Co-ordinates of proposed project area
- Map and boundaries of footprint (total area, and certain phases, see 3.3.2)
- Include any closed/exclusion areas.

3.3 Description of the proposed development

3.3.1 Project duration and phasing

- Overall life of project
- Duration of different operational phases (timeline) from mobilisation to decommissioning
- Development timetable should be detailed, and perhaps outline here but include an appendix covering:
  - Pre-construction tasks
  - Construction schedule, staging of activities
  - Commissioning and operational schedules
  - Infrastructure development
  - Closure schedule.

3.3.2 Proposed project scale

- Spatial scale of the proposed operation, including how it is proposed to evolve through time.
- Include indicative rates of extraction, total extraction, depths of extraction (both below sea level and depth of seabed) overburden estimates, discharge rates etc.

3.3.3 Mining or drilling methodologies

- Proposed methods of extraction (dredging, coring, etc.).
- Describe technical specifications of equipment, including construction and operating standards for design of gear.
- Include details of the operation throughout the water column, from seabed to surface.

3.3.4 Support equipment

- Describes any equipment needed for support (e.g., tender, supply vessels, barges), includes handling of hazardous materials.
- Describe frequency of vessel movements for support, supply, barge removal etc.

3.3.5 Proposed processing operation

- Includes:
  - Commissioning
  - On-site operations (including how onsite operations will be powered)
  - Off-site operations
  - Transport of material off-site
  - Disposal of waste (including hazardous waste)
  - Decommissioning
- A schematic diagram should be included of the key components of the operation.

3.3.6 Other alternatives considered

- What other locations, methods etc. were considered, and rejected in favour of what is proposed.

4. Description of the existing physico-chemical environment

4.1 Key messages

- Overview of key content covered in this section (this is a box with up to 6 bullet points of the main aspects covered, or the main findings).

4.2 Regional Overview

- General regional context (includes map, covers wider area around proposed activity area)
- Include site-specific issues and characteristics, particularly sensitive environments

- Reference to relevant technical data/previous studies will be required
- The regional overview is a brief section, but provides the broader scale context for the more detailed site-specific description below.

4.3 Meteorology and Air Quality

- General overview of climatology e.g., wind directions and speeds, seasonal patterns, cyclones
- Description of air quality, including chemical characteristics

4.4 Geological setting

- Describe the general geological landscape and topographic features of the site
- Include notable characteristics of the site, such as hydrothermal vents, seamounts, canyons
- Describe in detail the nature and extent of the resource (including aspects such as thickness, horizontal extent for crusts or nodules).

4.5 Physical oceanographic setting

- Describe oceanographic aspects such as currents, waves, vertical stratification, sedimentation rates.
- Detail is required on the regional setting as well as the specific site, and include changes with depth, and horizontal distance (near-field, far-field).

4.6 Water quality

- Describe water mass characteristics at the site at various depths, including salinity, nutrients, particle concentrations, temperature, geochemistry, chemical composition, dissolved gas profiles, etc.

4.7 Seabed substrate characteristics

- Substrate composition with special reference to sediment composition, sediment chemistry, nutrient characteristics, pore water profiles, and grain size.

4.8 Natural hazards

- Volcanism, seismic activity, tsunami etc.

4.9 Noise and light

- Ambient noise if any, influence of existing exploration and maritime activity.

4.10 Gas and chemical emissions

- Describe the level of gas and chemical emissions from both natural and anthropogenic activities, as well as those affecting seafloor or water column chemistry (e.g., acidity).

4.11 Summary of existing physical environment

- Bring together key findings e.g. any sensitive environments or highly valued areas.
- This will be up to a page, and more extensive than the Key messages in the first section.

5. Description of existing biological environment

- This section is divided by depth regime for the site into a description of the various biological components and communities that are present or utilise the area
- The format of this could be handled in many different ways. However, it is useful to structure it by depth as this reflects the likely division of impacts in the 3 main areas of the water column. It is the approach taken by the International Seabed Authority (2012).

5.1 Key messages

- Overview of key content covered in this section (this is a box with up to 6 bullet points of the main aspects covered, or the main findings).

5.2 Regional Overview

- General regional context
- Include site specific issues and characteristics, particularly sensitive environments
- Existing conservation areas, protected species etc.
- Reference to relevant technical data/previous studies will be required
- The regional overview is a brief section, but provides the broader scale context for the more detailed site-specific description below.

5.3 Biological communities

5.3.1 Surface

- From the surface down to 200 m - this includes plankton (phytoplankton and zooplankton), surface/near surface fish such as tunas, also seabirds, turtles, marine mammals.

5.3.2 Midwater

- Open water from a depth of 200 m down to within 50 m of the seafloor and includes zooplankton, mesopelagic and bathypelagic fishes, deep-diving mammals.

5.3.3 Seafloor

- Benthic invertebrate and fish communities, including infauna to an appropriate depth of sediment, and demersal fish up to a distance of 50 m from the seafloor.

5.3.4 Ecosystem/Community level description

- Summary of ecosystem studies, where elements of the above components are integrated

Existing data should be analysed if possible to be more than a simple list of animals found. This could include multivariate analysis of community structure, at appropriate scales with replication, as well as genetic diversity and trophic relationships. The section should span the size ranges from megafauna through to microfauna.

5.4 Summary of existing biological environment

- Bring together key findings e.g. any sensitive environments or highly valued areas.
- This will be up to a page, and more extensive than the Key messages in section 5.1.

6. Description of the existing onshore environment

- This section should describe the conditions of the area where onshore processing operations will be located, as well as any relevant environmental information on transit lanes/areas.
- Although other legislation may apply onshore, there are advantages to having the entire operation and chain of processing and potential impacts covered in a single EIA.
- The level of detail provided in this section will depend on the extent of onshore activities and any overlap with the RMA management regime to 12 nm offshore.

6.1 Key messages

- Overview of key content covered in this section (this is a box with up to 6 bullet points of the main aspects covered, or the main findings).

6.2 Overview

- General context for the onshore area
- Include site specific issues and characteristics
- Existing conservation areas, protected species etc.
- Reference to relevant technical data/previous studies will be required
- The overview is a brief section, but provides the broader scale context for the more detailed site-specific description below.

6.3 Physico-chemical environment

- Land and any waterbodies that may be affected. Air quality issues.

6.4 Biological environment

- Terrestrial or aquatic communities in the area.

6.5 Summary of existing onshore environment

- Bring together key findings.
- This will be up to a page, and more extensive than the Key messages in section 6.1.

7. Description of existing socio-economic environment

7.1 Key messages

- Overview of key content covered in this section.

7.2 Existing Interests

7.2.1 Fisheries

- If the project area occurs within an area used by fisheries, then this needs to be described here.

7.2.2 Marine Traffic

- This section describes the non-project related marine traffic occurring within the project area.

7.2.3 Tourism

- This section describes areas used by cruise-liners, game fishing, sightseeing, marine mammal watching, other tourism activities.

7.2.4 Marine Scientific Research

- Outline the current scientific research programmes that are taking place in the area.

7.2.5 Conservation areas

- Describe any Marine Protected Areas or Marine Reserves, Marine Mammal sanctuaries etc.

7.2.6 Other

- Other uses of the project area not related to fisheries, marine traffic, tourism, scientific research or conservation (e.g. recreational activities (sailing, diving), telecommunications cables, other hydrocarbon or mineral exploration or mining projects etc.).

7.3 Cultural environment

- Cultural significance of the proposed project area (including specific sites).
- Iwi authorities, customary marine title groups, customary rights groups who may be directly affected by the application

7.4 Historic heritage

- Historic significance of the proposed project area (e.g. shipwrecks).

7.5 Socio-economic and socio-cultural aspects

- Adjacent coastal communities' regional demographic and economies, including local port information if relevant
- Emphasise existing coastal uses by communities that could be affected.
- Existing economic conditions and issues must be described

7.6 Summary of existing socio-cultural environment

- Bring together key findings e.g. any existing interests.
- This will be up to a page, and more extensive than the Key messages in section 7.1.

8. Assessment of impacts on physico-chemical environment and proposed mitigation

Provide a detailed description and evaluation of potential impacts of the operation to the physical environment components identified in section 4. This may need to consider effects that may happen during construction/development (pre-commissioning), operational, and decommissioning phases, as well as the potential for accidental events. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impacts; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

Note: This section (and section 10) will focus on aspects of greatest risks to the environment. Before an EIA is written, an environmental risk assessment (ERA) should be carried out which will evaluate the likelihood and consequences of the operation having an impact on the physical and biological environment. This means the EIA can describe in greater detail the main impacts on the environment and not elements of minor risk. The methods and results of the ERA should be provided as an appendix to the EIA, or as a separate report.

8.1 Key messages

- Overview of key content covered in this section.

8.2 Identification of threats

- Summarise the results of a previous ERA (done as part of the initial scoping stage of the EIA process). This is expected to be a separate report, with only the summary provided here to highlight the major issues of concern.
- This ERA identifies the key parts of the project which have potential to impact the existing environment.
- The detail is in the associated ERA, and so this frees the EIA to focus on the main impacts, not have a lot of detailed description of minor effects.
- Include the results of any test mining (if applicable) that is relevant to identifying impacts.

8.3 Meteorology and Air Quality

8.3.1 Potential impacts and issues to be addressed
8.3.2 Environmental management measures
8.3.3 Residual impacts

8.4 Geological setting
8.4.1 Potential impacts and issues to be addressed
8.4.2 Environmental management measures
8.4.3 Residual impacts

8.5 Physical oceanographic setting
8.5.1 Potential impacts and issues to be addressed
8.5.2 Environmental management measures
8.5.3 Residual impacts

8.6 Water quality
8.6.1 Potential impacts and issues to be addressed
8.6.2 Environmental management measures
8.6.3 Residual impacts

8.7 Seabed substrate characteristics
8.7.1 Potential impacts and issues to be addressed
8.7.2 Environmental management measures
8.7.3 Residual impacts

8.8 Natural hazards

8.8.1 Potential impacts and issues to be addressed
8.8.2 Environmental management measures
8.8.3 Residual impacts

8.9 Noise and light
8.9.1 Potential impacts and issues to be addressed
8.9.2 Environmental management measures
8.9.3 Residual impacts

8.10 Gas and chemical emissions/climate change issues
8.10.1 Potential impacts and issues to be addressed
8.10.2 Environmental management measures
8.10.3 Residual impacts

8.11 Vessel waste management
8.11.1 Potential impacts and issues to be addressed
8.11.2 Environmental management measures
8.11.3 Residual impacts

8.12 Cumulative impacts
The nature and extent of interactions should be considered. This is at both local and regional scales.

8.12.1 Potential impacts and issues to be addressed
8.12.2 Environmental management measures
8.12.3 Residual impacts

8.13 Summary of residual effects
- A table may be a useful summary format

9. Assessment of impacts on biological environment and proposed mitigation
Provide a detailed description and evaluation of potential impacts of the operation to the biological environment components identified in section 5. This may need to consider effects that may happen during construction/development (pre-commissioning), operational, and decommissioning phases, as well as the potential for accidental events. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impacts; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

Note: This section (as for section 9) will focus on aspects of greatest risks to the environment. Before an EIA is written, an ecological risk assessment (ERA) should be carried out which will evaluate the likelihood and consequences of the operation having an impact on the biological environment. This

means the EIA can describe in greater detail the main impacts on the physical and biological environment and not elements of minor risk. The methods and results of the ERA should be provided as an appendix to the EIA, or as a separate report.

9.1 Key messages

- Overview of key content covered in this section.

9.2 Identification of threats

- Summarise the results of a previous ERA. This is expected to be a separate report, with only the summary provided here to highlight the major issues of concern.
- This ERA identifies the key parts of the project which have potential to impact the existing environment.
- The detail is in the associated ERA, and so this frees the EIA to focus on the main impacts, not have a lot of detailed description of minor effects.
- Include the results of any test mining (if applicable) that is relevant to identifying impacts.
- Include description of baseline survey work undertaken relevant to future monitoring.

9.3 Biological environment

9.3.1 Surface
9.3.1.1 Potential impacts and issues to be addressed
9.3.1.2 Environmental management measures
9.3.1.3 Residual impacts

9.3.2 Midwater
9.3.2.1 Potential impacts and issues to be addressed
9.3.2.2 Environmental management measures
9.3.2.3 Residual impacts

9.3.3 Seafloor
9.3.3.1 Potential impacts and issues to be addressed
9.3.3.2 Environmental management measures
9.3.3.3 Residual impacts

9.3.4 Ecosystem/community level
9.3.4.1 Potential impacts and issues to be addressed
9.3.4.2 Environmental management measures
9.3.4.3 Residual impacts

9.3.5 Cumulative and cross-boundary effects
9.3.5.1 Potential impacts and issues to be addressed
9.3.5.2 Environmental management measures
9.3.5.3 Residual impacts

NOTE: As in section 5.3, this assessment of impacts can also be structured by "receptor" rather than by the depth range. The format does not matter, as long as the depth component is retained in the description of the range of taxa that need to be included.

9.4 Other issues

- Outline where there are other more general issues or overlap with other marine management regimes or regulations such as maritime safety, biosecurity, waste management etc.
- Aspects of existing conservation areas, management plans etc.

9.5 Summary of residual effects

- A table may be a useful summary format
- Potential cumulative effects should also be included.

10. Assessment of impacts on the onshore environment and proposed mitigation

Provide a detailed description and evaluation of potential impacts of the operation to the onshore environment components identified in section 6. This may need to consider effects that may happen during construction/development (pre-commissioning), operational, and decommissioning phases, as well as the potential for accidents. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impacts; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

10.1 Key messages

- Overview of key content covered in this section.

10.2 Identification of threats

- Summarise the results of a previous Ecological Risk Assessment. This is expected to be a separate report, with only the summary provided here to highlight the major issues of concern.
- This ERA identifies the key parts of the project which have potential to impact the existing environment.
- The detail is in the associated ERA, and so this frees the EIA to focus on the main impacts, not have a lot of detailed description of minor effects.

10.3 Physico-chemical environment

10.3.1 Potential impacts and issues to be addressed

10.3.2 Environmental management measures

10.3.3 Residual impacts

10.4 Biological environment
10.4.1 Potential impacts and issues to be addressed
10.4.2 Environmental management measures
10.4.3 Residual impacts

10.5 Summary of residual effects

- A table may be a useful summary format
- Potential cumulative effects should also be included.

11. Assessment of impacts on socio-economic environment and proposed mitigation

As per preceding sections, provide a detailed description and evaluation of potential impacts of the operation to the socio-economic components identified in section 7. This may need to consider effects that may happen during construction/development (pre-commissioning), operational (including maintenance), and decommissioning phases, as well as potential for accidental events. The preferred approach in this template is that for each component there is a description of:

(i) the nature and extent of any actual or potential impact, including cumulative impacts;

(ii) measures that will be taken to avoid, remedy or mitigate such impact; and

(iii) what unavoidable (residual) impacts will remain.

It is also important for these sections to make clear the expected time to recover following disturbance, the longevity of residual effects, and if possible an indication of potential state shifts, so that the duration of residual effects is clear.

11.1 Key messages

- Overview of key content covered in this section.

11.2 Identification of threats

- This identifies the key parts and activities of the project which have potential to impact the existing social or economic environment.

11.3 Existing Uses

11.3.1 Fisheries
11.3.1.1 Potential impacts and issues to be addressed
11.3.1.2 Environmental management measures
11.3.1.3 Residual impacts

11.3.2 Marine Traffic
11.3.2.1 Potential impacts and issues to be addressed
11.3.2.2 Environmental management measures
11.3.2.3 Residual impacts

11.3.3 Tourism
11.3.3.1 Potential impacts and issues to be addressed
11.3.3.2 Environmental management measures
11.3.3.3 Residual impacts

11.3.4 Marine Scientific Research
11.3.4.1 Potential impacts and issues to be addressed
11.3.4.2 Environmental management measures
11.3.4.3 Residual impacts

11.3.5 Conservation Areas
11.3.5.1 Potential impacts and issues to be addressed
11.3.5.2 Environmental management measures
11.3.5.3 Residual impacts

11.3.6 Other
11.3.6.1 Potential impacts and issues to be addressed
11.3.6.2 Environmental management measures
11.3.6.3 Residual impacts

11.4 Cultural environment
11.4.1 Potential impacts and issues to be addressed
11.4.2 Environmental management measures
11.4.3 Residual impacts

11.5 Historic heritage
11.5.1 Potential impacts and issues to be addressed
11.5.2 Environmental management measures
11.5.3 Residual impacts

11.6 Socio-economic and socio-cultural aspects
11.6.1 Potential impacts and issues to be addressed
11.6.2 Environmental management measures
11.6.3 Residual impacts

11.7 Summary of residual effects
- A table may be a useful summary format.
- Potential cumulative effects should also be included.

12. Environmental management, monitoring and reporting
Sufficient information should be provided to enable regulatory agencies to anticipate possible environmental management, monitoring and reporting requirements for an environmental permit. Information listed should reflect the proponent's environmental policy (Environment Management System) and the translation of that policy to meet the requirements under this section and previous sections during different stages in the project life, i.e. from construction to decommissioning and closure. Information detailed in this section should include, but not be limited to, the headings below:

12.1 Organizational structure and responsibilities
This section should show how the Contractor's environmental management team fits into its overall organizational structure. Responsibilities of key personnel should be outlined.

12.2 Environmental Management System (EMS)
Although a full EMS may not exist at the time the EIA is submitted, this section should outline the standards that will be considered and/or aligned with in developing the EMS for the project.

12.3 Environmental Management Plan (EMP)

This differs in detail between what is needed for the EMP component of a New Zealand assessment, and the EMP subsequently needed under the ISA and SPC processes. Irrespective of position in the sequence, an EMP will be submitted as a separate document for approval prior to exploitation operations commencing. This section should provide an overview of what an EMP would entail. This section shall include, as a minimum, the following headings:

12.3.1 Mitigation and Management

This section should summarize the actions and commitments that have arisen from the impact minimisation and mitigation strategies. There may be different rehabilitation strategies and activities for operations during mining, and those for closure.

12.3.2 Monitoring plan

This section should summarize the monitoring plan approach and specific detail of the monitoring programme.

12.3.3 Closure plan

It is expected that a closure plan will be submitted as a separate document for the Regulatory Authority's approval. However, this section should provide an overview of what the closure plan will entail, including decommissioning, continued monitoring and rehabilitation measures, if applicable.

12.4 Reporting

12.4.1 Monitoring

This section should outline how results of monitoring studies will be reported to the Regulatory Authority.

12.4.2 Incident Reporting

This section should outline how incidents will be reported.

13 Consultation

- This describes the nature and extent of consultation with parties identified to have existing interests in the proposed project area, as well as relevant Iwi Māori, imi Moriori and other stakeholders
- This can be considered earlier in the document in some situations where knowledge of the extent of consultation is critical to progressing further. It may aid gaining confidence in the information to be provided in the body of the EIA.

13.1 Consultation methods

- Describe how you have consulted with different groups.

13.2 Existing interests

- Identify any parties with potential existing interests in the area that may be impacted by the proposed activity.

13.3 Tangata whenua

- Any iwi, hapū, customary marine title group, and protected customary rights group that have been notified and consulted.
- This should include iwi Māori and imi Moriori

13.4 Other stakeholders

- Include other stakeholders that have been consulted.

13.5 Public consultation

- Describe the goals and approach to methods and workshops that have occurred with the general public.

13.6 Ongoing consultation plans

- What further consultation with stakeholders is planned, or needed?

14. Glossary

- Relevant terms explained (e.g. terms under different legislation, technical terms).
- List of acronyms.

15. Study team

- A list and description of the main people involved in the EIA, their areas of skill and technical expertise, and institute/consultancy/company affiliations.

16. References

- Citations from the EIA.
- Technical reports, previous studies.

17. Appendices

- Include technical reports carried out for parts of EIA (e.g., the ERA, other important studies such as sediment plume modelling, ecotoxicity research).

Appendix D Bibliography of useful reading and websites

Name	url	Comments
ISA	http://www.isa.org.jm/en/documents	ISA publications
New Zealand Environmental Protection Authority	http://www.epa.govt.nz/Pages/default.aspx	EPA home page
	http://www.epa.govt.nz/EEZ/Pages/default.aspx	EEZ Act pages
New Zealand Ministry for the Environment	http://www.mfe.govt.nz/index.html	MfE home page
	http://www.mfe.govt.nz/publications/rma/	For RMA references such as preparing AEEs
Quality Planning	http://www.qualityplanning.org.nz/index.php/consents	For good practice in implementing the RMA
Biological databases	www.iobis.org	for invertebrates
	www.fishbase.org	for fishes
	www.iucnredlist.org	endangered species
NABIS	http://www.nabis.govt.nz/Pages/default.aspx	NZ's National Aquatic Biodiversity Information System. An interactive web-based mapping tool which provide information relevant to NZ's marine environment
PBE	http://www.gns.cri.nz/Home/Our-Science/Energy-Resources/Oil-and-Gas/Petroleum-Basin-Explorer	Petroleum Basin Explorer
data.govt.nz	https://data.govt.nz	New Zealand government held datasets
AODN	http://portal.aodn.org.au/aodn	the Australian Ocean Data Network Portal (AODN - http://portal.aodn.org.au/aodn/
ARGO	http://www.usgodae.org/argo/argo.html	ARGO Data
CORIOLIS	http://www.coriolis.eu.org/	The Coriolis project provide operational oceanography data to monitor and forecast the ocean behaviour. Includes : Sea-surface observation; In situ measurements; and Assimilation of in-situ and satellite data
Statisphere	http://statisphere.govt.nz/	NZ's official statistics portal to find information about NZ's official statistics system
LINZ Geospatial Office	http://geodata.govt.nz	Land Information New Zealand (LINZ) geospatial office
NZPAM	https://data.nzpam.govt.nz/GOLD	New Zealand Petroleum and Mineral Online exploration database
NIWA Data Catalogue	http://dc.niwa.co.nz	NIWA data catalogue
NZ Bathymetry	www.bathymetry.co.nz	The New Zealand bathymetry, offers dataset for the New Zealand Region (CANZ, 2008).
Ecoconnect	http://ecoconnect.niwa.co.nz/	environmental forecasting and information

Appendix E Summary of recommended scientific studies and methodologies for baseline and monitoring surveys (from Swaddling et al. 2016).

	Aspect	Reason	Main Parameters	Sampling
Geology	Topography	Seabed characteristics, classification of habitats for assessment, survey stratification, selection of test and control areas	Bathymetry, morphometry, seafloor type	Shipboard/towed acoustic systems, optical sensors, dredges, box-corer, drilling equipment
	Backscatter	Seabed characteristics, classification of habitats for assessment, survey stratification, selection of test and control areas	Acoustic reflectivity	Shipboard/towed acoustic systems; sidescan sonar, hyperspectral imaging
	Sub-seafloor	Petrology, geochemistry, and mineralogy for resource characterisation	Penetration layers, rock properties, mineral and chemical composition	Seismic, drilling, rock sampling (dredges, coring)
Sediment characteristics	Sediment properties	Sediment plume dynamics, classification of habitats	Substrate type, sediment and pore water measurements: water content, grain size, specific gravity, porosity, depth of oxic layer, carbon content, chemical composition (trace and heavy metals)	Sediment cores (box corer or mulitcorer)
	Bioturbation rates	Natural mixing of sediments	Bioturbation depth, faunal zonation, Pb210 activity	Sediment cores (box corer or mulitcorer)
	Sedimentation rates	Distribution and concentration of natural suspension, settlement rates	Particle flux, suspended particle concentrations, settlement rates	Moorings and sediment traps
Pelagic community	Deepwater pelagic (plankton and nekton)	Impacts of sediment plume and discharges on midwater communities, vertical migrators, and near-bottom hyper-benthos	Species composition, distribution, abundance. Biological characteristics (sensitivity, recoverability parameters)	Opening/closing nets for plankton (Remotely Operated Vehicle (ROV) also possible). Pelagic trawls/commercial records for fish
	Surface fauna	Effects of surface discharges, presence of vessels and equipment	Species composition, distribution, abundance. Biological characteristics (sensitivity, recoverability parameters)	Opening/closing nets, surface plankton nets, remote-sensed data
	Marine mammals/sea birds	Effects of surface discharges, presence of vessels and equipment	Species composition, distribution, abundance. Biological characteristics (sensitivity, recoverability parameters)	Marine Mammal Observer protocols

	Aspect	Reason	Main Parameters	Sampling
Seafloor community	Megafauna	Impacts on benthic communities	Species composition, distribution, abundance. Biological characteristics (sensitivity, recoverability parameters)	Photographic surveys from ROV/towed camera; direct sampling from dredge/sled/trawl/ROV
	Macrofauna	Impacts on benthic communities	Species composition, distribution, abundance. Biological characteristics (sensitivity, recoverability parameters)	Multicorer or box corer, and epibenthic sled; photographic surveys from ROV/towed camera; direct sampling from dredge/sled/trawl/ROV
	Meiofauna	Impacts on benthic communities	Biodiversity, distribution, abundance	Multicorer or box corer; direct sampling from dredge/sled/trawl/ROV
	Microfauna	Impacts on benthic communities	Biodiversity, distribution, abundance	Sediment cores (box corer or mulitcorer)
	Specific resource fauna	Endemic species or communities, sensitive habitats (including biogenic habitats)	Species composition, distribution, abundance	ROV/towed camera, epibenthic sled; direct sampling by ROV, box corer for nodule environments
	Scavenger/demersal fish	Impacts on benthic communities	Species composition, distribution, abundance	Baited lander, fish trawls, traps, ROV observations
	Ecotoxicity	Impacts of heavy metals/contaminants on benthic communities, accumulation through food chain potential	Tissue samples from representative and abundant fauna	Various direct sampling methods (as above)
Physica	Currents	Dispersal of impacts, biological connectivity	Current speed, direction, depth variation, tidal dynamics, Sea Surface Temperature (SST), Sea Surface Height (SSH), ocean colour	Conductivity Temperature Depth profiler (CTD), current meters, Acoustic Doppler Current Profiler (ADCP), remote-sensed data, profiling moorings
	Hydrodynamic modelling	Dispersal of impacts, sediment plume dynamics, biological connectivity	Oceanographic parameters (temperature, salinity, current flow and direction), turbulence, turbidity, bathymetry	Various models applicable: e.g. Regional Ocean Modelling System (ROMS), Hybrid Coordinate Ocean Model (HYCOM), CORMIX (discharges)

	Aspect	Reason	Main Parameters	Sampling
Chemical oceanography	Water quality	Effects of discharges, sediment plume	Chemical composition (including heavy metals and toxic contaminants), turbidity, suspended sediment, dissolved oxygen, pH	Water samples (from CTD), surface remote-sensed data, core samples, nephelometer, transmissiometer, optical backscatter sensors
	Visual characteristics	Effects of discharges, sediment plume	Optical backscatter, light attenuation, black disc distance	Transmissiometer, optical backscatter sensors, remote sensing
	Bottom water chemistry	Effects of sediment/rock disturbance, release of chemicals, effluent discharge	Elutriation for chemical and toxicity testing, pH, trace and heavy metal concentrations, dissolved oxygen	Water samplers (CTD-Niskin bottles), core samples
	Water column chemistry	Effects on chemical characteristics due to sediment plume and discharges	Nutrients (P, N, Si, C), dissolved oxygen, trace and heavy metal concentrations	Water samplers (CTD-Niskin bottles)