

**Final report of the Interim Ministerial Advisory Group
for Limits and Targets:**

Proposed attributes for the National Planning Framework

13 July 2023

Acknowledgments

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1. Executive summary

The Natural and Built Environment Bill will introduce a regulatory National Planning Framework (NPF) to coordinate and facilitate national direction. The NPF will, among other things, allow government to set mandatory environmental monitoring requirements and to define national limits and targets in relation to human health, and environmental health and functioning. The interim Ministerial Advisory Group was convened to provide advice to the Ministers for the Environment and Conservation on the quality and integrity of the science practice underpinning the contents of the initial version of the NPF.

A holistic framework grounded in te ao Māori is required to effectively evaluate attributes, limits and targets set via the NPF: Boundaries between attributes, domains, and management areas can easily fail to appreciate the interconnectedness of all things – a concept that is central in te ao Māori. Our approach was grounded in the Ngā Kete o te Wānanga framework, which reflects a mātauranga Māori conceptualisation of the relationship between values and resource limits, and which aligns to Te Oranga o te Taiao – the te ao Māori principle underpinning the proposed Natural and Built Environment Bill and the NPF.

We recommend the inclusion of seven attributes in the initial version of the NPF: Fine particulate matter in air samples smaller than 2.5 µm (PM_{2.5}), proportion of terrestrial indigenous vegetation cover by land environment, coastal salt marsh extent, estuarine seagrass extent, sediment mud content and accretion rate, nuisance macroalgae, and terrestrial erodible soil stabilisation.

Additional attributes will be needed in future iterations of the NPF: New attributes will be needed to ensure resource management decisions are made based on a sufficient understanding of environmental drivers, pressures, states, impacts and responses. The attributes we have recommended will help ensure a minimum level of information is available to decision makers and provide a basis as tohu mātua, or ‘parent’ attributes, for the subsequent development of related and complementary ‘descendant’ attributes.

Transitional and system-wide aspects must be considered as part of NPF development: We identified several transitional and systemic issues that we consider need to be resolved before the system of regulatory limits and targets will have the desired impact:

- **Setting limits at ‘current state’ could lock in further environmental degradation:** Under the version of the Bill¹ we have considered, limits are set at the ‘current state’ which, in many cases, is very degraded. Maintaining ecosystem functioning/health at very degraded levels will not achieve Te Oranga o te Taiao and may: implicitly endorse environmental degradation, slow progress towards setting and achieving targets, and fail to serve effectively as a mechanism for environmental protection or enhancement. As the framework of ‘limits and targets’ evolves through the statute-making process, careful attention must be paid to the practical implications of definitions and their consistency with the initial policy intent. We suggest that Te Oranga o te Taiao may be better achieved by following the approach established via the National Policy Statement for Freshwater Management which introduces a hierarchy of obligations, where the first priority is the health and wellbeing of ecosystems.

¹ Natural and Built Environment Bill 186-2 Reported from the Environment Committee on 27 June 2023

- ***Cause-and-effect linkages (biophysical, human health, societal, and cultural health) must be captured in future NPF iterations:*** Sufficient resourcing and time is required to ensure that ecosystem functions and processes are properly taken into account when setting limits and targets, and so that future changes to the NPF are made after giving due consideration to: cause-and-effect linkages, the interconnectedness of biophysical systems (including across management units and between domains), and the interconnectedness of people and places (see figure A).
- ***Regional and local government, iwi, hapū, and other Māori partners, local communities, and other stakeholders must be adequately resourced to implement the new system:*** The scope and pace of change required by the new system needs to align to the ability of regional and local government to deliver – there is little point introducing more attributes than there is the capacity and capability to monitor. Current resources are insufficient to generate all the information government will be mandating through the NPF, if we continue to rely on current approaches. Systemic change is required both to align the key players at local, regional, and national scales, and to target new investment where it is needed most. This will involve investment to build understanding of and embed respect for Te Tiriti, lift capability and capacity in environmental science, monitoring, and modelling, and to re-align roles and responsibilities across the system.
- ***Information from across the system will be required for implementation to be successful:*** Community participation is required to achieve the necessary degree of ‘buy in’ from affected parties for implementation to be successful. It is vital that the information held across the system by science providers, regional and central government, enterprises, communities, iwi, hapū, and other Māori partners is acknowledged and considered, where appropriate, in the setting of limits and targets. Importantly, under-represented and under-resourced groups must be supported to continue their citizen science, mātauranga, kaitiakitanga, and stewardship, and to provide for their meaningful involvement in monitoring, reporting, and decision-making.
- ***Shortcomings in data quality and uncertainty must not be used as a reason to delay decision-making:*** There will be many scenarios, particularly at the earlier stages of regulatory plan-making and implementation, where decisions will need to be made without complete and/or scientifically robust data. Clear practice guidance is required to prevent a lack of available data, and/or uncertainty in its interpretation, from delaying action.
- ***Caution should be used when using offsetting as a tool:*** While offsetting may be an effective tool in some domains and contexts, we are concerned about relying too much on offsetting to achieve ‘no net loss’ or environmental gains, particularly in relation to native biodiversity where there are well-documented issues with the application and implementation of offsetting as a practical tool, both in Aotearoa New Zealand, and globally.
- ***The selection of future attributes and the setting of Limits and Targets should provide insight into ecosystem resilience and aim to support decisions that mitigate the impacts of climate change:*** The impact of the January 2023 floods and cyclone Gabrielle have brought home the reality of the impacts of climate change for many New Zealanders. Future iterations of the NPF should incorporate deeper analyses of attributes that account for natural system variability and help build resilience, taking into account stochastic processes or events.

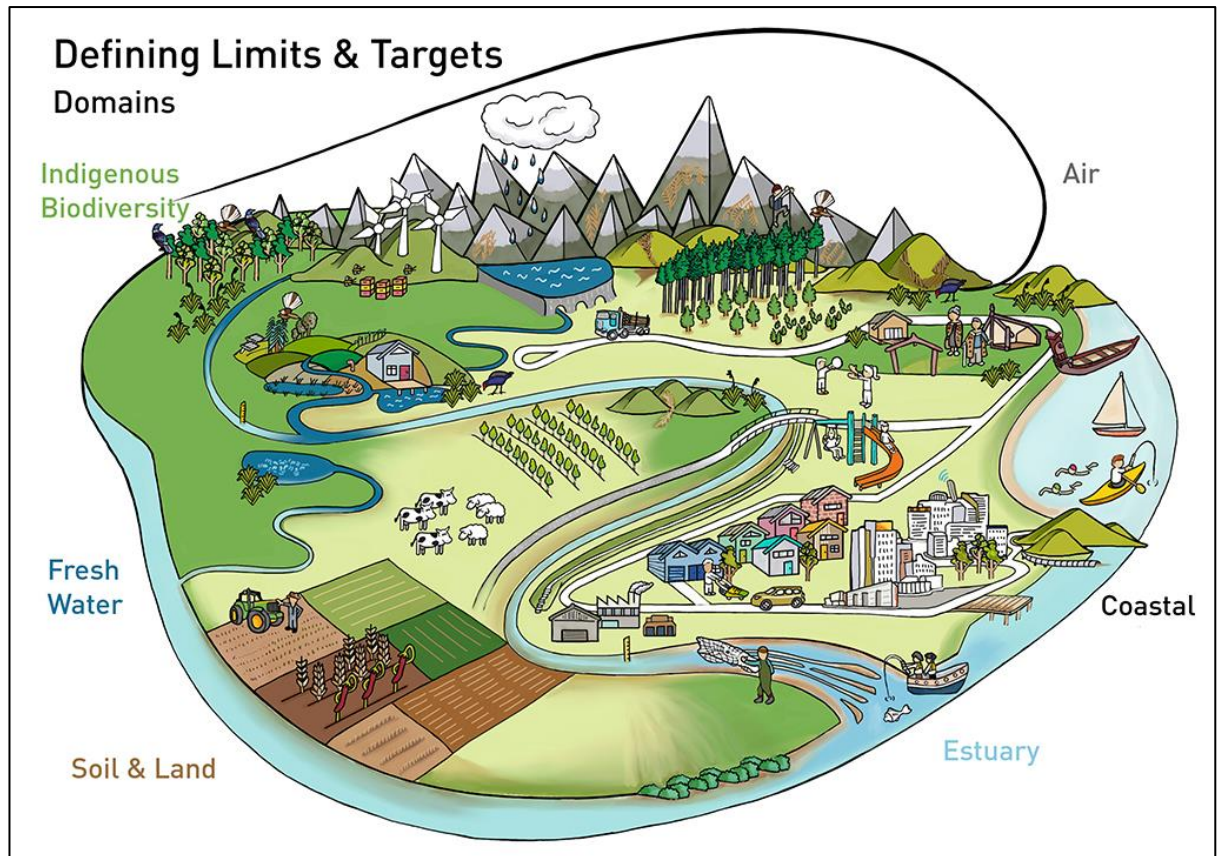


Figure A. The six environmental domains that are incorporated in the NPF, showing their interconnections, and their interrelationships with people.

2. Report overview

New Zealand's statutory framework for resource management is undergoing significant reform. Once enacted, The Natural and Built Environment Bill will introduce a regulatory National Planning Framework (NPF) to coordinate and facilitate national direction. The NPF will, among other things, allow government to set mandatory environmental monitoring requirements and to define national limits and targets in relation to environmental health and functioning (see Figure 1 in section 3 for a visual explanation of the limits and targets framework).

The initial version of the NPF will require local government and other authorities to collect data on attributes that have not previously been mandated via national direction. This is intended to ensure there is a minimum acceptable level of information across environmental domains (air, indigenous biodiversity, soils, coasts, estuaries, and freshwater) to provide an understanding of environmental state, pressures, and trends, and to support effective planning and decision-making, and reporting. This level of information will be built on over time as scientific knowledge develops for additional attributes.²

An Interim Ministerial Advisory Group – Limits and Targets (MAG) was convened to provide advice to the ministers for the Environment and Conservation on the quality and integrity of the science practice underpinning the contents of the initial version of the NPF. This report sets out the findings and recommendations of the MAG. A statutory Ministerial Advisory Panel will be established when The Natural and Built Environment Bill (The Bill) is enacted. A key role of the statutory Ministerial Advisory Panel will be to determine regulatory limits and targets. The first step in doing this is to identify suitable attributes across the range of environmental domains – 'attributes' being those things that we measure, and through which limits and targets can be quantified. It is important to emphasise that the analysis undertaken by the MAG, and described in this report, focused only on attributes. We did not attempt to identify or establish specific biophysical or cultural thresholds or 'breakpoints' that are necessary to define limits and targets and to establish management 'bands' – this would require more time and resource than were available to us.

In exercising our responsibility as a Ministerial Advisory Group, we sought to respond to the overarching direction of the proposed legislation by adopting a conceptual framework and method of analysis designed to give expression to Te Oranga o te Taiao via the way attributes are evaluated and recommended for inclusion in the initial version of the NPF.

Our approach involved first reviewing the work of technical specialists at the Ministry for the Environment, testing the quality and integrity of the science and knowledge underpinning the proposed attributes, and questioning them to determine whether:

- the evidence they used was inclusive, rigorous, transparent, and accessible, and
- proposed attributes provide effective, reliable, and sufficient measures, and can be monitored, reported on, and relied upon to evaluate environmental drivers, state, pressures, trends, and responses.

² The MAG was advised that attributes included in the National Policy Statement for Freshwater Management (NPS-FM) are being 'carried over' to the first version of the NPF – the identification of attributes for the freshwater domain were therefore out of scope for this piece of work.

Once we were satisfied the potential attributes met the above criteria, we expanded our assessment to consider the potential attributes through a te ao Māori lens and tested whether they could provide suitable insight to Te Oranga o te Taiao and environmental integrity in a holistic sense. We were guided by the Ngā Kete o te Wānanga framework to refine our assessment criteria and to assist with our evaluation of proposed attributes. This framework reflects a mātauranga Māori conceptualisation of the relationship between values and resource limits, and which aligns to Te Oranga o te Taiao – the te ao Māori principle underpinning the proposed Natural and Built Environment Act and the NPF.

We found this approach to be very effective and recommend that the Ngā Kete o te Wānanga framework be considered for adoption in future processes for evaluating potential attributes, limits, and targets for inclusion in subsequent versions of the NPF. We do note, however, that while this approach goes some way towards meeting Te Tiriti obligations with respect to the generation of science and information, more needs to be done to meet the expectation of partnership established by Te Tiriti – including engaging more broadly with Māori to seek input on analytical processes and recommendations and ensuring future processes are sufficiently resourced to provide for adequate input from Māori.

Having undertaken our assessment using the approach described above, we recommend the inclusion of seven initial attributes across five environmental domains in the initial version of the NPF:

Domain	Attribute
Air	Fine particulate matter smaller than 2.5 µm (PM _{2.5})
Indigenous biodiversity	Proportion of indigenous vegetation cover by land environment
Estuaries and coastal waters	Salt marsh extent
	Seagrass extent
	Sediment mud content & accretion rate
	Nuisance macroalgae
Soil	Erodible soil stabilisation

In providing our advice we have been mindful that national direction will continue to evolve to keep pace with changing contexts, pressures, and objectives. Additional attributes, both new and ‘descendant’ attributes – relating to and complementing existing attributes – will be needed to ensure resource management decisions are made based on a sufficient understanding of environmental drivers, pressures, states, impacts and responses. In this regard, the attributes we have recommended ensure a minimum level of information is available and provide a basis as tohu, or ‘parent’ attributes, for subsequent development of related and complementary ‘descendant’ attributes. With that in mind we have augmented our initial analysis of the first tranche of attributes with some commentary on subsequent attribute development.

While undertaking our analysis and in reaching conclusions on attributes for inclusion in the initial version of the NPF, we identified a range of broader matters we considered significant and relevant to the design and implementation of the NPF. In this report we highlight several transitional and systemic issues that we consider need to be resolved before the new system of regulatory limits and targets will have the desired impact:

- Notwithstanding our support for the enhanced role ‘environmental limits and targets’ are to play in Aotearoa New Zealand’s resource management system, we agree with, and would like to emphasise, concerns raised by the Parliamentary Commissioner for the Environment regarding the effectiveness of limits and targets *as currently conceived and defined in the version of the Bill we have had available to us.*³ Under that version of the Bill, limits for ecological integrity are proposed to be set at the ‘current state’ (see Figure 1). In many instances the current state is very degraded. Maintaining ecosystem functioning/health at very degraded levels will not achieve Te Oranga o te Taiao. We are concerned that setting a limit at this level may have perverse implications – implicitly endorsing environmental degradation, slowing progress towards setting and achieving targets, and failing to serve effectively as a mechanism for environmental protection or enhancement. As the framework of ‘limits and targets’ evolves through the statute-making process, careful attention must be paid to the practical implications of definitions to ensure they maintain consistency with the initial policy intent and purpose of the legislation. In this regard, we question whether the conceptualisation and definition of limits and targets in the Bill accurately represents the policy intent. As an alternative, we suggest Te Oranga o te Taiao may be better achieved by following the approach established via the NPS-FM by introducing a hierarchy of obligations, where the first priority is maintaining or achieving the health and wellbeing of ecosystems.
- For a system of resource management based on limits and targets to be effective, management units will need to be designed to capture interconnections between ecosystems and across environmental domains. In general, management units should extend from headwaters, through land and freshwater environments, to estuaries and coastal environments and the ocean – following the principle of ki uta ki tai (a ‘Mountains to Sea’ approach). Overall, our view is that while the attributes proposed for the first iteration of the NPF are a necessary starting point, more work will need to be done to ensure that:
 - ecosystem functions and processes are taken into account in future attributes,
 - cause-and-effect linkages and interconnectedness (of biophysical systems, and of people with places) are given due consideration in future, and
 - the co-benefits of policy work across government (e.g., zero-carbon goals influencing Aotearoa’s ability to achieve targets for the PM2.5 particulates attribute, or the soil conservation attribute positively impacting carbon sequestration) have been fully explored regarding the identification of future attributes.
- A great deal of data, information, and knowledge is held outside of regional councils by science providers, central government, enterprises, communities, iwi, hapū, and other Māori partners. In transitioning to the new environmental management system, it is vital that information held by these parties is acknowledged and, where appropriate, considered in the setting of limits and targets. Sufficient funding, resourcing, guidelines, and time will be needed to ensure that limits and targets set after the introduction of the NPF are based on robust evidence and analysis. Similarly, for implementation to be successful, sufficient funding and resourcing must be available to enable the level of community participation required achieve the necessary ‘buy in’ from affected parties. We consider that regulations

³ Natural and Built Environment Bill 186-2 Reported from the Environment Committee on 27 June 2023

- are most likely to be effective when parties affected by the regulations can participate in their development at the national level, and interpretation and application at regional and local levels.
- The achievement of desired outcomes will rely on a willingness to broaden monitoring roles and responsibilities and benefit from councils sharing or delegating monitoring responsibilities, as has been done for Lake Taupō with Tūwharetoa accepting responsibility from Waikato Regional Council for water quality monitoring in the lake. To allow stakeholders and partners to continue their citizen science, mātauranga, kaitiakitanga, and stewardship, and to provide for their meaningful involvement in monitoring, reporting, and decision-making, adequate resourcing (i.e., funding) will need to be made available to under-represented and under-resourced groups including community groups, iwi, hapū, and other Māori partners. Resourcing this work, investing in building greater capacity and capability across the system, and sharing monitoring responsibilities will help deepen connections between people and Te Taiao.
- The NPF will require regional government and other interested parties to monitor attributes that have not previously been mandated under national direction and, for which there may be no existing data record. The resultant information gaps may create uncertainty and cause delay in decision-making, which could have perverse implications (i.e., the incentive to use or extract resources before information is gathered and regulations made to restrict or control activities – the so called ‘gold rush’ effect). There will be many scenarios, particularly at the earlier stages of regulatory plan making and implementation, where decisions will need to be made in the absence of complete and scientifically robust data – guidance is required to prevent this delaying action.
- The scope and pace of change required on transition to the new system needs to align to the ability of regional government and other actors in the system to deliver – there is little point introducing more attributes than there is the capacity and capability to monitor, for instance. In this regard, we note that:
 - Regional and local government authorities need robust data that allows them to describe the local context, highlight the key dimensions of issues, frame resource management decisions, and describe what needs to be done (and is being done) to achieve community-defined objectives. To achieve this, councils monitor and report on much more than that which national direction currently requires.
 - It is not reasonable to expect that councils will be able to comply with additional environmental monitoring requirements introduced via the National Planning Framework (NPF) within existing baseline funding. Without additional investment across the system, the continued addition of nationally mandated monitoring requirements may force councils to shift funding from other areas or to discontinue monitoring programmes that are not required by the NPF but essential to local decision-making or valued highly by local communities.
 - National-level reporting is not an explicit function of regional or local government and communities are near or at ‘peak’ levels in terms of their primary funding

sources (i.e., rates). If national monitoring requirements continue to expand, and if national monitoring drivers impinge on local drivers, councils will face complicated trade-offs unless other resourcing is made available. In these cases, it may be difficult to explain to local communities why ratepayer money should be taken from highly valued local monitoring programmes and allocated to nationally mandated monitoring programmes that may generate more value at the national than at the local level.

- There is considerable scope for streamlining the number of limits (and targets) across environmental domains – a ‘state’ attribute in one domain could potentially be used as a ‘response’ variable in another, for instance. Particular consideration should be given to identifying such ‘cross-domain’ indicators and attributes.
- We are concerned about overemphasising the role of offsetting within the Effects Management Hierarchy as a tool to achieve ‘no net loss’ or environmental gains. While potentially attractive and applicable in some domains (i.e., air quality, sediment), there are well-documented issues with the application and implementation of offsetting as a practical tool both in Aotearoa and globally in other domains (e.g., biodiversity). Should offsetting of biodiversity values be provided for via the NPF, it is strongly recommended that recent advances in systematic conservation planning are employed to help identify and prioritise areas for offsetting within Management Units. Further, the concept of ‘exchange’ or ‘like for like’ should be explored through a te ao Māori lens – mātauranga Māori may be available that could be used now or in the future to improve understanding and/or refine the applicability and application of offsetting. To our knowledge this has not yet been explored.
- The impact of the January floods and cyclone Gabrielle brought home the reality of the impacts of climate change for many New Zealanders. The first tranche of attributes will not necessarily account for dynamism and increasing variability in ecosystems owing to drivers such as climate change. Future iterations of the NPF should incorporate deeper analyses of attributes that account for natural system variability and help build resilience, taking into account stochastic processes or events.

3. Recommendations

1. The **Minister for the Environment** should:

a. Include the following attributes in the National Planning Framework on its introduction:

Domain	Attribute
Air	Fine particulate matter smaller than 2.5 µm (PM _{2.5})
Indigenous biodiversity	Proportion of indigenous vegetation cover by land environment
Estuaries and coastal waters	Salt marsh extent
	Seagrass extent
	Sediment mud content and accretion rate
	Nuisance macroalgae
Soil	Erodible soil stabilisation

b. Make public the intention to introduce further attributes, and provide an indicative schedule and scope for this work programme,

c. Make available sufficient funding, resourcing, and time to ensure that attributes are identified and assessed and that associated limits and targets are derived based on robust and inclusive evidence and analysis,

d. Require that processes for the identification and assessment of attributes seek to:

- i. account for natural system variability,
- ii. capture the effects of unpredictable, infrequent, and severe events, and
- iii. provide insight into the resilience of natural systems to the effects of climate change.

2. The **statutory Ministerial Advisory Panel** should:

a. Adopt an approach to identifying potential future attributes that:

- i. recognises the interconnectedness of natural systems and considers environmental integrity across environmental domains,
- ii. facilitates the identification of connections between ecological integrity, human health, and societal and cultural wellbeing,
- iii. prioritises attributes that provide insight into ecosystem health, are responsive to management intervention, and can be monitored or observed efficiently and reliably,
- iv. is relevant to Māori values,
- v. gives effect to Te Tiriti o Waitangi, and
- vi. provides effectively for the contribution of mātauranga Māori.

b. Consider using the Ngā Kete o te Wānanga framework when analysing further potential

attributes for inclusion in future versions of the National Planning Framework.

- c. Adopt an approach to establishing limits and targets that is based on a sufficient understanding of:
 - i. cause-and-effect relationships,
 - ii. the accuracy and uncertainty of model predictions,
 - iii. the quality and reliability of monitoring data,
 - iv. the maturity of monitoring networks, and
 - v. the capacity and capability of local government authorities to undertake monitoring and reporting activities.
3. The **Ministry for the Environment** should:
- a. Complete a stocktake of relevant environmental monitoring data and information collected by local government authorities, Crown Research Institutes and other research organisations, iwi/ Māori, and private sector stakeholders, and provide advice to the statutory Ministerial Advisory Panel highlighting gaps and priorities for action, and identifying potential sources of information that could complement regional council data and increase understanding of environmental drivers, pressures, state, impacts, and responses.
 - b. Compile and synthesise the results of previous consultation with Treaty Partners and the general public designed to clarify their concerns and aspirations regarding the health and functioning of ecosystems, and analyse this information to identify potential gaps in data and understanding in relation to environmental drivers, pressures, state, impacts, and responses.
 - c. Collaborate with local government authorities, including through the 'Environmental Monitoring and Reporting Steering Group', to identify and explore options for filling gaps in knowledge and increasing the quality of information during the period of transition following the introduction of the Natural and Built Environment Act, Spatial Planning Act, and National Planning Framework.
 - d. Provide advice to the statutory Ministerial Advisory Panel on options for reducing the operational burden associated with undertaking environmental monitoring and generating environmental information, giving particular consideration to:
 - i. integrating and rationalising attributes across environmental domains,
 - ii. leveraging the opportunities from new technologies that allow for more cost-effective, accurate and spatialised data generation and capture,
 - iii. prioritising the generation of information relating to attributes of particular relevance to local environments, and
 - iv. ensuring local knowledge can contribute to regional and national understanding of environmental drivers, state, pressures, impacts, and responses.
 - e. Provide advice to the Minister for the Environment and the statutory Ministerial Advisory Panel on options for changing operational roles and responsibilities and governance

- arrangements in New Zealand's environmental management system to:
- i. address capacity and capability constraints and drive greater efficiency in environmental monitoring and the generation of environmental information,
 - ii. address inequities in access to resources to implement the NPF, and
 - iii. give effect to Te Tiriti o Waitangi in regional and local level planning and decision-making processes.
- f. Provide guidance and resourcing to local authorities to prevent or reduce the risk of decision-making being delayed owing to missing, insufficient, or uncertain information.
 - g. Evaluate the suggestions in this report regarding potential future attributes and provide advice to the statutory Ministerial Advisory Panel on whether they should be considered for inclusion in subsequent versions of the NPF.
 - h. Evaluate the effectiveness of previous measures to avoid perverse outcomes on the transition to the new system and in response to the introduction of rules to manage or limit access to natural resources (e.g., the introduction of moratoria and the direct introduction of monitoring requirements into regional plans without requiring a plan change process), and provide advice to the statutory Ministerial Advisory Panel on the potential to use similar measures to avoid 'gold rushes' from occurring in response to the introduction of new attributes, limits, and targets via the National Planning Framework.
 - i. Provide guidance to local and regional government and other actors in the system on what is required to achieve an integrated understanding of Te Oranga o te Taiao, placing particular emphasis on how to monitor and manage at and across the boundary of management units to facilitate environmental integrity.
 - j. Rigorously evaluate and assess, including through a te ao Māori lens, whether the attributes proposed by the interim Ministerial Advisory Group are suitable for exchange, trade, or offsetting, and provide:
 - i. advice to the Minister for the Environment and statutory Ministerial Advisory Panel on when and under what circumstances offsetting is appropriate, and
 - ii. practice guidance to local authorities on offsetting, drawing on experience with established environmental offsetting and exchange systems internationally and in New Zealand to avoid operational uncertainty regarding statutory interpretation and implementation, and
 - k. Evaluate and provide advice to the Minister for the Environment and statutory Ministerial Advisory Panel on the potential to use recent advances in systematic conservation planning and new spatial prioritisation tools to help identify and prioritise areas for offsetting ecological effects within management units.

4. Introduction

The New Zealand government is currently reforming the country's legislative framework for environmental management. These reforms will, among other things, introduce a new regulatory National Planning Framework (NPF), which will allow government to provide mandatory environmental monitoring requirements and to set national limits and targets in relation to ecological integrity and human health. The NPF will provide national direction to guide the development of regulatory plans made by local authorities under the new legislation. Limits and targets set through the NPF will play a critical role in preventing further ecological degradation and achieving local and national aspirations for ecological improvement.

The Natural and Built Environment Bill specifies that **limits** in the NPF will be set to reflect the current state of the natural environment to prevent any further degradation of ecological integrity, and to protect human health and wellbeing, based on relevant health guidelines. Similarly, minimum acceptable limits and mandatory **targets** in the NPF will be set to lift environmental health and ecosystem functioning to meet minimum acceptable levels in instance where the natural environment is considered "unacceptably degraded" (see Figure 1).

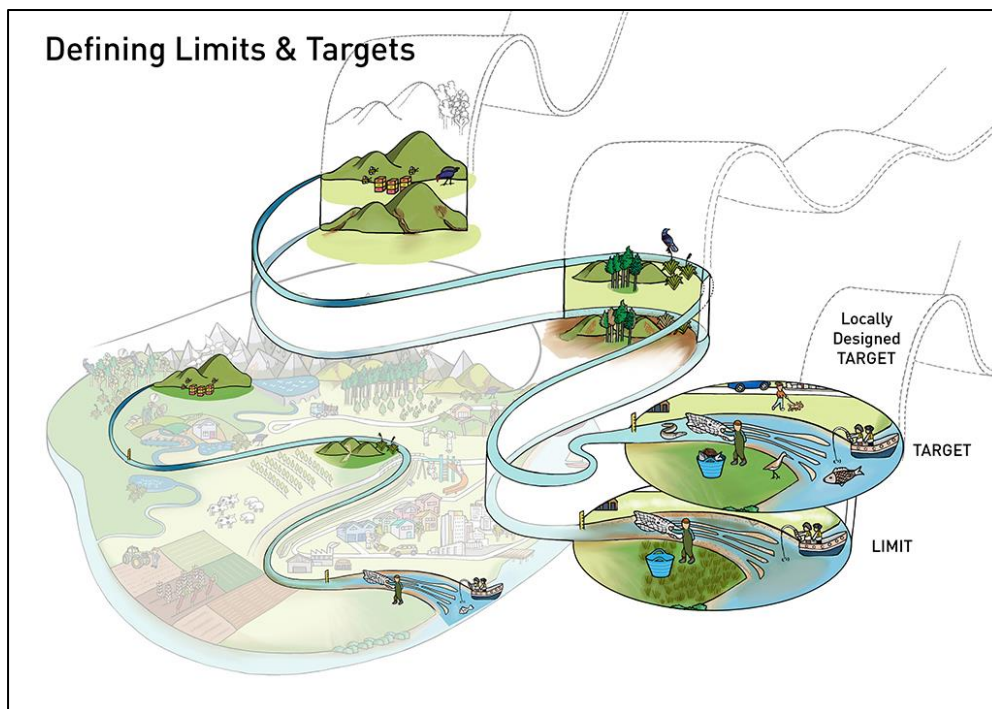


Figure 1: Visual explanation of the framework of 'attributes, limits, and targets'. In this theoretical example, the limits set for the part of the coastal environment shown in the diagram are at or about current state, which is degraded. However, through local processes, more aspirational targets have been developed, representing a healthier environment. Note that for human health and wellbeing attributes, targets must be put in place in situations where current state is below relevant health guidelines.

An initial version of the NPF will be introduced at the same time the new legislation is enacted. In addition to incorporating existing direction from, for instance, the National Policy Statement for Freshwater Management 2020 (NPS-FM) the initial version of the NPF will specify newly mandated biophysical 'attributes' that councils must include within their monitoring programmes. Their inclusion is intended to ensure there are sufficient attributes across the environmental domains of air, freshwater,⁴ indigenous biodiversity, land and soils, coasts, and estuaries to provide an understanding of the current state, and trends in and pressures on ecosystem health. Freshwater attributes are not in scope for the process of analysis described in this report.

The Natural and Built Environment Bill requires that the Ministers for the Environment and Conservation appoint a statutory Ministerial Advisory Panel for providing advice to the Minister(s) on the quality and integrity of the science practice underpinning potential limits and targets. The relevant Minister will then decide whether to consult publicly on the introduction of limits or targets via amendments to the NPF. In advance of establishing a statutory Ministerial Advisory Panel on Limits and Targets, the Ministry for the Environment has established an interim Ministerial Advisory Group – Limits and Targets (MAG) to help ensure the attributes included in the first version of the NPF:

- provide effective, reliable, and sufficient measures to protect human health, human wellbeing, and the ecological integrity⁵ of the natural environment, and
- can be monitored, reported on, and evaluated; and
- are underpinned by evidence that is inclusive, rigorous, transparent, and accessible.

Our Terms of Reference (see Appendix A) emphasise that it is essential for New Zealand's communities and regulatory decision-makers to be confident the attributes, limits, and targets specified in the NPF have been established based on the best available science and information and have been subject to rigorous testing. The analysis and rationale underpinning their adoption must also be transparent, accessible, and available for scrutiny, and the process for identifying and evaluating potential attributes, limits, and targets must:

- respect the role of iwi, hapū, and other Māori partners,
- create space for Māori knowledge systems, biophysical science, social and economic sciences, and other knowledge systems to collectively inform analysis and decisions, and
- give effect to Te Tiriti o Waitangi.

⁴ We understand that attributes for the freshwater domain will be advanced via the NPS-FM.

⁵ In this report, consistent with the definitions adopted by the NBE Bill:

Ecological integrity means the ability of the natural environment to support and maintain:

- representation: the occurrence and extent of ecosystems and indigenous species and their habitats, and
- composition: the natural diversity and abundance of indigenous species, habitats, and communities, and
- structure: the biotic and abiotic physical features of ecosystems, and
- functions: the ecological and physical functions and processes of ecosystems.

Environmental integrity is a broader concept that encompasses ecological integrity and includes the health and wellbeing of people and communities and the built environment they create, the interconnectedness of all parts of the environment, the relationship between iwi and hapū and te Taiao that is based on whakapapa, and the social, economic, institutional, and cultural conditions that affect the health and wellbeing of ecosystems, people and communities.

5. Purpose and scope of this report

The core task of the MAG was to assess and provide recommendations to the ministers for the Environment and Conservation on a suite of proposed attributes for inclusion within the initial version of the NPF. This involved evaluating the work of specialists at the Ministry for the Environment and Department of Conservation, testing the quality and integrity of the science and knowledge underpinning the proposed attributes, and determining whether they are appropriate for inclusion in the initial version of the NPF.

In undertaking this work we are conscious that the government's legislative reform programme represents a significant reset of the current system for environmental management. Given the scale of change underway, we think it is important to take account of a number of contextual matters, including important linkages between the limits and targets framework and other parts of New Zealand's resource management system. These include:

- the relationship between the natural environment and society,
- the link between environmental condition and well-being,
- New Zealand's research, science and innovation system,
- the environmental monitoring and reporting system,
- SOE reporting frameworks,
- Resource management frameworks within local government,
- Design intent and international experience,
- Consideration of good 'environmental governance', and
- Climate change (see Appendix B).

With this in mind, while undertaking our analysis and in reaching conclusions on attributes for inclusion in the initial version of the NPF, we identified a range of broader matters we considered significant and of particular relevance to the design and implementation of the NPF. We consider that a secondary – but no less important – task of the MAG is to provide advice to the Ministry for the Environment and (yet to be established) statutory Ministerial Advisory Panel to assist with the development of subsequent versions of the NPF. As such, and with this objective in mind, we felt it was necessary to develop our own approaches and frameworks to facilitate a broader analysis.

A key role of the statutory Ministerial Advisory Panel will be to determine limits and targets. The first step in doing this is to identify suitable attributes across the range of environmental domains – 'attributes' being those things that we measure, and through which limits and targets can be quantified. It is important to emphasise that the analysis undertaken by the MAG, and described in this report, focused only on attributes. We did not attempt to identify or establish specific biophysical thresholds or 'breakpoints' that are necessary to define limits and targets and to establish management 'bands'. This would have required more resource and time than were available to us. We understand the statutory Ministerial Advisory Panel will contribute to these decisions once it has been established.

We consider it important to note that current resources are insufficient to undertake all the monitoring and generate all the information government will be mandating through the NPF, *if*

Aotearoa continues to rely on current approaches. Systemic change is required both to align the key players at local, regional and national scales, and to target new investment where it is needed most.

This will involve investment to build understanding of and embed respect for Te Tiriti, lift capability and capacity in environmental science, monitoring, and modelling, and to re-align roles and responsibilities across the system. These things will take time and will, among other things, require a willingness to:

- innovate and adopt new methods, techniques, and technologies for generating information, and leave behind old methods and techniques that are less suited to producing the information required to protect and promote Te Oranga o te Taiao,
- leverage new tools made available via statutory reforms (e.g., the new Regional Spatial Strategies anticipated by the Natural and Built Environment Bill),
- acknowledge the value of information held by those outside of the public sector management agencies,
- involve more parties in the process of gathering information, and resource the involvement of those who have been excluded from participation or who are resource-constrained, including iwi, hapū and other Māori partners.

In this regard, we are aware the Ministry for the Environment is leading the government's Environmental Monitoring and Reporting System (EMRS) reform programme. This programme will investigate and develop proposals for systemic improvement, including changes to the funding model and definition of roles and responsibilities in Aotearoa's environmental monitoring and reporting system. We understand this programme, which is about to commence, will coordinate with the Environment and Climate Research Strategy, build upon recent changes to the Environmental Reporting Act, and aim to generate outputs by mid 2025, including recommendations to government regarding the investment required to undertake and sustain systemic improvements.

These programmes must be integrated with the process of setting limits and targets. To facilitate this, the Ministry for the Environment should ensure the statutory Ministerial Advisory Panel is aware of these programmes' progress and outputs, and provides opportunities for dialogue to ensure that recommendations on attributes, limits, and targets for the NPF are aligned with any new initiatives, tools, and recommended changes to the system that emerge from the EMRS and other relevant government programmes.

We recommend the Minister for the Environment make available sufficient funding, resourcing, and time to ensure that attributes are identified and assessed and that associated limits and targets are derived based on robust and inclusive evidence and analysis.

6. Conceptual framework

The proposed Natural and Built Environment Act and the NPF are expressly intended to recognise and provide for a fundamental te ao Māori principle, Te Oranga o te Taiao. This principle can be considered to encompass human health, wellbeing, and the ecological integrity of the natural environment – recognising that human health and the wellbeing of our society stem from the environment.

Giving expression to this principle in the new resource management system is one way to give effect to Te Tiriti o Waitangi. In exercising our responsibility as a Ministerial advisory group, we have adopted an approach that responds to the overarching direction of the proposed legislation and is intended to give expression to Te Oranga o te Taiao via the approach taken to evaluate and recommend attributes for inclusion in the initial version of the NPF. We want to make it clear, however, that more effort is required to fully meet Te Tiriti o Waitangi obligations, including by engaging more broadly with Māori to seek input on analytical processes, evaluative judgements and recommendations, and by ensuring the statutory Ministerial Advisory panel and its processes are sufficiently resourced to provide for adequate input from Māori.

Our analytical framework and our recommendations seek to connect Te Oranga o te Taiao to the attributes and, ultimately, their associated limits and targets. In doing so, we want to ensure that our science advice keeps the policy context in mind and avoids any gaps between scientific and technical advice and policy intent, which can cause confusion and delay and frustrate implementation. In this regard, we note our belief that evaluating individual attributes in strict accordance with the criteria provided in the Terms of Reference for the MAG could provide useful insight into scientific rigour but risked siloed or disconnected analysis. Boundaries between attributes, domains, and management areas are to some extent arbitrary, and can easily fail to appreciate the interconnectedness of all things – a concept that is central in te ao Māori.

To give expression to Te Oranga o te Taiao in the NPF, we consider analysis needs to be broader and explicitly designed to generate attributes that reveal overall environmental integrity, respect the interconnectedness of natural systems, and facilitate the identification of connections between ecological integrity, human health, and societal and cultural wellbeing. As such, when evaluating proposed attributes, we have taken a holistic view and attempted to account for linkages and interdependencies among these attributes and also between them and attributes defined through the National Policy Statement for Freshwater Management 2020 (NPS-FM). We have also considered accessibility and the ease with which the attributes and their linkages can be understood by all stakeholders and decision-makers in the resource management system.

In addition, in forming our recommendations, we have taken account of the interpretation and implementation of previous National Policy Statements and National Environmental Standards, particularly the NPS-FM. At the heart of the NPS-FM is the “fundamental concept” of Te Mana o te Wai. To give effect to te Mana o te Wai, freshwater management must prioritise the protection of the health and well-being of freshwater ecosystems first, then human health needs, before enabling other uses. In conducting our analysis we were mindful of the consistency between the stated purpose of the Natural and Built Environment Bill – to uphold Te Oranga o te Taiao – and the hierarchy of obligations established by the NPS-FM, in which the first priority is the maintenance or achievement of ecological health. We have conducted our analysis and made recommendations on this basis.

We consider that ensuring Te Oranga o te Taiao is the core principle underpinning the selection of attributes and the derivation of limits and targets is consistent with the internationally recognised concept of environmental integrity, and implies the integration of attributes across environmental domains, management units, and the NPF. This extends the concept of ecological integrity by including consideration of fit-for-purpose linkages in monitoring, regulation, and legislation to ensure the goals of the environmental and resource management system are clear and achievable.

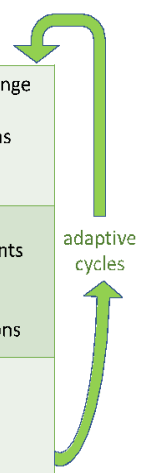
To help us to apply this conceptual approach we have adopted the “Ngā Kete o te Wānanga”, a mātauranga Māori framework described in Baker (2019).⁶ The elements of the framework are shown in Table 1. Further information on the framework, including details about each of the three aspects of resource knowledge it represents can be found in Appendix C.

“Ngā Kete o te Wānanga” sets out three specific aspects of knowledge for consideration when identifying priority attributes for managing resource use:

- Kete Tua-uri: what are our values and understanding of te taiao (the environment)?
- Kete Aronui: what do we observe or monitor to inform decisions?
- Kete Tua-ātea: what informs effective action to uphold environmental well-being, and for the purpose of the NPF, Te Oranga o te Taiao, into the future?

Table 1. Conceptual framework for evaluating and prioritising attributes

Evaluating attributes		
<i>Use information and knowledge to prioritise attributes in a policy process consistent with mātauranga Māori, that also ensures transparency and effective communication.</i>		
1. KETE TUA-URI	What are our values & understanding of te taiao?	<ul style="list-style-type: none"> • Recognises our values are subjective and change from place to place • Holds the line; support targets and aspirations • Sufficiency: Duty of care given impacts; • Includes necessary tiers, layers or hierarchies
2. KETE ARONUI	What do we observe or monitor to inform decisions?	<ul style="list-style-type: none"> • Observe whole of system, ecology, economy, socio-cultural including hotspots and big events • Understand whakapapa/relationships in the system that determine cause & effect • Consider multiple risks --> multiple preventions
3. KETE TUA-ĀTEA	What informs effective actions to uphold Te Oranga o te Taiao into the future?	<ul style="list-style-type: none"> • Use precaution to consider risk, imperfect knowledge and the burden of proof. • Degree of responsiveness to intervention • Clarity of who ‘owns the problem’ • Act on analysis of future scenarios



The diagram shows three green curved arrows forming a cycle. One arrow points from the top row (Kete Tua-uri) down to the middle row (Kete Aronui). A second arrow points from the middle row down to the bottom row (Kete Tua-ātea). A third arrow points from the bottom row back up to the top row. The text 'adaptive cycles' is written vertically next to these arrows.

7. Method

The MAG followed a two-part process when assessing and developing recommendations on the suite of proposed environmental attributes provided by the Ministry for the Environment and Department of Conservation for consideration.

The first part of our process involved reviewing proposals and supporting material provided by technical specialists from the Ministry for the Environment and Department of Conservation. This involved assessment and evaluation by individual members, discussions among members as a group, and ‘question and answer’ sessions with the Ministry’s and Department’s technical specialists at two day-long workshops. At these workshops we focussed initially on considering the quality and

⁶ Mahina-a-rangi Baker, “Te Kete Tua-ātea, Māori modelling of the future and the kaitiakitanga of water.” (PhD thesis., Massey University, 2019), <https://mro.massey.ac.nz/bitstream/handle/10179/15367/BakerPhDThesis.pdf?sequence=1&isAllowed=y>.

integrity of the science practice underpinning the proposed attributes and the supporting material we were provided. We then evaluated the potential attributes against the criteria provided in our Terms of Reference,⁷ and cross-checked our analysis against the Drivers, Pressure, State, Impact, Response (DPSIR) framework to confirm the applicability of proposed attributes in an operational/management context.

Once we were satisfied the attributes were robust enough to pass through that gate, we expanded our assessment and considered potential attributes through a te ao Māori lens to ensure they could provide suitable insight to Te Oranga o te Taiao and environmental integrity in a holistic sense. To help provide structure to our assessment we translated the “Ngā Kete o te Wānanga” framework into a set of criteria and used them to guide our consideration and prioritisation of potential attributes (see Table 2).

Table 2. Application of Ngā Kete o te Wānanga as a framework for evaluating attributes

Kete	Criteria	Score	Footnotes
Kete Tua-uri	1a. Recognises values, place and change		
	1b. Holds the line; supports targets		
	1c. Sufficiency to inform care that avoids potential impacts		
	1d. Includes necessary tiers, nested layers or hierarchies		
Kete Aronui	2a. Captures ecological, social/cultural, economic system		
	2b. Considers hotspots and big events		
	2c. Whakapapa/relationships determining cause & effect		
	2d. Considers multiple risks and multiple mitigations		
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk		
	3b. Incorporates responsiveness to interventions		
	3c. Delivers clear ‘ownership of the problem’		
	3d. Enables acting on analysis of future scenarios		

Table notes:

- **Criteria 1c and 2a-d address the question: is the proposed attribute sufficient?**
- **Criterion 1c also relates to whether additional attributes (or ‘descendant’ attributes of existing attributes) are needed to ensure sufficiency. For example, an attribute that is seen as lacking sufficiency on its own may be acceptable if it provides a clear basis as a tohu, or ‘parent’ attribute, supporting the later definition of a hierarchical set of ‘descendant’ attributes.**
- **Criteria 1c, and 2a-d are relevant to consideration of whether due process was followed in identifying the attribute.**
- **Definitions for each criterion and explanation of the way they have been applied are attached to this report (Appendix C.)**

⁷ The criteria provided to us were:

- inclusiveness - involves policymakers and is relevant and useful to them, considers many types and sources of evidence including mātauranga Māori, uses a range of skills and people),
- rigour - uses the most comprehensive, feasible body of evidence, recognises and minimises bias, is independently reviewed as part of a quality assurance process,
- transparency - clearly describes the methods, sources of evidence, and quality assurance processes communicates complexities and areas of contention, acknowledges assumptions, limitations and uncertainties, including any evidence gaps, declares personal, political and organisational interests and manages any conflicts, and
- accessibility - is written in plain language, is available in a suitable timeframe, is freely available online.

Each attribute was assessed under this framework using a Low (L) /Medium (M) / High (H) scoring system to reflect ‘lower-than-desirable’, ‘acceptable’ and ‘strong’ perceived alignment of the attribute being evaluated to each aspect in the Ngā Kete o te Wānanga framework.

Initially, MAG members drew on their expertise and experience in the attribute area to contribute individual ‘L, M or H’ scores. This involved drawing on the evidence base provided to the advisory group, as well as members’ own specialist experience and knowledge of peer-reviewed scientific papers and data and/or synthesis reporting of relevance to the attribute from both New Zealand and international sources.

Individual scores were then shared and debated by panel members, resulting in a collective (consensus) score. MAG Members with recognised expertise in each attribute area then produced content for the written report – summarising key points of discussion and resolution, along with a recommendation on each attribute considered. In addition to undertaking a peer review of the advisory group’s written report, an online moderation process was conducted by MAG members for each attribute to ensure consistency of evaluation and scoring across domains and attributes.

We consider that following this approach and applying this framework allowed us to determine with confidence whether proposed attributes:

- provide effective, reliable, and sufficient measures to protect human health, human wellbeing, and the ecological integrity of the natural environment, and
- can be monitored, reported on, and evaluated; and
- are underpinned by evidence that is inclusive, rigorous, transparent, and accessible.⁸

We recommend the statutory Ministerial Advisory Panel consider using the Ngā Kete o te Wānanga framework when analysing further potential attributes for inclusion in future versions of the National Planning Framework.

8. Evaluation of proposed attributes

8.1 General evaluation

8.1.1 Science rigour

We have based our comments and recommendations on the information presented to us by technical experts from the Ministry for the Environment and Department of Conservation and have, by and large, accepted the conclusions from their own peer review processes. We believe this approach is sufficient for the purpose of evaluating the proposed attributes. However, when it comes to defining numerical limits and targets, we consider that a deeper analysis will be required, including evaluation of the level of understanding of cause-and-effect relationships, the adequacy of models, or the quality and maturity of monitoring data. We suggest the Ministry consider the approach it takes to ensuring the analysis and recommendations it provides to the statutory Ministerial Advisory Panel is robust, and that this approach, including arrangements for external and independent peer review, is agreed to by the panel and open to scrutiny by panel members.

⁸ As referred to in the Terms of Reference (March 2023) for the interim Ministerial Advisory Group (see Appendix A)

The attributes that we were asked to evaluate for the first iteration of the NPF were chosen from a very long list of candidates and were based on three criteria: the urgency and importance of the environmental problem associated with the attribute, its suitability as a policy instrument to manage the associated issue, and the feasibility of the attribute in terms of science sufficiency. We consider these criteria appropriate, and their application in the shortlisting process to have been very sound. We want to acknowledge the excellent work by Ministry and Department officials and their independent advisors. The information that was provided to us was comprehensive, insightful, and of high quality, and was of great assistance to us in undertaking our evaluations.

We recommend the statutory Ministerial Advisory Panel adopt an approach to establishing limits and targets that is based on a sufficient understanding of:

- ***cause-and-effect relationships,***
- ***the accuracy and uncertainty of model predictions,***
- ***the quality and reliability of monitoring data,***
- ***the maturity of monitoring networks, and***
- ***the capacity and capability of regional councils to undertake monitoring and reporting activities.***

8.1.2 Scope of attributes

The natural environment is complex, dynamic, and unpredictable. Accordingly, it is essential that adequate levels of precaution are enabled by the scope of attributes specified via the NPF. We attempted to take a precautionary approach in our evaluation of the proposed attributes to ensure adequate coverage across the range of environmental domains, but detailed policy analysis will be required to ensure that potential perverse outcomes (e.g., loss of vegetation in threatened ecosystems) do not eventuate. We consider it is particularly important that careful consideration is given to ensure that ‘locking in’ an attribute now does not close off options for the development of future attributes and strengthens the limits and targets framework in future iterations of the NPF.

While the attributes proposed for the first iteration of the NPF are a suitable starting point, more work will need to be done to ensure that:

- ecosystem functions and processes are taken into account in future attributes,
- cause-and-effect linkages and interconnectedness (of biophysical systems, and of people with places) are given due consideration in future, and
- the co-benefits of policy work across government (e.g., zero-carbon goals influencing Aotearoa’s ability to achieve targets for the PM_{2.5} particulates attribute, or the soil conservation attribute positively impacting carbon sequestration) have been fully explored with regard to the identification of additional attributes.

Many of the attributes proposed for the first iteration of the NPF describe the ‘state’ of ecological integrity rather than ‘response’ under a DIPSr (Drivers-Impacts-Pressures-States-Response) framework. This was not regarded as an issue *per se*; rather, it was acknowledged that further evaluation of attributes will be required to efficiently integrate monitoring and management across

domains. We believe there is considerable scope for an efficient and streamlined number of limits (and targets) across environmental domains if, for instance, a ‘state’ attribute in one domain can be used as a ‘response’ variable in another (see Box 1).

Box 1: Integration of attributes within the NPF - ‘sediment’

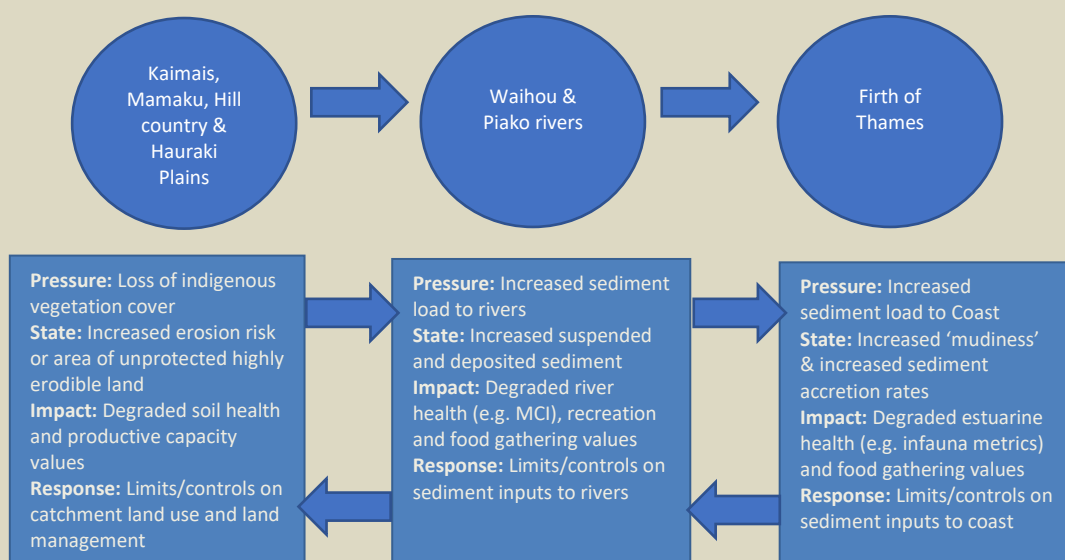
Our soil is a fundamental resource, a cornerstone of terrestrial ecological integrity, but also a ‘master’ stressor when lost to freshwater and marine ecosystems. The first iteration of the National Planning Framework is likely to contain a suite of attributes across six mandatory matters (air, coastal waters, estuaries, freshwater, indigenous biodiversity, and soil). These attributes will be used to define Limits and Targets that will prescribe desired outcomes and associated limits on resource use. In considering this suite of attributes and their application in effective and efficient policy, we must consider how they can be managed in an integrated manner. We believe that soil and associated processes (i.e., erosion, transport and deposition) provide a useful example of how we might integrate attributes that span multiple domains.

The concept of *ki uta ki tai* (Mountains to the Sea) is well-established and provides a longitudinal context for integration of soil/sediment-related attributes. Such an approach also reflects New Zealand’s natural systems – our catchments start in the mountains and hills, with rivers and streams travelling down through the landscape to the sea, eventually flowing out into the coastal marine environment. The example of the Hauraki Freshwater Management Unit below highlights how it would be possible to define management units relevant to the values of interest (e.g., ecological integrity).

The catchments of the Waihou and Piako rivers in the Waikato Region both drain to the Firth of Thames. The river catchments drain the Hauraki Plains, Kaimai Ranges, Mamaku Plateau and hill country associated with several extinct volcanic cones. Clearance of indigenous vegetation for pastoral agriculture, mining, horticulture and urban development have significantly increased the area of highly erodible land and increased the risk of mass erosion during episodic intense rainfall events, the frequency of which are likely to increase with climate change. Subsequent soil loss has reduced landscape values, including indigenous vegetation restoration potential, productive capacity and the overall ecological integrity of soil ecosystems. Loss of soil to the Waihou and Piako rivers has caused significant increases in suspended and deposited sediments (NPS-FM attributes), with adverse effects on ecological health of these waterways. Transport of fine sediment to the Firth of Thames has significantly increased natural rates of sediment accretion, leading to increased muddiness of benthic habitats (Proposed NPF attributes) and has contributed to the loss of marine fauna, including keystone species such as mussels.

Within the Hauraki Management Unit, improvements in ecological integrity across coastal, freshwater and terrestrial ecosystems will require effective and integrated controls on the sources and transport of sediment from mountains to sea. Policies targeting sediment sources need to consider the chain of sensitive receiving water bodies downstream. Targets will need to be defined in a way that recognises the longitudinal and lateral connections from mountains to sea.

The following figure attempts to summarise this within a DPSIR framework (note that the Drivers are the same i.e., human activity overlaid by climate change):



While we acknowledge that the first iteration of the NPF prioritised ‘ecological integrity’ attributes, we were careful to consider future development of ‘human health and wellbeing’ attributes and how these might relate to the broader concept of environmental integrity. However, further work will need to be done in linking ecological integrity to human health and wellbeing in domains other than air quality. This is vital from a te ao Māori perspective: for instance, connection between people and place is a critical element of protecting and enhancing mahinga kai sites. In this regard, we note, in particular, the general lack of attributes proposed for inclusion in the first version of the NPF relating to Māori values and specifically those relating to land and landscape.

We recommend the statutory Ministerial Advisory Panel should adopt an approach to identifying potential future attributes that:

- ***recognises the interconnectedness of natural systems and considers environmental integrity across environmental domains,***
- ***facilitates the identification of connections between ecological integrity, human health, and societal and cultural wellbeing,***
- ***prioritises attributes that provide insight into system health, are responsive to intervention, and can be monitored or observed efficiently and reliably,***
- ***is relevant to Māori values,***
- ***gives effect to Te Tiriti o Waitangi, and***
- ***provides effectively for the contribution of mātauranga Māori.***

8.2 Evaluation of individual attributes

8.2.1 Air

PM_{2.5}

The proposed PM_{2.5} attribute is the only attribute currently under consideration that is intended for the protection of human health and wellbeing. As such, it must be based on relevant health guidelines. The epidemiological evidence linking exposure to small particles in the air to adverse effects on human health is well settled. Aotearoa-specific studies indicate substantial local impacts (Kuschel et al, 2022)⁹, and are consistent with a large body of overseas evidence. National environmental standards for air quality have been in place in New Zealand since 2003 and include a maximum concentration for PM₁₀ (MfE 2002).¹⁰ The science is now clear that the smaller size fractions, i.e., those less than 2.5µm, are the most harmful. The World Health Organisation (WHO) produced ambient air quality guidelines that included a limit for PM_{2.5} in 2005, and amended this in 2021 with more stringent thresholds for both annual and daily averages.

⁹ Kuschel G et al, 2022. *Health and air pollution in New Zealand 2016 (HAPINZ 3.0)*. Report prepared for the Ministry for the Environment, Ministry of Health, Te Manatū Waka Ministry of Transport, and Waka Kotahi NZ Transport Agency. Auckland, New Zealand.

¹⁰ Ministry for the Environment (MfE) 2002. *Ambient air quality guidelines. 2002 update*. Wellington, New Zealand.

It is clear to us that an Aotearoa limit for PM_{2.5} is necessary to protect human health and well-being in relation to air quality, standing alongside limits for other contaminants currently included in the National Environmental Standard for Air Quality 2004. However, we note that all contaminants included in the standards, and others that are not yet regulated, need to be reviewed regularly to ensure their sufficiency. For example, it is likely that limits for black carbon, a component of particulate matter, will need to be determined. Although regulatory thresholds are yet to be either determined or implemented in an international context, the links between black carbon, atmospheric warming and human health, mean that limits for this contaminant should be prioritised as relevant research findings become available. We also note that, unlike other jurisdictions, New Zealand does not have environmental standards for indoor air quality beyond those safeguards encompassed by the legislation dealing with health and safety in the workplace, and it may be appropriate to consider limits that provide protection for other indoor situations.

We have evaluated a potential PM_{2.5} limit against the criteria set out in our framework. Overall, we have high confidence that this proposed attribute is well-aligned in terms of the perspective and intent of the framework, and rates well against all the individual criteria. In further developing the PM_{2.5} attribute the government may wish to take into account the substantial variation in airsheds around the country in terms of potential compliance, and the significant technical and economic challenges for some communities in making the required improvements. One option is to use a phased approach in which highly compromised airsheds have an initial target based on the WHO 2005 guidelines, with full compliance with the 2021 values required by a clearly signalled future date. Such an approach is consistent with NPF requirements for limits for the protection of human health and well-being, which must be based on relevant health guidelines. Recommendation:

We recommend the inclusion of an attribute for fine particulate matter smaller than 2.5 µm (PM_{2.5}), in the first tranche of attributes for the National Planning Framework

8.2.2 Indigenous Biodiversity

Proportion of Indigenous Vegetation Cover (IVC)

The twin crises of indigenous biodiversity loss and climate change will have profound impacts on Aotearoa. Preventing further declines in indigenous biodiversity thus forms the basis for a pivotal attribute for the first tranche of the NPF. The first step in preventing such declines is to mitigate one of the primary drivers of biodiversity loss, i.e., loss of indigenous vegetation cover (IVC).

Ideally, Aotearoa should have a universally agreed, data-driven system for classification of indigenous ecosystems (ecosystem extent). However, we acknowledge that development of such an attribute is complex and would require further work.

In the absence of such a system we support inclusion of the IVC attribute as the best immediate alternative. Whilst this attribute lacks sufficiency (i.e., it is a 'tohu mātua' or 'parent attribute'), it provides a vital starting point for establishing descendant attributes in future iterations of the NPF. It will lay foundational work for dynamic, spatially scalable ecosystem mapping in future, and for quantifying how ecosystem functions and habitat quality are changing in real time. We were also of the view that including the IVC attribute now provides significant scope for development of linked

human health and/or wellbeing descendant attributes in future, many of which may be important to iwi and hapū and other Māori partners.

LENZ Level II is a good initial approach to establishing limits and targets for percentages of indigenous vegetation cover, providing an appropriate balance between capturing key elements of ecological representation and the ability of councils to set attribute 'bands' and target states that would signal future land use changes within a Management Unit. Further, standard monitoring methodologies are available and already in use by councils, iwi and hapū and other kaitiaki, and in the research sector, facilitating national consistency. If implemented correctly, this attribute would help prevent further decline in the most vulnerable areas (e.g., lowland areas where impacts on indigenous vegetation have been most profound). The MAG was comfortable that it would be reasonably straightforward to integrate this attribute with attributes in other domains (e.g., the potential for restoration of indigenous vegetation to mitigate sediment loss into waterbodies and estuaries; see Box 1, page 24).

Further, we were also satisfied that the IVC attribute demonstrated congruence with the National Policy Statement for Indigenous Biodiversity (NPS-IB); alignment with Department of Conservation Threatened Environments classifications and work on Significant Natural Areas (SNAs); and suitability for integration with existing monitoring of indigenous vegetation by councils, hapū and iwi, given that LENZ II is in common usage already. Again, this sets a solid foundation for national-scale management of all IVC, with scope for local decision-making to protect ecological integrity. It also has potential to help Aotearoa fulfil international obligations in relation to indigenous biodiversity, such as that agreed at COP15 in 2022: "Effective conservation and management of at least 30% of the world's lands, inland waters, coastal areas and oceans, with emphasis on areas of particular importance for biodiversity and ecosystem functioning and services."

Notwithstanding our support for inclusion of this attribute, we noted several shortcomings that should be addressed. Clarifying the scale and size of Management Units will be crucial to enabling the ability of local and regional decision-makers to distinguish indigenous vegetation cover and set appropriate targets for managing the state of this attribute. Yet there is a lack of data on which to make robust decisions, and this should be addressed both now and in future iterations of the NPF to develop and refine monitoring protocols and guidelines.

Related to the gap in data/knowledge of IVC is the way in which IVC will be managed within a Management Unit. In the NBE Bill, Management Units must be determined by reference to scientific knowledge and mātauranga Māori (see clause 55 (1)b). Appropriately, mātauranga will be iwi/hapū owned. However, a key focus will need to be on supporting and appropriately resourcing iwi, hapū and other Māori partners to access IVC information and use and integrate this parent attribute into the creation of their own mātauranga.

Strong guidance will also be required in implementing the Effects Management Hierarchy to prevent continued degradation (or removal) of poorly protected remnant vegetation. Consideration of such perverse outcomes is covered in our commentary about offsetting in Section 9.5. Reliance on non-regulatory tools (e.g., incentives) for local communities to increase IVC by setting targets will require careful coordination across local and national government agencies (e.g., with the Department of Conservation), alongside iwi, hapū, and other Māori partners.

Given the nature of this attribute as a parent attribute, consideration of descendant attributes for future iterations of the NPF should start without delay, as these could take time to develop. A nationally-agreed ecosystem classification system (ecosystem extent) would more fully capture critical ecosystems that lack vegetation but hold important biodiversity values, e.g., scree slopes or braided river gravels. However, further work needs to be done to explore the implications of an ecosystem extent attribute to tailor it to avoid odd or unintended consequences. Other descendant attributes could include but are not limited to: ecosystem condition, degree of ecosystem fragmentation (or the corollary, connectivity), succession or regeneration processes, quantification of biodiversity values within an ecosystem, and impacts on these such as weed and pest invasion.

All of these can be summarised generally as guidance from the MAG to shift from ‘pattern to process’ in future iterations of this attribute, i.e., to more fully capture elements of ecosystem function as a critical element of ecological integrity; link healthy ecosystems explicitly with human health and wellbeing; build resilience to climate change impacts and their interplay with other major drivers such as large-scale impacts of plant pathogens (e.g., kauri dieback, myrtle rust) major losses of vegetation cover from extreme weather events and shifting ecosystem distributions.

We recommend the inclusion of an ‘indigenous vegetation cover by land environment’ attribute (specifically: percentage of indigenous vegetation cover within LENZ Level II) in the first tranche of attributes for the National Planning Framework.

8.2.3 Estuaries and coastal waters

Salt marsh extent

Salt marsh, a collective term for many species of salt-tolerant plants, is an important habitat for indigenous species and performs key ecological functions, including the trapping of sediment and nutrients generated in the catchments of estuaries. Salt marsh vegetation is associated with mahinga kai species and so its abundance and diversity have substantial cultural implications. It has a clear link to ecological integrity, in terms of ecological representation, composition, structure and function. It also has an important role to play in carbon sequestration. Compared to its historical state, salt marsh extent has been substantially reduced (Thomsen et al, 2008),¹¹ being susceptible to pressures from coastal development, drainage, reclamation, and invasive weeds, and to physical damage from vehicles and livestock. Because salt marsh habitat often straddles administrative boundaries, its management can be subject to conflicting or poorly aligned regulation or other policy approaches. In the absence of consistent national or local direction salt marsh is prone to both incremental and abrupt degradation.

One of the key benefits of including salt marsh extent in the initial suite of NPF attributes is the promotion of consistent methods for its measurement, so the development of appropriate national guidance is a critical prerequisite of attribute implementation. We also note that this attribute responds to multiple drivers, so that while cause and effect relationships are well understood in the

¹¹ Thomsen MS, Adam P, Silliman BR. (2009). Anthropogenic Threats to Australasian Coastal Salt Marshes. In Silliman BR, Grosholz ED, Bertness MD (Eds.), *Human Impacts on Saltmarshes: A Global Perspective* (pp 361–390). University of California Press, Berkeley and Los Angeles, California.

<https://ref.coastalrestorationtrust.org.nz/site/assets/files/7237/thomsen-09-book-chapter-nz-saltmarsh.pdf>

broad sense, the way these interact are likely to be site-specific, which means that the effectiveness of management interventions will be dependent on both monitoring and investigation programmes.

We have evaluated the attribute against our framework (see Appendix D for summary assessments) and consider that, overall, it has a strong fit with the criteria, with a couple of qualifications. We note that salt marsh extent meets our definition of a parent attribute. In conjunction with the proposed seagrass extent attribute, it covers a broad range of pressures on estuarine and coastal ecosystems, but these will not be sufficient to ensure the ecological integrity of all such ecosystems. Accordingly, we have suggested additional attributes for investigation for future iterations of the NPF, including those that go beyond extent to capture quality and function.

The degree to which this attribute enables managers to put precautionary strategies into place is uncertain: restoration of lost habitat, although technically feasible, can be very challenging, and criteria for success are still emerging.

We have also recognised that pressures on salt marsh habitat associated with sea level rise are not easily amenable to management intervention, and careful thought will need to be given to effects such as coastal 'squeeze' in policy design.

We recommend the inclusion of an attribute for salt marsh extent in estuaries and coastal waters in the National Planning Framework

Seagrass extent

Seagrass is considered a key biogenic habitat in estuaries and shallow coastal waters, providing an important nursery habitat for juvenile fish. Seagrass stabilises and provides physical structure on the seabed and contributes to important biogeochemical processes.

Seagrass has declined in extent over the last ~60 years, especially in New Zealand's subtidal areas. Human-induced pressures, particularly increased nutrient loading and sedimentation, along with physical disturbance are responsible for most of the observed loss.

Many regional councils already map seagrass extent as part of existing estuarine state of environment monitoring. The Coastal Special Interest Group (c-SIG) of regional councils is currently preparing a protocol that will support consistent and representative monitoring programmes throughout NZ. However, it should be recognised that further work is needed to develop appropriate descriptors (e.g., bands) for seagrass extent.

From a management perspective, there is strong evidence of cause-effect linkages between seagrass extent and the levels of nutrients and sediments discharged to coastal and estuarine systems. The impacts of physical disturbance (e.g., moorings, dredging) are also reasonably well understood. We are confident that we have sufficient evidence to impose controls on activities leading to either physical disturbance or increased nutrient enrichment and sedimentation within estuaries.

Given widespread decline in seagrass extent, evidence of cause-effect relationships and clear management opinions, we consider it appropriate to include this attribute in the first version of the NPF. However, we do need to stress, as indicated by coastal scientists leading development of the attribute, that multiple stressors may be present in any given system. Effective and efficient

management approaches will need to consider the potential interacting effects of these multiple stressors in setting targets for this attribute.

We recommend the inclusion of a ‘seagrass extent’ attribute in the first tranche of attributes for the National Planning Framework.

Sediment mud content and accretion rate

Sedimentation in estuaries and coastal waters is widespread in New Zealand (MfE, 2019a).¹² Sediment is a recognised major stressor on estuarine and coastal ecosystems (Neverman et al., 2023)¹³, and is often described as a ‘master contaminant’ – when soils erode from hillslopes, riverbanks and other parts of the landscape, the sediment that is produced and carried into waterways typically carries other contaminants that can cause environmental harm (e.g., nitrates and phosphates) or affect human and animal health (e.g., E. coli, heavy metals; MfE, 1999b).¹⁴ As such, the proposed two sediment-related attributes (sediment mud content and sediment accretion rate) are important indicators not only of sediment stressors, but also wider ecological impacts.

The evidence linking higher-than-natural sediment deposits to adverse impacts on the environment (including smothering of shellfish beds, effects on fish and bird populations, and ecosystem impacts such as reduced storm protection, water filtering and nutrient regulation; MacDiarmid et al., 2013),¹⁵ health, and cultural practices such as mahinga kai (food gathering) are well established. The impacts described scientifically in New Zealand directly mirror research findings internationally. There is strong evidence that climate change is expected to exacerbate sedimentation and its impacts (Neverman et al. 2023).

Currently, policies relating to sedimentation and integrated management are included in the New Zealand Coastal Policy Statement 2010 (NZCPS), with a requirement to “assess and monitor sedimentation levels and impacts on the coastal environment” along with requirements to control sediment runoff from subdivision, forestry, and other activities. However, not all regional councils and unitary authorities have given effect to the NZCPS. In addition, the NPS-FM includes interventions relating to the management of sediment in freshwater; however, it is unclear if management directed only to freshwater attributes will protect estuaries and coastal waters from adverse effects associated with sedimentation. That said, sediment mud content, sediment accretion rate, or both, are already measured and reported on by many regional councils and unitary authorities as part of their estuarine state of environment monitoring programmes, in line with broadly consistent methodologies set out in the National Estuary Monitoring Protocol (Robertson et al. 2002)¹⁶ or other guidance (e.g., Hunt 2019).¹⁷

¹² MfE (2019a). Updated sediment load estimator for New Zealand. <https://environment.govt.nz/publications/updated-sediment-load-estimator-for-new-zealand/>

¹³ Neverman et al. (2023). [Climate change impacts on erosion and suspended sediment loads in New Zealand](#). Geomorphology

¹⁴ MfE (1999b). Organochlorines in New Zealand: Ambient concentrations of selected organochlorines in estuaries.

¹⁵ MacDiarmid AB, Law CS, Pinkerton M, Zeldis J 2013. New Zealand marine ecosystem services. In Dymond JR ed. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, New Zealand.

¹⁶ Robertson et al. (2002). Estuarine Environmental Assessment and Monitoring: A National Protocol.

¹⁷ Hunt, S. (2019). Summary of historic estuarine sedimentation measurements in the Waikato region and formulation of a historic baseline sedimentation rate. Waikato Regional Council.

From a management perspective, there is clear evidence of cause-and-effect linkages between land use (and land use change including deforestation) and both sediment mud content and sediment accretion rate in estuarine and coastal systems. In-estuary activities (e.g., dredging) are also well understood in terms of both cause and effect, and management interventions to prevent or reduce impacts.

Establishing specific estuarine attributes relating to sediment to support management interventions is a logical extension of existing approaches under the NPS-FM and is also consistent with direction in the NZCPS. Such an approach would appropriately recognise the cumulative nature of effects in sensitive receiving environments such as estuaries, particularly given that critical sediment sources occur throughout the landscape (i.e., from mountains to sea).

Given the scale of, and significant impact from, sediment loading from human activities in estuarine and coastal ecosystems, clear evidence of cause-effect relationships and specific, well-demonstrated management options, we consider it appropriate to include these two attributes in the first version of the NPF.

These attributes are also recommended as there is scientific consensus on attribute measurement, and many councils already monitor sediment mud content and/or accretion rate in estuaries using largely consistent methodology. That said, there are challenges associated with the temporal and spatial distance between the source of the pressure (viz. human-accelerated erosion on land, and discharge of sediment to waterways upstream of estuaries) and how this specifically translates into impacts within estuaries. Improved understanding of sediment sources and loads, and careful selection of representative monitoring sites are therefore key to ensuring effective targets and limits relating to these two attributes.

We recommend the inclusion of two ‘sediment’ attributes in the first tranche of attributes for the National Planning Framework:

- 1) a ‘sediment mud content’ attribute***
- 2) a ‘sediment accretion rate’ attribute***

Nuisance macroalgae

Nuisance macroalgae can be considered a primary symptom of the eutrophication of our estuaries. Proliferation of macroalgae commonly leads to reduced biodiversity, loss of seagrass, and degraded sediment quality.

The main driver of nuisance macroalgae in estuaries is increased nutrient inputs, which have increased significantly over the past ~50 years. As a result, eutrophication symptoms in New Zealand estuaries are now widespread. A large proportion of the nutrients come from anthropogenic sources (diffuse and point sources) often transported to estuaries via river systems.

Measurement of nuisance macroalgae will use the Opportunistic Macroalgae Blooming Tool (OMBT), a tool developed for the European Union, modified for New Zealand, and currently in use by seven regional councils. Numeric and narrative bands have been established based on overseas and New Zealand data and have been adopted in Environment Southland’s objective setting process under the NPS-FM.

Good evidence exists of cause-effect relationships between nutrient loading and nuisance macroalgae in New Zealand estuaries (Robertson & Savage 2021).¹⁸

Current management interventions and approaches relevant to this attribute include the management of nutrients in freshwater under the NPS-FM and policies relating to water quality and integrated management under the NZCPS.

Regional councils are already grappling with the need to set Limits and Targets relating to nutrients in sensitive receiving bodies through the NPS-FM (2020, section 3.13). It is likely that as councils develop their 2024 regional plans to give effect to the NPS-FM we will see increasing uptake of estuarine attributes, with controls placed on upstream nutrient sources.

Other indicators of eutrophication in estuaries include water column nitrogen and phosphorus concentrations, and oxygen, total nitrogen, or total organic carbon content of sediments. These attributes should be considered for future iterations of the NPF but scientific consensus is that these attributes need further development.

Given the increased nutrient and sediment loading of freshwater and estuarine systems over the last few decades, inclusion in the NPF of a primary attribute relating to eutrophication of estuaries, would seem to be an important consideration.

We recommend the inclusion of a 'nuisance macroalgae' attribute in the first tranche of attributes for the National Planning Framework.

8.2.4 Soil

Erodible soil stabilisation

Soil erosion presents a serious problem for New Zealand as a 'high-standing island' – implying the combined amplification of large areas of steeplands and high rainfall intensity occurring when marine storm tracks encounter mountains. The resulting orographic precipitation may be amplified by climate change and causes severe impacts through mass movement erosion such as landslides¹⁹ observed in storms like cyclones Bola (1988) and Gabrielle (2023).

Erosion of soil causes not only a loss of a resource that provides for upland productivity,²⁰ but has historically had severe impacts downhill or downstream on infrastructure, settlements, productive land and on the integrity of freshwater, estuarine and coastal ecosystems.

Research on erosion following Cyclone Bola and previous storm events produced strong published evidence that was incorporated in the Land Resource Inventory's Land Use Capability classification and has been reflected in the planning rules already implemented in regional council plans.

¹⁸ Robertson, B. P., & Savage, C. (2021). Thresholds in catchment nitrogen load for shifts from seagrass to nuisance macroalgae in shallow intertidal estuaries. *Limnology and Oceanography*, 66(4), 1353-1366.

¹⁹ <https://landslides.nz/nz-landslides-database/>

²⁰ Blaschke, P. M., N. A. Trustrum, and D. L. Hicks. (2000). "Impacts of mass movement erosion on land productivity: a review." *Progress in Physical Geography* 24 (1): 21-52.

Stabilisation of erodible soil requires the identification and implementation of vegetation cover that ensures roots provide the soil strength to resist erosion^{21, 22}. This is achieved through effective controls on the removal of vegetation and requirements for restoration of vegetation cover. For example, in the case of preventing excessive landsliding on soft rocks including mudstones, woody vegetation is required on slopes exceeding approximately 23°. This example has been implemented in Greater Wellington Regional Council's long standing Soil Plan, by defining highly erodible land as having slopes over 23° in the eastern part of the region where soft rocks dominate, and then establishing rules limiting the disturbance of woody vegetation and requiring restoration where disturbance has occurred. The same rules apply to the western part of the region where the slope threshold is 28°. ²³ Other regions have implemented similar planning rules and there are also examples of similar research for the prevention of erosion in urban landscapes having been implemented through zoning rules.²⁴

The attribute for protecting highly erodible land from mass movement erosion can be termed erodible soil stabilisation and should match land characteristics to the vegetation required to protect from erosion through the strength of healthy roots in the soil i.e., the extent of vegetation taller than a specified height with roots capable of stabilising the landform in specified gradients and soil types.

Sufficient mapping and information exist for rapid implementation of an NPF including this attribute, consistent with many regional council plans, and can be improved through advancements in land information such as precise and detailed elevation surveys being completed using LIDAR, enhanced soil mapping, and research following Cyclone Gabrielle. The attribute would optimise existing council monitoring of erodible soil stabilisation, and the intended development of national environmental monitoring standards would achieve consistent aggregable data constituting evidence that work is being done towards environmental improvement. Future development of monitoring programmes that build on this attribute can link upland erosion reduction to the management of downstream impacts related to attributes for freshwater, estuaries and coasts.

We recommend the inclusion of an 'erodible soil stabilisation' attribute in the first tranche of attributes for the National Planning Framework.

8.3 Potential future attributes

Our evaluation of potential attributes for inclusion in the initial version of the NPF was undertaken rapidly and with a narrow focus on ensuring a minimum acceptable coverage of attributes across the environmental domains. The scope of our analysis was largely determined by the material, evidence,

²¹ Watson, Alex, Chris Phillips, and Michael Marden. (1999). "Root strength, growth, and rates of decay: root reinforcement changes of two tree species and their contribution to slope stability." *Plant and Soil* 217 (1): 39-47.

<https://doi.org/10.1023/a:1004682509514>. <http://dx.doi.org/10.1023/A:1004682509514>.

²² Gomez, B., K. Banbury, M. Marden, N. A. Trustrum, D. H. Peacock, and P. J. Hoskin. (2003). "Gully erosion and sediment production: Te Weraroa Stream, New Zealand - art. no. 1187." *Water Resources Research* 39 (7): 1187.

²³ See <https://www.gw.govt.nz/assets/Documents/2000/10/Soil-plan.pdf> definition on p15 and Rules p 33-35.

²⁴ Lawrence, J.H., D.R. Depledge, D.J. Oakley, R.J. Eyles, and M.J. Salinger. (1982). *Landslip and flooding hazards in Eastbourne Borough : a guide for planning*. Vol. 37 *Water and Soil miscellaneous publication*. Wellington: Water and Soil Division, Ministry of Works and Development.

and options provided to us by staff from the Ministry for the Environment and Department of Conservation, after conducting their own internal and independent external peer review processes. While we are therefore confident of the rigour and quality of the information provided to us, we are mindful that if regulatory decisions and actions are to protect and promote environmental integrity, they must be based on information that is both comprehensive and integrative across environmental domains. We consider, therefore, that the statutory Ministerial Advisory Panel will need to conduct a more comprehensive evaluation when considering future attributes.

We have noted elsewhere that we consider there will be significant gaps that the statutory Ministerial Advisory Panel will need to address in subsequent iterations of the NPF, particularly in relation to attributes that connect ecological integrity to human health, and societal and cultural wellbeing. During our analysis, discussion, and deliberations we identified several areas or topics that warrant investigation to establish whether they should be considered as potential attributes for inclusion in future versions of the NPF – either as descendant attributes of those included in the initial version of the NPF, or as new attributes.

We present these areas and topics here as suggestions to assist central government agencies to prepare for the incoming statutory Ministerial Advisory Panel and to signal to those central and regional government agencies responsible for implementing the NPF areas where medium to longer-term research may be required.

We wish to emphasise that our intent is not to pre-empt or constrain the work of the statutory Ministerial Advisory Panel. Rather, we wish to make transparent some of the areas and topics we discussed and that could be investigated further in subsequent processes. These include:

- **Air:** Nitrogen dioxide, black carbon, attributes relevant to indoor air quality, and the development of a national air quality index
- **Terrestrial ecosystems:** Ecosystem extent and the degree of ecosystem fragmentation and connectivity, indicators of ecosystem function, the impacts of plant and animal pests, and the development of a national system of ecosystem classification
- **Estuarine and coastal habitats:** The quality of salt marsh and seagrass habitat, the extent and health of shellfish beds and their ability to sustain harvesting, the extent and health of kelp forest and bryozoan thickets, phytoplankton, estuarine nutrient loading and sediment contaminants (e.g., heavy metals), and indicators of biogenic function in estuarine and coastal environments (e.g., macroinvertebrates)
- **Land and soil:** Surface erosion and riparian soil protection (as attributes following the same attribute form as susceptibility to landslides), the extent of peatlands, soil quality and the extent of versatile soils, soil contaminants and the development of national ecological soil guideline values
- **Human health:** Suitability of freshwater and marine environments for contact recreation, food gathering, and mahinga kai
- **Cross-domain attributes:** the effects of microplastics, emerging organic contaminants, light pollution, and climate change on both human health and ecosystem health and functioning.

We recommend the Minister for the Environment make public the intention to introduce further attributes and provide an indicative schedule and scope for this work programme.

We recommend the Ministry Environment evaluate the suggestions in this report regarding potential future attributes and provide advice to the statutory Ministerial Advisory Panel on whether they should be considered for inclusion in subsequent versions of the NPF.

9 Broader considerations – system integrity and implementation

9.1 Defining and deriving limits and targets

The natural environment is complex, dynamic, and unpredictable. The use of environmental limits and targets as a key mechanism for environmental management may be conceptually attractive, but their effectiveness depends on the quality and resolution of information used to set them and to monitor compliance with or progress towards achieving them.

The effectiveness of limits and targets may be compromised where there is uncertainty due to a lack of information or understanding, coupled with a strong economic incentive to extract or use natural resources. For this reason, we consider it essential that a system based on mandated attributes, limits, and targets provides an adequate level of protection and is suitably precautionary to avoid inadvertently undermining ecosystem health and functioning.

In this regard, and notwithstanding our support for the enhanced role ‘environmental limits and targets’ are to play in Aotearoa’s resource management system, we agree with and would like to emphasise concerns raised by the Parliamentary Commissioner for the Environment²⁵ regarding the effectiveness of limits and targets *as currently conceived and defined in the Bill*:

“...if limits are only set at levels that prevent ‘the ecological integrity of the natural environment from degrading from the state it was in’ at the time the bills are passed into law, they will lock in currently degraded states of the environment. Balancing an ‘aspirational and forward-looking’ planning approach to social and economic outcomes against an undemanding limit opens the way to leaving the natural environment in a perpetually degraded state”.

and

“Defining environmental limits at the environment’s current state regardless of the level of compromise that represents is conceptually and fundamentally flawed. Most people’s understanding of a limit is a threshold beyond which it is unsafe or excessively risky to proceed – for example a speed limit. That is not how the bill conceives of an environmental limit.”

and

“At the very least, environmental limits should be set at an objective level of healthiness, informed by science and advice...”

At the time of finalising this report, the Natural and Built Environment Bill provides that environmental limits will be set at the ‘current state’ which, in many instances, will be very degraded. Maintaining ecosystem functioning and/or health at very degraded levels will not uphold Te Oranga o te Taiao. While we understand the expectation is that minimum acceptable limits and

²⁵ <https://pce.parliament.nz/media/i5bgi0x/pce-submission-on-the-nbe-and-sp-bills.pdf> (pce.parliament.nz)

mandatory targets will be set where the current state is unacceptably degraded, we are unclear how judgements regarding what is and what isn't acceptable will be made, and we have concerns regarding the complexity of the limits and targets framework. In both instances the implications could be perverse – implicitly endorsing environmental degradation in areas that are degraded but not judged to be 'unacceptably degraded', slowing progress towards setting and achieving targets, and failing to serve effectively as a mechanism for environmental protection or enhancement.

In this regard, we question whether the conceptualisation and definition of limits and targets in the Bill accurately represents the policy intent. We suggest as an alternative that Te Oranga o te Taiao may be better upheld by following the approach established via the NPS-FM, which introduced a hierarchy of obligations, where the first the priority is the health and wellbeing of ecosystems. While it may be too late to change the current provisions relating to limits and targets in the Bill, we wish to record our concern regarding the potential consequences arising from the way these sections are currently constructed.

The definitions of limits and targets have evolved since the Bill's introduction and may continue to evolve during the Bill's passage. Whatever is finally settled in this regard, we consider that careful attention must be paid to the implications of the wording of definitions to avoid outcomes which are contrary to the overall policy intent and purpose of the legislation. Further, the implementation of the framework of limits and targets as currently proposed requires making decisions about the 'acceptability' or otherwise of environmental degradation, with these judgements determining whether minimum acceptable limits and/or mandatory targets are to be set. We consider it critical that such decisions are informed by expert independent advice and note that advisory role could be performed by the statutory Ministerial Advisory Panel.

Related to the above point, we understand the decision to prioritise "ecological integrity" in the first version of the NPF, and appreciate that this meant we were asked to evaluate attributes that primarily related to ecological health and functioning. However, in line with the MAG Terms of Reference, we consider that further work is now urgently required to better link ecological integrity to human health and wellbeing in domains other than air quality. This is vital from a te ao Māori perspective, and we consider the connection between people and ecosystems and people and place to be critical to upholding Te Oranga o te Taiao (e.g., the desire to harvest food – mahinga kai – can be a powerful lever for protecting and promoting ecological integrity).

We also noted that many of the attributes proposed for the first iteration of the NPF describe the 'state' of ecosystems rather than their 'response' under a DIPSr (Drivers-Impacts-Pressures-States-Response) framework. This was not regarded as an issue *per se*, but we consider that further evaluation of attributes will be required to efficiently integrate monitoring activities across domains.

Importantly, there is considerable scope to streamline the number of limits (and targets) across environmental domains in Aotearoa – a 'state' attribute in one domain could potentially be used as a 'response' variable in another, for instance.

Overall, our view is that the attributes proposed for the first iteration of the NPF are a necessary starting point, but more work will need to be done to ensure that:

- ecosystem functions and processes are taken into account in future attributes,
- cause-and-effect linkages and interconnectedness (of biophysical systems, and of people with places) are given due consideration in future, and

- the co-benefits of policy work across government (e.g., zero-carbon goals influencing Aotearoa’s ability to achieve targets for the PM_{2.5} particulates attribute, or the soil conservation attribute positively impacting carbon sequestration) have been fully explored with regard the identification of future attributes.

We have noted previously that undertaking such work was beyond what the MAG could contemplate given the resources and time available, and that the ministers for the Environment and Conservation should ensure that sufficient funding, resourcing, and time are available to future processes for defining attributes and deriving associated limits and targets, to ensure they are sufficiently robust and based on inclusive evidence and analysis.

We recommend the Ministry for the Environment:

- ***Complete a stocktake of environmental monitoring data and information collected by regional councils, Crown Research Institutes and other research organisations, iwi/ Māori, and private sector stakeholders, and provide advice to the statutory Ministerial Advisory Panel highlighting gaps and priorities for action, and identifying potential sources of information that could complement regional council data and increase understanding of environmental drivers, pressures, state, impacts, and responses.***
- ***Provide advice to the statutory Ministerial Advisory Panel on options for reducing the operational burden associated with generating environmental information, giving particular consideration to:***
 - ***integrating and rationalising attributes across environmental domains,***
 - ***leveraging the opportunities from new technologies that allow for more cost-effective, accurate and spatialised data generation and capture,***
 - ***prioritising the generation of information relating to attributes of particular relevance to local environments, and***
 - ***ensuring local knowledge can contribute to regional and national understanding of environmental drivers, state, pressures, impacts, and responses.***

9.2 Managing the transition to the new system

Sufficient funding, resourcing, guidelines, and time will be needed to ensure that limits and targets set after the introduction of the NPF are based on robust evidence and analysis, and that there is sufficient community participation and consultation to achieve the necessary ‘buy in’ from affected parties for implementation to be successful. The scope and pace of change required on transition to the new system needs to align to the capacity to deliver – there is little point introducing more attributes than there is the capacity and capability to monitor, for instance.

In this regard, we note that a great deal of data, information, and knowledge is held outside of regional councils by science providers, enterprises, communities, iwi, hapū, and other Māori partners. In transitioning to the new environmental management system, it is vital that the information held by these parties is acknowledged and, where appropriate, considered in the setting of limits and targets.

We would like to emphasise that regulations are more likely to be effective when affected parties are able to participate in their development at the national level, and in their interpretation and application at regional and local levels. This is exemplified by the sentiments a dairy farmer who spoke at a recent seminar on water management run by the Stout Research Centre at Victoria University:

“[Paraphrasing] Involve me in the development of rules and help me understand why they make sense, and I will be innovative in exceeding expectations. Present me with rules I haven’t been involved in developing and don’t understand or agree with, and I will be innovative in getting around them.”²⁶

Involving people in monitoring and decision-making will require the provision of adequate resourcing (i.e., funding) to under-represented and under-resourced groups, including communities, iwi, hapū, and other Māori partners, to allow them to continue their citizen science, mātauranga, kaitiakitanga, and stewardship. It will also require regional councils to exercise powers to share monitoring responsibilities with other partners, as has been done in Taupo, with Tuwharetoa accepting responsibility from Waikato Regional Council for water quality monitoring in Lake Taupo. Resourcing this work and sharing monitoring responsibilities will help deepen the connections between people and Te Taiao.

The changes anticipated by the Natural and Built Environments Bill and introduction of the NPF are significant and it is expected that additional requirements will be introduced incrementally (i.e., through the release of subsequent versions of the NPF). To help coordinate regulatory changes with plan-making processes, and to facilitate forward planning and resource allocation, it would be useful to signal in advance the general nature of and timeframe for introducing these new requirements. We do acknowledge that a balance needs to be struck between foreshadowing upcoming changes, and inadvertently creating perverse outcomes by prompting a ‘gold rush’ mindset, which could result in further environmental degradation before legislation comes into effect.

In this regard, we consider it should be possible to signal the intention to introduce further attributes via subsequent versions of the NPF without being overly specific, while also consulting widely to prevent distrust, lobbying, and to mitigate against the risk of developing naïve regulations. Steps may need to be taken, however, to avoid the ‘gold rush’ effect and we suggest the Ministry for the Environment should assess the effectiveness of previous measures taken to address this issue (e.g., providing for moratoria, giving ‘weight’ to rules for protecting the natural environment on notification, introducing monitoring requirements immediately without having to wait for them to be reflected in plans made under the new legislation and/or introducing these requirements directly into plans without the need for plan changes.)

Efforts to manage the transition to the new system should be undertaken collaboratively between the Ministry for the Environment, regional sector, and Māori, and coordinated with EMRS (Environmental Monitoring & Reporting System) reform work currently being done in response to amendment of the ERA (Environmental Reporting Act).

²⁶ Aidan Bichan, Seminar 4, Stout Research Centre Seminar Series – Wai Aotearoa <https://www.wgtn.ac.nz/stout-centre/about/previous-events/wai-aotearoa-seminar-series>

We recommend the Ministry for the Environment:

- ***Collaborate with local authorities, including through the Environmental Monitoring and Reporting Steering Group, to identify and explore options for filling gaps in knowledge and increasing the quality of information during the period of transition following the introduction of the Natural and Built Environment Act, Spatial Planning Act, and National Planning Framework.***
- ***Compile and synthesise the results of previous consultation with Treaty Partners and the general public designed to clarify their concerns and aspirations regarding the health and functioning of ecosystems, and analyse this information to identify potential gaps in data and understanding in relation to environmental drivers, pressures, state, impacts, and responses.***
- ***Evaluate the effectiveness of previous measures to avoid perverse outcomes on the transition to the new system and in response to the introduction of rules to manage or limit access to natural resources (e.g., the introduction of moratoria and the direct introduction of monitoring requirements into regional plans without requiring a plan change process), and provide advice to the statutory Ministerial Advisory Panel on the potential to use similar measures to avoid ‘gold rushes’ from occurring in response to the introduction of new attributes, limits, and targets via the National Planning Framework.***

9.3 Managing uncertainty in decision-making processes

The proposed attributes for limits and targets as set out in the NPF will need to be implemented as soon as the Natural and Built Environment Bill is enacted. The NPF will require local government authorities to monitor attributes that have not previously been mandated under national direction and, for which, there may be no existing data record. The resultant information gaps may create uncertainty and cause delay in decision-making, which could have perverse implications (i.e., the incentive to use or extract resources before information is gathered and regulations made to restrict or control activities – a so called ‘gold rush’).

The implication is that local authorities must not delay making decisions solely because of the uncertainty that arises from the quality, quantity, and accuracy of the information available. In other words, decisions on limits and targets made through regulatory plans in response to newly introduced attributes will need to use the best information available at the time. Whilst this requires the use of complete and scientifically robust data where it is available, there will be many scenarios, particularly at the earlier stages of implementation, in which decisions will need to be made in an absence of complete and scientifically robust data.

This points to a set of needs, both to address knowledge gaps and encourage and enable decision-making despite uncertainty, including:

- Understanding that the best information available may include partial data, or information obtained from other sources, including expert opinion or local knowledge holders.
- Identifying and/or developing processes to identify gaps in data, knowledge, or information, and articulate those requirements to the scientific community and/or local knowledge

holders, with coordination across government and with Tiriti partners to ensure central government investment and cost-sharing into priority areas and people.

- Prioritising data collection to inform the development and use of environmental models to: help characterise uncertainty and its implications; increase understanding of environmental variability; predict environmental responses to management interventions; and facilitate extrapolation to demonstrate progress at regional and national scales.
- Recognising that there will be significant work required on data standards and that many organisations – including communities – may have access to fine-scale and high-quality data that is not available to local government authorities.
- Acknowledging that issues around intellectual property and data sovereignty will need to be addressed when drawing on local knowledge and/or data from local communities to set limits and targets or develop future attributes.
- Anticipating that emerging technologies as well as new and/or transformative tools for environmental monitoring will be coming ‘on stream’, actively avoiding closing off options for future monitoring, and building-in flexibility to enable the rapid use of new technologies and tools when establishing and operating a management framework based on limits and targets.

We recommend the Ministry for the Environment:

- ***Provide guidance and resourcing to local authorities to reduce the risk of decision-making being delayed due to uncertainty arising from missing or insufficient information.***
- ***Provide advice to the Minister for the Environment and statutory Ministerial Advisory Panel on options for changing operational roles and responsibilities and governance arrangements in New Zealand’s environmental management system to:***
 - ***address capacity and capability constraints and drive greater efficiency in the generation of environmental information,***
 - ***address inequities in access to resources, and***
 - ***give effect to Te Tiriti o Waitangi in regional and local level planning and decision-making processes.***

9.4 Defining management areas appropriately

For resource management based on limits and targets to be effective, management units will need to be designed to capture interconnections between ecosystems and across environmental domains. In general, management units should extend from headwaters, through land and freshwater environments, to estuaries and coastal environments and the ocean – following the principle of te uta ki tai (a ‘Mountains to Sea’ approach).

Guidance on the setting of freshwater management units under the NPS-FM and significant natural areas under the NPS-IB, and on the monitoring of attributes within these areas should clearly define what is required to achieve an integrated understanding of Te Oranga o te Taiao. This should clearly

explain how to monitor and manage at and across the boundary of units to facilitate environmental integrity.

We recommend the Ministry for the Environment provide guidance and resourcing to local authorities on what is required to achieve an integrated understanding of Te Oranga o te Taiao with particular emphasis on how to monitor and manage at and across the boundary of management units to facilitate environmental integrity.

9.5 Ensuring offsetting is appropriate

The MAG is concerned about the risk of overemphasising the use of offsetting within the Effects Management Hierarchy as a tool to achieve ‘no net loss’ or potentially even environmental gains. While potentially attractive and applicable in some domains (e.g., offsetting emissions across airsheds to achieve air quality outcomes, or offsetting sediment loss across catchments to achieve water quality outcomes) there are well-documented issues both in Aotearoa and globally with the practical application and implementation of offsetting as a tool in some domains.

These issues are particularly evident where offsetting is used as a tool for biodiversity management where calculating ‘ecological equivalency’ and ‘no net loss’ of biodiversity values have been two of the biggest issues.²⁷ When applied incorrectly these have resulted in continued declines of indigenous biodiversity (e.g., in New South Wales²⁸). There have also been problems with quantifying the effectiveness of biodiversity offsetting schemes (including monitoring and compliance issues), and variable success in their application and use across vegetation types.²⁹ Key risks can be summarised as “failing to observe avoidance where appropriate, lack of equivalency of exchange, and non-completion of the requirement through non-compliance or failure”.³⁰

At the time of finalising this report our understanding is that, under the proposed provisions of the Natural and Built Environment Bill, biodiversity offsetting must be enabled within management units. It is unclear to us, however, how biodiversity exchanges will work in practice and how such exchanges might affect adherence to a minimum biophysical state (limit) or provide a pathway for the use of offsetting to help set targets.

We note that biodiversity management is an area that suffers from lack of data or information needed to develop a robust offsetting system – significant levels of monitoring or comprehensive ecological assessments are often required to fill gaps in understanding of biodiversity values. We were reassured by significant cross-agency work done, particularly between the Department of Conservation and the Ministry for the Environment, in relation to the Indigenous Biodiversity attribute, to ensure that threatened species and environments are given the highest levels of protection. However, it is still not clear how offsets might be used both within and outside

²⁷ Maseyk, F. J. F., Barea, L. P., Stephens, R. T. T., Possingham, H. P., Dutson, G., & Maron, M. (2016). A disaggregated biodiversity offset accounting model to improve estimation of ecological equivalency and no net loss. *Biological Conservation*, 204, 322-332.

²⁸ Audit Office of New South Wales. (2022). Effectiveness of the Biodiversity Offsets Scheme. New South Wales Auditor-General's Report.

²⁹ zu Ermgassen, S. O., Baker, J., Griffiths, R. A., Strange, N., Struebig, M. J., & Bull, J. W. (2019). The ecological outcomes of biodiversity offsets under “no net loss” policies: A global review. *Conservation Letters*, 12(6), e12664.

³⁰ Brown, M. A., & Penelope, J. (2016). Biodiversity offsets in New Zealand: addressing the risks and maximising the benefits. *Policy Quarterly*, 12(1).

significant natural areas within a management Unit, and whether threatened species and environments will be excluded from offsetting schemes.

If offsetting is to be advanced as a tool for biodiversity management under the Natural and Built Environment Bill, recent advances in systematic conservation planning should be employed to help in prioritising areas as offsets within a management unit, and sufficient controls should be put in place to manage for non-completion of requirements through non-compliance or failure.³¹ Further, the concept of ‘exchange’ or ‘like for like’ should be explored through a te ao Māori lens - mātauranga Māori may be available that could be used now or in the future to improve understanding and/or refine the applicability and application of offsetting. To our knowledge this has not yet been explored.

In general, our view is that each of the proposed attributes should be carefully scrutinised as to its suitability as an attribute to be exchanged or traded via offsetting. It is currently not clear to us whether offsets could or should be used in all domains or for all attributes – not just to achieve a minimum state and ‘no net loss’, but also to achieve ‘net gain’ within a management unit.

We recommend the Ministry for the Environment:

- ***Rigorously evaluate and assess, including through a te ao Māori lens, whether the attributes proposed by the interim Ministerial Advisory Group are suitable for exchange, trade, or offsetting, and provide:***
 - ***advice to the Minister for the Environment and statutory Ministerial Advisory Group on when and under what circumstances offsetting is appropriate, and***
 - ***practice guidance to local authorities on offsetting, drawing on experience with established environmental offsetting and exchange systems in the Auckland and Canterbury regions, to avoid operational uncertainty regarding statutory interpretation and implementation.***
- ***Evaluate and provide advice to the Minister for the Environment and statutory Ministerial Advisory Panel on the potential to use recent advances in systematic conservation planning and new spatial prioritisation tools to help identify and prioritise areas for offsetting ecological effects within management units.***

9.6 Responding effectively to a changing climate

The impact of the January 2023 floods and Cyclone Gabrielle brought home the reality of the impacts of climate change for many and brought into relief the range of issues likely to emerge as sea level rises (e.g., greater vulnerability to storm surges at high tide in settlements close to the coast, estuaries, and rivers). In evaluating the proposed attributes for the first iteration of the NPF, the members of the MAG agreed that the first tranche of attributes will not necessarily account for dynamism and increasing variability in ecosystems. Future iterations of the NPF should incorporate

³¹ Moilanen A, Kohonen I, Lehtinen P, Jalkanen J, Virtanen E, Kujala H 2022. Zonation 5 V 1.0 user manual. Available for download from <https://zonationteam.github.io/Zonation5/>

deeper analyses of attributes that account for natural system variability and help build resilience, taking into account stochastic processes or events.

We believe that these issues should be considered and resolved prior to the second iteration of attribute development under the NPF. It is currently not clear to the MAG, for instance, what might occur when widespread or large-scale events lead to irreversible changes (i.e., tip a natural system over a threshold into another state), such as the widespread loss of soil from highly erodible land and the massive spike in sediment loading that occurred in Te Tai Rāwhiti during Cyclone Gabrielle. These scenarios are becoming increasingly common. In such cases, will environmental limits be re-set? And what would be the expectation of local bodies under the NPF for re-setting targets to track towards a new limit?

To illustrate the point, in future iterations of the NPF we understand the intention is to work towards an 'ecosystem extent' attribute for indigenous biodiversity. With this in mind, hypothetically, a future limit could include the extent of regenerating shrub ecosystems. If this attribute was proportionally high (as is the case in many parts of the country right now), with natural succession into end-successional stage forest the limit would be breached (reduced regenerating shrub), thus creating an incentive to halt the natural successional process. This outcome would not support the concept of ecosystem resilience.

We recommend the Minister for the Environment require that processes for the identification and assessment of attributes seek to:

- ***account for natural system variability,***
- ***capture the effects of unpredictable, infrequent, and severe events, and***
- ***provide insight into the resilience of natural systems to the effects of climate change.***

Ministerial Advisory Group

For assessing the quality and integrity of the science practice underpinning potential limits and targets.

Terms of Reference

Context

The Ministry for the Environment (Ministry) is leading the Government's reform of the resource management system, including the development of a new National Planning Framework (NPF) that will direct regional spatial strategies (RSSs) and combined regulatory plans (NBA plans).

The NPF is critical for ensuring the success of the new resource management system and achieving the Government's reform objectives. As part of the NPF, environmental limits and associated targets will be established and will play a critical role in setting boundaries for the use of the natural environment. These will be prescribed in the NPF as:

- Limits
 - set as the current state of the ecological integrity of the natural environment, and
 - limits for the protection of human health will be based on relevant health guidelines and not be prescribed according to the current state of the environment for the protection of human health
- Targets
 - setting a minimum level target where an aspect or area of the natural environment is “unacceptably degraded”

Under the Resource Management reform, the Minister for the Environment and the Minister of Conservation will be responsible for prescribing limits and targets in the NPF.

It is important that decision-makers and affected communities are confident that limits and targets are founded on good science and evidence, which is rigorously tested, transparent, and accessible. To ensure this, the NBA will require that the Minister for the Environment appoint a statutory Ministerial Advisory Panel for providing advice to the Minister(s) on the quality and integrity of the science practice underpinning potential environmental limits and associated targets. The relevant Minister will then decide whether to propose the limit or target in the NPF for public consultation.

To begin the process of setting appropriate environmental limits and targets in the NPF, an advisory group will be established ahead of the legislated statutory Ministerial Advisory Panel. The advisory group will focus only on the proposed attributes (and supporting information on associated limits and targets) for the first version of the National Planning Framework (NPF). This will occur over a six-month period, with the possibility of extension while the statutory Ministerial Advisory Panel is established.

These Terms of Reference are for the advisory group only. The legislated statutory Ministerial Advisory Panel will be established later (post legislation) and will have its own terms of reference.

Purpose and scope

The purpose of the advisory group is to provide advice to the Minister on the quality and integrity of the science practice underpinning the potential environmental limits and targets for the first version of the NPF. This purpose is aligned with that of the future statutory Ministerial Advisory Panel required by the NBA.

The advisory group's advice will not be binding on the Minister(s) and the advisory group will not have formal decision-making powers or accountabilities. The Minister(s), along with Ministry CEOs will remain responsible for directing Ministry officials.

The role of the advisory group is to:

1. ensure the quality and integrity of science-based knowledge used in the formulation of limits and targets. This includes determining if the evidence used follows the four principles of effective evidence synthesis:
 - a. inclusiveness - involves policymakers and is relevant and useful to them, considers many types and sources of evidence including mātauranga Māori, uses a range of skills and people),
 - b. rigour - uses the most comprehensive, feasible body of evidence, recognises and minimises bias, is independently reviewed as part of a quality assurance process,
 - c. transparency - clearly describes the methods, sources of evidence, and quality assurance processes communicates complexities and areas of contention, acknowledges assumptions, limitations and uncertainties, including any evidence gaps, declares personal, political and organisational interests and manages any conflicts, and
 - d. accessibility - is written in plain language, is available in a suitable timeframe, is freely available online.
2. provide assurance to the Minister(s) on the extent to which the first set of potential limits and targets under the NPF, provide effective, reliable, and sufficient measures and can be monitored, reported on, and evaluated.

Accountability

The advisory group will report to the Minister as directed from time to time.

Appointment

The Ministry does not have an established process for setting up interim advisory group. This resulted in a three-month delay in setting up the interim Science Advisory group (SAG) and ongoing complications in paying members over the last year. Setting up an interim limits and targets panel for a longer duration, without a documented process to follow and in the timeframe permitted, is not realistic. To fulfil the intent, an advisory group will instead be established for a shorter duration using an adapted process.

Due to the specific member criteria and the short time frame available for the establishment process, an advisory group will be established without an advertising campaign seeking expressions

of interest. The Ministry will instead directly contact individuals who meet the selection criteria, seeking their interest in being a member of the advisory group. Additionally, the SAG and the regional sector will be requested to support the process by providing recommendations of potential members, in addition to those identified by Ministry officials. This will allow for sufficient transparency and comfort around the independence of the advisory group while still meeting timeframes.

A selection panel made up of both the Ministry and external members will use the specified criteria to assess and agree on the candidate's suitability as a member. The selection panel will support the Minister in assembling a shortlist and then the final member recommendations, with the Minister having the final say on the candidates appointed as members of the advisory group.

The subsequent statutory Ministerial Advisory Panel will be established using the more formal Environmental Legal Assistance process, made possible by the longer time available. The process will include an external expression of interest to ensure the required number of panel members (preferably seven to nine) are found. The advisory group members may apply to be members of the statutory panel.

Panel Member Selection

As will be required by the NBA for the statutory panel, the advisory group will collectively hold sufficient diversity across the following topics:

- ecological integrity
- the interplay between the natural environment and human health
- mātauranga Māori in relation to the natural environment
- environmental science
- environmental and natural resource management policy

At least one member of the advisory group will demonstrate experience and/or understanding with one or more of the following:

- working in politically contested and high uncertainty science domains
- the application of science in a policy framework to ensure policy relevance while avoiding policy prescription
- working on scientific or other policy panels to advise on the various aspects of the natural environment and human health
- the connectedness of the natural environment in terms of drivers, pressures, and state and how these relate to ecological integrity or human health
- the four principles of inclusiveness, rigour, transparency, and accessibility to make evidence synthesis more useful for policy
- strategic knowledge on wider environmental issues to help focus limits and targets work on what is important

The advisory group needs to collectively reduce or eliminate conflict of interest in a single member. To achieve this, we recommend the advisory group will always:

- comprise at least five members and no more than nine members
- include at least one member that is an experienced mātauranga Māori practitioner
- include a panel chair
- include a regional council representative.

Membership

The advisory group will always comprise of at least five members and no more than nine members, with at least one member being an experienced mātauranga Māori practitioner and a Regional Council representative.

At any time, the Ministry, delegated by the Minister, may co-opt or appoint additional experts into the advisory group on a temporary basis. This will be at the Ministry's sole discretion and may occur at the group's recommendation.

The Ministry will appoint one of the members as the group Chair, who will have the responsibility of chairing meetings, assisting in the co-ordination of meetings alongside Ministry officials, and ensuring the delivery of advice to the Minister.

Tenure

The advisory group is to be established by 1 March 2023. The initial term is expected to extend until 31 August 2023. This term may be shortened or extended by the Ministry if required and in relation to the establishment of the statutory Ministerial Advisory Panel that will be legislated by the NBA.

Members will be advised of any revisions to the term by the Ministry via the Chair of the advisory group. Members of the advisory group will be eligible for appointment to the statutory Ministerial Advisory Panel, that will be established by a separate selection process.

Members of the advisory group may resign at any time by written notice to the Chair, copied to the delegated Ministry officials.

A member of the advisory group may be removed by written notice by the Ministry for non-performance, including for missing two or more consecutive meetings at any time.

Roles and Responsibilities

- Advisory Group members will commit to:
- Participating in all scheduled meetings
- Sharing all communications and information across all members
- Seeking to reach consensus in a timely manner but providing for different views to be put forward
- Providing a report to the relevant Minister with their assessment of the quality and integrity of the science practice behind each of the potential limits and targets provided to them
- Providing advice as to the risk or uncertainty generated by a potential limit or target being deficient in one or more criteria and suggest mitigations.
- Providing advice around any other related work as requested by the Minister.

Advisory group members can expect:

- That each member will be provided with report(s) about potential limits and targets that provide all relevant information for their assessment
- To be given reasonable time to read and assess the reports prior to their scheduled meetings
- To be provided access to Ministry officials responsible for developing potential limits and targets

Meetings

- All meetings will be chaired by the chair or their delegate where they are unable to attend.
- Meeting agendas and minutes will be provided by the Ministry.
- Meetings will be held once per month on average and may extend into a second day.
- Meetings will be a mix of online and in-person. Initial meetings are likely to be held in person for the purpose of meeting the other group members and Ministry officials.

Interaction with Other Advisory Groups

With the approval of the delegated Ministry officials, the advisory group may engage with other advisory groups or panels established by the Ministry, outside government agencies or other organisations. Engagement between advisory groups should be for the purpose of information sharing and facilitating delivery on their respective Terms of Reference.

Interaction with other advisory groups may include the recently established NPF Advisory Group. This advisory group may have interest in the work around environmental limits and targets and any associated direction in the NPF to give effect to them.

Where there is interaction with other advisory groups or panels, confidentiality, independence of advice, and other operating principles described in this Terms of Reference are to be upheld.

The advisory group cannot directly commission or be commissioned by another advisory group.

Remuneration

Members of the advisory group are to be paid in accordance with the Cabinet Fees Framework Group 4, level 2 job-size assessment, and will be paid daily rates of:

- a. \$616 for a member
- b. \$974 for a chair

The daily rate will be paid to each member for the day(s) when meetings occur and for the day(s) when preparation work is required beforehand (a minimum of two days in total for each monthly scheduled meeting will be paid). If the chair is unable to attend a meeting, a deputy chair will be elected as the stand-in chair, paid at the daily rate for the chair.

If in-person meetings are required, remuneration will include reimbursement for reasonable travel costs such as flights or vehicle mileage, accommodation, and food costs directly incurred in delivering the work. If travel costs are incurred, adherence to the Ministry's Travel Policy is required.

Confidentiality

All advisory group members are required to maintain confidentiality of matters discussed at meetings and any other group business, unless specified by Ministry officials. All members agree to the Ministry's Confidentiality Undertaking.

Conflict of Interest

All advisory group members must formally declare any real or potential conflicts of interest and agree to make the Ministry's Conflicts of Interest Declaration. Members should operate on the understanding that "if in doubt, disclose the interest". The appearance and perception of a conflict is just as important to manage as an actual conflict.

Amendment, modification, or variation

These Terms of Reference may be amended, varied, or modified in writing by the Ministry after consultation with the advisory group members.

Effectiveness date

These Terms of Reference are effective from 1 January 2023 until the tenure for the advisory group expires (31 August 2023) or otherwise notified.

Appendix B. Relevant contextual considerations

The relationship between nature and society

A recent report from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has underpinned the importance of understanding our relationship with nature³². Nature nurtures and nourishes us. Our economic and social systems rely on functioning ecosystems. Importantly, understandings of how we relate to and value nature vary across worldviews and knowledge systems.³³ Instrumental values of nature tend to be associated with the benefits we receive from nature (often known as “ecosystem services”), while intrinsic and relational values of nature refer, respectively, to the inherent value of nature and the meaningfulness of interactions with and through nature.

Many international initiatives focus on the instrumental values of nature and have documented the significant contributions nature makes to human society. These initiatives include: IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services), MEA (Millennium Ecosystem Assessment), and TEEB (The Economics of Ecosystems and Biodiversity).

In the New Zealand setting, we recognise that peer nations and global markets increasingly place value in upholding environmental limits and integrity. Thus, our environmental performance has important implications for our international reputation and trade.

Wellbeing and the environment

Recent commentary from the PCE on the Treasury's Living Standards Framework (LSF)³⁴ notes that the social and economic models we use in developing policy and assessing performance are at odds with a Māori world view, not least because of the way they compartmentalise human well-being and the environment, that is, they take an instrumental perspective as opposed to one which is based on relational or intrinsic values. While Māori wellbeing is still human orientated it is not anthropocentric as it shifts the importance to the connections of all things, not just to the individuals themselves³⁵.

Links to environmental reporting

The development of the Limits and Targets piece of work is part of a wider (global) system change to ensure that environmental data generation, investment in associated research and innovation, and environmental reporting are aligned to, and reflect, current science methods, technologies and socio-cultural values. In this context, New Zealand's environmental performance is subject to regular international review. This means the government is required to produce national environment reports on the environment which are reviewed both domestically by the Parliamentary Commissioner for the Environment (PCE) and by international bodies (such as the OECD).

The Environmental Reporting Act (ERA) 2015 states “The purpose of this Act is to require regular reports on New Zealand's environment.” When this Act was passed, it was made clear that reporting would draw only on existing and available data.

³² Watson et al., (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES Secretariat: Bonn, Germany, 22-47.

³³ Ibid

³⁴ PCE 2021 Wellbeing budgets and the environment. A promised land?
<https://pce.parliament.nz/media/lxgb4pt5/wellbeing-budgets-and-the-environment-report-pdf-225mb.pdf>

³⁵ Ibid

The ERA provides a framework to support environmental reporting, producing national environmental statistics that have a similar trusted status to other national statistics. The PCE recently recommended changes to the ERA³⁶, which are under consideration and have undergone consultation. A key recommendation was that reports need to provide a reliable evidence base to enable the effectiveness of policies and management practices to be assessed.³⁷ Moreover, the PCE recommended that the main purpose of environmental reporting should be to “provide evidence to enable an open and honest conversation about what we have, what we are at risk of losing, and where we can make changes.”³⁸ Some of the PCE’s recommendations may be appropriate to consider through the relationships between environmental reporting and the new system of limits and targets.

Effective environmental reporting requires nationally consistent, credible, and accurate data on environmental condition (state) and how it changes over time (trend). Regional councils, and in some places iwi/hapū (under arrangements with local councils), collect data through environmental monitoring. However, a recent review of our environmental monitoring system found a lack of consistency in the way we monitor the environment, and in many important domains, an absence of data.³⁹ This limits our ability to understand, report on, and take action on key aspects of our national environmental performance.

To address shortcomings in our current environmental monitoring system, the report calls for:

- a comprehensive, nationally coordinated environmental monitoring system, including the development of a dedicated set of core environmental indicators and the design of a national-level monitoring network
- a standardised and consistent approach to collecting, managing, and analysing data
- a nationally mandated strategy to ensure that known environmental data gaps are progressively filled

Regional councils, and in some places iwi/hapū (under arrangements with local councils), collect data through environmental monitoring. However, there are gaps in current national datasets and in provision for needed data and the resulting policy responses. This limits our ability to understand, report on, and take action on key aspects of our national environmental performance.

The proposed NPF will define Limits and Targets across various domains (air, estuaries and coastal waters, freshwater, indigenous biodiversity, and soil) and will set requirements for consistent environmental monitoring of associated attributes. This will support improvements to local, regional and national environmental reporting.

Ensuring that limits are effective in practice will require large amounts of monitoring data, contextual information, and new knowledge from research. This will not be possible without significant new investment in environmental monitoring. Moreover, a long-term funding stream along with stable data infrastructure and collections support is needed.⁴⁰

³⁶ Parliamentary Commissioner for the Environment. (2019). Focusing Aotearoa New Zealand’s environmental reporting system. <https://pce.parliament.nz/publications/focusing-aotearoa-new-zealand-s-environmental-reporting-system>

³⁷Ibid

³⁸ Ibid

³⁹ Ibid

⁴⁰ Submission on: The Natural and Built Environment Bill and the Spatial Planning Bill (Simon Upton 2023)

Links to the research, science and innovation system (RSI)

The majority of national environmental monitoring data is generated (and held) by Crown Research Institutes (CRIs) and the growing databases of regional councils federated through Land Air Water Aotearoa (LAWA). These datasets are costly to maintain, develop, and make available for integration and interpretation. A current lack of national strategy and clear priorities for environmental information, combined with fragmented funding, has limited the ability of the research, science and innovation system to fill critical data and knowledge gaps. Filling these gaps would help decision-makers better understand environmental conditions relative to national limits and targets or more localised mātauranga Māori led aspirations. Reforms of the RSI system are in progress, and provide an opportunity to resolve some of the constraints outlined above. There is an opportunity for MfE, DOC and other agencies to engage with MBIE's Future RSI Branch overseeing Te Ara Paerangi Future Pathways reform. [One member of the Limits and Targets Advisory Group, Troy Baisden, crosses over with membership on MBIE's Te Ara Paerangi Reference Group.]

The major reform of resource management legislation and RSI represents an opportunity for significant system change. The OECD has developed a workstream on Anticipatory Innovation Governance that aims to improve the outcomes from systemic change in decades-old policy systems to better provide for wellbeing and environmental limits, including climate change responses.⁴¹ The OECD recommends, for example, that during major system redesign, rigour should focus on evidence-informed policy rather than evidence-based policy, so that the evidence base needed to support the goals of the system can be effectively transformed. This is consistent with work developing the Ngā Kete o te Wānanga as a te ao Māori framework for freshwater management and is also consistent with extensions to link freshwater and estuaries⁴² or a wider ki uta ki tai mountains to the sea framework.

Links to other frameworks

The DPSIR framework

The Environmental Reporting Act requires reporting to be based on a pressure-state-impact (PSI) framework. This is a truncated version of the internationally accepted drivers-pressure-state-impact-response (DPSIR) framework for reporting on environmental issues. The DPSIR framework recognises a chain of causal links from driving forces (or drivers), through to human-induced pressures on the state of the environment, to impacts and the deployment of responses aimed at mitigating the potential impacts of those pressures.

Contextually responsive collective impact

Contextually responsive, collective action, combined with a duty of care to all participants, appears to be a necessary feature of systems that respect Te Tiriti o Waitangi and empower both Māori and local communities in resource management processes.

This approach is exemplified in Aotearoa by the Healthy Families NZ programme.⁴³ First implemented in late 2014 and now established in 11 communities across Aotearoa, Healthy Families NZ aims to improve people's health where they live, learn, work and play. To achieve this, the

⁴¹ Tönurist, P., & Hanson, A. (2020). Anticipatory innovation governance: Shaping the future through proactive policy making.

⁴² Parliamentary Commissioner for the Environment. (2020). Managing our estuaries. <https://pce.parliament.nz/publications/managing-our-estuaries/>

⁴³ Rayne, A., Arahanga-Doyle, H., Cox, B. *et al.* Collective action is needed to build a more just science system. *Nat Hum Behav* (2023). <https://doi.org/10.1038/s41562-023-01635-4>

initiative uses whole-of-community approaches that make sustainable and long-term changes to the systems that influence the well-being of individuals, families and communities. The whole-of-community systems approach has been described as a 'game changer' in the most recent evaluation of the Healthy Families NZ programme. The initiative makes a strategic move away from fragmented, small-scale and time-limited programmes by supporting existing local action on health, while influencing local and national funding and policies to be more responsive to communities and their diverse contexts. Sharing success and failures across the community teams has been key to the initiative's success, along with fostering a responsive, timely and trusting contractual relationship with the central agency funder, and acknowledging the role of relationships and networks, and implicit and explicit power dynamics and mental modes. This approach and these lessons appear highly relevant to resource management, the design and implementation of monitoring frameworks, and the setting of limits and targets designed to support Te Oranga o te Taiao.

In 1990, Elinor Ostrom published the results of a global study of natural resource management systems which identified a series of underlying attributes that were generally present in longstanding (and therefore considered 'robust') institutional arrangements for resource management. In the decades since, these attributes have been corroborated by many researchers in diverse locations and cultures around the world and have gained widespread recognition as useful principles to guide the design and operation of institutions for the management of natural resources.⁴⁴ A key feature of these principles is the emphasis they place on empowering local communities to develop, evolve, and manage the delivery of their own solutions. This Noble Prize-winning research corroborates the importance of collective action and aligns with the principles included in the that guide people as they seek to restore and preserve the balance between water, the wider environment, and the community:

- Mana whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater
- Kaitiakitanga: the obligations of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations
- Manaakitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others
- Governance: the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future
- Stewardship: the obligations of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations
- Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation.

⁴⁴ These principles are:

1. Clearly define the boundaries of the common resources
2. Use rules that fit local circumstances
3. Ensure those affected by rules can participate in rulemaking
4. Effective monitoring creates accountability
5. Graduated sanctions can be applied with community rules are violated
6. Conflict resolution is low cost and accessible
7. Higher authorities respect and value the community's rules and self determination
8. Develop multiple tiers or layered nodes to manage large and complex resource pools

Appendix C. Ngā Kete o te Wānanga framework

To ensure that the process of identifying and evaluating attributes gives effect to Te Tiriti o Waitangi, and provides for a mātauranga Māori approach, the Panel adopted 'Ngā Kete o te Wānanga'. The framework and its application for attribute identification is described in Baker (2019)⁴⁵. It is a framework grounded in Māori oral tradition of the pursuit of knowledge as is described by Marsden (2003b)⁴⁶ and Royal's (1998⁴⁷) further interpretation of that tradition as a conceptualisation of a Māori worldview.

When applying a mātauranga Māori approach the first aspect of knowledge requiring consideration (Kete Tua-uri) is our understanding of te taiao (the environment) and the spectrum of values it comprises. This establishes a 'values-based' approach to identifying attributes. The fundamental value of te taiao arises from our understanding of the interdependence of human well-being with the well-being of the wider environment (taiao). This informs evaluation criteria that include ensuring that attributes capture what is sufficient to support life, prevent further degradation, and achieve local and national aspirations in relation to the environment. It also necessitates recognition that beyond that fundamental value of dependence on te taiao, values associated with the environment are subjective, and change across time and place.

The second aspect of knowledge for consideration (Kete Aronui) is what we can observe and monitor across the whole system of te taiao. The environment is a complex system containing many interconnected elements, including social-ecological dynamics. Recognising this informs an approach where collectively, attributes need to inclusively reflect different values across the system, in order to reflect the cause and effect relationships and other system dynamics that use of the environment needs to be sensitive to. This also includes a consideration of the merit of attributes in light of the potential observation of hotspots and significant events. This idea of observing whole systems (rather than individual components of a system) is captured by the idea "ki uta ki tai".

The final aspect of knowledge for consideration (Kete Tua-ātea), is what needs to be understood about environmental systems in order to ensure that management actions such as the application of limits and targets, and subsequent planning to achieve these, are in fact effective, both now, and into the future. This involves recognising that across attributes which should reflect a broad range of values, criteria are required to prioritise attributes that are actually responsive to intervention, and for which it is in fact possible to identify which resource users may need to change their behaviour or resource use in order to achieve limits and targets. This aspect also includes consideration of the ability to use precaution and deal with inevitable uncertainty and risk.

This aligns with a key recommendation given in the "Wellbeing budgets and the environment" report: Develop baseline forecasts or outlooks that provide an indication of how future environmental conditions across different domains of the environment are expected to change over time.

⁴⁵ Mahina-a-rangi Baker, "Te Kete Tua-ātea, Māori modelling of the future and the kaitiakitanga of water." (PhD thesis., Massey University, 2019),

⁴⁶ Marsden, M. (2003b). Kaitiakitanga: A definitive introduction to the holistic world view of the Māori. In T. A. C. Royal (Ed.), *The woven universe: Selected writings of Rev. Māori Marsden* (pp. 54–72). Ōtaki, New Zealand: The Estate of Rev. Māori Marsden.

⁴⁷ Royal, T. A. C. (1998). *Te whare tapere: Towards a model for Māori performance art* (PhD thesis). Victoria University of Wellington, New Zealand.

Appendix D. Summary notes from evaluation of attributes

Kete	PM _{2.5}	Score	Notes
Kete Tua-uri	1a. Recognises values, place and change	H	
	1b. Holds the line; supports targets	H	
	1c. 1c. Sufficiency to inform care that avoids potential impacts	M-H	1
	1d. Includes necessary tiers, nested layers, hierarchies and/or connections	H	2
Kete Aronui	2a. Captures ecological, social/cultural, economic system	H	
	2b. Considers hotspots and big events	H	3
	2c. Whakapapa/relationships determining cause & effect	H	4
	2d. Considers multiple risks and multiple mitigations	M-H	1, 5
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	H	6
	3b. Incorporates responsiveness to interventions	H	7
	3c. Delivers clear 'ownership of the problem'	H	8
	3d. Enables acting on analysis of future scenarios	H	9

1. Addresses known health risk from outdoor exposure, but does not consider indoor air quality in domestic situations.
2. PM_{2.5} is a subset of PM₁₀, which in turn is a component of all particulate matter. PM_{2.5} also includes ultra fine particles – i.e., those that are less than 0.1 µ in diameter.
3. Standard measurement techniques are responsive to spikes, and issues with high baselines from sea spray, wildfire etc can be taken into account in designing interventions.
4. Source apportionment is possible, and there are numerous epidemiological studies linking cause and effect
5. Particulate matter is only one of many air quality contaminants with known human health impacts. A number of these are monitored regularly and are included in current regulations. However, national settings may need to be revisited as understanding of dose-response relationships improves and international standards are adjusted accordingly (e.g., oxides of nitrogen)
6. If the new WHO guideline thresholds are used, this provides a higher level of protection than PM₁₀ and better targets the health-relevant particle size fraction, although we note that for particulate there is no “no observable effects level”.
7. A PM_{2.5} limit is very responsive to a range of policy/management interventions.
8. Clearly places ownership of the problem on urban sources in airsheds, although resource managers also need to recognise the contribution from non-anthropogenic sources such as wildfires and sea spray. These latter sources are quantifiable.
9. Yes, models predicting future state, including the impacts of various management scenarios are developed and applied routinely in air shed management.

Kete	Indigenous Biodiversity – Indigenous Vegetation Cover	Score	Notes
Kete Tua-uri	1a. Recognises values, place and change	H	1
	1b. Holds the line; supports targets	M	1
	1c. Sufficiency to inform care that avoids potential impacts	M	1
	1d. Includes necessary tiers, nested layers* or hierarchies	M	1
Kete Aronui	2a. Captures ecological, social/cultural, economic system	M	2, 5
	2b. Considers hotspots and big events	M	1, 6, 7
	2c. Whakapapa/relationships determining cause & effect	M	1, 2
	2d. Considers multiple risks and multiple mitigations	M	1, 7
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	M	1, 3, 6, 7
	3b. Incorporates responsiveness to interventions	M	1, 6, 7
	3c. Delivers clear 'ownership of the problem'	M	4, 5
	3d. Enables acting on analysis of future scenarios	H	5, 6, 7

1. As a tohu mātua, this attribute lacks scale to ensure adequate resolution and protection, although it is a necessary first step. Development of additional, well-supported descendant attributes will be essential in iterations 2 and 3 of the NPF in order to: (a) achieve stronger protection; (b) understand cause-and-effect relationships; (c) quantify the impacts of threatening processes, and (d) represent a full range of ecological integrity values.
2. This attribute captures ecological features but does not yet have social, cultural or economic descendant attributes built in. Development of human health attributes linked to indigenous vegetation should be a particular priority.
3. Supports precaution in general, but presents a risk unless offsetting is used with stringent parameters, as a final option in the effects management framework once all other options have been actively pursued.
4. Defines ownership by area but not the values associated with particular indigenous vegetation.
5. Difficult to assess how LENZ II mapping will integrate with Management Units, and how offsetting might work both within and between MUs.
6. Despite proposed integration with the National Policy Statement on Indigenous Biodiversity, including implementation of SNAs, greater clarity is required to ensure that hotspots of rare or threatened biodiversity will be fully protected and not further degraded.
7. It is not clear how this attribute would support responses to events such as wildfires, storm damage, or future biosecurity incursions such as myrtle rust. Development of future attributes suggested in Table 3 will be essential to build resilience in ecological systems.

Kete	Sea Grass	Score	Footnotes
Kete Tua-uri	1a. Recognises values, place and change	H	1
	1b. Holds the line; supports targets	H	4
	1c. Sufficiency to inform care that avoids potential impacts	M	3
	1d. Includes necessary tiers, nested layers* or hierarchies	M	4,7
Kete Aronui	2a. Captures ecological, social/cultural, economic system	H	2
	2b. Considers hotspots and big events	H	5
	2c. Whakapapa/relationships determining cause & effect	M	1,2
	2d. Considers multiple risks and multiple mitigations	H	4
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	M	6,7
	3b. Incorporates responsiveness to interventions	M-L	2,7
	3c. Delivers clear 'ownership of the problem'	L	4
	3d. Enables acting on analysis of future scenarios	M	8,9

1. Recognises the importance of Sea grass as habitat and primary producer in harbours and estuaries. Incorporates multiple stressors - this may create difficulties when untangling cause/effect.
2. Captures the habitat aspect of ecology and also the impacts to it (comparable to MCI's role for foodweb); demonstrated as a cultural health indicator by Kura Paul-Burke's work.
3. Multiple attributes will be required for a full picture of the health of coasts and estuaries. Sea grass is an integrator but is only one of a suite of appropriate indicators.
4. Very integrated measure (habitat, primary producer and sentinel species) – serves as a parent tohu attribute but does not easily reveal detail (e.g. difficulty teasing out cause/effect);
5. Post-Gabrielle responses appear possible and are currently being mapped; known to respond to impacts of recreational boat traffic, or other activity.
6. Difficult to respond with foresight based on current knowledge, but does signal when activity has exceeded limits. Change in sea grass extent will signal significant shifts in estuarine health.
7. There may be an opportunity to add detail by considering sea grass density, reproductive health or quality.
8. Able to be evaluated based on stresses using the types of BBNs highlighted by the PCE Estuaries Reports; however we understand the direction of effects but making quantitative predictions may be difficult, particularly given multiple, interacting stressors. (Adaptive management may be required)
9. Restoration is likely possible but requires restoring conditions for health and/or transplants. This makes natural recovery difficult or very slow, and restoration potentially challenging or expensive but open to innovation.

Kete	Salt marsh extent	Score	Notes
Kete Tua-uri	1a. Recognises values, place and change	H	1,6
	1b. Holds the line; supports targets	H	2
	1c. Sufficiency to inform care that avoids potential impacts	M	3
	1d. Includes necessary tiers, nested layers* or hierarchies	M	3
Kete Aronui	2a. Captures ecological, social/cultural, economic system	H	1,4,5,6
	2b. Considers hotspots and big events	M-H	7
	2c. Whakapapa/relationships determining cause & effect	H	1,7
	2d. Considers multiple risks and multiple mitigations	H	1
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	L-M	
	3b. Incorporates responsiveness to interventions	H	1,8
	3c. Delivers clear 'ownership of the problem'	H	1
	3d. Enables acting on analysis of future scenarios	L-M	9

1. This attribute reflects the importance of salt marsh as habitat for indigenous species, for primary production, contaminant filtration, carbon sequestration, and its association with mahinga kai species. It is strongly impacted by localised physical disturbance, as well as more distant land uses and activities.
2. There are challenges in holding the line because of the impacts and interactions of multiple stressors (e.g., reclamation, physical disturbance by livestock grazing and trampling, incursion of invasive species, sea level rise), which need to be identified and managed site by site. Can be amenable to restoration (see note 8)
3. Serves as a parent (tohu) attribute. Its ultimate effectiveness will depend on the development of descendant attributes to provide a fuller measure of habitat characteristics/suitability (particularly in terms of quality and function)
4. Is a very integrated measure, with strong cultural, social and recreational dimensions, depending on location. Is a key component in determining local mahinga kai values.
5. Has a critical role in terms of carbon sequestration, and contributes to other ecosystem services (e.g., storm protection, nutrient and sediment filtration)
6. Note that mangroves are excluded from the salt marsh attribute because they are generally expanding in extent (in response to sedimentation and eutrophication), and so are not likely responding to human induced-stressors in the same way as salt marsh.
7. Responds to both acute and chronic effects of physical disturbance and climate change (sea level rise and storms)
8. The degree to which precautionary strategies are enabled is uncertain: restoration of lost habitat, although technically feasible, can be challenging, and criteria for success are still emerging.
9. Is sufficient knowledge to enable prediction of the effects/impacts of future activities and land uses

Kete	Mud* content & accretion rate	Score	Notes
Kete Tua-uri	1a. Recognises values, place and change	H	7
	1b. Holds the line; supports targets	H	
	1c. Sufficiency to inform care that avoids potential impacts	H	1
	1d. Includes necessary tiers, nested layers* or hierarchies	H	1,5,6
Kete Aronui	2a. Captures ecological, social/cultural, economic system	H	
	2b. Considers hotspots and big events	H	
	2c. Whakapapa/relationships determining cause & effect	M	1,3, 5
	2d. Considers multiple risks and multiple mitigations	H	5
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	H	4,5
	3b. Incorporates responsiveness to interventions	M-H	2,5
	3c. Delivers clear 'ownership of the problem'	L-M	3,5
	3d. Enables acting on analysis of future scenarios	H	4,5

*Mud is defined as the silt and clay fraction, which is less than 63 µm

1. The scientific correlation between sedimentation deposition and environmental impact (stress) is well demonstrated, with clear and direct linkages between land-based disturbances or upstream causes and immediate impacts in downstream waterways.
2. Interventions upstream to reduce sediment deposition can be effective, but it is difficult to remove mud once it is in an estuary.
3. Identifying the specific sources of mud is still difficult, with specific sediment source fingerprinting still emergent in terms of applicable, highly-accurate scientific methods at the landscape-scale.
4. Once initially deposited in estuarine environments, sediments can move over lengthy periods in highly variable ways due to a number of drivers, including storm impacts and tidal resuspension.
5. Given the dynamism described in footnote 4 above, sediment deposition and movement could be improved by better understanding of suspended sediment and use of models.
6. Nutrient loading and heavy metal loads in sediments could be added to the attribute framework as descendant attributes at a later stage. These two contaminant types can have significant ecological and human health implications and would warrant monitoring in future.
7. Methodologies exist and are in use in New Zealand to assess both mud content and accretion (rate of change).

Kete	Nuisance macroalgae (OMBT)	Score	Notes
Kete Tua-uri	1a. Recognises values, place and change	H	1
	1b. Holds the line; supports targets	H	1
	1c. Sufficiency to inform care that avoids potential impacts	H	4
	1d. Includes necessary tiers, nested layers* or hierarchies	M	5
Kete Aronui	2a. Captures ecological, social/cultural, economic system	H	1
	2b. Considers hotspots and big events	M	2,3
	2c. Whakapapa/relationships determining cause & effect	H	1,2,3
	2d. Considers multiple risks and multiple mitigations	H	5
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	H	4
	3b. Incorporates responsiveness to interventions	H	1
	3c. Delivers clear 'ownership of the problem'	M-H	3
	3d. Enables acting on analysis of future scenarios	H	1

1. Indicator of eutrophication in estuaries and often associated with loss of multiple values (e.g. food gathering). Change in macroalgae usually associated with changes in catchment nutrient loading. There is good NZ evidence of a relationship between macroalgal abundance and nutrient concentrations. Assumption is that moving up and down nutrient loading gradient will influence macroalgal biomass. In reality there may be hysteresis effects, particularly when seeking to reduce macroalgal biomass through nutrient load reductions.
2. Evident at some hotspots often linked to nutrient point sources. Big events may 'reset' macroalgal biomass and monitoring design needs to take this into account.
3. May be clear for point sources but difficult to attribute catchment nutrient loading to diffuse sources
4. A comprehensive metric (Opportunistic Macroalgal Blooming Tool; OMBT) has been adapted from European use with modifications for NZ, and is appropriate for harbours with large intertidal flats
5. Need to consider multiple attributes for estuaries/coasts; a further tool could be considered for subtidal estuaries (where nuisance macroalgae is not a useful attribute). Understanding of estuarine flushing/hydrodynamics needed for establishing responses.

Kete	HEL → Erodible Soil Stabilisation	Score	Notes
Kete Tua-uri	1a. Recognises values, place and change	H	1,4
	1b. Holds the line; supports targets	H	1
	1c. Sufficiency to inform care that avoids potential impacts	H	2
	1d. Includes necessary tiers, nested layers* or hierarchies	H	3
Kete Aronui	2a. Captures ecological, social/cultural, economic system	H	4
	2b. Considers hotspots and big events	H	
	2c. Whakapapa/relationships determining cause & effect	M-H	6
	2d. Considers multiple risks and multiple mitigations	H	2
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	H	
	3b. Incorporates responsiveness to interventions	H	8
	3c. Delivers clear 'ownership of the problem'	M,H	4,5,6,7
	3d. Enables acting on analysis of future scenarios	H	7

1. This attribute is already managed by council plans, and the required information is readily available from LRI, LUC, Smap, DEM, Lidar.
2. May require localised definitions of land characteristics (incorporating LUC, soils, geology slope, etc) and appropriate vegetation for stabilisation
3. Can be customised and expanded over time to represent multiple forms of erosion and associated mitigation. For example, surface erosion and riparian (stream bank) protection can be added using parallel spatial information layers.
4. The mappable land areas are clear, and can be overlaid with data on Māori land ownership, but evaluation of equity and related considerations is likely to require consideration of historic land ownership and management.
5. It has been observed (related to Significant Natural Areas - SNAs) there can be a gap in management between regional (rural land) and district/city councils. For example, zoning of residential land in urban hills can be traced back to the example set by Lawrence et al 1983.
6. Consider cause-effect and risk mitigation issues arising after major storms such as Hale and Gabrielle. For example who owns or is responsible for damage when restoration was underway when the event occurred?
7. Check this criteria specifically for consistency with information layers used for the indigenous vegetation cover attribute
8. There are good published studies, particularly for post-Bola hill country, providing evidence for certain key land types. These can be updated with information assessed after cyclones Gabrielle and Hale.

Moderation Table

Kete	Criteria	PM2.5	Indigenous biodiversity	Sea Grass	Salt Marsh	Mud content & accretion	Nuisance macroalgae	Highly erodible soils
Kete Tua-uri	1a. Recognises values, place and change	H	H	H	H	H	H	H
	1b. Holds the line; supports targets	H	M	H	H	H	H	H
	1c. 1c. Sufficiency to inform intervention that avoids potential impacts	M-H	M	M	M	H	H	H
	1d. Includes necessary tiers, nested layers* or hierarchies	H	M	M	M	H	M	H
Kete Aronui	2a. Captures ecological, social/cultural, economic system	H	M	H	H	H	H	H
	2b. Considers hotspots and big events	H	M	H	M-H	H	M	H
	2c. Whakapapa/relationships determining cause & effect	H	M	M	H	M	H	M-H
	2d. Considers multiple risks and multiple mitigations	M-H	M	H	H	H	H	H
Kete Tua-ātea	3a. Uses precaution to include uncertainty and risk	H	M	M	L-M	H	H	H
	3b. Incorporates responsiveness to interventions	H	M	M-L	H	M-H	H	H
	3c. Delivers clear 'ownership of the problem'	H	M	L	H	L-M	M-H	M-H
	3d. Enables acting on analysis of future scenarios	H	H	M	L-M	H	H	H