Submitter information

The Ministry of Business, Innovation and Employment (MBIE) would appreciate if you would provide some information about yourself. If you choose to provide information in the "About you" section below it will be used to help MBIE understand the impact of our proposals on different occupational groups. Any information you provide will be stored securely.

A. About you

Name: Dr Matt Boyd, Prof Nick Wilson

Email address: Privacy of natural persons

B. Are you happy for MBIE to contact you if we have questions about your submission?

☒ Yes ☐ No

C. Are you making this submission on behalf of a business or organisation?

☒ Yes ☐ No

If yes, please tell us the title of your company/organisation:

Islands for the Future of Humanity: https://www.islandfutures.earth/

Adapt Research Ltd: https://adaptresearchwriting.com/

D. The best way to describe your role is:

☒ Academic/researcher/research institute
☐ Community group (please specify below)
☐ Consultant (please specify below)
☐ Tradesperson (please specify below)
☐ Industry group (please specify below)
☐ Industry participant (please specify below)
☒ Independent expert (please specify below)
☐ Business owner (please specify below)
☐ Environmental NGO (please specify below)
☐ Student (please specify below)
☐ Other (please specify below)
☐ Prefer not to say

Please specify here:

Islands for the Future of Humanity is an independent and non-partisan collaborative think tank and charitable trust that develops resilience options to help ensure island nations can weather the impact of global catastrophes.

Adapt Research Ltd provides independent research and analysis and initiated, led, and coordinated the 2023 Aotearoa NZ Catastrophe Resilience Project.

Key personnel: Dr Matt Boyd, Professor Nick Wilson, Sam Ragnarsson, Pia Johanson.

E. Privacy information

☐ The Privacy Act 2020 applies to submissions. Please check the box if you do not wish your name or other personal information to be included in any information about submissions that MBIE may publish.

☐ MBIE may upload submissions, or a summary of submissions, received to MBIE's website at www.mbie.govt.nz. If you do not want your submission or a summary of your submission to be placed on our website, please check the box and type an explanation below:

I do not want my submission placed on MBIE's website because… [insert reasoning here]

F. Confidential information

☐ I would like my submission (or identifiable parts of my submission) to be kept confidential and have stated my reasons and ground under section 9 of the Official Information Act that I believe apply, for consideration by MBIE.

If you have checked this box, please tell us what parts of your submission are to be kept confidential.

A Draft Critical Minerals List for New Zealand

MBIE is developing a critical minerals list for New Zealand to identify the minerals that are:

- essential to New Zealand's economy, national security, and technology needs, including renewable energy technologies and components to support our transition to a low emissions future; and/or
- in demand by New Zealand's international partners to enable us to benefit from international economic opportunities, contribute to the diversification of global mineral supply chains and improve the pipeline of the end-use products for which these minerals are essential; and
- susceptible to supply disruptions domestically and internationally. In some instances, we rely on domestic sources of minerals, but the supply of these minerals can be constrained, for example by regulatory factors and social licence. Internationally, supply chain disruptions could arise due to geopolitical risks and external market forces.

Minerals play an essential role in New Zealand's economic growth through high-paying jobs, Crown royalties, direct positive impact in the regions where mining takes place, and through export revenues. Minerals are also critical inputs into products that are necessary for other sectors to thrive, including the use of aggregates in construction and infrastructure.

Minerals are also essential to modern economies as they are needed to manufacture advanced technologies such as semi-conductors, defence applications and medical equipment. Minerals are also critical for a clean energy transition as low emission technologies requires more mineral inputs than those fuelled by fossil fuels.

The extraction and processing of the minerals essential to New Zealand and our international partners are concentrated in a few countries. Any disruption that interrupts operations at a large facility or group of facilities can have a major impact on supply availability, and therefore on prices. The greater the concentration of production the larger the affect a disruption can have.

In addition, New Zealand does not manufacture a wide range of technologies, we are generally an end consumer of many products produced internationally and rely on the functioning of international supply chains and their access to resilient supplies of minerals.

The development of a critical minerals list is one of the key actions identified in the draft Minerals Strategy that was publicly consulted on from 23 May – 31 July 2024. Due to the technical nature of the list, MBIE engaged a consultancy with specialist expertise, Wood Mackenzie, to support the development of the list.

We are seeking feedback on the content of the draft list that has been developed by Wood Mackenzie for New Zealand. It identifies the minerals that are critical to New Zealand and summarises the reason for their inclusion in the list. Once the list is finalised, actions could be identified to help us reduce the 'criticality' of those minerals, i.e., secure better access to them.

Please see the draft Critical Minerals List attached below for more information.

Questions for the consultation

1. Have we missed the inclusion of any mineral(s) on the draft Critical Minerals List?

☒ Yes, (please provide more details below) ☐ No, the list is okay. ☐ Not sure/no preference
Is there anything you would like to tell us about the reason(s) for your choice?

We recommend the following be ADDED to the list:

- **Gold**
- **Silver**
- **Iron**
- **Calcium (Limestone)**
- **Thermal Coal**
- **Salt (sodium chloride)**
- **Iodine**
- **Geological Hydrogen**

We STRONGLY AGREE with the following minerals already included:

- **Potassium**
- **Phosphate**
- **Boron**
- **Cobalt**
- **Copper**
- **Magnesium**
- **Selenium**

Our main point in making this submission is that decisions around critical minerals must be taken through a lens that includes global catastrophic risks where international trade could collapse in the face of severe infrastructure disruption and destruction. A completely new context, and therefore new priorities could emerge (ie where global reserves and global supply are inaccessible). This lens should be used in addition to considerations of mineral needs under business-as-usual for economy, trade, sustainability, and general security considerations.

We now explain our reasoning:

We are most concerned about the class of risks that would cause the most harm to New Zealand (including a risk of permanent economic and social damage). These global catastrophic risks (GCRs) include: major volcanic eruptions at global pinch points, nuclear war (with or without nuclear winter or high-altitude electromagnetic pulse), severe pandemics (natural or engineered), major global food shock, industry disabling solar flares, devastating global cyber-attack, catastrophe from misaligned artificial intelligence (AI), large asteroid/comet impact, etc.

We have written a detailed report **about this kind of risk and how New Zealand might ensure resilience.**

Although individually such risks may have a low probability of occurring in any given year, collectively they are plausible, and some are even likely in the long term. Each GCR could cause persistent medium to long-term supply chain disruptions, significantly altering life in New Zealand. The risk of GCRs is probably rising given advances in biotechnology and AI, increasing geopolitical tensions, and the amplifying impact of climate change.

From a risk analytic perspective, almost all the harm that occurs is contained in a few extreme events. For example, Covid-19 has caused 95% of all disaster deaths in the 21st Century. The same is true for harm to industry and the economy, where occasional devastating catastrophes do most of the damage. We are concerned that much risk mitigation activity in New Zealand addresses only

smaller more common risks (eg, floods, earthquakes, 10% fuel supply disruptions) and therefore leaves most of the actual future harm to New Zealanders unaddressed.

In contrast we note that the US has a Global Catastrophic Risk Management Act (2022) and the first US report on how to supply 'basic needs' in such scenarios is imminent.

Turning to the specific resilience issue of critical minerals:

Following a global catastrophe of the kind listed above, it will be necessary to focus on ensuring that basic needs (water, food, shelter, energy, communications, transport) are able to be supplied and distributed. Therefore, through the GCR lens the most critical minerals are:

Potassium and Phosphate: Although on the list, we reiterate their importance. Both are critical inputs to industrial agriculture (along with liquid fuel, agrichemicals, and a nitrogen supply). Continuation of agriculture at scale is essential for the survival and health of the New Zealand population and other populations to which we export food.

Boron, Cobalt, Copper, Magnesium, and Selenium: Although on the list we reiterate their importance due to locality-specific soil deficiencies in NZ, and therefore their relevance for use in fertiliser production and therefore food security. Several of these minerals are also needed for alloyed steel production (see below).

Limestone/Calcium (along with Aggregate/Sand): Important for construction, in particular concrete and road repairs. New Zealand's marked over-dependence on road trucking, and inability to secure reliable Cook Strait and coastal shipping, means that distribution of food and agricultural industrial inputs is at risk should roads be damaged following a global catastrophe scenario (eg, by a severe cyclone or earthquake following international trade disruption due to nuclear war or an Indonesian supervolcano eruption that closes shipping in Asia).

Iron (and consider Bauxite): Iron is noted in the Wood MacKenzie Report to be at low global supply risk (but note our caveats above). Iron is essential for tool-making and construction (although salvage of scrap iron might do during a short to medium-term catastrophe) and should a global catastrophe disable international trade New Zealand would be advised to have a sufficient domestic production capability. 'Low risk' of global supply issues is a separate issue from the 'expected harm' when considering the likelihood and impact of disruption to iron supply (ie, low likelihood x catastrophic impact = serious expected harm). When considering post-catastrophe production of steel it is important to also consider coking coal/metallurgic coal (listed in the Wood MacKenzie Report), which is a reducing agent in steel production. Important elements used for various types of alloyed steel production include: aluminium, boron, chromium, cobalt, copper, manganese, molybdenum, nickel, niobium, silicon, titanium, tungsten, and vanadium.

Thermal Coal: Is noted in the Wood MacKenzie Report to be in surplus for business-as-usual demand, but it may be a needed energy source if volcanic winter or nuclear winter diminishes precipitation and impairs hydroelectric generation. (Indeed, recent modelling of nuclear winter scenarios indicates large reductions in precipitation are plausible.) Coal might wisely be stockpiled (and not burned) in pre-catastrophe times so that accessible reserves exist that can be burned in cases where liquid fuel supplies for extraction are exhausted, or where the electrical grid has collapsed (eg, post electromagnetic pulse, solar storm, or massive cyber-attack) impairing the ability to mine coal. Additionally, supplies of coal from Australia may be inaccessible in scenarios where global shipping has collapsed because of infrastructure destruction or disruption. (See also above for coking coal needed for steel production.)

Salt (sodium chloride): Does not appear to be considered in the Wood MacKenzie Report but could be critical as it enables food preservation in the absence of electricity/refrigeration. Sodium chloride is also used in a wide range of industrial processes, including the production of **chlorine** – which is very important for treating reticulated water supplies and preventing water-borne disease outbreaks.

Gold (and/or Silver) are noted in the Wood MacKenzie Report to be at minimal risk for securing demand, however, these may be needed to base a new currency in the event the NZ dollar collapses. Additionally, supplies of gold in Australia may be inaccessible in scenarios where global

shipping has collapsed because of infrastructure destruction or disruption. Other minerals relevant to producing a new range of coinage (eg, based on a new gold or silver standard) include copper, iron, and zinc (eg, current-day pennies in the USA are comprised of copper-plated zinc, but copper-plated steel is an alternative).

New Zealand should collaborate with Australia and prioritize locally controlled assets facilitating trans-Tasman (and interisland) trade.

In GCR cases where shipping trade with Australia or Indonesia is possible, New Zealand is advised to have something of value to these countries to trade, so should ensure access to minerals in demand by regional partners to facilitate trade and resilience. Furthermore, if post-GCR, New Zealand typically lacks exports that neighbouring countries might want to purchase – then at least precious metals such as gold and silver could be used to buy critical supplies (eg, buying pharmaceuticals and vaccines produced by Australia).

Iodine is noted in the Wood MacKenzie Report, but should be given more consideration. After a GCR it could be important to prevent dietary deficiencies via addition to table salt or flour (NZ soils are generally deficient in iodine), and to produce iodoform disinfectants. Iodine supplementation would also be needed for ensuring livestock health in some localities.

Minerals used as Catalysts for Biofuel Production: The Wood MacKenzie Report notes some generally used catalysts (ie, manganese, platinum, vanadium and zirconium), but it needs to consider those relevant to biofuel production (including **sodium** and **potassium**). Such indigenous production of biofuels would be critical for New Zealand after a GCR to run agricultural machinery, to transport food, and to import supplies (eg, medicines) from Australia. Relevant catalysts for synthetic diesel production can include iron and cobalt. For hydroprocessing and gasification, the following metal catalysts are potentially relevant: cobalt, nickel, palladium and ruthenium.

Geological Hydrogen Gas: Does not appear to be considered in the Wood MacKenzie Report, but deposits have been identified in a growing number of countries – and could plausibly be identified in New Zealand in the future. It could be an important fuel source if a GCR ended New Zealand's liquid fuel imports.

2. Have we included any mineral(s) that you think should not be on the list?

☐ Yes, (please provide more details below) ☒ No, the list is okay. ☐ Not sure/no preference
Is there anything you would like to tell us about the reason(s) for your choice?

N/A

3. Do you have any further feedback on the list, or the methodology under which it was developed?

☒ Yes, (please provide more details below) ☐ No, the list is okay. ☐ Not sure/no preference
Is there anything you would like to tell us about the reason(s) for your choice?

The method appears to assume that a degree of global trade continues, as Global Reserves and Global Supply are key factors in the supply risk assessment. However, there are plausible scenarios where global trade is completely disrupted (see for example our Hazard Profile detailing the impact of a Northern Hemisphere nuclear war on NZ). In such cases even trade with Australia may take some time to re-establish at scale. We feel that the analysis does not yet adequately consider a range of global catastrophic risk scenarios. Some of these should be spelled out explicitly.

We note the definition of critical minerals, "to be included in the draft list, a mineral must be:

- essential to New Zealand's economy, national security, and technology needs, including renewable energy technologies and components to support our transition to a low emissions future and/or
- in demand by New Zealand's international partners, and
- susceptible to supply disruptions domestically and internationally.

Essential is defined as critical to maintaining the New Zealand's economy today and into the future and not readily substitutable."

This definition, and the "total mineral demand" calculation performed for the Wood MacKenzie Report, appears to omit minerals that, while not essential under business-as-usual, may attain particular significance in situations where global conditions are radically altered, such as following a global catastrophe that potentially lasts years or a decade or more (eg, nuclear winter). In such circumstances minerals such as Potassium and Phosphate (which are not on our international partners' Critical Mineral Lists) may be particularly important, as might Gold, Silver, Coal, Iron, Calcium/Lime. The analysis needs to include a global catastrophic risk lens and contemplate the downstream context following the potential GCRs we listed above.

One plausible context is richly described in our Hazard Profile about nuclear war/winter from the perspective of New Zealand (albeit this hazard profile has a lot of relevance to other types of GCR).

Additionally, the particulars of "In demand by New Zealand's international partners" should include analysis of scenarios where global trade has collapsed and trade operates on a restricted regional basis (eg New Zealand, Australia, Indonesia), as this context may alter what is "in demand" regionally.

In a post-catastrophe scenario, easily accessible surface deposits or recycling from existing infrastructure might be more crucial than deep mining operations that require advanced technology. This should be evaluated when prioritising new mineral initiatives.

We covered a number of these issues in our previous submission to the Productivity Commission's Economic Resilience Inquiry and this submission might be useful reading.

Extensive background on global catastrophic risks from the perspective of New Zealand can be read at our Adapt Research Blog.

Thank you for this opportunity to contribute this submission. We would very much welcome the opportunity to do a short presentation to you (eg, by Zoom or face-to-face) on the value of considering "critical minerals" in terms of building New Zealand's resilience to global catastrophic risks.

Thank you

Thanks for your feedback, we really appreciate your insight on the development of New Zealand's Critical Minerals List.