



Proposed Amendments to the Environmental Reporting Act 2015

Cost Benefit Analysis

May 2022



Document status:	Final
Version and date:	V3.0; 13/05/2022
Author(s):	Dave Grimmond, Nick Leffler
Filing Location:	\A+C\NZ - Work\MfE\Full CBA of ERA Amendments\04 Deliverables
Peer / technical review:	Nick Leffler
Verification that QA changes made:	Dave Grimmond, Nick Leffler
Proof read:	Sarsha Sivanantham
Formatting:	Nick Leffler
Final QA check and approved for release:	Nick Leffler, Senior Consultant

Allen + Clarke has been independently certified as compliant with ISO9001:2015 Quality Management Systems



CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	2
1.1. Background	2
1.2. Proposed Changes to the ERA	2
1.3. Expected benefits	3
2. APPROACH AND ASSUMPTIONS	5
2.1. Approach	5
2.2. General Assumptions	5
2.3. Overarching Assumptions	8
3. NET BENEFITS	10
3.1. Summary results	10
3.2. Distribution of Summary Results	11
4. ANALYSIS OF EXPECTED COSTS FOR INDIVIDUAL PROPOSALS	14
4.1. Proposal 1: Clarify the purpose of environmental reporting	14
4.2. Proposal 2: Mandate a government response to synthesis reports	14
4.3. Proposal 3: Add drivers and outlooks to the reporting framework	16
4.4. Proposal 4: Adjust roles and responsibilities	17
4.5. Proposal 5: Mandate a standing advisory panel	18
4.6. Proposal 6: Replace environmental domains with cross-domain themes	19
4.7. Proposal 7: Reduce the frequency of synthesis reports to six-yearly	21
4.8. Proposal 8: Replace domain reports with one commentary each year	21
4.9. Proposal 9: Establish a set of core environmental indicators	22
4.10. Proposal 10: Strengthen the mechanisms for collecting data	24
4.11. Cost of Māori Partnership	26
4.12. Legislative Costs	28
4.13. Total Costs	29
5. ANALYSIS OF EXPECTED BENEFITS	30
5.1. Reduced Regulatory Burden	30
5.2. Slower ecosystem degradation	31
5.3. Less Harm from Pollution	33
5.4. Improved Māori Partnership	36
5.5. Reduction in Staff Turnover	37
5.6. Total Benefits	38
ANNEX 1 – REFERENCES	40

EXECUTIVE SUMMARY

Under the Environmental Reporting Act 2015 (ERA), the Ministry for the Environment (the Ministry) and Statistics New Zealand (Stats NZ) are required to produce six independent reports on the state of New Zealand's environment over a period of three years. Based on the experience over two reporting cycles of the Ministry, Stats NZ, and other contributing agencies amendments to the ERA are being proposed to enhance its effectiveness, including to:

1. Clarify the purpose of environmental reporting.
2. Mandate a government response to synthesis reports.
3. Add drivers and outlooks to the reporting framework.
4. Adjust roles and responsibilities.
5. Mandate a standing advisory panel.
6. Replace environmental domains with cross-domain themes.
7. Reduce the frequency of synthesis reports to six-yearly.
8. Replace domain reports with one commentary each year.
9. Establish a set of core environmental indicators.
10. Strengthen the mechanisms for collecting data.

Beyond the specific proposals, the Government intends to better integrate te ao Māori and mātauranga Māori in environmental reporting. These changes will be developed with Māori and will be integrated into the reporting process, including throughout the specific proposals outlined above.

In parallel with public consultation, the Ministry contracted *Allen + Clarke* to develop a Cost Benefit Analysis (CBA) of the proposed amendments. Through engagement with affected Government agencies, regional councils, Crown research institutes, and other key stakeholders, cost estimates were developed based on staffing requirements and other expected costs to implement the proposed amendments. Benefits were estimated at an aggregate level for all proposals combined as they are highly complementary, and the expected benefits are only expected to accrue if the proposed amendments are implemented as a package. Owing to the uncertainty of the estimates of the costs and benefits, Monte Carlo analysis was conducted to determine 95% confidence intervals of the estimates.

In aggregate, the CBA estimates a benefit cost ratio of 1.90 with a 1.2% probability of the costs exceeding the benefits.

Table 1: Estimated aggregate costs and benefits

Costs (including deadweight cost of taxation)	Central Estimate (NZ\$ m)	95% confidence band (NZ\$ m)
Total Costs (C)	560.5	(402.1 / 779.7)
Total Benefits (B)	1,064.3	(683.4 / 1,540.1)
Net Benefits (=B – C)	503.8	(60.0 / 1,012.4)
Benefit-Cost Ratio (=B/C)	1.90	(1.09 / 3.20)
Probability of costs exceeding benefits	1.2%	

1. INTRODUCTION

1.1. Background

Under the Environmental Reporting Act 2015 (ERA), the Ministry for the Environment (the Ministry) and Statistics New Zealand (Stats NZ) are required to produce six independent reports on the state of New Zealand's environment over a period of three years. Based on the experience of completing two three-yearly cycles and the Parliamentary Commissioner for the Environment's (PCE) review of the effectiveness of the environmental reporting system, the Ministry and Stats NZ are proposing several amendments to the ERA to increase the impact of environmental reporting. A consultation document¹ was issued by the Ministry in early 2022 inviting feedback on the proposed amendments.

This report outlines the expected costs and benefits of the proposed amendments to the ERA. It will inform the final recommendations in the Cabinet paper including a Regulatory Impact Statement (RIS) to support Government decisions in progressing the proposed amendments to the ERA.

1.2. Proposed Amendments to the ERA

In 2019, the PCE issued a report on how well New Zealand reports on the state of its environment. *Focusing Aotearoa New Zealand's environmental reporting system* critiqued the approach to reporting set up under the ERA and outlined steps to improve the system. The report included, amongst others, specific recommendations on amendments to the ERA to improve its effectiveness.

Based on the experience of the Ministry, Stats NZ, and other contributing agencies the proposed amendments to the ERA are as follows:

1. Clarify the purpose of environmental reporting.
2. Mandate a government response to synthesis reports.
3. Add drivers and outlooks to the reporting framework.
4. Adjust roles and responsibilities.
5. Mandate a standing advisory panel.
6. Replace environmental domains with cross-domain themes.
7. Reduce the frequency of synthesis reports to six-yearly.
8. Replace domain reports with one commentary each year.
9. Establish a set of core environmental indicators.
10. Strengthen the mechanisms for collecting data.

Beyond the specific proposals, the consultation document also outlines the Government's intention to better integrate te ao Māori and mātauranga Māori in environmental reporting. These

¹ Ministry for the Environment. 2022. Te whakawhanake i te pūnaha rīpoata taiao o Aotearoa | Improving Aotearoa New Zealand's environmental reporting system: Proposed amendments to the Environmental Reporting Act 2015: Consultation document. Wellington: Ministry for the Environment.

changes will be developed with Māori and will be integrated into the reporting process, including throughout the specific proposals outlined above.

1.3. Expected benefits

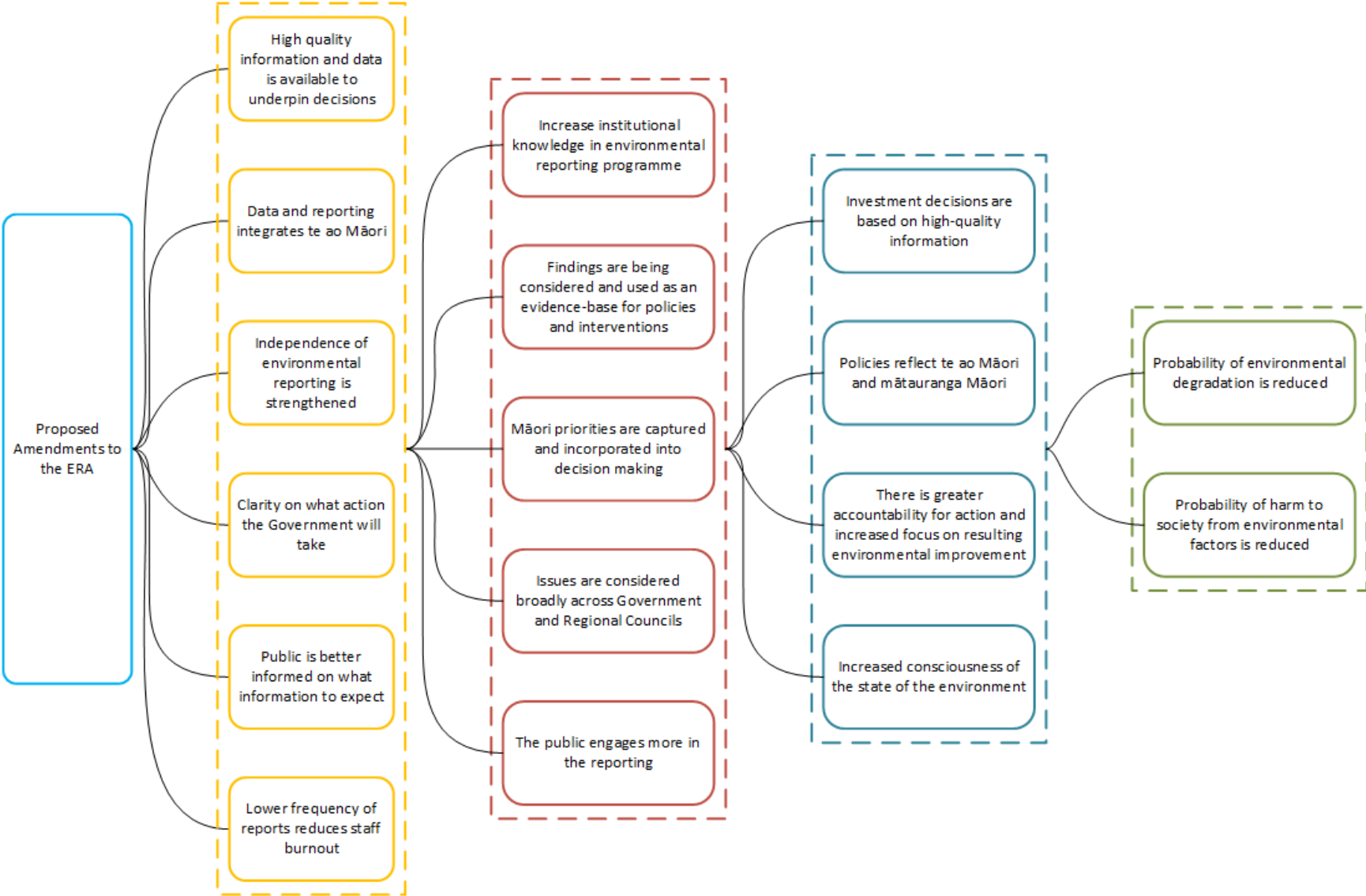
As it is difficult to isolate the potential impacts of individual proposals and because they have a high level of complementarity between them, the benefits of the proposed amendments accrue primarily from considering the proposed amendments as a package. The synergies between proposals also mean that many of the benefits will not be achieved without all the proposals being enacted. For example, the benefits from developing a suite of core indicators (proposal 9) will be enhanced by an expansion in the collection of data (proposal 10), core indicators alone are unlikely to yield the benefits of both combined.

A results chain for the expected benefits from the proposed amendments to the ERA was developed to contextualise the process through which these benefits are achieved. It draws from the benefits identified by the Ministry in its consultation document, describing primarily non-monetised benefits. Additional benefits that were identified as monetisable are included in different stages of the results chain, including:

- **Reduced regulatory burden:** With an improved understanding of environmental status, policy makers will be better placed for setting environmental priorities with an expected reduction in the regulatory burden of the resource management system.
- **Improved Māori engagement:** The integration of te ao Māori and mātauranga Māori into the environmental reporting programme will increase the relevance of the reporting, increasing the likelihood that environmental policies reflect Māori values and priorities. Ongoing engagement with Māori, and integration of Māori information, will further strengthen the environmental reporting programme and its impact.
- **Slower ecosystem degradation:** An improved evidence base for policy making will increase the likelihood of effective decisions and investments. Together with increased accountability and greater consciousness of the environment, this is likely to reduce the pace of environmental degradation, increasing the ecosystem services available to society.
- **Less harm from pollution:** Similar to environmental degradation, better policy decisions and increased consciousness is likely to reduce harm to society from poor air quality, water quality, excess noise, and other environmental harm factors.
- **Reduction in staff turnover:** The decrease in reporting frequency is expected to lead to lower levels of stress, which reduces the likelihood of staff burnout and therefore enhancing staff retention. As a result, recruitment costs are lowered, productivity increases, and institutional knowledge is maintained across multiple cycles of environmental reporting.

The results chain is presented in Figure 1 overleaf.

Figure 1: Results chain of impact of proposed amendments to the ERA



2. APPROACH AND ASSUMPTIONS

2.1. Approach

This CBA builds on a preliminary desk-based CBA that was conducted in November 2021. The preliminary CBA focused primarily on the costs with commentary provided on potential benefits and risks. To supplement the information reviewed during the preliminary CBA, a set of targeted interviews were held with several key stakeholders to refine the analysis and discuss monetisation of benefits. A total of 23 interviews were conducted with stakeholders from the following entities:

- **Government Agencies:** The Ministry, Stats NZ, Department of Conservation, Waka Kotahi, Te Puni Kōkiri, and Te Arawhiti
- **Crown Entities and Crown Research Institutes:** Kaupapa Kura Taiao,² NIWA, Manaaki Whenua Landcare Research and the Office of the Parliamentary Commissioner for the Environment.
- **Regional Councils:** Canterbury Regional Council, Horizon Regional Council, Marlborough District Council, Waikato Regional Council, and West Coast Regional Council
- **Others:** Federated Farmers.

In addition, other relevant documentation was identified and reviewed.

The approach has been to estimate specific costs for proposals 2, 3, 5, 6, 9 and 10 individually. The other proposals (1, 4, 7 and 8) are not expected to generate any additional costs, other than the process costs associated with amending the legislation. These legislation costs are accounted for in a separate cost item. The final cost item relates to engagement with Māori to better incorporate te ao Māori and mātauranga Māori in environmental reporting.

Monetised benefits are estimated against the five areas outlined in Section 1.3. The general approach used to quantify these potential benefits is to seek evidence on realistic unit values of the benefits. We have however, been conservative in attributing benefits likely to be generated by the ERA amendments.

Given the nature of the expected costs and benefits and the assumptions required to produce this CBA, a Monte Carlo analysis has been carried out to assess the range and probability of potential outcomes.

2.2. General Assumptions

The following general assumptions apply to all proposals:

- Present value calculations
- Labour costs
- Deadweight cost of taxation
- Compliance Costs

² Part of the Environmental Protection Authority.

- Current costs of passing the ERA amendments
- Monte Carlo analysis.

2.2.1. Present value calculations

The cost benefit analysis (CBA) has been conducted over a thirty-year time period. This time period is consistent with other CBAs conducted recently for the Ministry. It also conveniently represents five cycles of the proposed six-year environmental reporting cycle. Set-up costs incurred prior to the enactment of the proposed amendments are assumed to take place in year zero. Costs and benefits are allocated to individual years, but results are reported in present value terms:

$$PV = \sum_{n=1}^{30} FV_n \frac{1}{(1 + \delta)^n}$$

Where the present value (PV) is the sum of future values (FV) in each period (n) discounted by the discount rate (δ). Present values are used to account for the opportunity cost of devoting resources to the project of interest. Unless explicitly noted, all values in this document are in constant 2021 prices, as this is the most recent data available from Stats NZ. As recommended by Treasury, the central discount rate used is 5%³.

2.2.2. Labour costs

The cost of public sector time is benchmarked on a 2015 comprehensive investigation into the cost of policy advice in New Zealand, which has been adjusted for inflation to 2021 prices by subsequent increases in public sector wages (The Treasury. 2015.). The approach is to account for frontline policy or analytical FTE labour inputs including also accounting for all overhead costs. This will include management overheads and support staff providing ancillary activities such as accounts, IT support and HR. Thus, while staff engaged in the direct activities of interest will earn less than the numbers used in the tables and graphs below, the calculations account for the higher comprehensive cost to society represented by these higher cost figures.

The original Treasury study presented a range of estimates that differed between departments. The Ministry's results in 2014 were close to the median result. Translated into 2021 prices, this median value is estimated to be \$229,400, which is used to value general departmental labour costs and labour costs at Crown research institutes (CRIs). A value of \$170,000 is used to value Stats NZ labour inputs, based on specific advice provided by Stats NZ. This value is also used to value regional council labour inputs. A higher value of \$247,330 is used for the Ministry, reflecting specific information from the Treasury study.

2.2.3. Deadweight cost of taxation

The analysis uses the Treasury recommendation that a 20% deadweight cost of tax premium be applied to costs that will require tax funding as an assumption (The Treasury. 2015 (b)). Most of the costs of a project typically arise from the consumption of resources, such as labour, materials etc. But additional costs arise where the funds for the project come from taxation. Taxes encourage

³ See <https://www.treasury.govt.nz/information-and-services/state-sector-leadership/investment-management/plan-investment-choices/cost-benefit-analysis-including-public-sector-discount-rates/treasury-cbax-tool>

people to move away from things that are taxed and toward things that are not taxed or more lightly taxed. Their consumption choices are distorted away from what they would prefer in the absence of taxes. The change in the mix of consumption has an adverse welfare effect which is additional to the loss of welfare resulting directly from the loss of money that is taken away in the form of tax. This welfare loss is referred to as the deadweight cost of taxation (or sometimes as a deadweight loss, or 'excess burden').

2.2.4. Compliance costs

The cost estimates presented assume that agencies external to central government will be reimbursed on a full cost recovery basis. In some cases, an explicit monetary spend has been assumed, say for contracting expert advice or research. Although these other potential purchase costs have been explicitly accounted for, our estimates make no judgement about budget allocation decisions. The key presumption is that there will be budget that will fund full cost recovery so that the proposals will not impose any further compliance costs on society.

2.2.5. Costs of passing the ERA amendments

A number of activities involved with the ERA proposals are considered to be business as usual for the Ministry and other agencies involved and so are not regarded as imposing explicit additional costs on society. This includes all processes in relation to the design of amendments, consultation processes, and the government costs associated with passing legislation. This means that it is assumed that Proposal 1 (Clarify the purpose of environmental reporting) and Proposal 4 (Adjust roles and responsibilities) will have no additional cost consequences. However, from a national perspective there is an opportunity cost associated with the administrative activities associated with drafting legislation, consultations and parliamentary processes. Resources involved could potentially be used for other government activities. Our approach is to cost the legislation costs for the entire suite of proposed amendments and not allocate such costs to specific proposed amendments.

2.2.6. Cost of Māori engagement

Likewise, although Māori engagement is likely to support many of the proposed amendments, our approach is to cost the activity associated with engagement processes, without allocating such costs to specific amendments. The one exception relates to proposal 10 (Strengthen the mechanisms for collecting data), where explicit allowance is made for funding Māori contributions to environmental reporting. It should be noted that these costs in proposal 10 relate to the funding of environmental reporting activity and not the engagement activities that will have preceded and accompany direct reporting activities.

2.2.7. Monte Carlo Analysis

Monte Carlo simulation techniques provide a method for investigating the interactions between multiple areas of uncertainty. A Monte Carlo simulation is a computer-based technique that uses statistical sampling and probability distributions to simulate the effects of uncertain variables on model outcomes. It provides a systematic assessment of the combined effects of multiple sources of risk.

The approach adopted here is to simulate 20,000 observations for each varied component assuming random inputs into a Beta distribution.⁴ The assumed distribution takes into account prior information about the potential distribution and can also constrain the distribution to avoid impossible outcomes, like negative costs.

The strength of the Monte Carlo simulation is that it allows a wide range of combinations between the different components (for example, one simulation could effectively assume that some costs are low, but others are high). Twenty thousand simulations were found to be sufficient to ensure that results were stable between different samplings.

A key implication of undertaking Monte Carlo analysis is that it allows us to present a graphical (histogram) presentation of the distribution of cost estimates and also to provide 95% confidence intervals for the cost estimates.

2.3. Overarching Assumptions

Graphs present distributions of present value calculations for 20,000 iterations of cost and benefit items using Monte Carlo analytical methods using Beta distributions. There are eight cost items (proposals 2, 3, 5, 6, 9, 10, Māori engagement, and legislation costs) and five forms of potential benefits (resource management efficiency gains, lower Ministry staff turnover, ecosystem services due to slower rates of degradation to natural environments, a slower pace of increase in pollution, and benefits from Māori engagement).

A 30-year time horizon is used⁵, with central estimates of present values calculated with a 5% discount rate (2% - 8% low/high bands). Cost estimates apply a deadweight cost of taxation allowance (0%/20%/40% low/central/high beta distribution assumptions). The assumption is that the amendments will be enacted in 2023. A 30-year horizon means that the analysis

⁴ A Beta distribution was selected as it provides scope to constrain the distribution outcomes within plausible bounds (established by the A and B terms) and to allow skewed distributions (established by the relative size of the α and β terms).

In practice each alpha term has been set to 1 and then the beta value adjusted (which sets the distribution skewness) to ensure that the resulting distribution mean matches the values used in the central calculations. The resulting distributions are bound by plausible constraints but also utilise available information about the likely distribution.

For example, if the average price of a milkshake is \$10, prices below zero and over \$50 may be excluded as impossible or implausible. But as the average price is \$10, observations of \$8-\$12 would be expected to be more likely than observations of \$38-\$42. So, in this example, A would be set to 0, B to 50, and with α set to 1, a value of 5 would be chosen for β , as this is the value that will generate a sample average of 10.

For the Monte Carlo analysis of the cost estimates of the proposed ERA amendments, the following assumptions have been made:

- $\alpha = 1$
- β = adjusted to ensure that the distribution average equals the central estimate
- A = lower bound of distribution (if not constrained by a zero lower bound, assumed to be lower than the low sensitivity test value by a proportion that is 25% of the gap between the sensitivity low value and the central estimate)
- B = upper bound (typically assumed to be greater than the high sensitivity test value by a proportion that is 25% of the gap between the sensitivity high value and the central estimate).

⁵ Note that the Preliminary CBA used a 12-year time horizon to cover two reporting cycles. A 30-year horizon has been selected for the Full CBA to allow for longer term benefits to better be measured and to align with other recent CBAs.

incorporates five six-year reporting cycles. Values are presented in constant 2021 prices in present value terms for the entire 30-year period. Key assumptions are outlined in Table 2.

Table 2: Assumptions

Assumption	Low	Central	High	Beta (skewness)
Discount rate	2%	5%	8%	1.00
Deadweight cost of taxation	0%	20%	40%	1.40
<i>Labour costs per FTE</i>				
Ministry for the Environment	\$183,619	\$247,327	\$328,987	1.30
Other departments and Crown research institutes	\$206,523	\$229,426	\$279,207	2.20
Statistics New Zealand and Regional Councils	\$153,029	\$170,000	\$206,886	2.20

3. NET BENEFITS

3.1. Summary results

Summary results are presented in Table 3. The central column presents the mean outcome for each cost and benefit item. The bounds of the 95% distribution of outcomes from each Monte Carlo distribution is presented in brackets. Note that the 95% confidence intervals do not sum to the Total Costs, reflecting that each simulation will have a different combination of high and low inputs. The probability that all costs are simultaneously low is much lower than individual components being low. Hence, the 95% lower bound for total costs (\$402.1m) is greater than the sum of the individual cost lower bounds (\$312.9).

Table 3: Overview of Costs and Benefits, 30-year Present Values, 2021 NZ\$ millions

Costs (including deadweight cost of taxation)	Central Estimate (NZ\$ m)	95% confidence band (NZ\$ m)
Clarify the purpose of environmental reporting	0.0	(0.0 / 0.0)
Mandate a government response to synthesis reports	6.7	(3.1 / 12.5)
Add drivers and outlooks to the reporting framework	69.5	(41.0 / 113.5)
Adjust roles and responsibilities	0.0	(0.0 / 0.0)
Mandate a standing advisory panel	23.1	(12.3 / 40.3)
Replace environmental domains with cross-domain themes	0.8	(0.3 / 1.4)
Reduce the frequency of synthesis reports to six-yearly	0.0	(0.0 / 0.0)
Replace domain reports with one commentary each year	0.0	(0.0 / 0.0)
Establish a set of core environmental indicators	81.6	(49.5 / 130.6)
Strengthen the mechanism for collecting data	287.7	(156.7 / 494.6)
Māori partnership	88.0	(48.9 / 148.2)
Legislative costs	3.2	(1.2 / 6.0)
Total Costs (C)	560.5	(402.1 / 779.7)
Benefits	Central Estimate (NZ\$ m)	95% confidence band (NZ\$ m)
Reduced regulatory burden	248.9	(128.4 / 431.0)
Improved Māori engagement	101.1	(50.3 / 183.7)
Slower ecosystem degradation	446.8	(219.4 / 811.4)
Less harm from pollution	266.6	(121.8 / 505.3)
Reduction in staff turnover	0.9	(0.5 / 1.5)
Total Benefits (B)	1,064.3	(683.4 / 1,540.1)
Net Benefits (=B – C)	503.8	(60.0 / 1,012.4)
Benefit-Cost Ratio (=B/C)	1.90	(1.09 / 3.20)
Probability of costs exceeding benefits	1.2%	

The net result is that only 1.2% of the 20,000 iterations return a negative net benefit. Benefits are estimated to exceed costs in the other 98.8% of the 20,000 iterations, with a mean net benefit of \$504 million and an average benefit cost ratio of 1.9. The benefit cost ratio ranges from 1.09 to 3.20 for 95% of the iterations. This result emerges despite a conservative approach used for assigning attribution of potential benefits resulting from improved environmental reporting (see

Section 5). This reflects the potential for increases in wellbeing that can come from a better understanding of the state of the environment and environmental processes. Regulating resource management is costly, meaning that there is considerable scope for improving its efficiency. Many households have their sense of wellbeing harmed by exposure to pollution (noise irritants, and poor air and water quality). Wellbeing is also enhanced by ecosystem services provided by the natural environment that have degraded over time and risk further degradation.

The major cost item relates to Proposal 10: Strengthen the mechanisms for collecting data. This reflects feedback that improved data collection is fundamental for the proposed amendments to deliver the intended improvements in environmental reporting. For example, potential benefits from better identification of relevant indicators (Proposal 9) would be undermined if the data required to populate these indicators is not collected. An implication is that the adequacy of data collection funding and the quality of its implementation is likely to be a critical aspect underpinning the scale of benefits expected from the amendments.

The second tier of cost items are Proposal 9: Establish a set of core environmental indicators (with a central present value cost estimate of \$81.6m), Māori engagement (\$88.0m) and Proposal 3: Add drivers and outlooks to the reporting framework (\$69.5m).

3.2. Distribution of Summary Results

Histograms of the count of outcomes from 20,000 iterations of the cost benefit analysis are presented below. In each graph also noted are the mean outcomes as well as the 95% range of the distribution (presented numerically in brackets and graphically by the red lines).

Figure 2: Distribution of Present Value of Total Costs

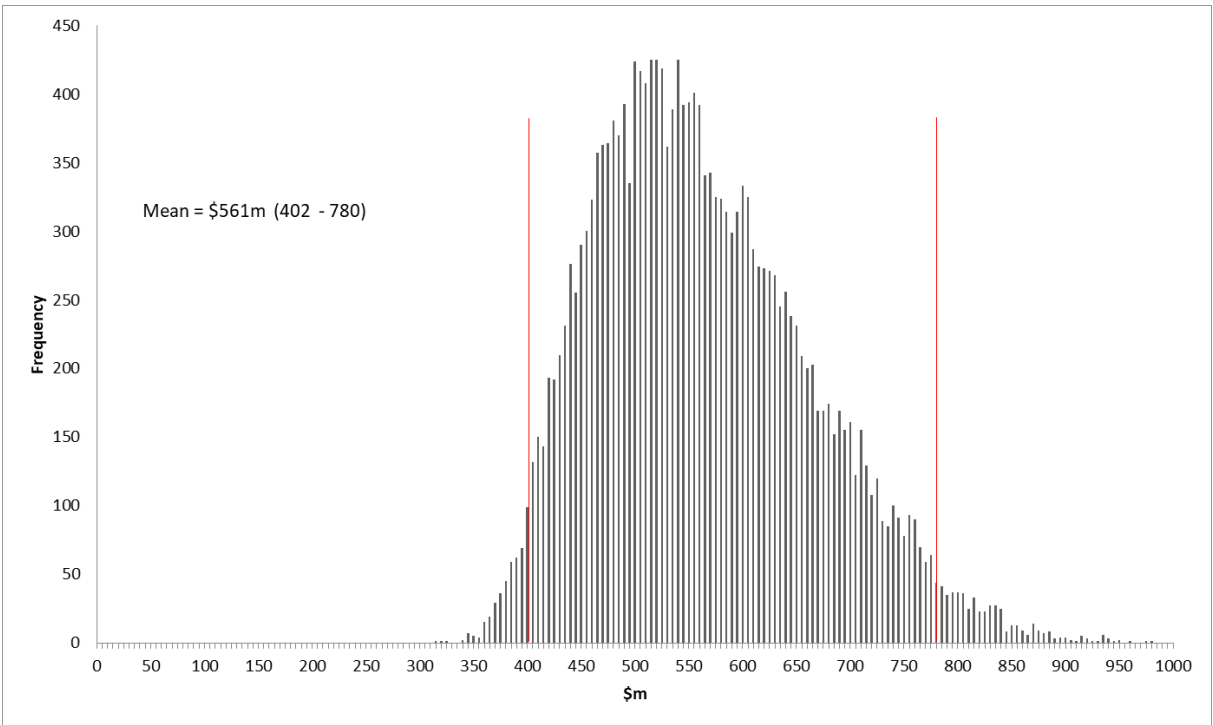


Figure 3: Distribution of Present Value of Total Benefits

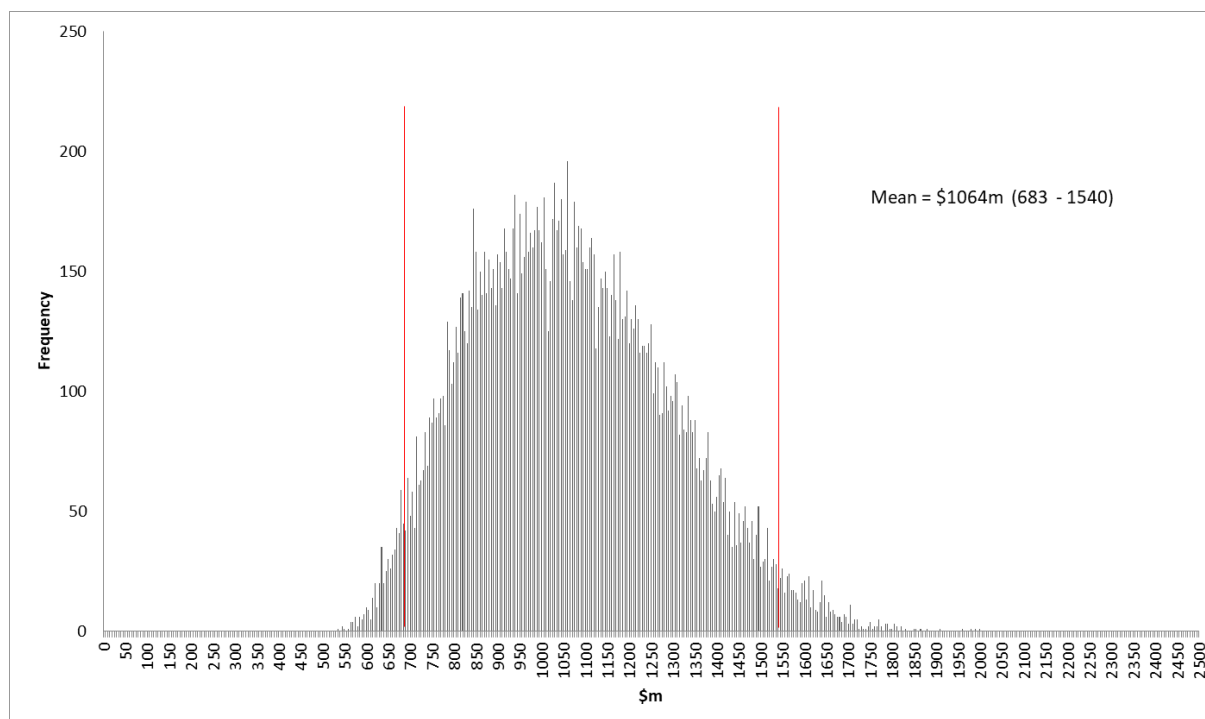


Figure 4: Distribution of Present Value of Net Benefits

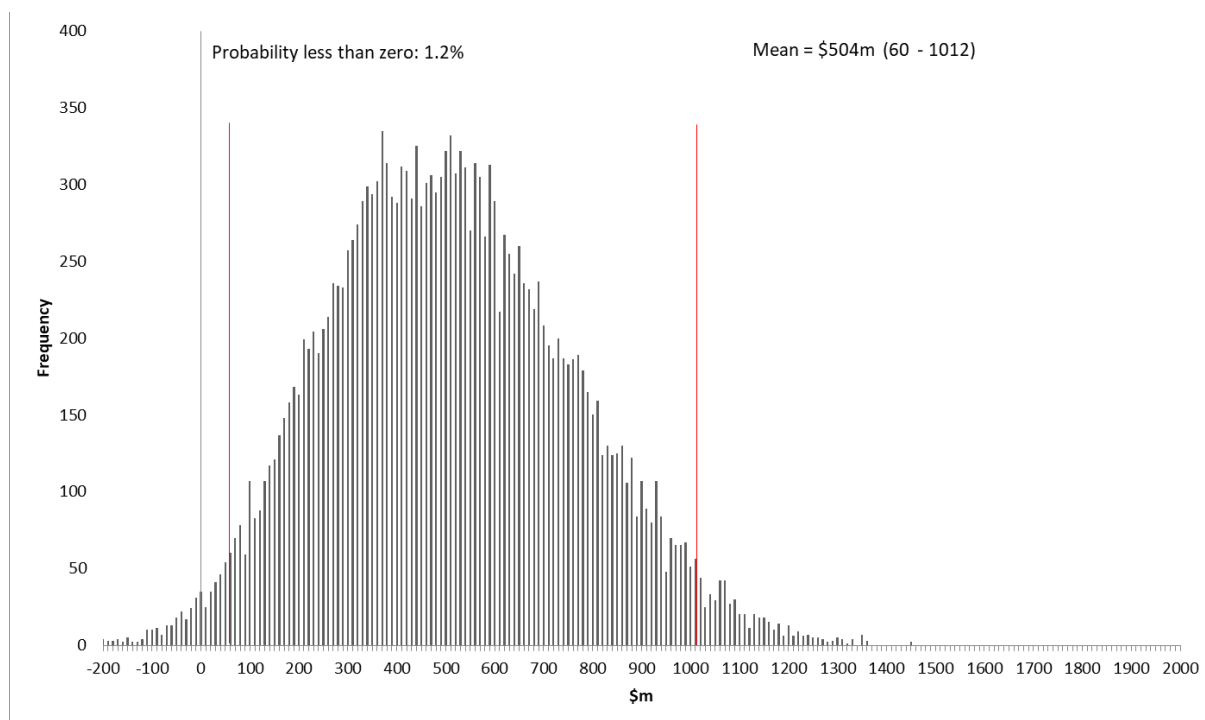
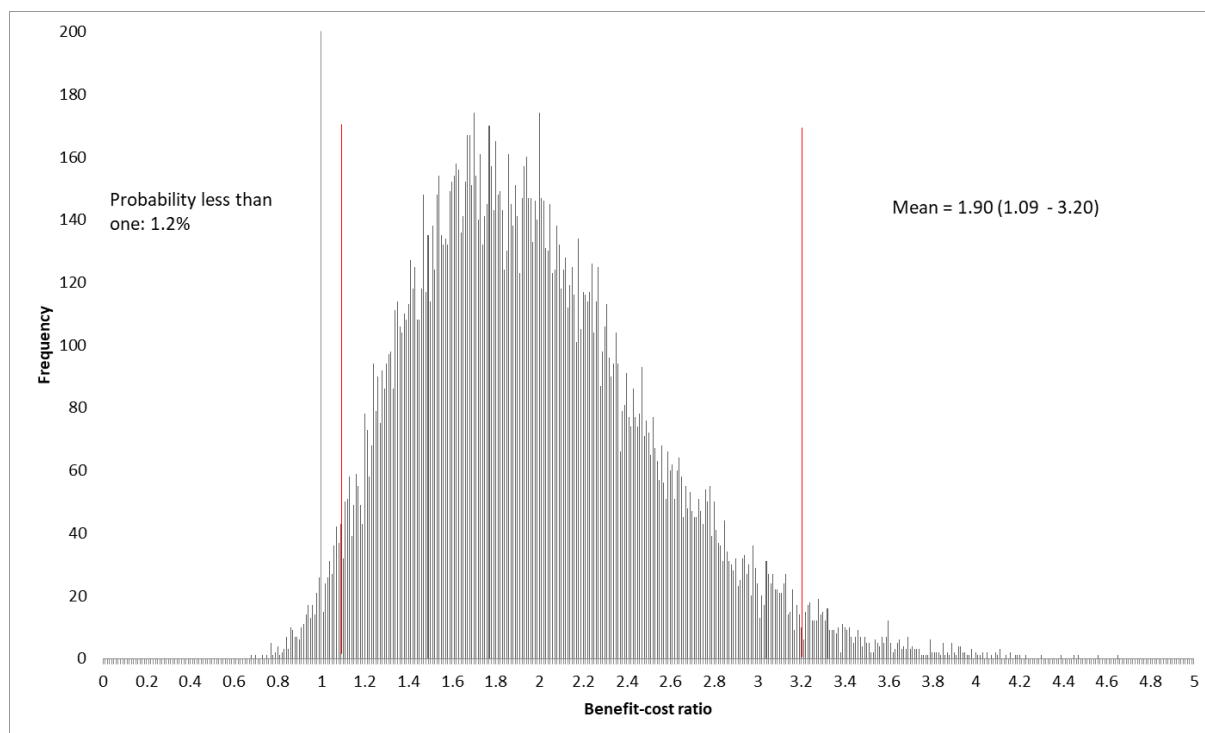


Figure 5: Distribution of Present Value of Benefit Cost Ratio



4. ANALYSIS OF EXPECTED COSTS FOR INDIVIDUAL PROPOSALS

Below we present exposition of the estimation of costs from each cost source: the 10 proposed amendments included in the preliminary CBA plus estimates for the cost for engagement with Māori to better incorporate te ao Māori and mātauranga Māori in environmental reporting and estimates for drafting and enacting the proposed amendments. For each source a brief description is provided of activities involved, assumptions underpinning the cost estimates, the assumptions underpinning the Monte Carlo distribution analysis, and a presentation of cost estimates in present value terms.

4.1. Proposal 1: Clarify the purpose of environmental reporting

Details of proposed change

Clarify the purpose of the ERA to include the purpose of reporting on the state of the environment and what the reports are supposed to achieve.

Assumptions

Although a key component of the suite of ERA proposals, it is presumed that the activities involved fall within the business-as-usual activities of the Ministry. This means there should be no explicit additional cost implications from this proposal.

Costs

This proposed change has no impact on FTE requirements or costs.

Monte Carlo analysis

No Monte Carlo analysis undertaken for Proposal 1 as there is no associated cost.

4.2. Proposal 2: Mandate a government response to synthesis reports

Details of proposed change

The purpose is to encourage a timely and comprehensive response from the Government to the evidence presented in national synthesis reports.

Assumptions

It is assumed that this proposal will have resource implications every six years in the year following the release of synthesis reports.⁶ The Ministry is expected to require one full time equivalent resource to co-ordinate responses from other departments. Our cost estimates assume nine FTE inputs to assess implications and responses to each synthesis report, 0.5 FTE from the Ministry and 8.5 from other departments.

⁶ Given CBA covers a 30-year period, though the costs are expected to be incurred in the year following the release of the report, the costs have been included in years 6, 12, 18, 24 and 30 to capture the costs of five cycles of reporting.

Costs

The cost estimates of Proposal 2 are presented in Table 4. The 10 FTE government labour requirement is estimated to impose a \$2.3m cost on one year during the proposed six-year reporting cycle. The present value of five cycles over a 30-year period (based on 5% discount rate and applying a 20% deadweight cost of tax) is \$6.7m.

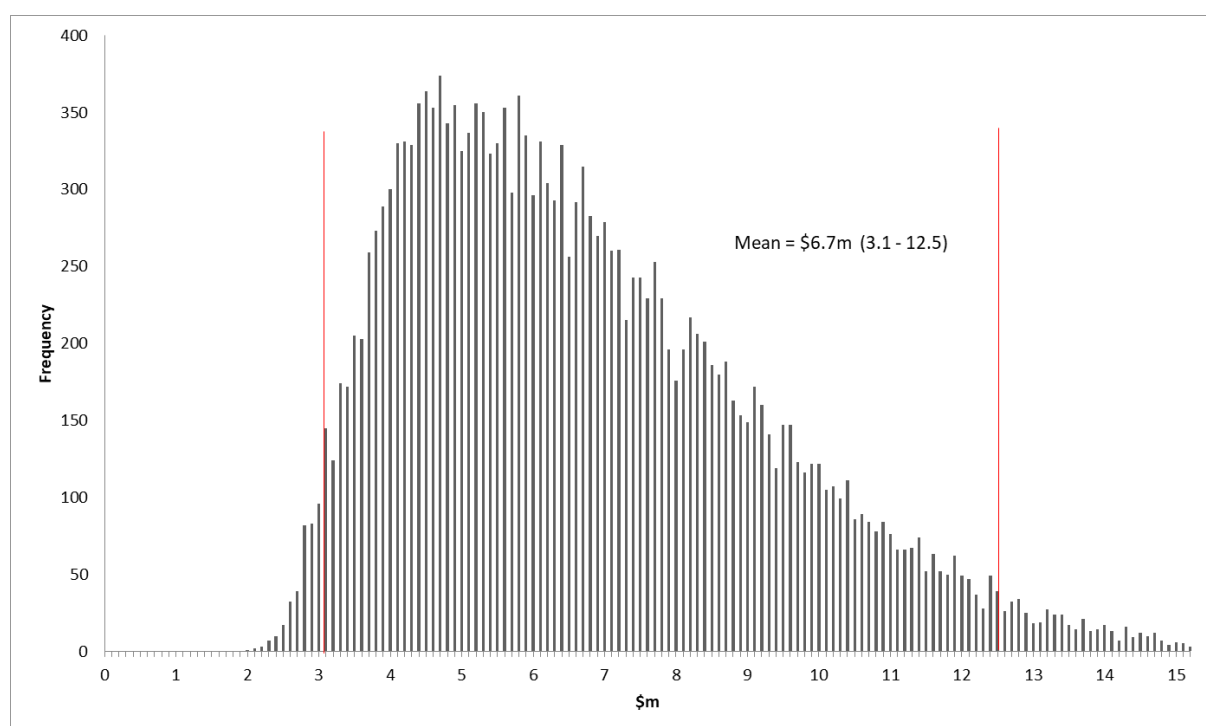
Table 4: Cost Assumptions and Present Value of Proposal 2

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE every 6th year)</i>				
Ministry for the Environment	0.2	1.5	3	1.25
Statistics New Zealand	0.0	0.0	0.0	1.00
Other Departments	5.0	8.5	20.0	3.30
Crown research institutes	0.0	0.0	0.0	1.00
Regional Councils	0.0	0.0	0.0	1.00
Other costs (NZ\$ m)	\$0.0	\$0.0	\$0.0	1.00
30-year Present Value (NZ\$ m)	\$3.1	\$6.7	\$12.5	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the critical cost estimate risks for Proposal 2 revolve around the actual level of labour input used in responding to the synthesis reports and co-ordinating these responses. Allowing for variations in assumptions as presented in Table 2 implies a 95% confidence interval around the present value of cost estimates for Proposal 2 that range from \$3.1m to \$12.5m. The distribution of potential costs associated with Proposal 2 are illustrated in Figure 6.

Figure 6: Distribution of Present Value of Proposal 2



4.3. Proposal 3: Add drivers and outlooks to the reporting framework

Details of proposed change

Extend the pressure-state-impact framework to include a requirement for information on:

- drivers – factors that cause the pressures on the environment
- outlooks – how the state of the environment may change in the future, and the likely impact of such changes.

Assumptions

Stats NZ has estimated that set up activities will involve one full FTE, with an additional 2 FTE required in each subsequent year. Feedback from the Ministry indicates that there is little set-up activity required but that this proposal will require ongoing expert advice. An initial input of 0.5 FTE is increased to 4 FTE of expert resources. An additional ongoing input from CRIs and regional councils has also been incorporated. An additional cost of \$1m per year has been provided to purchase services from other organisations.

Costs

The cost estimates of Proposal 3 are presented in Table 5. The 12 FTE labour requirement and budget for purchase of services is estimated to impose a \$3.5m cost per year, which represents a present value of \$69.5m over a 30-year period.

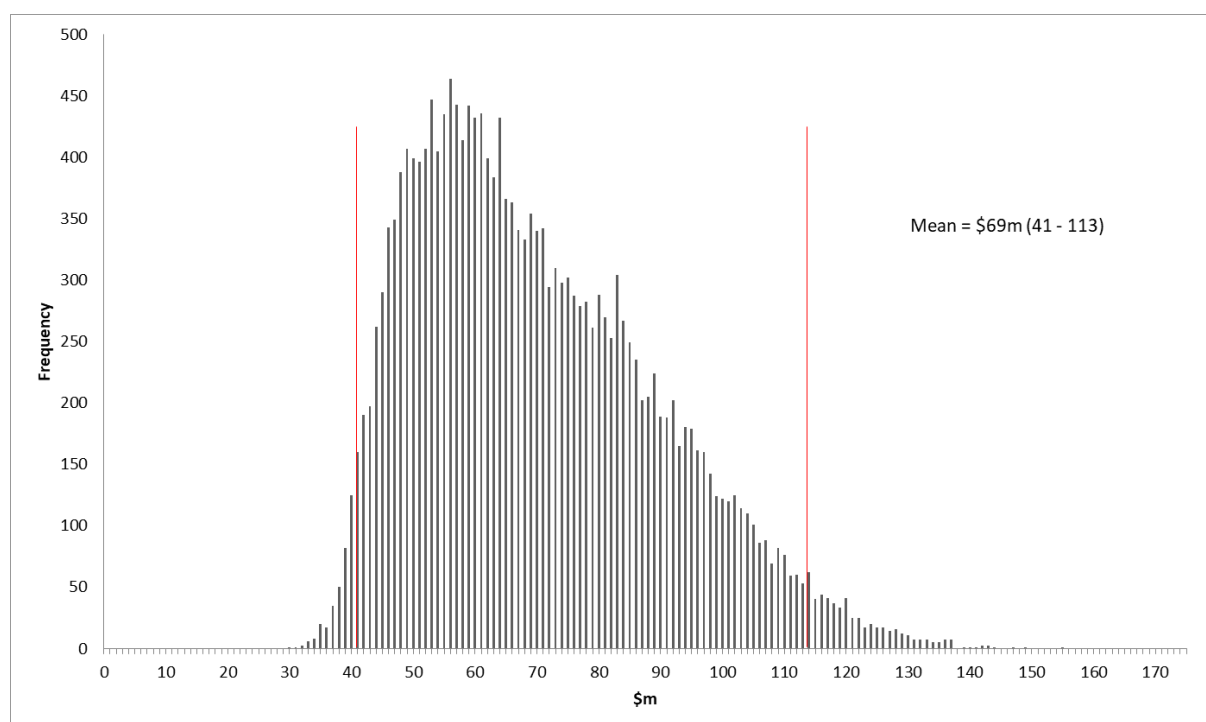
Table 5: Cost Assumptions and Present Value of Proposal 3

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE)</i>				
Ministry for the Environment				
Set-up	0.2	0.5	1.0	1.68
Ongoing	2.0	4.0	8.0	2.00
Statistics New Zealand				
Set-up	0.2	1.0	2.0	1.25
Ongoing	0.5	2.0	5.0	2.00
Other Departments				
Set-up	0.0	0.0	0.0	1.00
Ongoing	0.0	0.0	0.0	1.00
Crown research institutes				
Set-up	0.0	0.0	0.0	1.00
Ongoing	0.8	2.8	6.0	1.60
Regional Councils				
Set-up	0.0	0.0	0.0	1.00
Ongoing	1.6	3.2	6.4	2.00
Other costs (NZ\$ m)				
Set-up	\$0.1	\$1.0	\$3.0	2.50
Ongoing	\$0.1	\$1.0	\$3.0	2.50
30-year Present Value (NZ\$ m)	\$41	\$69.5	\$113.5	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the critical cost estimate risks for Proposal 3 revolve around the actual level of labour input used in the Ministry, Stats NZ, CRIs, and regional councils. In addition, we have allowed for annual purchases averaging \$1m per year. Allowing for variations in assumptions (as presented in Table 2) underpinning analysis of adding drivers and outlooks to the reporting framework implies a 95% confidence interval around the present value of cost estimates for Proposal 3 that range from \$41m to \$113.5m. This distribution is illustrated in Figure 7.

Figure 7: Distribution of Present Value of Proposal 3



4.4. Proposal 4: Adjust roles and responsibilities

Details of proposed change

Adjust the roles and responsibilities for the Secretary for the Environment and the Government Statistician, to reduce overlaps and ensure that each organisation uses their expertise, with:

- the Secretary for the Environment as the steward for New Zealand's environment
- the Government Statistician as the leader of the official statistics system.

Assumptions

It is assumed that the costs involved in delivering this proposal represent business as usual activities for both agencies and so no additional cost implications are expected.

Costs

This proposed change has no impact on FTE requirements or costs.

Monte Carlo Analysis

No Monte Carlo analysis undertaken for Proposal 4 as there is no associated cost.

4.5. Proposal 5: Mandate a standing advisory panel

Details of proposed change

Require the establishment of a standing advisory panel under the ERA.

Costs

The costs associated with formally instituting a standing advisory panel include the Ministry providing secretariat services for the advisory panel and the costs of holding panel meetings. The cost estimates presented are based on secretariat duties requiring 3.5 FTE input from the Ministry each year. We have assumed that there will be on average nine panel members who will meet on average nine times per year. We also assume that reimbursement costs for panel members will average \$3,415 for each member attending a meeting. This amount includes travel, accommodation, and meeting fees according to the Cabinet Fees Framework. It is presumed that each meeting will involve three days of work for each panel member. An allowance of \$1000 per meeting is also allowed for venue hire⁷ and catering purposes.

Once established the annual cost of the standing advisory panel is likely to be \$1.2m with a present value of \$23.1m over a 30-year period.

Table 6: Cost Assumptions and Present Value of Proposal 5

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE)</i>				
Ministry for the Environment				
Set-up	1.0	3.0	5.0	1.00
Ongoing	1.5	3.5	7.0	1.75
<i>Standing Advisory Panel</i>				
Number of panel members	5	9	15	1.50
Average cost per panel member (NZ\$)	\$1,500	\$3,415	\$5,000	0.83
Venue hire (NZ\$)	\$250	\$1,000	\$3,000	2.66
Number of panel meetings	3	9	12	0.50
30-year Present Value (NZ\$ m)				
	\$12.3	\$23.1	\$40.3	

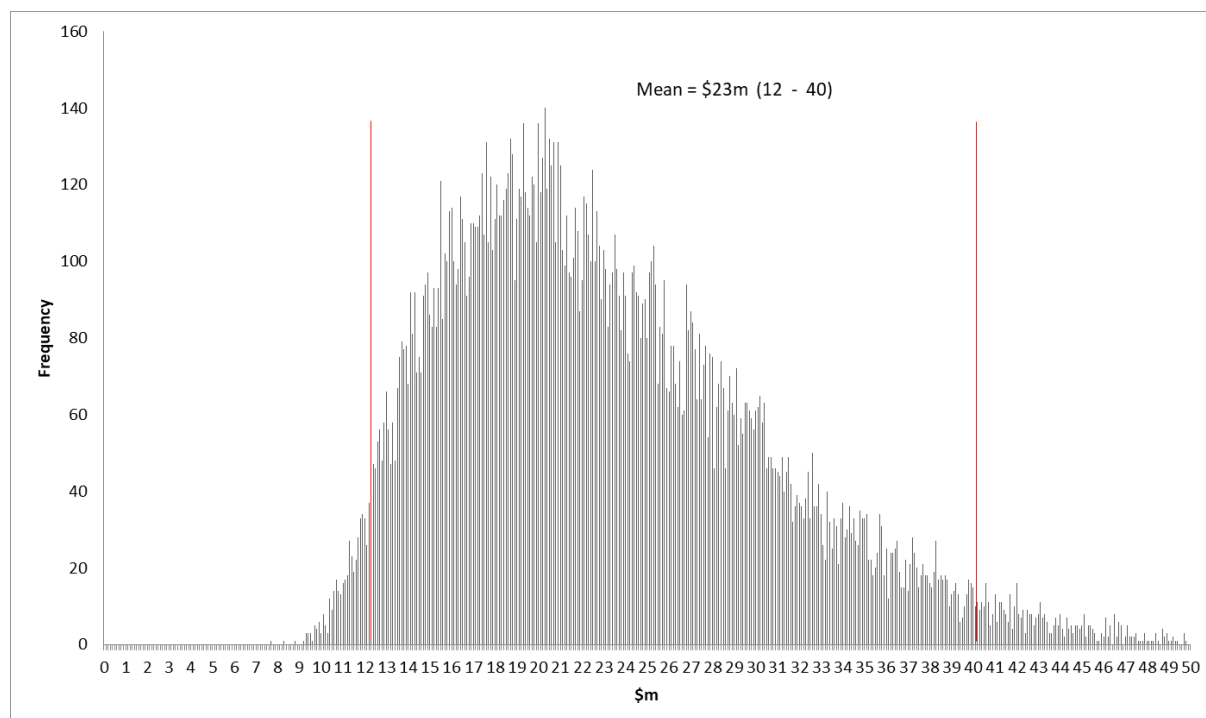
Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the critical cost estimate risks for Proposal 5 revolve around the actual level of labour input required to provide secretariat services for the panel. Factors to be considered include the size of the panel, the number of times they meet each year, and the costs associated with holding each meeting. Allowing for variations in assumptions as presented in Table 2 implies a 95%

⁷ While it is likely that premises will be available at the Ministry, including the premises' costs accounts for the opportunity cost of the premises.

confidence interval around the present value of cost estimates for Proposal 5 that ranges from \$12.3m to \$40.3m. This distribution is illustrated in Figure 8.

Figure 8: Distribution of Present Value of Proposal 5



4.6. Proposal 6: Replace environmental domains with cross-domain themes

Details of proposed change

Replace environmental domains with cross-domain themes that form the basis of synthesis reports and in-between commentaries.

Assumptions

It is assumed that there will be upfront design and planning costs associated with a transition from domains to themes, but once embedded there will be no ongoing cost implications from this proposal.

Costs

Upfront input by three FTE will be required to manage the transition to a cross-domain theme focus. This includes one FTE each from the Ministry and Stats NZ, plus the equivalent of one FTE from other government departments. This will have a resource cost equivalent to \$0.8m (see Table 7).

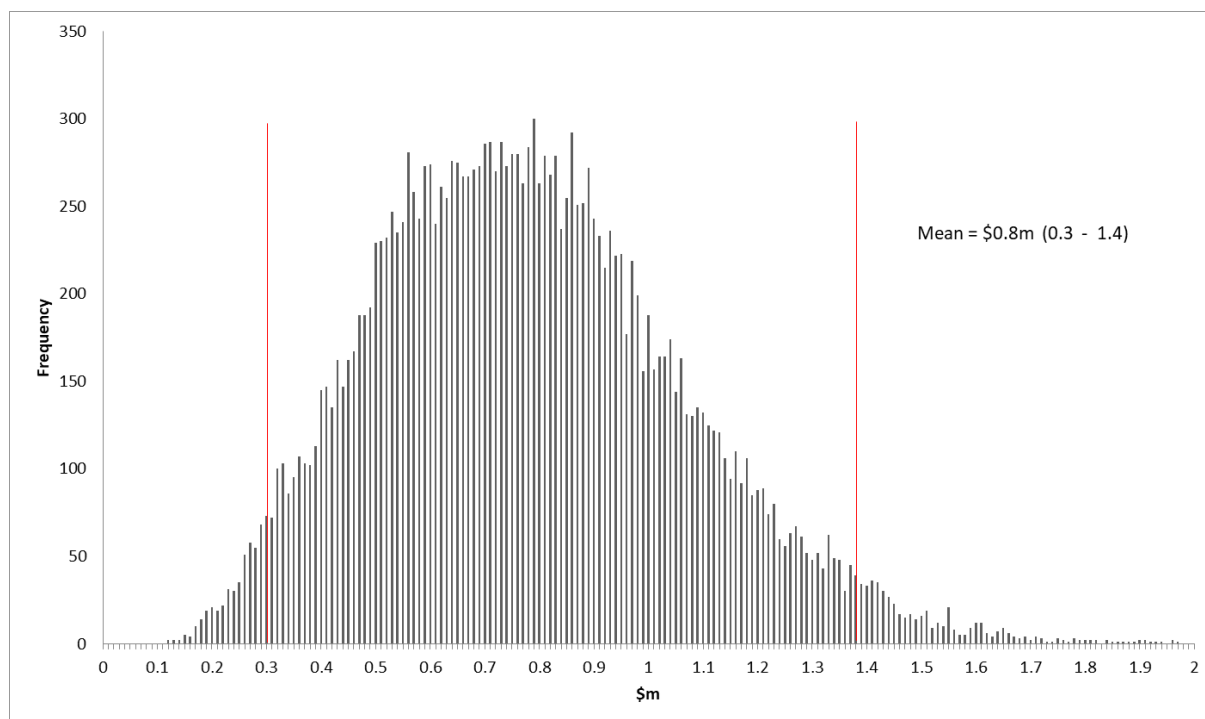
Table 7: Cost Assumptions and Present Value of Proposal 6

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE)</i>				
Ministry for the Environment				
Set-up	0.2	1.0	2.0	1.25
Ongoing	0.0	0.0	0.0	2.00
Statistics New Zealand				
Set-up	0.2	1.0	2.0	1.25
Ongoing	0.0	0.0	0.0	1.68
Other Departments				
Set-up	0.5	1.0	2.0	2.00
Ongoing	0.0	0.0	0.0	1.00
Crown research institutes				
Set-up	0.0	0.0	0.0	1.00
Ongoing	0.0	0.0	0.0	1.60
Regional Councils				
Set-up	0.0	0.0	0.0	1.00
Ongoing	0.0	0.0	0.0	2.00
Other costs (NZ\$ m)				
Set-up	\$0.0	\$0.0	\$0.0	2.50
Ongoing	\$0.0	\$0.0	\$0.0	2.50
30-year Present Value (NZ\$ m)	\$0.3	\$0.8	\$1.4	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the critical cost estimate risks for Proposal 6 revolve around the actual level of labour input required to manage the proposed transition. Allowing for variations in assumptions as presented in Table 2 implies a 95% confidence interval around the present value of cost estimates for Proposal 6 that range from \$0.3m to \$1.4m. This distribution is illustrated in Figure 9.

Figure 9: Distribution of Present Value of Proposal 6



4.7. Proposal 7: Reduce the frequency of synthesis reports to six-yearly

Details of proposed change

Move from a three-yearly to a six-yearly cycle for synthesis reports.

Assumptions

No cost implications are expected from this proposal, as a reduction in report frequency is not expected to reduce staffing requirements, but instead enable more in-depth analysis underpinning the reports.

Costs

No cost implications expected.

Monte Carlo Analysis

No Monte Carlo analysis undertaken for Proposal 7 as there is no associated cost.

4.8. Proposal 8: Replace domain reports with one commentary each year

Details of proposed change

Between six-yearly synthesis reports, replace the six-monthly domain reports with one commentary each calendar year.

Assumptions

As with Proposal 7, the reduction in report frequency is not expected to have resource or cost implications as reductions in report frequency are expected to be offset by improvements in depth of analysis.

Costs

No cost implications expected.

Monte Carlo analysis

No Monte Carlo analysis undertaken for Proposal 8 as there is no associated cost.

4.9. Proposal 9: Establish a set of core environmental indicators

Details of proposed change

Define a set of core environmental indicators in the regulations and develop those indicators to help achieve the purpose of the ERA.

Assumptions

It is assumed that the Ministry will require a substantial initial upfront investment of resources to help define an appropriate set of environmental indicators and design a programme of work to enhance the set of indicators over time. For this reason, it is assumed that the Ministry will need to maintain activity in this area. Input from Stats NZ, and others, will be required to help collect data and manage indicator series. Interest has been expressed by other government agencies to be involved with this proposal, particularly in relation to the initial selection and set up of indicators, so allowance for FTE involvement from other agencies has been included in the cost estimates.

Costs

Three stages have been factored into labour requirement estimates: an initial set up phase requiring 7 FTE from the Ministry and 3 FTE from Stats NZ; a high input period during the first six years as core indicators are identified and established, and the mature phase from year seven on. A modest allowance for efficiency gains has been factored into labour requirements from year seven on (see Table 8). The cost implications are a set up cost of \$2.1m, costs of \$4.9m per year for years one to six, and then \$3.7m per year from year seven on. This generates a central present value estimate of \$82m.

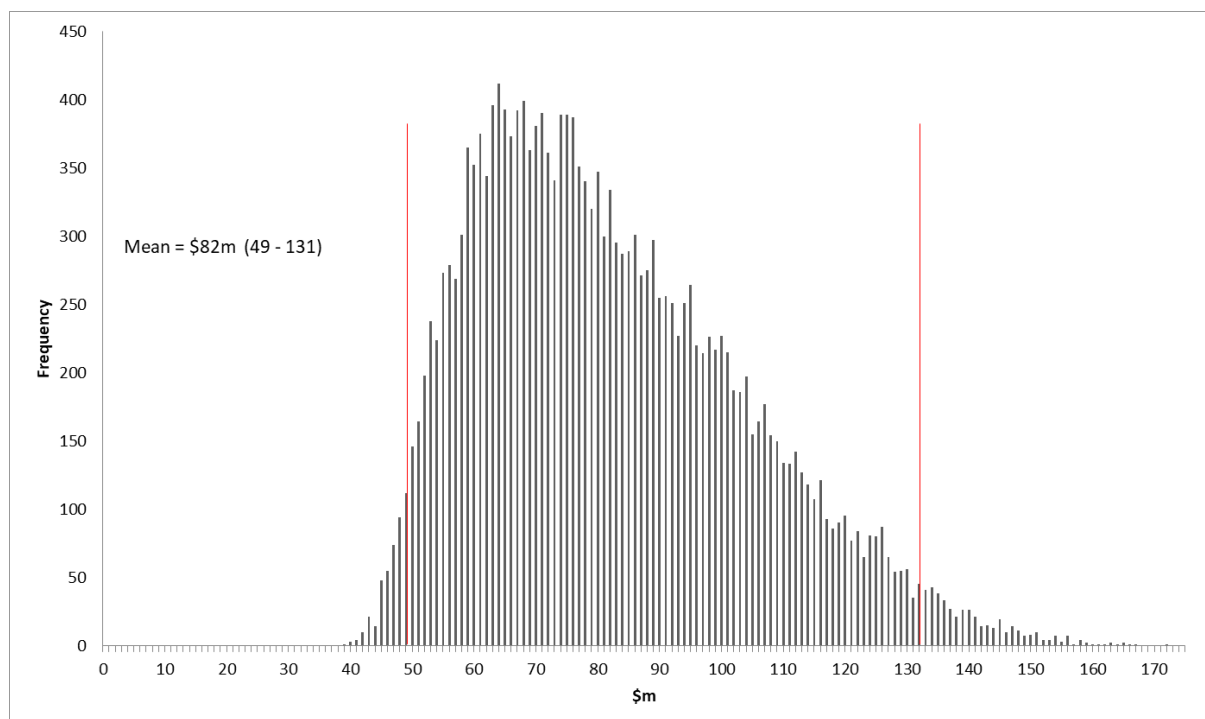
Table 8: Cost Assumptions and Present Value of Proposal 9

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE)</i>				
Ministry for the Environment				
Set-up	1.0	7.0	10.0	0.55
Year 1-6	1.0	5.0	10.0	1.25
Year 7 onwards	1.0	4.0	9.0	1.67
Statistics New Zealand				
Set-up	0.5	3.0	6.0	2.00
Years 1-6	2.0	5.0	12.0	2.33
Year 7 onwards	1.5	4.0	10.0	2.40
Other Departments				
Set-up	0.0	0.0	0.0	1.00
Years 1-6	1.0	2.0	5.0	3.00
Year 7 onwards	0.8	1.0	3.0	8.00
Crown research institutes				
Set-up	0.0	0.0	0.0	1.00
Years 1-6	3.0	7.5	12.0	1.00
Year 7 onwards	2.0	5.6	10.0	1.21
Regional Councils				
Set-up	0.0	0.0	0.0	1.00
Years 1-6	2.0	4.0	8.0	2.00
Year 7 onwards	1.5	3.0	6.0	2.00
Other costs (NZ\$ m)				
Set-up	\$0.0	\$0.0	\$0.0	1.00
Ongoing	\$0.0	\$0.0	\$0.0	1.00
30-year Present Value (NZ\$ m)				
	\$49.5	\$81.6	\$130.6	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the critical cost estimate risks for Proposal 9 revolve around the actual level of labour input required. Allowing for variations in assumptions as presented in Table 2 implies a 95% confidence interval around the present value of cost estimates for Proposal 9 that range from \$49.5m to \$130.6m. The distribution of these estimates is illustrated in Figure 10.

Figure 10: Distribution of Present Value of Proposal 9



4.10. Proposal 10: Strengthen the mechanisms for collecting data

Details of proposed change

Include new provisions in the ERA to set out powers for acquiring existing data for national environmental reporting, acquiring new data, and setting environmental monitoring and data standards.

Assumptions

It is assumed that most government department labour inputs associated with this proposal will be upfront, but that a level of ongoing input will also be required. Our cost estimates factor in a reasonable scale of input from CRIs and regional councils. In addition, an allowance has been made for increased environmental monitoring and data collection activity, particularly from regional councils, but also by Māori. It is assumed that these data collection costs will be funded by the Ministry. We have assumed that these data costs will be equivalent to each regional council increasing the number of sites they monitor by 10 per year for the first six years and then by one per year beyond year six. These sites have been costed at \$30,000 to establish a new site and \$10,000 per year to maintain each site. In addition, we have explicitly allowed for environmental data collection by Māori to reach, and be maintained at, \$3m per year by year six.

Costs

The implication is that ERA amendment associated data costs are expected to increase to \$15m per year in the first decade and modestly increase to around \$17m by year 30. Allowing for a 20% deadweight cost of tax and using a 5% discount rate produces a 30-year central present value estimate of \$287.7m.

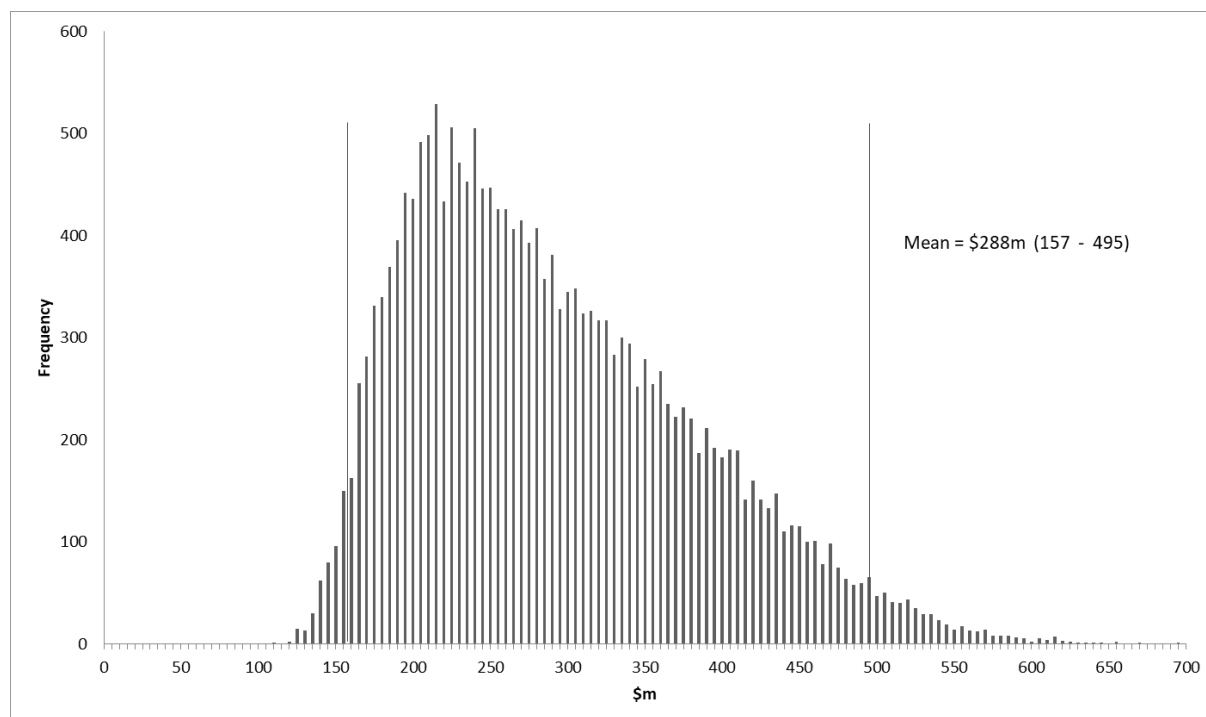
Table 9: Cost Assumptions and Present Value of Proposal 10

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE)</i>				
Ministry for the Environment				
Set-up	0.2	1.0	2.0	1.25
Ongoing	0.1	0.3	1.0	5.00
Statistics New Zealand				
Set-up	0.2	2.0	5.0	1.67
Ongoing	0.1	0.5	2.0	3.75
Other Departments				
Set-up	0.0	0.0	0.0	1.00
Ongoing	0.0	0.0	0.0	1.00
Crown research institutes				
Set-up	0.7	3.5	7.0	1.25
Ongoing	0.4	0.9	3.5	5.00
Regional Councils				
Set-up	1.6	4.0	10.0	2.50
Ongoing	1.6	4.0	10.0	2.50
Other costs (NZ\$ m)				
Year 6	\$5.4	\$16.3	\$48.9	3.00
Year 12	\$4.8	\$14.4	\$43.1	3.00
Year 30	\$5.8	\$17.3	\$51.8	3.00
30-year Present Value (NZ\$ m)				
	\$156.7	\$287.7	\$494.6	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the cost estimate for Proposal 10 will be influenced by assumptions on labour input requirements and on the budget for purchasing improvements. Allowing for variations in assumptions as presented in Table 2 implies a 95% confidence interval around the present value of cost estimates for Proposal 10 that range from \$156.7m to \$494.6m as shown in Figure 11.

Figure 11: Distribution of Present Value of Proposal 10



4.11. Cost of Māori Partnership

Details

Embedding a partnership approach with Māori that gives effect to The Treaty of Waitangi (Te Tiriti o Waitangi) is required to design better ways of incorporating te ao Māori and mātauranga Māori across the environmental reporting system.

Assumptions

Feedback indicates that effective engagement requires a long-term commitment to partnership. Although, there are strong benefits from co-ordination of engagement processes, such as moving from an output focus to a relationship focus, we are hesitant about assuming there is much scope for cost savings when environmental reporting is added to engaging with Māori (one of the Ministry's multiple Māori engagement interests). Our cost estimates therefore assume that the costs of engaging with Māori with respect to environmental reporting will be entirely in addition to other actual or prospective engagements.

The central cost estimates assume that the Ministry will require a dedicated team of 4 FTE to be responsible for engagement with Māori on environmental reporting issues. Engagement is assumed to take place in three levels. An engagement design phase which involves interaction with select kaumātua. The cost estimates assume eight meetings over a two-year period with 40 kaumātua, with a cost of \$1m per year. The second level is national hui. Each national hui has an estimated cost of \$750,000. The cost estimates assume one national hui in year one, two in year two, and four in each subsequent year. Smaller regional hui make up the third level. Each regional hui is assumed to cost \$75,000. The cost estimates assume 10 regional hui per year beginning from year three.

Costs

This translates to an investment of \$1.8m in year one, increasing to \$2.5m in year two, and stabilising at \$3.8m per year thereafter. With Ministry labour costs of \$1m per year and allowing for a 20% deadweight cost of tax and using a 5% discount rate generates a central estimate of the 30-year present value for Māori engagement activities of \$88m.

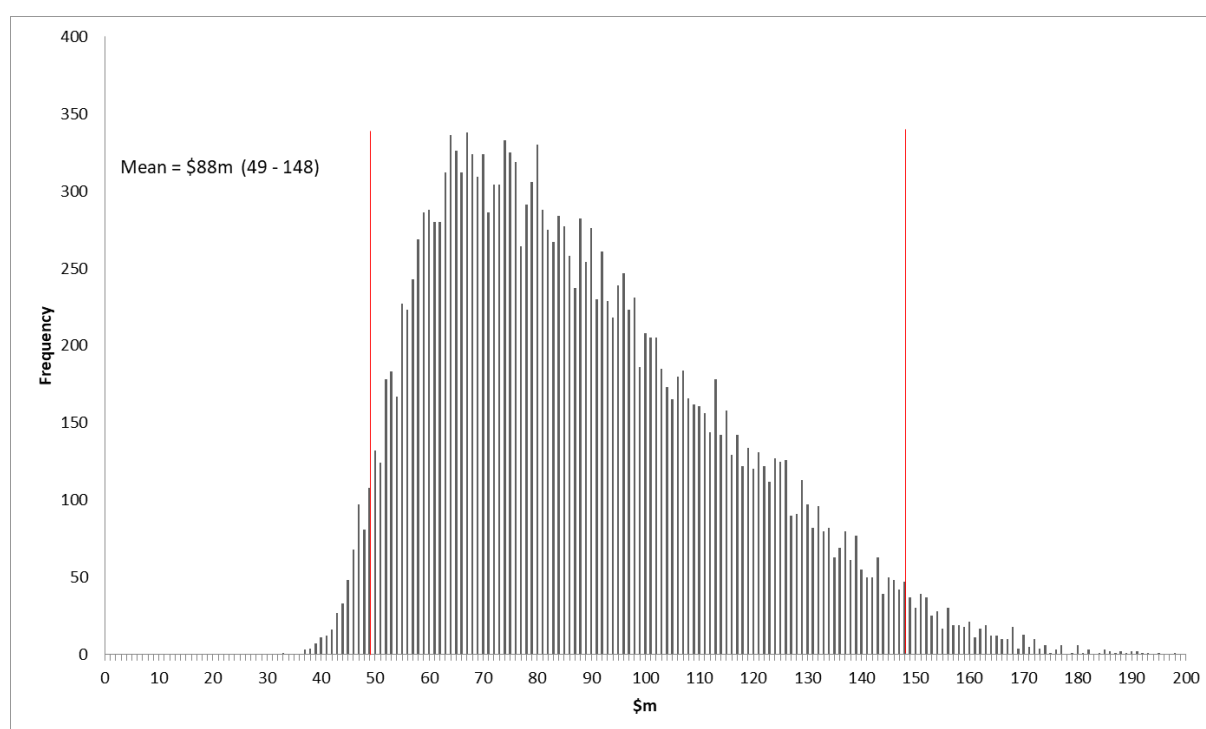
Table 10: Cost Assumptions and Present Value of Māori Partnership

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE)</i>				
Ministry for the Environment				
Set-up	0.0	0.0	0.0	1.00
Ongoing	2.0	4.0	8.0	2.00
<i>Other costs (NZ\$ m)</i>				
Year 1	\$0.6	\$1.8	\$5.3	3.00
Year 2	\$0.8	\$2.5	\$7.5	3.00
Year 3 onwards	\$1.3	\$3.8	\$11.3	3.00
30-year Present Value (NZ\$ m)	\$48.9	\$88.0	\$148.2	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the cost estimate for Māori engagement will be influenced by assumptions on the budget allocated for engagement. Allowing for variations in assumptions as presented in Table 2 implies a 95% confidence interval around the present value of cost estimates for Māori engagement that range from \$48.9m to \$148.2m. These outcomes are illustrated in Figure 12.

Figure 12: Distribution of Present Value of Māori Engagement



4.12. Legislative Costs

Details

The cost associated with legislation needs to be explicitly accounted for as from a national perspective there is an opportunity cost associated with the administrative activities associated with drafting legislation, consultations and parliamentary processes. Resources involved could potentially be used for other government activities. Our approach is to cost the legislation costs for the entire suite of proposed amendments and not allocate such costs to specific proposed amendments.

Assumptions

Departmental costs for legislation are based on the assumption of 5 FTE from the Ministry and 0.5 FTE from Stats NZ. This provides a central departmental cost of \$1.3m. International literature suggests a rule of thumb that associated parliamentary costs are 43% of departmental costs. Here we have taken a more conservative approach assuming that parliamentary costs will match departmental costs.

Costs

As all legislation costs are assumed to be set up costs, the present value of legislation is estimated to be departmental costs (\$1.3m) plus parliamentary costs (\$1.3m) multiplied by the 20% deadweight cost of tax allowance, implying a present value of \$3.2m.

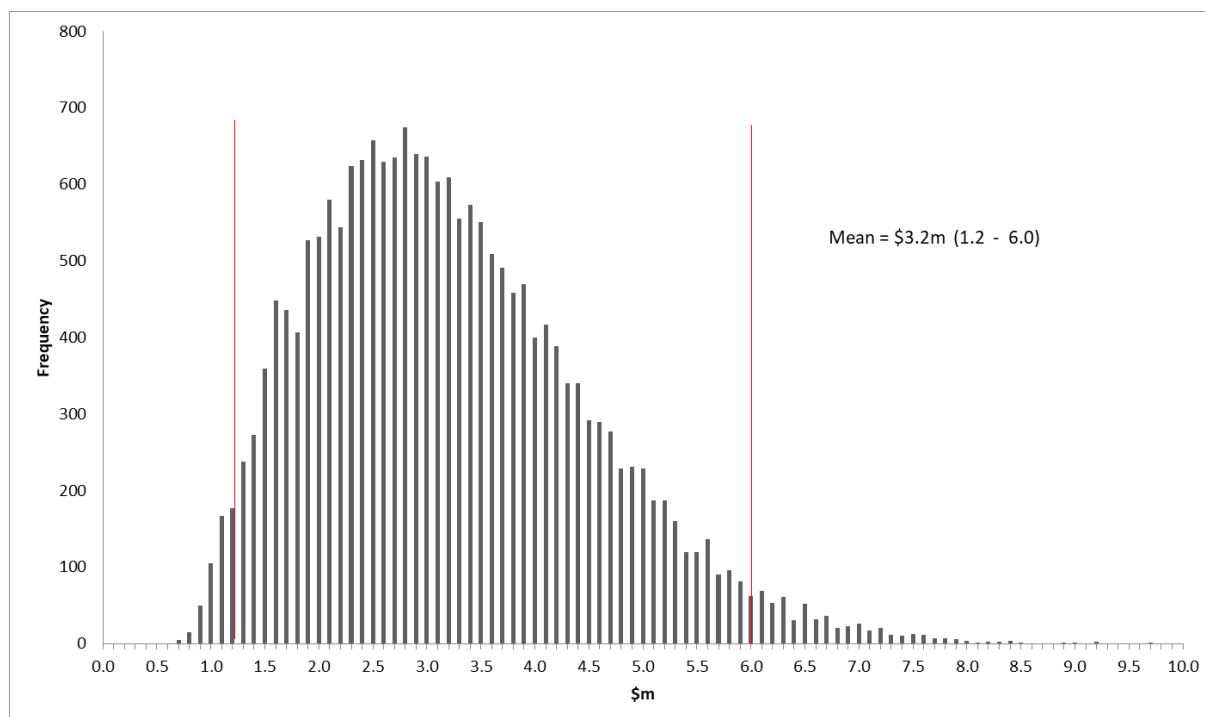
Table 11: Cost Assumptions and Present Value of Legislation Cost

Cost Elements	Low	Central	High	Beta (skewness)
<i>Labour requirements (FTE)</i>				
Ministry for the Environment	2.0	5.0	8.0	1.00
Statistics New Zealand	0.3	0.5	2.0	6.00
<i>Other costs (NZ\$ m)</i>				
Parliamentary Costs	\$0.5	\$1.3	\$4.0	3.26
30-year Present Value (NZ\$ m)				
	\$1.2	\$3.2	\$6.0	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, deadweight costs of taxation and labour costs, the cost estimate for legislation will be influenced by assumptions on departmental labour requirements and the efficiency of parliamentary processes. Allowing for variations in assumptions as presented in Table 2 implies a 95% confidence interval around the present value of cost estimates for legislation amendment that range from \$1.2m to \$6.0m. These outcomes are illustrated in Figure 13: Distribution of Present Value of Legislation Cost.

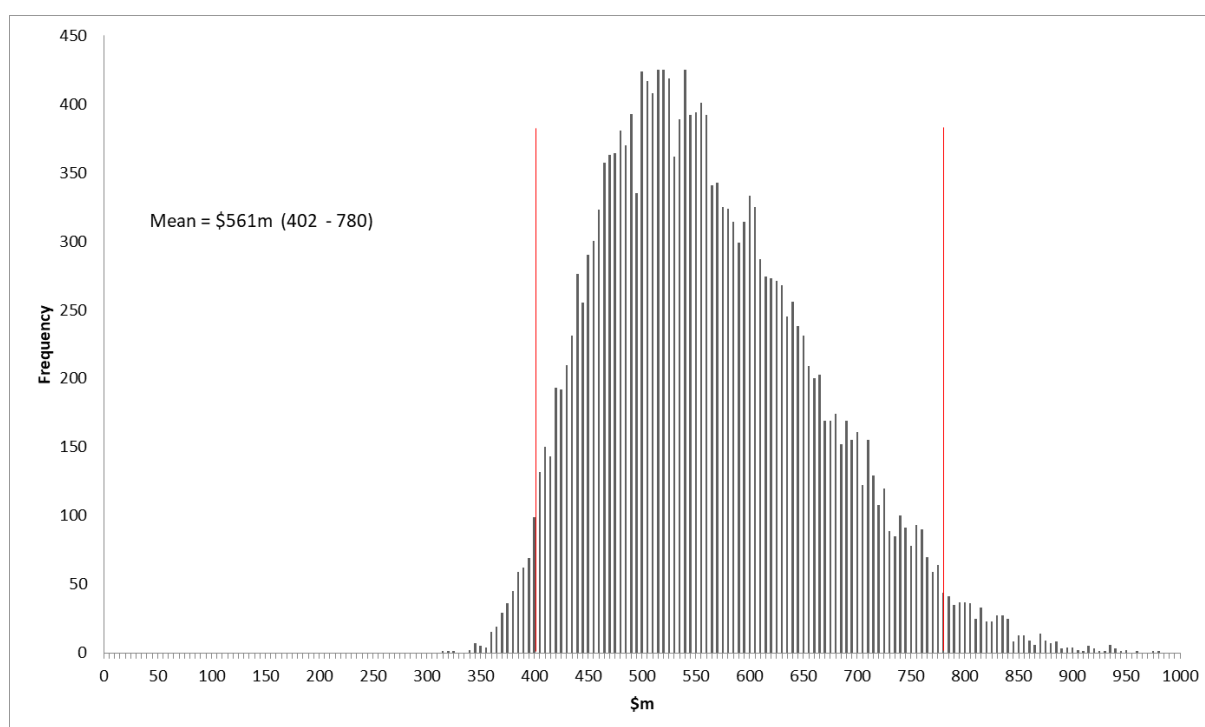
Figure 13: Distribution of Present Value of Legislation Cost



4.13. Total Costs

Combining all estimated costs produces a central estimate of \$560.5m for the present value of costs associated with proposed amendments to the ERA. Monte Carlo analysis produces a 95% confidence interval for these present value costs that range between \$402.1m and \$779.7m (see Figure 14).

Figure 14: Distribution of Present Value of Total Costs



5. ANALYSIS OF EXPECTED BENEFITS

As outlined in Section 1.3, the impacts of individual proposals have not been estimated. In particular, as there are significant synergies between different proposals the potential impact of the suite is likely to be greater than the sum of its individual parts. This section sets out the assumptions and estimates of benefits against each of the categories of monetised benefits identified. Note that benefit calculations do not involve a tax impact, so no adjustment is made for tax deadweight cost impacts.

5.1. Reduced Regulatory Burden

With an improved understanding of environmental status, policy makers will be better placed for setting environmental priorities with an expected reduction in the regulatory burden of the resource management system. In an independent analysis conducted by Castalia for the Ministry it was stated that improvements in resource management systems could generate national benefits with an annual benefit of \$210m. Although the ERA amendments are not intended to influence the efficiency of resource management systems, there is some potential that they could indirectly encourage further resource management system efficiency gains. A better understanding of the state of the environment and, importantly, of the sources of pressures has the potential for improving the strategic focus of resource management. Some of this improvement would be expected to result in better environmental outcomes, but there is also the potential for efficiency gains as a result of a resource management system that is better focused due to a better understanding of the state of the environment. Our calculations are based on the ERA amendments eventually generating resource management efficiency gains equivalent to 10% of those generated by the resource management reforms, i.e., \$21m per year from year six onwards.⁸

This generates a central estimate for the present value of \$248.9m for the benefit expected from efficiency gains to resource management regulatory processes. This is based on calculations using a 5% discount rate. Again, we note that benefit calculations do not involve a tax impact, so no adjustment is made for tax deadweight cost impacts.

Table 12: Benefit Assumptions and Present Value of Reduced Regulatory Burden

Benefit Elements	Low	Central	High	Beta (skewness)
Resource Management Efficiency Benefit (NZ\$ m)				
Before year 6	\$0.0	\$0.0	\$0.0	1.00
After year 6	\$10.5	\$21.0	\$105.0	8.00
30-year Present Value (NZ\$ m)	\$128.4	\$248.9	\$431.0	

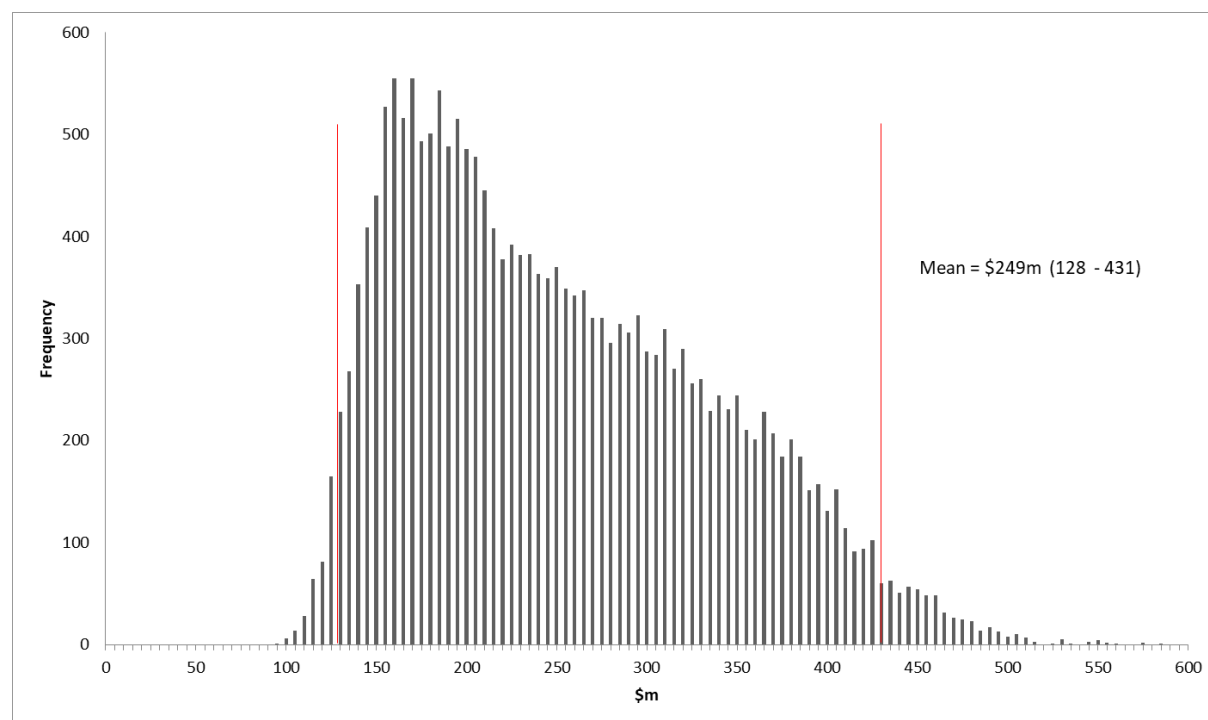
Monte Carlo analysis

In addition to the standard risks around the size of discount rate, the benefit estimate from efficiency gains from the resource management system will be influenced by assumptions on the extent that ERA will generate efficiency improvements. Our low assumption presumes an ERA impact of just 5% of the resource management CBA estimate. The high figure is equivalent to 50%. This upward skew in the distribution analysis reflects perspectives, although difficult to predict,

⁸ We estimate the 10% assumption of efficiency gains to be a conservative.

that changes in focus have the potential to generate very large gains in efficiency. That is, what you choose to do can have more profound impacts than changing how you do things. As the ERA amendments are all about improving our understanding of the state of the environment, but more importantly about what truly matters, there is a non-trivial chance that this improved understanding could produce profound efficiency gains. However, do note that the Monte Carlo analysis accounts for the fact that these high outcomes come with a low probability, so the 95% confidence interval is estimated to range from \$128.4m to \$431m (see Figure 15).

Figure 15: Distribution of Present Value of Reduced Regulatory Burden



5.2. Slower ecosystem degradation

Ecosystem services from inland wetlands, indigenous forest, indigenous grasslands and coastal systems are incorporated in the estimation of potential benefits from the ERA amendments. We attempt to estimate a benefit that would come from the ERA amendments encouraging policy and/or behaviour responses that slow down the pace of environmental degradation. The approach is to estimate the value of ecosystem services generated by natural capital in New Zealand. A lower level of natural capital will generate lower levels of ecosystem services, which will have wellbeing impacts for New Zealanders, either through reduced services (e.g., scenic values, leisure opportunities, water purification, carbon sequestration, etc.) or through increasing adaptation opportunity costs (e.g., coastal protection, sewage treatment, desalination, etc.).

Valuations of per hectare ecosystem services are sourced from de Groot et al 2012⁹, translated into 2021 New Zealand prices, see Table 13.

⁹ Rudolf de Groot et al., 'Global Estimates of the Value of Ecosystems and Their Services in Monetary Units', *Ecosystem Services* 1, no. 1 (1 July 2012): 50–61, <https://doi.org/10.1016/j.ecoser.2012.07.005>.

Table 13: Estimates of the value of services provided by different ecosystems, NZ\$/Ha (2021 prices)

Environment	Mean	Median	High	Low
Inland wetlands	\$73,648	\$47,416	\$300,900	\$8655
Indigenous forest	\$8,646	\$3,233	\$47,065	\$798
Indigenous grassland	\$8,236	\$7,740	\$17,012	\$356
Coastal system	\$82,925	\$76,737	\$120,619	\$75,036

To obtain national values, the amount of land with indigenous forest cover and wetlands was sourced from the Ministry's LUCAS land use map tables.¹⁰ The indigenous grassland area was assumed to be 13% of New Zealand's land area¹¹ and coastal systems were calculated based on 15,000 km² (assuming a width of 1km around the New Zealand coastline). The resulting range of ecosystem services from these environments is presented in Table 14 below.

Table 14: Estimates of the annual value of services provided by ecosystems in NZ, NZ\$ m (2021 prices)

Environment	Mean	Median	High	Low
Inland wetlands	\$53,600	\$34,500	\$218,900	\$6,300
Indigenous forest	\$67,000	\$25,000	\$364,500	\$6,200
Indigenous grassland	\$28,700	\$27,000	\$59,300	\$1,200
Coastal system	\$124,000	\$115,100	\$180,900	\$112,600

The benefit generated by the ERA amendments assumed in the CBA estimates is effectively to assume a one-off, but sustained prevention of a 0.02% degradation in each environment. There is no firm basis for this choice of degradation reduction, except that according to LUCAS it represents the average annual decline in indigenous forest area in New Zealand since 2001. That is, the CBA assumes that over a 30-year period the ERA amendments will reduce environmental degradation by an amount equivalent to the recent pace of one year's decline in indigenous forest area.¹² No impact is accounted for in the first five years, with a gradual increase in "saved" ecosystem services over the next 12 years. This is a remarkably small attribution of benefit expected to result from the ERA amendments. Our central estimates incorporate an annual benefit of \$4.6m in year six increasing gradually to \$54.7m per year from year 17 onwards. Over the 30-year analysis period this represents a present value of \$446.8m.

Table 15: Benefit Assumptions and Present Value of Reduced Degradation

Benefit Elements	Low	Central	High	Beta (skewness)
Reduced Annual Degradation Benefit, from Year 17 (NZ\$ m)				
Inland wetlands	\$0.6	\$10.7	\$43.8	3.85
Indigenous forest	\$0.6	\$13.4	\$72.9	5.55
Indigenous grassland	\$0.1	\$5.7	\$11.9	1.33
Coastal system	\$11.3	\$24.9	\$36.2	0.84
30-year Present Value (NZ\$ m)	\$219.4	\$446.8	\$811.4	

¹⁰ <https://www.mfe.govt.nz/more/data/available-datasets/land-use-map>

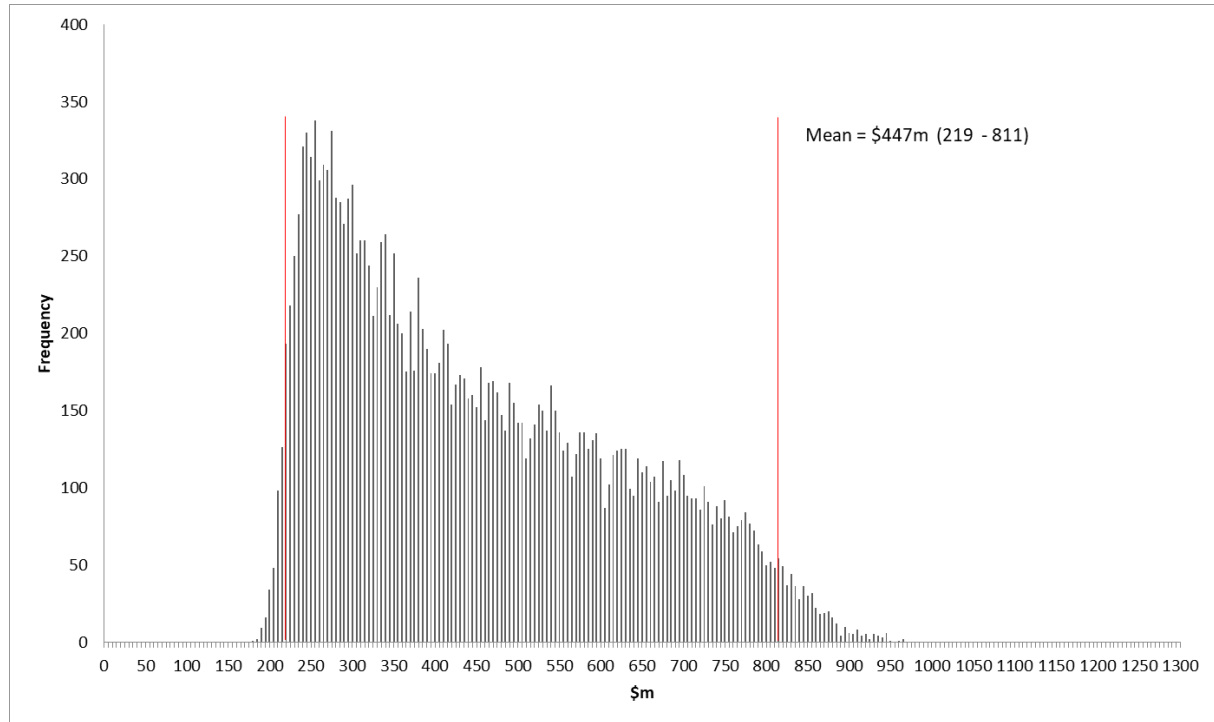
¹¹ <https://www.environmentguide.org.nz/issues/biodiversity/new-zealands-biodiversity/grasslands/>

¹² As no data is available for degradation of other ecosystems, the degradation rate of indigenous forests is estimated to be a conservative assumption.

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, the benefit estimate of reduced natural environmental degradation will be influenced by the accuracy of ecosystem valuation estimates and the extent that the ERA amendments will be able to slow the pace of degradation. These factors are implicitly accounted for in the Monte Carlo analysis by adjusting the value of ecosystem services between the high and low estimates presented in Table 13 and Table 14. The resulting change in inputs into the benefit estimates are presented in Table 15. Applying this range of assumptions into the Monte Carlo analysis generates present value estimates of the benefits from reduced environmental degradation that range from \$219.4m to \$811.4m (see Figure 16).

Figure 16: Distribution of Present Value of Reduced Degradation



5.3. Less Harm from Pollution

The valuation of the potential impact of pollution on wellbeing was estimated using information from the 2018 Quality of Life Survey¹³ by regressing individual response data to the 2018 survey of the form:

$$Y_{ij} = \alpha + \sum_j \beta_j X_{ij} + \gamma F_{ij} + \mu_{ij}$$

Whereby household income is estimated to be a function of a number of control variables (X), and whether respondents stated that they were impacted by the factor of interest (F). The resulting estimate of the parameter γ provides an estimate of the marginal trade-off of the factor with household income and so provides a method for monetising the impact of the social or environmental wellbeing phenomenon of interest. Typically, the analysis from the survey

¹³ Nielsen. (2018) Quality of Life Survey 2018. (A report to participating City and Regional Councils). Wellington, New Zealand.

indicates a negative correlation between household income and exposure to wellbeing damaging problems such as noise or air pollution.

The premise behind this approach is that the financial equivalence of a factor can be deduced by the ability for people to use their financial resources towards avoiding exposure to the factor. For example, people living beside an airport will be exposed to noise irritations. There will naturally be a house price or rental discount associated with being exposed to such irritations or conversely there is likely to be a premium on dwellings that are insulated from such noise (either due to location or building design and materials). Thus, those who have sufficient wealth can reduce their exposure to a wellbeing harming irritant. Of course, this comes at a financial cost to them (e.g., they have to spend more on rent), but they have a lower exposure to the irritant. The price that these people are willing to spend to avoid this irritant therefore provides a financial-equivalent estimate of the cost to people who remain exposed to the irritant.¹⁴

This approach provides estimates of the monetised value of exposure to noise or poor-quality air or water, with such exposure self-defined by survey respondents. To provide some context 19% of survey respondents in 2018 reported that water quality was a “big problem” locally. Similar figures for air quality and noise problems were 4% and 7% respectively. Table 16: Estimates of annual costs of pollution, 2018 provides the central results of this pollution valuation analysis.

Table 16: Estimates of annual costs of pollution, 2018

	Water	Air	Noise
Annual cost to individual affected households (\$)	\$2,230	\$11,950	\$7,460
Household count with potential issues	319,400	67,300	123,300
Implied national value (\$m)	\$713.5	\$804.8	\$918.1

To value the potential impacts that the ERA amendments might have on the costs to society from exposure to pollution we assume that:

- The benchmark exposure to pollution will remain proportional to the 2018 Quality of Life Survey (i.e., the number of houses exposed will increase with population growth, as projected by Stats NZ).
- The ERA amendments are assumed to reduce the pace of increase in exposure by 10% from 2029 onwards.¹⁵ Thus, if annual population growth is 0.6% in a particular year, the ERA amendments are assumed to reduce the increase in households exposed to a problem from 0.6% to 0.56%.

The result of this approach generates values that vary from year to year, but generally increase due to the impact of population growth (a given level of pollution is likely to adversely affect more people when the population is larger). Our estimates assume no impact before year six, when impacts are valued at less than \$1m for each type of pollution but increase to annual impacts of \$15m to \$20m by year 30. Despite the quite minor potential impact attributed to impacts from ERA amendments¹⁶, the estimated positive impact on wellbeing has a present value of \$266.6m.

¹⁴ For further information about this analysis see the Appendix of (Grimmond 2020).

¹⁵ The Quality of Life Survey provides circumstantial evidence that environmental policies can have meaningful impacts on wellbeing with a 29% reduction in the number of households complaining about air quality between 2014 and 2018 potentially reflecting changes in emission regulations. A 10% assumption is therefore a conservative estimate.

¹⁶ The 20% reduction in complaints reported in the Quality of Life Survey are far in excess of potential benefits assumed here, where we are factoring in slower growth rates in exposure to pollution, not the reductions that actually occurred between 2014 and 2018.

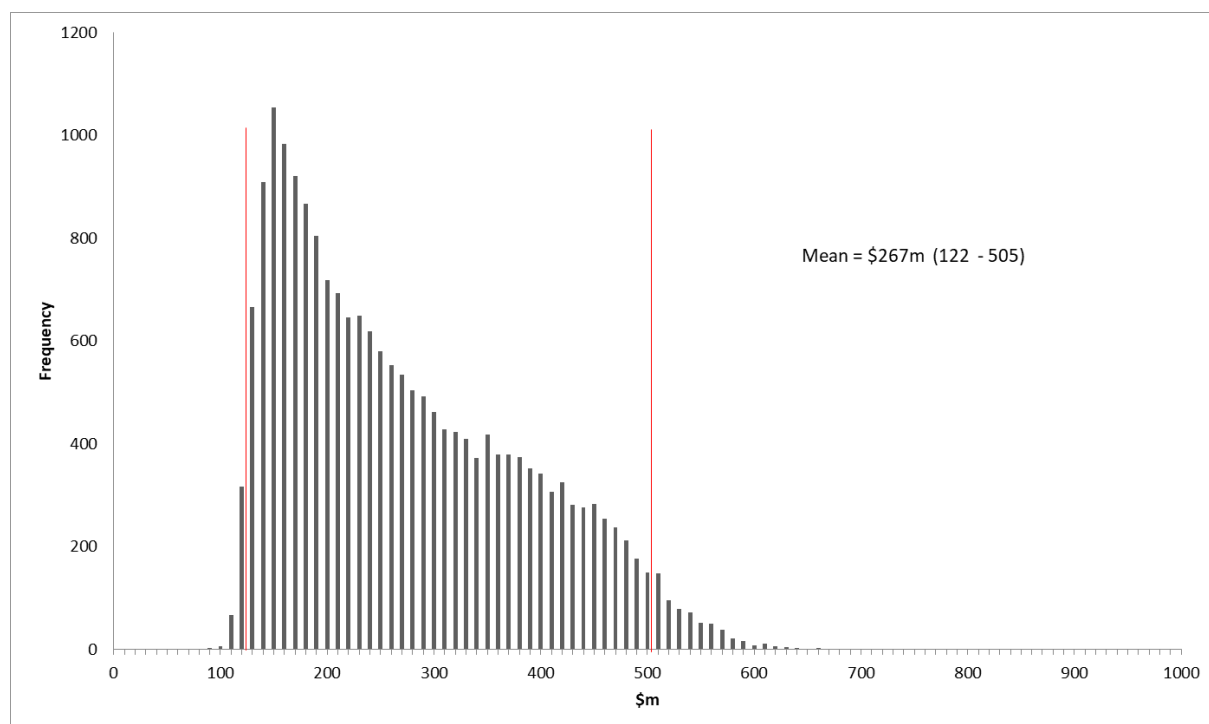
Table 17: Benefit Assumptions and Present Value of Less Harm from Pollution

Benefit Elements	Low	Central	High	Beta (skewness)
Less Harm from Pollution Benefit (NZ\$ m)				
Air Quality				
Year 6	\$0.2	\$0.7	\$3.0	4.45
Year 30	\$5.1	\$15.5	\$61.6	4.45
Water Quality				
Year 6	\$0.0	\$0.7	\$4.0	5.75
Year 30	\$0.9	\$14.7	\$81.8	5.75
Noise				
Year 6	\$0.3	\$0.9	\$3.6	4.52
Year 30	\$5.3	\$17.9	\$74.6	4.52
30-year Present Value (NZ\$ m)				
	\$121.8	\$266.6	\$505.3	

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, the benefit estimate from reduced exposure to pollution will be influenced by the accuracy of the estimates of valuations of the impact of pollution on wellbeing and the extent that the ERA amendments will be able to slow the increase in exposure to pollution. These factors are implicitly accounted for in the Monte Carlo analysis by adjusting the value of pollution and the impact attributed to the ERA amendments. The net impacts of these adjustments are summarised as the high and low estimates presented in Table 17. Applying this range of assumptions into the Monte Carlo analysis generates present value estimates of the benefits from reduced environmental degradation that range from \$121.8m to \$505.3m (see Figure 17).

Figure 17: Distribution of Present Value of Less Harm from Pollution



5.4. Improved Māori Partnership

Improved partnership with Māori is hoped to encourage increased Māori participation in and influence over the direction of environmental reporting, and result in greater recognition and provision for te ao Māori and mātauranga Māori. In one respect better environmental outcomes will benefit Māori in a similar way that such improvements have wellbeing benefits for the rest of society. Such improvements are already accounted for in the assessment of benefits the ERA amendments will potentially have in terms of greater access to ecosystem services and less exposure to harm from pollution. However, more effective Māori engagement on environmental reporting will benefit society in many ways, such as increasing the chances that environmental policies reflect Māori values, increasing Māori sense of self-worth (an enhanced sense of being listened to and involved in policy development processes), and conversely reduced likelihood of Māori feeling that they have to resort to disruptive actions in order to draw attention to issues. Such benefits go beyond a pure environmental wellbeing domain and into the social wellbeing domain. The novel nature of increased Māori participation in environmental reporting means that there is considerable uncertainty in assessing the scale of potential benefits. Although any attempt to quantify the potential wellbeing impact is likely to be speculative, we also note that the alternative approach of ignoring potential benefits, i.e., assuming a zero value for any potential social wellbeing benefits, is itself a potentially more extreme assumption.

The approach we have adopted here is to assume that the social wellbeing benefit resulting from increased engagement and Māori involvement with environmental reporting will be equivalent to the Māori wellbeing proportion of the expected reduction in environmental degradation. This is estimated here as 17% of the ecosystem service benefits estimated in section 5.2, where 17% reflects the Māori proportion of the New Zealand population. As with the estimated environmental impact, the social benefit is expected to emerge only gradually, but to emerge five years prior to the assumed emergence of environmental improvements. The central assumption is for the annual social wellbeing benefit to increase from \$0.8m in year two to an annual level of \$9.3m from year 13 on.

The 30-year present value of the benefit from enhanced Māori engagement in environmental reporting is \$101.1m. Although this represents 9.5% of the total benefits estimated to accrue from the ERA amendments, we note that benefits from Māori engagement are not critical to the overall CBA results. Omitting this quantification of Māori engagement benefits would reduce the net benefit estimate from \$504m to \$403m and the benefit-cost ratio from 1.90 to 1.72.

Table 18: Benefit Assumptions and Present Value of Māori Partnership

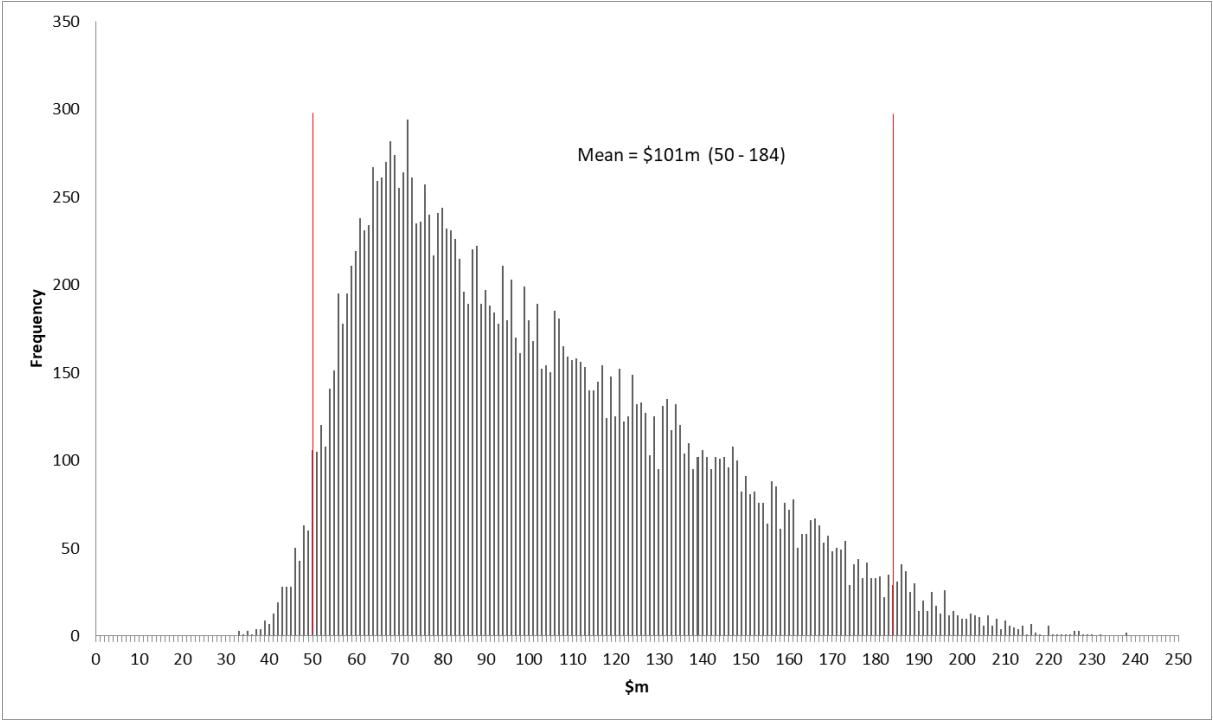
Benefit Elements	Low	Central	High	Beta (skewness)
Māori Partnership Benefit (NZ\$ m)				
Year 1	\$0.0	\$0.0	\$0.0	1.00
Year 2	\$0.2	\$0.8	\$2.3	2.61
Year 3-12	<i>Gradual increase</i>			
Year 13 onwards	\$2.1	\$9.3	\$28.0	2.61
30-year Present Value (NZ\$ m)	\$50.3	\$101.1	\$183.7	

Monte Carlo analysis

As noted, there is considerable uncertainty associated with the scale of potential national benefits expected to accrue from enhanced Māori engagement associated with environmental reporting.

The Monte Carlo analysis has factored impacts up and down by a factor of three to allow for this uncertainty. By year 13 this leads to potential annual benefits ranging from \$2m to \$28m (see Table 18). Applying this range of assumptions into the Monte Carlo analysis generates present value estimates of the benefits from Māori engagement that range from \$50.3m to \$183.7m (see Figure 18).

Figure 18: Distribution of Present Value of Māori Partnership



5.5. Reduction in Staff Turnover

Lower staff burn out related to environmental reporting is assumed, from year two onwards, to delay staff resignations to the point that staff turnover is one lower each year.¹⁷ A rule of thumb of \$60,000 per resignation is used (due to costs associated with hiring, training, lost institutional knowledge, and lower initial productivity). The present value of this impact is estimated to be \$0.9m, which is low relative to other costs and benefits, but not trivial from a section budget perspective.

Table 19: Benefit Assumptions and Present Value of Reduction in Staff Turnover

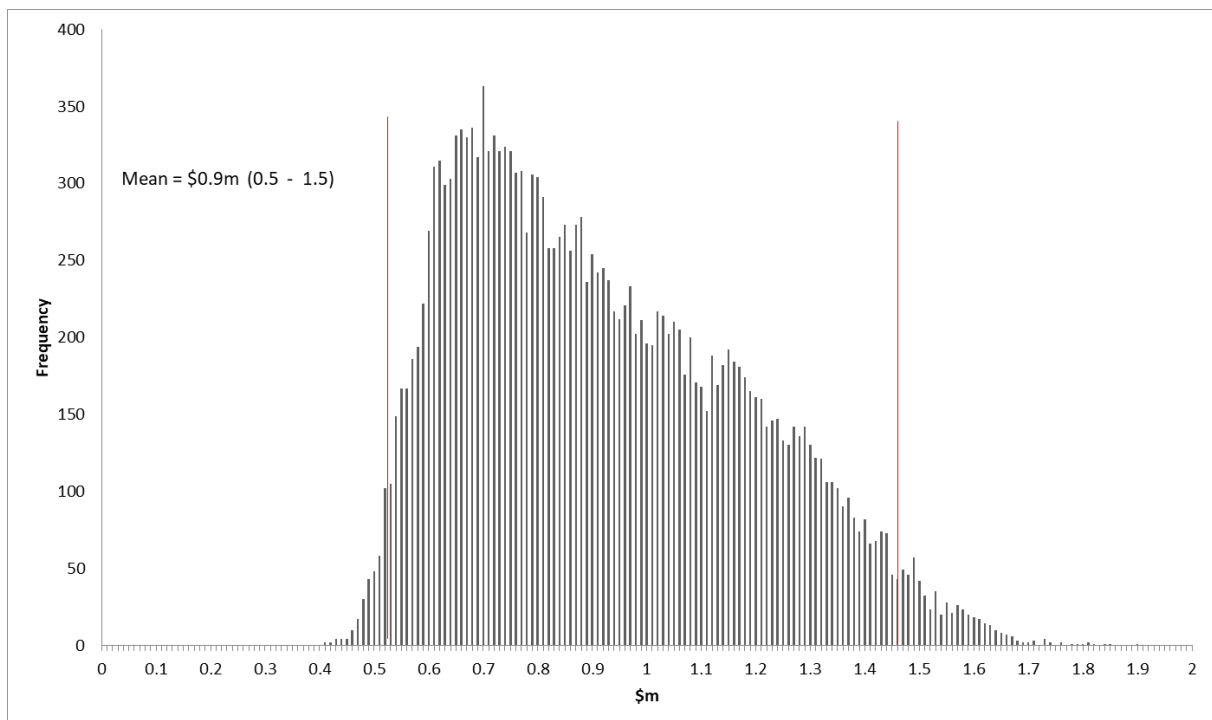
Benefit Elements	Low	Central	High	Beta (skewness)
Staff Retention Benefit (NZ\$ m)				
Before year 2	\$0.0	\$0.0	\$0.0	1.00
After year 2	\$0.03	\$0.06	\$0.18	4.00
30-year Present Value (NZ\$ m)	\$0.5	\$0.9	\$1.5	

¹⁷ This is based on increasing retention at the Ministry by 1 FTE per annum and makes takes no account of potential gains at other impacted institutions. This is therefore a conservative estimate.

Monte Carlo analysis

In addition to the standard risks around the size of discount rate, the benefit estimate from increased staff retention will be influenced by assumptions on the extent that a lower reporting frequency will reduce staff burn-out and promote staff retention. Our low assumption is for a reduction equivalent to one person staying at the Ministry for an extra six months (rather than an entire year as assumed in the central estimates). The high assumption is for triple the impact of the central estimate. This reflects that there is more upside than downside potential. However, as with resource management efficiency, the Monte Carlo analysis accounts for the fact that these high outcomes come with a low probability, so the 95% confidence interval is estimated to range from \$0.5m to \$1.5m (see Figure 19).

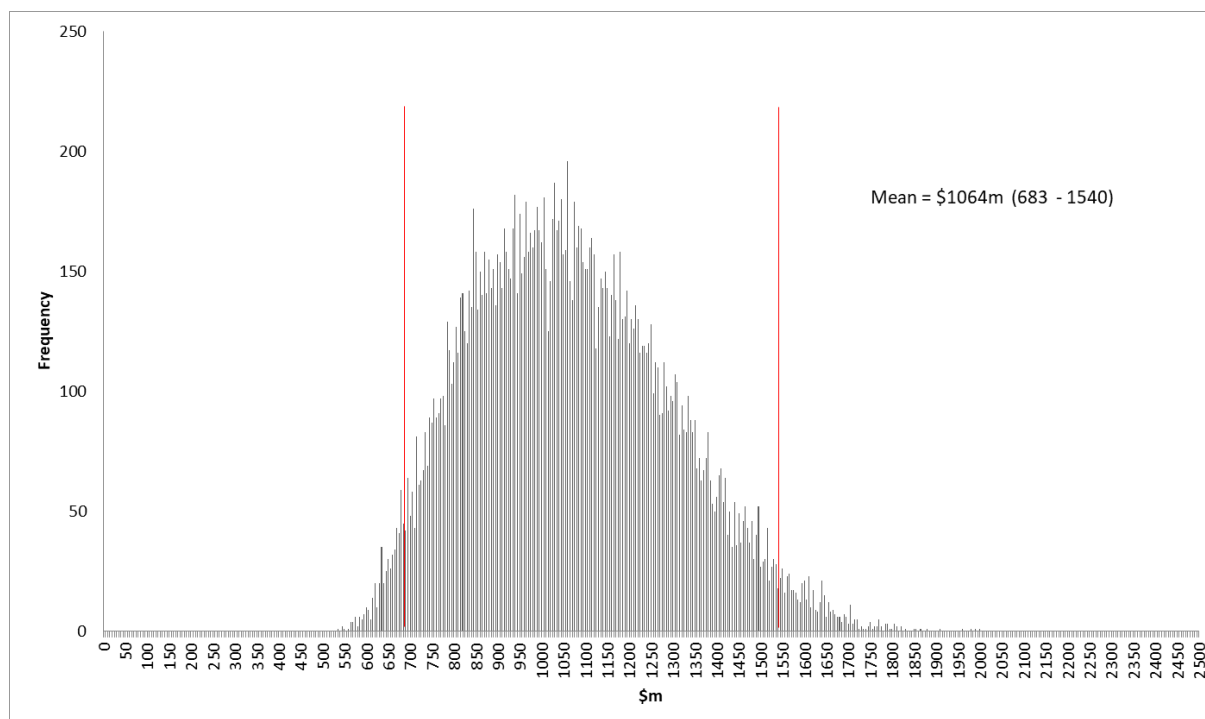
Figure 19: Distribution of Present Value of Reduction in Staff Turnover



5.6. Total Benefits

Combining all estimated benefits produces a central estimate of \$1,064.3m for the present value of benefits associated with proposed amendments to the ERA. Monte Carlo analysis produces a 95% confidence interval for these present value benefits that range between \$683m and \$1540m (see Figure 20).

Figure 20: Distribution of Present Value of Total Benefits



ANNEX 1 – REFERENCES

- Grimmond, Dave. 2020. 'Greater Wellbeing: Measuring Wellbeing in Wellington'. Economic Working Paper 20/1. Greater Wellington Regional Council.
- Groot, Rudolf de, Luke Brander, Sander van der Ploeg, Robert Costanza, Florence Bernard, Leon Braat, Mike Christie, et al. 2012. 'Global Estimates of the Value of Ecosystems and Their Services in Monetary Units'. *Ecosystem Services* 1 (1): 50–61.
<https://doi.org/10.1016/j.ecoser.2012.07.005>.
- Ministry for the Environment. 2021. Economic Analysis of the Independent Panel's Proposed Reforms to the Resource Management System: Final report. Prepared for the Ministry for the Environment by Castalia. Wellington: Ministry for the Environment.
- Ministry for the Environment. 2022. Te whakawhanake i te pūnaha ripoata taiao o Aotearoa | Improving Aotearoa New Zealand's environmental reporting system: Proposed amendments to the Environmental Reporting Act 2015: Consultation document. Wellington: Ministry for the Environment.
- The Treasury. 2015. 'Policy Measurement Report 2014/15'. New Zealand Government.
<https://www.treasury.govt.nz/sites/default/files/2016-09/policy-measurement-report-14-15.pdf>.
- The Treasury. 2015 (b). 'Guide to Social Cost Benefit Analysis'. New Zealand Treasury.
<https://treasury.govt.nz/publications/guide/guide-social-cost-benefit-analysis>.
- The Treasury. 2021. 'CBAX Tool User Guidance'. The Treasury.
<https://www.treasury.govt.nz/publications/guide/cbax-tool-user-guidance>.