Appendix C: Qualitative descriptors for risk/benefit assessment

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C1 Assessing risks, costs and benefits qualitatively

This section describes how the Agency staff and the Authority address the qualitative assessment of risks, costs and benefits.

Risks and benefits are assessed by estimating the magnitude and nature of the possible effects and the likelihood of their occurrence. For each effect, the combination of these two components determines the level of the risk associated with that effect, which is a two dimensional concept.

C1 Because of a lack of data, risks are often presented as singular results. In reality, they are better represented by 'families' of data which link probability with different levels of outcome (magnitude).

C2 Describing the magnitude of effect

The magnitude of effect is described in terms of the element that might be affected. The qualitative descriptors for magnitude of effect are surrogate measures that should be used to gauge the end effect or the 'what if' element.

Tables C1 and C2 contain generic descriptors for magnitude of adverse and beneficial effect. These descriptors are examples only, and their generic nature means that it may be difficult to use them in some particular circumstances. They are included here to illustrate how qualitative tables may be used to represent levels of adverse and beneficial effect.

The sample qualitative descriptors for effects on the market economy listed in the ERMA New Zealand technical guide to decision making[93] include representative numbers. These 'economic' descriptors were developed prior to the publication of the technical guide on identification and assessment of effects on the market economy,[94] which refines the approach that ERMA New Zealand applies to identifying and assessing economic effects. These numbers do not align well with the qualitative descriptors in the other categories (effects on the environment, effects on human health, and effects on society and communities), as they relate more to an event than an effect. In particular the numbers are unclear about how they take account of time (are they annual, or over the life of the activity) and they do not have a local, regional or national context.

ERMA New Zealand has adopted a revised set of qualitative descriptors for the magnitude of effect on the market economy, as shown below.

Table C1: Magnitude of adverse effect (risks and costs)

Descriptor	Examples of descriptions: ADVERSE
Minimal	Mild reversible short term adverse health effects to individuals in highly localised area
	Highly localised and contained environmental impact, affecting a few (less than ten) individuals members of communities of flora or fauna, no discernible ecosystem impact
	Local/regional short-term adverse economic effects on small organisations (businesses, individuals), temporary job losses
	No social disruption
Minor	Mild reversible short term adverse health effects to identified and isolated groups
	Localised and contained reversible environmental impact, some local plant or animal communities temporarily damaged, no discernible ecosystem impact or species damage
	Regional adverse economic effects on small organisations (businesses, individuals) lasting less than six months, temporary job losses
	Potential social disruption (community placed on alert)
Moderate	Minor irreversible health effects to individuals and/or reversible medium term adverse health effects to larger (but surrounding) community (requiring hospitalisation)
	Measurable long term damage to local plant and animal communities, but no obvious spread beyond defined boundaries, medium term individual ecosystem damage, no species damage
	Medium term (one to five years) regional adverse economic effects with some national implications, medium term job losses
	Some social disruption (e.g. people delayed)
Major	Significant irreversible adverse health effects affecting individuals and requiring hospitalisation and/or reversible adverse health effects reaching beyond the immediate community
	Long term/irreversible damage to localised ecosystem but no species loss
	Measurable adverse effect on GDP, some long term (more than five years) job losses
	Social disruption to surrounding community, including some evacuations

93 ERMA New Zealand. 2004. *Decision Making: A Technical Guide to Identifying, Assessing and Evaluating Risks, Costs and Benefits*, ER-TG-05-01. Wellington: Environmental Risk Management Authority.

94 ERMA New Zealand. 2005. *Assessment of Economic Risks, Costs and Benefits: Consideration of Impacts on the Market Economy*, ER-TG-06-01. Wellington: Environmental Risk Management Authority.

Descriptor	Examples of descriptions: ADVERSE
Massive	Significant irreversible adverse health effects reaching beyond the immediate community and/or deaths
	Extensive irreversible ecosystem damage, including species loss
	Significant ongoing adverse effect on GDP, long term job losses on a national basis
	Major social disruption with entire surrounding area evacuated and impacts on wider community

Table C2: Magnitude of beneficial effect (benefits)

Descriptor	Examples of descriptions: BENEFICIAL
Minimal	Mild short term positive health effects to individuals in highly localised area
	Highly localised and contained environmental impact, affecting a few (less than ten) individuals members of communities of flora or fauna, no discernible ecosystem impact
	Local/regional short-term beneficial economic effects on small organisations (businesses, individuals), temporary job creation
	No social effect
Minor	Mild short term beneficial health effects to identified and isolated groups
	Localised and contained beneficial environmental impact, no discernible ecosystem impact
	Regional beneficial economic effects on small organisations (businesses, individuals) lasting less than six months, temporary job creation
	Minor localised community benefit
Moderate	Minor health benefits to individuals and/or medium term health impacts on larger (but surrounding) community and health status groups
	Measurable benefit to localised plant and animal communities expected to pertain to medium term.
	Medium term (one to five years) regional beneficial economic effects with some national implications, medium term job creation
	Local community and some individuals beyond immediate community receive social benefit.
Major	Significant beneficial health effects to localised community and specific groups in wider community
	Long term benefit to localised ecosystem(s)
	Measurable beneficial effect on GDP, some long term (more than five years) job creation
	Substantial social benefit to surrounding community, and individuals in wider community.
Massive	Significant long term beneficial health effects to the wider community
	Long term, wide spread benefits to species and/or ecosystems
	Significant ongoing effect beneficial on GDP, long term job creation on a national basis
	Major social benefit affecting wider community

C3 Determining the likelihood of the end effect

Likelihood in this context applies to the composite likelihood of the end effect, and not either to the initiating event, or any one of the intermediary events. It includes:

- the concept of an initiating event (triggering the hazard), and
- the exposure pathway that links the source (hazard) and the area of impact (public health, environment, economy, or community).

Thus, the likelihood is the likelihood of the specified adverse effect[95] resulting from that initiating event. It will be a combination of the likelihood of the initiating event and several intermediary likelihoods.[96] The best way to determine the likelihood is to specify and analyse the complete pathway from source to impact.

Likelihood may be expressed as a frequency or a probability. While frequency is often expressed as a number of events within a given time period, it may also be expressed as the number of events per head of (exposed) population. As a probability, the likelihood is dimensionless and refers to the number of events of interest divided by the total number of events (range 0–1). (See Table C3.)

Table C3: Likelihood

	Descriptor	Description
1	Highly improbable	Almost certainly not occurring but cannot be totally ruled out
2	Improbable (remote)	Only occurring in very exceptional circumstances.
3	Very unlikely	Considered only to occur in very unusual circumstances
4	Unlikely (occasional)	Could occur, but is not expected to occur under normal operating conditions.
5	Likely	A good chance that it may occur under normal operating conditions.
6	Very likely	Expected to occur if all conditions met
7	Extremely likely	Almost certain

C4 Using magnitude and likelihood to construct risk

Using the magnitude and likelihood tables a matrix representing a level of risk can be constructed (Table C4).

Table C4: Level of risk

	Magnitude of effect				
Likelihood	Minimal	Minor	Moderate	Major	Massive
Highly improbable	A	A	B	C	D
Improbable	A	B	C	D	E
Very unlikely	B	C	D	E	E
Unlikely	C	D	E	E	F
Likely	D	E	E	F	F
Very likely	E	E	F	F	F
Extremely likely	E	F	F	F	F

The level of risk/benefit can be assigned as follows in Table C5.

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95 The specified effect refers to scenarios established in order to establish the representative risk, and may be as specific as x people suffering adverse health effects, or y% of a bird population being adversely affected. The risks included in the analysis may be those related to a single scenario, or may be defined as a combination of several scenarios.

96 Qualitative event tree analysis may be a useful way of ensuring that all aspects are included.

Table C5: Assignment of level of risk/benefit

A & B	Negligible
C	Low
D	Medium
E	High
F	Extreme