Ecological Impact Assessment (EcIA)

EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems

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Environment Institute of
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To contact the authors or provide feedback, please contact the New Zealand Chapter: newzealand@eianz.org

Foreword

The Environment Institute of Australia and New Zealand Inc. (EIANZ) was founded in 1987 and is the leading professional body for environmental practitioners in Australasia.

The Primary Purposes of EIANZ are to:

- Facilitate interaction among environmental professionals;
- Promote environmental knowledge and awareness; and
- Advance ethical and competent environmental practice.

In 2010, as a contribution to advancing "competent environmental practice" the EIANZ's Ecology Special Interest Section drafted a general guidance around ecological assessment and biodiversity management.

While the essential components of Ecological Impact Assessment (description, evaluation, assessment, impact management and monitoring) are the same anywhere in the world, their practical application depends on the local regulatory framework (which usually reflects local cultural and environmental factors).

Environmental professionals across Australia and in New Zealand work within different regulatory frameworks, with each jurisdiction having its particular requirements for environmental impact assessment. In New Zealand, environmental impact assessment is regulated through the *Resource Management Act 1991* (RMA). The RMA is "effects-based" requiring a rigorous approach to planning and environmental assessment based on a sound understanding of existing environmental conditions, and prediction of their potential future states. In relation to ecological features and values, a range of approaches and methods to address these requirements have been used, resulting in inconsistent descriptions, evaluation, assessment and decisions.

In 2012 a group of ecologists in the EIANZ New Zealand Chapter embarked on the development of specific practice guidance for environmental professionals working in New Zealand under the RMA, and related legislation. What has emerged is the New Zealand Guidelines for Ecological Impact Assessment: terrestrial and freshwater ecosystems (NZ Guidelines).

These NZ Guidelines provide references to many of the approaches, methods and techniques used in ecological impact assessment in New Zealand. They are guidance on good practice environmental management without being prescriptive. Nor are the NZ Guidelines intended to be interpreted as a binding requirement on environmental professionals conducting Ecological Impact Assessments. They will be revised from time to time, in keeping with changes in regulatory requirements, case law, evolving good practice in the field of Ecological Impact Assessment, and user feedback.

The NZ Guidelines are written from an ecologist's perspective. They reflect the relationship between the processes of ecological science and New Zealand's planning and regulatory framework. In some situations, ecological science and New Zealand case law on a topic may not be entirely in accord, and where this occurs there is guidance on how the environmental professional may approach the resolution of such discordance.

The NZ Guidelines provide a reference source, founded in ecological science, that describe what Ecological Impact Assessment is, how it should be carried out, and what is specifically considered good practice. The EIANZ believes they will, in their application:

- improve the scientific rigor, objectivity and consistency of Ecological Impact Assessments, and in so doing, raise the standard of practice in New Zealand;
- support the work of auditors in assessing the quality of Ecological Impact Assessment practice as a component of environmental impact assessments;
- improve community confidence in the ability of environmental professionals to undertake impartial, scientifically based, objective Ecological Impact Assessments;
- guide the development of more potent policy on biodiversity aspects of resource management;
- provide a source of reference for students, and those setting out on a career as an environmental professional, to learn more about a key component of the environmental impact assessment process; and
- contribute to better decision making on environmental matters in New Zealand.

If the community is to be assured of the standard of Ecological Impact Assessment practice it must also be confident that ecologists carrying out the work are acting in a professional and ethical manner. The ethics of Ecological Impact Assessment practice are also addressed, by providing some guidance for ecologists drawn from the EIANZ *Code of Ethics and Professional Practice* and broader professional publications. Ethics is a complex topic; the NZ Guidelines can provide only a discussion of some of the main issues encountered by ecologists.

The strength of the NZ Guidelines for Ecological Impact Assessment lies in the contribution their application makes to good practice environmental management, and better outcomes for New Zealand's biodiversity and environmental values. Comments on their applicability and opportunities for further development are welcome.

Jon Womersley FEIANZ, CEnvP
President, EIANZ

Ian Boothroyd MEIANZ, CEnvP
President, New Zealand Chapter

Editor's preface

Ecological Impact Assessment (EcIA) is a process for identifying, quantifying and evaluating the potential impacts of defined actions on ecosystems or their components; and providing a scientifically defensible approach to ecosystem management.

Ecological practitioners implement EcIA every time they describe ecological features and make an assessment of their likely future condition. This may be part of tasks that seem as diverse as undertaking an Assessment of Environmental Effects (AEE), preparing a conservation management assessment, or developing planning policy. However, few New Zealand ecologists would use the term EcIA, and probably fewer would recognise the definition put forward by Jo Treweek in 1999. "Ecological Impact Assessment" is not in the common or legislative vocabulary of New Zealand.

A group of experienced ecologists and planners within EIANZ recognised that as a consequence of this, approaches to impact assessment and the quality of process and reporting vary across New Zealand. This means that frequently, during consent application reviews and hearings, greater time is spent discussing the merits of methods than in developing good ecological outcomes. There are concerns that inconsistency across the profession leads to inappropriate decision-making and, as a consequence, poor biodiversity protection and management. The group saw the need for guidance on good practice, similar to that developed by the Institute of Ecology and Environmental Management (IEEM) in the UK.

In 2012 the group started the task of scoping and drafting text to guide ecological and professional good practice. Over the next 18 months we shaped the Guidelines through email, Skype and limited face-to-face meetings; workshops, conference presentations and newsletter articles elicited further ideas; and legal and planning perspectives were incorporated. In mid-2014, a draft document was independently reviewed by New Zealand ecologists and planners so that today Version 1 represents a widely canvassed view.

Our focus was on terrestrial and freshwater environments, since these are particularly well-covered by ecological literature and have less complex legislative contexts than the coastal environment.

In most areas we present options for good practice. But on the topic of assessing effects we present a single approach. Assessment of effects on ecological values is not done consistently under the RMA and we propose that a specific approach, adapted from the IEEM Guidelines (and originally developed by Karen Regini), could be tested further here. A matrix system, with supporting interpretation, provides a consistent way to record how the level of an effect is a combination of the magnitude of that effect and the value of the receptor. As part of this we also make some suggestions about how "value" may be assigned for assessment purposes.

I am truly grateful to everyone who has helped make these NZ Guidelines happen. All the contributors gave their time voluntarily in spite of their own workloads, family commitments, and for some, the ongoing stresses of insurance and 'quake rebuild issues. The assistance of their employers is also acknowledged.

I would like to thank Caroline McParland whose enthusiasm in the initial stages and knowledge of the IEEM Guidelines helped to shape the document. Although she is now back in the UK, Caroline has been a valuable sounding board throughout the drafting process. Thanks too, to Mark Sanders, Geoff Walls, Ian Boothroyd, Graham Ussher, and Olivia Burge who made generous contributions of time and expertise to the text as well as to challenging discussions around matters of interpretation and practice (and grammar!). Review input from Joh Taylor, Claire Webb, Fred Overmars and Craig Redmond and proof-reading by Merryn Hedley helped to shape the final document and is greatly appreciated. A large number of other ecologists, planners and impact assessment professionals assisted with advice and comment throughout the development of the Guidelines.

The New Zealand Chapter of EIANZ has provided energy and support for the project throughout, especially through the three Presidents during its development: Jeska McNicol, Joh Taylor and Ian Boothroyd. Ian has been a great help in the latter stages, guiding the document through the EIANZ "system".

There is always room for improvement. Legislative changes are possible; ecological science and knowledge will expand; methodologies will develop and change; some sections will need expansion; and an ecologist somewhere will have information about "good practice" that we have missed. So Version 1 is a living document and needs to be used, tested and regularly updated by New Zealand ecologists: those undertaking Ecological Impact Assessments; those auditing the reports; and those making decisions about ecological management. We would also like to have more case studies and photographs to illustrate them in future versions as well as further input from other professions such as planning and impact assessment.

Please take the time to report to us on your use of the Guidelines, so that they become a valuable tool for good ecological management in New Zealand.

Dr Judith Roper-Lindsay
CEnvP, MCIEEM, MEIANZ

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Glossary

Assessment of Environmental Effects (AEE): the process of preparing a written statement identifying the effects of a proposed activity or activities on the environment. If the proposal is going to have negative effects, it is also the process of identifying how these can be avoided or reduced. (MFE website, http://202.36.137.86/publications/rma/aee-guide-aug06, Sept 2014). The report prepared to document the process and outcomes is often also called an 'AEE'. See also EIA.

Biodiversity (biological diversity): the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (United Nations, 1992).

Biodiversity offsetting: measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground (*Guidance on Good Practice Biodiversity Offsetting in New Zealand* (New Zealand Government, 2014)). This document provides definitions of biodiversity type, biodiversity components and biodiversity attributes used in offset design.

Business and Biodiversity Programme (BBOP): an international collaboration between companies, financial institutions, government agencies and civil society organisations. The members are developing best practice in following the mitigation hierarchy (avoid, minimise, restore, offset) to achieve no net loss or a net gain of biodiversity. (BBOP website, http://bbop.forest-trends.org Sept 2014)

Continuing Professional Development (CPD): the means by which people maintain their knowledge and skills related to their professional lives. (Wikipedia, http://en.wikipedia.org/wiki/Continuing_professional_development, Sept 2014)

Certified Environmental Practitioner (CEnvP) Scheme: a scheme that aims to ensure that talented, skilled and ethical environmental professionals are given due recognition in line with their professional counterparts from engineering, accounting, planning and architecture. (CEnvP website, http://www.cenvp.org)

Ecological features: specific aspects of ecosystems that are described and evaluated; the term includes components (e.g. species, habitats), processes (e.g. gene flow, nutrient cycling) and functions (e.g. roosting, feeding, establishing territory).

Ecological Impact Assessment (EcIA): the process of identifying, quantifying and evaluating the potential impacts of defined actions on ecosystems or their components. If properly implemented it provides a scientifically defensible approach to ecosystem management (Treweek, 1999).

Ecological integrity: The degree to which the physical, chemical and biological components (including composition, structure and process) of an ecosystem and their relationships are present, functioning and maintained close to a reference condition reflecting negligible or minimal anthropogenic impacts (Schallenberg et al., 2011).

Ecological values: the worth placed on ecological features (such as species, habitats, processes, ecosystems, community composition) determined by their rarity, vulnerability and role in ecosystem functioning.

Environmental compensation: any action (work, services or restrictive covenants) to avoid, remedy or mitigate adverse effects of activities on a relevant area, landscape or environment, as compensation for the unavoided and unmitigated adverse effects of the activity for which consent is being sought. (*JF Investments Limited v Queenstown Lakes District Council*, Environment Court C48/2006).

Environmental Impact Assessment (EIA): the process of identifying the future consequences on the environment of a current or proposed action. (IAIA website, http://www.iaia.org, Sept 2014). See also AEE.

Ecosystem: a dynamic complex of plant, animal, and microorganism communities and their non-living environment interacting as a functional unit. (*Ecosystems and human well-being: Policy responses: Findings of the Responses Working Group of the Millennium Ecosystem Assessment*, 2005)

Habitat: the place or type of area in which an organism naturally occurs. (NZ Biodiversity Strategy – Glossary, https://www.biodiversity.govt.nz/picture/doing/nzbs/glossary.html, Sept 2014). A habitat may be made up of biotic and/or abiotic components.

Indigenous: describing a plant or animal species which occurs naturally in New Zealand. A synonym is 'native'. (NZ Biodiversity Strategy – Glossary, https://www.biodiversity.govt.nz/picture/doing/nzbs/glossary.html, Sept 2014).

Resilience: the ability of a species, community, or ecosystem to respond and adapt to external environmental stresses (NZ Biodiversity Strategy – Glossary, https://www.biodiversity.govt.nz/picture/doing/nzbs/glossary.html, Sept 2014).

Vulnerability: exposure to contingencies and stress, and the difficulty in coping with them. Three major dimensions of vulnerability are involved: exposure to stresses, perturbations, and shocks; the sensitivity of people, places, ecosystems, and species to the stress or perturbation, including their capacity to anticipate and cope with the stress; and the resilience of the exposed people, places, ecosystems, and species in terms of their capacity.(*Ecosystems and human well-being: Policy responses: Findings of the Responses Working Group of the Millennium Ecosystem Assessment*, 2005).

Zone of influence: the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities.

1 Introduction

Introduction
Key points

Ecological Impact Assessment (EcIA) is an independent, stand-alone, and specific scientific process for identifying, quantifying and evaluating the potential impacts of defined actions on ecosystems or their components; and provides a scientifically defensible approach to ecosystem management in the context of development.

EcIA should be integrated with environmental impact assessment for **projects, strategies or policies** that have potential effects on ecosystems or biodiversity features.

After the need for an EcIA has been determined through screening, the **key steps** are:

- Scoping
- Detailed investigations
- Assessment of effects
- Impact management and mitigation
- Monitoring

EcIA is required to assist decision-making under the **Resource Management Act**, Conservation Act and other New Zealand legislation. It should address matters in National Policy Statements, National Environmental Standards, Regional Policy Statements and Regional and District Plans.

1.1 What is Ecological Impact Assessment?

In defining Ecological Impact Assessment, Treweek states:

> "EcIA is firmly rooted in ecological science, drawing on traditional techniques of survey, monitoring, functional analysis and predictive modelling. In addition however, EcIA requires evaluation of the implications of any predicted outcomes. It is this aspect of evaluation which distinguishes EcIA from the pure science of ecology and which has created demand for new approaches to the ways in which ecological information is handled...Ecological outcomes must therefore be translated into a common language or scale for comparison with other findings, whether these are of a social, economic or political nature. In short, EcIA should provide a scientifically defensible rationale for decision making and for environmental management" (Treweek, 1999).

Its purpose is to provide reliable information about, and interpretation of, the ecological implications of any project or policy, from inception to operation and, where appropriate, decommissioning. An ecological assessment is an integral part of the preparation of an Assessment of Environmental Effects (AEE) supporting an application under the Resource Management Act 1991 and Resource Management Amendment Act 2013 and other pieces of legislation.

An ecologist should be involved in the early project discussions with the proponent and his/her advisors about whether ecological issues are likely to be such that an EcIA will be needed, and, if so, at what level or scale (screening). In its simplest form, an assessment may determine at the scoping stage that potential and actual effects will be minor or negligible so that further investigations are unnecessary.

Local authority consents staff need to receive a good quality EcIA in order to make a decision on whether to notify a consent, either fully or with limited notification, where there are effects on ecological components. Notification is undertaken when the effects of the proposed activity are considered to be more than minor – a rigorous assessment of effects is needed to guide consent staff on this, even if the proposal is small in scale. Only 4% of consent applications were notified in the period 2010–2011(the latest period for which figures are available)[1] (Ministry for the Environment, 2014).

Although EcIA is commonly used for large developments or major activities, it might equally apply to any occasion where change must be assessed; for example, monitoring and management of protected areas, monitoring of biodiversity across whole landscapes, assessing the potential impacts of proposed local authority plans, or Strategic Environmental Assessment (SEA)[2]. EcIA should be integrated with the stages of project or policy development and complement or link to work in other disciplines being carried out in undertaking an EIA or preparing an AEE.

Comprehensive ecological impact assessments have been carried out as part of a number of large scale projects recently. Some well-documented processes and reports are described in these two projects:

Transmission Gully proposal, Wellington: see the EPA website http://www.epa.govt.nz/Resource-management/previous/tg/Pages/default.aspx (accessed 19 March 2014)

Mt Cass windfarm, North Canterbury: see Hurunui District Council website for Environment Court decision and conditions http://www.hurunui.govt.nz/services/consents-and-permits/mt-cass-wind-farm (accessed 19 March 2014)

[1] http://www.mfe.govt.nz/publications/rma/annual-survey/2010-2011/key-facts/index.html).

[2] Strategic Environmental Assessment is widely undertaken in UK and EU countries (see www.unep.ch/etu/publications/textONUbr.pdf), but less often in New Zealand.

1.2 Key Steps in EcIA

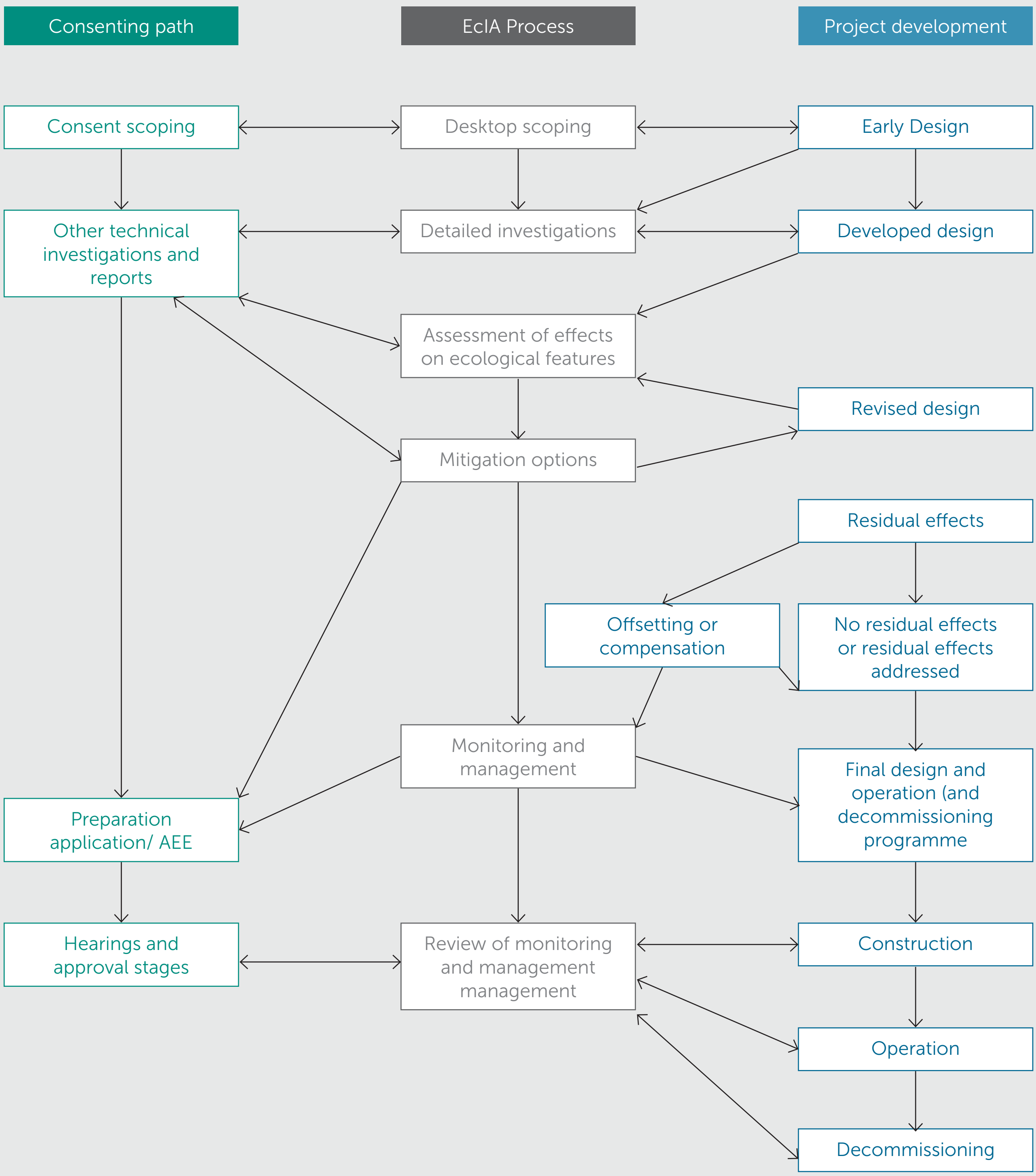
The key steps in the EcIA process for an activity, project, or policy are:

- **Screening** – a broad review of the need for, and potential scope of, an ecological assessment; often carried out as part of initial project development by a generalist environmental advisor. An ecological impact assessment should be made whenever a proposed activity or policy has potential effects on ecosystems or their components.
- **Scoping** – a preliminary ecological assessment at the early planning stage which forms the basis for selecting those valued ecological resources to be subject to detailed assessment due to potentially serious impacts, and for early identification of impact strategies.[3]
- **Detailed investigations** – work carried out during the detailed planning and design stages, to identify and describe ecological features of interest within the zone of influence.
- **Assessment of actual and potential effects** – identification and prediction of potential positive and adverse effects of the activity, and their degree of impact; determining the need for impact avoidance, remedy and mitigation, as well as other management opportunities such as enhancement.
- **Impact management and mitigation** – establishing measures needed to avoid, remedy or mitigate adverse effects, and their likely success; then assessment of the residual effects. If significant negative effects are still likely, it may be necessary to consider the need for, and value of, ecological compensation or biodiversity offsetting. The positive impacts of such compensation proposals should be rigorously assessed.
- **Monitoring** – development of appropriate monitoring requirements and management strategies, programmes or plans.

Figure 1 Ecological Impact Assessment Process in the Project Life Cycle illustrates the link between EcIA stages and commonly used project development phases. The process of scoping, investigation, analysis of results and feedback into the project, should be iterative so that ecological outcomes can be optimised. This can often lead to more efficient progression of a proposal through the resource consent process with consequentially lower legal, planning and compliance costs. In practice, the steps in environmental and ecological assessment processes are often not so clear cut or linear. As a project develops, changes in scope, area, timing or other factors may require further investigation and reassessment.

[3] Note: "Environmental scoping" is the broader initial planning review of all aspects of a project to determine critical investigation and resource needs.

Figure 1 Ecological Impact Assessment Process in the Project Life Cycle



1.3 Legislation

1.3.1 Introduction

Although the primary legislation relating to an EcIA is the RMA, the ecologist undertaking an assessment should seek guidance from a resource management lawyer or planner on legislation relevant to the project being assessed. The ecologist should also be aware of the contents of specific New Zealand legislation relating to ecological or biodiversity features and values, and make their client aware of the range of responsibilities; for example, the need to have permits to handle wildlife should the project go ahead. It important to remember that the EcIA process and report(s) do not make the decision about whether a proposal should go ahead – the purpose is to provide information that will assist the decision-maker to make their decision under the relevant piece of legislation. **Appendix 1** provides information about relevant national legislation. Regional and district plans are discussed in the next section.

1.3.2 Regional and District Plans

Regional Policy Statements, and Regional and District Plans provide the most immediate and relevant regulatory framework for assessing effects on ecological features and values and implementation of the RMA, National Policy Statements and National Environmental Standards. The ecologist should be aware of the Plan provisions relating to ecological features in the area in which the project is being undertaken and its zone of influence.

Regional and District Plans can be viewed online and in some cases interactive maps are available. Websites and contact details for each council can be obtained through http://www.localcouncils.govt.nz or http://www.lgnz.co.nz/home/nzs-local-government/new-zealands-councils.

While plans differ, some key matters that the ecologist should check in undertaking an EcIA are:

- Maps and/or Schedules of areas of ecological value. These have different names in different places, including Significant Natural Areas (SNA), Areas of Significant Conservation Value (ASCV), natural heritage areas, and Ecological Heritage Sites. These sites have planning status and can provide good basic information about the locality. It is important to consider the values for which such sites were originally listed and/or mapped in current ecological terms. It is important to remember that ecologically valuable sites may be present, but not listed for political or other reasons; for example in some places, sites were only listed in a plan after the landowner gave approval.
- Rules associated with the mapped/listed areas of ecological value. There may be constraints on activities to protect ecological values that are relevant to the proposal.
- Criteria for identification of areas of ecological significance or value (in relation to section 6(c) RMA). Often these are given in a plan, and must be used to assess any site as part of an application.
- General rules related to land or water use in the zone of influence. These may set standards for matters such as permitted activities, mitigation activities, monitoring or non-notification.
- Biodiversity offsetting policy in relevant plans. Few plans have policy on offsetting in place yet, but as the concept and its implementation develop, more are likely to do so. The Proposed National Policy Statement on Indigenous Biodiversity prescribes the need for this policy to be developed by territorial local authorities, but is not operative. The Government has published guidance for biodiversity offsetting in New Zealand: http://www.doc.govt.nz/publications/conservation/biodiversity-offsets-programme.

1.4 Other guidance

These NZ Guidelines draw on two other published sets of guidelines.

The "*Ecological Impact Assessment Guidelines: First Working Draft*" (Environmental Institute of Australia and New Zealand, 2010) are available on the EIANZ website and provide a good discussion of some of the key elements of biodiversity management and EcIA in general. These remain a "draft" and are not intended to give detailed practice guidance. They provide the general background to the New Zealand document; but for ecologists working in New Zealand, these NZ Guidelines 2015 supersede the 2010 Guidelines.

The Institute of Ecology and Environmental Management (IEEM[4]) produced the *Guidelines for Ecological Impact Assessment in Britain and Ireland: Terrestrial, Freshwater and Coastal* in 2011 (Institute of Ecology and Environmental Management, 2011), updating the *Guidelines for Ecological Impact Assessment in the United Kingdom* (Institute of Ecology and Environmental Management, 2006). These have been widely adopted as best practice in the UK and complement the 2010 *Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal* (Institute of Ecology and Environmental Management, 2010) (http://www.cieem.net/publications-info).

The Quality Planning website provides a good overview of many aspects from the planner's perspective.[5]

In August 2014 the EIANZ Impact Assessment Special Interest Section released *Draft Guidelines for Impact Assessment* (see http://www.eianz.org/aboutus/impact-assessment) which addresses the broader impact assessment process.

[4] In 2013 IEEM became the Chartered Institute of Ecology and Environmental Management, CIEEM.

[5] http://www.qualityplanning.org.nz/index.php/planning-tools/indigenous-biodiversity/describing-and-evaluating-biodiversity-values.

2 Professional practice and EcIA

Professional practice and EcIA
Key points

An ecologist paid to do or review an Ecological Impact Assessment is a professional, and therefore has important responsibilities to their clients and professional colleagues.

A professional ecologist **must comply** with the law, and should also be:

- An expert – competent and skillful, working within the widely accepted paradigms and knowledge base of the profession
- Ethical, trustworthy, reliable and committed to the profession
- Dedicated to their professional development both for him/herself and for those people who are affected by their work
- It means providing a service to their client (or employer), while acting in the best interests of the public or society and the natural environment.

The **EIANZ Code of Ethics and Professional Conduct** addresses:

- Promotion of ecological conservation principles
- Advocating for the use of objective scientific and technical knowledge in describing, evaluating, protecting and managing ecological values
- Considering the knowledge, information and views of all stakeholders on ecological matters
- Seeking advice from others in relation to areas outside their expertise and working collaboratively with other professionals in multi-disciplinary teams.

Guidance is given for circumstances where the ecologist may need to address conflict between ecological science and RMA requirements.

In carrying out their work, a professional ecologist should consider:

- Conflicts of interest – real and perceived
- Personal bias
- Facts, professional judgment and personal opinion
- Maintenance of their personal professional integrity.

Duties to your client or employer include:

- Making them aware of the full range of ecological components of the project, especially any major ecological values and/or risks associated with the project
- Respecting obligations of confidentiality and privacy
- Providing accurate and clear information and advice, making ecological information as accessible and understandable to them as possible
- Ensuring that they are aware of the limitations of any ecological work caused by timing or resourcing issues outside your control
- Acting professionally in relation to time and financial management.

It is important to recognise the limits of your skills and undertake continuing professional development (CPD).

2.1 Introduction

This section focuses on the role of an ecologist as a professional, with particular reference to working on EcIA.

Because ecosystem functioning and biodiversity are critical to the whole environment and to people, now and in the future, it is sometimes difficult for an ecologist to separate his or her role as a scientist and technical advisor from his or her personal opinions and concerns about environmental management. Many ecologists would argue that the two cannot and/or should not be separated.

In undertaking ecological impact assessment, it is important to acknowledge the different aspects and to provide professional judgment rather than personal opinion.

Some people are concerned that if an ecologist (or, indeed, any professional) is paid to give advice, then that advice will be shaped to suit the person paying them. Equally, an ecologist working *pro bono* for an organisation or community may be considered to be a supporter of that group and its wider objectives. In this section, the ways in which an ecologist should conduct him- or herself to avoid these perceptions (or realities) are discussed.

2.2 The professional ecologist

Being paid to be an 'ecologist' is a profession, so all work needs to adhere to good professional practice. Compliance with the law in relation to ecological impact assessment is a minimum standard. In New Zealand, an ecologist will usually be carrying out an ecological impact assessment as part of an application under the Resource Management Act 1991, but as discussed in Chapter 1, other legislation may be involved. The *Environment Court of New Zealand Practice Note*[6] provides clear guidance for preparation of evidence, and can also be used to guide general professional actions. A new Practice Note came into effect on 1 December 2014.

The *EIANZ Code of Ethics and Professional Conduct* (Environmental Institute of Australia and New Zealand, 2012) provides guidance for all aspects of environmental practice. However, this can be in conflict with requirements of New Zealand legislation, as discussed later (Section 2.3).

Being 'professional' means:

- Being an expert (defined by qualifications, ongoing professional development and practice).
- Being competent and skillful.
- Being trustworthy, reliable and committed to your profession.
- Being dedicated to your professional development, both for yourself and for those people who are affected by your work.
- Working within the widely accepted definitions, insights and knowledge base of the ecological profession.
- Working within one's area of expertise and acknowledging the source when relying on other, identified, evidence.
- Behaving in an ethical way.

It also means providing a service to your client (or employer), while acting in the best interests of the public or society and the natural environment. This is where an ecologist may find it hard to achieve the balance between providing advice to inform a client's EcIA brief and project requirements, and their understanding of the natural environment. Clear enunciation and documentation of ecological values, the significance of potential adverse effects, and the adequacy of mitigation to address those effects are essential for giving advice.

EIANZ also produces Position Statements which members can use to clarify their thinking and support arguments. There are currently Position Statements on:

- Biodiversity
- Climate Change
- Conservation of Native Vegetation
- Energy
- Environmental Education
- Environmental Management Systems
- Public Environmental Reporting
- Public Participation in Environmental Decision Making
- Sustainability
- Water

These are regularly updated and added to.

[6] http://www.justice.govt.nz/courts/environment-court/documents/environment-court-practice-notes-2014.

2.3 Ethics and professional conduct in ecological impact assessment

The *EIANZ Code of Ethics and Professional Conduct* (Environmental Institute of Australia and New Zealand, 2012) serves the needs of the wide range of disciplines and expertise found in environmental practitioners in the Institute. Based on the Code, when involved in an EcIA, a professional ecologist should:

1. Promote ecological conservation principles:
   a. integrity of the natural environment and the health, safety and well-being of the human community and future generations
   b. consideration of the whole-ecosystem context, not just components such as threatened taxa
   c. stewardship/kaitiakitanga: humans as custodians rather than owners
   d. recognition of representativeness; how well the ecosystem fits in with natural patterns and processes in the ecological district, region, country and beyond?
   e. recognition and nurturing of special natural features
   f. recognition of the degree of vulnerability and resilience of the ecosystem
   g. recognition of the degree of natural sustainability of the ecosystem; what human input is required long term?
   h. no net loss of ecosystems, ecosystem processes, ecosystem services or biodiversity components; seek maintenance of existing levels of indigenous biodiversity and enhancement where possible
2. Advocate for the use of objective scientific and technical knowledge in describing, evaluating, protecting and managing ecological values.
3. Consider the knowledge, information and views of all stakeholders on ecological matters.
4. Seek advice from others in relation to areas outside their expertise and work collaboratively with other professionals in multi-disciplinary teams.
5. Adopt the *Environment Court of New Zealand Practice Note* (Environment Court, 2014)

Principle 1h, above, is not a requirement of the RMA 1991. While some documents (e.g. *Proposed National Policy Statement on Indigenous Biodiversity*, and *Canterbury Regional Policy Statement 2013*) and plans set out policies in relation to net loss and gain of indigenous biodiversity, the RMA itself does not. An ecologist needs to be aware of the potential tension between promoting conservation principles, and the legislation under which an assessment is being prepared.

Conflicts of interest should always be declared. A conflict of interest arises where an ecologist employed on a project has an interest which conflicts (or might conflict, or might be perceived to) with the interests of the employer. Examples of this are: working for or having worked for a competitor; having a pecuniary interest such as shares or performance incentives; having a relative working for the local authority processing the application; being a member of an NGO with direct interest in the application. The key question to ask when considering whether an interest might create a conflict is: **Does the interest create an incentive for the employee or contracted person to act in a way which may not be in the best interests of the employer or client?** If the answer is 'yes', a conflict of interest exists and the ecologist should discuss this with their employer to investigate options to declare and address the potential conflict rather than not carry out the work. The existence of the incentive is sufficient to create a conflict. Whether or not the ecologist employee / contractor would actually act on the incentive is irrelevant.

Personal bias should also be declared. This arises when an ecologist is a personal friend, relative or associate of the employer or client – a relationship that might (or might be perceived to) bias the interpretation of potential ecological impacts unduly in favour of the interests of the employer or client.

Facts, professional judgment and personal opinion. Ecologists understand interconnectedness in the environment. They are skilled in assigning ecological value to biodiversity components and identifying potentially harmful activities through the environmental impact assessment process. The IAIA Special Publication No. 3 *Biodiversity in Impact Assessment* says:

> "Biodiversity matters to everyone. Its loss impoverishes the environment and reduces its capacity to support people now and in the future. Impact assessment can help to ensure development is compatible with the conservation and sustainable use of biodiversity". (International Association of Impact Assessment (IAIA), 2005)

Ecologists generally (though not universally) have a personal commitment to ensure that loss of biodiversity is minimised. It is important that this personal commitment is clearly differentiated from professional judgment and advice.

Personal interest in a particular species, group or location developed over a long period of study should not be allowed to cloud professional judgement. Peer review and use of objective measures of assessment can help to separate personal bias from professional perspectives.

Of great importance is **professional integrity**. The ability to state an impartial ecological view is vital for credibility and avoidance of conflict. This can be difficult to achieve in a litigious setting, where expert witness briefs may be limited in scope and/or employers/clients may apply pressure for the evidence to support their particular case. In such polarised situations, it is best to stick to ecological facts and holistic perspectives, to avoid being lured or manoeuvred into a perceived intellectual capture by the employer or client. The *Environment Court of New Zealand Practice Note* (Environment Court, 2014) notes that material gaps or omissions in evidence should be declared – the same should apply to undertaking impact assessment.

In ecology it is rarely possible, if ever, to prove that a particular outcome will definitely occur, so uncertainty and differences in opinion are acceptable traits of an investigation. Variation in judgement may also reflect real environmental variation but opinions are only valid when they are based upon appropriate evidence or knowledge based on considerable professional experience, peer review and cross-referencing.

Expert professional judgment develops with time and experience. An ecologist should recognise their lack of expertise in an area and not make judgments or assessments for which they feel inexperienced. Others in the project team or mentors outside the project or company should be consulted.

An ecologist's findings should address only ecological matters, and not incorporate areas outside their expertise. The ecologist should clearly spell out the implications of their findings to assist decision-makers to make the decision, rather than attempt to direct the decision itself.

2.4 Employers and clients

Without employers or clients to pay fees or salaries, there is no profession. In this section the term 'client' is used to cover providers of long term employment and short term contracts or consultant work. It encompasses the ecologist preparing an EcIA report, the specialist providing information about a specific ecological aspect, and the ecologist advising local authority planning staff receiving an application and EcIA report.

The ecologist advising a project proponent has a duty to his or her client:

- To have a good understanding of the project for which the assessment is being done prior to accepting the job.
- To make the client aware of the full range of ecological components of the project, even if not explicitly briefed to do so (for example, permit or biosecurity aspects that may arise during construction or operation).
- To make the client aware as soon as possible of major ecological values and/or risks associated with the project.
- To be honest and trustworthy – to avoid misrepresentation or obfuscation.
- To respect obligations of confidentiality and privacy.
- To provide accurate information and advice in a clear written, illustrated or verbal form; to consider the recipient and to make the ecological information as accessible and understandable to them as possible.
- To explain ecological work and conclusions fully and answer questions openly.
- To ensure that the client is aware of the limitations of any ecological work caused by timing or resourcing issues outside the ecologist's control (and notified where possible before work is carried out).
- To act professionally in relation to time-keeping, incurring expenses and invoicing.

In relation to EcIA work, the ecologist working within a local authority has a duty to:

- To have a good understanding of the project for which the assessment is being done.
- To be aware of the full range of ecological components of the project, (for example, permit or biosecurity aspects that may arise during construction or operation).
- To be honest and trustworthy – to avoid misrepresentation or obfuscation in discussions with other staff, the applicant or in reporting.
- To respect obligations of confidentiality and privacy.
- To ensure that the scale of assessment carried out is appropriate for the proposal.
- To provide accurate information and advice in a clear written, illustrated or verbal form; to consider the recipient and to make the ecological information as accessible and understandable to them as possible.
- To explain ecological work and conclusions fully and answer questions openly.
- To act professionally in relation to time-keeping and other administrative matters.

An ecologist should promote the highest standards of ecological investigation and advice to the client and to other members of any team working on a project.

Clients using the services of an ecologist often have a poor understanding of the natural environment – the ecologist should be able to explain their subject clearly, especially in relation to the uncertainty surrounding assessment of effects on ecosystems and biodiversity. Sometimes, a client may not agree with the findings in an ecological report or recommendations put forward, and seek changes in content or wording, posing an ethical dilemma for the ecologist. While each situation will be different, the ecologist's general options to deal with this include:

- To discuss the points at issue with the client for clarification of meaning and implications in relation to the project; and/or
- To discuss the matter with ecological colleagues for review of content and/or format.

Many clients (especially government departments) will have their own 'environmental policy' or similar documentation. An ecologist should find out whether this exists, and what it says, as part of taking on a project. Any potential conflicts between the project and the client's in-house environmental policy should be identified and acted on as soon as possible.

2.5 Continuing Professional Development

A professional ecologist should keep up to date as far as practical – the focus should be on his or her area of particular interest and expertise. It is important for ecologists carrying out EcIA to be familiar with the relevant sections of the RMA and Conservation Acts, and to follow reforms to this legislation. An ecologist should also be familiar with relevant policy documents. However, the ecologist should seek the assistance of a lawyer or planner for a detailed interpretation of legislation.

It is important for an ecologist to work with specialist sub-consultants or colleagues in areas where he or she is not skilled or does not have the appropriate level of understanding. Seeking assistance to provide better advice should not be considered a negative, but instead a benefit through information and knowledge sharing.

There is no organisation specifically representing professional ecologists in New Zealand. EIANZ is the leading professional body for environmental practitioners in Australasia – it has a Special Interest Section for Ecology. Currently[7] 60 members (of which only three are based in New Zealand) clearly identify themselves as 'ecologists' although it is likely that more are trained and practising as ecologists. The EIANZ database of members, certified practitioners (CEnvPs), contacts and subscribers lists over 150 professional ecologists. Ecological topics feature strongly at EIANZ conferences and workshops in both countries.

The trans-Tasman 'Certified Environmental Practitioner' (CEnvP) Scheme recognises experienced ecologists through both a general certification and a specialist 'Ecology' certification process. Certification is gained through application, referee reports, ethical behaviour, work experience, interview and a commitment to undertaking 50 hours of Continuing Professional Development (CPD) over each two year period.

To ensure that standards of professional practice are maintained it is important that an ecologist undertakes CPD.

CPD can also provide an opportunity to meet other ecologists and professionals, which can contribute to best practice standards of work.

The New Zealand Ecological Society and the Ecological Society of Australia are organisations that promote the study of all aspects of ecology. They hold annual conferences and occasional joint conferences, where ecologists can come together, present research results and exchange ideas. They publish journals and newsletters. These organisations thereby set standards for ecological competence, without having defined guidelines or criteria for professionalism. Membership of the relevant Ecological Society is an essential requirement for practising ecologists in New Zealand and Australia.

[4] October 2014.

3 Scoping

Scoping
Key points

Scoping an EcIA is the process of determining the broad type and nature of biodiversity and ecological features, and the potential effects of a project or development. These guide the appropriate scale and scope of further investigations, project development, impact management, and monitoring which will make up the full ecological impact assessment.

At this stage, the lead ecologist needs to cast a **wide net** over the project, ecological values, issues and options **to inform the client** in relation to project design, risks, timing and financial resources.

Ecological findings and recommendations at this stage should be **documented**.

Project features to investigate include:

- Proposed **activities and methodologies** throughout construction, operation and decommissioning
- **Location** of activities
- **Timing and duration**
- **Quantities and areas** involved

Liaison with other project team members is important to ensure that environmental information is shared and that there is a **common understanding** of the project components. A **map defining boundaries** of areas such as zone of influence, study area, and project site is essential.

Scoping should report on:

- **Existing ecological features and values**
- **Potential effects** and ecological issues
- **Options** for project development, impact management and monitoring
- Requirements for full or **further investigations** and reporting to meet legislation

Methods will include:

- **Desktop** /online searches and review of published information
- **Site visit**
- Establishing **ecological values** based on limited data
- **Limited consultation** with stakeholders and local experts

The ecologist has to address the **limitations** that may be imposed on Scoping in relation to time/timing, resources, early stage project development and lack of integrated planning between project team members.

3.1 Introduction

In some countries, such as Australia and the UK, the first step in the EcIA process required by law is '**screening**'. This determines the need for an assessment process. In the UK[8] an environmental impact assessment is not always required by law, but can be sought through a formal process under the EIA Directive 2011/0080 (European Parliament, 2011). In Australia, too, different types of project trigger the need for an EIA.

In New Zealand, screening is a general assessment of the need for an EcIA carried out prior to embarking on RMA processes. Any application for resource consent must provide some environmental information through an Assessment of Environmental Effects; the type and extent of information depends on circumstances as set out in Schedule 4 of the Resource Management Amendment Act. An ecologist should consult with the client's legal and planning advisors to clarify the type of application and therefore the type and level of detail required for an individual application.

Scoping discussed in this Chapter refers to the first step in an ecological assessment carried out in association with a project for which consent under the Resource Management Act or Conservation Act is required.

Scoping may also be referred to as 'gap analysis' or 'fatal flaws analysis'.

[8] *Guidelines for Ecological Impact Assessment in Britain and Ireland: Terrestrial, Freshwater and Coastal* (Institute of Ecology and Environmental Management, 2011) page 10.

3.2 Matters to cover in scoping

Ecological **Scoping** is the process of determining the broad type and nature of biodiversity and ecological features and the potential effects of a project or development. It is a guide to the appropriate scale and scope of further investigations, project development, mitigation and monitoring carried out during the full ecological impact assessment.

Scoping may be carried out by an experienced ecologist working alone, or a team. The need for specialist ecological input at this stage will depend on individual skills, the diversity of the environment and the complexity of the project.

Through initial site and desktop investigations, an ecologist can make preliminary observations of key biodiversity and ecological features and the constraints or opportunities these may pose to the project. A wide net should be cast over ecological features, values, processes, effects and options to provide a base for making decisions about the development of both the project and the EcIA. Information from a wide range of sources – desktop and site-based – should be collated and analysed.

Scoping is also an essential step in informing the project proponent of further surveys or investigations, stakeholder consultation, statutory implications, and design and mitigation options, at an early stage in project development.

It also provides information about the scale of the biodiversity and ecological values and effects on which to base time and costs estimates for further ecological work (and its integration into project development). Time and funds spent on project scoping, can prove valuable in early identification of issues and opportunities that can be addressed efficiently through later project design or operational changes.

While a scoping report is not always required by a client or regulatory body, it is a valuable discipline to record clearly all data, information and analysis so that it can be referred back to later in the assessment process. Scoping should be described in a final EcIA Report. It is also necessary in preparing evidence or answering questions at a hearing, or when the question of alternatives is raised, to be able to explain why certain ecological matters were omitted or included in full investigations and assessments.

At this stage too, the use of peer reviewer(s) should be considered. Peer review, especially in a complex project, provides the lead ecologist and client, employer or project developer with an independent appraisal of strategy, methods and reporting.

The CIEEM *Guidelines for Preliminary Ecological Appraisal* (Chartered Institute of Ecology and Enviromental Management (CIEEM), 2013) provide some site and deskwork guidance relevant to Scoping in New Zealand, but are generally tailored to the UK planning provisions.

3.2.1 The project

It is critical to understand the project being assessed. This is sometimes difficult at the earliest scoping stages, since the project itself may be in early development stages. However, for scoping purposes the ecologist needs to know answers to:

- What is the project about? For what activities are consents being sought? Are these activities continuous or occurring at certain times? A map drawn up by the project proponent is preferable at this stage to avoid any misunderstanding about locations and areas.
- What is the location of the activity or activities and for what duration? What will construction activities be and what will operational activities be? If relevant, what decommissioning activity is planned? Does the project have effects away from the main site?
- What spatial extent – how much land or water? This should include activities away from the main site even if not covered by consent application, since these may have ecological/biodiversity effects.
- At what time of year is construction work planned, and will operation have any seasonal or annual differences?
- What quantities of water or climatic/weather conditions are required? What land, water, geological, soil or other environmental conditions constrain or determine the project location and/or operation?

3.2.2 Project team

Liaison with other environmental practitioners involved in the project should occur as early as possible. Ideally, the project manager will convene a meeting of all professionals at the start of the project, but this is not always done. The ecologist should make contact with project staff or consultants involved in land and water investigations, to ensure consistency around base information, assessment methods and project development options. Liaison with a person working on cultural assessment may be appropriate on some projects.

It is important at the scoping stage that ecological investigations are based on correct understanding of parameters such as water quantity and quality, underlying geological or soil conditions, landscape attributes, and cultural values. The ecologist should also make other environmental practitioners aware of any need for specific data or information collection as part of their investigations. For example, if water flows are to be monitored for baseline data collection, the ecologist may want to suggest a monitoring point relating to potential ecological values to assist in scoping.

3.2.3 Defining spatial scale and extent

Before describing the site it is helpful to define and map the boundaries of the site, activities and effects. These vary greatly between projects, activities and ecological features and processes, and terms have to be decided according to the project and ecological features being assessed.

The term 'zone of influence' (ZOI) is used in the UK to encompass the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities (Institute of Ecology and Environmental Management, 2006). The extent of the ZOI will depend on:

- species, communities and ecosystems likely to be affected; and
- temporal and spatial scale of potential effects on them.

The extent of the ZOI should be revisited during the course of scoping and investigations as more information becomes available. It extends the potentially affected area to provide for description and assessment of effects on mobile species (e.g. migratory fish or birds), up or downstream habitats (e.g. in river systems) and on regional or national populations (e.g. of rare plant species).

The study site is then considered to be defined by the outer boundaries that encompass the core project investigations. These boundaries may be determined (as appropriate) by land parcel boundaries or wider geographic features such as catchments, waterbodies or roads.

The project site or 'envelope' (sometimes 'corridor' for linear features) describe bounds within the study site within which the project will be undertaken. Often this is the space within which consent for an activity or activities is sought. For example, in a roading project it is common to have a 'construction corridor' or 'footprint' which will be disturbed by construction work and within which a 'road corridor' will be the final road footprint.

As the project develops, there may also be 'exclusion zones' or 'buffer zones' which are specific areas that are specifically excluded from the project site (often as a result of surveys in order to protect existing ecological values.)

3.2.4 Ecological features and values

The scoping process should identify ecological features and values of the study site and ZOI, including those values recognised through statutory processes and publications. A preliminary map of vegetation types or habitat types should be prepared, together with a list of biota. Preliminary assessments should be made of:

- Ecological values in the ZOI based on national, regional or local databases or publications.
- Biodiversity quantity/area (although this may be only an estimate at the preliminary stage).
- Ecological trends and vegetation/habitat quality.
- Ecological services provided by the study area.
- Complex areas such as terrestrial/freshwater transitional zones.

3.2.5 Effects and issues

The preliminary assessment of effects should be based on what is known about the nature of the project and values established during scoping investigations. At this stage, the aim is to identify:

- Key potential adverse (and beneficial) effects on ecological features and biodiversity values.
- The issues that they raise for project design, construction, and operation.
- Any issues for the consultation and consenting processes.

The ecologist needs to ensure that these outcomes are presented clearly to help the project proponent understand their implications. This may be in the form of a report or memo. Simple mapping of key areas of potential value will assist in project decision making and planning further investigations.

It is also important to identify the limitations around the information on which these preliminary assessments are made (see Section 3.4 below)

3.2.6 Addressing adverse effects

The RMA states that every person "...has a duty to avoid, remedy or mitigate any the adverse effect on the environment..." (RMA 1991, S17) and this is fundamental to the way that adverse effects are addressed.

The meaning and use of some words associated with 'mitigate' are still developing through case law[9] and the ecologist should be familiar with current interpretations and take legal advice in using the terms. Mitigation actions can include restoration, rehabilitation, and minimising adverse effects. When adverse effects cannot be mitigated, biodiversity offsetting or compensation should be considered.

This is discussed further in Chapter 7 Impact Management.

In practical terms, the ecologist's role is to identify those ecological values which are so high that impacts on them should be avoided by the project; and to provide advice on other impact management options for achieving the best outcomes for indigenous biodiversity in those situations where avoidance is not possible.

At the scoping stage, the ecologist should indicate general options to avoid, remedy, or mitigate the potential adverse effects on ecological and biodiversity values. It is important to discuss avoidance at the scoping stage, since it is likely that the project development is also at an early stage when changes may be more easily made. A client may explicitly ask for a 'fatal flaws' analysis i.e. are there any aspects of the proposal that make it impossible to avoid, remedy or mitigate adverse effects?

Legal or planning advice should be taken where words such as 'reasonable' or 'practical' are used in relevant statutory documents to describe the extent to which each of the actions is applicable or acceptable.

At the scoping stage, options to address effects that should be discussed with the proponent and project team include:

- **Avoidance**: ways in which the project might be modified to avoid effects on areas or features of high ecological value. Further investigation may be needed to refine the boundaries of areas to be avoided. Avoidance will need to consider the nature of the activity, sensitivity of the ecological features concerned, and the financial implications of avoidance and any residual adverse effects.
- **Minimisation**: refining areas disturbed by construction or operation to minimise effects on areas of biodiversity or ecological values. Adverse effects may also be minimised through restricting timing or duration of activities, or by screening, shielding or buffering areas from disturbance.

[9] Biodiversity Offsets – the latest on the law (Christensen & Baker-Galloway, 2013). Anderson Lloyd Lawyers. Also NZHC 1346 *Royal Forest and Bird Protection Society Inc vs Buller District Council*.

- **Remediation/restoration/rehabilitation**: these terms encompass options for work carried out at the site or close to the adverse effects and include: transplanting, translocating fauna, planting to enhance existing vegetation or create new areas of indigenous vegetation, plant and animal pest management/control, physical habitat enhancement, flow regime modifications, fencing, and site protection.
- **Biodiversity offsetting**: at the scoping stage of an EcIA, the ecologist should consider whether offsetting is likely to be needed as part of the package of actions required to address potential adverse effects of the project. If an offset is likely to be needed, then the ecologist needs to discuss this with the project proponent and legal and planning advisors, and to advise on the way that this will influence further investigations and consultation. The selection, assessment and procurement of an offset site or sites may be a complex and time-consuming process, and this needs to be allowed for in project planning.
- **Compensation**: current interpretation of compensation is that it is a positive effect (in this case on biodiversity values) achieved through actions undertaken as part of the project but at another site.

At the Scoping stage a preliminary list of monitoring requirements should be drawn up (see Chapter 8).

3.2.7 Full assessment

The Scoping process will determine the need for, scope, and extent of further investigations to enable a comprehensive assessment of effects to be carried out. The Scoping should identify gaps in information which require:

- Further site work, noting need for seasonal or regular visits to try to establish patterns or trends.
- Additional expertise in: specific biodiversity topics such as herpetofauna, invertebrates, soil organisms, and dendrochronology; ecological context, such as hydrological patterns, geology or soils; and historical or cultural topics, such as traditional uses of sites or fossil records.
- Background/desktop research: for example, to enable a better understanding of trends in site ecology; restoration and rehabilitation techniques for specific plants or animals; past land or water uses associated with the site; and aerial photographic history of change.
- Consultation: general consultation about biodiversity/ecological values as part of overall project consultation; stakeholder consultation as part of any biodiversity offset programme; consultation with tangata whenua in relation to taonga species or traditional uses on site; and consultation with local amateur naturalists or professional scientists who have specific knowledge of the site, its biodiversity values or the potential effects of the project.

Scoping will enable the ecologist to prepare a methodology and programme for carrying out the full assessment and based on this, to estimate the scope of work, time and costs associated with the assessment, including preparation of reports.

3.3 Methods for scoping

3.3.1 Introduction

Scoping is intended to provide a relatively quick appraisal of the potential ecological effects of a proposal. To do this efficiently, the ecologist should select from a range of tools and methods to work at both the site and desktop levels. The information gathered here can also be incorporated into the main baseline information where appropriate.

Links to the most commonly used desk-top sources of published information are given in **Appendix 2** and the reader should refer to the more detailed discussions in Chapters 4 and 5 of these NZ Guidelines. At the scoping stage, information should be gathered from, at minimum:

- Aerial photos from Google, Bing websites as well as those held by local authorities.
- Local authorities' websites, publications (e.g. SNA assessments), databases and GIS viewers, strategies, policies and plans.
- Land Environments of New Zealand (LENZ).
- Freshwater Ecosystems of New Zealand (FENZ).
- Landcover database (LCBD).
- Scientific journals and interest group publications.
- Protected Natural Area (PNA) programme reports, if available.

3.3.2 Site visit

A site visit at the scoping stage is needed to confirm or review boundaries as well as to become familiar with the location itself and ecological features of the project site. It is usually best to undertake the site visit after some initial desktop investigations have been done, including studying aerial photographs. At this stage a preliminary vegetation or habitat map should be drawn up and a description of the existing environment developed. A basic Scoping Site Check-list for a simple site is presented in **Appendix 3** and encompasses terrestrial and aquatic features – it should be expanded and modified for a larger site, or more complex project with a large ZOI. This lists the essential information that should be collected during an initial scoping site survey, and forms the basis of a Record Sheet to be taken into the field as well as of the more comprehensive site record sheet that can be developed during the course of later investigations.

3.3.3 Method to assign value

At the Scoping stage an initial evaluation will be made of the value of:

- plant and animal species and communities;
- ecosystems and habitats; and
- places, sites or areas.

Evaluation should be based on:

- National databases – particularly the threat lists for species (see **Appendix 6**) and ecosystem types (see **Appendix 4**)
- Regional or District Plans for priority species or ecosystems
- Published local lists or maps of occurrences and distributions, such as may appear in Regional or District Plans, Botanical Journals, Ornithological Society Atlas (see **Appendix 2**)
- Discussion with local experts – both professional and amateur naturalists (this may be limited by confidentiality requirements at the scoping stage)
- Site survey

More details on assigning value are given in Chapter 5.

At the scoping stage the published lists should enable a simple/general biodiversity or ecological value to be assigned to species and ecosystem types (for example, low, moderate, high, very high). However, because different publications have different ways of describing, ranking, valuing or scoring species, ecosystems and places the ecologist will need to develop a system to make these comparable and consistent. For example, to establish comparability between a species considered to be 'Nationally Threatened – Vulnerable' with an ecosystem type considered 'Critically Endangered'.

As a guide, at the Scoping stage, the following precautionary approach to assigning values for species and ecosystems is proposed in **Table 1**.

Table 1 Assigning values to species and ecosystems

Determining factors	Value
Nationally Threatened species found in the ZOI or likely to occur there, either permanently or occasionally	Very High
Species listed as At Risk – Declining found in the ZOI or likely to occur there, either permanently or occasionally	High
Species listed as any other category of At Risk found in the ZOI or likely to occur there, either permanently or occasionally	Moderate-high
Ecosystems considered Critically Endangered, Endangered or Vulnerable (Holdaway, Wiser, & Williams, 2012)	High
Locally rare or distinctive species or ecosystems	High
Waterways with high MCI and good water quality but not appearing to support any of the above species	Moderate
Waterways having low MCI and low water quality	Low
Indigenous species not threatened	Low

These assigned values should be reviewed as part of the full investigations (see Chapter 5).

At the scoping stage, areas or sites should be evaluated against traditional conservation matters, again using a simple high/moderate/low ranking:

- Representativeness
- Rarity
- Distinctiveness
- Diversity and pattern
- Ecological context

Carrying out this evaluation using readily accessible material will also identify gaps that need to be addressed during full investigations to enable the full assessment to be made.

3.3.4 Consultation

As well as being an important part of project development and the consenting process, consultation during the scoping stage is a useful tool for gathering local and professional input on ecological values. Consultees may also provide innovative ideas for mitigation or compensation. It is more appropriate for discussions to be held with individuals or small groups, than in large public meetings or similar situations.

For reasons of project confidentiality it may not be possible to consult with the public during the scoping stage of a confidential project; however, some consultation with statutory organisations on a confidential basis may be sought. This can provide information about the proposal's location or similar developments to provide a context for assessing cumulative effects. The local or central government organisations may also provide an indication of the regulatory position on the proposal, and biodiversity or ecological issues.

As part of the Scoping reporting, there should be a summary of consultation done and an outline of further consultation needs. The later stages of assessment should demonstrate how the consultees' comments have been addressed or explain why they have not been.

3.4 Scoping issues

A statement may be needed about the certainty or confidence levels associated with findings or predictions made in situations where the scoping stage has been influenced by limitations.

It is important to indicate when a report and any recommendations have been prepared using limited data. There is unlikely to be time for full site surveys of all plants and animal groups, and the time of year/season of the scoping site work may limit the chances of seeing the full range of biota that use the site (or the project's ZOI). Weather conditions or access issues may also limit survey work. Data collection may have been restricted by the scope of the client's brief and funding.

In the early stages of a project, all aspects of the project activities may be ill-defined. The ecologist needs to recognise this, and when investigating or reporting, state the parameters that have been used.

A key element will be how the zone of influence of a project is determined. This will differ for different ecological features and for different development activities, and mapping it out or defining it underpins the whole evaluation and impact assessment process that follows. This zone of influence should form the spatial scope of the scoping assessment although it may be modified for the full assessment. It is important to be clear on site boundaries so that scoping of ecological and biodiversity values and effects is consistent with other assessments or investigations being undertaken concurrently.

Similarly, it is important to ensure that a consistent temporal scope is used when discussing whether or not effects are permanent or temporary. In projects with a decommissioning phase, such as wind farms, the temporal scope can often be defined by the time from the start of construction to the end of decommissioning.

The assessment process is iterative. Ideally, project proponents and their development teams will be prepared to review project design, construction or operation in the light of Scoping findings and then provide time for re-assessment. The ecologist should be professional in keeping their client informed of findings that may be significant for the project, and presenting information in a timely and effective manner. However, occasionally the proponent may not take the Scoping report advice into consideration in project development. At this point the ecologist may have to reconsider their further involvement in the project team.

4 Description of existing environment

Description of existing environment
Key points

The description of the ecological features and processes in the existing environment is a **critical basis** for assigning a value to biodiversity and ecological features and for a comprehensive assessment of effects. It **builds on** the initial findings of the Scoping stage.

It should include information on:

- The **spatial context** in which the project is set or may have effects
- The **physical environment**
- **Flora, fauna, ecological processes and ecosystem services**

The description should use one of the established **national, regional or local frameworks** to set the spatial context, selecting the ones most appropriate to the type of environment and likely effects.

Physical environment data may be supplied by other professionals working on the project, and the ecologist should liaise with them to ensure that **relevant** physical environmental information is provided.

The biological components or features should be described in terms of **sites, species, habitats and ecosystems** and information should be taken from **existing sources and field surveys** specifically carried out for the ecological impact assessment.

Sources of existing information will include: **publications, websites and individuals or organisations**. Existing information **should be reviewed** to ensure its **adequacy** for the proposal being assessed, its age or **currency**, **accuracy**, and **completeness**.

A **site survey** is almost always needed to prepare a comprehensive description of the environment. Many survey methods are available for specific biological features and some of these are recognised as '**standard**'. The **rationale** for choice of survey method and any variations from standard should be well documented, as well as any **assumptions** or **limitations**.

4.1 Introduction

A description of the existing environment is the basis for evaluation of the importance or value (Chapter 5) of the environment, and an assessment of impacts (Chapter 6). Although not explicitly stated in the RMA, a good description of the existing environment is an essential basis for preparation of an Assessment of Environmental Effects (RMA s88 and Schedule 4.)

In New Zealand, the term 'existing environment' is by convention used to refer to the ecological features being assessed in an Ecological Impact Assessment. The RMA term 'receiving environment' is also used, particularly when referring to the adverse effects of a discharge or emission. A description of the existing environment should describe ecological features or components, and reflect the fact that the spatial and temporal zone of influence of an activity will vary among different biological and physical components and processes. It should also include descriptions of past and ongoing changes of the site or sites and systems, i.e. the trends and processes occurring in the absence of the proposal being assessed.

Typically, a description of the existing environment will review existing information and/or collect new information in order to:

- Place the ecological features and/or site within a broad spatial context, usually with reference to existing spatial schema, such as Ecological Districts or Land Environments of New Zealand (LENZ).
- Describe and interpret the physical environment and processes of the features/site (e.g. soils, geology, topography, climate, hydrological features, geomorphological processes).
- Describe and interpret the flora and fauna that potentially would be affected, at appropriate organisational and temporal scales (e.g. species, communities, ecosystems).

4.2 Spatial frameworks

To provide a meaningful description of a site, it is necessary to place it within its broader ecological context. In New Zealand this usually entails discussing the site with reference to some or all of the following national frameworks for terrestrial and freshwater ecosystems[10]:

- Ecological Regions and Districts (Biological Resources Centre & Department of Conservation, 1987). A system of 85 Regions encompassing 268 Ecological Districts. Ecological Districts are areas that have characteristic landscapes and biological communities. They form the basis of ecological description and protected area planning.
- Land Environments of New Zealand (LENZ) (Leathwick et al., 2003). A quantitatively-based classification of New Zealand's terrestrial environments and environmental parameters (https://lris.scinfo.org.nz/search/?q=lenz).
- New Zealand Land Cover Database (LCDB). A digital map of the land surface of the country based on satellite imagery. Version IV is at https://lris.scinfo.org.nz/layer/412-lcdb-v40-land-cover-database-version-40.
- The Land Resource Information (LRI) System. http://lris.scinfo.org.nz/layer/76-nzlri-land-use-capability. This is administered by Landcare Research and includes the New Zealand Land Resource Inventory (NZLRI), the National Soils Database (NSD) and information on Fundamental Soil Layers (FSL). Land Use Capability units are based on the LRI polygons.
- The River Environment Classification (REC). The REC maps rivers that have a similar character across New Zealand. https://www.mfe.govt.nz/environmental-reporting/about-environmental-reporting/classification-systems/fresh-water.html.
- Freshwater Ecosystems of New Zealand (FENZ). This geo-database provides an independent, national representation of the biodiversity values and pressures on New Zealand's rivers, lakes and wetlands. http://www.doc.govt.nz/conservation/land-and-freshwater/freshwater/freshwater-ecosystems-of-new-zealand.

10 For brief reviews of these and other classification frameworks, see Singers et al. (2014) and https://www.biodiversity.govt.nz/resources/environments.

4.3 Physical environment and processes

A description of the existing environment needs to include a description of the physical environment and processes because these influence, and can be influenced by, the biological processes that 'play out' on or in this physical environment. The level of detail required regarding the physical environment will vary with the nature and scale of the activities being assessed, and the features present at the site. For smaller projects, the ecologist may simply need to describe these features from existing data sources.

Larger projects (e.g. damming, diverting water, road construction, or mining) may result in substantial alteration of the physical environment and/or physical processes.

In these larger, multi-disciplinary projects, ecologists will often need to synthesise and interpret multiple sources of information from a range of disciplines (**Table 2 Physical features and processes commonly described in 'Description of Existing Environment'**). This will usually entail collaboration with other experts throughout the EcIA process to ensure first, that the necessary physical data is collected and provided in a suitable form for the ecological description and assessment; and second, that the ecologist has correctly interpreted the data.

Table 2 Physical features and processes commonly described in 'Description of Existing Environment'

Feature	Sources of information
Geomorphological features and processes – landforms/topography, and fluvial, glacial, hill slope, tectonic, volcanic and other processes. In some cases, detailed analyses of slope, aspect, and elevation may be required to inform vegetation and habitat descriptions and assessments.	Aerial/satellite photographs (Including Google Earth) Topographic maps General geomorphological descriptions in existing books and reports Geological maps (e.g. OMAP) Site-specific survey data e.g. LIDAR (typically prepared by other specialists)
Soils – New Zealand soil classifications are described at http://www.nzsoils.org.nz	NZ Soil portal (Landcare Research website) https://soils.landcareresearch.co.nz/contents/index.aspx Soil maps Regional councils (e.g. Grow Otago)
Climate – temperature, rainfall, seasonal patterns, prevailing winds Hydrological features and patterns – river flows, lake levels	Regional council websites NIWA/Metservice Rainfall maps Site-specific surveys and/or compilations of existing data (typically prepared by other specialists)
Land use	Field observations Land Use Capability maps
Noise	Field observations Other specialists reports
Lighting	Field observations Other specialist reports

4.4 Biological components

Whilst the overall description of freshwater and terrestrial environments should provide a holistic account of the ecological features and/or site, it is usually convenient to start by breaking the description down by sub-categories, typically:

- Terrestrial vegetation; indigenous and exotic, including non-vascular plants
- Birds
- Bats
- Herpetofauna
- Terrestrial invertebrates
- Freshwater fish
- Freshwater invertebrates
- Freshwater plants
- Ecosystem processes and trends
- Ecosystem services

4.4.1 Review of existing information

A description of the existing environment will usually entail, at a minimum, a review of the existing ecological information sourced at the scoping stage. A more intensive search of peer-reviewed scientific literature and the 'grey' literature (unpublished, non-peer-reviewed reports etc., which must be treated with particular caution) should be carried out, focusing on topics raised through scoping. Extensive collections of more detailed/primary data can now be accessed on-line via various web services and user interfaces.[11] Important sources of data are listed in **Appendix 2**. Key starting points are:

From the scoping stage:

- Aerial photos from Google, Bing websites as well as those held by local authorities.
- Local authorities' websites, publications (e.g. SNA assessments), databases and GIS viewers, strategies, policies and plans.
- Land Environments of New Zealand (LENZ).
- Freshwater Ecosystems of New Zealand (FENZ).
- Landcover database (LCBD).
- Scientific journals and interest group publications.
- Protected Natural Area (PNA) programme reports, if available.

At the national level:

- The Terrestrial and Freshwater Biodiversity Information System (TFBIS) Programme provides access to fundamental data and information about terrestrial and freshwater biota and biodiversity http://www.doc.govt.nz/tfbis.
- Databases for birds, fish, amphibians and reptiles, invertebrates, weeds and pests.

At the regional or local levels:

- University theses
- Botanical Society publications and members
- Fish and Game New Zealand
- Museum records (for historical trends)
- Regional (council) databases and geospatial data layers

All data sources, including personal communications and websites, should be cited and acknowledged.

[11] Many are summarised at: http://www.doc.govt.nz/Documents/getting-involved/volunteer-or-start-project/funding/tfbis/biodiversity-data-landscape-diagram.pdf.

4.4.2 Adequacy of existing information

Having reviewed existing information, it will be necessary to determine whether this information provides an adequate basis for the Ecological Impact Assessment, or whether further information needs to be collected. Factors to consider in making this determination include:

- How comprehensive, up to date and reliable is the existing information? E.g. have recent surveys been undertaken?
- Will any particular species/habitat/vegetation type be affected? If not, less detail is required.
- What is the plausible magnitude of effects and how sensitive are the particular species or communities? E.g. detailed species characterisation of cultivated cropland/pasture is probably not required, whereas an indigenous wetland that will be affected would require a detailed survey.
- Can a species' presence, absence or abundance can be reliably predicted based on knowledge of the species habitat requirements and distribution? If so, a survey may not be required. E.g. where a site provides no suitable habitat for a particular species or group.
- How well-documented are complex areas such as ecotones and other transitional communities?

The rationale behind these decisions should be recorded at the time, and detailed in the written report. When these decisions are made in consultation with stakeholders, a formal record of their agreement (or otherwise) should be kept by all parties.

4.4.3 Biological surveys

In most cases, existing information will not be sufficient to support a reliable assessment of ecological impacts, and additional biological surveys will be required.

In general, more reliable and specific information (and therefore more thorough surveys) will be required where ecological risks are higher. Methods should be selected carefully and clearly described (in full or by citation of standard methods). The description of method should include: spatial scale; sampling design; location, duration and timing of surveys; equipment and personnel (including any training given); and data treatment.

Numerous detailed methods exist for various organisms, and new methods are constantly being developed. Ecologists need to ensure that they are up to date with current best practice when deciding what survey methods to employ. Survey methods for various taxa and ecosystems are too numerous to list here, but a good starting point for overviews and links to details of key methods is the Department of Conservation inventory and monitoring toolbox (http://www.doc.govt.nz/getting-involved/run-a-project/our-procedures-and-sops/biodiversity-inventory-and-monitoring). Other useful links to methods can be found on the websites of Landcare Research, the Ministry for the Environment, and professional societies such as the NZ Freshwater Sciences Society. Recent ecological assessments of similar projects should also be referred to, as should the New Zealand ecological literature. Methods involving sampling and statistical analysis may be necessary in projects of greater complexity.

The rationale for the choice of methods should be clearly explained. This is particularly important if standard methods are not used, if new methods are developed, or if the particular methods have been agreed on through consultation with stakeholders.

Decisions about the type and amount of information required will be have been made initially at the scoping stage of the EcIA. However, characterisation of the existing environment is often an iterative process, particularly on larger projects where initial findings inform decisions about the need for further surveys. Where methods have changed over time, the changes and the reasons for the changes should be explained.

Assumptions and limitations of the methods (including any problems encountered) and resultant data and conclusions should be described and discussed. It is often helpful to include a separate 'Data Limitation' section in written reports (including in any summary) that explicitly discusses these limitations.

Approvals to undertake certain biological survey methods may be required (e.g. animal ethics, authority to handle wildlife, collecting on DOC public conservation land).

4.4.4 Scope of biological description

The description of the terrestrial and freshwater components of the environment should include:

- A description of the vegetation including species lists and classification of vegetation types. The level of detail provided will vary, but may range from broad narrative description, to formal vegetation classification (e.g. following Atkinson (1981); Johnson and Gerbeaux (2004); and Singers and Rogers (2014)).
- A more detailed analysis of the areas of various vegetation types may be required, typically presented as tables listing vegetation type, area, and percentage of site (or sub-site) occupied. This should be supported by a vegetation map of the same vegetation types. A clear legend, easily-read scale (that is 1:100,000 not 1:98,574) and north pointer are essential.
- A representative set of photographs, with clear captions pointing out important vegetation and other features. Set photopoints may be established if likely to be useful through the project.
- An evaluation of existing vegetation condition and comments on likely future condition, taking account of influences such as grazing, pest animals, invasive plants, and land use practices. Where historical data is available, comment on vegetation history and changes should be included.
- Descriptions of fauna, which may range from simple records of present/not recorded through to detailed quantitative data. (n.b. 'not recorded' does not necessarily demonstrate absence).
- Information on how animal species presence or abundance varies over time (e.g. in relation to tides, day/night, feeding resources, breeding or migration seasons), or in relation to other factors such as weather and availability of food (on and off-site).
- Assessments of the quantity and quality of type of habitat available for fauna at various times of year or life-cycle (e.g. breeding, spawning, foraging, refugia, roosting sites, pre-migration 'staging' sites, terrestrial and aquatic migration routes)
- For both flora and fauna, comments on notable species or communities e.g. species at limits of distributional range, new records, lack of records of expected species. Are the species/communities typical/representative/unusual?
- Explicit description and discussion of Threatened and At Risk species, or other species of conservation concern (e.g. trans-equatorial migrant bird species).
- Description and threat status of ecosystem types found – threat status is a work in progress nationally; also may be available regionally in Auckland, Waikato and any other region where data exists at appropriate level. Information about ecotones/transitional ecosystems is scarce.
- Comments on the ecological context of the communities, including notes on the location of important vegetation and habitats in the general vicinity.
- Comments on the recreational use of the biological resources of an area for fishing, hunting or other recreational activities (drawn from any recreation or social impact assessment work for the project).
- Comments on the cultural value of the biological resources of an area (drawn from the cultural impact assessment work for the project).

Ecological assessments often contain valuable new information and methodologies. Every effort should be made to ensure that such information remains in the public domain, in the spirit of contributing to collective ecological knowledge as well as drawing upon it. Data should be contributed to national databases where they exist (e.g. the NZ Freshwater Fish Database, NatureWatch). For some organisms (e.g. lizards), this may be a requirement of the survey or collection permit.

5 Assigning value or importance

Assigning value or importance
Key points

This is an area in which the **meanings of words** used must be particularly clear. 'Value' and 'importance' are used synonymously here.

Evaluation of ecological features is an expression of **societal values**, and these vary. However, those values can be informed by ecological science. As part of an ecological impact assessment, an ecologist is bringing together both **ecological science and societal values** assigned to ecological features or places.

Other values, for example cultural or educational, are not addressed here.

'**Significance**' has particular meaning under the RMA where a site, vegetation or habitat is considered either 'significant' or not; it is best to use the term only in this context. Ecological values occur along a **continuum** and an EcIA needs to recognise this.

A method is proposed to **rank ecological values from Very High to Low**, to assist in assessing impacts or effects according to a matrix method developed by Regini (2000). Full discussion of the rationale behind any rankings must be provided in an EcIA Report.

The ecological values of a **site** include **previously assigned values** – such as National Park or Significant Natural Area – and those found during the **investigations** carried out for the EcIA. **Species, communities, assemblages, and habitats** should be evaluated. The **spatial scale** against which they are valued will depend on the project zone of influence and existing frameworks and evaluations. Sites should be assessed using criteria drawn from traditional conservation **assessment matters** (representativeness, rarity, diversity/pattern, distinctiveness, and ecological context) or those prescribed by the relevant planning policy.

The ecological values of a species can be assigned according to **national threat classification** systems (recognizing the limitations of these) with **local or regional modifications** as needed. Introduced species may also be evaluated when relevant to the project.

Vegetation and habitats are valued using government's **"Protecting our Places"** (2007a, 2007b) guidance and regional and local priorities (Regional Policy Statements and schedules of significant sites).

When applying the criteria it is important to consider:

- How the area to be evaluated is **selected**
- How to **combine** the evaluation of areas or sub-areas
- What weight to give to any **evaluation in a Regional or District Plan**
- How to combine evaluations from different **sources of information**

There is no unifying set of attributes for assigning value to freshwater systems, although those used for terrestrials systems can be applied.

5.1 Introduction

Having described or characterised the 'existing environment', the next step is to assess the value or values of that environment, in order to ultimately assess the scale of predicted impacts.

By definition, evaluation of ecological features (sites, species, ecosystems, processes etc.) is an expression of human values. Individuals vary greatly in the value they place on any particular aspect of the environment. This chapter provides guidance on making ecological assessments that aim to consistently and transparently reflect the value that society – informed by ecologists – places on ecological features. The term 'value' is used synonymously with 'importance' in this document.

Areas of indigenous vegetation or habitat can also have recreational, cultural, landscape or spiritual values. Just as an ecologist may rely on the knowledge and information provided by another professional to assist in evaluation, ecological information may feed into these other types of value. These NZ Guidelines however, address only ecological value.

The term 'significance' has a particular meaning under section 6(c) of the RMA, and should be reserved for use in that context (discussed in 5.2.1 below). However, significance is not defined in the RMA. Significant /not significant is a binary condition – there are no degrees of significance. But the ecological value or importance of an area is a continuum ranging from (for example) none to very high. In general, an area of very high or high ecological value is likely to reach the threshold to be considered 'significant' under s6(c) criteria.

In this chapter, a method is proposed for assigning value for terrestrial sites that uses criteria that are consistent with those commonly used for significance assessment, but that allows for a ranking of ecological value, rather than simply assessing an area as 'significant' or 'not significant'. We also present a method for evaluating freshwater systems.

5.1.1 A matrix approach

Ecological features can be considered at a range of spatial and organisation scales (e.g. species, ecosystems, land environments; discussed below). A range of methods have been applied in New Zealand to assign value at these various scales, ranging from descriptive narratives, to highly structured formal evaluations such as threatened species lists for individual species, and the Land Environments of New Zealand classification (Leathwick et al., 2003). See **Appendix 7**.

Here, we propose a framework using a matrix to integrate these various levels of ecological evaluation and provide the overall assessments of ecological value that are required for impact assessment. The framework is based on guidelines developed by the Institute of Ecology and Environmental Management (Institute of Ecology and Environmental Management, 2006, 2011; Regini, 2000). The IEEM approach entails three main steps:

1. Ecological values are ranked on a scale of Low, Moderate, High, or Very High
2. The magnitude of effects on these values is ranked on a similar scale
3. The overall importance (or 'significance') of effect is determined by a combination of value and the magnitude of the effect.

This chapter deals with the first of these steps. Steps 2 and 3 are addressed in Chapter 6.

This matrix framework does not replace the need for rational interpretation of ecological data based on a sound understanding of environmental principles; an impact assessment always requires professional ecological judgement. The EcIA report must explain the judgement; in simple cases a matrix approach may be an unnecessary addition. Placing ecological interpretation within a standard framework should lead to more consistent and transparent assessments of effects. The approach may be especially suitable for large, complex projects. An example of this is the Transmission Gully Ecological Assessment (Boffa Miskell Ltd, 2011), which used this approach to bring together extensive data on a wide range of ecological features. We draw heavily on this example in this chapter and chapter 6.

5.1.2 Sites to be assessed

Ecological evaluation typically comprises assessment of:

a. Sites that have previously been recognised as having ecological value and assigned a value

Many projects will potentially affect sites that have already some assigned value and level of formal protection based partly or entirely on their ecological values (e.g. National Parks; conservation areas and reserves; areas identified by territorial authorities as significant areas of indigenous vegetation or significant habitats of indigenous fauna under the RMA; and covenanted sites). They may also potentially affect sites that, although not formally protected, have been identified as having value in other ecological publications, e.g. Recommended Areas for Protection (RAPs) identified in Protected Natural Area Programme (PNAP) reports.

The fact that these sites have some existing formal status or level of recognition warrants consideration, and may require re-evaluation, as part of project investigations. Where the ecologist's evaluation differs from a previous evaluation, the reasons for this need to be explained (e.g. the extent of a RAP may have changed since the original surveys).

b. Sites identified in the course of investigations of the specific project (but not previously recognised as having value)

Assessments of ecological value of these sites will be based on the review of existing data and additional investigations (as described in Chapter 4)

5.1.3 Levels of ecological organisation

For any given site, it is conventional to assign value at some or all of the following levels of ecological organisation:

- Species (or in some cases sub-species or taxonomically indeterminate taxa).
- Assemblages or communities of plants and/or animals, especially when considering vegetation and soils ('vegetation types').
- Habitats of fauna. Whilst habitat may be determined by vegetation, it also includes abiotic components. Some habitats may have contain little or no vegetation (e.g. scree, sand or gravel spits, some freshwaters). Vegetation of low value in itself may provide habitat for high value fauna.

  Genetic and molecular levels of ecological organisation are not usually considered by EcIA.

When preparing an EcIA report, it is convenient to address these levels of organisation for terrestrial and freshwater systems separately. However, it is also important that these assessments can be drawn together to provide an overall higher-level assessment of value for a site or area.

5.1.4 Questions of spatial scale

Questions relating to spatial scale often arise, especially when dealing with impacts that may be spread over large spatial scales, sometimes in a fragmented manner: what sized units of vegetation or habitat should be considered? At what spatial scale should they be evaluated e.g. local, regional, national, or international? How should local authority boundaries be addressed in relation to Ecological District boundaries?

There are no consistent definitions of 'local' or 'regional'. Assessments vary between using the local authority boundaries (where generally, District = local, Region = regional) and Ecological Region and District boundaries as the spaces within which value is assessed. The latter system is most appropriate in ecological terms. However, there may be circumstances where due to overlaps or distances between Ecological District/Region and local authority boundaries, an ecological feature that is common throughout an Ecological District is rare in a particular local authority area, or vice versa. The EcIA should note this, so that it can be taken into account in the decision-making process.

Decisions about which ecological features and at what level of organisation and spatial scale to evaluate them are influenced by the assessment of effects and mitigation requirements. The values and effects on individual species should not be overlooked or amalgamated or averaged; but where there are likely to be effects of a similar level of significance, requiring similar mitigation actions, these can be addressed together at the community or assemblage level. For example, an area or site (such as a wetland) is likely to contain a variety of habitats, vegetation types, and plant and animal communities and assemblages having different values. These should be treated separately or grouped according to value, likely seriousness of effects, and mitigation opportunities for components.

5.2 Assigning value

5.2.1 Terrestrial sites or areas

The ecological value of a site or area is determined by the values of species, communities, and habitats found there. Value has aspects of both quantity (rarity or extent) and quality (functionality or condition).

The Regional Policy Statement, Regional Plan and/or District Plan for the site or ZOI location should be consulted first to determine what matters to consider and criteria to use to meet regulatory requirements. Broad consistency around "matters" and "criteria" for use with them are developing through recently notified Plans, applications and case law. However, if any of the matters or criteria in a planning document appear to be inconsistent with conservation science, this should be discussed and alternative or additional assessment work undertaken.

Where a site or ZOI has not been previously assessed by the territorial authority, and where the Plans do not provide evaluation criteria, terrestrial vegetation and habitats of fauna should be assessed according to the standard set of broad ecological matters set out in **Table 3 Matters to be considered when assigning ecological value to a site or area** below. These matters are now widely accepted. They are based on those described by O'Connor et al. (1990) and underpin New Zealand nature conservation.

Criteria[12] are needed to decide the extent to which the site exemplifies each matter. Criteria may be based on existing examples for similar environments or developed for the specific location. Canterbury Regional Policy Statement (CRPS 2013) and Auckland Proposed Unitary Plan (AC 2014) are given as examples, in **Appendix 5**, of the matters to be considered and criteria used for assessing ecological value and significance.

The Canterbury matters and criteria, together with a set of guidelines (*Guidelines for the Application of Ecological Significance Criteria for Indigenous Vegetation and Habitats of Indigenous Fauna in Canterbury Region* (Wildlands, 2013)) assist in their application developed by Environment Canterbury,[13] clarify their application. This addresses the difference between 'ecological value' and 'significance'. For some criteria, sites either meet the standard or threshold, or do not (e.g. presence of a nationally Threatened species). For other criteria, sites meet the criteria to a lesser or greater degree (low to high). A site has to meet the threshold for only one criterion to be considered 'significant'. Where the threshold lies for those criteria which it is possible to meet to 'some degree', has to be set locally. The 'not significant' sites are still recognised as having ecological value and can be managed according to the specific biodiversity or ecological values they support.

Table 3 Matters to be considered when assigning ecological value to a site or area

Matters	Topics for which criteria are needed
Representativeness	Extent to which area is typical or characteristic Size
Rarity/distinctiveness	Amount of habitat or vegetation remaining Supporting nationally or locally[14] threatened, at risk or uncommon species Regional or national distribution limits Endemism Distinctive ecological features Natural rarity
Diversity and pattern	Level of natural diversity Biodiversity reflecting underlying diversity
Ecological context	Contribution to network, buffer, linkage, pathways Role in ecosystem functioning Important fauna habitat Contribution to ecosystem services

[12] Criteria are principles or standards by which something may be judged or decided (Oxford Dictionary).
[13] http://ecan.govt.nz/publications/Plans/ecological-significance-indigenous-vege-canterbury.pdf.
[14] Locally – defined as Ecological Region or District depending on scale of proposal and impacts.

In relation to assessing the significance of a site, criteria are reviewed at: http://www.qualityplanning.org.nz/index.php/planning-tools/indigenous-biodiversity/describing-and-evaluating-biodiversity-values.

Maseyk and Gerbeaux (2015) compare the assessment of significant habitats as part of plan preparation in two Regions, West Coast and Manawatu-Wanganui. The authors summarise the important role played by these two cases in the development of criteria under the RMA.

5.2.2 Assigning value at the species level

'Conservation concern' at the national level is usually the focus of assigning value to terrestrial and freshwater plant and animal species. All indigenous species have some ecological value as a part of a functioning ecosystem, but an indigenous species that is under threat/at risk is of greater conservation concern than a more common, not threatened species. In assigning value to a species during EcIA, it is important to emphasise that 'low value' does not mean 'no value'. Species of low value may still be at risk of adverse effects and require mitigation action.

Generally, the NZ Threat Classification System (see **Table 4 New Zealand threat classification system**) assesses risk to species becoming extinct and can be used as a guide to species that should be considered in EcIA, although international migrant birds (categorised as 'migrant') should also be considered, and the IUCN system referred to where necessary[11]. The New Zealand Threat Classification System is specifically designed for New Zealand, and should be used in preference to other systems such as the IUCN system, unless there are good reasons not to (although the New Zealand system is complementary to the more global views of IUCN). Expert assessments of levels of threat and conservation concern of different plant and animal groups are made periodically, and lists published. The most up to date lists should always be used. Current lists and references are given in **Appendix 6**.

There may be valid reasons to disagree with the threat status of a specific species, such as insufficient or new information. If so, the ecological impact assessment needs to justify and provide evidence as to why the published status should not be accepted. The system for classifying threats to New Zealand species, by assessing risk of extinction, is described in the Department of Conservation manual, Townsend et al, (2008).[12]

Introduced species have lower ecological value under the RMA, but still need to be evaluated because they can have ecological value. This includes value as habitat for indigenous species, or where they are valued for non-ecological reasons (e.g. an assessment of effects on game birds may be needed to inform an assessment of effects on recreation).

Table 4 New Zealand threat classification system

Summarised from Townsend et al 2008

Threatened taxa
1. Nationally Critical
2. Nationally Endangered
3. Nationally Vulnerable
At Risk taxa
1. Declining
2. Recovering
3. Relict
4. Naturally Uncommon
Not Threatened

[15] http://www.iucnredlist.org.
[16] www.doc.govt.nz/upload/documents/science-and-technical/sap244.pdf.

In many cases it is also necessary to assess the value of a species at a local level; for example, where a plant that is widespread in other parts of the country (and therefore not on the national Threatened Species list) is not common in the Ecological Region or District in which the site being assessed is located. Comprehensive descriptions of Ecological Regions or Districts are not common. In some places a Protected Natural Area Programme (PNAP) survey may have been carried out and give an assessment of threat to species; however, many PNA surveys and reports are now out of date. A good way to assess current local conservation value of a species found at a site is through consultation with local experts in a range of plant and animal groups. This may include members of local groups such as botanical and ornithological societies. Herbarium or museum records may also be referenced.

In assigning values to use in assessing impacts, the ecologist needs to convert levels of threat into an expression of value, e.g. high or low value. A proposed conversion for species based on the national threat classification and extended for cases of local rarity or threat was set out in **Table 1** (Chapter 3) as:

Determining factors	Value
Nationally Threatened species found in the ZOI or likely to occur there, either permanently or occasionally	Very High
Species listed as At Risk – Declining found in the ZOI or likely to occur there, either permanently or occasionally	High
Species listed as any other category of At Risk found in the ZOI or likely to occur there, either permanently or occasionally	Moderate-high
Locally rare or distinctive species or ecosystems	High

The relevant Regional or District Plan may assist with this if threat-based criteria are defined for significance assessment, or a local level assessment of species value has been made by the local authority.

This evaluation is most straightforward for plants or where the animals are resident within the area covered. However, for migratory or highly mobile species the assessment will need to consider the importance of the area for their life-cycle. For example, an occasional record of a single bird would warrant a different value from regular visits by breeding birds. The relative values should be explained.

Knowledge about species' use of a site or area will always be incomplete. At the scoping stage, the EcIA must identify the important species and use the full assessment stage to gather sufficient information to assess their values. If this cannot be done, or there is uncertainty about the presence of a species, then this must be noted, and an expert assessment of value made and taken into consideration when assessing effects.

An example of how published evaluations could be aligned to assist in assessment is given in **Table 5**. Whatever method is used, it should be explained and documented in the Assessment report. This evaluation and alignment may be refined through the full assessment.

The role of a species in ecosystem services should be considered in the evaluation. However, there is no national or regional guidance on setting these values. The ecologist must assess this according to each site/ZOI and their understanding of the ecosystems involved. Ecosystem services are discussed further in 5.4 below.

[17] For a good example of description and assessment in Australia see: http://www.depi.vic.gov.au/__data/assets/pdf_file/0009/228771/VQAM-V1_3-Chapters-1-11.pdf.

5.2.3 Assigning value at the terrestrial vegetation, habitat or ecosystem level

There is no national system for classifying or prioritizing the full range of vegetation types, habitats or ecosystems.[13] Singers and Rogers (2014) present a new classification of ecosystems while Holdaway, Wiser, & Williams (2012) identify the threat status of originally rare ecosystems. Landcare Research work on the topic is ongoing. Currently DOC, Auckland City Council and Landcare Research are working on a prioritisation for ecosystems in the Auckland region.

The Government's "*Protecting our Places*" (2007b) identifies four National Priorities for Biodiversity Protection. This is not a statutory document, but represents scientific research and advice.

The four are:

- **National Priority 1**: To protect indigenous vegetation associated with land environments (defined by LENZ at Level IV) that have 20 percent or less remaining in indigenous cover.
- **National Priority 2**: To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.
- **National Priority 3**: To protect indigenous vegetation associated with "originally rare"[14] terrestrial ecosystem types not already covered by priorities 1 and 2.
- **National Priority 4**: To protect habitats of acutely and chronically[15] threatened indigenous species.

[18] Based on Williams et al (2007).

[19] Although changes have taken place in the naming used in classifying threatened species, in practice species that in 2007 were considered Acutely and Chronically Threatened would still be in the 'Threatened' or 'At Risk' categories under the new system. (Townsend et al., 2008).

Table 5 Possible evaluation system for ecological features

Species		Assigned value	Comment
Threat category (From Townsend et al 2008)			
	Threatened – Nationally Critical	Very high	
	Threatened – Nationally Endangered	Very High	
	Threatened – Nationally Vulnerable	Very High	
	At Risk – Declining	High	
	At Risk – Recovering	Moderate-High	
	At Risk – Relict	Moderate-high	
	At Risk – Naturally Uncommon	Moderate-High	
	Locally uncommon/rare but not Threatened or At Risk Nationally	Moderate	The level of 'local' threat will depend on the size of the ZOI and availability of 'local' information. Consult regional and/or district council for local priority listings.
	Not Threatened	Low	

Ecosystems			
Threat category (From Holdaway, Wiser, & Williams, 2012			
	Naturally uncommon ecosystems	High	Refer to Landcare Research website for assessment of ecosystems on case by case basis.

Other			
Priority areas for protection (Ministry for the Environment & Department of Conservation, 2007a, 2007b)			
	1 Indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV), that have 20% or less remaining in indigenous cover.	High	
	2. Indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.	High	
	3. Indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.	High	
	4. Habitats of acutely and chronically threatened indigenous species.	High	Species' status need to be checked in updated classification system and latest lists.
	Role in ecosystem services		To be assessed on case by case basis.
Wetlands of National Importance	Nationally recognised wetland	High	Refer to Ausseil et al (2008).

5.2.4 Matters to consider in applying evaluation criteria

In assigning value for an EcIA the ecologist must decide:

1. What systems should be used at the different levels of ecological organisation. These are discussed in the preceding sections, and summarised in **Appendix 7**.
2. To what area should the criteria be applied to ensure that the full range of values is recognised? For example, the whole site (which may be large and contain many different habitats and environments) or to subsets of the site divided according to habitat or landform that may contain areas of differing value? This must be decided according to the site diversity and the way in which the project is likely to impact the different areas.
3. How should values be assigned to the site or subset areas? Assigning value of the selected site/subset area then should be based on:

- Other studies, surveys and assessments done in the area
- Results of EcIA scoping and full investigations
- Discussions with DOC, Regional Council ecologists and other local experts

4. How should the values assigned to different subset areas be combined to give a single site value? Combining values should be avoided to avoid suppressing project impacts on individual features or components.
5. What weight to put on the given value of a site that is already identified as 'significant' in a Regional or District Plan? An assessment needs to be made of:

- The criteria used to assess the site as significant and whether they are appropriate for conservation management today – some sites may have been carried over from old lists.
- How those criteria were applied – the rigour of any desk top or field testing.
- The current ecological condition of the site – it may have decreased or increased in value since the significance assessment was made.
- Any policies or rules attached to significant sites – these may affect or limit the activities proposed through the project being assessed.

In assigning value to a site which is not identified in a Plan, the ecologist will usually be expected to assess whether it would meet any criteria for assessing significance in the relevant Plan.

The simplest value system uses the very high-high-moderate-low range. Each area is assessed as having very high, high, moderate or low value for each of the criteria. Again, the Plans may assist in deciding where the thresholds for very high, high, moderate, low are; but if not, the ecologist must decide. This again requires:

- Consultation with other local experts.
- Review of publications addressing similar vegetation, habitats, species or processes.

5.2.5 Combining assessment under each criterion to yield an overall site score

These very high, high, moderate, low values for each criterion/matter for each area then feed into a scoring system to give an overall value for each area assessed, as shown in **Table 6 Assessment scoring for areas of terrestrial vegetation and habitats**. This value feeds into the assessment of effects matrix (Chapter 6).

Table 6 Assessment scoring for areas of terrestrial vegetation and habitats

(Following Boffa Miskell (2011), and Regini (2000))

Value	Description
Very High	Rates High for all or most of the five assessment matters listed in Table 3 Matters to be considered when assigning ecological value to a site or area. Likely to be nationally important and recognised as such.
High	Rates High for at least one of the assessment matters and moderate for the majority of the others. Likely to be regionally important and recognised as such.
Moderate	Rates moderate for the majority of assessment matters. Important at the level of the Ecological District.
Low	Rates Low or Nil for all assessment matters. Limited ecological value other than as local habitat for a tolerant native species.

5.3 Assigning value to freshwater habitats

5.3.1 Criteria

In the same way as a terrestrial ecosystem is evaluated, the ecological value of a location, reach, catchment, lake or wetland is determined by the values of species, communities and habitats found there and the ecological context (typically catchment) in which they exist and interact. The ecological values of freshwater ecosystems similarly have aspects of both quantity (rarity or extent) and quality (functionality or condition).

Some regulatory documents identify and specify the ecological value of specific freshwater locations. Regional Policy Statements, Regional Plans and/or District Plans for the site or ZOI location should be consulted first to determine what matters to consider and criteria to use to meet regulatory requirements.

Although a wide range of metrics and measures are used in the assessment of freshwaters, unlike for terrestrial ecosystems there is no unifying set of attributes used to assign value or significance. Measures that are considered when assigning ecological value to a site do fall broadly into the matters related to significance as detailed in **Table 3 Matters to be considered when assigning ecological value to a site or area**, although the application of these attributes varies widely between regions and is somewhat inconsistent amongst practitioners. **Table 7 Matters that may be considered when assigning ecological value to a freshwater site or area** indicates how the matters commonly recognised in terrestrial ecosystem evaluation may be applied in freshwater ecosystems.

Table 7 Matters that may be considered when assigning ecological value to a freshwater site or area

Matters	Topics for which criteria are needed
Representativeness	Extent to which site/catchment is typical or characteristic Stream order Permanent, intermittent or ephemeral waterway Catchment size Standing water characteristics
Rarity/distinctiveness	Supporting nationally or locally[20] threatened, at risk or uncommon species Regional or national distribution limits Endemism Distinctive ecological features Type of lake/pond/wetland/spring
Diversity and pattern	Level of natural diversity Diversity metrics Complexity of community
Ecological context	Stream order Role in ecosystem functioning Instream habitat Riparian Contribution to ecosystem services

[20] Locally – defined as Ecological Region or District depending on scale of proposal and impacts

Even where criteria for the assignment of 'significance' exist within a regulatory plan, the practice for freshwater practitioners is to default to measured and observed attributes recorded from a stream reach under investigation. In part this is because qualitative and quantitative indicators and metrics that include a scale or ranking for developing a hierarchy have been developed by freshwater ecologists. Because any assignment of significance or value to freshwater ecosystems (especially stream ecosystems) is based on empirical information (unlike terrestrial ecosystems which rely on descriptive information and overlays of information) then greater reliance is placed on the captured information rather than subjective criteria.

5.3.2 Stream Ecological Valuation (SEV)

The Stream Ecological Valuation (SEV) was developed by the then Auckland Regional Council in 2004 in response to the rate of loss of small waterways in the Auckland Region. The SEV is a method for scoring the ecological condition of Auckland streams and for quantifying environmental compensation. It is not in itself a method for assigning value to a stream; but the SEV score can be used to contribute to an assessment of ecological value. The SEV was developed for application to permanent streams in Auckland and has not been tested for use in other regions, although regulatory authorities in some regions are adopting the SEV as a practice. Most typically the outcome of the SEV is used in the development of an Ecological Compensation Ratio (ECR) that can be used for quantifying the offset required for the loss of stream habitat and function (see Section 7 for further explanation).

5.3.3 Ecological integrity of freshwater ecosystems

Schallenberg et al. (2011) consider that measures of Ecological Integrity (see Glossary) integrate a wide range of ecological values related to the structural and functional processes of ecosystems. The concept and implementation of measures of ecological integrity as part of assigning value or significance has not found common practice in New Zealand. Nevertheless, Schallenberg et al. (2011) considered four attributes to assess ecological integrity of New Zealand freshwaters:

- **Nativeness**: the degree to which an ecosystem's structural composition is dominated by the indigenous biota characteristic of the particular region.
- **Pristineness**: relates to a wide array of structural, functional and physico-chemical elements (including connectivity), but is not necessarily dependent on indigenous biota constituting structural and functional elements.
- **Diversity**: richness (the number of taxa) and evenness (the distribution of individuals amongst taxa); link to a possible reference condition; the use abundance weighting; and geographical scale.
- **Resilience (or adaptability)**: quantifying the probability of maintaining an ecosystem's structural and functional characteristics under varying degrees of human pressure.

Ecological integrity can be used as a "measure" of the condition of a freshwater ecosystem.

5.4 Assigning value to ecosystem services

In the simplest definition, ecosystem services are 'benefits that people obtain from ecosystems'. The Millennium Ecosystem Assessment (2005)[21] highlighted the importance of these services, while The Economics of Ecosystems and Biodiversity initiative[22] (TEEB) is one of many organisations working to quantify and develop accounting methods for them.

Ecosystem services link closely with the "life-supporting capacity of ecosystems" (RMA S 5(2) (b)).

The science and policy around ecosystem services is not well developed. Nevertheless an ecologist carrying out an EcIA needs to recognise and describe them. If it appears that ecosystem services may be impacted by a proposal, then more detailed assessment should be carried out. In New Zealand research is being carried out at Lincoln and Massey Universities, and Landcare Research is undertaking research for the Sustainable Business Council.[23]

The four types of ecosystem service are:

- **Support (or habitat) services**; e.g. habitats for plants and animals on which other services are based; genetic diversity.
- **Regulating services**; e.g. pollination, bio-control, erosion and flood control.
- **Cultural services**; e.g. for recreation and tourism; culturally or spiritually important ecosystems and habitats.
- **Provisioning services**; e.g. habitats for food species; drinking and irrigation water; bio-prospecting and research areas.

For further information and valuation of ecosystem services an expert in this particular area should be consulted.

[21] http://en.wikipedia.org/wiki/Ecosystem_services.
[22] http://www.teebweb.org/resources/ecosystem-services.
[23] http://www.sbc.org.nz/projects/ecosystem-health.

6 Assessing effects

Assessing effects
Key points

The **actual or potential effects** of activities should be addressed.

Matrices are proposed to assist in clarifying assessments, but the effects must also be thoroughly described and discussed.

The link between the **level or seriousness** of adverse ecological effect and the RMA concept of 'significant adverse effect' is discussed.

Determining the nature and level of potential changes to ecological features and function, caused by proposed actions, requires knowing:

- Structure (including composition) and functioning of existing ecological environment as far as practicable
- Proposed actions or plans
- Timing and staging of proposal

Direct and indirect **activities** may occur through:

- Construction
- Operation
- Decommissioning

Effects should be **characterised** in terms of:

- Spatial scale
- Temporal scale
- Duration
- Reversibility
- Timing
- Risk and uncertainty
- Confidence in predictions

Ecological change should consider:

- Key features of ecological structure and function
- Potential changes to the features
- Changes that might take place should the proposed actions not occur

Magnitude of effect is a measure of the extent or scale of the impact and the degree of change that it will cause. A typical scale of magnitude ranges from very high/severe to negligible. The scale should be explained for each assessment context.

Level of effect is determined by the magnitude of effect and the value of the affected biodiversity or ecological feature. A typical scale ranges from very high to negligible, depending on the magnitude and nature of the effect and the importance of the affected ecological feature. The scale should be explained for each assessment context.

Cumulative effects should be described for direct and indirect effects over a larger area; a longer period of time; due to interactions with other actions; and include other past, existing and future actions.

6.1 Introduction

This chapter looks at ways of assessing the nature and level (or seriousness) of the potential effects of a proposal (including its different component activities) on ecological values.[24] An assessment of effects is carried out initially at the scoping stage to provide feedback into the early stages of project design. It is repeated throughout project development as further investigations are carried out. Assessments of effects inform decisions about the nature and scale of mitigation or impact management (see Chapter 7).

'Significance of effect' is not used here as an ecological term. The link between the level or seriousness of adverse ecological effect and concept of 'significant adverse effect' as used in the RMA is discussed.

The level of adverse effects (or impacts) or positive (or beneficial) effects on an ecological feature or process is determined by the magnitude of the effect, the nature of the effect, and the ecological value of the feature or component. Ecological value may have a temporal component (e.g. seasonality).

The ecologist must use the thorough description of ecological features and processes within the zone of influence and an understanding of the proposed activities to decide what ecological features or components the assessment will consider; for example, whether to assess effects on a site (e.g. reach of a stream), plant communities (e.g. riparian vegetation, emergent vegetation) or individual species (e.g. a nationally threatened plant within that riparian community).

The assessment of effects should have:

- a thorough description and discussion of all potential effects on ecological features;
- a discussion of the likelihood of the effects occurring; and
- a clear rationale for assessing the level of effects.

In the following sections, matrices are proposed to assist ecologists to make assessments that are clear and can be compared with other environmental evaluations as appropriate. However, matrices alone are insufficient, and must always be used in conjunction with thorough discussion to show how the scores have been allocated to the matrix cells and how evaluations have been made. This is especially important when evaluation is not clear-cut and may fall 'between the cells' of a matrix.

[24] Note: the CIEEM Guidelines (2013) and Regini (2000) use the term 'sensitivity' instead of 'value'.

6.2 Activities and effects during the project lifecycle

6.2.1 Describing activities

The ecologist must identify and describe the specific effects potentially caused by activities (either singly or in combination). To do this the ecologist must have a good understanding of the proposal and be clear about:

- what activities will be undertaken;
- where they will be carried out;
- how they will be carried out;
- when (including duration and when the activities may cease); and
- by whom they will be carried out.

This includes both construction and operational activities for which consent (or other planning permit, concession etc.) is required. The regulatory body may also require information about, and assessment of, effects of decommissioning.

Activities may be temporary or permanent/on-going; and the effects they may cause may be:

- temporary (especially, but not always during construction), e.g. access roading to pylon sites
- permanent (especially those associated with the operation of something that has been constructed), e.g. stormwater management system, road
- direct, e.g. removal of vegetation
- indirect, e.g. landform shaping affecting waterways
- off-site, e.g. at a workers' accommodation site

Sometimes, 'mitigation' activities that reduce the adverse effects at the site may be considered to be part of the project. This may be a matter of legal requirement or best practice (e.g. stormwater treatment to maintain water quality) or project design (e.g. enhancement of a waterway through a residential subdivision.) These project components can be included in the initial assessment of effects or treated as separate mitigation actions incorporated at the redesign stage. Either approach is acceptable as long as the components are clearly defined.

6.2.2 Construction activities likely to affect ecological features

These will vary in detail according to the purpose of the construction activity (e.g. road, building, jetty, wind farm) but there are general types of activity that have effects on ecological values:

- Excavation and earthworks, including waterway diversion.
- Abstraction and drawdown of water.
- Import of soil and other fill materials.
- Use of machinery and vehicles (including aircraft) on site – compaction, noise, hazardous chemicals, dust.
- Increase in human activity associated with construction – noise, pests, litter, facilities and services.
- Vegetation clearance in construction corridors and access areas.
- Construction of stormwater management structures.

6.2.3 Operational activities likely to affect ecological values

These too will be specific to the proposal being assessed, but generally effects on ecological values will be associated with:

- Use of noisy equipment/machinery/vehicles
- Discharging to water or land
- Taking water from the surface or groundwater
- Presence of structures (e.g. turbines, dams, bridges, culverts)
- Introduction or increased presence of humans (e.g. workers, tourists, recreational visitors)
- Management associated with environmental enhancement (e.g. indigenous planting, pest control, legal protection)

6.2.4 Decommissioning activities likely to affect ecological values

Because decommissioning is likely to occur in the distant future, it will not be possible to describe in detail activities and effects. Many decommissioning activities will be those associated with construction (deconstruction). Other effects may arise through the removal of environmental enhancement management or cessation of activities that were having adverse effects.

6.3 Describing the effects on ecological features

6.3.1 Parameters

When describing or characterising the potential effects on ecological features from activities at any stage, the following aspects must be considered:

Direct or indirect. As well as direct effects on ecological features and processes found or occurring within the zone of influence, are there potential indirect effects caused by changes brought by the project. For example, weed or pest incursions into adjacent lands facilitated by establishing worker camps for the project.

Positive or beneficial as well as **adverse** effects should be assessed.

Spatial scale or extent. Over what area will the impact act? What area of habitat or vegetation type could be affected? This should be expressed in terms such as study area, corridor, project footprint, or zone of influence which were established at the start of the assessment process. Distance of the effect from the activity causing it is not a measure of the level of ecological effect.

Temporal scale. Will the effect be temporary or permanent; continuous or occasional? At the start of the assessment process, timescales should have been established and defined; ideally these should tie in with project stages but this is not always possible. The timescales should make sense in ecological terms (e.g. relating to periods such as life cycles or vegetation regeneration times.

Duration. This is the time for which the effect will last and should be measured in ecological timescale rather than human (e.g. fish life cycles). An activity may be short in duration but the effect on a population or community may be long term, see **Table 8 Possible timescales for duration of effects.**

Table 8 Possible timescales for duration of effects[25]

Permanent	Impacts continuing for an undefined time beyond the span of one human generation (taken as approximately 25 years) Where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees that need > 25 years to reach maturity, or restoration of ground after removal of a development) the impact can be termed 'long term'.
Temporary	Long term (15–25 years or longer – see above) Medium term (5–15 years) Short term (up to 5 years)

[25] There has been some discussion on duration, noting that in some environments (low fertility) or with some species (slow growth rates, long lived, low fecundity) 25 years may be an underestimate.

Related to this is **Reversibility**. Are the potential effects reversible – either totally or partially? This can apply to both positive and adverse effects. An irreversible (permanent) effect is one from which recovery is not possible within a reasonable timescale; a reversible one (temporary) is an effect for which natural recovery may be possible or for which there is a commitment for mitigation action at the site (e.g. rehabilitation of ground cover).

Timing. How will the timing of undertaking activities and occurrence of their effects relate to plant or animal cycles and patterns? At what time of year will they occur and how does this relate to events such as breeding or migration?

Risk and uncertainty. The EcIA process is itself uncertain, since long term outcomes cannot be proved. In New Zealand there are gaps in knowledge about biodiversity (distributions, occurrences, trends etc.) and ecological processes and relationships. Many of these are fundamental to evaluation and assessments of effects on ecological values. It is not reasonable or, indeed, possible for a project proponent to fill in many of these gaps (for example, population trends or regional species distributions). The ecologist must take a reasoned approach to uncertainty around both the availability of data and the delivery of forecast outcomes, and the risk this poses to biodiversity (and possibly to the project). Expert opinion must be used to make assessments, evaluations and predictions where there is insufficient information. The way in which such analysis has been done should be documented.

Confidence in predictions. Given the data available on all aspects of the project and of the ecological features studied, the ecologist should give an indication of the confidence in the predicted effects, that is, the likelihood of them occurring in the way predicted. Some things will be certain, e.g. vegetation clearance will reduce the population of some species by a proportion that can be measured or estimated; other effects less certain, e.g. the potential effects of a wind turbine on a migratory bird species is more difficult to predict. Modelling tools can assist in predicting effects and the level of effects (e.g. stormwater run-off models that predict the amount of sediment likely to reach a waterway). However, the limitations of any model must be recognised and predictions used with appropriate levels of caution. When using model (or any other) information provided by a third party, the ecologist must ensure s/he has a good understanding of that model and its limitations.

6.3.2 Potential effects on ecological features

When characterising effects the ecologist should refer to a wide range of aspects of ecological structure and function. **Appendix 8** gives examples of matters to consider – broadly these include:

- Physical resources/environment.
- Stochastic processes.
- Ecological processes.
- Human influences on ecological patterns and processes.
- Historical context.
- Ecological relationships.
- Ecosystem properties.

These features may be affected directly or indirectly or cumulatively through any activities causing disruption, such as:

- Fragmentation or isolation e.g. by removal of vegetation.
- Loss/ mortality e.g. by contamination, earthworks, impact with structures.
- Food chain effects e.g. by loss of food species.
- Disturbance e.g. through increased human access, construction vehicles, noise.
- Barriers e.g. through damming, roading.
- Removal, reduction of physical resource e.g. by abstraction of water, removal of vegetation.
- Change in physical resource e.g. through change to flow regime/patterns, run-off.

6.4 Evaluation of the level of effects

Matrices are tools to assist in clarifying the evaluation of the level of effects, although in reality effects occur along a continuum. Matrices must always be accompanied by discussion and interpretation of the information they summarise and the limitations and uncertainty associated with their use. The matrices proposed here are based on Regini (2000, 2002), used in developing the IEEM Guidelines. They do not appear in the issued IEEM Guidelines (Institute of Ecology and Environmental Management, 2006, 2011), where a more discursive approach is adopted.

The approach proposed for New Zealand is that the level of an effect is determined by a combination of the magnitude of the effect and the value of the receptor (affected ecological feature). Magnitude is determined by a combination of scale (temporal and spatial) of effect and degree of change that will be caused in or to the ecological component. Criteria for determining magnitude are proposed in **Table 9 Criteria for describing magnitude of effect** but these may be modified according to the nature of a particular project and the ecological context. In particular it may be appropriate to add intermediate ranks (e.g. moderate-high, low-moderate) or a numerical rank may be preferred. Some ecologists may prefer to use a scale used in the planning documents against which the project application will be assessed.

6.4.1 Criteria for describing magnitude of effect

Table 9 Criteria for describing magnitude of effect shows how the loss, change or deviation from the existing or baseline ecological conditions can be described in terms of the extent and duration of alteration to describe the magnitude of the effect. 'Existing' and 'baseline' conditions may be the same; however they may differ when the existing environment is expected to change before the activity causing an effect takes place. Ecological experience is needed to assess terms such as 'major' and 'minor' and these terms should be explained or defined in the report text.

The criteria consider the effects on ecological features on the site or in the zone of influence. At this stage too, the contribution of the particular example of the ecological feature to the wider population or ecosystem must be considered: what would be the implication of loss of this example? E.g. does the example (whether population or individual) represent a high proportion of the known population?

Table 9 Criteria for describing magnitude of effect

Adapted from Regini (2000) and Boffa Miskell (2011)

Magnitude	Description
Very high/severe	Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally change and may be lost from the site altogether; AND/OR Loss of a very high proportion of the known population or range of the element/feature
High	Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR Loss of a high proportion of the known population or range of the element/feature
Moderate/medium	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature
Low/minor	Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR Having a minor effect on the known population or range of the element/feature
Negligible	Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR Having negligible effect on the known population or range of the element/feature

6.4.2 Assigning value to species

As discussed earlier, there is no nationally agreed method for assigning 'value' to species in a way that can be used in impact assessment in New Zealand although some regional documents discuss regional threat status and priorities for ecosystems and species in their region.[26] A very simple system based on national threat classification lists with additional placing for 'locally rare' species was described in Chapter 5, as part of **Table 5**, and is shown again in **Table 10 Assigning value to species for assessment purposes** below:

[26] In other countries, national priority lists for species, habitats and vegetation types are often available.

Table 10 Assigning value to species for assessment purposes

Determining factors	Value
Nationally threatened – critical or vulnerable	Very high
Nationally at risk – declining	High
Nationally at risk – recovering, relict or naturally uncommon	Moderate–high
Locally uncommon/rare, not nationally threatened or at risk	Moderate
Not threatened nationally, common locally	Low

6.4.3 Assigning value to vegetation types or habitats

The valuation of vegetation or habitats was described in Chapter 5. In the absence of a national system for valuation, a proposed alignment is shown in **Table 11 Assigning value to vegetation or habitat for assessment purposes**.

Table 11 Assigning value to vegetation or habitat for assessment purposes

Determining factors	Value
Supporting more than one national priority type[27]	Very high
Supporting one national priority type or naturally uncommon ecosystem (Holdaway, Wiser, & Williams, 2012)	High
Locally rare or threatened, supporting no threatened or at risk species	Moderate
Nationally and locally common, supporting no threatened or at risk species	Low

6.4.4 Criteria for describing level of effect

Assessment under the RMA typically requires the ecologist to score or rate the degree or extent of effect on an ecological feature; e.g. assessing an adverse effect as 'significant', 'high' or 'less than minor'. The RMA requires an applicant to consider alternative locations when there are "significant adverse effects" so this determination is very important for maintenance of ecological values. To determine the level of effect, the score or rating for magnitude of effect (**Table 9 Criteria for describing magnitude of effect**) is then combined with the value of the ecological feature/attribute (**Table 10 Assigning value to species for assessment purposes, Table 11 Assigning value to vegetation or habitat for assessment purposes**) to determine the overall seriousness of the effect – see **Table 12 Criteria for describing level of effects**. Those cells in bold type would typically be considered to represent 'significant' effects. Cells with low or very low levels of effect indicate low risk to ecological values, but not low ecological value per se.

[27] Refer MFE, DOC (2007a & 2007b) Protecting Our Places and Chapter 5.

Table 12 Criteria for describing level of effects

Ecological Value → Magnitude ↓	Very high	High	Moderate	Low
Very high	**Very high**	**Very high**	**High**	Moderate
High	**Very high**	**Very high**	**Moderate**	Low
Moderate	**Very high**	**High**	Low	Very low
Low	**Moderate**	Low	Low	Very low
Negligible	Low	Very low	Very low	Very low

Level of effect can then be used as a guide to the extent and nature of ecological response required (including the need for biodiversity offsetting). For example:

- Very high and High represent a high level of effect on ecological or conservation values and warrant avoidance and/or extremely high intensity mitigation and remediation actions. Biodiversity offsetting should be considered where these adverse effects cannot be avoided.
- Moderate represents a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be mitigated through avoidance, design, or extensive appropriate mitigation actions.
- Low and Very low should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking mitigation into consideration, then it is essential that prescribed mitigation is carried out to ensure Low or Very low level effects.
- Very low level effects can generally be considered to be classed as 'not more than minor' effects.

The Quality Planning website proposes a slightly different set of criteria (see http://www.qualityplanning.org.nz/index.php/consents/environmental-effects. There, a scale for determining the 'extent' of adverse environmental effects of a proposal (as opposed to effects on an ecological or biodiversity feature) is proposed. In this, effects range from 'Nil effects' to 'Unacceptable adverse effects' (**Table 13 Extent of adverse effects of a proposal**). This approach is used when deciding whether an application should be considered on a notified, limited or non-notified basis and also in determining if an activity is appropriate under ss 104 and 105 of the RMA. It may be helpful to use this scale of evaluation where ecological factors may be critical to such planning decisions. While positive effects are taken into consideration, 'mitigation' does not include biodiversity offsetting in these matters.

Table 13 Extent of adverse effects of a proposal

(From QP website, Feb 2014)

Nil Effects	No effects at all
Less than minor adverse effects	Adverse effects that are discernible day-to-day effects, but too small to adversely affect other persons
Minor adverse effects	Adverse effects that are noticeable but that will not cause any significant adverse impacts
More than minor adverse effects	Adverse effects that are noticeable that may cause an adverse impact but could be potentially mitigated or remedied
Significant adverse effects that could be remedied or mitigated	An effect that is noticeable and will have a serious adverse impact on the environment but could potentially be mitigated or remedied
Unacceptable adverse effects	Extensive adverse effects that cannot be avoided, remedied or mitigated

6.5 Cumulative effects

"Cumulative effects are changes to the environment that are caused by an action in combination with other past, present and future human actions." (Canadian Environmental Assessment Agency, 2014). There are many definitions, but this simple one encompasses the fundamental aim of assessing cumulative effects.

In 2003 a UNEP Working Group noted:

> "However, there is often little understanding among regulatory authorities and developers of the concept of cumulative effects. This is also true in part for environmental impact assessment practitioners" (UNEP, 2003).

An assessment of cumulative effects of a proposal should:

- Assess effects over a larger (e.g. 'regional') area that may cross jurisdictional boundaries; this includes effects due to natural perturbations affecting environmental components as well as other human actions.
- Assess effects occurring over a longer period of time than the specific project (both past and future).
- Consider effects on valued ecological features or attributes due to interactions with other actions, and not just the effects of the single action under review.
- Include other past, existing and future (i.e. reasonably foreseeable) actions beyond the specific project in question.
- Evaluate the level of cumulative effects in consideration of other than just local, direct effects.

Cumulative effects are not necessarily very different from direct or indirect effects examined in an EcIA; in fact, they may be the same; e.g. where the EcIA considers the various components of a project footprint together such as a quarry and its access road. Cumulative effects assessment ensures that assessment is considered at an Ecological Region or District scale where appropriate. The assessment must determine:

- how large an area around the action should be assessed
- how long in time, and
- how to practically assess the often complex interactions among the actions

As in the case of assessment of direct and indirect effects, a combination of matrices and descriptive text is recommended. The magnitude/significance matrices described above can be used as basic tools, adapted according to the scale and nature of the proposal being assessed.

The application for reclamation works on the Onehunga Foreshore[28] recently addressed some cumulative effects in the coastal area.

[28] http://www.aucklandcouncil.govt.nz/SiteCollectionDocuments/aboutcouncil/hearings/hearingdecisiononehungaforeshorerespjt20111213.pdf.

6.6 Effects and impact management

The scale and nature of adverse effects guide the design and implementation of impact management and monitoring. Where there are effects that cannot be managed through avoiding, minimising, or remedying, then an offset or compensation may be needed.

The case was argued by opponents of Mt Cass Windfarm (Christensen & Baker-Galloway, 2013) that any effects on a significant ecosystem (in that case a historically rare karst ecosystem) would result in unacceptable loss. However, the Court noted that the extent and nature of the disturbance caused must also be taken into account when considering whether offsetting is appropriate or not. In that case, the small scale of disturbance and disruption was considered insufficient to rule out offsetting. This illustrates the need to be comprehensive in describing effects as well as simply assigning values in a matrix.

7 Impact management

Impact management
Key points

From an ecological management perspective, 'Impact management' is considered to include the f**ull range of actions** taken to **address adverse effects** on indigenous biodiversity and ecosystems, including through the use of biodiversity offsetting.

Case law determines that **biodiversity offsetting** or other forms of **off-site environmental enhancement** are not 'mitigation' since they do **not act at the point of impact**, but elsewhere, to create a positive effect. New Zealand case law has determined that offsets are not a form of environmental compensation.

Impact management must where possible:

- meet **regulatory standards**; and
- enable **maintenance of existing** levels of indigenous biodiversity

Practical measures must:

- avoid
- remedy (remediate, restore, rehabilitate, reinstate)
- mitigate (minimise, moderate, alleviate, reduce)
- offset
- compensate

Other additional or **supporting conservation actions** may be taken.

Biodiversity offsets are "Measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground" (New Zealand Government, 2014)

International **guidance on biodiversity offsets** is produced by the Business and Biodiversity Offset Programme (BBOP) and national guidance issued by the New Zealand Government. The Proposed National Policy Statement on Indigenous Biodiversity and some Regional and District Policy Statements and Plans seek to regulate offsets in New Zealand.

The question of **how much** impact management effort is needed is an expert judgment **guided by**:

- National standards or policy; and
- Regional/District policy; and
- Significance of ecological values adversely impacted; and
- Level of ecological effects; and
- Feasibility of implementation;
- Costs, benefits and likelihood of success; and
- Proponent's ability and willingness to pay.

Adaptive management is a tool that addresses the uncertainty and risk around impact prediction and management in indigenous ecosystems. It should be a rigorous process,

7.1 Introduction

Where an impact is predicted to result from a development, there is an opportunity to manage the impact. In practical terms, impact management covers a broad range of actions taken to address adverse effects (including avoidance), and ranges from controlling the source of the impact to managing the exposure of the receptor species or environments.

The term 'impact management' is used here to encompass all the options that an ecologist must consider to manage potential adverse impacts on biodiversity and ecosystems with the aim of:

- meeting the relevant regulatory standards, objectives and policies; and
- seeking to maintain existing levels of indigenous biodiversity and enhancement where possible (see Principle 1h in Chapter 2)

In relation to impact management, Part 2, section 5(2)(c) of the RMA requires:

- avoiding, remedying, or mitigating any adverse effects of activities on the environment

The terms 'avoiding, remedying, or mitigating' are not defined in the RMA which has led to some confusion.

Most definitions of mitigation (e.g. Canter (1996)) suggest that impact management approaches (in environmental impact assessment generally) should be implemented sequentially, with avoidance measures assuming priority:

- Avoiding the impact altogether, by modifying design or operations or seeking an alternative location.
- Minimising the impact by limiting the degree or magnitude of an action, or implementing best practice treatment of controls to minimise impact.
- Rectifying impacts through repair, reinstatement or restoration of the receptor site.
- Offsetting residual impacts by replacing or enhancing substitute resources or environments.
- Compensating for the impact by providing substitute resources for implementation elsewhere or for a different purpose.

The ecological management terms used in these NZ Guidelines are aligned with wording in the RMA (and other policy) terms in **Table 14 RMA and ecological impact management terms (Adapted from Treweek 1999)** below. In the area of biodiversity offsets the terms used in New Zealand and Australia (and in some cases internationally) differ. These NZ Guidelines discuss the terms and their application in the New Zealand context. Impact management measures are described further in the next section.

In June 2013, Justice Fogarty (NZHC 1346) noted that:

> "The usual meaning of 'mitigate' is to alleviate, or to abate, or to moderate the severity of something."[29]

In practice, most forms of impact management have commonly been collectively termed 'mitigation' or represented in a comprehensive 'mitigation package'. In common with overseas practice, increasingly additional mechanisms (and terminology) for impact management are being introduced in New Zealand so that terms often change.

Justice Fogarty also notes that offsets do not 'mitigate' because they are not carried out at the point of impact; rather, offsets offer a positive, new effect, one which did not exist before, and is not at the point of impact.

The term 'mitigation hierarchy' is avoided here because it often incorporates 'mitigation' in the hierarchy, which is tautology. However, the order of priority for ecological impact management is:

1. Avoid
2. Remedy
3. Mitigate
4. Offset
5. Compensate
6. Supporting actions

This chapter covers:

a. The types of impact management measures (including offsets) – the focus is on ecological responses to effects.
b. The ecological aspects of setting an order of priority for impact management actions.
c. The role of biodiversity offsetting.

[29] NZHC 1346 para 72.

Table 14 RMA and ecological impact management terms (Adapted from Treweek 1999)

RMA and policy	Ecological impact management measures
Avoid	Avoidance
	Sensitive design
	Siting based on least damage criteria
	Avoidance of key areas (e.g. protected habitat) – seek alternative location
	Avoidance of key periods (e.g. breeding or migrating season(s))
	Preventing impact generating activities
Remedy	Remediation, rehabilitation, restoration, reinstatement at receptor site
	Reinstatement of habitat
	Reseeding habitat
	Restoration of damaged habitat
	Decommissioning of infrastructure
	Restoration of damaged biophysical processes
Mitigate	Minimisation, moderation, reduction, alleviation of adverse effect on receptors
	Emission controls
	Noise barriers
	Screens
	Oil interceptors
	Controlled access during construction
	Wildlife bridges, tunnels, ecoducts
	Wildlife fences
	Pest and weed checks, vehicle washings
	Treatment of wastewater discharges
	Stormwater treatment
	Translocation of plants and/or animals
	Translocation of habitat
	Removal of habitat
	Removal, storage and reinstatement of habitat/species
Biodiversity offsetting for residual adverse effects	Providing long term protection for alternative habitat areas to ensure no net loss of biodiversity (or net gain) – not at point of impact
	Restoration offset
	Averted loss offset
Environmental compensation for residual adverse effects	Compensation for biodiversity and ecological function
	Creating new habitat on alternate sites
	Providing funding for alternate ecological enhancement actions at another site
	Providing protection and enhanced ecological management of an area, without ensuring no net loss of biodiversity
Supportive conservation actions	Education
	Research
	Public awareness-raising activities
	Raising local community capacity to carry out biodiversity conservation work

7.2 Impact management measures

7.2.1 Avoidance

The avoidance of impact on biodiversity or ecological values is the most effective element of managing adverse effects. It can be spatial (e.g. through locating the proposal or a component of the proposal somewhere else to avoid sensitive habitat or vegetation); or temporal (e.g. avoiding an activity during bird migration or roosting periods which will reduce impacts on bird populations and recruitment).

For avoidance to be successful, ecological impacts need to be considered during the early stages of a project so that modification of design and operations can be taken into consideration. However, avoidance through project redesign can occur at any stage of the project. Avoidance can gain particular impetus when the practicalities or costs of mitigation and ecological enhancement (offsetting or compensation) become apparent. Although the avoidance of ecological impacts is considered early in some sectors of industry, there can be some reluctance to implement it if other alternative impact management approaches are available.

Legal protection status may require that specific areas are avoided. At a local level, in most cases protection or regulation follows the recognition of significant ecological or natural areas (SEAs or SNAs), generally identified and mapped in Council regulatory documentation or via published and unpublished records.

For some activities based on natural resources, avoidance may not be possible since their location is dependent on the location of the resource (e.g. quarrying specific materials; ski-field development). In some cases, it may be possible to manage some impacts through timing of specific actions. In others there will be unavoidable adverse effects on biodiversity and ecosystems.

Avoidance of impacts carries the greatest certainty of outcome for biodiversity within the proposed project footprint. Where risk and uncertainty form an important part of the impact management assessment process, avoidance should therefore be given the highest priority over other steps of the impact management 'hierarchy' for which outcomes are less certain and risk of failure more likely i.e. remedying, mitigating, offsetting or compensation.

7.2.2 Remediation/rehabilitation/restoration

These are remedying measures taken to improve degraded or removed ecosystems following exposure to impacts that cannot be completely avoided. Although the terms remediation, rehabilitation and restoration are often used interchangeably the meaning of each in practice is quite specific.

- Restoration attempts to return an area to the original ecosystem that occurred before impacts.
- Rehabilitation aims to restore basic ecological functions and/or ecosystem services (e.g. through planting vegetation alongside streams to carry out riparian functions; or enhancement planting within remnant forest).
- Remediation is the action of trying to improve the condition of an ecosystem, especially in reference to the reversal or stopping of damage to the environment. It encompasses actions taken to promote regeneration.

Remediation, rehabilitation and restoration are typically needed towards the end of a project's lifecycle, but it may be possible to implement them either prior to commencement or during construction and operation of a development. Early initiation of these steps is recommended.

7.2.3 Mitigation: minimisation (moderation, reduction)

These are the measures taken to reduce the duration, intensity and/or extent of impacts that cannot be completely avoided. Effective minimisation can eliminate some negative impacts. Examples include implementing best practice guidelines for storm water management, earthworks and sediment management; air quality controls and treatment prior to discharge; designing infrastructure to reduce the likelihood of fatalities or injury to wildlife; reducing barriers to plant dispersal and animal movements; or building wildlife crossings on roads.

7.2.4 Mitigation: translocation, relocation, rescue

Any transfer of plants or animals requires integrated and preparatory planning to ensure that the plant/animals are in good condition prior to the move and that a suitable receiving environment is well-established prior to transfer. Transfer of indigenous species of animal usually requires a permit from the Department of Conservation. These elements must be considered early in the EcIA process as they can involve considerable time requirements for procedural processing and implementation.

7.2.5 Biodiversity offset

As considered by the hierarchy, avoidance, remedy and the components of mitigation serve to reduce, as far as possible, the impacts that a development may have on the ecological character, community and function project of an area. Often these steps are sufficient to provide overall mitigation for the potential or actual impacts of a planned project. However, in some cases, even after best attempts have been carried out and effectively applied, there are residual adverse effects on biodiversity or ecological values that cannot be mitigated. To address these, additional steps may be required to deliver No Net Loss or a Net Positive Impact.

Biodiversity offsets are measures taken to counterbalance any residual adverse impacts after implementation of the hierarchy. Biodiversity offsets are of two main types: 'restoration offsets' which aim to rehabilitate or restore degraded habitat, and 'averted loss offsets' which aim to reduce or stop biodiversity loss (e.g. future habitat degradation) in areas where this is predicted. Offsets are often complex and expensive, so attention to earlier steps in the hierarchy is usually preferable. In New Zealand, offsets for residual adverse effects on freshwater habitat and species have been addressed through the Stream Ecological Valuation (SEV) and ecological compensation framework (see 7.5 below). Offsetting for residual effects on terrestrial and wetland biodiversity offsets is still in development in New Zealand, with no universally agreed accounting and exchange system. The recently published *Guidance on Good Practice Biodiversity Offsetting in New Zealand* (New Zealand Government, 2014) and the Business and Biodiversity Offset Programme are the primary information sources.

7.2.6 Compensation

This term is used when positive actions to protect and/or enhance biodiversity values take place as a result of the project and positive outcomes for biodiversity are predicted and/or achieved, but 'no net loss of biodiversity' cannot be ensured. Environmental compensation may be carried out at the site of the adverse activity or nearby (Brown, Clarkson, Barton, & Joshi, 2013). In practice, compensation can be wide-ranging and may include: actions to protect and/or enhance biodiversity values at a site distant from the site of the adverse effects (possibly in a different Ecological District or LENZ environment); biodiversity/ecological research or education initiatives; interpretation and access initiatives related to biodiversity and ecological features; and funding for existing or new community biodiversity projects.

7.2.7 Supporting conservation actions

These are additional measures taken by the proponent which have positive effects on biodiversity. However, they are difficult to quantify and often difficult to link to the effects of the proposal being assessed. These qualitative outcomes do not fit easily into the mitigation hierarchy, but may provide crucial support to mitigation actions. For example, awareness activities may encourage changes in government policy that are necessary for implementation of novel mitigation; research on threatened species may be essential to designing effective minimisation measures; or capacity building might be necessary for local stakeholders to engage with biodiversity offset implementation.

7.3 Biodiversity offsets

The Department of Conservation has developed a *Guidance on Good Practice Biodiversity Offsetting in New Zealand* on behalf of the New Zealand Government, released by the Minister of Conservation in July 2014 (http://www.doc.govt.nz/publications/conservation/biodiversity-offsets-programme).

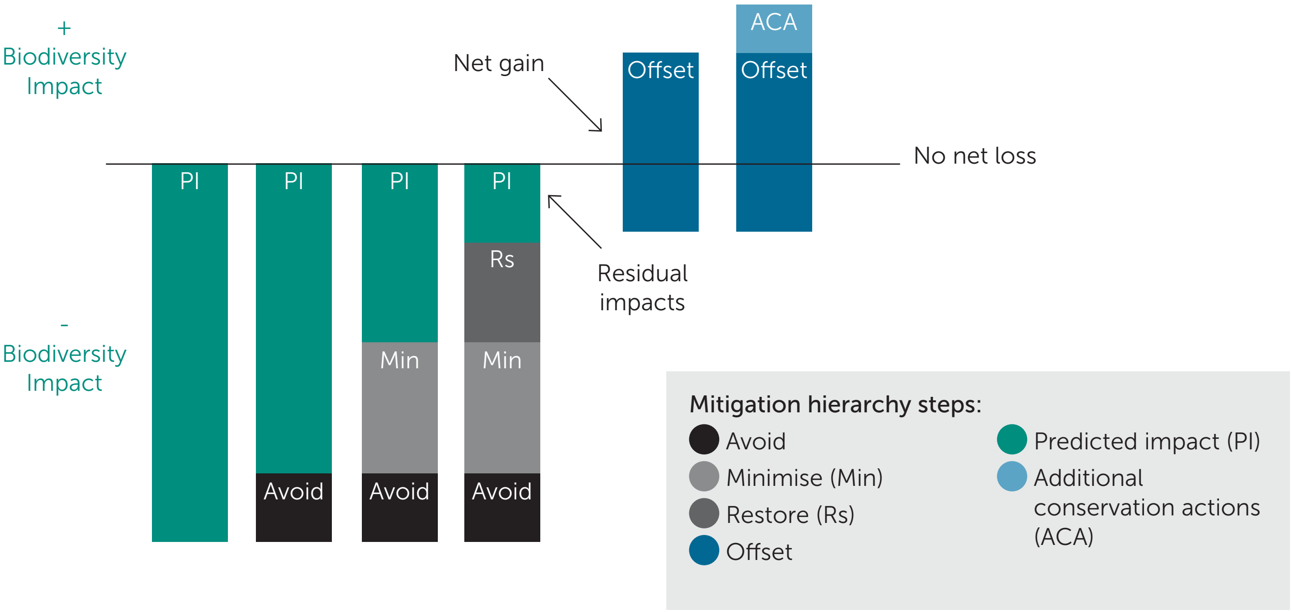
It defines biodiversity offsets as:

> "Measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground" (New Zealand Government, 2014)

Figure 2 Impact management for net biodiversity gain illustrates the application of the hierarchy in this area as described by BBOP (Business and Biodiversity Offsets Programme (BBOP), 2009). Although the words used differ from those under the RMA and discussed above, the underlying avoidance/mitigation principles are the same. Working from the left: at each of the first four stages a step is applied to the Predicted Impacts of a proposal: avoidance; minimisation; finally restoration (or remediation). At this point there remain unmitigated residual impacts so there is a net loss of biodiversity. By developing an offset, the net loss is turned into a net gain; and this is increased with the further additional (supporting) conservation actions.

Figure 2 Impact management for net biodiversity gain

(From Business and Biodiversity Offsets Programme (BBOP), 2009, p. 60).



As illustrated in **Figure 2 Impact management for net biodiversity gain** it is important to note that biodiversity offsetting should be used to assist develop a suite of impact management actions. By itself, and especially at an individual project level, biodiversity offsetting, even when planned and implemented effectively is still likely to result in net loss of ecological values from the project area and landscape

Offsetting that is voluntarily applied by business, which includes all adverse effects at a site and seeks to provide a net positive impact outcome, is more likely to result in overall positive benefits to biodiversity.

Regulatory provision for biodiversity offsetting varies between territorial authorities. In locations where there is no regulatory requirement to do otherwise, offsetting considers only significant adverse effects (not activities for which their effects are deemed insignificant) and many projects avoid regulatory constraints on development impacts if activities are within permitted thresholds. Therefore, even the best no-net-loss impact management may contribute to local or regional decline of biodiversity.

Some local authorities may require offsetting to address any residual adverse effects (e.g. Canterbury Regional Policy Statement, Policy 9.3.6 (Environment Canterbury, 2013).[30]

The *Proposed National Policy Statement on Indigenous Biodiversity* (Ministry for the Environment, 2010),[31] also defined offsetting and followed closely (but not exactly) the BBOP and New Zealand Government definitions. No date is available for the release of a revised or final NPS.

In the absence of national guidance, some local authorities (e.g. *Canterbury Regional Policy Statement*, (Environment Canterbury, 2013)) have developed policy for offsets (which may or may not correspond with national and international approaches).

The science and practice of biodiversity offsetting is evolving internationally. The Business and Biodiversity Offsets Programme has developed a framework and its website (http://bbop.forest-trends.org) provides a large amount of information and data on principles, practice, pilot studies and standards.

At this stage, then, it appears that in considering offsets as part of impact management, an ecologist should first consider relevant local authority policies and plans. The *Guidance on Good Practice Biodiversity Offsetting in New Zealand* then provides guidance on good practice process and methods for implementation. However, it is important to note that each project, environment, and biodiversity context is different so that there is no single recipe for implementation. Innovative approaches and outcomes should be considered.

A number of issues have arisen including in relation to:

- Offsetability/limits to offsetting – how to determine whether a biodiversity feature is so valued that it cannot be offset.
- Measuring and accounting for biodiversity loss and gain – how to measure net values and calculate future values at an offset site, determine equivalence of exchange between biodiversity types, and apply accounting frameworks to provide risk-adjusted exchanges over time.
- Offset site – how to locate similar sites and achieve measurable biodiversity.
- Certainty – how to be sure that offset management work is ecologically and financially feasible, and provides guarantees of permanence of conservation gains into the future.

Good process, scientific accuracy, transparency, consultation and documentation are essential in considering offsets as part of the impact management package.

Internationally, ten principles for biodiversity offsetting were developed by the Advisory Committee of the Business Biodiversity Offsets Programme (see **Appendix 9**). These provide a comprehensive foundation when offsetting is considered in jurisdictions where established environmental laws are absent or ineffective. The ten principles establish a framework for designing and implementing biodiversity offsets and verifying their success.

In New Zealand the Proposed NPS on Indigenous Biodiversity lists a set of seven principles, a subset of the BBOP principles, to be applied when considering a biodiversity offset (Schedule 2, MFE 2011).

More principles around offsetting identify core considerations or New Zealand–specific guidance are found in:

- Guidance on Good Practice Biodiversity Offsetting in New Zealand (New Zealand Government, 2014).
- Norton and Warburton (2015) which identifies 7 key conditions that should be fulfilled when using offsetting to enhance biodiversity values through the funding of invasive species control programmes.
- Norton (2008) which provides 6 principles for New Zealand specific application, and
- Gardner et al. (2013) which provides 4 key principles relating to scientific considerations of offsetting, including adhering to the mitigation hierarchy, equivalent of exchange, additionality of offset management and permanence of biodiversity benefits.

[30] http://ecan.govt.nz/publications/Plans/canterbury-regional-policy-statement.pdf.
[31] http://www.mfe.govt.nz/sites/default/files/media/Biodiversity/Proposed%20National%20Policy%20Statement%20on%20Indigenous%20Biodiversity_0.pdf.

7.4 How much mitigation is necessary?

One of the key questions around ecological impact management is "how much mitigation is needed?" This relates to the amount of ecological work to ensure no net loss and the nature of work needed to meet regulatory requirements. It is closely associated with the cost of doing such work to the proponent, so must be discussed openly between proponent and ecologist/consultant.

The ecologist should propose the amount of compensatory ecological enhancement that they consider necessary to address the damage or loss through adverse effects and meet relevant regulatory requirements. They should be prepared to put a cost on implementation of this work (including long term management needed) and to discuss this with the proponent/client. They should also be prepared to discuss this with consenting authority staff (reporting officers) and in any hearing by Commissioners or Environment Court judges.

The need for compensation/offsetting should be identified as early as possible in the assessment process – ideally at scoping.

The assessment of biodiversity value affected and the scale of adverse effects guides what action is needed and where.

As a guide, the amount of enhancement effort and activity needed is guided by:

1. National standards or policy; and
2. Regional/District policy; and
3. Significance of ecological values adversely impacted; and
4. Level of ecological effects; and
5. Feasibility of implementation; and
6. Costs and benefits and likelihood of success of impact management; and
7. Proponent's ability and willingness to pay.

There is no published guidance on what area, habitat, vegetation, or number of plants or animals need to be protected, restored or otherwise managed to mitigate or adequately compensate for effects on a specific area or number subject to adverse effects. This remains something that is the subject of expert judgment and stakeholder consultation for each project and environment, taking into account the seven factors listed above.

Where there are multi-ecosystem type impacts, policy directives such as 'like for like' and 'no net loss' generally distinguish between the different types of impact management required. For example, quantification of impacts on a remnant forest are separate from impacts on a riparian margin or a wetland. It follows that any compensatory impact management (offset, conservation actions, compensation) needs to be clearly distinguished for each ecosystem type. In some cases, 'trading up', where impacted values are compensated for by improvements to values of higher conservation priority in a 'like-for-unlike' offsetting exchange, may be permitted, encouraged or even required as part of a formal offsetting assessment. It should be noted that the *Guidance on Good Practice Biodiversity Offsetting in New Zealand* is a bit more circumspect on this topic, indicating that "A like for unlike exchange is not therefore considered to be a no net loss biodiversity offset although, depending on the circumstances, it may still contribute to conservation gains at the offset site."(New Zealand Government, 2014, p. 22)

Double-dipping occurs where the management of impacts on one ecosystem type are counted again as management of impacts on a different ecosystem type. For example, the planting of 2 ha of stream margin as offset for the loss of a waterway cannot be again counted as 2 ha for the offset planting for the removal of an area of wetland habitat. An evaluation of the additional value generated by proposed management should thus form a key consideration of the offset's contribution towards managing adverse effects on specific ecological values. This ensures that management proposals are truly additional to work that would be undertaken anyway in the absence of the project, and to avoid double-dipping where multiple, overlapping advantages may accrue from single management actions.

7.5 Stream Ecological Compensation Ratio (ECR)

In response to the loss of small streams in the Auckland region, the then Auckland Regional Council developed an ecological compensation ratio (ECR) as a means of guiding the quantification of compensation for the loss of stream habitat and function (ARC 2011). The ECR is derived from the stream ecological valuation score which is derived from a suite of attributes that assess stream condition. As offset environmental compensation is aimed at 'like-for-like' then the purpose of the stream ECR is to restore specific functions and values of the same kind that are going to be lost. In terms of stream ecological function 'in-kind' includes streams of the same stream order and streams that are close to the development site. The purpose is to help safeguard against the cumulative loss of certain stream types within catchments and to assist with maintaining habitat connectivity and function.

Details of the ECR as applied to streams in the Auckland region can be found at: http://www.aucklandcouncil.govt.nz/SiteCollectionDocuments/aboutcouncil/planspoliciespublications/technicalpublications/tr2011009streamecologicalvaluation.pdf.

It is worth noting that the SEV and ECR were developed for use in permanent streams and should be used with caution and expert advice if applied to intermittent or ephemeral streams.

7.6 Adaptive management

7.6.1 What is adaptive management?

Despite all best efforts, understanding and managing the impacts of development on natural resources often involves high levels of uncertainty and complexity; and decisions about impact management are based on expert opinion and related assumptions. In undertaking an ecological impact assessment, the ecologist has to seek ways of ensuring the best outcome for biodiversity in the long term. A better understanding of impacts and effects is needed, and this can be gained through trial and improvement.

Overcoming these difficulties often requires ongoing learning and a capacity to alter courses of action in response to new knowledge and understanding. This requires scientific, social and technical insights, and the capacity to generate knowledge and adjust actions based on that learning. Frequently, decision-makers impose a condition requiring 'adaptive management' as part of the impact management process. It is important that ecologists understand what this requires on their part.

Adaptive management, developed in the USA during the 1970s, has been defined as "an integrated, multidisciplinary and systematic approach to improving management and accommodating change by learning from the outcomes of management policies and practices" (Holling, 1978). It can equally be described as 'a process of learning by doing'. By its nature it is an iterative process through which greater understanding of natural resource systems can be developed and management approaches tested over time until the best management options are reached.

It is the precautionary approach to environmental management that has, at least in part, given rise to the adaptive management approach. This provides for ongoing monitoring of the effects of an activity, in order to promote careful and informed environmental decision-making, on the best information available. It is a precautionary technique that provides a pragmatic way forward, enabling development while securing the ongoing protection of the environment, in complex cases where there are ecological or technological uncertainties as to the effects of the proposal. The use of adaptive management in New Zealand has developed through a number of Environment Court cases dealing with the impacts of proposed developments.

The following principles must be satisfied for the adaptive management to be appropriate:[32]

1. There will be good baseline information about the receiving environment;
2. The conditions provide for effective monitoring of adverse effects using appropriate indicators;
3. Thresholds are set to trigger remedial action before the effects become overly damaging; and
4. Effects that might arise can be remedied before they become irreversible.

7.6.2 Components of adaptive management

Adaptive management is likely to mean integration of ecological information with that from other professionals involved in the project. Components of adaptive management include:

- Taking a holistic/consultative approach, acknowledging that biodiversity is part of a complex system with bio-physical, social and economic components.
- Identifying the values and interests of all stakeholders.
- Understanding the bio-physical, social and economic dimensions of the problem and the impacts of management regimes on all stakeholders and cumulative effects assessment.
- Developing models based on a collective understanding of the stakeholders, which are used to assess gaps in information and predict outcomes from alternative management strategies.
- Developing natural resource management plans (sometimes in conjunction with stakeholders) to meet outcomes and generate new information to fill any gaps.
- Specifically including feedback loops from monitoring back to research, objective-setting, policy development and planning.

[32] Board of Inquiry Decision: New Zealand King Salmon requests for Plan Changes and Applications for Resource Consents. EPA 2014.

- Monitoring and evaluating the adaptive management process is integral to the process itself.
- Implementing management plans, usually anticipating that results will be monitored, information analysed, and management adapted.
- Modifying the management strategy on an ongoing basis, as the system is more comprehensively and collectively understood.
- Implementing management strategies as processes lead to better understanding of the natural resource base.

This integrated and iterative process enables further refining of the actions to be taken, leading ultimately to best management practice.

The scale of adaptive management proposed to manage unknowns has potential implications for the application of biodiversity offsetting as an effective impact management tool. Offsetting is a predictive process and by definition relies upon information about adverse effects and predicted management benefits, and the risk and uncertainty associated with those. However, it is generally acknowledged that where there are high levels of uncertainty and risk of not achieving anticipated outcomes, the quantitative forecasts of biodiversity benefits may hold little weight or not be a reliable guide for assessing impact management proposals. In such cases, subjective assessments and compensation proposals may assume greater importance in developing ecological impact management strategies.

Monitoring is an important part of adaptive management and the monitoring programme needs to be tailored to provide data and information relevant to the management. Feedback from monitoring has to be evaluated in relation to existing management to make adjustments for improvement and any new management regime. Therefore the monitoring needs of an adaptive management proposal may differ from those of other aspects of impact management.

7.6.3 Conditions warranting the application of adaptive management

Not all resource management decisions can or should be adaptive. In some cases there is no chance to apply learning. In other cases, there is little uncertainty about what action to choose, or there are irreconcilable disagreements about objectives. It is tempting to apply the 'learning by doing' concept such that there is a risk that 'adaptive management' could be applied almost indiscriminately. In such circumstances there is a risk that projects fail to achieve expected improvements; such failure may have less to do with the approach itself than with the inappropriate contexts in which it is applied (Gregory, Ohlson, & Arvai, 2006).

Whether or not a biodiversity management problem calls for adaptive management is an important question that should, as much as is possible, be addressed early in the project development; on occasions the need for adaptive management may emerge during the consultation or decision-making process. Strong, specific consent conditions and a requirement for preparation of a management plan prior to work commencing may be used to give more certainty around adaptive management proposals.

In some cases investment in trials or research as part of the EcIA process may be warranted. For example, where information is lacking about the significance of a species or the merits of proposed impact management methods, trials may clarify issues or solutions and greatly reduce the uncertainty and risk associated with proposed enhancement programmes.

Ultimately, adaptive management should be regarded as a risk management approach where information is lacking, whereas targeted trials can be regarded as risk minimisation or elimination strategies that add confidence in the efficiency and performance of proposed mitigation or enhancement initiatives.

There is a large resource of published material on adaptive management. Williams and Brown (2012) provides a comprehensive overview for the ecologist requiring more details.

8 Monitoring

Monitoring
Key points

Monitoring of effects and outcomes of impact management is **good practice**, but not always required by regulators.

Monitoring can **provide information** about ecological values, and enable better decision-making in future. The lack of monitoring of effects and impact management may be obscuring biodiversity losses, globally and locally.

The purposes of EcIA monitoring are to:

- **Observe and measure** (to the extent possible) the actual **effects** of the proposal assessed on ecological values and biodiversity, to determine the accuracy of predictions of potential effects.
- **Observe and measure the progress and outcomes** of impact management carried out in relation to ecological values and biodiversity affected by the proposal assessed, to provide feedback on their implementation to the proponent and consenting authority.
- **Enable better outcomes** for ecological values and biodiversity, by informing future assessments, impact management and decision-making.

Types of monitoring include:

- Census
- Survey
- Surveillance
- Ecological state

Different aims include:

- To detect **breach** of a consent condition
- To determine **adverse effect** on the ecosystem, habitat, community or species
- To obtain **early warning** of environmental deterioration
- To determine whether ecosystem or habitat conditions or community or species populations are being **maintained, improved, or are deteriorating**
- To determine **compliance** with a specific outcome value or standard
- To determine the **success** or otherwise of anticipated mitigation or restoration outcomes

Ecological characteristics and project impact management outcomes need to be considered alongside any **existing monitoring** programmes when designing the programme for a particular project.

8.1 Introduction

It is good practice to develop a monitoring programme to review impact assessment outcomes and measure the success (or otherwise) of the implementation of the agreed impact management.

Monitoring can occur during the implementation of impact management, at the end, or for a period of time after the completion of impact management, or even a combination of all three. It will involve some measurements prior to the commencement of the development to form the baseline against which any anticipated changes or enhancements are measured; or indeed to confirm that there are no changes or impacts.

However, RMA Schedule 4 clause 1(i) states:

> "where the scale or significance of the activity's effect are such that monitoring is required, a description of how, once the proposal is approved, effects will be monitored and by whom"

This presents a tension between good ecological management practice and statutory requirements in relation to the amount and nature of monitoring needed, which should be discussed between ecologist and client/employer.

Globally, including in New Zealand, there is a concern that a lack of monitoring is obscuring biodiversity losses. Monitoring outcomes of impact assessment and consent conditions around biodiversity is not widely carried out (Brown, Clarkson, Barton, & Joshi, 2013). The most recent Survey of Local Authorities (Ministry for the Environment, 2014) reports that 80% local authorities say they have limited resources for monitoring and enforcement, making it difficult to meet expectations for those processes.

Design of a monitoring programme that is ecologically rigorous, and provides useful information for impact management is an important component of EcIA, but one that is often undervalued. A project proponent may be reluctant to pay for monitoring after a project is implemented, while a consenting authority may not have the staff resources to ensure post-consent monitoring is carried out.

This chapter:

1. Outlines and define the types of monitoring that may be triggered by an ecological impact assessment.
2. Outlines considerations for developing and designing a monitoring programme.

8.2 Purpose of monitoring

In the context of ecological impact assessment, the purpose of monitoring is to:

- Observe and measure (to the extent possible) the actual effects of the proposal assessed on ecological values and biodiversity, to determine the accuracy of predictions of potential effects.
- Observe and measure the progress and outcomes of impact management carried out in relation to ecological values and biodiversity affected by the proposal assessed, to provide feedback on implementation to the proponent and consenting authority.
- Enable better outcomes for ecological values and biodiversity, by informing future assessments, impact management and decision-making.

8.3 Types of monitoring

Although monitoring is now regarded as an essential component of impact assessment in New Zealand, there is a variety of types of monitoring with specific meaning. Different types of monitoring aim to address different ecological questions and serve to meet different management or regulatory needs, including whether previously formulated standards (e.g. National Standards) are being met. As part of any ecological impact assessment some or all aims may be addressed at various times and localities during the investigation.

Different types of monitoring include:

- **Census**: Typically refers to population counts which may be used in monitoring programmes.
- **Survey**: An exercise in which a set of standardised observations is taken from a site (or series of sites) within a short period of time to furnish qualitative or quantitative data. This form of 'monitoring' is typically carried out at the commencement of an assessment of environmental effects but may be repeated again, during or after development. Typically survey monitoring may form a baseline of the ecological condition of a location or localities for future consideration.
- **Surveillance**: A continued programme of surveys systematically undertaken to provide a series of observations over time. Observations may include reference or control sites.
- **Ecological state of ecosystems**: An assessment of the integrity of ecosystems or ecosystem health in relation to a specific impact. This form of monitoring may also be defined as state of environment monitoring but is different (see below). Similar attributes may be measured in each type of monitoring. Observations may include reference or control sites.
- **State of the environment (SOE) monitoring**: Monitoring undertaken to detect trends over a period of time and usually across a wide area, such as a local authority Region or District. Observations may include reference or control sites. State of the environment monitoring is generally not used to measure the success of specific impact management. However, it may provide information about trends in the wider environmental context against which proposal-related trends can be assessed. SOE monitoring is not discussed further in this document.

Each of the above types will have specific advantages dependent on the objective of the study and the overall question being asked. A clear understanding of the purpose of the monitoring is therefore necessary, along with an understanding of how the information will finally be used (see below). In New Zealand, monitoring is often mix of the kinds defined above, each occurring at different stages of a sampling programme.

8.4 Design of monitoring programmes

8.4.1 Objectives and purpose of monitoring

What might the aims of a monitoring programme be? Several possible aims relevant to the assessment of the impacts are considered below.

- To detect every single breach of a particular consent condition.
- To determine whether there is a significant adverse effect on the ecosystem, habitat, community or species.
- To obtain early warning of environmental deterioration by monitoring to detect change in ecosystem, habitat, community or species or a combination of some or all.
- To determine whether ecosystem or habitat conditions or community or species populations are being maintained, improved, or are deteriorating as a result of the development.
- To determine compliance with a specific outcome value or standard.
- To determine the success or otherwise of anticipated mitigation or restoration outcomes

Each monitoring objective will require a different sampling programme design in order to obtain defensible results. Detection or monitoring of spatial biological pattern, natural spatial environmental pattern or natural temporal environmental change, are all confounding influences (or noise) as far as achieving the stated objective is concerned. Study designs therefore must facilitate the making of appropriate comparisons through the collection of relevant data, elimination of confounding effects and the selection of appropriate analyses.

A sampling strategy to meet the given objective must consider the number and locations of sampling sites, sampling methods, sampling frequency, sample replication, sample processing protocols and the need for qualitative, quantitative, semi-quantitative or relative abundance data.

8.4.2 Study design and the use of statistics in monitoring programmes

Study design and the use of statistics in monitoring programmes is beyond the scope of these NZ Guidelines. The user is referred to other literature for more detailed information on the subject (e.g. Downes, Barmuta, Fairweather, Faith, & Keough, 2002; Lindenmayer & Gibbons, 2012; Lindenmayer & Likens, 2010; Southwood & Henderson, 2000; Spellerberg, 2005). Monitoring programmes invariably involve studying patterns of distribution and abundance of organisms in order to detect environmental changes, and to infer the causes of change by associating biological changes with corresponding changes in biotic or abiotic variables.

8.4.3 Considerations for monitoring

Several elements need to be considered for any monitoring programme:

- Sample site selection
- Sampling frequency
- Sampling methods
- Sample size and sample replication
- Qualitative, semi-quantitative or quantitative data?
- Statistical testing and data analyses
- Use of remote sensing balanced by field observations

Cost-effective ecological monitoring as part of EcIA should focus on matters that are key to the proposed impact management:

- Ecological value of the affected species, habitats, ecosystems, targeting valued ecological features
- Predicted effects of proposal and expected frequency/duration of effects, targeting the effects on valued ecological features
- Life-cycles and movements of species affected, to ensure the monitoring programme reflects temporal and spatial patterns
- Predicted outcomes of impact management and timing of their expected occurrence, setting realistic target dates and goals at different stages of impact management
- Existing monitoring programmes in place relating to the site or affected ecological feature, to avoid duplication but allowing for synergies
- Requirements for feeding results back into adaptive management programme or consent authority
- National, regional or local conservation goals, strategies or policies, to identify gaps in data that might be filled through EcIA monitoring.

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Appendix 1
Legislation

The Conservation Act 1987, Crown Minerals Act 1991 and the Wildlife Act 1953 are the statues most widely applicable to Ecological Impact Assessment after the RMA, and are summarised below. Other acts of more restricted scope which may be relevant include the Biosecurity Act 1993, Hazardous Substances and New Organisms Act 1996, Fisheries Act 1996, Freshwater Fisheries Act 1983, Overseas Investment Act 2005 and Marine and Coastal Area (Takutai Moana) Act 2011.

The Resource Management Act legislation requires an assessment of effects on ecological values (EcIA) as part of an assessment of environmental effects (AEE) (refer in particular to RMA section 88 (2) and Schedule Four 2(c)) when an application is prepared. Proposals to amend the RMA were approved under the Resource Management Amendment Act 2013. Different sections of this Amendment Act will commence at different times so that it is important to consult a lawyer or planner to ensure all relevant aspects are addressed. Under the RMA, the use of land is essentially permissive; applications for consent will not be required unless the contemplated activity is regulated by a planning document, such as a district plan (s 9). Conversely, discharges to environment and most activities relating to water will require consent unless expressly authorised (ss 14–15).[33]

National Policy Statements

National Policy Statements (NPS) and National Environmental Standards are developed to guide local authorities in implementing the RMA and setting consistent standards across the country. They must be considered when carrying out an EcIA, although not all will be relevant to ecological matters.

Currently the following **National Policy Statements** (see MFE website[34]) are in place:

- electricity transmission
- renewable electricity generation
- NZ coastal policy statement (led by the Department of Conservation)
- freshwater management

Work has also been done by the Ministry for the Environment on:

- scope of an NPS on Urban Design
- a proposed NPS on Indigenous Biodiversity

MfE also provides NPS guidance for councils implementing these NPSs on:

- NPS Freshwater Management guidance
- NPS Renewable Electricity Generation guidance

National Environmental Standards

National environmental standards, also listed on the MFE website,[35] should also be considered:

National environmental standards in effect

- Air quality standards
- Sources of human drinking water standard
- Telecommunications facilities
- Electricity transmission
- Assessing and managing contaminants in soil to protect human health

The following standards are at various stages of development, ranging from initiating consultation to being legally drafted.

- Ecological flows and water levels
- Plantation forestry

The *Conservation Act 1987* (CA) has a number of functions, all aimed at managing conservation areas (defined in s 2) held by the Crown. The Act established the Department of Conservation, the New Zealand Conservation Authority and Conservation Boards. The Department is to manage all conservation areas in accordance with general policy statements and where applicable, more specific conservation management strategies, conservation management plans and freshwater fisheries management plans.

33 http://www.legislation.govt.nz/act/public/1991/0069/latest/DLM233858.html.
34 http://www.mfe.govt.nz/rma/central/nps.
35 http://www.mfe.govt.nz/laws/standards/index.html.

The CA requires applications for all activities on conservation land, bar certain exceptions. These exceptions include: mining activities authorised under the CMA (below, but note that an access arrangement will still need to be obtained from DOC); other activities specifically authorised by the CA; and recreational activities (e.g. tramping). Section 17S sets out the requirements for an application under the Act. Effects are defined in s 2 as having the same meaning as under the RMA. The application will be assessed (s 17U) both in terms of the effects and mitigation measures proposed (as under the RMA), but additionally, cannot be granted if the proposed activity is contrary to the purposes for which the land is held, or the provisions of the CA. There are various 'classes' of conservation land, determined by the purposes for which they are managed. Alternative locations are given greater prominence than under the RMA (s 17U(4)), which may be relevant to the scope of an ecological assessment under this Act.

The *Crown Minerals Act 1991* (CMA) is aimed at the management of Crown-owned minerals. It replaces a number of statutes, including the Mining Act 1971, the purpose of which was "to provide improved facilities for the development of mineral resource"; the Petroleum Act 1937; and the Coal Mines Act 1979. The CMA was developed separately from the RMA, as it was reported that "any form of an extractive industry is essentially not sustainable in the pure sustainable definition" [Minister of Energy, *NZ Parliamentary Debates* (1991) p 3040]. Applications for mining will often include applications under the CMA and RMA. Section 9 of the CMA requires compliance with the RMA, which will require consent be sought under the relevant district and regional plans as appropriate. Its focus is reflected in s 12, which sets out the purpose of the minerals programmes.

The *Wildlife Act 1953* deals with wild animals and birds, and the management of game. It will be most relevant to activities that affect wildlife deemed protected under the Act (refer s 3 and schedules 1-5 which categorise species). The Department of Conservation has a useful guide to working through the Act on its website (http://www.doc.govt.nz/about-doc/role/legislation/wildlife-act). Most native species are absolutely protected, which means a permit is required to kill or possess them. This may apply both in terms of construction or operation of activities, but also in terms of mitigation – for example, the possession of threatened species for translocation away from impact sites. Special protection is provided to all wildlife in wildlife sanctuaries (s 10; sanctuaries may be created under s 9, or under the Reserves Act 1977).

Appendix 2
Key sources of ecological data in New Zealand

General sources

- Aerial photos from Google and Bing websites, as well as photos held by local authorities
- Google Scholar/Google and other search engines
- Local authorities' websites, publications, databases and GIS viewers
- Scientific journals and interest group publications
- University theses
- Museum records (especially for historical trends)

Organisation	Subject area	Link or database
Landcare Research	National vegetation survey	http://www.landcareresearch.co.nz/resources/data/national-vegetation-survey-nvs
	Land environments (LENZ)	http://www.landcareresearch.co.nz/resources/maps-satellites/lenz
	Next generation ecosystem classification	http://www.landcareresearch.co.nz/resources/maps-satellites/lenz/next-generation-ecosystem-classification
	Naturally uncommon ecosystems of New Zealand	http://www.landcareresearch.co.nz/science/plants-animals-fungi/ecosystems/rare-ecosystems
	New Zealand Lizards Database	http://nzlizards.landcareresearch.co.nz/Default.aspx
	Systematics Collections Data	https://scd.landcareresearch.co.nz
	General	http://www.landcareresearch.co.nz/resources/data
NIWA	River Environment Classification (REC)	http://www.niwa.co.nz/our-science/freshwater/tools/rec
	NZ freshwater fish database (NZFFD).	http://www.niwa.co.nz/freshwater-and-estuaries/nzffd Available to registered users
	General	http://www.niwa.co.nz/our-services/databases
Department of Conservation	Terrestrial and Freshwater Biodiversity Information System (TFBIS) Programme provides access to fundamental data and information about terrestrial and freshwater biota and biodiversity	http://www.doc.govt.nz/tfbis
	Freshwater Ecosystems of New Zealand (FENZ) incorporates Waters of National Importance, WONI)	http://www.doc.govt.nz/conservation/land-and-freshwater/freshwater/freshwater-ecosystems-of-new-zealand
	Electronic Atlas of the Amphibians and Reptiles of New Zealand	http://www.doc.govt.nz/conservation/native-animals/reptiles-and-frogs/reptiles-and-frogs-distribution-information/electronic-atlas

	BioWeb Herpetofauna. Administered by DOC	Available to registered users. Hosts data from the Amphibian and Reptile Distribution Scheme (ARDS) and SpecCard Access database
	Wetlands	http://www.doc.govt.nz/about-doc/role/international/ramsar-convention-on-wetlands/nz-wetlands-of-international-importance
	Wetlands of Ecological and Representative Importance (WERI)	Database held by DOC. Mostly 1980s, dated
	Protected Natural Area (PNA) programme reports (for some areas, some outdated)	http://www.doc.govt.nz/publications/conservation/land-and-freshwater/land; http://www.biodiversity.govt.nz/pdfs/funded_projects_2.pdf
	New Zealand Threat Classification System	http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system
	Sites of Special Wildlife Interest (SSWI)	Mostly 1980s, dated
Ministry for the Environment	Land Cover Database (LCDB)	http://www.mfe.govt.nz/issues/land/land-cover-dbase
Others	New Zealand Plant Conservation Network	http://www.nzpcn.org.nz
	Botanical Society publications	http://www.nzpcn.org.nz/page.aspx?publications_Botsoc_journals
	New Zealand Virtual Herbarium	http://www.virtualherbarium.org.nz
	Fish and Game New Zealand	http://www.fishandgame.org.nz
	Nature Watch	http://naturewatch.org.nz
	NZ Birdsonline	http://www.nzbirdsonline.org.nz
	eBird NZ	http://ebird.org/content/newzealand
	Ornithological Society	http://osnz.org.nz
		Atlas of Bird Distribution in New Zealand 1999–2004. Published by the Ornithological Society of New Zealand. Wellington. Underlying data may also be available from the OSNZ on request.

Appendix 3
Basic site survey checklist for scoping

Location

1. Site name
2. Site reference number
3. Location – latitude/longitude and NZTM reference
4. GPS waypoint reference number
5. Property/ownership details
6. Access details – how to get there, who to contact

Physical Environment – General

1. Land cover
2. Land use
3. Adjacent land cover and land uses
4. Geology
5. Soils
6. Landforms on site
7. Waterways/water bodies
8. Infrastructure

Biological Environment

Terrestrial habitats with vegetation

1. Communities/vegetation types
2. Dominant species in tiers, and cover estimates
3. Condition – weeds, pests, modifications
4. Sketch map with GPS points for significant features/species
5. Fauna observed

Terrestrial habitats without vegetation

1. Ground cover/habitat type
2. Fauna observed

Aquatic habitat

1. Dimensions
2. Flow characteristics
3. Substrate characteristics
4. Vegetation species and cover
5. Fauna observed

Photographs

1. Number and GPS

Comments and general description notes

Appendix 4
Threatened naturally uncommon ecosystems

(from Holdaway, Wiser, & Williams, 2012)

Critically endangered	Endangered	Vulnerable
Shell barrier beach	Active sand dune	Coastal cliffs on mafic rock
Coastal turf	Dune deflation hollow	Screes of calcareous rock
rock		
Old tephra plains	Stony beach ridge	Young tephra plains and hill slopes
Inland sand dunes	Shingle beach	Boulder fields of calcareous rock
Outwash gravels	Stable sand dune	Cliffs, scarps and tors of mafic rocks
Inland saline	Coastal cliffs on calcareous rock	Cliffs, scarps and tors of calcareous rocks
Leached terraces	Ultramafic sea cliffs	Moraine
Fumaroles	Volcanic dunes	Lake margins
Geothermal stream sides	Sandstone erosion pavements	Blanket mire
Geothermal heated ground	Frost hollows	Estuary
Geothermal hydrothermally altered ground	Volcanic boulder fields	
Seabird guano deposits	Sinkholes	
Seabird burrowed soil	Dune slacks	
Marine mammal influenced sites	Domed bog (Sporadanthus)	

Appendix 5
Matters and criteria – examples

Canterbury Regional Policy Statement

(operative January 2013)

Appendix 3. Criteria for determining significant indigenous vegetation and significant habitat of indigenous biodiversity.[36]

Representativeness

1. Indigenous vegetation or habitat of indigenous fauna that is representative, typical or characteristic of the natural diversity of the relevant ecological district. This can include degraded examples where they are some of the best remaining examples of their type, or represent all that remains of indigenous biodiversity in some areas.
2. Indigenous vegetation or habitat of indigenous fauna that is a relatively large example of its type within the relevant ecological district.

Rarity/Distinctiveness

3. Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20% of its former extent in the Region, or relevant land environment, ecological district, or freshwater environment.
4. Indigenous vegetation or habitat of indigenous fauna that supports an indigenous species that is threatened, at risk, or uncommon, nationally or within the relevant ecological district.
5. The site contains indigenous vegetation or an indigenous species at its distribution limit within Canterbury Region or nationally.
6. Indigenous vegetation or an association of indigenous species that is distinctive, of restricted occurrence, occurs within an originally rare ecosystem, or has developed as a result of an unusual environmental factor or combinations of factors.

Diversity and Pattern

7. Indigenous vegetation or habitat of indigenous fauna that contains a high diversity of indigenous ecosystem or habitat types, indigenous taxa, or has changes in species composition reflecting the existence of diverse natural features or ecological gradients.

Ecological Context

8. Vegetation or habitat of indigenous fauna that provides or contributes to an important ecological linkage or network, or provides an important buffering function.
9. A wetland which plays an important hydrological, biological or ecological role in the natural functioning of a river or coastal system.
10. Indigenous vegetation or habitat of indigenous fauna that provides important habitat (including refuges from predation, or key habitat for feeding, breeding, or resting) for indigenous species, either seasonally or permanently.

36 Guidelines for interpretation and use of these criteria are on the Council's website: http://ecan.govt.nz/publications/Plans/ecological-significance-indigenous-vege-canterbury.pdf.

Auckland City Proposed Unitary Plan

4.3.4 Biodiversity

Policies

Identifying areas

1. Identify and protect areas of significant indigenous vegetation and the significant habitats of indigenous fauna in terrestrial, freshwater and coastal environments as SEAs using one or more of the following criteria:
   a. **representativeness**: The area is important for the indigenous habitats and/or ecosystems it supports because they are ecologically representative of the mature and successional stages of the vegetation of each ecological district in Auckland and provide cumulatively for at least 10 per cent of the natural extent of each ecosystem type
   b. **stepping stones, buffers and migration pathways**: The area is significant because of its context with other habitats or ecosystems. This includes groups of smaller sites that together form an important vegetation component in the landscape, cumulatively provide critical habitat for a native species, provide buffers to other significant ecological areas or act as stepping stones or ecological corridors providing for movement
   of species across the landscape
   c. **threat status and rarity**: The area supports genes, species, habitats and/or ecosystems that have been classified as threatened with extinction or are naturally rare in Auckland or New Zealand
   d. **uniqueness or distinctiveness**: The area supports genes, species, communities, habitats and/or ecosystems that are endemic, or near endemic, and only naturally occur in Auckland
   e. **diversity**: The area supports indigenous vegetation that is ecologically diverse, close to the typical species or ecosystem diversity for that habitat or supports indigenous vegetation that extends across at least one environmental gradient.
2. Identify other areas that do or can enhance indigenous biodiversity values, or make a significant contribution to providing ecosystem services, including:
   a. areas of predominantly indigenous vegetation in riparian margins and the coastal environment
   b. habitats of indigenous species that are important for recreational, commercial, traditional or cultural purposes
   c. steep or erosion prone areas
   d. areas that make a significant contribution to landscape or natural character values.

Appendix 6
References/location of current threatened species information

Current threatened species lists can be found at: http://www.doc.govt.nz/publications/conservation/nz-threat-classification-system/nz-threat-classfication-system-lists-2012-14.

At September 2014 these are published in:

Vascular plants

de Lange, P.J.; Rolfe, J.R.; Champion, P.D.; Courtney, S.P.; Heenan, P.B.; Barkla, J.W.; Cameron, E.K.; Norton, D.A.; Hitchmough, R.A. 2013: Conservation status of New Zealand indigenous vascular plants, 2012. *New Zealand Threat Classification Series 3*. Department of Conservation, Wellington. 70 p.

Reptiles

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Appendix 7

The main systems used in New Zealand to assign ecological value, at various levels of ecological organisation and spatial scale

System	Comments and reference
Criteria for significance under RMA	Background in international conservation evaluation literature Various adaptations in New Zealand: O'Connor et al (1990), Norton & Roper-Lindsay (2004), a plethora of 'offshoot' interpretations in DPs etc. Regional and District planning documents with criteria and schedules
NZ Threat Classification system and lists	Preferred over IUCN. Updated from time to time – planning documents may refer to older versions, so need to reflect current versions as well as any in planning documents Represent 'best endeavours' by panel of experts, but can be limited information. See reference for full list of current appraisals. http://www.doc.govt.nz/publications/science-and-technical/products/series/new-zealand-threat-classification-series
Recommended Areas for Protection (RAP) under PNAP programme	Technical Advisory Group, PNA Programme (1986) (Myers, Park, & Overmars, 1987)
Local systems	E.g. O'Donnell (2000) evaluation of water bird habitats in Canterbury Rivers Auckland City Proposed Unitary Plan
RAMSAR Wetlands of National Importance (WONI)	http://www.doc.govt.nz/about-doc/role/international/ramsar-convention-on-wetlands/nz-wetlands-of-international-importance
SSWI, WERI	Created under Wildlife Act (1953) so take a dated view on ecological values but can provide good base information
National Priorities for Protecting Rare and Threatened Indigenous Biodiversity	No statutory status, but widely referred to implicitly referred to in Canterbury Regional Policy Statement https://www.mfe.govt.nz/issues/biodiversity/initiatives/private-land/work-programme.html
Threatened Land Environment Classification	http://www.landcareresearch.co.nz/resources/maps-satellites/threatened-environment-classification
NZ River Environment Classification	http://www.niwa.co.nz/our-science/freshwater/tools/rec
Stream Evaluation System	Maybe has status in some planning documents Designed primarily for soft-bottomed streams in Auckland, so be wary when using in other habitats
Originally Rare Ecosystems	Williams et al. (2007) Holdaway, Wiser, & Williams, 2012
RAMSAR and World Heritage Convention	International obligations http://www.ramsar.org/pdf/lib/manual6-2013-e.pdf http://whc.unesco.org/en/guidelines

Appendix 8

Examples of ecological structure, function, features and processes to consider when describing potential effects

Physical resources/environment

- Habitat for territory, hunting/foraging/feeding, shelter and roost sites, breeding sites; spawning runs; corridors for migration, dispersal; stepping stone sites
- Food and water
- Soil minerals, nutrients, processes
- Solar radiation and gaseous resources

Stochastic processes

- Flooding
- Drought
- Wind/storms
- Disease
- Eutrophication
- Erosion, deposition and other geomorphological processes
- Fire
- Climate change and irregular/rare events

Ecological processes

- Population dynamics, cycles
- Survival rates and strategies
- Reproduction rates and strategies; dispersal, migration and genetic exchange
- Competition
- Predation
- Seasonal and life-cycle behaviours
- Vegetation dynamics, colonisation, succession, regeneration, competition and nutrient cycling

Human influences on ecological patterns and processes

- Farming practices – grazing, mowing, application of pesticides and herbicides, drainage, irrigation, earthworks, fertilising, nutrient run-off/leaching, vehicle use, introduction of plant and animal species
- Pollution/contamination/eutrophication
- Recreation, tourism and access disturbances
- Pests
- Conservation and restoration activities
- Water abstraction, diversion, damming, impedance of fish passage

Historical context

- History of flora, fauna, vegetation and habitats over pre-European and pre-human time-frames
- Natural patterns of change
- Uses and management by tangata whenua

Ecological relationships

- Food webs, predator-prey links, herbivore plant links, herbivore-carnivore links
- Adaptation, dynamism, uncertainty and unpredictability
- Ecological role, function
- Species and guilds; decomposer, primary producer, herbivore, parasite, predator, keystone species
- Ecosystem services

Ecosystem properties

- Fragility, stability, carrying capacity and limiting factors, productivity, community dynamics
- Connectivity, patchiness, fragmentation, mosaic; networks, corridors
- Population numbers; metapopulations; minimum viable populations; sex-age ratios

Appendix 9
Principles for biodiversity offsets

From BBOP *Guidance Notes to the Standard on Biodiversity Offsets* (Business and Biodiversity Offsets Programme (BBOP), 2012)
http://www.forest-trends.org/documents/files/doc_3099.pdf

Principle 1. Adherence to the mitigation hierarchy: A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimisation and on-site rehabilitation measures have been taken according to the mitigation hierarchy.

Principle 2. Limits to what can be offset: There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.

Principle 3. Landscape context: A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.

Principle 4. No net loss: A biodiversity offset should be designed and implemented to achieve in situ, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.

Principle 5. Additional conservation outcomes: A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.

Principle 6. Stakeholder participation: In areas affected by the development project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation, and monitoring.

Principle 7. Equity: A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a development project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.

Principle 8. Long term outcomes: The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the development project's impacts and preferably in perpetuity.

Principle 9. Transparency: The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.

Principle 10. Scientific information, and, where applicable, traditional knowledge, shall be utilised when designing and implementing the offset.