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**IMPLEMENTATION OF SUSTAINABLE RESOURCE  
MANAGEMENT  
A PROCESS FOR ENVIRONMENTAL EVALUATION  
AORANGI AWARUA CASE STUDY**

**A thesis presented in fulfilment of  
the requirements for the degree of  
Master of Resource and Environmental Planning  
at Massey University**

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**1992**

*IN MEMORY*  
*OF*  
*DR KEVIN MAKIN*

## ABSTRACT

"Implementing Sustainable Resource Management - A Process for Environmental Evaluation" is a review and discussion of the theoretical concepts associated with sustainability; and the development of these into practical guidelines for implementation.

Regional councils have a legislative responsibility to carry out sustainable resource management. This implies a commitment to ecological sustainability; the management of resources within the life supporting capacity of the environment, and the recognition of all of the environmental effects (costs) associated with resource use.

Implementation of sustainable resource management will require the development of a set of practical guidelines and tools. Such mechanisms necessarily range from the conceptual to the practical, and will include general principles relating to the concept of sustainability and legislative tools such as regional policy statements, regional plans and resource consents. A "Model for Sustainable Resource Management" has been developed which allows for the integration of the ecological, economic and social schools of thought. A programme for environmental and performance monitoring and the development of appropriate indicators is a prerequisite for sustainable resource management. Such a programme will enable and assist with the identification of environmental limits. The requirement for a process for the assessment of the effects of current and proposed resource use on the environment is also emphasised.

Rather than develop all of these mechanisms in detail, this thesis focuses on the development of an "Environmental Evaluation Process" within the planning context, for the determination of the adverse environmental effects associated with resource consent applications in New Zealand.

The natural environment has value independent of the instrumental or mechanistic (use) value attributed to it by human beings. These values can be categorised as non-use and intrinsic.

Traditional analytical techniques such as Environmental Impact Assessment, Cost-Benefit Analysis and Planning Balance Sheet are useful in terms of identifying, organising and attributing dollar terms to tangible environmental costs and benefits. However, these methods do not go far enough. For a comprehensive analysis of any resource management issue, the true environmental costs of "development" must be incorporated into the decision making process. Contingent valuation method is the most appropriate method for non-market valuation of natural resources and environments.

A process for environmental evaluation (which includes the Contingent Valuation Method) has been developed and applied to the Aorangi-Awarua Case Study.

The Thesis concludes with some recommendations as to the implementation of sustainable resource management, with particular reference to the practicality of parts and all of the Process for Environmental Evaluation for use by regional councils.

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NPV	Net Present Value
NWASCA	National Water and Soil Conservation Authority
NZFS	New Zealand Forest Service
OECD	Organisation for Economic Co-operation and Development
PBS	Planning Balance Sheet
PSDR	Private Sector Discount Rate
PV	Present Value
PW	Present Worth
RFBS	Royal Forest and Bird Society
RMA	Resource Management Act 1991
RMS	Regional Monitoring Strategy
RPS	Regional Policy Statement
ROC's	Reference Operating Conditions
RWCB	Rangitikei-Wanganui Catchment Board
RWTP	Real Willingness to Pay
SCBA	Social Cost Benefit Analysis

SCRCA	Soil Conservation and Rivers Control Act
SDA	Social Discount Rate
SMS	Safe Minimum Standard
SOCR	Social Opportunity Cost Rate
STPR	Social Time Preference Rate
TCPA	Town and Country Planning Act 1977
TEV	Total Economic Value
TWTP	True Willingness to Pay
WAC	Wanganui Acclimatization Society
WCED	World Commission on Environment and Development
WSCA	Water and Soil Conservation Act 1967
WTA	Willingness to Accept
WTP	Willingness to Pay

## GLOSSARY

AORANGI AWARUA BLOCK/ FOREST	Aorangi Block and Awarua 1DB Nos. 1 and 2 Blocks.
BIAS	Systematic error in relation to CV surveys.
BIOPHYSICAL BOTTOM LINE	Refer Environmental Limits
ECOLOGICAL SUSTAINABILITY	The persistence of all components of the biosphere.
EFFECT	In relation to any use, development or protection of resources includes any positive or adverse effect; any temporary or permanent effect; any past, present or future effect; and any cumulative effect which arises over time or in combination with other effects - regardless of the scale, intensity, duration, or frequency of the effect, and also includes - any potential effect of high probability; and any potential effect of low probability which has a high potential impact (RMA).
ENVIRONMENT	Ecosystems and their constituent parts, including people and communities; and amenity values; and the social, economic, aesthetic, and cultural condition which affect ecosystems, natural and physical resources and amenity (RMA).
ENVIRONMENTAL EVALUATION	The assessment of all potential environmental effects and impacts using analytical and non-market valuation techniques.
ENVIRONMENTAL GOODS AND SERVICES	Natural resources and the services that these provide to other components of ecosystems and human beings.

ENVIRONMENTAL LIMITS	Critical points, or zones beyond which further depletion or degradation of a resource will be irreversible.
EXISTENCE VALUE	This is a type of "intrinsic" value and is the value of simply knowing that a resource exists.
GOALS	An end towards which a design trends.
KAWANATANGA	The right of sovereignty given to the Crown by the Treaty of Waitangi
INTRINSIC VALUE	Value associated with natural resources and the environment that is unrelated to human beings altogether.
OBJECTIVES	Specific steps towards the attainment of a goal.
OPTION VALUE	Value associated with still having the opportunity to use a resource in the Future.
MAXIMUM SUSTAINABLE YIELD	Maximum harvest that can be taken from a resource each year without causing irreversible environmental damage.
QUASI-OPTION VALUE	The value of preserving options in anticipation of improved knowledge and technology.
RANGITIRATANGA	The right of Maori to manage their tribal resources.
SAFE MINIMUM STANDARDS	Refer Environmental Limits
STAKEHOLDERS	Individuals and Organisations who have an interest in, or who will be affected by a proposal.
SUSTAINABILITY	The overall concept of society living within the self perpetuating limits of the environment (biosphere).

SUSTAINABLE DEVELOPMENT	World economic progress within the biophysical imposed by nature, together with a concern for social inequities and the global redistribution of wealth.
SUSTAINABLE RESOURCE MANAGEMENT	"Managing the use, development and protection of natural and physical resources, in a way, or at a rate, that enables people and communities to provide for their social, economic and cultural well being and for their health and safety" - without compromising ecological sustainability.
USE VALUE	The value of present and future use of a resource (commercial, recreation, scenic etc.)
WILLINGNESS TO ACCEPT	The amount of money people would be willing to accept as compensation for a loss of an environmental "good or service".
WILLINGNESS TO PAY	The amount of money people would be willing to pay to ensure the preservation or continued supply of an environmental "good or service".

## CHAPTER ONE

### INTRODUCTION TO THESIS

#### **1.1 BACKGROUND AND MOTIVATION**

Since the 'Brundtland Report' of 1987, the concepts associated with 'sustainable development' have reverberated around the world. Many countries, including New Zealand, are taking up the challenge and are attempting to introduce the concept of sustainability into policy and legislation. But can the theoretical concepts be applied in reality, particularly in the context of economic recession and increasing poverty in many parts of the world?

Regional councils have a legislative responsibility to carry out 'sustainable resource management' under the Resource Management Act 1991 (RMA). What does this actually mean and what are the implications for decision making?

These questions are ones which are continuously being raised, and for which there appears no easy solutions. It is the search for some answers which has provided the inspiration for this thesis. As a Policy Analyst working for the Manawatu-Wanganui Regional Council (MWRC), the author has become very aware of the policy and legislative directives of Central Government, and the difficulty for regional councils in trying to implement sustainable resource management.

Regional councils came into being in November 1989 as a result of Local Government Reform. Also around this time the Resource Management Bill was released. The Bill was the result of the integration of all New Zealand's major resource laws with a view towards sustainable resource management (Ministry for the Environment {MFE}, 1989).

The operating climate is thus one where new 'resource management' organisations must come to terms with untried and untested legislation; in an environment where Central Government is devolving responsibilities whilst simultaneously withdrawing funding. Such an operating climate has served to provoke many ideas on future resource management techniques and issues, which the author will discuss, and attempt to resolve, as part of this Thesis.

This Thesis is therefore centred on two issues currently being faced regional councils. Firstly, that of implementing sustainable resource management; and secondly, the need to incorporate true environmental costs and benefits into the decision making process. While they appear to be two separate issues, it is the strong belief of the author that they are in fact inter-related, and that what is required is a process for environmental evaluation which includes non-market valuation.

The overall aim of this Thesis is to provide some guidelines for the implementation of sustainable resource management; and to develop a process, within the context of these guidelines, for the assessment of resource consent applications which have the potential for significant adverse environmental effects.

The MWRC has been involved in an application for consent under both the Town and Country Planning Act 1977, and the Soil Conservation and Rivers Control Act 1959. The application involves the 'selective logging' of native timber on a block of Maori owned land known as Aorangi Awarua. The Aorangi Awarua proposal provides an excellent case study for the practical application of the resource management concepts and techniques discussed in this Thesis.

## **1.2 OVERALL AIM**

The overall aim of this Thesis is to take the concept of 'sustainability' and, within the context of the New Zealand legislative and institutional framework, derive a set of practical guidelines and tools for the implementation of sustainable resource management. Within the context of these guidelines, develop a process for environmental evaluation and apply this process to the Aorangi Awarua application.

## **1.3 GOALS AND OBJECTIVES**

The goals and objectives to attain the overall aim of the Thesis, are outlined in this section. Goals are 'an end towards which a design trends, an aim or purpose ....' (Chadwick 1971, p.125-126). While objectives are 'specific steps toward the attainment of a goal ....' (Eddison 1975, p.26).

### **1.3.1 Operating Climate**

#### *Goal*

To review the legislative and institutional framework for resource management within New Zealand.

#### *Objectives*

To identify and discuss those parts of the Resource Management Act 1991 of relevance to this thesis.

To identify and discuss the role of Regional Councils in implementing sustainable resource management.

### **1.3.2 Literature Review**

#### ***Goals***

To analyze the theoretical concepts of sustainable resource management.

To outline the theoretical concepts associated with "environmental values".

To review some of the analytical techniques which may be used for the evaluation of environmental impacts and the costs and benefits associated with policy and development proposals.

To identify and discuss techniques which have been developed for non-market valuation of the environment (natural resources).

To select the method of non-market valuation which is most applicable for use by the MWRC; to discuss the theoretical basis for this method; and to review some recent applications.

#### ***Objectives***

To determine whether existing theory can assist with the implementation of 'sustainable resource management' in New Zealand (as required under the Resource Management Act).

To identify the types of value associated with the natural environment.

To identify and discuss analytical techniques for environmental evaluation which are applicable within the New Zealand context, and more specifically to the Aorangi Awarua planning application.

To determine and select the technique most appropriate for the non-market valuation of the Aorangi Awarua Block.

To determine the validity, reliability and accuracy of this method for measuring environmental value.

### **1.3.3 Process and Aorangi Awarua Case Study**

#### *Goals*

Utilise the resource management concepts and techniques discussed in the literature review to develop a process for the evaluation of resource consent applications which have the potential for significant adverse environmental impacts.

To apply this process to the Aorangi Awarua application.

#### *Objectives*

To examine the issues and resource management conflicts which arose as a result of the Aorangi Awarua proposal.

To identify the social, economic and environmental costs and benefits associated with the Aorangi Awarua application using Planning Balance Sheet, Environmental Impact Assessment, and Cost Benefit Analysis.

To carry out a non-market valuation of the Aorangi Awarua Block.

To provide the MWRC with recommendations regarding the use of non-market valuation.

## 1.4 OUTLINE OF THESIS

This thesis is presented in a way that allows for the logical development of theoretical concepts into practical guidelines for implementation. Refer to Figure One which shows the Thesis structure in diagrammatic form.

Chapter Two sets out the legislative and institutional frameworks which make up the operating climate in which the theoretical concepts are to be applied.

A review of the relevant literature, and a discussion on the concepts and definitions associated with sustainability, sustainable development and sustainable resource management is included in Chapter Three. The conclusions of this Chapter, relating to the importance of ecological sustainability, lead directly into Chapter Four, Implementing Sustainable Resource Management; and Chapter Five, Environmental Assessment.

Chapter Four provides for the development of the concepts discussed as part of the literature review into a set of practical guidelines and tools for regional councils to use in the implementation of sustainable resource management.

In Chapter Five the types of values associated with the natural environment are discussed. These values must be incorporated in resource management decision making if ecological sustainability, and by implication sustainable resource management, is to be achieved. Chapter Five therefore includes a review of the literature relating to analytical techniques for environmental evaluation. Traditional techniques do not go far enough with respect to incorporating environmental values. A review of the literature on non-market valuation of environmental "goods and services" is therefore included. The Chapter concludes with the selection of the contingent valuation method as the most appropriate technique for the regional councils to consider utilising.

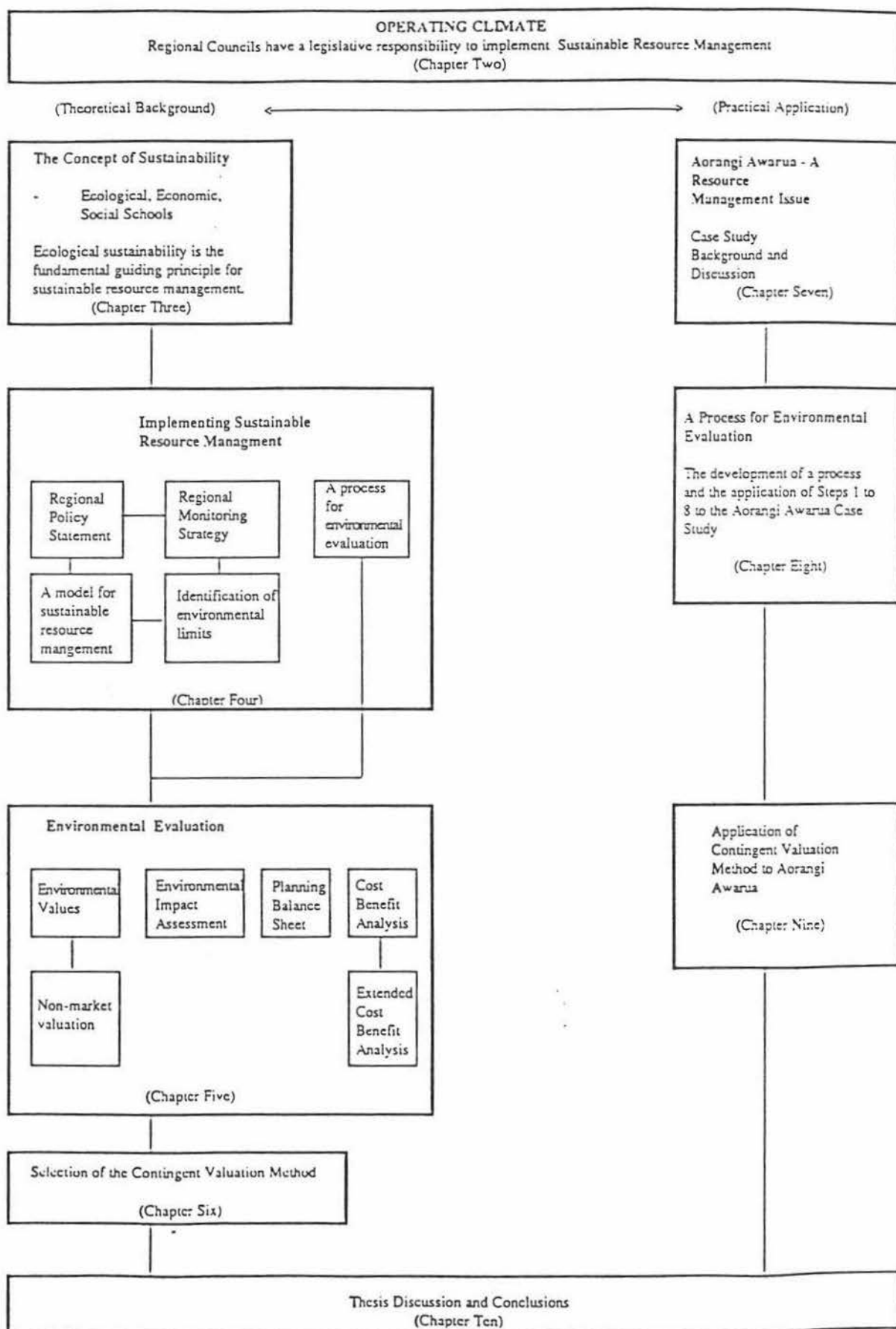
Chapter Six provides a fairly extensive review of the literature on Contingent Valuation Method (CVM) including the methodology; the strengths and weaknesses of the method; criteria for enhancing reliability and validity of the results; and recent examples of CVM applications.

Chapter Seven outlines the resource management issues associated with the application for selective logging of Aorangi Awarua. A process for the environmental evaluation of the impacts associated with this application is then proposed, and applied to Aorangi Awarua as a case study in Chapters Eight and Nine.

Chapter Ten sets out the Thesis Discussion, Conclusions and Recommendations.

As this part of Chapter One shows, this thesis covers a broad spectrum of concepts and a number of practical techniques. To understand the importance of the theoretical concepts and the choice of techniques discussed, it is necessary to examine the operating climate (the legislative and institutional background) which provides the framework for resource management in New Zealand.

Figure One. Thesis Structure



## CHAPTER TWO

### OPERATING CLIMATE

#### 2.1 PURPOSE

The purpose of this Chapter is to examine the operating climate in which resource management in New Zealand is carried out. The focus of the Chapter is on the legislative and institutional frameworks, rather than the "political" setting. The discussion on the institutional framework has been restricted to regional councils. It is acknowledged that in reality the "operating climate" includes many additional political, economic, and social factors; and involves all three levels of government (central, regional and territorial) as well as the private sector.

#### *Objectives*

To identify and discuss those parts of the Resource Management Act 1991 of relevance to this thesis.

To identify and discuss the role of Regional Councils in implementing sustainable resource management.

#### 2.2 LEGISLATIVE FRAMEWORK

##### 2.2.1 Introduction

"The enactment of the Resource Management Act 1991 marks the beginning of a new era in environmental administration." (MFE, 1991b, p.5).

New Zealand's RMA is a world first in that all of our major resource

management legislation has been brought together in one piece of legislation with a fundamental purpose of sustainable resource management.

The primary focus is on "outcomes" or "environmental effects"; and the RMA reflects the philosophy consistently promoted by Organisation for Economic Co-operation and Development (OECD), of integrated resource management. That is, a holistic philosophy which ensures environmental policies are integrated in the management of land, air, water and other resources. Environmental policies must also be integrated with economic policies and with agricultural, energy, industry and other sector policies.

For the purposes of this section of the Thesis it is only relevant to examine Sections 5, 6, 7, 8, 30, 35, 60, and 63 - 65 of the RMA, in so far as they relate to sustainable resource management. As mentioned in Chapter One, Background and Motivation, it is this legislative imperative which has provide much of the impetus for this Thesis. It is not intended to provided a wide ranging overview of the RMA, but rather to discuss the interpretation of the purpose of the Act from the perspective of regional councils. This part of Chapter Two will then form the basis of the discussion relating to sustainable management in Chapter Three.

### **2.2.2 The Purpose of the Resource Management Act - Sustainable Resource Management**

Section 5 of the Act reads:

- "(1) .... The purpose of this Act is to promote the sustainable management of natural and physical resources.
- (2) In this Act, "sustainable management" means managing the use, development, and protection of natural and physical resources, in

a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well being and for their health and safety while -

- (a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
- (b) Safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
- (c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment."

Section 5 applies to every part of the RMA. Sustainable Resource Management is the paramount and overriding purpose of the Act. All functions under the RMA must be consistent with this purpose. In achieving this purpose the RMA focuses on the outcomes or effects of decisions rather than inputs.

The concept of sustainable resource management encompasses the use, development or protection of resources. The RMA then defines sustainable management through three principles (Gow, 1991; MWRCa, 1991).

The first principle (Section 5(2)(a)) is to sustain the potential that natural resources have to meet the reasonably foreseeable needs of future generations.

This requires that resources should not be used, or adversely affected to the point where people in the future will find that these resources can no longer meet their immediate or reasonably foreseeable needs. Judgement will be required as to what that potential is, or how much a resource can be used, modified or degraded before that potential for future use is significantly

depleted (Gow, 1991; MWRC, 1991a). In order to make such judgements, resource managers will require "tools" which can assist with decision making. The conceptual model, the programme for environmental and performance monitoring, the determination of environmental limits; and the environmental evaluation process which are discussed in Chapter Four are examples of these "tools".

The second principle is that the life supporting capacity of the receiving environments (air, water and soil), are to be safeguarded (Gow, 1991; MWRC, 1991a). This can be thought of as not violating any ecological "bottom line" (refer to Chapters Three and Four).

The third principle is that any adverse effects of activities on the environment are to be avoided, remedied or mitigated. This refers to policies and decisions relating to the use and development of resources. It requires that adverse effects of use and development are minimised to the greatest extent practicable. It means that potential effects should be avoided; or where this is not possible the damage caused by them be remedied; or where this is not possible, adverse effects be mitigated (Gow, 1991; MWRC, 1991a).

These three principles make up a top order hierarchy in the RMA. The purpose of the RMA is defined as sustainable resource management and everything else is bound by this definition. This means that sustainable management of natural and physical resources cannot be compromised for the attainment of social and economic objectives.

Clause 5(2) emphasises that through sustainable management the Act will enable communities to provide for their own social, economic and cultural aspirations. The sustainable management of natural and physical resources cannot be compromised for the attainment of social and economic goals.

Past environmental management has generally focused on balancing and

reconciling competing resource demands, controlling unwise development, and allocating public resources on a "first-come" basis. The RMA encourages resource managers to focus on some "desirable environmental state", the achievement of which will be the result of sustainable resource management. The overall nature of New Zealand's desirable environmental state has been determined to some extent by Section 6 and 7 of the RMA (Gow, 1991; MWRC 1991a; Bosselmann, 1991).

Section 6 lists "matters of national importance" that must be "recognised and provided for". Section 7 lists "other matters" which decision makers must "have particular regard to". These are equivalent wordings to those in the superseded Town and Country Planning Act. There is well supported case law to show that the matters in 6 are of greater importance than 7. There is no priority order given for the matters listed in each individual clause.

For resource managers who have to implement the requirements of the Act, the simplest way of interpreting Sections 6 and 7 is to categorise each matter according to the activity required. This then gives policy direction to decision makers rather than relying on "recognise and provide for" and "have particular regard to".

#### 2.2.2.1 *Protection*

The first major concept is that of **protection**. Sections 6 and 7 are quite specific with regard to protecting or preserving certain features of the natural environment. These are as follows:

##### Section 6(a)

The **preservation** of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the **protection** of them from inappropriate

subdivision, use and development.

Section 6(b)

The **protection** of outstanding natural features and landscapes from inappropriate subdivision, use and development.

Section 6(c)

The **protection** of areas of significant indigenous vegetation and significant areas of indigenous fauna.

Section 6(e) in conjunction with Section 8. Treaty of Waitangi

The relationship of Maori and their culture and traditions with waihi tapu and other taonga. This will include providing for the protection of some of these sites.

Section 7(e)

The **recognition and protection** of the heritage value of sites, buildings, places or areas.

Section 6(f)

The **protection** of the habitat of trout and salmon.

### 2.2.2.2 *Maintain or Enhance*

The second concept is that of **maintaining or enhancing** particular values. These are as follows:

#### Section 6(d)

The **maintenance and enhancement** of public access to and along the coastal marine area, lakes and rivers.

#### Section 7(c)

The **maintenance and enhancement** of amenity values. Amenity values are defined in the RMA as "those natural or physical qualities and characteristics of an area that contribute to people's appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes.

#### Section 7(f)

The **maintenance and enhancement** of the quality of the environment.

### 2.2.2.3 *Guardianship*

The third concept involves **guardianship** in relation to the **quality/quantity** of a particular ecosystem or resource. These are as follows:

#### Section 7(a)

The concept of Kaitiakitanga or stewardship. This is defined in the RMA as the exercise of guardianship, and in relation to a resource includes the ethic of stewardship based upon the nature of the resource

itself.

Section 7(d)

The intrinsic values of ecosystems. These are defined in the RMA as meaning "those aspects of ecosystems and their constituent parts which have value in their own right" including:

- i. Their biological and genetic diversity; and
- ii. The essential characteristics that determine an ecosystem's integrity, form, functioning and resilience.

Section 7(g)

The finite characteristics of ecosystems.

**2.2.2.4**      *Efficient Use and Development*

Section 7(b)

The other matter listed in Section 7 is the efficient use and development of natural and physical resources.

**2.2.2.5**      *Treaty of Waitangi*

Section 8 requires that in achieving sustainable resource management (the purpose of the Act), "..... all persons ..... in relation to managing the use, development, and protection of natural and physical resources, shall take into account the principles of the Treaty of Waitangi".

As Section 8 is included in the Purposes and Principles Section (Part II), of the

RMA, it has a degree of primacy over later sections of the Act (MWRC, 1991b). However, the RMA does not provide any guiding 'principles' for implementing Section 8 in relation to the management of resources.

A paper by K.P. Bills (MWRC, 1991b) argues that an understanding and commitment to Article II of the Treaty, incorporating rangitiratanga and kawanatanga, is of fundamental importance for regional resource management issues.

Article II of the Treaty guarantees Maori rangitiratanga over their lands, villages and all their treasures. This includes an ability to manage these tribal resources, and therefore has special significance when considering the management of the region's resources.

The right of kawanatanga (sovereignty) given to the Crown by the Treaty must be balanced alongside Rangitiratanga (Boast, 1989). While the Crown has the right to make laws and govern, this needs to be qualified by the rights reserved to Maori under rangitiratanga.

### **2.2.3 Functions of Regional Councils**

Section 30 of the RMA sets out the functions of regional councils in relation to achieving sustainable management. Section 30(c) is of relevance to this Thesis, in that it states that regional councils shall "... control the use of land for the purpose of -

- (i) Soil Conservation:
- (ii) The maintenance and enhancement of the quality of water in water bodies ....:"

#### **2.2.4 Regional Policy Statements**

Under Section 60 of the Resource Management Act, regional councils are required to prepare a Regional Policy Statement. The purpose of the Regional Policy Statement, as set out in Section 59 of the Act, is to achieve the purpose of the Act by providing an overview of the resource management issues of the region, and of the policies and methods to achieve integrated management of the natural and physical resources of the region.

The Regional Policy Statement defines the boundaries of sustainable management on a regional basis and ensures that an integrated approach across all resources and ecosystems is taken (MFE, 1991a, p.10).

The Regional Policy Statement is therefore the primary "tool" for setting guidelines and direction for the implementation of sustainable resource management at the regional level.

#### **2.2.5 Regional Plans**

Sections 63-65 of the Act set out the purpose and requirements for regional councils to put in place regional plans. Regional councils must have a Regional Coastal Plan, and may have any other plans that are considered necessary to assist the council to carry out its functions. Plans may contain rules which prohibit, regulate or allow activities (Section 68).

#### **2.2.6 Monitoring**

Section 35(2) of the RMA requires local authorities to gather information which is necessary to enable it to carry out its functions effectively; and to monitor:

- (a) The state of the whole or any part of the environment of its region ....;
- (b) The suitability and effectiveness of any policy statement or plan ....;
- (c) The exercise of any functions, powers, or duties ....; and
- (d) The exercise of resource consents ....

To meet these legislative requirements, an overall monitoring strategy is required to ensure that monitoring is carried out efficiently, effectively and in a fully integrated way. Monitoring is an essential prerequisite for achieving sustainable resource management. Regional council must have information on the regional environment to set appropriate policies for the management of natural resources and to monitor the impacts of both council policies and resource use (MWRC, 1991d).

### 2.2.7 Discussion and Conclusions

The paramount purpose of the RMA is to promote the sustainable management of natural and physical resources while enabling communities to provide for their social, economic and cultural aspirations.

The RMA enables resource managers to pursue a broad range of environmental goals; to consider the detrimental effects of any resource use; to allocate resources for environmental as well as social and economic purposes; and to incorporate Maori cultural values in decision making.

Although the processes established through Sections 5, 6, and 7 of the RMA create a framework upon which change towards sustainable resource

management can be developed, they will not in themselves facilitate the change required. (MFE, 1989, Blakeley, 1990). While the Regional Policy Statement will provide the policy direction, this still will not ensure the implementation of sustainable resource management at the "grass-roots level". What is required is a "method" or "model" for implementing sustainable resource management which incorporates a strategy for monitoring the "state of the environment", the "performance" of sustainable management policies, and "compliance" with resource consents. These implementation issues will be developed further in Chapter Four.

### 2.3 INSTITUTIONAL FRAMEWORK

"Institutions are important means for putting sustainable development policy into practice" (Baines, 1989, p.46).

Regional councils were established in 1989 as a result of a comprehensive reform of local government. They have been specifically designed to carry out resource management. They are multi-disciplinary, independent authorities; which are autonomous, cost-effective, and accountable to the people they serve; can avoid conflicts of interest, and are capable of developing policy for a wide range of integrated resource management issues.

Regional councils are seen as the appropriate type of institution to implement sustainable resource management for the following reasons (MWRC, 1990):

#### *Autonomy*

Organisations need to be made up of elected members (not nominated), and have independent sources of funds. They require their own administrative and technical staff. If organisations do not have this autonomy they will not be able to make decisions or carry out their statutory responsibilities.

***Policy***

Such organisations need to be concerned with policy making and planning for the broad spectrum of resource management. They require sufficient power and status to co-ordinate, facilitate, mediate and advocate the aspirations of varying and often conflicting objectives which exist in the regional community of interest.

***Efficiency***

They need to be 'lean' cost-effective and efficient bodies, with sufficient resources to provide expertise and to achieve innovative and strategic planning, monitoring and forecasting and implementation of plans and policies for resource management.

***Accountability***

They need to be accountable to the people they purport to serve - through both direct election of their members, and a funding system that relates closely to the functions they are required to carry out.

***Separation of Regulation and Service Delivery***

They need to have clear purposes and objectives that do not involve conflicts of interest. It is impossible to expect the authority responsible for sewage disposal to have an unbiased approach to regulation of discharges, or water quality.

***Intra and Inter Regional Resource Management***

Natural resources are part of the natural system which covers many districts and communities. Regional council boundaries are specifically designed to effectively manage the natural system, based as they are on water catchments. Regional government therefore has the ability to address problems which transcend territorial boundaries, and regional boundaries.

It is for these reasons, and after considerable public consultation, legislators responsible for both local government reform and natural resource management were satisfied that a regional system of government is the most appropriate institution to undertake sustainable resource management.

Regional councils are planners and regulators, allocating natural resources and maintaining their quality independent of the motives of resource users.

Regional councils are required to maintain a long term view, ensuring that natural resources are retained for future generations as well as sustaining the current fabric of society.

## 2.4 DISCUSSION AND CONCLUSIONS

Chapter Two has identified and discussed the legislative and institutional framework for resource management in New Zealand. From the above discussion it is possible to conclude with two major points.

Firstly, sustainable resource management, as defined in Section 5 of the RMA, comprises two things:

- i. recognising more fully the environmental costs of activities and policies in order to protect our natural and physical resources (better environmental valuation); and
- ii. better consideration of the earth's resources, with a view to conserving the potential of resources for future generations (better environmental stocktaking) (MFE, 1991b; MWRC, 1991a).

Secondly, implementation of the RMA, and by implication sustainable resource management, centres around the existence of some sort of regional organisation

responsible for managing natural resources. That regional councils are the most appropriate institutions (albeit with some fine tuning) to carry out this task is evident in the continued failure by the Minister of Local Government to abolish or substantially change regional government.

## CHAPTER THREE

### THE CONCEPT OF SUSTAINABILITY

#### 3.1 PURPOSE

The purpose of this Chapter is to examine and analyze recent literature which discusses the concepts associated with 'sustainability'; to take those concepts which are applicable in the New Zealand context; and to derive a set of practical guidelines and tools for the implementation of sustainable resource management.

#### *Objective*

To determine whether existing theory can assist with the implementation of 'sustainable resource management' in New Zealand (as required under the RMA).

#### 3.2 BACKGROUND

The environmental, economic and social problems now being faced at both national and international levels are vastly different and considerably more severe from those of the past. The solutions to those problems are to be found in the way in which we use and manage natural and physical resources (Hayward, 1991).

The concept of sustainable development was popularised in 1987 by the World Commission on Environment and Development (WCED), also known as the "Brundtland Commission". In its report the Commission defined the idea as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Munn, 1989, p.1).

But what are the issues and problems which have turned 'sustainable development' into such a live concept throughout the world? The answer is clear. For too long nature and the environment have taken a back-seat to economic development, and now, when environmental problems have reached global proportions, environmentalists, economists and sociologists have joined the debate.

### **3.3 THE CONCEPT OF SUSTAINABILITY - THREE SCHOOLS OF THOUGHT**

Within the last three to four years there has been a rapidly growing and rich literature, full of debate and disagreement, on the 'elusive' concept of sustainability. The concept has acquired a diversity of interpretations and has come to mean different things to different people.

However, "...from this diversity, all definitions of sustainability fall generally into one of three schools of thought" (Hayward, 1991).

#### **3.3.1 Economic School**

Proponents of this school believe that sustainability refers to an adequacy of resources to ensure economic activity, usually in the short to intermediate term. Resources are viewed in aggregate with supply balancing demand such that economic activity can be maintained. In this school of thought the preservation of the resource base is less important than the preservation of the economic system. Thus, agricultural production which causes erosion can be justified if the benefits from production outweigh the costs of erosion.

Natural environments are thought of as a stock of natural assets serving economic functions. These assets act as:

- i. A supply of natural resource inputs to the economic production process - soil quality, forest and other biomass, water, genetic diversity, etc.
- ii. A means of assimilating waste products and residuals from the economic process - oceans and rivers as waste-receiving media, etc.
- iii. A source of direct human welfare through aesthetic and spiritual appreciation of nature; and
- iv. A set of life support systems - bio-geochemical cycles and general ecosystem functioning.

Sustainability thus implies a transition away from economic growth based on depletion of non-renewable resource stocks and towards progress (i.e., improvement in the quality of life) based more on renewable resources over the long run. (Goodland and Ledec, 1987; Ledec and Goodland, 1988).

Economic activities which waste or contaminate natural resources, or which destroy the future sustainability of the ecosystems are clearly undesirable. The task now before resource managers is to encourage the desirable economic activities while restricting the undesirable ones (Ellyard, 1989).

"Economics throws light on the meaning of sustainable development because the environment and the economy necessarily interact" (Pearce, Markandya, and Barbier, 1989, p.xiv). There is an interdependence both because the way we manage the economy impacts on the environment, and because environmental quality impacts on the performance of the economy.

If these concerns are to permeate economic policy and decision-making, it is clear that resources and environments have to be valued in terms of their economic functions (Pearce et al, 1989; Dept. of the Env't., 1989; Barbier, Burgess and Pearce, 1989).

### 3.3.2 Ecological (Stewardship) School

The ecological approach to sustainability can be summarised as "a pursuit of sustainable development requires .... a production system that respects the obligation to preserve the ecological base for that development" (WCED, 1988, as cited in Pearce *et al.*, 1989, p.185).

The ecological viewpoint tends to be supported by natural and physical scientists, and others who give priority to the ecological basis for economic activity (Geerling, Breman and Berczy, 1986). The concern here is with how natural systems operate and evolve in the very long term. For example, agricultural systems that disrupt ecological processes and balances would be regarded as non-sustainable regardless of the economic benefits that they might create.

For the concepts associated with sustainability to become a reality, a shift in the way economic progress is pursued is necessary. Environmental concerns must be properly integrated into economic policy and decision making from the highest (macro-economic) level to the most detailed (micro-economic) level.

Chisolm (1988) considers that sustainable economic development is seen as requiring:

- i. The maintenance of essential ecological processes and life-support systems (e.g. agricultural systems, forests and coastal and freshwater systems).

- ii. The preservation of genetic diversity.
- iii. Sustainable utilization of species and ecosystems.

Ecologists consider that "as the term 'sustainable development' has been embraced by the political mainstream, so it has been stripped of its original concern with ensuring future ecological stability" (Rees, 1990, p.18). In other words it is no longer a challenge to the conventional economic paradigm but rather has become another excuse for continued economic growth. "True sustainability demands a radically different economics which fully recognizes the processes and limits of the biosphere" (Ibid, p.18).

### 3.3.2.1 *Carrying Capacity*

For ecologists, the concept of carrying capacity is of utmost importance. Carrying capacity can be defined as the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a defined planning region without progressively impairing ecological productivity and integrity (Ibid, p.20-21).

The deteriorating biosphere suggests that human populations and the present scale of economic activity may already exceed global carrying capacity. Many ecological processes have been over-loaded and the long-term dependability of certain critical functions is in jeopardy. Another factor to consider is that the closer we push the biosphere to its limits, the more likely we are to reach critical thresholds of unpredictable systems behaviour.

It should be understood that while human society depends on many ecological resources and functions for survival, carrying capacity is ultimately determined by the single vital resource or function in least supply.

Carrying capacity is not fixed. It will fluctuate in response to limiting factors such as climate variability, the availability of critical resources such as energy, water and soil nutrients, and the level of predators, pests and diseases. Thus, in the context of sustainable development, carrying capacity must incorporate the natural variability of environmental factors that are not totally controllable by humans (Baines, 1989, p.8).

### 3.3.2.2 *Risk and Uncertainty*

Risk and Uncertainty are also of utmost importance to achieving global sustainability from an ecological view point (although these concepts are also recognised by economists). The future is inherently uncertain. This uncertainty is exacerbated when the period under consideration spans many generations into the future and when our ability to develop and implement new technologies outstrips our capacity to predict, monitor, and mitigate the adverse affects of those technologies (Meister, 1990; Randall, 1987; Chisolm, 1988).

There are two types of uncertainty which are significant.

- i. Technological Uncertainty

Technological uncertainty is the lack of knowledge of the adverse impacts of new technologies on the one hand, and the inability to foresee the new technologies that will be developed in the future. Such technologies may permit more readily available resources to substitute for non-renewable resources. New technologies may also find valuable uses for things not currently considered resources. For example, human history has been marked by the discovery of new medicinal uses for chemical compounds found in particular biological species.

ii. Demand Uncertainty

Demand uncertainty is also a serious concern. The tastes, preferences, and opportunities of future generations may differ from those of current generations. Thus there is substantial uncertainty as to how future demand will relate to particular resources.

**3.3.2.3 *Irreversibility***

Irreversibility is another important concept for ecological sustainability. For example the extinction of a biological species is irreversible; as is the creation of some new destructive organism (such as a disease); the generation of hazardous wastes (nuclear waste, toxic synthetic chemicals); and the vanishing wilderness (is only expensively recreated) (Meister, 1990; Randall, 1987; Chisolm, 1988).

Proponents of the ecological school will argue that sustainability involves not making decisions or taking actions which result in biophysical irreversibility (Rees, 1990; Meister, 1990; McGiffen, 1986; Ellyard, 1989).

**3.3.2.4 *Maximum Sustainable Yields, Safe Minimum Standards, Biophysical Bottom Lines***

Ecologists will argue that it is relatively easy to develop a strategy to manage a forest or a fishery in a sustainable manner. The terms maximum sustainable yield, safe minimum standards, biophysical bottom lines, and life-supporting capacity of the environment, encapsulate the idea (Chisolm, 1988; Pearce *et al.*, 1988; Munn, 1989; RMA).

Chisolm argues such strategies appear to be strongly correlated with a goal of sustainability in the sense that " .... so long as critical zones are avoided a system will continue to be sustainable" (1988, p.19).

The safe minimum standard (SMS) of conservation by Ciriacy-Wantrup (as cited in Hufschmidt, James, Meister, Bower, and Dixon, 1983), refers to a state of conservation which avoids a threshold or critical zone beyond which further depletion of a resource is irreversible. Both Ciriacy-Wantrup and Bishop 1978 argue that a SMS, determined by experts should be included into cost benefit analysis to prevent irreversible damage to resources (Ibid).

SMS is thus a positive descriptive term relating to the physical and biological condition of a resource. The basic decision rule of the SMS approach states that the SMS should be adopted unless the social costs of doing so are unacceptably large. How much is 'unacceptably large' is seen ultimately to involve a political judgement.

The concept of the safe minimum standard was developed to analyze the problems concerning endangered species, but by expanding the concept to mean a "biophysical bottom line" (BBL) beyond which the quality or quantity of a resource is not permitted to fall, decision makers can ensure that the problems of uncertainty and/or irreversibility are included in the decision. An example of a BBL would be the level of water quality which must be maintained if a particular species of fish is to continue to survive. In other words a BBL relates to the quality or quantity of a resource or environment.

Pearce considers that there exists a 'minimum stock' of resources below which no nation should go if it is to avoid major disruption. This is a safe minimum standard. A measure of carrying capacity indicates the maximum number of people that can exist in a sustainable manner, on the basis of existing or projected resources. It is a limit, not an optimum. The stock corresponding to carrying capacity offers one definition of a safe minimum standard.

Safeguarding the life-supporting capacity of the air, water, soil and ecosystems is ecological sustainability as laid down in the RMA. One aspect of this is improving the health of threatened ecosystems. Another aspect is ensuring

ecosystems are not exploited to the point where irreversible damage or loss occurs. The habitats and levels of environmental quality necessary to achieve this must be provided (MFE, 1991b). In the New Zealand context it is assumed that the life supporting capacity of an ecosystem will be defined by a biophysical bottom line, and the two terms are used interchangeably, with neither being accurately defined.

These environmental limits offer a type of safeguard, or critical zone which must not be transgressed, as further depletion or damage to the resource will be irreversible. If environmental limits are identified, a 'sustainability constraint' can be incorporated into decision making. This type of constraint can be workable at the project level and is essential if the problems of risk, uncertainty and irreversibility are to be included in the analysis of projects. (Randall, 1987; Pearce, 1988; Chisolm, 1988; Gow and Jones, 1990).

However, the identification of environmental limits is difficult and the consequences can often be irreversible if these predetermined "standards" are wrong. Munn sums this difficulty up with the following statement: "Since the world is full of surprises, the selection of appropriate pathways towards sustainability is very difficult (1989, p.6). Another problem is that if environmental limits are set, then resource managers may simply ensure that these limits are not transgressed, rather than to try and improve environmental quality.

However, if sustainable resource management is to be achieved, resource managers, with the help of ecologists or scientists, must attempt to identify environmental limits. By setting these environmental limits, it becomes possible to incorporate the concepts of sustainability into the assessment of the environmental impacts of development proposals and policy (Chisolm, 1988; Pearce, 1988; Gow and Jones, 1990).

### 3.3.3 Social School

The social school of thought has, as its primary focus, a concern for human communities in perpetuity. This view gives priority to the inter-dependencies of people and their environments and the values that promote well-being, self sufficiency and communities living in harmony with nature. Humans are not thought of as production factors, or the means for production and whose mobility is important to the health of an economic system. Rather, they are viewed as the reason for an economic system (Hayward, 1990 and 1991).

A primary goal of sustainable development is to achieve a reasonable and equitably distributed level of economic well-being that can be perpetuated continually for many human generations. This includes a concern for social inequities and global redistribution of wealth (MFE, 1991b).

For the proponents of the social school of thought, sustainable development therefore implies using non-renewable (exhaustible) mineral resources in a manner which does not unnecessarily preclude easy access to them by future generations.

Sustainable development will therefore require:

- i. the use of long-term planning (rather than merely short-term market forces) to guide the transition to renewable energy sources, (including solar, wood and other biomass, wind, hydroelectric and other water-based sources); and
- ii. the harvesting of renewable resources on a sustained-yield basis rather than 'mining' them to near extinction.

"Although it is impossible to predict with much precision the likely interests of future generations, it is prudent to assume that their need for natural resources (soil, air, water, forests, fisheries, plant and animal species, energy and minerals) will not be markedly less than ours" (Goodland and Ledec, 1987, p.37).

Tietenberg states:

"The sustainability criteria suggests that, at a minimum, future generations should be left no worse off than current generations."  
(Pearce *et al.*, 1989, p.186).

Sustaining development in these broader terms involves providing a bequest to the next generation of an amount and quality of wealth which is at least equal to that inherited by the current generation. Sustainable development is therefore partly about inter-generational equity.

According to Pearce (1988) and Pearce *et al.* (1989), sustainable development is consistent with:

- i. Justice in respect of the socially disadvantaged.
- ii. Justice to future generations.
- iii. Justice to nature.
- iv. Aversion to risk arising from our ignorance about the nature of the interactions between environment, economy and society; and the social and economic damage arising from low margins of resilience to external 'shock'.

Bosselmann (1991) argues that a sustainable society is founded on basic value principles contrary to the basic value principles of the industrial society. Human beings depend utterly for their continued survival upon the whole environment. Its continued existence is a prerequisite for the existence of human society. However, industrial societies are ill-equipped to acknowledge the dependence of humans on nature. An anthropocentric approach overlooks the need to recognise that the natural world has intrinsic value independently of the instrumental value it has for humans (this concept is compatible with the ecological school of thought).

Thus a shift from a "human-centred" to an "eco-centred" world view is required. Such a shift will require new political and legal priorities. The "God-given" right of humans to exploit nature has to be abolished and replaced with the "right" of the natural world to exist on its own terms (Bosselman, 1991, p.8).

#### **3.3.4 Integration of the Economic, Ecological and Social Schools of Thought**

"Sustainable resource management strategies will only be achieved when all schools of thought are brought into balance" (Hayward, 1990, p.9). The only way to implement sustainable resource management is to integrate the three schools of thought and the associated value systems, all of which are significantly different. This can only be achieved by a social participatory process. Therefore, the extent to which resource management strategies are to be truly sustainable will be determined primarily by the adequacy of our participatory decision-making processes (Hayward, 1990 and 1991).

Education is a major component of this integration process. Ellyard (1989) claims that amongst other things, we need education to:

- i. promote the advancement of knowledge and professional skills in order to increase our ability to manage the environment more effectively;
- ii. provide the research and development expertise to develop the innovations, products, services and technologies to help realise sustainable development; and
- iii. to challenge human values and behaviour patterns which are currently contributing to a lack of ecological sustainability, and to change these so that sustainable development is realised. This includes the development of an appropriate "world view".

In addition, integration will require a change from reactive planning to anticipatory or proactive planning. (Pearce *et al.*, 1989; Dept. of the Env't. 1989). Rather than see sustainability as an end state, it should be viewed as an integrated and ongoing process of resource management (Hayward, 1991, Ellyard, 1989).

Pearce (1988) and Rees (1990) both identify a number of principles which provide for the integration of the three schools of thought.

Firstly, the economy is an integral component of the biosphere. The maximum sustainable level of global material economic activity is limited by, and depends upon, the condition of the biosphere. Environmental limits which give an indication of a 'minimum stock' or a 'maximum carrying capacity' will need to be identified for resources and/or resource locations.

Secondly, there is a need to move from a society oriented to satisfying the artificial wants of a few to one committed to satisfying the basic needs of all. This implies that harvest rates in the renewable resource sectors must be limited to average rates of production and not be responsive to ever-increasing market demand. Rates of waste discharge must be limited to the rate at which ecosystems can absorb and degrade the wastes. In the case of carcinogens and similar dangerous compounds zero tolerance is warranted.

Thirdly, there will have to be a more comprehensive valuation of environmental functions. Society at large will have to pay the true costs of goods 'production'. In general, market prices should reflect producers' costs for ecosystems maintenance. It must be recognized that historic levels of profits may not be compatible with sustainable development.

As society makes the necessary adjustments, special measures must be put in place to ensure that the burden does not fall unfairly on the poor. The basic necessities for a decent life must be affordable to all. Global population control must become an international priority.

### **3.4 DEFINING THE CONCEPT OF SUSTAINABILITY**

In the literature, the term 'sustainability' is used interchangeably with 'sustainable development' and 'sustainable resource management'. Because these terms are not easily defined, there exists some confusion, both in the literature and in the minds of resource management practitioners. "For sustainability to be a fundamental concept underlying the whole process of resource management, it requires interpretation and illustration" (Baines, Wright, Taylor, Leathers, and O'Fallon, 1988, p.1).

This section of Chapter Three will examine the concepts associated with the three terms; sustainability, sustainable development, and sustainable resource

management.

### 3.4.1 Sustainability

"The broadest sense of global sustainability includes the persistence of all components of the biosphere, even those with no apparent benefit to humanity" (Brown, Hanson, Liverman, and Merideth, 1987, p.171).

Chisolm (1988) argues that sustainability is probably the single most important criterion advanced for judging the effectiveness of productive systems and for generally guiding decisions on preservation/development issues.

But what does this mean?

"Sustainability is increasingly viewed as a desired goal of development and environmental management ... The meaning of the term is strongly dependent on the context in which it is applied and on whether its use is based on a social, economic, or ecological perspective". (Ibid, p.714).

Despite the many ways of defining sustainability, a number of common themes associated with the concept emerge. These include limited growth economies with the emphasis on small-scale and self reliance; the long-term maintenance of the stock of biological resources and the productivity of agricultural systems, together with continued quality of environment and ecosystems; and the continued support of human life on earth and the stabilisation of human populations.

Although there are problems with defining the concept(s) of sustainability, indefinite human survival on a global scale requires basic support systems which can be maintained only with a healthy environment and a stable human population. Most of the authors agree that this is the starting point from which

the concepts of sustainability must be extended to provide useful guidelines for resource management (Brown *et al.*, 1887; Pearce *et al.*, 1989; Cronin, 1988; Dept. of the Env't., 1989).

Hunt (in Howell (ed), 1986, p.61-76) argues that sustainability involves patterns of resource use which can be maintained indefinitely. The main elements of this approach are that we should regard future people as we regard ourselves; and that we must plan an orderly transition to a society based primarily on the use of renewable resources.

These overall concepts of sustainability are incorporated into the more operational ideals of sustainable development and sustainable resource management. However, 'sustainability' should not be seen as absolute. There is no one sustainable utopia, rather we move along a continuum toward more sustainable or less sustainable situations. To know in which direction we are moving, we need to know indicators of sustainability (Wright 1990b; Cowie, 1991).

The Review Group for the Resource Management Bill stated in its report of February 1991 that the principles stated in Section 7 emphasise and explain the concept of sustainability. These principles, particularly that of *kaitiakitanga*, referring to the ethics of guardianship; and the intrinsic values of ecosystems, referring to the importance of diversity, ecosystem integrity, and *mauri* (life force or life principle), are inherent to the idea of sustainability (Bosselmann, 1991).

In summary, 'sustainability' is best described as referring to the overall concept of society living within the self-perpetuating limits of the environment (Pearce *et al.*, 1989; Goodland and Ledec, 1987).

### 3.4.2 Sustainable Development

"Sustainable development is ultimately a frustrating idea.....But as a broad goal, sustainable development is still useful. Like many important ideas, it is better than nothing for as long as there is nothing better." (*The Economist*, Sept.16 1989, p.79).

WCED (1987) defines sustainable development "... development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (as cited in Pearce *et al.*, 1989. p.xiv).

Goodland and Ledec (1987) define sustainable development as "a pattern of social and structural economic transformations (i.e. 'development') which optimizes the economic and other societal benefits available in the present, without jeopardizing the likely potential for similar benefits in the future. A primary goal of sustainable development is to achieve a reasonable (however defined) and equitably distributed level of economic well-being that can be perpetuated continually for many human generations. Sustainable development therefore has the following implications:

- i. using renewable natural resources in a manner which does not eliminate or degrade them, or otherwise diminish their usefulness for future generations;
- ii. using non-renewable (exhaustible) mineral resources in a manner which does not unnecessarily preclude easy access to them by future generations; and
- iii. depleting non-renewable energy resources at a slow enough rate so as to ensure the high probability of an orderly societal transition to renewable energy sources.

MFE (1991b) states that "Our Common Future", the report of the WCED, defines sustainable development as comprising of three main interrelated goals:

- i. to ensure that all society's needs are met (needs as distinct from wants, and this refers to those essential inputs required to sustain human life);
- ii. to ensure that all members of society have their needs met (in other words better equity in the use of resources); and
- iii. to ensure that all development is sustainable over time in a social, economic and environmental sense.

The WCED thus outlines seven objectives for sustainable development:

- i. Reviving growth;
- ii. Changing the quality of growth;
- iii. Meeting essential human needs;
- iv. Ensuring a sustainable level of population;
- v. Conserving and enhancing the resource base;
- vi. Re-orienting technology and managing risk; and
- vii. Merging environment and economics in decision making. (MFE, 1989, p.49-53).

In summary, sustainable development refers to world economic progress within the biophysical limits imposed by nature, together with a concern for social inequities and the global redistribution of wealth. There is a requirement to pass on to future generations a bequest of environmental assets - man-made and natural, no less than that possessed by the current generation (WCED, 1988; Norgaard, 1988; Dept. of the Env't., 1989; Pearce *et al.*, 1989; MFE, 1989, 1991b).

The practical task of sustainable development, therefore, is to fully recognise the environmental costs of all economic activities and to minimise the use of materials and energy per unit of economic activity. That is increasing efficiency of resource use, improving product design, promoting avoidance, reuse and recovery of wastes (Bosselmann, 1991).

Kuik and Verbruggen (1991) argue that although sustainable development is becoming a key concept and even a goal in international environmental policy, unless there is some clear measure, or at least some indicator of sustainable development, the effectiveness of environmental or other policy towards achieving this goal cannot be assessed. What is required is adequate information that is tailored to qualitative environmental objectives.

### **3.4.3 Sustainable Resource Management**

"Sustainable management of resources is now recognised worldwide as the key to resolution of global and local environmental problems" (Blakely 1990, p.12).

Sustainable resource management means recognising the wider systems of which we are a part - locating human activities as a subsystem of the biosphere and constrained by the physical laws of the earth. This suggests the notion of a hierarchy built upon sustaining the integrity of the natural environment (Cronin, 1988; Baines, 1989).

There are four components to the hierarchy.

#### **3.4.3.1**      *Ecological Sustainability*

At the top of the hierarchy is ecological sustainability. Ecological sustainability involves not deliberately interfering with major cycles in the biosphere to an extent that makes them hazardous for life; and maintaining genetic diversity and diversity amongst ecosystems as the basis for biological resilience and adaptability.

Ecological sustainability then provides the underlying principle for sustainable resource use (management) and waste management. Which in turn, provide the basis for a sustainable society.

#### **3.4.3.2**      *Sustainable Resource Use*

Sustainable resource use should not threaten ecological sustainability. It involves harvesting resources within the carrying capacity of the renewable resource systems involved; and linking stock depletion with resource conservation and recycling so that unsustainable resource demands are not fuelled that would jeopardise an orderly transition to renewable substitutes.

#### **3.4.3.3**      *Sustainable Waste Management*

Sustainable waste management should not threaten ecological sustainability and involves minimising waste production and managing waste disposal within the receiving capacities of environmental sinks; and avoiding the production of hazardous substances.

### 3.4.3.4 *Sustainable Society*

A sustainable society involves acceptance of the physical bounds of ecological sustainability, sustainable resource use and waste management. The achievement of such a society relies on the integration of ecological, social, and economic considerations in resource management decision making.

Sustainable resource management is defined in the RMA through three principles (refer to Chapter Two, Legislative Framework).

The first principle is to sustain the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations.

The second principle is to safeguard the life supporting capacity of air, water, soil and ecosystems.

The third principle is to avoid, remedy or mitigate the adverse impacts of activities upon the environment.

Bosselmann (1991) identifies a number of questions which immediately arise out of this somewhat general and legally 'loose' definition.

- i. What are the criteria for a judgement of the potential of a resource?
- ii. How much modification of a resource can be tolerated?
- iii. How much can be consumed before the potential is removed?
- iv. What is the ecological "bottom line", the point beyond which environmental damage occurs and becomes irreversible?

- v. How can avoidance of adverse effects be achieved when mere mitigation of them is regarded as insufficient?

Sustainable resource management, as embodied in the RMA, relates to only one of the three elements of the WCED's (1987) third goal (to ensure that all development is sustainable over time in a social, economic and environmental sense). That is, sustainable resource management seeks to achieve only sustainable development in an "environmental sense" (MFE, 1991b). It does not attempt to cover the wider concerns of sustainable development in terms of social inequities and global redistribution of wealth.

MFE, the Resource Management Bill Review Group, and the New Zealand Government agree that built into this definition is a recognition that people and communities must provide for their social, economic and cultural wellbeing and for their health and safety. However, these needs must be met within the context of sustainability of the environment.

The definition of sustainable resource management set out in Section 5 of the RMA has the potential to accommodate ecological sustainability as a guiding set of principles, with its ethical justification the recognition of intrinsic values of ecosystems, kaitiakitanga, and the principles of the Treaty of Waitangi. That is the definition has the potential to provide for the necessary integration of ecology, economy and society to provide for an "ecologically sustainable society" in the long term. However, there are several problems.

Firstly, as Bosselmann (1991) argues, traditional Western capitalism has major difficulties with these new ethical foundations which represent a major challenge to the current world view, socio-political and economic systems. "Any government which promotes sustainability as the guiding principle ..... should be fully aware of what it is actually promoting. The aim of a sustainable society means a farewell to the industrial society driven by short-term economics and unbridled materialism" (1991, p.9).

Secondly, sustainability of human society depends upon the integrity of all parts of the ecosystem. The literature reviewed is consistent with Bosselmann (1991, p.9) in the following points. To ensure such ecological sustainability requires that:

- i. The life-support systems must be safeguarded. This will require the virtual elimination of discharges of toxic substances and the gradual abolition of chemical pesticides for agriculture.
- ii. Biotic diversity must be protected and enhanced. This will require a reversal of present deforestation policies to a policy of reforestation. Diversity itself must be considered from different levels including natural communities, particular species and individual populations of species of particular importance.
- iii. Resource management must maintain and enhance the integrity of ecosystems. This will include positive rehabilitative measures for ecosystems which are badly degraded by resource extraction, over-use or pollution.

Thirdly, the exclusion of minerals from the sustainability criteria of Section 5 represents a fundamental shortsightedness on the part of the New Zealand government. This is an indication that despite so called political commitment to the RMA, any challenge to the status quo will be categorically rejected.

Fourthly, and again quoting from Bosselmann (1991, p.9), the list of New Zealand's environmental problems make the challenge for sustainable management truly massive. For example, more than three-quarters of New Zealand's land show signs of erosion; significant areas of native forest and wetlands have been lost; there has been a significant number of species lost, with a rate of extinction among the highest in the world; and a dependence on non-renewable resources, with a consumption of minerals three times higher

than the world average.

However, despite these problems, the RMA represents the dramatic shift in the ethical basis for resource management that was first given legislative backing with the Environment Act 1986, and the Conservation Act 1987. It may be that it is the New Zealand public, who are becoming increasingly environmentally aware, that force change and commitment at the political level. The importance of education and information transfer in the implementation of sustainable resource management should not be underestimated.

### **3.5 DISCUSSION AND CONCLUSIONS**

An analysis of the literature on sustainability exposes the complex relationships between the environment, society, politics, and the economy. It was found that the concepts associated with sustainability fall generally into one of three schools of thought.

The proponents of the economic school believe that sustainability refers to an adequacy of resources to ensure economic activity. Sustainability of the capitalist economic system is more important than sustainability of the environment.

In contrast, proponents of the ecological school believe that sustainability refers to ecological sustainability and therefore implies an obligation to preserve the environment. Any economic activity which compromises the integrity of ecosystems is therefore regarded as non-sustainable.

The social school of thought is concerned primarily with the long term sustainability of human communities. This view is more compatible with the ecological school of thought in that it gives priority to the inter-dependencies of people and the environment, and argues that the continued existence of the

environment is a prerequisite for the existence of human society. The aim of a sustainable society therefore means an end to the capitalist system. What is required for the implementation of sustainable resource management is the integration of the three schools of thought.

Sustainability refers to the overall concept of society living within the self-perpetuating limits of the environment and is implicit in the definitions of sustainable development and sustainable resource management.

Sustainable development refers to world economic progress with the biophysical limits imposed by nature, together with a concern for social inequities and the global redistribution of wealth. There is also a requirement to pass on to future generations a bequest of environmental assets, no less than that possessed by the current generation.

Sustainable resource management as embodied in the RMA refers to ecological sustainability as the fundamental principle. The economic, social and cultural needs of people and communities must be met within the context of sustainability of the environment. This definition has the potential to provide for integration of the concepts associated with the three schools of thought.

One objective of the Literature Review was "to determine whether existing theory can assist with the implementation of sustainable resource management in New Zealand".

It is concluded that, with the exception of the work by Gow (1991), and Kuik and Verbruggen (eds., 1991), the literature does not go far enough to assist regional councils in the implementation of sustainable resource management. While very rich in terms of providing discussion and debate at a theoretical level, the literature fails to make the link between the understanding and interpretation of what sustainable resource management is and how to put it into practice.

## CHAPTER FOUR

### IMPLEMENTING SUSTAINABLE RESOURCE MANAGEMENT

#### 4.1 PURPOSE AND BACKGROUND

Regional councils have a legislative responsibility to implement sustainable resource management (Chapter Two). This implies a commitment to ecological sustainability (Chapter Three).

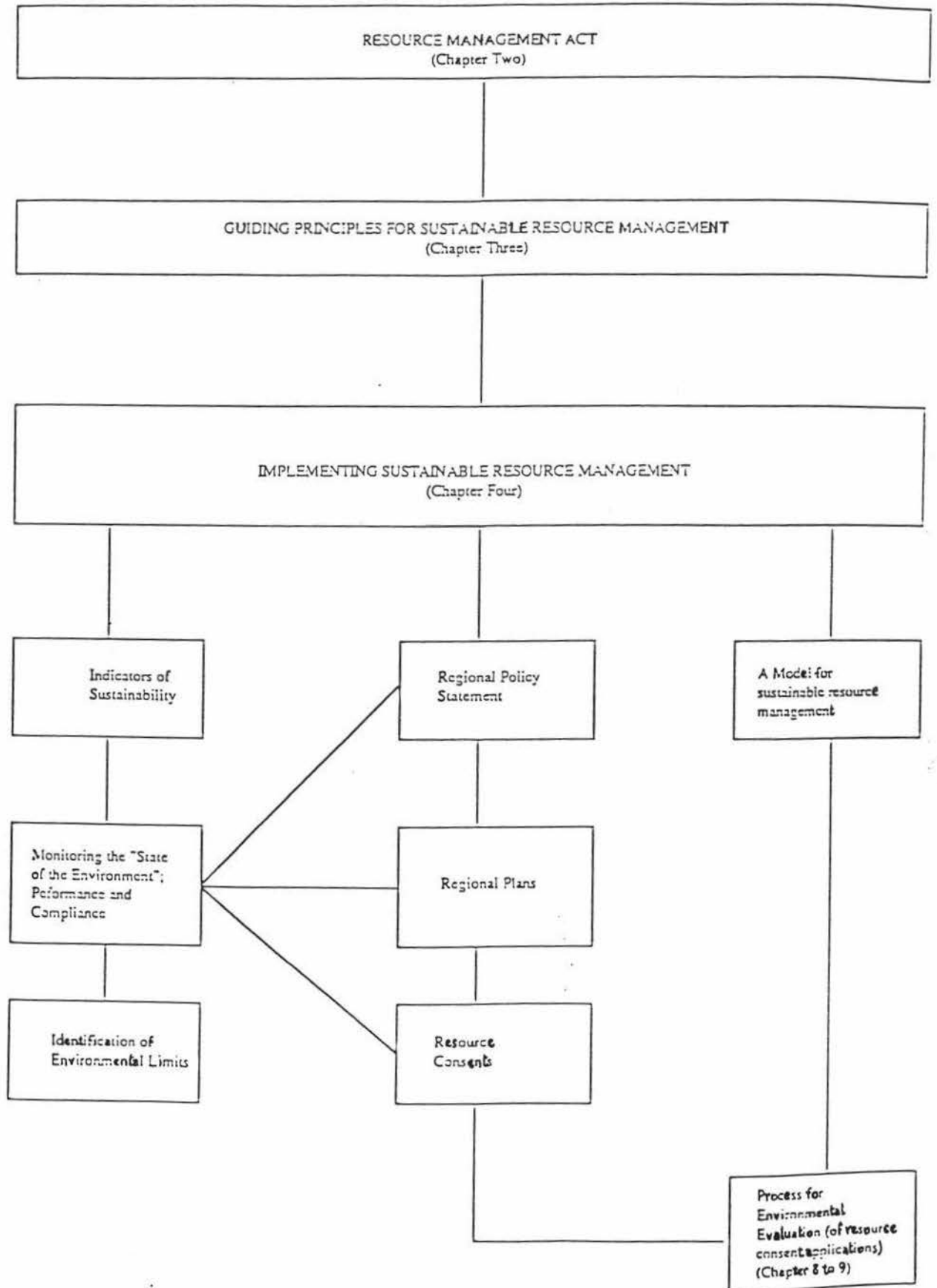
The literature has not yet moved from the theoretical and conceptual levels to the practical. Very little consideration has been given as to how regional councils can utilise the legislative mechanisms included in the RMA to implement sustainable resource management.

The purpose of this Chapter is therefore to develop a framework for the implementation of sustainable resource management.

The RMA includes a number of legislative mechanisms for the implementation of sustainable resource management. Those of most relevance to regional councils include Regional Policy Statements, Regional Plans, Resource Consents, and the requirement for local authorities to monitor environment and performance. The relationship between these mechanisms for implementing sustainable resource management is illustrated in Figure Two, "Mechanisms for Implementing Sustainable Resource Management".

This Chapter will discuss each mechanism in detail. The process for environmental evaluation will then form the basis of the rest of this Thesis.

Figure Two. Mechanisms for Implementing Sustainable Resource Management



## 4.2 REGIONAL POLICY STATEMENTS

Regional Policy Statements (Sections 59 - 62) of the RMA must provide for integrated resource management which recognises resource interdependence. Policy statements should also include, or allow for the development of, a programme for sustainable resource management. This will involve the establishment of 'targets' (objectives) for environmental/resource quality and quantity, and time-frames for achieving these targets.

In addition, it is necessary to determine the relationship of particular communities to resources, and whether those resources provide for primary (economic activity) and/or secondary (supports life systems and/or absorbs waste) uses, demands and needs for particular resources. In some cases it may be possible to impose a sustainability constraint on resource use (particularly new development proposals) to the effect that, as far as possible, environmental capital in aggregate is not reduced.

The next stage, once resource management policies have been developed and the information needs outlined above have been met, is the assessment and determination of the management interventions/decisions needed.

## 4.3 REGIONAL PLANS

The purpose of a Regional Plan is to assist the regional council to carry out its functions. Regional plans are designed to address specific resource management issues or areas for which the regional council has responsibility under the RMA, for example, water management, soil conservation, natural hazard mitigation, gravel management, specific catchment management. Plans may contain rules which prohibit, regulate or allow activities.

#### 4.4 A MODEL FOR SUSTAINABLE RESOURCE MANAGEMENT

In practice the development of a Regional Policy Statement is not as straight forward as the legislation implies. To develop policies for the management of resources which are realistic and implementable, which take into account the purposes and principles of the RMA, and which will achieve more than just "lip service" to the concept of sustainable resource management is extremely difficult, particularly given the lack of guidance available.

A conceptual "Model for Sustainable Resource Management" is currently being developed by Dr Brent Cowie and the Policy and Planning Department of the MWRC to try and overcome some of these difficulties. This model is illustrated in Figure Three. The purpose of the Model is to provide a set of principles for resource management decision making. These principles will guide the development of the resource management policies included in the Regional Policy Statement; and the nature and contents of Regional Plans.

Figure Three portrays three categories of environment. The highest category of represents environments which have high intrinsic quality. For example areas with the most productive soils, or rivers which are by nature fast-flowing with clean, clear water. Such environments may not exist at their full intrinsic potential due to present unsustainable use. Some environments may be managed in a sustainable manner at this point in time, however their intrinsic quality will never allow them to reach the highest category of environment. For example, the Whanganui River in its pristine state, would still not be of the same intrinsic quality as the upper reaches of the Rangitikei River.

The medium category represents environments where existing use is sustainable, but no feature of the environment merits protection. For example dairy farming in the Manawatu (provided effluent disposal and non-point source pollution are managed).

Figure Three. A Model for Sustainable Resource Management

				ENVIRONMENT		
				Intrinsic	Environmental	Quality
				Highest	Medium	Lowest
Existing Resource Use	Sustainable	Sustainable	Unsustainable			
Resource Management Policies	Protect	Maintain and/or Enhance	Prevent Unwise Use			
			Restore and/or Enhance	Avoid Remedy Mitigate in All Circumstances		
Future Resource Use	Sustainable					

The lowest category is where existing use is unsustainable, for example the hill country farms on the East Cape; or where unwise decisions could lead to unsustainable use, for example the allocation of further consents to take water from the Oroua River.

The implication is that sustainable resource management, as prescribed in the RMA, requires **protection** of the highest quality environments (resources); **maintenance and enhancement** of the middle category; **prevention of unwise uses** and **restoration and enhancement** of the lowest quality environments. Resource managers have a legislative responsibility to **avoid, remedy and**

**mitigate** any adverse environmental effect. This applies to all three categories of environment, and will enable/ensure resource use moves towards being more sustainable (Gow, 1991; MWRC, 1991a).

The categories are not mutually exclusive. For example, a given piece of land could currently be used unsustainably for agriculture, yet have an outstanding land-scape feature that merits protection.

For the highest category, the Act states that resource managers must provide for the **protection** of those features listed in Sections 6 and 7, and in relation to Section 8 Treaty of Waitangi. Resource managers must decide whether they will endeavour to protect other high quality environments not included in the lists. For example the highest quality agricultural land. This may lead to policies which not only prevent inappropriate use and development, but which restrict or influence in some way the agricultural practices so as to **avoid** adverse environmental effects such as soil compaction. That is, resource managers should avoid effects/outcomes which may lead to the current sustainable use becoming unsustainable in the long term; and the actual quality of the environment would be below its intrinsic potential.

For the medium category, where use of the environment is presently sustainable, resource managers need to ensure that use of the resource does not become unsustainable by **avoiding and mitigating** adverse environmental effects. Where environments have slipped below their intrinsic potential and where the costs and benefits, including the environmental costs and benefits (refer Chapter Five) indicate, adverse environmental effects should be **remedied**.

The lowest category is that of low quality environments where existing use is not sustainable. Here resource managers have a clear legislative responsibility to endeavour to ensure that the use of these environments become sustainable in the future.

What the model is attempting to do is to superimpose current land use, and by implication current environmental quality, onto intrinsic environmental potential. The appropriate resource management decision/activity (protect, maintain, enhance, avoid, remedy, mitigate) will depend where on the continuum the environment (resource) currently lies compared with where it should lie, according to its intrinsic potential. This also enables the concept of **guardianship** to be incorporated.

The model could be applied generally to illustrate the concepts as it is being used here, or it could be made specific to a particular resource. This would show where on the continuum of sustainability management of a particular resource (for example the Oroua River) lies with respect to its intrinsic potential quality.

The aim of the model is to assist resource management decision making within the context of regional councils and the RMA. The political reality is that regional councils have to take account of social and economic concerns and in some cases these will over-ride ecological concerns. What the model attempts to do is to provide a framework which allows for the integration of social, economic and environmental concerns, without compromising the environment. The model should guide decision making in such a way that resource use becomes more sustainable over time.

#### **4.5 REGIONAL MONITORING STRATEGY**

Monitoring is an essential prerequisite for achieving sustainable resource management. Regional councils must have information on the regional environment to set appropriate policies for the management of natural resources; to monitor the impacts of both council policies and resource use; to monitor compliance with resource consents; and to monitor the "state of the environment". The monitoring strategy will also provide for adequate reporting

and information transfer.

A Regional Monitoring Strategy (RMS) is being developed by the MWRC which will allow the Council to meet the monitoring requirements of the RMA (Section 35). A copy of the RMS has been included at Appendix A1. The RMS will provide the overall guiding principles for all investigations and monitoring activities to be carried out by the Regional Council.

Although sustainable resource management is the legislative responsibility of regional councils, there are no "measuring sticks" to measure practical policy initiatives against this goal. Unless there is some clear measure or at least some indicator of sustainability, the effectiveness of resource management policies and decision making towards this goal, cannot be assessed. What is required is information which gives a clear indication of whether resource management objectives are being met, and on the environmental system as a whole (Kuik and Verbruggen, 1991).

Appropriate environmental indicators will need to be developed so the quality and quantity (range, type and state) of the environment (resources) may be monitored. This will enable "environmental limits" to be identified, together with the regulating ecological factors in both the natural ecosystem and the land-use system, including the assimilative capacity of the environment. The primary function of indicators lies in their simplification. Therefore they will often have to be a compromise between scientific accuracy and the demand for concise information.

Indicators of sustainable resource management should take account of the integrity and diversity of natural ecosystems. Measures of sustainable resource management should therefore include indicators of the pressure from society on the environment (pollution, resource use), and indicators for the "state of the environment" (ecological integrity or bio-diversity). Both sets of indicators

should enable the comparison of actual resource use with sustainable resource use (Ibid).

#### **4.6 IDENTIFYING ENVIRONMENTAL LIMITS**

Environmental monitoring of resources is an essential part of establishing environmental limits, both in terms of initial identification, evaluation of their effectiveness, and review. Information derived from environmental monitoring will assist in the determination of environmental limits to development. Such limits are an important mechanism for achieving sustainable resource management.

Setting environmental limits to resource use is a necessary part of implementing sustainable management of resources. For the purposes of this Thesis, the term "environmental limits" has been chosen to incorporate all of the concepts associated with biophysical bottom lines, safe minimum standards, carrying capacity, and maximum sustainable yield (refer Chapter Three).

While determining environmental limits is difficult, by focusing on the quality of the ecosystem (measured by a number of parameters) the problem of setting environmental limits is no longer insurmountable. Composite indicators of the "state" or "quality" of a particular resource/ecosystem should be developed and used to provide information for resource managers on its "assimilative" or use capacity. Like environmental indicators, environmental limits will have to be a compromise between scientific accuracy and subjective assessment based on expert knowledge.

That is, scientific accuracy is probably not required in terms of making resource management decisions. Biophysical bottom lines need not be specific, rather they should be determined by a number or set of parameters. Together these parameters are capable of providing an indication of the state of a

particular ecosystems, and the level at which, due to the cumulative effect of the degradation of each of these parameters, the life supporting capacity of the environment is endangered.

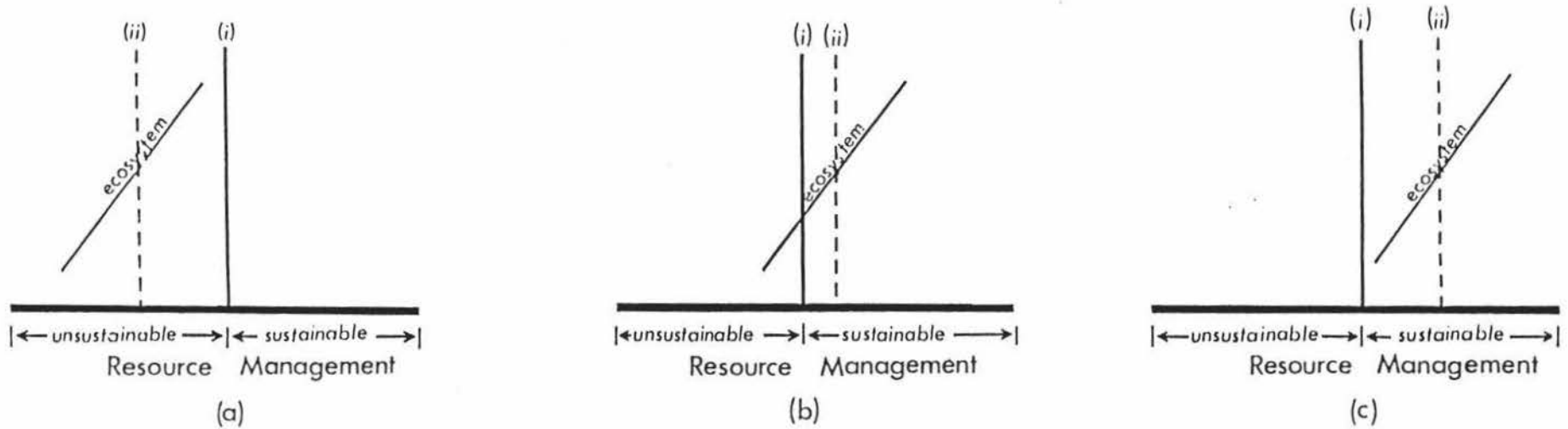
It will not be possible to establish environmental limits for all resources immediately. However, in some cases, resource managers (former catchment boards and now regional councils) have a long history of data and knowledge which may allow them to make informed decisions as to what acceptable environmental limits are. Resource management decisions can therefore be made within the context of these limits to further use. For example, the MWRC has enough scientific data and historical knowledge about the Oroua River to know that any further extraction will severely compromise the ability of the river to assimilate waste without damaging the river ecosystem.

Care will always need to be taken to ensure that where limits are established, they are set using the best information available, and that they err on the side of caution.

For some types of resources, such as water quality or national parks, the public will almost always demand a standard of environmental quality, a "social bottom line", which exceeds that of any "ecological bottom line". The identification of environmental limits is still useful, and often necessary, particularly where use pressures mean that social expectations of environmental quality will have to be traded off against economic and political demands for "growth" and employment.

By identifying environmental limits for those resources experiencing use pressure, and/or where conflicting uses have to be reconciled, trade-offs can be made which, although may compromise social bottom lines, do not threaten the integrity (the life supporting capacity) of an ecosystem. This concept is shown diagrammatically in Figure Four.

Figure Four. Ecological and Social Bottom Lines



(i) ——— Ecological Bottom Line  
 (ii) - - - - Social Bottom Line

- (a) Unsustainable Resource Management  
 Irreversible environmental effects. Condition of total ecosystem below ecological bottom line.
- (b) Short Term Sustainable Resource Management  
 Resource use is sustainable up to the point where the ecological bottom line is transgressed. Below this point it is unsustainable.
- (c) Sustainable Resource Management  
 Trade-offs possible. Social bottom Line is above ecological bottom Line.

Resource management policies will determine the relationship between the "state of the environment" and the ecological bottom line (ie. the position of the ecosystem in Figure Four). Where social bottom lines are below ecological bottom lines, current resource use is likely to be unsustainable. One of the objectives of resource management policies will therefore be to influence the position of the social bottom line, in order to bring about a more sustainable use of resources.

The application of environmental limits to a particular resource has not been attempted as part of this Thesis.

#### **4.7 A PROCESS FOR ENVIRONMENTAL EVALUATION**

The RPS and Regional Plans will determine in what circumstances resource consents will be required. A process for environmental evaluation is required that ensures that regional councils adequately assess the potential environmental effects of any major development proposals.

Sustainable resource management involves implementing "the kinds of resource use that do not have in them the seeds of their own demise" (Baines, 1989, p.29).

This will require a process for evaluating the environmental effects of major resource consent applications. Such a process must provide for the valuation of environmental goods and services and the integration of these values into project appraisal. One of the goals of this Thesis is to develop such a process and this will be examined further in Chapters Five to Ten.

## 4.8 DISCUSSION AND CONCLUSIONS

As discussed in Chapter Two, regional councils have a legislative responsibility to implement sustainable resource management. However, it is beyond their legislative or political scope to adopt either one of the three schools of thought discussed in Chapter Three, in isolation.

What is required, within the framework of the legislative mechanisms provided by the RMA, is the integration of the concepts associated with the three schools of thought, and the development of a set of guiding principles for resource management decision making. These principles must take account of the economic, social, and political realities and constraints faced by regional councils, while at the same time ensuring commitment to a policy of ecological sustainability.

A conceptual model for sustainable resource management is currently being developed by the MWRC. The Model attempts to provide for the integration of social, economic and ecological objectives, within the constraints of ecological sustainability. The purpose of the Model is to provide a set of principles for resource management decision making relating to resource policies, plans and rules.

A programme for environmental and performance monitoring; the development of a set of environmental indicators; and the identification of environmental limits for development, are essential mechanisms for the implementation of sustainable resource management. Similarly, a commitment to ecological sustainability also requires the development of a process for the assessment and prediction of the effects of current and proposed resource use on the environment.

**CHAPTER FIVE**  
**ENVIRONMENTAL VALUES:**  
**TECHNIQUES FOR THEIR ASSESSMENT**

**5.1 PURPOSE**

The purpose of Chapter Five is to briefly examine the literature relating to the values associated with the natural environment; and to provide an examination of some of the techniques for assessing the impacts of resource consent applications on these environmental values. The uses and limitations of each traditional technique will be discussed, and then a review of more recent non-market valuation techniques will be carried out. The methodology for each of the techniques examined will be included in the Appendices B1, B2, and B3.

*Objectives*

To identify the types of values associated with the natural environment.

To identify and discuss analytical techniques for environmental evaluation, which are applicable within the New Zealand context, and more specifically to the Aorangi Awarua planning application.

To determine and select the technique most appropriate for the non-market valuation of the Aorangi Awarua Block.

**5.2 BACKGROUND**

The implementation of sustainable resource management requires a commitment to ecological sustainability (Chapters Three and Four).

Inherent in the concept of ecological sustainability is the concept of intrinsic values of ecosystems. These values are independent from, and in addition to, the anthropocentric use and non-use values people associate with a resource.

### 5.3 VALUES ASSOCIATED WITH NATURAL RESOURCES

Pearce *et al.* (1989), Jakobson and Dragun 1989, and Kerr 1986, argue that there are several types of value which may be obtained from natural resources and their environments. These types of value may be separated into three categories: use value, non-use value, and intrinsic value.

#### 5.3.1 Use Value

Use value is the value of present and expected use of a resource whether it be for commercial, sport, scenic or other activities. Use values may be differentiated as follows:

- i. Direct productive values where certain resources are harvested for the sale of their products;
- ii. Direct consumptive values, such as recreational fishing, hunting etc;
- iii. Indirect productive values where some species provide food for productive species; and
- iv. Non-consumptive uses such as bush walking, camping, viewing or photographing and other categories such as the knowledge obtained to improve agricultural crops.

### 5.3.2 Non-Use Value

The second category is that of non-use or intrinsic value. The importance of non-user benefits in the valuation of unique environmental amenities has long been recognized (Krutilla 1967, Weisbrod 1964; as cited in Cory and Saliba, 1987). There are several types of non-use values. These are outlined below.

#### i. Option Value

Option value reflects the value of still having the opportunity to use a natural resource in the future. Option values include the value associated with future use by the individual, and the value associated with use by future individuals.

As there is a risk associated with future demand or supply of a resource, expected future use values must be modified to account for people's attitudes to risk. This adjustment is option value, and can be thought of as a type of insurance premium that some people are willing to pay above (or below) expected use values (Kristrom, 1988).

#### ii. Quasi-option Value

This is the value of preserving options, and is associated with improved knowledge/technology in relation to resource uses which result in irreversible changes. For example, some species may turn out to have medicinal benefits. Quasi-option values could be negative, as in cases where retaining genetic diversity allows new diseases to develop.

Thus for any species there is a positive probability that a new use with a positive value will be discovered (Randall 1985).

With extinction, the probability of discovering a use drops to zero. Quasi-option value is also a means for accounting for uncertainty.

Since we do not know of these future outcomes now, quasi-option value cannot be estimated (Kerr 1986), although it should be recognised.

### iii. Existence Value

People value aspects of the natural environment and other species even when there are no apparent "uses" made of them (Smith 1991, p.3). This is the value of "simply knowing that a resource exists" and is completely separate from use value.

### 5.3.3 Intrinsic Value

Intrinsic value is defined in the RMA as those aspects of ecosystems which have value in their own right including their biological and genetic diversity, the essential characteristics that determine an their integrity, form, functioning, and resilience; and their finite characteristics.

Intrinsic value is "a value that resides in something and that is unrelated to human beings altogether" (Pearce *et al.*, 1989, p.61).

## 5.4 TOTAL ECONOMIC VALUE

Pearce *et al.* (1989) argues that total economic values associated with environmental goods and services (including resources) are comprised of:

Actual Use Values + Option Values + Existence Values.

The relevant comparison when looking at a decision on a development project is between therefore the cost of the project, the benefits of the project, and the Total Economic Value (TEV) that is lost by the development. Therefore development should proceed only if the total benefits less the total costs less the benefits of preservation, are greater than zero (Pearce *et al.*, 1989). That is:

- i. Proceed with the development if

$$(Bd - Cd - Bp) > 0$$

- ii. Do not develop if

$$(Bd - Cd - Bp) < 0$$

where:

$Bd$  refers to the benefits of development;

$Cd$  refers to the costs of the development;

$Bp$  refers to the benefits of preserving the environment.

It should be noted that this concept of 'total economic value' fails to take account of intrinsic value.

## **5.5 Analytical Techniques for Assessing the Environment**

### **5.5.1 Environmental Impact Assessment (EIA)**

The purpose of an EIA is to determine, before implementation, the environmental effects of a proposed action. EIA provides information to developers, managers, consent-granting authorities and planners (Meister, 1990). The methodology for EIA has been included at Appendix B1.

The major limitation of EIA is that assessments merely identify impacts. To be really effective quantitative information is necessary, particularly in terms of how much society values the out-put of a proposal, compared with the environmental consequences. Only with that kind of information can decisions about trade-offs be made.

However EIA can ensure that environmental aspects are given equal status with economic, technical and social considerations during the evaluation of proposals.

For EIA to be effective it must combine with other techniques to allow the valuation of impacts. In other words, in reality, the EIA is merely the first step in the total process used by planners for evaluating proposed policies and projects. It should combine with other techniques to allow the valuation of impacts to make it more effective as a decision making tool (Meister, 1990).

### **5.5.2 Cost-Benefit Analysis (CBA)**

CBA and EIA are complementary techniques. EIA provides much of the data to be used in a CBA while CBA provides the evaluative power that EIA lacks. CBA goes beyond EIA in that it not only identifies and measures the impact of projects or policies in terms of costs and benefits expressed in monetary terms

but also provides a criterion to judge the desirability of the projects in the light of objectives set (Meister, 1990).

Resource management involves a balancing of costs and benefits and an evaluation of trade-offs, ranging from those that can be expressed in tangible economic terms to those that defy objective measurement. Cost-benefit analysis has often played an important role in this process. Its methodology provides a framework for organising thoughts, for listing all pros and cons, for determining what can be quantified and valued and what can not, and for ranking non-quantifiable factors.

CBA is a technique which can be used to describe and quantify the social advantages (benefits) and disadvantages (costs) of a project or policy in terms of a common monetary unit. Since benefits and costs are distributed over time, a discounting routine is required to express the net social benefits in terms of a common point in time, generally the present. When the social discount rate (SDR) is used the net present value (NPV) is a measure of the social worth of a policy or project.

The reference to 'social' in CBA is generally understood to be synonymous to the national view point. Where 'social' is replaced with 'individual', the analysis is then a financial CBA (FCBA) or investment analysis, which then adopts the individual viewpoint in its definition of costs, benefits and discount rate.

Over the last 15 years, a whole new methodology has developed in the CBA field. CBA is now specifically defined into two groups, traditional cost-benefit analysis and the new methodologies. The latter incorporate trade efficiency and distributional issues of time (consumption and investment) and income. Social cost-benefit analysis (SCBA) includes distributional issues and, more recently, environmental considerations. This has been made possible by improvement in valuation techniques, including future costs and benefits; the

integration of environmental considerations by way of non-market valuation techniques; and the incorporation of a sustainability constraint in the appraisal policies and projects. (Meister, 1990; Randall, 1987; Forbes, 1984; Mishan, 1975; Loomis and Walsh, 1986).

In the management of natural resources, decision makers are often faced with conflict situations in which an activity is likely to improve the welfare of some people, whilst degrading the welfare of others.

Both EIA and CBA provide a framework for organising all of the beneficial and detrimental factors associated with projects, programmes or policies. However, a cost-benefit analysis requires that all the impacts of a particular activity be valued in monetary terms (Harris, 1984, p.199).

CBA, especially in its extended form including non-market valuation, can therefore provide a highly useful picture of the relative merits of policies or projects, and in that way facilitates the process of decision making and also making it more transparent.

### **5.5.3 Extended CBA - Integrating Sustainability into CBA**

The prime requirement for assessment of the environmental impacts of a policy or development proposal is the integration of environmental values with economic appraisal. Cost Benefit Analysis provides the best technique for this integration. Sustainability can be introduced into CBA by setting a constraint on the depletion and degradation of the stock of natural resources (capital).

In practice what a sustainability constraint would mean is:

- i. checking carefully what environmental impacts a given programme of investments is likely to have;

- ii. valuing these impacts;
- iii. adjusting the programme in such a way that the overall net environmental damage is as close to zero as possible; and
- iv. adopting particular projects, within the programme, which generate environmental benefits (this will help to balance those projects which are adopted out of necessity, but which have some negative environmental impacts).

At the single project level, Pearce *et al.* (1989) argue that the sustainability constraint outlined above would be too restrictive. However at the programme level (a combination of projects and policies within a defined region or subregion), the constraint will ensure that environmental capital in aggregate is not reduced.

Within the CBA context, a Safe Minimum Standard (SMS) is any non economic criterion which a project must meet before it can be approved. When used in the appraisal of development proposals, SMS constrain the economic CBA by specifying environmental (or social) criteria which the project must meet. This type of constraint thus allows the incorporation of sustainability goals into economic CBA.

If a project is modified to meet SMS criteria, any extra costs of such modification are added to other project costs in CBA. If a project cannot be modified to meet SMS criteria, it should not be given approval. CBA which incorporates SMS is therefore a type of constrained economic optimization.

The SMS approach explicitly assumes that for number of resource management issues the problems of social, economic and technological uncertainty, together with the irreversibility of many environmental impacts, mean that the outcomes of policies and development proposals and the associated environmental losses

are often poorly understood. The SMS approach thus offers a type of environmental safeguard, or critical zone which must not be transgressed, as further depletion or damage to the resource will be irreversible.

Environmental concerns are more completely addressed through constrained CBA because SMS can be established to deal with specific environmental goods and services which, despite the techniques outlined above, may be neglected or undervalued because of problems of measurement, valuation, discounting, and irreversibility.

SMS appears to provide a means of incorporating the concepts of sustainability into the assessment of the environmental impacts of development proposals and policy.

#### **5.5.4 Planning Balance Sheet (PBS)**

The PBS framework has been developed in response to the weaknesses of traditional cost-benefit analysis. The PBS is essentially an extension of CBA (Meister, 1990).

The starting point of the PBS is to identify all the relevant community groups which are likely to be affected by, and/or involved in, the plan or scheme in question. The approach thus concentrates on the distribution of the impacts. Parties are divided into producers or consumers. All impacts are quantified (either in monetary terms or in physical units). Where quantification is not possible a description is given. All impacts and effects (benefits and costs) are assigned to either the producers or the consumers. The initial table showing the distribution and the magnitudes of impacts (tangible and intangible) can be summarised further by assigning scores to different outcomes (as compared to the status quo or other alternatives). These scores can be weighted and summed. A large amount of subjectivity is involved in the choice of consumer

and producer groups and in the weighting process.

PBS can be used to demonstrate the nature and the incidence of costs and benefits arising development projects and/or policies. The PBS has to date mainly been used in urban planning situations but there does not appear to be any reason why it would not be as useful in resource management issues, particularly where there are competing users with conflicting objectives.

PBS provides a sound vehicle for project evaluation exercises. There is considerable scope for the extension and recasting of many cost-benefit exercises in PBS terms, so that the nature, and particularly the distribution, of all relevant items is more fully considered in the decision-making process.

## **5.6 NON-MARKET VALUATION TECHNIQUES**

### **5.6.1 Background**

Intangible environmental values are associated with features of the natural world which have a significant intrinsic value, quite apart from any economic value which they may have (Goodland and Ledec, 1987).

One of the central themes of natural resource (environmental) economics, and sustainable development thinking also, is the need to place proper values on the goods and services provided by natural environments. The central problem is that many of these services are provided "free". They have a zero price simply because no market place exists in which their true values can be revealed through the acts of buying and selling (Pearce *et al.*, 1989; Jakobsson and Dragun, 1989).

Resources and environments serve economic functions and have positive economic value. "This simple logic underlines the importance of valuing the environment correctly and integrating those correct values into economic policy" (Pearce *et al.*, 1989, p.7).

Non-market valuation is a set of procedures for valuing natural environments, using the monetary values adopted by CBA. To efficiently allocate resources the resource manager needs to know the values that society places upon various products and activities. These values need to be measured in a common unit to allow direct comparisons to be made (Kerr, 1986 and 1990). While preferences for the preservation of the natural environment or for environmental improvement can show up in various ways, placing money values on these preferences measures the degree of concern, by the willingness or individuals to pay for the environment.

While the absence of markets or indirect markets makes the process of economic evaluation more difficult, it by no means renders it impossible. The absence of a market or indirect market does not mean that economic gains are not present (Ibid, 1990). The important principle to establish is that in carrying out resource management there is a need to try, as best we can, to record the economic values that natural environments provide. The reality is that choices have to be made in contexts of scarce resources. "Money as a measuring rod is a satisfactory means of proceeding" (Pearce *et al* 1989, p.54).

Economic valuation of intangibles gives an indication of individual's willingness to pay for maintaining environmental quality or particular characteristics associated with the natural world. If the monetary values which are revealed are sufficiently large, they offer a supportive argument for maintaining environmental quality. Monetization permits comparison with other monetary costs and benefits arising from a particular development proposal or policy (OECD, 1989).

Both Smith 1991, and Kerr 1990 state that the last 25 years have seen a remarkable growth in knowledge about non-market environmental values. During this period the first theoretically sound valuation method, Clawson's travel-cost method, has been refined and accepted to such a degree that it is commonly applied in many decision-making contexts. Measurement of existence, bequest and option values has been attempted (Brookshire, Eubanks and Randall, 1983; Walsh, Bjonback, Aiken and Rosenthal, 1984; Cummings, Brookshire and Schulze, 1986; Desvousges et al 1986), indicating that the contingent valuation method may be an appropriate measurement tool, and that non-use values may be significant elements of total value.

## **5.6.2 Basic Economic Principles**

As Kerr (1986) argues, in order to understand non-market valuation techniques, it is necessary to have a basic understanding of economic principles. These principles are outlined below.

### **5.6.2.1 *Indifference Curves***

If a set of indifference curves is available it is possible to derive a goods' demand curve. Indifference curves show the various combinations of two goods which give a consumer, or society, the same amount of utility.

Given prices and a budget, the consumer decides the quantity of each good that should be purchased to reach the indifference curve which yields the greatest utility. The optimal point is found where the budget constraint is just touching the highest indifference curve.

### 5.6.2.2 *Consumer Surplus*

All measures of value discussed here are related to the concept of **consumer surplus**. This can be thought of as the total amount one would be **willing to pay** for a given quantity of goods over and above their cost rather than go without the goods altogether.

This is the basis used for measuring the value of non-marketed goods. If we can identify a demand curve and know the price faced by consumers (often zero for non-market goods) we can estimate consumer surplus.

### 5.6.2.3 *Compensating Measures*

Assuming we wish to value the loss of an amenity that is unambiguously beneficial, then compensating measures are the minimum amounts people must be paid to willingly accept the loss.

- i. Compensating variation is the amount of extra income necessary to obtain the initial utility level if the consumer is free to rearrange purchases.
- ii. Compensating surplus is the amount of extra income necessary to obtain the initial utility level, after the price change, given that the consumer is constrained to purchase the original bundle of goods.

### 5.6.2.4 *Equivalent Measures*

Equivalent measures are the maximum amounts people would pay to prevent the loss. Equivalent measures of value are found with reference to the final level of utility if the proposed change occurred.

Equivalent variation is the amount the consumer would be willing to pay to prevent a price increase if purchases are not constrained. Equivalent surplus. The definition of equivalent surplus follows directly. If a consumer paid to prevent the price of a good from increasing, the reduction in income would mean the quantities of the goods purchased would decrease.

### 5.6.3 Techniques for Non-Market Valuation

Techniques for non-market valuation can be broadly classified as direct and indirect (Pearce, *et al.*, 1989; Smith, 1986). Indirect methods estimate the relation between the "dose", (for example, siltation) and the effect (decrease in water quality). Once this has been established, 'willingness to pay' and 'willingness to accept' (compensation for environmental damage suffered) measures taken from direct valuation approaches are applied (Pearce *et al.*, 1989).

Direct techniques consider environmental goods and services and seek to directly measure their money value. This may be done by looking for a surrogate market or by using experimental techniques. Such measures include Travel Cost, Hedonic Pricing and Contingent Valuation. These methods are discussed at Appendix B3.

Each of the valuation methods has practical difficulties which limit the range of goods may be valued, or the reliability of the values obtained (Rowe and Chestnut, 1983). For example, data deficiencies often hinder the application of the hedonic price method; contingent valuation provides biased values when people surveyed are unfamiliar with the good being valued or when there is uncertainty over the outcomes (Cummings *et al.*, 1986); and the travel costs method cannot adequately value sites which are being used by people who are partaking in activities at other sites during the same journey (Kerr 1990).

Several comparative studies have been made employing CVM alongside other valuation techniques such as travel costs or simulated markets (Bishop and Heberlein, 1987, Bohm, 1984, and Seller et al 1985, as cited in Mitchell and Carson, 1989; Brookshire, Randall and Stoll, 1980; Brookshire, Thayer, Shulze, and D'Arge, 1982). These comparisons have shown that differences sometimes do exist between methods, but usually these are of a minor nature, certainly well within an order of magnitude.

## 5.7 DISCUSSION AND CONCLUSIONS

Chapter Five focuses on three areas:

i. Environmental Values

It provides an outline of the theoretical concepts associated with "environmental values", and identifies these as use, non-use, and intrinsic values. Non-use values are categorised as option (bequest), quasi-option and existence values. Intrinsic values are unrelated to human beings altogether.

ii. Analytical Techniques for Environmental Assessment

It reviews some of the analytical techniques which may be used for the evaluation of environmental impacts and the costs and benefits associated with resource consent applications; and which have relevance to the Aorangi Awarua case study.

iii. Non-market Valuation Techniques

It identifies and provides a brief discussion techniques which have been developed for non-market valuation of the

environment.

From the discussion in each of these areas, the following conclusions can be made.

Implementing sustainable resource management, as defined in the RMA, implies commitment to a policy of ecological sustainability. Such a policy requires the identification of all of the values associated with the natural environment, and the incorporation of these values in resource management decision making.

Both EIA and CBA provide a framework for organising all of the beneficial and detrimental factors associated with projects, programmes or policies. SMSs are one method of incorporating sustainable resource management concepts into the assessment of environmental impacts of policy and/or development proposals. CBA, especially in its extended form incorporating SMS's, can provide a highly useful picture of the relative merits of policies or projects, and in that way facilitates the process of decision making and also making it more transparent.

PBS provides a sound vehicle for project evaluation exercises. It is perhaps most useful as a tool to determine the issues associated with various development applications, and will help to identify whether further economic analysis, such as CBA, is required.

However, individually these traditional techniques do not go far enough. In order to present a comprehensive analysis of any resource management decision which involves a choice between the preservation or development of a natural ecosystem, the decision maker must be able to measure the benefits which arise from both options.

Non-market valuation is a term describing a range of techniques which have been developed to meet the needs of decision makers endeavouring to allocate resources to their most valued uses. The values placed by the community on preservation or protection of the environment frequently cannot be expressed through the market mechanism, but such values should be included in the assessment of the environmental impacts of proposed policy or development (Pearce *et al.*, 1989; Randall, 1987; Kerr, 1986).

By simulating markets for environmental goods and services and deriving estimates of intrinsic values and environmental damage costs, the environmental impacts of policy and development proposals can be directly compared with the economic and social benefits associated with (for example) profit and employment.

Sustainable resource management will require the recognition of intrinsic environmental values. The incorporation of these values into any economic analysis may help to ensure that ecological sustainability is achieved in the long term. By trying to value environmental goods and services we are forced into a rational decision-making frame of mind. That is we are forced to think about all of the gains and losses, the benefits and costs of resource management decisions.

While it may be questionable to place monetary values on non-economic intangibles (such as intrinsic values associated with natural resources), at least by attempting to value them, they are explicitly considered in any analysis. Non-market valuation ensures that resource management decisions are made recognising that "goods and services" provided by the environment, as well as any externalities associated with resource use, are not "free".

One objective of the literature review was to determine and select the technique most appropriate for the non-market valuation of the Aorangi Awarua Block. The contingent valuation method is theoretically applicable to measuring all types of non-market values, and is potentially the most useful method for non-market valuation given its superiority over other methods for determining non-use and intrinsic values.

While the existence of some bias indicates that the CVM cannot be used for fine economic decision-making it does provide some information on the likely values of non-market goods and services which is certainly more useful than no information at all.

For this reason, CVM has been selected to try and determine the non-market values associated with the Aorangi-Awarua Block. Chapter Six therefore provides a detailed examination of the CVM research to date, together with the strengths and weaknesses associated with the method.

**CHAPTER SIX**  
**SELECTION OF THE CONTINGENT VALUATION METHOD**

**6.1 PURPOSE**

Chapter Five concluded with the selection of the Contingent Valuation Method (CVM) as an appropriate technique for the non-market valuation of the Aorangi Awarua Block.

The purpose of this Chapter is therefore to further examine the state of the art of CVM, with a view to providing the necessary information to enable the author to carry out a contingent valuation of the Aorangi Awarua Block.

*Objective*

To determine the validity, reliability and accuracy of CVM for measuring environmental value.

**6.2 BACKGROUND**

CVM involves the use of surveys as a means for deriving estimates for values associated with non-market goods. The survey is designed around the notion of a hypothetical market. Because the values elicited are contingent upon the particular hypothetical market described to the survey respondent, this approach came to be called the contingent valuation method (Brookshire and Eubanks, 1978; Schulze and d'Arge, 1978; Brookshire and Randall, 1978; as cited in Mitchell and Carson, 1989).

Most of the more recent literature in non market valuation involves the use of the CVM in order to measure use and non-use values (Boyle and Bishop, 1988; Kirkland, 1988; Mitchell and Carson, 1989; Walsh, Bjornback, and Rosenthal, 1990; Stone, 1991; Dumsday, Jakobsson and Ransome, 1991).

Mitchell and Carson (1989) argue that, of all the methods which have been developed by economists to value public goods, CVM represents the most promising. It appears as accurate as other methods, it requires the researcher to make fewer assumptions, and it is capable of measuring types of benefits that other methods cannot.

Kirkland (1988) indicates that the major strengths of CVM include:

- i. the method is virtually independent from secondary data which allows it to be applied to a wide range of public and open access "goods";
- ii. the method is capable of generating values which compare well with analogous values obtained from alternative market based methods;
- iii. the method currently provides the only flexible technique for estimating the value of environmental resources to both users and non-users. These non-use benefits are commonly referred to as preservation values and include option, existence and bequest values.

Although there are problems with CVM in that the use of surveys to obtain consumer responses to hypothetical situations makes the method vulnerable to various types of error and bias, considerable research has established the fact that contingent valuation can provide useful estimates of value for public policy decisions (Boyle and Bishop, 1988, p.27).

In an experiment to determine the comparative reliability of the dichotomous choice and open ended contingent valuation methods, Loomis (1988) found that individuals total willingness to pay responses are not "random noise". The results of a test-retest survey with a nine month interval indicated that reliable estimates of total willingness to pay can be obtained, and that the recreation, option and existence values obtained from an initial survey appear to be relatively good predictors of the long term values people place on a resource.

### **6.3 INTRODUCTION TO THE METHODOLOGY OF CVM**

The method uses survey questions to elicit people's preferences for public goods by finding out what they would be willing to pay (WTP); or alternatively, what they would be willing to accept (WTA) as compensation for a loss. It should be noted that for the purposes of this Thesis, the focus of the CVM will be on WTP as it has been found that the WTA approach does not elicit valid data in many circumstances. CVM is thus aimed at eliciting people's WTP in dollar amounts (Bishop and Heberlein as cited in Kerr, 1986; Mitchell and Carson, 1989).

Surveys may be either by way of personal interviews, telephone, or mail. Personal interview techniques allow better descriptions of proposed resource changes with the use of audio-visual aids which can not be employed in written or telephone surveys. However, telephone surveys and personal interviews in particular are much more expensive than postal surveys, which may limit their use to some extent.

Cummings, Cox and Freeman, (1986), and Mitchell and Carson (1989) describe the following procedure for applying the CVM.

i. Determine Sample

In order to carry out a CV survey it is necessary to determine the population of people whose values will be estimated. That is, to define whose values are to be counted. If contingent values are to be valid and useful, the object being valued must be appropriately defined so as to reflect the issue being addressed.

ii. Design of the questionnaire:

Survey respondents are presented with material which consists of three parts:

- a. A detailed description of the good(s) being valued and the hypothetical scenario which is created for the respondent. Carefully presented descriptions of the resources or changes in environmental quality that are to be valued are necessary. Visual aids such as photographs, charts and maps are also used.
- b. Questions which elicit the respondents' WTP for the good(s) being valued. These questions are designed to facilitate the valuation process without themselves biasing the respondent's WTP amounts.
- c. Questions about respondents' characteristics (for example age, income, location), their preferences relevant to the good(s) being valued, and their use of the good(s).

For respondents to express realistic values, some specific mechanism for payment, called the 'payment vehicle' must be

specified as part of the contingent valuation questions. For example taxes, rates, trust-funds, prices for products, sewage fees, hunting and fishing licence fees.

- iii. Carry out a "pilot survey" using a small selected sample of respondents and/or focus groups:
- iv. Select final survey design.
- v. Draw random sample.
- vi. Training of interviewers (unless mail survey is used).
- vii. Implementation of the survey.
- viii. Analysis of results.
- ix. WTP

The final step is to use the WTP amounts to develop a benefit estimate. Loomis (1987) and Mitchell and Carson (1989) argue that providing the sample is meticulously selected by means of random sampling procedures, if the response rate is high enough, and if the appropriate adjustments are made to compensate for participants who fail to respond (non-respondents) and for those who give "poor" quality data, the results can be generalised with a known margin of error to the population from which the sample was drawn.

### 6.3.1 Elicitation - How the CV Question Will be Posed

The objective of the CV survey is to determine the respondent's consumer surplus for the good(s) in question. That is, the maximum amount the good is worth to the respondent before he/she would prefer to go without it.

An explanation of the different elicitation methods follows.

#### 6.3.1.1 *Open Ended Questions*

The CVM in its simplest form may be applied as open-ended questions in a mail questionnaire. For example:

*How much are you willing to pay in extra rates to ensure the Aorangi  
Awarua Block of native timber is not logged?*

*\$\_\_\_ per year.*

However, respondents often find it difficult to select a value, particularly as they are not used to working with hypothetical markets for public goods. As a consequence, the open-ended format tends to produce an unacceptably large number of non-responses or protest bids (Desvouges, Smith, and McGivney, 1983).

This problem has led researchers to experiment with elicitation techniques which attempt to facilitate the respondents' valuation process by simplifying the choice process or by offering a context in which to value the good. These techniques help to reduce the number of non-responses and make it easier for respondents to successfully complete the valuation process (Mitchell and Carson, 1989).

### 6.3.1.2 *Dichotomous Choice - The "Take-it-or-leave-it" Approach*

This approach was developed by Bishop and Heberlein (1979, 1980, as cited in Mitchell and Carson, 1989). Questions are of the type:

*Would you be willing to pay \$X extra rates each year to ensure the Aorangi Awarua Block of native forest is not logged?*

*Yes/No*

The amount is varied amongst the questionnaires so that it is possible to predict the probability for any person of given characteristics being willing to pay a given amount. This is termed the dichotomous choice approach. Analysis is conducted by plotting probability of being willing to pay against the dollar amounts nominated.

Dichotomous choice has a theoretical advantage over other forms of contingent valuation since it is very like the type of market we actually use for most of our purchases. The respondent has only to make a judgement about a given price. For example, in buying a meal there is a given price which the consumer can take or leave. If the consumer is unwilling to pay the price the benefits of the meal are foregone. This approach is therefore especially suitable for mail surveys (Mitchell and Carson, 1989).

The disadvantage with dichotomous choice questions is that a very large sample is required to achieve an acceptable level of statistical precision. This is because only a discrete indicator of maximum WTP is obtained instead of the actual WTP amount. In addition fairly sophisticated analysis relying on logistic or probit regression curves is required to determine the mean WTP (Mitchell and Carson, 1989).

Loomis carried out an experiment to determine the comparative reliability of dichotomous choice and open-ended contingent valuation methods. In a

resurvey of the same households nine months after an original survey, test-retest correlations on willingness to pay showed that reliable estimates of total willingness to pay for preservation of natural resources can be obtained using either type of CVM (1988, 1990).

### 6.3.1.3 *Iterative Bidding Technique*

The iterative bidding technique may be applied using personal interviews or telephone surveys. This technique requires the respondent to answer yes or no to a series of questions of the following type:

*Are you willing to pay an extra ten dollars rates per year to ensure the Aorangi Awarua Block of native forest is not logged?*

Depending upon the answer received the interviewer will then alter the bid until the maximum WTP or minimum WTS is found. This is a series of dichotomous choice questions, so should have all the advantages of that method. Further advantages are thought to be that the iterative bidding process will capture the highest price consumers are willing to pay, thereby measuring the full consumer surplus; and that the process of iteration will enable the respondent to more fully consider the value of the amenity (Hoehn and Randall, 1983, as cited in Cummings, Brookshire, and Schulze, 1986).

However, Mitchell and Carson (1989) state that these desirable features are achieved at what is now regarded as an unacceptable cost by many CV researchers. The starting bid tends to imply a value for the good. Studies have shown that even if a respondent rejects the initial bid, starting points will significantly increase/decrease the revealed WTP amount (refer to discussion on starting point bias).

#### **6.3.1.4      *The Payment Card Method***

This method was developed by Mitchell and Carson in 1983 (Mitchell and Carson, 1989) as an alternative to the bidding game.

The method aims to maintain the properties of an open ended question approach, while increasing the response rates for the WTP questions by providing respondents with a visual aid which contains a large array of potential WTP amounts, ranging from \$0 to a large amount. This procedure avoids the need to provide a starting point, yet offers the respondent a context for bidding.

#### **6.3.1.5      *Contingent Ranking***

Contingent Ranking is a relatively new technique. Respondents are not asked to value environmental assets directly, but rather to rank various combinations of environmental quality and monetary outlays. Respondents are asked to rank the alternatives from most preferred to least preferred and values are inferred through statistical analysis of rankings (Bishop and Heberlein, 1985, as cited in Cummings, Brookshire and Schulze, 1986).

### **6.4      RELIABILITY, VALIDITY AND THE ISSUE OF BIAS - SOURCES OF ERROR IN CONTINGENT VALUATION STUDIES**

Although widely accepted as a viable non market valuation technique, concerns over the accuracy and reliability of CVM persist (Bergstrom and Stoll, 1989; Kealy, Dovidio and Rockel, 1988).

Concerns and criticism about the accuracy of contingent valuation have focused on potential biases. That is, the WTP amount elicited by CVM may in fact be

an imperfect measure of true WTP. Some of the causes for this discrepancy are random and affect the reliability of the estimate, while others are systematic and bias the WTP measure thereby affecting the validity of the estimate (Mitchell and Carson, 1989).

#### **6.4.1 Reliability**

Reliability usually refers to the extent to which the variance of a response or estimate is a result of random sources or "noise". Reliability is affected by sample size and design, choice of instrument and interviewer effects. The smaller the sample, the less well formed the respondent's value for a good, and the less understandable and meaningful the WTP questions are to the respondent, and greater the chance that answers will represent guesses rather than considered responses. Ambiguity in question wording, and scenarios too unrealistic to be meaningful to respondents, are therefore important contributors to the random error in contingent valuation studies. Careful pretesting to explore a survey's weaknesses is probably the single most effective way to enhance a study's reliability (Mitchell and Carson, 1989, p.122 - 123).

#### **6.4.2 Validity**

To the extent that an instrument measures the concept under investigation (ie. is unbiased) it is valid. The question of bias in contingent valuation surveys has been inferred by understanding of respondent behaviour and by experimenting with survey questions (Mitchell and Carson, 1989, p.123 - 124). Bishop, (1982) concludes that the magnitude of systematic error (bias) greatly exceeds that caused by random sampling error (reliability).

Mitchell and Carson (1989, p.236 - 237) have identified a "Typology of Potential Response Effect Biases in CV Studies" (refer Appendix C1). The types and sources of bias which occur most often, and which have the greatest potential to effect the validity of a CV survey, have been outlined below.

#### 6.4.2.1 *Strategic Bias*

Strategic bias may occur when the respondent believes that he/she may be able to influence the outcome of the survey and therefore does not offer a truthful bid. That is, there may be an incentive to "free ride", and concern is expressed by critics of CVM that it is exceedingly difficult to get individuals to reveal their true preferences in contexts where, by not telling the truth, they perceive they will secure a benefit greater than the costs they will actually have to pay.

For example, people may overestimate their willingness to pay if they think it will achieve the conservation of a resource; or conversely, they may underestimate their willingness to pay if they consider that the results may be used to actually set charges for use of a resource. One approach to reducing the incentive to bias results in this manner is to emphasise the hypothetical nature of the survey, and to convince people to state their bid honestly (Kerr, 1986; Stone, 1991).

Cummings, Brookshire and Schulze quote studies which have been carried out (in particular Brookshire, Ives, and Schulze (1976); Rowe, d'Arge, and Brookshire (1980); and Mitchell and Carson (1981), which "... find .... consistent lack of success in identifying such biases in these studies" (Cummings, Brookshire and Schulze, 1986).

Throsby and Withers question these results (Throsby and Withers, 1986, p.314), and conclude that "free-rider behaviour does exist and is empirically significant". However, Mitchell and Carson (1989, p.155) consider that the motivation for strategic bias is weak and should not be a problem in carefully

designed surveys. The majority of the literature appears to support this statement, while acknowledging that strategic and other biases need to be recognised and questionnaires designed to minimise these problems.

#### 6.4.2.2 *Hypothetical Bias*

The basis of CVM is to elicit hypothetical bids for non-market goods and services. However, people do not always behave as they say they would in hypothetical circumstances, "ask a hypothetical question, get a hypothetical answer" (Kerr, 1986).

There are several reasons for hypothetical bias. Firstly, unless the respondent is directly affected by the issue being surveyed, there may be a lack of incentive for them to determine their own preferences, which can be perceived as quite a difficult task particularly if there is no immediate or obvious reward. Secondly, respondents may not understand the issue at hand; and thirdly they may not believe that their actions will be taken seriously by decision makers.

Questionnaires must therefore be made as real as possible, and be fully understandable by respondents, in order to encourage people to behave as they would if faced with the situation in real life. Respondents must also believe that their action in accepting or paying compensation will be considered in decision making (Kerr, 1986).

Sinden (1988) reviewed 17 empirical studies comparing actual to hypothetical donations, and concluded that "... Hypothetical bias may not occur when a carefully prepared questionnaire is presented carefully to a co-operative group of subjects" (as cited in Stone, 1991, p.2).

### 6.4.2.3 *Instrument Bias/Vehicle Bias*

Instrument Bias, also known as vehicle bias, arises from the choice of instrument for payment. Such vehicles include changes in local taxes or rates, entrance fees, surcharges on bills, higher prices for goods, introduction or increase of permit/licence fees. That is, the method for collecting or paying the bid may influence its magnitude.

For example, if a particular organisation had recently been irresponsible with funds, and it was suggested that the donation would be to a similar, though hypothetical, organisation there may be a level of aversion to the payment vehicle (Stone, 1991).

Another example is provided by Kerr (1986), who states that in valuing a freshwater fishery, proposed license fee increments to pay for fishery enhancement work were reflected by many respondents who perceived the mechanism as a step towards establishing private rights over fisheries.

Different instruments may impinge upon varying numbers of people causing a form of strategic bias if respondents see a fixed cost spread over all payers. Some instruments allow varying degrees of substitution over commodities, so will elicit different bids. For example, a tax rebate of equal dollar value to a site use subsidy is worth more since it allows the recipient more flexibility in spending that income. Some instruments are seen as totally inappropriate, or unfair (Kerr, 1986).

Vehicle bias can be partly observed by asking zero bidders whether they would have preferred the money to be collected in an alternative manner (Stone, 1991, p.4).

#### 6.4.2.4 *Information Bias*

Information is an important determinant of perceived values which people place on environmental goods and services, and is a critical component of contingent valuation studies (Bergstrom, Stoll and Randall, 1990).

The amount of information provided to respondents about the implications of the proposed changes can affect bids. This is a problem of the hypothetical nature of the method, and the inability of respondents to completely visualise all changes, or predict the actions of others (Kerr, 1986).

Bergstrom *et al.* (1990) tested the impact of information on willingness to pay for wetlands protection. Results supported the hypothesis that information is important for accurate valuation of environmental commodities; and that additional information regarding the potential uses associated with the preservation of the wetland, increased willingness to pay.

Stone 1991 states that the potential for information bias can be minimised by keeping information simple and objective, and to present it in a consistent way.

#### 6.4.2.5 *Starting Point Bias*

Starting point bias may arise where an iterative bidding process is used. That is, where respondents are presented with an initial amount and then asked to raise or lower this to reflect their own value. The bias arises when respondents are unsure of their true value and are lead or guided by the amount initially presented to them. In some interview applications the starting point for bidding has affected the maximum bid offered. The respondent may view the first bid offered as being in the likely range of payments expected and so try to please the interviewer by providing a bid in that area. Or, if the initial bid is far from the true bid the respondent may tire of the iterative process and shortcut it by settling on a lower than true bid. (Kerr, 1986).

Boyle, Bishop and Welsh (circa 1986) developed a test for starting point bias and applied it to the data from three contingent valuation studies and one simulated market study. Starting point bias was found to be a problem in all three contingent valuation studies but did not exist in the simulated market study, suggesting that starting point bias may be an artefact of hypothetical markets. They concluded that "the ultimate conclusion may be that iterative bidding is not worth the trouble or expense" (Boyle *et al.*, c.1986, p.14).

One way to minimise starting point bias is to show respondents a payment card which presents a range of values for them to choose from (Stone, 1991, p.3). Boyle and Bishop (1988) conclude that although the iterative bidding estimate contains a starting point bias, the effect on respondents final bids does not appear to make a dramatic difference of value and the estimates derived from the other techniques.

## **6.5 ENHANCING RELIABILITY AND VALIDITY - REFERENCE OPERATING CONDITIONS**

The accuracy of the CVM is a recurring theme throughout the CV literature. As V. Kerry Smith (in Cummings, Brookshire and Schulze, 1986) notes, much of economists' hard data may be subject to the same type of criticism, as do estimates from indirect market methods.

Subject to CVM satisfying particular criteria in its design, application and analysis, consensus of opinion appears to be that despite the problems of reliability and bias, the method produces order of magnitude estimates (Kirkland, 1988, p.47).

Bishop and Heberlein concur (Sappideen, 1989, p.9), "... as long as certain caveats are met, the contingent valuation method is able to provide monetary values for many environmental goods and services which are sufficiently

accurate to be useful in public decision making".

Kerr (1986) states that: "In well defined studies these biases are of no significance". Recent work by Bishop and Heberlein (in Kerr and Sharp, 1987), Cummings *et al.* (1986); Sinden (in Stone, 1991); and Boyle and Bishop (1988), have generally failed to establish that these biases are significant.

Many of the authors reviewed emphasise the importance of careful design and implementation of CVM surveys. A contingent valuation scenario must be informative; clearly understood; realistic; have uniform application to all respondents; and leave the respondent feeling that his/her responses are needed (Cummings, Brookshire and Schulze, 1986; Boyle and Bishop, 1988; Mitchell and Carson, 1989).

Recommendations and guidelines for the application of CVM have been proposed. For example, Cummings, Brookshire and Schulze (1986) detail "reference operating conditions" (ROC's) which must be satisfied before contingent valuation can be expected to provide estimates of value comparable to those for marketed goods. These are as follows:

- i. Subjects must understand, be familiar with, the commodity to be valued.
- ii. Subjects must have had (or be allowed to obtain) prior valuation and choice experience with respect to consumption levels of the commodity.
- iii. There must be little uncertainty.
- iv. WTP, not WTA, measures are elicited.

- v. Payment vehicles must be well defined and credible vis-a-vis the CVM commodity; values obtained with one vehicle may not be interpretatively "transferred" to those which we would obtain with other vehicles.
  
- vi. CVM application must involve:
  - a. No basis for starting points or anchoring;
  - b. "appropriate" information concerning the commodity and valuation process;
  - c. initial, non-iterated valuations;
  
- vii. Subjects must be given as a simple a choice as possible;
  
- viii. Outliers should not unduly influence research;
  
- ix. Subjects should be permitted to abstain from the valuation process;
  
- x. Subjects must view the CVM process as a meaningful opportunity to influence policy via their responses; or subjects must view questions as being sufficiently hypothetical so as not to provide incentives for strategic behaviour;
  
- xi. Close" correspondence between attitudes and behaviour is required.

## 6.6 RECENT EXAMPLES OF THE USE OF THE CONTINGENT VALUATION METHOD

This part of Chapter Six is a brief review of some recent examples of the use of CVM, particularly in respect to obtaining non-use values.

Protection of water quality was the first resource for which empirical estimates of option and existence values were estimated, along with recreational values, using CVM. The following values were derived; \$56 per household for recreation use, \$22 per household for option value, \$25 per non-user household and \$34 per user household for existence value, and 17 per non-user household and \$33 per user household as bequest value (Walsh, Erickson, Arosteguy and Hanson, 1980)

Also in 1978, Brookshire, Eubanks and Randall presented their first attempt to measure option values for Wyoming bighorn sheep and grizzly bears. This experiment was later refined in 1983 (Brookshire, Eubanks and Randall, 1983). The option price averaged \$21 and \$23 annually per respondent for grizzly bears and bighorn sheep, respectively. The existence values, per survey respondent, averaged \$24 annually for grizzly bears and \$7 annually for bighorn sheep.

Daubert and Young (1981) utilised the CVM to determine the value placed by recreationists on the instream flows of the Cache la Poudre River in northern Colorado. By directly estimating the recreationist's willingness to pay for instream flow quantity changes, it was possible to determine marginal values of water that are comparable to the value of water for irrigation. The findings indicate that variations in instream flow strongly affect fishing and white-water recreation experiences. It was found that during periods of relatively low flows, the estimated instream flow marginal value exceeds the marginal value of water in irrigation, suggesting a need for altered water allocation policies. If water were to be diverted and stored at different times of the year at reservoirs

further downstream than at present, total fishing benefits would increase by \$10 000 during September; and in October, total recreation benefits would increase by at least \$11 000. This water policy change would not lead to a decrease in crop production as water supplies remain constant or even increase; only the storage location and timing changes.

Bennet (1984) carried out an empirical study of the value a sample of Canberra residents places on the continued provision of the existence benefits of the Nadgee Nature Reserve. It was concluded that while direct questioning of respondents in terms of their willingness to pay may be subject to some biases, the method is capable of providing a reasonable estimate of existence benefits. The average existence value per Canberra adult was found to be at least \$20, that is \$2 per annum in perpetuity given a 10 per cent real interest rate.

Harris (1984) used CVM to determine the economic worth of a water pollution control programme for the Waikato River, New Zealand. In the early 1960s, public response to water pollution led to legislation and the establishment of statutory bodies necessary for some level of control over pollution discharges. As a result, over the past 20 years, there have been significant changes to both the measurable and visible quality of the Waikato River. However, the cost of achieving and maintaining this water quality improvement has been high. By 1984, an estimated \$35 million (1984) has been expended on controlling pollution in the waters of the Waikato Basin. Adjusted to present day values (1984), this figure would be close to \$100 million. It was found that the population of the Waikato Basin would be prepared to pay approximately \$3.7 million per year for the defined water quality improvements. This represents an average of approximately \$16 per person, a valuation which is limited to the "intangible" aspects of health, recreation, aesthetics and conservation values.

A study by Walsh, Loomis and Gillman in 1984 found that the average household in Colorado was willing to pay \$58 in higher taxes and prices to improve management programs so as to allow removal of all fish and wildlife

from the Threatened or Endangered Species list in the United States. Of this \$58, 29% was for recreation, 20% was for option values, 23% was for existence values, and 28% was for bequest values.

Desvougues, Smith and Fisher (1986) carried out a contingent valuation survey designed to estimate the option price bids for the improved recreation resulting from enhanced water quality in the Pennsylvania portion of the Monongahela River. Generally the results confirm the state-of-the-art assessment by Cummings, Brookshire and Schulze (1986). Contingent valuation studies appear to be capable of providing estimates of the benefits realized from enhancing one or more aspects of environmental quality, and that these benefits need not be confined to user related values (Desvougues *et al.*, 1987, p.265).

Morteza Rahmation (1987) used the Contingent Valuation Method to measure user, existence, option and bequest values. Once the values were estimated they were to be used to influence the public choice of whether or not the National Park should be preserved. The "use value" was found to be only a very small portion of the preservation value bid, indicating that people view the Grand Canyon as a national treasure well worth preserving even though they many not have any plan to visit the site in the future.

Kerr carried out a contingent valuation survey to determine the values placed on the Kawerau Gorge by both users and non-users (Kerr and Sharp, 1987, p.159-161). The Kawerau Gorge has historical, aesthetic, and recreational values for many New Zealanders. It was considered likely that preservation values (option, bequest and existence) would provide a significant proportion of the total value. Those surveyed were asked to choose whether hydro development in the Kawerau Gorge should proceed, given a stated money cost of not completing the hydro schemes. It was apparent from the results of the survey that the aesthetic values of the Kawerau Gorge would be significant when aggregated over New Zealand. The analysis indicated that the mean household consumer surplus loss from building the scheme was about \$64.

Kirkland (1988) applied the Contingent Valuation Method to evaluate the non-market benefits from preserving and improving the Whangamarino Wetland as an environmental amenity. The Whangamarino Wetland is a large swamp area in the upper North Island of New Zealand and provides an important wildlife habitat for many varied plants and animals. The wetland also has significant potential for agricultural and horticultural development as well as providing benefits in the form of fishing revenues and flood control. The results of the CVM survey indicated that the willingness to pay for the preservation of the wetland (net present value) is \$126 135 000.

In 1990, Walsh, Bjonback, Aiken and Rosenthal applied the contingent valuation method to measure the public benefit of forest quality. The results confirmed the hypothesis that the general public would be willing to pay for protection programs. It was found that forest quality was valued equally by people in all walks of life - with varying income, education and age. Demand for recreation use was not a prominent motivation, with option, existence and bequest values accounting for nearly three quarters of the total willingness to pay value.

Also in 1990 the Australian Research Commission carried out utilised CVM to help the government decide whether to allow mining on the edge of Kakadu National Park. Just over 2000 people were interviewed in Australia at large, and a further 500 in the Northern Territory, where mining would have occurred. Results indicated that, even if the impacts of mining were minor, Australians were willing to pay at least \$826 million a year to prevent mining. That sum exceeded the value of the minerals thought to be in Kakadu. Unfortunately the results of the survey attracted a great deal of negative media attention, and was attacked by the mining industry and other critics. The survey did not decide the fate of Kakadu. When Bob Hawke, Australia's prime minister at the time, turned down the mining proposal in June 1991, the reason he gave was that the area is considered sacred by the Jawoyn aborigines. However, the survey was perhaps more important as an indicator

of public feeling against mining than for assigning a cash value to Kakadu (Australian Bureau of Agricultural and Resource Economics, 1990; *The Economist*, Aug.17, 1991).

Stone (1991) used the CVM to estimate the economic value of the Barmah Wetlands in Australia. The CVM was considered the only method able to capture both use and non-use values associated with the Barmah Wetlands. A sample of 203 Victorians were asked, using direct questioning (personal interviews), about their willingness to pay to preserve the wetlands. Results show that the present day value of the Barmah wetland to Victorians lies between \$76.9 million and \$97.5 million. Of this, preservation value accounts for between \$76.9 million and \$97.5 million.

Dumsday, Jakobsson and Ransome (1991) focused on valuing the special environmental and recreational characteristics associated with rivers selected by the Land Conservation Council for protection of the nature conservation, cultural heritage, recreation and scenic values of particular rivers and their corridors. What the survey aimed to do was to measure in dollar terms the net change in the welfare of Victorians that is expected to be brought about by the recommendations of the Land Conservation Council. The draft recommendations aim at protecting 23 rivers and their corridors, and include protection of some 46 essentially natural catchments of small streams. For all 23 candidate river corridors it was found that protection was worth about \$50-54 per household per annum (assuming 1m households). For the proposed high naturalness catchments the total was \$1.60-\$3.20 per household per annum.

Refer to Appendix D1 for current and proposed CVM research from around the World (Kristrom, 1991).

Contingent valuation has been cited in legal cases only since the mid-1980's, and only in 1990 did the Court of Appeals approve the validity of the technique. Litigation is now advancing techniques for measuring natural

resource damage.

It is interesting to note that when America's courts decide what civil damages Exxon must pay for the 1989 Exxon Valdez oil spill in Alaska's Prince William Sound, the amount will be partly based on three rival contingent valuations: one each by the Federal Government and the state of Alaska, both of whom are suing Exxon; and one by Exxon itself (*The Economist*, August 17th, 1991).

## 6.7 DISCUSSION AND CONCLUSIONS

Chapter Six provides a discussion on the theoretical basis for CVM, and reviews some recent applications.

An objective of this Thesis was to determine the validity, reliability and accuracy of CVM for measuring environmental value. It is possible to conclude with the following points.

Firstly, provided certain design and methodology criteria are met, CVM is able to provide monetary values for many environmental goods and services which are sufficiently accurate to be useful for resource management decision making. Contingent valuation (CV) surveys have the ability to reach a representative sample and respondents are able to make informed decisions.

Secondly, contingent valuation will not provide exact values, and it will not provide all the answers needed for correct decision-making and efficient resource allocation. Nevertheless, contingent valuation will provide the decision-maker with considerably more objective and quantitative information on which to base his/her judgements than has been the case to date. It is theoretically and practically superior to alternative methods of providing monetary evaluations of non-market goods, such as the Travel Cost Method

and Hedonic Pricing.

Thirdly, a review of some recent applications shows that CVM has been successfully used to derive the WTP for the preservation or enhancement of a variety of environments and resources.

Finally, the findings of even a flawed CV survey may provide some crude insights into the way a community feels about a particular resource or resource issue. CVM has been selected for use as one step in a broader process for environmental evaluation, which will be applied to the Aorangi Awarua Case Study.

The purpose is not to "test" the method, which has been the focus of much of the CV work to date, but to use CVM as a tool to determine the non-market values associated with the forest. From this it will be possible to make some recommendations as to whether CVM can assist resource managers to resolve complex resource allocation issues/conflicts.

Chapter Seven will provide the background and examine the issues relating to the Aorangi Awarua Case Study. Chapter Eight will then include the development and application of a process for environmental evaluation; with CVM being applied to the Case Study in Chapter Nine.

## CHAPTER SEVEN

### AORANGI AWARUA - A RESOURCE MANAGEMENT ISSUE

#### **7.1 PURPOSE**

The purpose of this Chapter is to examine a resource management issue, Aorangi Awarua. This will set the scene for the application of some of the concepts and techniques discussed in Chapters Three through to Six, in Chapter Eight.

#### *Objective*

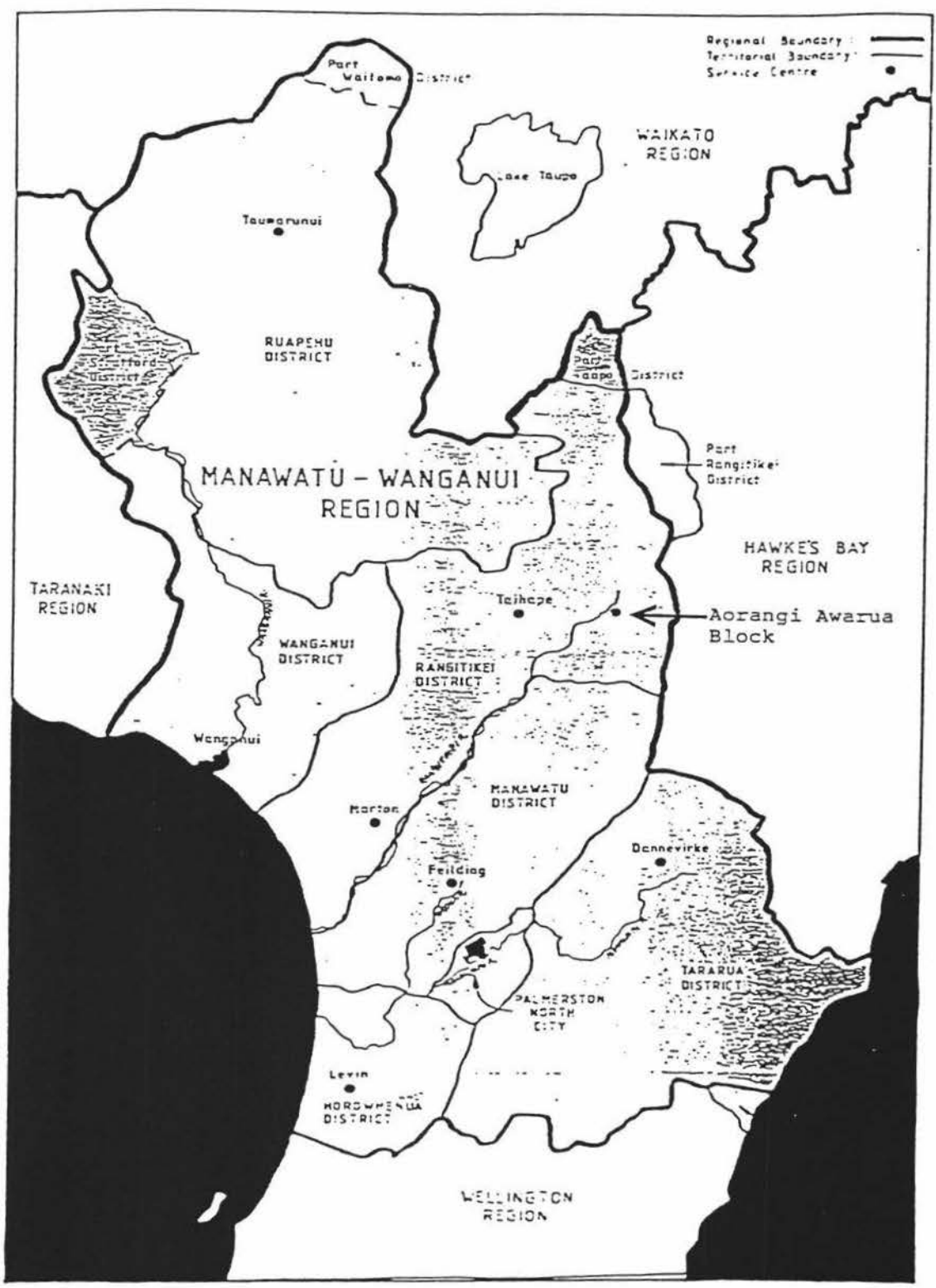
To examine the issues and resource management conflicts which arose as a result of the Aorangi Awarua proposal.

#### **7.2 BACKGROUND**

The Manawatu-Wanganui Regional Council (MWRC) has been involved in an application for consent under both the Town and Country Planning Act 1977, and the Soil Conservation and Rivers Control Act 1959.

The Trustees of Aorangi Awarua Block and Reeves Contractors Limited applied to the Rangitikei District Council for planning consent to carry out selective logging on land east of the Rangitikei River and described as Aorangi Block and Awarua 1DB No.s 1 and 2 Block (refer to Maps 1 and 2). As well the application requested consent to construct a bridge across the Rangitikei River at "the Narrows".

Map 1. Location of Aorangi Awarua Forest





The application involves two components:

- i. To conduct 'selective logging' on the Aorangi Awarua Block of native forest
- ii. To construct a bridge at "the Narrows" section of the Rangitikei River.

This application is a classic example of conflicting objectives with respect to the management of a natural resource. The conflict is further complicated by Maori and private property right issues as the block is owned by a number of Maori people and governed by a group of appointed Trustees, not all of whom are in agreement.

Although the Aorangi Awarua proposal must continue to be dealt with under the Town and Country Planning Act 1977, it is important to note that under the RMA, given the mandate for sustainable resource management in Part One together with these provisions under Section 30, the Regional Council would have had even stronger legal grounds for objection to the application for logging.

It should also be noted that if the case does go to the Planning Tribunal it will continue to be dealt with under the TCPA, however for the purposes of this Thesis it has been examined within the context of the RMA.

### **7.2.1 Planning Application**

An application for planning consent was made in December 1987, and in January 1988 the Rangitikei County Council notified the proposal to log the Aorangi Awarua Block as consent was required under the Town and Country Planning Act 1977 (TCPA). The application thus proceeded to the stage where

objections had been called for and received, but no hearing was held. The reason for not continuing at the time was that the applicants had previously made an application to the Rangitikei-Wanganui Catchment Board as required by a notice issued by the Board under Section 34 of the Soil Conservation and Rivers Control Amendment Act 1959 (SCRCA).

### **7.2.2 Section 34 Application**

In 1985 Reeves Contractors Limited, pursuant to Section 34 of the SCRCA, made an application to the Rangitikei-Wanganui Catchment Board (RWCB) to cut and disturb the land. The Aorangi Awarua block is covered by a Section 34 notice, and therefore Reeves Contractors required the consent of the RWCB to remove timber and disturb the land. The purpose of this notice is to protect land which has a severe erosion hazard (O'Connor, 1990, pers.com.).

In 1987 the RWCB declined consent to the application on the grounds that it would be "imprudent land use practice and detrimental to water and soil values".

The RWCB decision was subsequently appealed to the National Water and Soil Conservation Authority (NWASCA). The result of this appeal was the approval of the Section 34 application subject to a series of conditions. (Refer Appendix E2).

The NWASCA decision was appealed by the RWCB, in March 1988, to the High Court on points of law. As a result of this appeal the Rangitikei County Council deferred a hearing of the planning application pending the outcome of the High Court hearing.

The High Court found in favour of the applicants, and the decision was delivered in September 1989. The High Court Judge made some significant

comments on points of law relating to the consideration of the Section 34 application. In brief, the consideration of water quality under the Water and Soil Conservation Act 1967 and other broad social, economic and environmental impacts under the Town and Country Planning Act 1977 were not relevant to the consideration of the Section 34 application.

### **7.2.3 Hearing on the Planning Application**

In October 1989 the applicants wrote to the Rangitikei District Council suggesting that the Planning Application should proceed. The application was considered to have been current and was simply re-advertised, so accordingly the objections from the 1988 application together with those received after the application was re-advertised in 1990, were all considered to be valid objections.

The MWRC lodged an objection to the application. In summary the Regional Council objected to:

- i. The construction of the bridge in total in that it would:
  - a. Conflict with the intent of the proposed Water Conservation Order over the Rangitikei River.
  - b. Detract from the recreational, cultural and environmental values of "the Narrows".
  - c. There is insufficient information regarding the "design flood level" of the bridge.

- ii. The logging proposal in total as:
  - a. The Council was concerned about the overall environmental disturbance resulting from the proposal.
  - b. Insufficient information was made available by the applicant to enable a full assessment of the proposal.

The hearing was held in May 1990. The application was declined by the Rangitikei District Council Planning and Regulatory Services Committee for the following reasons:

- i. The logging proposal would be contrary to the public interest and would significantly and detrimentally alter the natural character of the area.
- ii. That any bridge constructed over "the Narrows" would be inappropriate given its classification in the District Scheme as a place of historical and archaeological interest to be preserved.

(For a full text of the decision refer to Appendix E3.)

#### **7.2.4 Appeal to the Planning Tribunal**

In June 1990 the owners of the Aorangi Awarua Block and Reeves Contractors Limited appealed to the Planning Tribunal against the decision of the Rangitikei District Council.

The grounds on which the appeal is based are that the decision of the Rangitikei District Council was wrong in fact and in law and contrary to sound

town and country planning principles (refer to Appendix E4).

The Respondent Council has lodged with the Planning Tribunal a Notice of Reply to the appeal, seeking the dismissal of the Appeal (refer to Appendix E1).

Pursuant to section 157 of the Town and Country Planning Act 1977, the Manawatu-Wanganui Regional Council has notified the Planning Tribunal that it seeks to exercise its right to be heard and to call evidence on matters that should be taken into account in this appeal.

#### **7.2.5 Legislative Background**

For the purposes of this Thesis it is not considered necessary to examine the legislative background in detail. The relevant legislation for this application is:

- i. Section 34 of the Soil Conservation and Rivers Control Amendment Act 1959;
- ii. The Town and Country Planning Act 1977;
- iii. The Rangitikei District Scheme; and
- iv. Section 20(B) of the Water and Soil Conservation Act 1967 (Water Conservation Orders).

It should be noted that this legislation has now been superseded by the RMA 1991.

## 7.3 MAJOR RESOURCES OF AORANGI AWARUA BLOCK

### 7.3.1 Aorangi Awarua Block - Physical Description

The Aorangi Awarua block lies 25 kilometres east of Taihape in the north western corner of the Ruahine Range. It is bounded by the Rangitikei River to the west, the Ohutu Stream to the south and the Ikawatea River to the east. Its most distinctive feature is the flat topped limestone cap of Mount Aorangi. The block is surrounded by farmland or tussock country to the north, west and east, and adjoins forested land in the Ruahine Forest Park to the south (Dept. of Conservation, 1987).

The Aorangi forests are developed on marine sedimentary rocks consisting of mud-stones, silt-stones, sandstones, and limestones of 2-7 million years of age, called Utiku Sandstone and Mangaweka Mudstone. The contact between these much younger marine rocks and the older greywackes of the Ruahine Range lies along the Ohutu Ridge, the upper limit of Aorangi's forest sequence.

The entire sequence of vegetation, from dense podocarp stands adjoining the Rangitikei River through to subalpine pink pine leatherwood scrub on Ohutu Ridge, straddles these marine rocks extending in altitude from 500 metres at "the Narrows" to 1345 metres on Aorangi.

The landforms are a dissected remnant of an ancient peneplain dipping to the west from Ohutu Ridge. The peneplain is well preserved at high altitudes about Ohutu Ridge, but below is steeply dissected into a series of radially aligned spurs surrounding Mt Aorangi. Mt Aorangi is a limestone-capped pedestal remnant of this peneplain. There is no landform equivalent to this in adjoining ecological districts.

### 7.3.2 Botanical (Indigenous Forest and Vegetation)

At lower altitudes, medium dense podocarp and podocarp/hardwood forests occur on less steep topography. Rimu and kahikatea dominate these stands though matai, miro and totara are common. A wide diversity of lower canopy and understorey tree species exist including black and white maire, ribbonwood, tarata, and rewarewa. This community extends to an altitude of 900 metres.

Steeper and more unstable gully or stream slopes support shrubs and low hardwood trees such as mahoe and kaikamako.

On the mid altitude slopes, black beech dominates with occasional rimu, miro, and Hall's totara.

In the Ohutu Stream catchment south-east of Aorangi, red beech and black beech predominate at mid altitudes. Above the beech belt, an open forest of kaikawaka and Hall's totara occurs with mountain toatoa and broadleaf in the lower canopy. Straddling the Ohutu Ridge, a scrub of pink pine-leatherwood occurs along with many small-leaved shrubs.

The merchantable podocarps occur in three broad forest types at low and mid altitudes, namely, medium dense podocarp forest, mixed podocarp/hardwood forest, and mixed beech-podocarp forest (Department of Conservation, 1987; Brady, 1990).

#### 7.3.2.1 *Intactness*

Apart from minor fire damage and quarry development on the truncated spurs and gullies fronting the Rangitikei River, the 850 metre sequence of vegetation from river bank to Ohutu ridge crest is unmodified. The key elements are not only the intactness of individual forest communities, in particular the podocarp

stands, but also the unity of the entire forest sequences.

### **7.3.2.2      *Representatives and Significance***

#### ***Podocarp Forest Communities***

Because of extensive forest clearance by both Maori and early Europeans, the forests of Moawhango Ecological District, which includes Aorangi Awarua block, have been reduced to only scattered, mostly high altitude, remnants. Substantial podocarp and podocarp-hardwood forests, which once characterised this Ecological District, occur now only in the Aorangi Awarua Block. Because the Aorangi podocarp forests are the last example of the original forests that dominated in the District at lower altitudes, they are highly representative. Similarly, the black beech-mixed podocarp stands at mid altitudes are represented nowhere else in the district and are also highly representative (Rogers, 1990).

#### ***Vegetation Sequences***

Two altitudinal forest sequences can be recognised in the area of the application. There are no similar sequences remaining in the District and therefore the two found on the Aorangi Awarua block are unique and highly representative (Rogers, 1990).

#### ***Scientific Significance***

For the scientific study and understanding of the forest regeneration processes following disturbance factors such as cyclones, snow-break, fire, mass-movement and soil-water changes, the Aorangi Awarua forest sequences are an invaluable asset because of their large extent, diversity and uniqueness (Ibid).

### 7.3.3 Wildlife

#### 7.3.3.1 *The Habitat and its Significance*

On the Aorangi Awarua blocks the forests with podocarp trees (especially those with rimu and kahikatea) provide the best habitat for indigenous birds. Forest of this type are notable on the low to middle slopes of Mt Aorangi's western flank. Especially high densities are found on the remnant river terraces above the Rangitikei River (Brady, 1990, p.2).

#### 7.3.3.2 *The Wildlife and its Significance*

During the wildlife survey conducted by Department of Conservation in 1987/88, 31 bird species and two species of land snails were detected. Although many of the species are common to forested areas, some are not. In this regard blue duck, falcon and kaka are regarded as nationally vulnerable (whereby if present causal factors continue it will shortly become endangered); while one of the land snails, *Powelliphanta marchanti*, is regarded as nationally rare (not currently endangered or vulnerable but is at risk by being in small populations and confined to small areas). One of the bird species, the parakeet, is regarded as 'regionally vulnerable' (Brady, 1990).

Blue duck and falcon were observed as pairs on the blocks it is likely they use the area for breeding. Under the criteria for the former Wildlife Service the presence of a breeding vulnerable species makes the blocks an 'outstanding site of special wildlife interest'.

All of the individuals of the species recorded are part of larger total genetic population of their species. Of special concern is the way the individuals using the blocks affect the genetic population birds contained within the Ruahine Forest Park.

For example, the three blue ducks identified were all in the Ohutu Stream. This stream is a sub-catchment of the larger Whakaurekou catchment which predominantly lies in the Ruahine Forest Park. Observations in the Whakaurekou catchment from surveys over the five year period to 1987 suggest outside of the Ohutu Stream only 20 birds are present. If the Ohutu Stream became unsuitable for blue duck, as a result of modification, the birds would almost certainly die. Their loss would have significant genetic impact on the integrity of the greater Whakareokou blue duck population. This population has no direct links with other populations of blue duck in the Ruahine Range or elsewhere because of the absence of unmodified water connection between (Ibid).

#### **7.3.4 Rangitikei River**

The Rangitikei River is recognised as a river of national standing for its fisheries and angling, attracting anglers from many areas of the country and overseas. Previous surveys (McDougall, 1990, p.4) clearly show that anglers value highly the water quality, scenic beauty, feelings of peace and solitude, the wilderness experience, catch rate and size of fish caught. The River supports a mixed brown and rainbow trout fishery and offers different experiences throughout the various sections of the river.

The most popular reach of the river for anglers is the middle reaches, which includes the section adjacent and downstream of Mount Aorangi.

A draft National Conservation Order has been formulated for the middle and upper Rangitikei River. (Refer to Appendix E6). The outstanding characteristics the order seeks to preserve and safeguard are:

- i. For the upper river:

- a. outstanding wild and scenic characteristics; and
  - b. outstanding recreational fisheries, and wildlife habitat features.
- ii. For the Middle river:
- a) Outstanding scenic characteristics
  - b) Outstanding recreational and fisheries features.

### 7.3.5 Recreation

The areas surrounding Mt Aorangi offer a diverse range of outdoor recreation activities although current recreational use of the Aorangi Awarua Block is considered to be low and restricted mainly to hunting and tramping parties that have permission from the Trustees. The Aorangi Awarua Block is adjacent to the Ruahine Forest Park and provides an extension of the activities enjoyed there.

Mount Aorangi is bounded to the west by the white water section of the Rangitikei River, well known as one of the top white-water rafting and kayaking resources in the country, with impressive scenery and distinctive landform features, notably the Narrows. The Rangitikei River is one of the central North Islands' major recreation resources. It is a highly valued canoeing resource, offering demanding white water (up to grade 5 rapids) for experienced canoeists, a wilderness/scenic experience in the upper reaches, and quieter water suitable for less experienced canoeists in the reaches below Pukeokahu. Throughout much of the popular canoeing and rafting sections the river flows through impressive gorge scenery. Two local rafting companies,

Rangitikei River Adventures and River Valley Ventures utilise these sections of the river extensively, with rafting forming the focus of their respective tourist operations. These two operators take approximately 3000 rafters down the river annually. Several other North Island commercial rafting companies also utilise the river. The white water section of the Rangitikei River is one of the top rafting resources in the North Island, offering exciting rafting through impressive scenery. The Rangitikei is also a highly valued angling river (refer Section 7.3.4).

The areas adjacent to the Aorangi Awarua Block are attracting an increasing number of visitors seeking adventure holidays, or simply a peaceful holiday in natural surroundings. The area has considerable potential in so far as abundant natural features, being located close to existing tourist areas, which in some cases are suffering from visitor pressure and is close to State Highway One. Development of the area's potential depends on good promotion, and protection and wise use of the natural features which are the basis of the areas tourism industry.

There is considerable scope to develop the recreational potential of the area, without diminishing natural and scenic values. Such activities as informal and/or guided walking or hunting trips, natural history tours or the development of a tourist lodge would all enhance the tourist potential of the area and provide an extension of the opportunities available in the adjacent Ruahine Forest Park. There is also potential for the development of a walking track through the forests of Mount Aorangi, onto Ohutu Ridge and across the Ruahine Range. (Hunt, 1990).

#### **7.3.6 Landscape Amenity**

The Aorangi Awarua Block is a very important landscape being a bush-clad representative of what once existed in surrounding areas and which existed in

the earlier geological history of the area.

Mt Aorangi is a focal point for the whole area, made more important by its relationship to the Ruahine and Kaimanawa Ranges. This relationship is reinforced by its indigenous forest cover. The block has high scenic and landscape values, both from the west and from Ohutu Ridge in the Ruahine National Park. "The Narrows" are regarded as one of the key areas of interest along the Rangitikei and is a slow section to the river where it is possible for rafting participants to look at the river environs (Nicholls, 1990).

### 7.3.7 Historical

"The Narrows" are listed in the Rangitikei District Scheme as a site for preservation, under objects and places of historic and archaeological interest. Such objects are entered in a register. The register gives the following description of "the Narrows":

"TE PAPA A TARINUKU RIVER NARROWS. At this point the Rangitikei River runs through a narrow gut not more than 12 feet wide. From time immemorial the Maori inhabitants crossed the river on poles which rested on shell rock ledges. Tamatea-pokia-whenua named the locality after the Ngati Hotu Chief Tarinuku. Tamatea and his son Kahungunu met this Chief at these narrows and Tarinuku presented Tamatea with birds preserved in their own fat; hence the name Te Papa a Tarinuku or "The Food Trough of Tarinuku". In the 17th Century Wharepurakau is reputed to have jumped the narrows to escape from his enemies."

### 7.3.8 Summary of Resources Associated with the Aorangi Awarua Block

The resources of the Aorangi Awarua Block can be summarised as follows:

- i. unique vegetation sequences in a large and sustainable area;
- ii. unique geology of "the Narrows";
- iii. excellent bird habitat;
- iv. presence of falcon, blue duck and kaka, all listed as vulnerable species;
- v. presence of pairs of blue duck and falcon, which earn the site the designation "outstanding site of special wildlife interest";
- vi. many native invertebrates, including at least one that is now rare;
- vii. species diversity;
- viii. sensitivity of the soils to erosion if disturbed;
- ix. high water quality of the Rangitikei River;
- x. scenic attractiveness of the Rangitikei River and its tributaries;
- xi. high recreational values of the Rangitikei River and its tributaries; and
- xii. important historical and cultural values of the area and the river.

## 7.4 THE APPLICATION

### 7.4.1 Logging

The deed between the owners and Reeves Contractors gives the company the right to "selectively log" the land. The deed defines selective logging as:

".... the cutting, felling, logging, extraction and removal of all live and dead timber growing or being on the land .... excepting such timber as may be growing or being on those parts of land:

- a) comprising the Aorangi Mountain Reserve;
- b) exceeding a 35 degree slope;
- c) within 100 lineal feet either side of streams or watercourses."

It should be noted that this is not the accepted definition of "selective logging" as used in New Zealand. "Selective logging" is defined by the Management Policy for New Zealand's Indigenous State Forests (NZFS, 1977, as cited in Hawley, 1990, p.3) as:

" .... logging conducted in a way that maintains the diversity of age, tiers, and species within the indigenous structure to provide a wide range of social, economic and environmental values, leaving open the options for various management objectives in the future".

This means that only part of the merchantable timber is removed so the forest can continue to yield high quality species on a sustained yield basis. The operation defined in the contract is in fact "clear felling".

Harvesting proposals cover an area of approximately 410 hectares (8%) of a total area of 5142 hectares. Harvesting will be a seasonal operation to minimise adverse impacts on soil and water values during the wet winter months, and will be confined to a maximum of 100 hectares per year. Work will conform to the conditions detailed in the National Water and Soil Conservation Authority tribunal decision of December 1987 (refer to Appendix E2). The operation will involve selectively logging podocarps winched up on to narrow skid trails. Buffer zones adjacent to all water courses will be left.

Harvesting will be restricted to terrain between 500 and 900 metres above sea level. The area proposed for harvesting consists of:

- i. 100 hectares of moderately sloped terrain in the lower Otapapa Stream catchment immediately south and east of "the Narrows".
- ii. 220 hectares of moderately steep dissected country south east of Aorangi Mountain.
- iii. 90 hectares in a narrow strip south of Ohutu Stream and adjacent to the Ruahine Forest Park boundary.

Estimates of the volume of millable timber available vary. It is reasonable to assume that volumes will be variable between 6000 board feet per acre up to 20 000 board feet per acre in dense stands (pers. comm., Rogers, 1991). On a yearly basis the volume of timber that will be extracted may amount to up to 4000 cubic metres which equates to an average of one truck per day (Richardson, 1990, p.9).

The company intends using one gang of six men for their harvesting operation, working a five day week. At least three of the gang will be long term employees of the company. It is intended to put a portable mill into the operation. The company may engage helicopters to carry out logs in some

situations. (Pool, 1990).

#### **7.4.2 Access to the Block - Bridging**

Fords, culverts, and bridges are the crossing methods to be used on the forest roads.

The access bridge across the Rangitikei River will consist of two steel girders with timber deck seated on concrete abutments (refer to Appendix D6). The exact position of the bridge is to be determined in consultation with the Regional Council. As the bridge is only required for a limited period a design flood flow of 50 years is considered adequate.

Other than a bridge across the Rangitikei River at "the Narrows" and possibly one across the Otapapa Stream (of permanent materials), other bridging requirements would be met by the construction of temporary log bridges.

The overall bridge length is likely to be 30 - 40 metres and even with the simplest construction is likely to cost \$60 to \$80 000 (Farley, 1990, p.4).

#### **7.4.3 Roading and Tracking**

Road formation width will be kept to a maximum width of 4.5 metres.

Formation of the main access road into the block will probably be done by a hydraulic excavator in combination with a dozer with rippers. Track formation would be done by bulldozer. Metalling would be carried out on the access road.

## 7.5 POTENTIAL EFFECTS OF THE APPLICATION

### 7.5.1 Erosion Potential

The Aorangi Awarua Block contains one of the few remaining stands of podocarp-hardwood-beech in the District that is not Reserve or State Forest.

The blocks straddle the boundary of the tertiary parent material of the Rangitikei basin and the emergent greywackes of the North Island axial range. At least four faults pass through this area and whilst these are not currently active, past movement has left the area geologically unstable. This increases the potential risk of deep seated erosion, which if initiated would be extremely difficult, if not impossible, to control (Harrison, 1990).

Overlying the greywacke and tertiary lithologies is volcanic ash of the Taupo and Tongariro ash showers which give rise to a complex mixture of soils. Soils formed from ash have physical characteristics which make them very prone to slip erosion unless protected by an adequate vegetative cover (Ibid).

The rainfall of the area ranges between 1400mm and 1600mm per year. This in itself is relatively high and high-intensity rain storms can be expected at any time of the year.

The block can be split into four areas (Appendix E1) (Harrison, 1990).

#### *Area 1*

This is the area surrounding Mount Aorangi above 900m altitude and is required by the owners to be set aside as a reserve. No tracking or logging will be permitted in this reserve.

## *Area 2*

This area is of most interest to Reeves. It has the greatest number and the highest concentration of merchantable trees.

Area 2 ranges in elevation from 600m to 900m with the largest continuous areas being in the south west. Ridges are somewhat rounded although not very broad, falling away steeply into more open gullies. The leading ridges themselves are steep and any tracking would need large numbers of culverts to prevent excessive scour.

Whilst difficult, it is considered that these areas could be tracked and logged. However a high level of management with careful logging practices as are set out in the "Forest Operation Guidelines" would be required to ensure that soil erosion was minimised and that off-site values were not detrimentally effected. Under no circumstances should roading or skidding of logs be permitted in the open gully system.

These gullies are infilled with material which is the result of erosion of adjacent slopes. At present they are reasonably stable but disturbance of the existing vegetation would lead to severe gully erosion.

Major roading would be required across the Ohutu Stream to gain access to the area on the southern boundary.

## *Area 3*

This area takes in the land lying between the Rangitikei River and the 900 metre contour, excluding Area 2.

This majority of slopes are steep to very steep, (being in excess of 26 degrees with most exceeding 30 degrees). There are numerous cliffs, bluffs and razor

backed ridges. The watercourses are steep and engorged in parts. Slopes often exceed 500 metres in length with elevations, gully to ridge, of nearly 300 metres. There are pockets of easier country but these are discontinuous, small and isolated. Merchantable trees throughout this area are generally sparse and confined to the isolated easier areas. Beech trees are present along most ridges with the major forest component being shrub-hardwoods. The steep faces adjacent to the Rangitikei River have a vegetative cover of grass species with limited scrub regrowth. There are significant areas of bare ground.

The significance of this area is that, to gain access to the main timber area in the south west (Area 2) and to extract logs, it has to be traversed by over 6 kilometres of roading. Any road through this area, particularly one capable of taking logging trucks, will require substantial earthworks with deep cuttings and fillings.

This long length of road, will require repeated cut, fill and side-casting of major proportions. When this is coupled with the high rainfall and steep terrain, it can only lead to severe erosion with the associated problems of detritus and siltation in the streams flowing from the block to the Rangitikei River.

#### *Area 4*

This area comprises the remainder of the Aorangi Awarua blocks generally east of the Aorangi Mountain. The elevation is all above 900 metres with the topography ranging from very steep ridges, spurs and headwaters through to the relatively easy rolling to moderately steep tussock plateau. These higher areas are characterised by a harsh climate and by the fragile volcanic soils suffering from sheet and wind erosion.

### *Effects of Logging, Roothing, Tracking, and Bridging*

The current application is for a ground based operation which will require a substantial roading programme. A major road, through very difficult country, will be required to gain access from the Rangitikei River to the easier ridges 375 metres higher and from this point tracking will be required along all ridges and spurs. Tracking across steep and very steep unstable slopes, or major modifications will lead to widespread severe erosion.

Condition 9 of the NWASCA consent (refer Appendix E2), requires spoil from access roads to be placed at sites where it will not enter water courses. At Aorangi Awarua this will be virtually impossible and economically impractical (Harrison, 1990).

Roothing is the main source of sedimentation in forest harvesting operations. The topographical, geological, and rainfall conditions at the Aorangi Awarua Block make this a high risk area for sedimentation from roading operations.

The creeks in the Block fall steeply into the Rangitikei River and any sediment deposited into the water courses or onto steep slopes would be rapidly transported to the River.

A number of factors relevant to conditions at the Aorangi block and the applicants proposal have the potential to exacerbate erosion problems. These include:

- i. rainfall during construction;

- ii. exposed cut and fill surfaces which are potentially a major source of excessive sediment discharge;
- iii. the placement of spoil from roading, some of which will inevitably enter water courses;
- iv. water tables and culverts which are a major cause of sediment discharge from logging roads unless these are adequately sized, located and maintained;
- v. the location of skid sites;
- vi. skid tracks which are a potential source of major sediment discharge. The length of skid track proposed in the application is excessive and proper roads should be required to at least the point where the area to be logged is less than 20 hectares; and
- vii. upon completion of logging natural deterioration of roads and tracks could lead to accelerated erosion in the future.

Roading to the intended NWASCA standards would cost in the order of \$35 000/km. A maintenance cost of \$1000 - \$2000/km/year could be anticipated (Farley, 1990, p.3).

Because of the low volume of timber which is available and the high percentage of inferior trees, the high capital costs of roading through Pukerimu station, bridging of the Rangitikei River and tracking on the block itself, there will be pressure to harvest all merchantable timber even on steeper more erosion prone sites.

"The construction of access roads and tracks would certainly cause extra landslipping to occur. One particular note of warning I consider deserves mention is the consequence of a quite minor landslip on the uphill side of a road or track, eating rapidly back upslope. Such progressive failure might well, over a period of a few years, eat into the Mt Aorangi Reserve from an initial failure two or three hundred metres downslope from the Reserve Boundary." (Hawley, 1990, p.6).

While it may be physically possible to track and log the Aorangi Awarua Block the inherent physical limitations of geological instability, erodible soils, steep slopes, high rainfall and harsh climate mean that on-site and downstream problems that would result, if ground based tracking and logging were permitted, would be excessive.

Although only land with a slope of less than 26 degrees will be permitted to be logged, by far the greatest percentage of tracking will have to be across land which exceeds 26 degrees.

Quite minor disturbances to the Aorangi Awarua Block (such as construction of vehicle access tracks and removal of a substantial proportion of the larger trees) would increase erosion rates significantly.

In view of the fact that the area has survived longer (geologically) than would be expected and is "over-ripe" for removal by erosion, and in view of the fact that many of the slopes, having been created by erosion, are already very close to their maximum stable steepness, there is a very real chance that quite minor disturbances would start patterns of instability which would, over a decade or two, change the look of the area quite spectacularly.

Logging the Aorangi-Awarua Block would almost certainly lead to a major increase in landslipping and gullying within five years, with a very real chance that a new erosion regime, once begun, would continue for several decades,

and the headward retreat of gullies would take the new erosion regime up into the Mount Aorangi Reserve and promote landslip there (Hawley, 1990, p.7).

### **7.5.2 Implications of the Proposed Bridge**

The proposed bridge at "the Narrows" is well below the annual flood level and therefore inadequate. It would be destroyed in a comparatively minor flood and may cause damage to adjacent land in the process.

The proposed bridge is of the wrong structural type to be able to withstand the impact of fast moving debris which comes down the Rangitikei River in times of flood. A low level bridge of this type is in any case unacceptable to the Regional Council, who has responsibility for flood control, because of the possibility of log jams being created in the Narrows and because of the potential hazard to river users (Doull, 1991).

A bridge constructed at a sufficiently high level would be acceptable from the point of view of waterway requirements, but may require associated earthworks on an unacceptably large scale (Ibid).

### **7.5.3 The Effects of Logging on Indigenous Forest and Vegetation**

The outstanding and unique forest communities, rimu-matai dominant forests such as Aorangi Awarua have been lost from virtually all the southern North Island.

Rogers (1990) stated that the podocarp and podocarp-hardwood stands of the western Aorangi/Awarua Block are nationally significant. Such a rating accords with their ecological district uniqueness, intactness, geographic extent, diversity, and their regional rarity about the wider Ruahine Range. In addition,

the altitudinal forest sequences of Aorangi and west Ohutu Ridge are unique in Moawhango Ecological District and in wider Ruahine Range. The forests are also of scientific importance, providing benchmark study sites of forest processes in a nationally rare forest type. Logging of the lower altitude stands would destroy the ecological fabric of the forests due to their low resilience.

Rogers (1990), in his evidence stated that:

"Despite many commercial and scientific attempts to selectively log podocarp forest on a sustainable basis, no technique has been successful. Research at the Forest Research Institute, Rotorua, has shown that post-logging mortality from roading, felling, and haulage disturbance, at various extraction rates, significantly exceeds the incremental growth rate of the forest. In effect, the fabric of podocarp forest is destroyed by logging. In addition, the geographic scales at which ecological processes apply, mean that logging in one community can have a detrimental, 'down-stream' effect in adjacent communities due to the ecological inter-connectivity of vegetation."

#### **7.5.4 The Effects of Logging on Wildlife**

The most sought after species for logging on the blocks are the tall podocarps. Subject to accessibility, those areas with these trees will be the most affected by logging operations.

Studies have shown forests that have been logged carry fewer native bird species than those that are not logged due to logged species providing the most critical seasonal foods. Conclusions from habitat-use studies indicate that although the merchantable podocarps represent a low proportion of the total forest biomass they are highly preferred by forest birds. As a consequence their removal has a disproportionately severe effect on the birds using them.

In addition, logging causes nutrification and sedimentation of waterways. This would have a noticeable impact on animals dependent on food from this source, such as blue ducks. Severe modification of stream quality would almost certainly eliminate their food supply.

Logging activities would also have an impact on native land snails. Land snails require moist litter layers and logging activities tend to open forests so that forest floor litter dries out.

The podocarp forests of the Aorangi Awarua Block provide significant habitat for indigenous birds. Because podocarp trees are predominantly the merchantable species this forest type will be the most affected by logging. This will result in a reduction in the number of birds present. Any species that is limited in number and in distribution will suffer the most from such changes.

The use of the machinery that is associated with logging will put at risk land snails that are within logged areas.

The area has high wildlife values with the threatened species kaka, kakariki, blue duck and falcon present. There are high kereru numbers, a species that is in major decline in the North Island.

Of the species detected on the blocks, three are nationally vulnerable bird species, one is a nationally rare land snail, while one bird species is regionally vulnerable. The indications of two vulnerable species breeding on the block, makes the area an 'outstanding site of special wildlife interest'.

The vulnerable species of native birds in the Aorangi Awarua Blocks are significant components of the total population of vulnerable birds in the Ruahine Range. Any reduction in their density will have a significant effect on the sustainability of the Ruahine population of these birds.

### 7.5.5 The Effects of the Proposal on Fisheries and Angling

Logging will adversely impact on these values, and a bridge across "the Narrows" will detract from the scenic and physical characteristics of this part of the river.

The topography, geology, soil type and climate make the Aorangi Awarua block prone to erosion. Logging, roading and tracking will increase the rate of erosion. Detritus will inevitably enter the Rangitikei River due to its close proximity to the Aorangi Awarua Block.

Soil entering rivers detrimentally affects fisheries by:

- i. killing fish or reducing their growth rate and resistance to disease;
- ii. by preventing the successful development of fish eggs and alevin;
- iii. by modifying natural movements and migrations of fish;
- iv. by reducing the abundance of food available to the fish;
- v. by affecting the efficiency of taking food;
- vi. by reducing suitable habitat; and
- vii. suspended sediment reduces the quality of fishing for anglers.

### **7.5.6 The Effects of the Proposal on Recreation**

If the blocks are logged the recreation/tourism potential of the area will not be realised. Increasing numbers of people are seeking outdoor experiences in natural areas. In its natural state Mount Aorangi offers such an experience. By leaving the forest intact the option to develop the areas recreation/tourism potential is left open, but a decision to log the forest precludes this option.

The major recreational uses of the Rangitikei River; rafting, canoeing and angling will also be adversely affected by logging due to subsequent increases in siltation and debris (logs, snags). One of the biggest dangers in rafting and canoeing is becoming trapped underwater by debris. It is likely that safety standards for commercial rafting would be compromised, possibly affecting the viability of these operations.

Bridging of "the Narrows", while facilitating access to the blocks will effectively compromise the wilderness and scenic aspects of a well known white water section of the Rangitikei River.

### **7.5.7 The Effects of the Proposal on Landscape Amenity**

The proposed application will affect the amenity of the area in many ways. Opinion of the effect on amenity is very much a 'value judgement'. However, the recreational pursuits common in the area and the identification of the area in the Draft National Conservation Order' as having outstanding characteristics, very much rely on the enjoyment of the natural environment as it is at present.

"The Narrows" are identified in the District Scheme, a document which represents the aspirations and values of the people of the district, as an 'object and place of historic and archaeological interest'.

To build a bridge across "the Narrows and scar the adjacent landscape with tracking and logging, would detract if not destroy the archaeological value and natural beauty of the site.

The proposal would also affect the amenity value of the area, in terms of the obvious de-vegetation of the native bush, and the decline of water quality as a result of silt and other debris entering watercourses.

#### **7.5.8 The Effects of the Proposal on Water Quality**

Forestry and associated activities such as tracking and roading have major impacts on the river ecosystem, both within the forestry site and downstream. These impacts include:

- i. changes to the hydrological regime (increased run-off rates causing 'flash' peak floods);
- ii. changes in water temperature;
- iii. changes to the 'energy base of the stream' (decreased litter and increased light penetration);
- iv. increased sedimentation;
- v. decreases in dissolved oxygen; and
- vi. changes in plant nutrients which normally flow into the watercourse.

## 7.6 ISSUES ASSOCIATED WITH THE APPLICATION

### 7.6.1 Cultural

The Aorangi Awarua Block has cultural associations of great significance for the Maori owners. Some of them are of the opinion that these will be degraded by the applicants logging activities and the bridging of "the Narrows".

#### *The Story of Aorangi*

In order to understand the cultural significance of both the land and "the Narrows" to the Maori people, an extract taken from the evidence of Rangipo Mete Kingi, who objected to the planning application, is quoted below.

"The story of Aorangi must begin with nature itself and in the Maori world, it begins with the primal parents, Ranginui (Sky Father) and Papatuanuku (Earth Mother). Between them over aeons of time the ecological garden of Aorangi was formed.

When Tamatea Pokai Whenua visited the area he marvelled at the wind swept heights of Tawhirimatea (the peaks) at the gushing streams and the towering giants of Tanemahuta (the forests). As he travelled throughout this natural wonderland he liberated living beings as an expression of his desire to be merged with the spiritual and ecological power that he felt there.

Today, we know these living beings to be guardians. They are seen from time to time, the lizard on the headland and the koura and patiki in the clear waterways. Aorangi is the spiritual platform of the mauri or life force for chains of ecological systems.

The application to log this land is the first direct challenge to the great legacy that nature has bestowed on Aorangi. Tamatea Pokai Whenua simply reaffirmed the special spiritual and ecological values that he knew to be present. Free flowing water and filtering trees and plants protect the earth mother. The removal of trees would represent the first stage of the man-made process of denuding and ultimately destroying the mauri of a living ecological system.

I for my part, stand in opposition to this logging application and to the proposal to build a bridge across the food trough of Taranuku ("the Narrows") on the grounds that the spiritual and traditional values of the Aorangi Awarua Block will be compromised (Town and Country Planning Act 1977 Section 3.1.(g)."

### *The Treaty of Waitangi*

The RMA requires that regional councils shall take into account the principles of the Treaty of Waitangi. Two issues are particularly relevant to this application and these involve the respective powers of the Crown and Maori (kawanatanga and rangatiratanga).

#### **7.6.2 Access**

The Aorangi Awarua Block is landlocked with no access to a legal road, other than via neighbouring properties. Implicit in the application is the assumption that trees will be removed from the block by road via a bridge over "the Narrows".

"The Narrows" are not connected to any existing formed road and the only legal road is one 20 metres wide which traverses the western bank of the Rangitikei River. It would be totally impractical to construct a road within that

legal boundary. However there is a provision in the Property Law Act 1952 for the "owner" to gain access to landlocked land by application to the Court. Thus if the appeal to the Planning Tribunal is successful, the owners could then make application to the Court for access over the neighbouring property.

### **7.6.3 Private Property Rights**

The land is owned by some 448 people, 323 owners of Aorangi and 125 owners of Awarua. The land is administered on behalf of the owners, by a group of Trustees. The block has special value to its owners and they want to retain that ownership. Although the block is of historical and cultural significance, some of the owners feel they have a right to be able to earn a reasonable income from their land, and to provide employment opportunities.

When the Aorangi Awarua Trust was ordered by the Maori Land Court, specific powers were given to the trustees to:

- i. sell by public tender or private contract the millable indigenous timber on the Aorangi Awarua lands;
- ii. continue to investigate future utilisation of the land including development for forestry, both native and exotic, and for that purpose to use funds obtained from the sale of indigenous timber; and
- iii. investigate the setting aside of the Aorangi mountain as a Maori reservation.

The Maori Land Court then expressly authorised the trustees to log the indigenous timber on the Aorangi Awarua lands. That is, the Maori Land Court gave the trustees the private property rights to the Aorangi Awarua

Block. However like all landowners, the trustees are still subject to legislation which restricts some aspects of private property rights. Although the Maori Land Court gave to the trustees "specific powers", these powers are subject to consent under the relevant legislation, as are all holders of private property rights.

#### **7.6.4 Local Government Rates**

The Maori owners are presently finding it difficult to pay rates owing to the Rangitikei District Council. However, the Rangitikei County Council has established a water supply scheme which drains water from the wetlands on the Aorangi Awarua Block. The owners were not asked permission for the scheme to be constructed on their land. Although royalties can not be charged for water as it is a Crown resource, access and construction of the scheme can be charged for but was not.

It may be possible (and more equitable) for the District Council to waive the rating charges in view of the facts behind the establishment of the water supply scheme, particularly if a covenant is to be established placing the Block under reserve status. That is rate remission in return for protection of a resource. The rates issue is another reason why DOC and the Maori owners are unwilling to settle for a one-off compensation deal. Most of the money would be lost in rates and no income generating ventures would be developed.

#### **7.6.5 Public Interest**

The timber on the Aorangi-Awarua Block is seen as a valuable resource by the owners. However there is a need to balance the individuals' right to utilise that resource against the detrimental environmental impacts of the proposal. Although the Aorangi Awarua block has a resource which the owners would

like to utilise, there is a responsibility on the part of the Regional Council, as resource managers, to ensure that the resources of water and soil, both on the block and downstream, are managed in a way which is sustainable, not only in the short term but for the future.

There were 53 objections to the application and of these only three were statutory organisations, the Department of Conservation, the Acclimatization Society and the Regional Council. The grounds given for the remainder of these objections were overwhelmingly similar and have been summarised below.

The proposal was considered to be contrary to public interest as it would have a detrimental effect on the physical environment both on the site and on the adjacent river. There was no recognition in the application for the concept of "sustainability" or any other provision for the future. The application would compromise conservation, scenic, amenity, recreation, social, cultural, and historical values, all of which were considered to be very important.

The number of objections, together with the grounds for objection, give an indication of what the 'public interest' is with regard to development proposals which have significant environmental impacts.

However the question has to be resolved as to the weight the 'public interest' is awarded when the proposal relates to the exploitation of a privately owned resource on privately owned land.

When considering this problem it is necessary to take into account the fact that the proposal will impact on 'public good' resources, such as the Rangitikei River and the catchment control purpose of the block, as well as existence values associated with a natural environment.

### 7.6.6 Economic Welfare of the Region

Whether or not the proposal will have any significant economic benefit to the district or region has not yet been determined. However it appears likely that the largely unquantifiable costs of 'downstream effects' may outweigh any economic benefits, particularly as Reeves Contractors Ltd are from outside the region. Any royalties paid to the Maori land owners, together with any injection of money into the local economy, are likely to be small and insignificant on a regional scale, and probably also from a district point of view.

The recreation and tourism value of the area is evident by the facilities which are already operating in the area. The proposal is a real threat to the existing industry and the potential for development in the future. The income foregone from tourism and recreation should somehow be included in the analysis as this industry has the potential to become a significant part of the regional economy in the future.

The trustees and owners see benefits to the community in the vicinity of the Aorangi Awarua block and in particular to the owners (Karaitiana, 1990). Employment opportunities generated by selective logging are expected to be around ten to twelve persons to be employed on a seasonable basis.

However in the Environmental Impact Report prepared for the applicant by P.N. Richardson (1990), it is stated that the company intends using one gang of six men, three of which will be long term employees of the company.

### 7.6.7 NWASCA Conditions

The tribunal set up in 1987 to consider the appeal against the Catchment Boards decision to decline the application under section 34, gave permission to Reeves to extract timber subject to certain conditions (refer Appendix E2).

It is the opinion of soil conservators at the Manawatu-Wanganui Regional Council that any contractors would find it difficult if not impossible to abide by some of these conditions, in particular Conditions 7, 8 and 9 (Harrison, 1990).

The physical characteristics of the country are such that any side-caste material will always be in a position where it could enter a watercourse. Being limited to a grade of one in eight will mean that there will need to be numerous changes in direction (zig-zagging) to gain height to reach the main ridge. the undercutting of slopes by 4.5 metres will substantially remove any slope support and lead to over-steepened slopes with consequential severe slipping.

## 7.7 ALTERNATIVE RESOURCE USE OPTIONS

The removal of native timber from parts of the Aorangi Awarua Forest, represents the exploitation of one resource. Other resources of the block include water, soil, botanical and ecological resources, wildlife, the scenic quality of the area, historic and archaeological sites, the existing and potential recreational and tourist resource of the area and the adjacent Rangitikei River, and the utility of the block in terms of catchment control.

The value of all these resources must be weighed against the use of the timber resource. This is very difficult to do as much of the value associated with these resources is intangible, and very difficult to quantify.

If it is considered that the type of 'selective' logging to be carried out is not a sustainable use of the resources contained within the Aorangi Awarua Block, then it is worthwhile to consider alternative uses of the Block and to assess the practicality and sustainability of these.

### **7.7.1 Alternative Logging Options**

There are alternative techniques available to extract the timber which would have substantial benefits in protecting the land from serious erosion.

It is considered that logging the area by helicopter is a practical alternative. Subject to certain conditions helicopter logging would be much less damaging to the land than ground logging (Pers. Comm., Moore, 1991; Harrison, 1990).

In a ground based operation the capital expenditure to bridge and road the area would be substantial. Regardless of subsequent events none of this expenditure would be recoverable. Because of these high fixed capital costs there would be a need for the contractor to recover every tree or log for which there was a market in order to help recover high initial costs.

Although a helicopter also has a high capital requirement it can easily be moved and used on other sites and projects. The operating cost of a helicopter is greater than ground operations, once the main access is provided. However, this factor gives added protection to water and soil in that the operators will need to be much more selective, removing only the high value logs, thus leaving sufficient trees and other vegetation for soil and water protection.

With helicopter logging there would be no tracking, and by adopting selective logging and directional felling techniques there would be minimal damage to

the remaining vegetation. In addition, trees which were in isolated areas and which it was impractical or uneconomical to obtain by tracking could be harvested.

Although it would seem that helicopter logging would be a viable option in terms of minimising environmental impacts, it appears from the comments made on behalf of Reeves at the Planning Hearing that the company does not consider it to be a viable alternative due to the expense involved. As well there is a shortage of heavy lift helicopters available for this type of work in New Zealand.

#### **7.7.2 Protection of the Block and Development of Associated Recreation and Tourism Potential**

Protection of the Block, and development of the recreation and tourism potential associated with the area is not a feasible option for the Maori land owners to consider on their own. Nor are they interested in a one off compensation payment from Department of Conservation, for the protection of the Block.

However, Department of Conservation is presently negotiating with the Maori owners to try and settle an agreement which involves the protection of the Block together with a joint DOC/Maori owners project to establish a tourism venture.

The owners have accepted the notion that protection is an option and have requested an offer from DOC regarding some sort of protective covenant.

At this stage it appears that any covenant will probably involve DOC purchasing the 'development rights' from the owners. The objectives of protection will be included in a legal document (covenant) and any development options will then be judged against these objectives.

The most feasible development option appears to be the establishment of a walkway of 'tourist' standard. The route will be circular and will travel from the river up into the Aorangi Mountain and back. Two lodges will be constructed. It is envisaged that the Maori people will be involved in the construction, maintenance and operation of the venture.

DOC are interested in the preservation of the whole Block as the Red Tussock country and the wetlands, which are not affected by the logging application, are of even greater ecological significance than the native forest. Any management of the Block aimed at protection must therefore take these features into account.

Because of the environmental significance of the Block, there are not many feasible development options which are also sustainable. DOC hopes to negotiate a joint land management agreement in conjunction with the reserve statement. Any land management costs will be financed by the proposed tourist venture (pers.comm., Nixon, 1991).

The negotiations for the placement of the Block under a protective covenant, and the feasibility studies for the proposed tourist venture are presently being undertaken and are running parallel to the planning procedures related to the logging proposal. However, the Maori land owners are bound by contract to Reeves and should the Tribunal find in favour of Reeves, even if the owners decide they wish to protect their land, DOC may have to offer Reeves the compensation (assuming that Reeves would accept, which is unlikely) to prevent logging.

Other options which could provide income include:

- i. Live deer capture  
This could be run in conjunction with other tourist activities. However it would not provide sufficient income to be the only alternative developed.
- ii. Possum trapping  
However the market for possum skins has declined and this may not provide a feasible income generator.
- iii. Grazing  
Some of the Block is suitable for grazing although some areas would have to be fenced to prevent ecological damage. This would probable cost more than any income derived.
- iv. Water supply  
Some sort of royalties could be charged for the water that is being taken from the wetlands by the District Council. Although water belongs to the Crown and royalties are not usually charged, the scheme was established on the Block without the owners permission. The most practical thing in this situation would be for the District Council to negotiate some sort of rate relief in return for the scheme being in place on the Block.

None of the above options will provide a significant amount of income to the Maori owners.

### 7.7.3 Summary

The only feasible development alternative is the joint DOC/Maori owners venture to establish and market tourism and recreation facilities which capitalise on the natural characteristics, and the historical and cultural significance of the Block and the adjacent Rangitikei River. This is the only option which has the potential to provide ongoing income for the owners. Although the economic feasibility of the proposal has yet to be determined, the fact that there are two companies operating in the area already indicate that there is definitely potential for development in this industry. Any new venture should aim to compliment the existing businesses.

It is likely that the project would need a large amount of capital to be injected from DOC and possibly other sources, but it is a more positive method of protecting the value of the Block than a one off compensation pay-out.

## 7.8 DISCUSSION AND CONCLUSIONS

Chapter Seven examines the resource management issues and conflicts associated with the Aorangi Awarua proposal.

The application by Reeves Contractors Limited to log the Aorangi Awarua Block of native forest and to construct a bridge across the Rangitikei River at "the Narrows" raises many complex resource management issues. The proposal has the potential to detrimentally effect the physical environment of the Aorangi Awarua Block and will have a major impact on wildlife, botanical, water quality, fisheries, landscape/amenity/scenic, intrinsic, recreation and tourism, historical, cultural and spiritual values associated with the area. As well, the existence and bequest values associated with natural areas like Aorangi Awarua would be lost.

The proposal provides an excellent case study for the practical application of the Process for Environmental Evaluation, developed as part of this Thesis. This Process will be developed and applied to the Aorangi Awarua Case Study in Chapters Eight and Nine.

## CHAPTER EIGHT

### PROCESS FOR ENVIRONMENTAL EVALUATION

#### **8.1 PURPOSE**

The overall purpose of Chapter Eight is to develop a process for the environmental evaluation of policies and proposals in relation to natural resources. This Chapter will therefore include the practical application of the techniques reviewed in Chapters Three through to Six, to the Aorangi Awarua Case Study outlined in Chapter Seven.

#### *Objectives*

To identify the social, economic and environmental costs and benefits associated with the Aorangi Awarua application using PBS, EIA, and CBA.

#### **8.2 BACKGROUND**

Chapter Three concluded that sustainable resource management implies a commitment to ecological sustainability. Chapter Four concluded that the implementation of sustainable resource management requires a process for the environmental evaluation of the potential effects associated with major resource consent applications. Such a process must ensure that the environmental costs of particular proposals are incorporated into the decision making process. However, as concluded in Chapter Five, the traditional assessment techniques (EIA, CBA and PBS) are not capable of this. Non-market valuation techniques, in particular CVM, may be able to ensure that values associated with the natural environment are incorporated into the decision making process (Chapter Six).

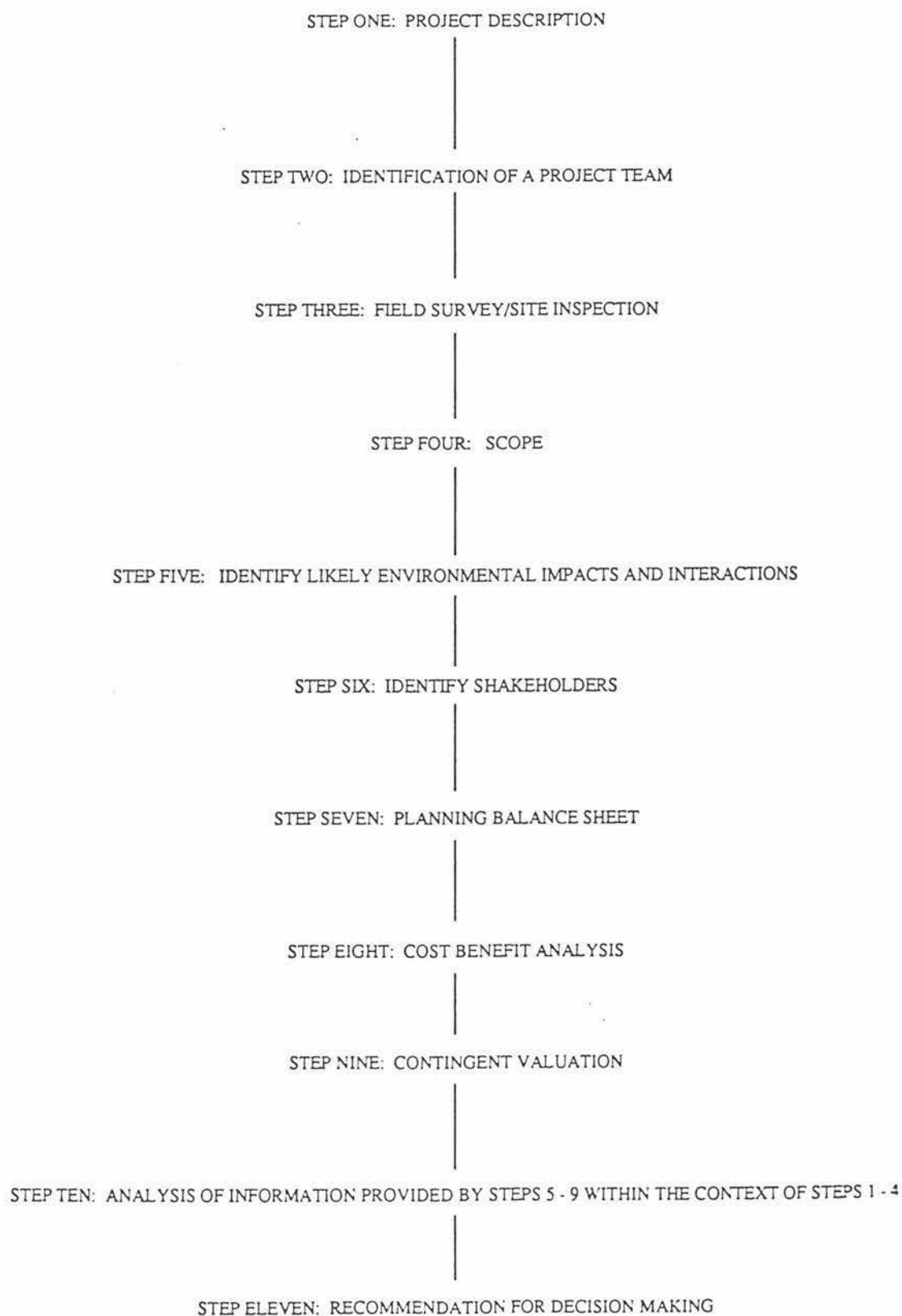
Under the RMA, an assessment of environmental effects is required with every application for a resource consent (Section 88(4)(b)). This requirement is intended to make the applicant think about the likely effects of the proposed activity on the environment and the way in which any adverse effects can be avoided, reduced or compensated for. The information gives the consent authority and interested members of the public an indication of the nature of the likely effects (both positive and negative) and the measures which can be taken to reduce any adverse effects.

The costs of assessment are to be met by the applicant. Should further information be required, and/or if the consent authority requires an independent report to be commissioned, it is possible that all or part of these costs will also be charged back to the applicant (MFE, 1991b). The implication is that it is now possible for regional councils to require the applicant to provide some of the information necessary for the environmental evaluation of proposed resource uses.

However, regional councils will still have to provide their own evaluation. The Process for Environmental Evaluation developed in this Chapter (Figure Five) has been designed to assist regional councils to carry this out.

### **8.3 PROCESS**

Figure Five illustrates the Process for Environmental Evaluation. The Process is a combination of Environmental Impact Assessment (EIA) and Planning Balance Sheet (PBS) methods, together with informal procedures which regional council planners can utilise. In addition, CBA and CVM have been included in Steps 8 and 9 of the Process.

**Figure Five. Process for Environmental Evaluation**

The Process is not intended as a "blue-print" to be followed religiously, rather it is a checklist, or a guide for resource management decision making.

In some cases it will be unnecessary to go any further than Step 7 of the process, the PBS, with the applicants themselves supplying much of the information. All that the planners will need to do is analyse this information in terms of Step 4, the Scope of the assessment, and make the appropriate recommendations to Council.

While it is unlikely that regional councils would be involved in carrying out a CBA, in the past developers (applicants) have often used this technique to generate evidence in favour of a proposal. CBA has also been used to justify major tax-payer/rate-payer funded projects. It is therefore an important technique to include in the process, particularly as it provides a measure of economic benefits. These benefits can then be compared with the environmental costs identified by non-market valuation techniques.

## **8.4 APPLICATION OF THE PROCESS TO AORANGI AWARUA**

### **8.4.1. Step 1. Project Description**

The project description will include the nature of the proposal, its location, and the relevant planning restrictions or zones.

The application involves the 'selective' logging of native timber from a privately owned block of Maori land. The block is located east of the Rangitikei River and is zoned Rural A under the Rangitikei County District Scheme.

The application is also for permission to construct a bridge across the Rangitikei River at "the Narrows". The Narrows are listed in the Scheme as a place of "historical and archaeological interest, to be preserved."

#### **8.4.2. Step 2. Project Team**

This will not always be necessary, but with most development proposals which have environmental implications staff from different departments within the regional council will need to work together on the assessment of the application.

Because of the nature of the application it will be necessary for the Area Soil Conservator, the Design Engineer, a team from the Hydrology Department, as well as the planners, to make up the Project Team. The planners will coordinate the investigations and any subsequent objections.

#### **8.4.3. Step 3. Field Survey/Site Inspection.**

A site inspection or field survey should be carried out at an early stage by the project team so that an appreciation of likely environmental effects. It is necessary to identify the terms of reference for the site inspection in order that the project team can get the maximum amount of the right sort of information from the visit. The project team involved with the application should visit the block and also "the Narrows".

The terms of reference are:

- i. to examine the block in terms of its erosion potential, its vegetation, and its scenic and amenity value; and
- ii. to evaluate the Rangitikei River in terms of its water quality, its

wild and scenic characteristics, the effect of sedimentation, the impact of the proposal on the historical values of "the Narrows", and the hydrological factors relevant to the bridge construction.

#### **8.4.4 Step 4. Scope**

The scope of the assessment is to evaluate the temporal and spatial boundaries of the proposal within which the environmental, social and economic implications will be considered. The scope will include the identification of those things for which the Regional Council has statutory responsibility for.

Under the RMA, the Regional Council has statutory responsibility for implementing sustainable resource management. This involves avoiding, remedying, and mitigating the likely adverse environmental effects of proposed resource use, and protecting "high quality" environments.

Section 30 of the RMA sets out the functions of regional councils in relation to achieving sustainable management. Section 30(c) is of relevance to this Thesis, in that it states that regional councils shall "... control the use of land for the purpose of:

- i Soil Conservation;
- ii The maintenance and enhancement of the quality of water in water bodies ....".

The scope of the Aorangi Awarua assessment is therefore to evaluate the environmental effects of the proposal not only on the block itself, but also in terms of "downstream" effects.

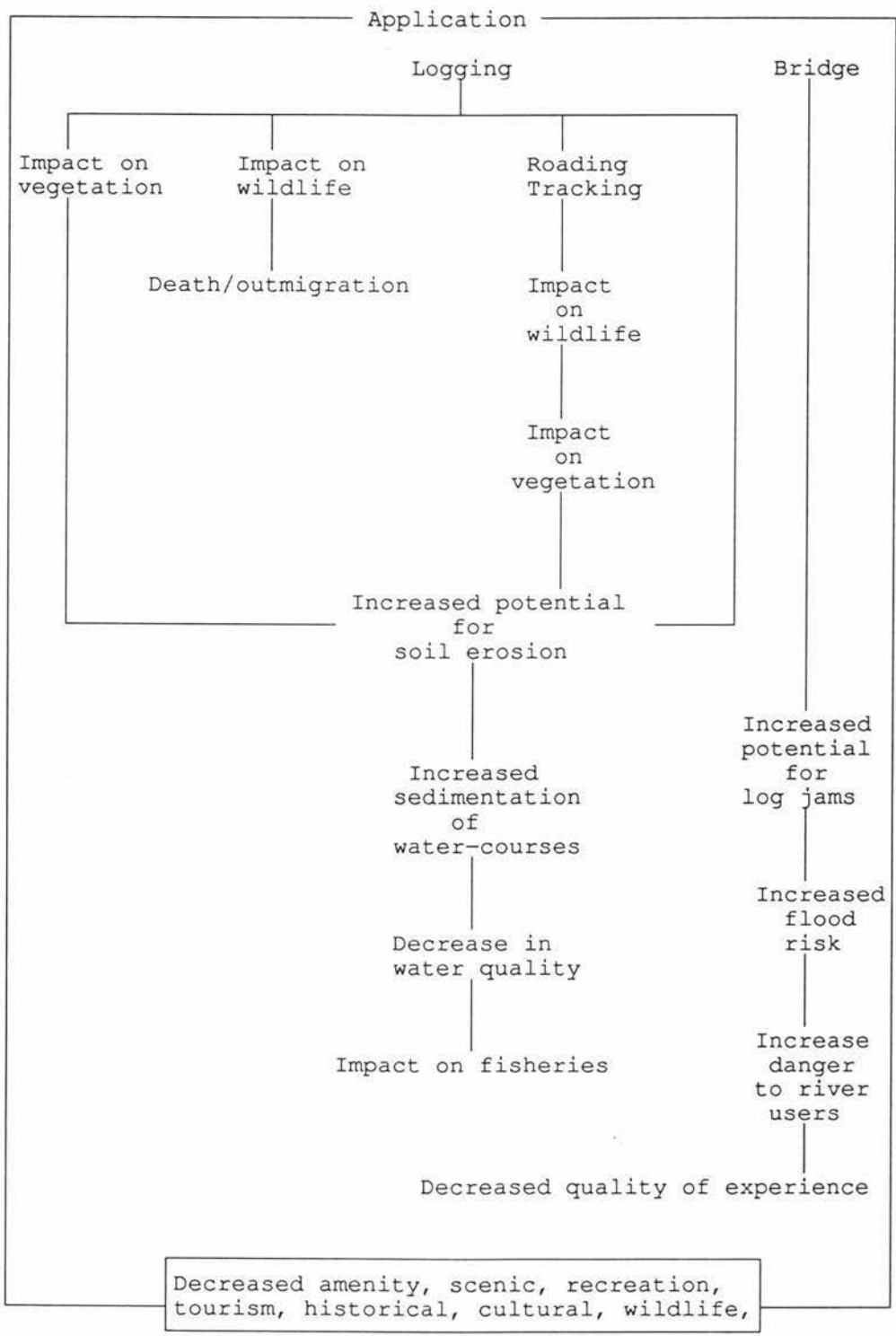
The scope of the assessment thus includes:

- i. soil conservation/erosion potential;
- ii. water quality;
- iii. wildlife;
- iv. vegetation;
- v. downstream effects;
- vi. existing and potential recreation/tourism industry; and
- vii. sustainable management of resources.

#### **8.4.5. Step 5. Environmental Impacts and Interactions**

A checklist of environmental impacts and interactions should be developed. It may be useful to produce flow diagrams to indicate what the environmental effects may be (Figure Six). This will help to determine the information which will need to be gathered to further assess the environmental implications of a proposal.

Figure Six. Environmental Impacts and Interactions - Aorangi Awarua Block



#### 8.4.6 Step 6. Identify 'Stakeholders'

It will be necessary to identify all the individuals, groups, and statutory organisations who have an interest in, or who will be affected by a proposal.

##### *Applicants*

Reeves Contractors Ltd

##### *Supporters*

Some of the Trustees and land owners

##### *Statutory Organisations*

Department of Conservation

Manawatu-Wanganui Regional Council

Wellington Acclimatization Society

##### *Environmental Action Groups*

Royal Forest and Bird Protection Society

Maruia Society

Native Forest Action Council

##### *Organisations*

Tramping Clubs

Canoe Clubs

Whitewater Rafting Clubs

##### *Companies*

River Valley Ventures Limited

Rangitikei River Adventures Company Limited

Woodrow Rafting Expeditions

Rangitikei Anglers

Wild Trout of NZ Limited

Adjoining Property Owners  
James Bull and Dennis Brown  
Western Frozen Foods  
Thomas and Jean Jones

### *Individuals*

#### **8.4.7 Step 7. Planning Balance Sheet**

The purpose of developing a PBS is to explicitly identify all the benefits, costs and issues associated with a proposal and to identify precisely the distribution of the impacts. The PBS will thus enable staff to determine which stakeholders will benefit from, and which stakeholders will be adversely affected by the project. The PBS should be used to identify which areas and issues require further evaluation.

For the purposes of this project the PBS is to be used as a tool to identify the 'stakeholders' and their objectives. This will help to ensure all the intangible factors associated with this proposal, which can not easily be given economic values, are taken into account in any further analysis of the application. Monetary values have not been used. Instead the concerns or objectives have been classified as either a cost or a benefit resulting from logging (refer Figure Seven).

In the Aorangi Awarua example, intrinsic and existence values of the natural world are well represented by 'stakeholders'. However this may not always be the case and such values are in danger of being overlooked. When formulating a PBS it will therefore be important to ensure that these type of values are included, with the stakeholder being the 'National Interest'.

Figure Seven.

**Planning Balance Sheet for Aorangi Awarua  
Block**

	Stakeholders	Objectives/Concerns	Costs/Benefits
<b>Producers</b>	Reeves	Net Income From Timber	Benefit
	Maori Owners	Income From Land	Benefit
<b>Consumers</b>	DOC	Conservation of: Botanical; Wildlife; Amenity; Scenic; Recreation; Historical; and Existence Values.	Environmental Costs
	MWRC	Sustainable Resource Management: Avoid, Remedy, Mitigate Adverse Effects; Protect High Quality Environments; Soil Conservation; Downstream Effects; River Control (Bridge); Water Quality.	Environmental Costs
	WAC	Water Quality; Fisheries; Draft WCO; Amenity; Scenic; Protection of Natural Characteristics.	Environmental Costs
	Individuals	Environmental Impacts; Roading; Effects on their Properties; Preservation/Protection of Wildlife and Indigenous Forests.	Environmental Costs
	Interest Groups - RFBS - Maruia - NFAC	Bird Life; Wildlife; Indigenous Forests.	Environmental Costs
	Recreation Clubs - Tramping - Canoe - Whitewater	Water Quality; Amenity; Scenic; River Use (Safety); Existing and Potential Recreation/Tourism;	Environmental Costs
	Companies	Existing Investment/Economic Impact; Existing and Potential Recreation/Tourism.	Environmental Costs
	Maori	Cultural Values; Existence Values; Ecological Values/Guardianship; Spiritual Values; Historical Values.	Environmental Costs

#### 8.4.8. Step 8. Cost Benefit Analysis

Cost Benefit Analysis (CBA) identifies and measures the impact of projects or policies in terms of costs and benefits (i.e. negative and positive effects expressed in monetary terms). If discounted benefits are greater than discounted costs, then the project or policy is judged to be desirable, irrespective of the distributional consequences (Meister, 1990, p.19). For a full explanation of the methodology refer to Appendix B2.

For the purposes of this Thesis the CBA will not be exhaustive but will be used to illustrate the process and to give an indication of the economic implications of the with/without logging scenarios.

This CBA has been carried out more as a financial analysis of the logging proposal and does not take into account environmental costs nor opportunity costs associated with the application, such as the effect on the recreational and tourism industry.

However, the evaluation of the results will be from a regional viewpoint and will attempt to make an assessment as to whether the income generated from logging will be greater than the environmental costs to the region. Non-market valuation of these environmental costs will then be attempted in Chapter Nine.

##### 8.4.8.1 *Assumptions*

1. The base data has been taken from a Ministry of Forestry Report which was commissioned by DOC in 1988.

The report divided the Block up into five distinct logging areas. The financial analysis carried out in this project has used these areas as a method to break down species and extraction costs.

Block A	95.6 ha
Block B	14.6 ha
Block C	17.37 ha
Block D	191.55 ha
Block E	64.83 ha
-----	
Total Area for logging	383.95 ha
-----	

- Royalties have been set in the contract at \$15.60 per cubic metre of Rimu and \$7.80 per cubic metre of other species.
- The value per cubic metre of the five species, Rimu, Kahikatea, Totara, Matai, and Maire are mill door values and were drawn from four sawmills cutting timber in the central and lower North Island. These values were taken from the MOF Report and are as follows:

Rimu	\$105 per cubic metre
Kahikatea	\$85 per cubic metre
Totara	\$75 per cubic metre
Matai	\$75 per cubic metre
Maire	\$55 Per cubic metre

There are other species of timber on the Block, however the MOF report dealt only with these five. It is assumed that these are the only species worth logging in terms of economic return.

- Royalties have been calculated using the MOF 1988 values for timber. The total royalties value calculated is thus in 1988 values in real terms.
- It is assumed that the area to be logged each year will be on average 65 hectares.

6. The duration of the logging operation is assumed to be seven years.
7. Logging of Blocks B and E will have to be carried out by heavy lift helicopters due to access limitations.
8. A discount rate of 10% has been used to account for the time value of money.
9. The Net Present Value represents Net Income prior to tax being deducted.

#### **8.4.8.2**      *Timber Resource*

Table 1 shows the volume (cubic metres) of each species of timber available within each of the five areas of the Block.

These volumes are then multiplied by the (1988) value per cubic metre in Table 2. This gives the value of each species within each block, together with the total value per block. It should be noted that these values have fluctuated since 1988 (pers. comm., Moore, 1991). However, for the purposes of this Thesis the 1988 figures were assumed to be sufficiently accurate.

The total value of the native timber resource within the Aorangi Awarua Block is thus calculated as being just under two million dollars (\$1 986 394).

#### **8.4.8.3**      *Royalties*

Table 3 shows the royalties to be paid to the Maori owners for the timber within each of the five blocks.

The maximum total royalties the owners can expect to receive is \$238 797.

#### 8.4.8.4 *Financial Analysis*

Table 4 shows a cost benefit analysis of the proposal to log the native timber resource on the Aorangi Awarua Block. The accounting stance used is from the point of view of Reeves Contractors in so far as it is simply an analysis of the costs and benefits to the firm, of the project, and does not take into account environmental costs or externalities.

The analysis has been carried out so as to include a break down of the blocks into two groups. Blocks A, C and D have been grouped together, and Blocks B and E. The reason for this is that Blocks A, C and D are the most accessible and contain the most timber. The viability of logging Blocks B and E is likely to be marginal due to access problems.

The NWASCA conditions restrict logging to a seasonal operation and also require that a maximum area of 100 ha per year is to be logged. Reeves have indicated that the actual area to be logged each year will probably be between 50 to 80 hectares per year. To calculate the duration of the logging operation it was assumed that 65 hectares per year would be logged. The total area available for logging is 383.95 hectares (refer Table 1). This means that the logging operation will take at least six years to clear all the available timber. Allowing for delays caused by construction of roads and the bridge, together with any other hold ups increased the likely duration of the operation to seven years.

It is possible the contractor will choose to log only Blocks A, C and D. Although this will mean that there is only 304.52 hectares, the majority of timber is contained within these blocks. As well, the access roads and the bridge requirements are the same as they would be if all the Blocks were to be logged. For these reasons the time scale has been left at seven years for both options.

The capital costs of the operation are made up of the construction of the bridge and the access roads and tracks. This comes to \$174 000 (Farley, 1990, p.5).

Road Maintenance has been calculated at \$6000 per year, being \$1500 per kilometre. There is approximately 4 kilometres of roading required (Farley, 1990, p.5).

The total royalties for Blocks A, C and D, and Blocks B and E, were divided by seven to give an average amount per year, payable to the Maori owners. In reality the owners would receive royalties proportional to the amount and type of species logged per year.

Extraction costs for Blocks A, C and D are made up of equipment, labour, overheads and transport costs. This has been calculated at \$23 per cubic metre (MOF, 1988), which gives a total for Blocks A, C and D of \$60 009.50 per year (\$420 066.50 in total).

Extraction costs for Blocks B and E include helicopter, equipment, labour, overheads and transport costs. This works out to be \$136.05 per cubic metre (MOF, 1988), which gives a total for Blocks B and E of \$70 452.00 per year (\$493 164 in total).

Total extraction costs for all available native timber are \$913 230.00.

The total cost of milling all the blocks is then subtracted from the total income available from all the blocks to give the Net Benefit. The Net Benefit for the first year (year 0) is negative \$174 000. After that the Net Benefit to Reeves is \$112 420.60 per year.

The Present Value (PV) has also been calculated. The PV is a return per year on the amount invested.

The Net Present Value (NPV) is calculated from the Net Benefit Flow. A discount rate of 10% has been used. The NPV is thus the present value of a series of future cash flows. In this case, the NPV for Reeves, if all the Blocks are logged is \$369 368.

The Internal Rate of Return (IRR) is based on capital investment. For a project to be viable the NPV must be equal to the discount rate, and the IRR must be equal to or greater than 0. If all the Blocks are logged the IRR is 23%. This is a considerable return on investment for Reeves.

If Reeves choose only to log Blocks A, C and D the Net Benefit for the first year (year 0) is still negative \$174 000. However, for each year after that, the Net Benefit to Reeves is \$127 576, an increase of over \$15 000 per year.

The NPV at 10% for Blocks A, C and D is \$436 448, approximately \$67 000 more than if all the Blocks are logged. This gives an IRR of 27%.

### ***Results***

1. The financial analysis shows logging of the Aorangi Awarua Block is a very profitable venture for Reeves. The logical option would be for the company to log only Blocks A, C and D which could make as much as \$436 448. The rate of return on investment at 27% makes the project worth their while.
2. The Maori owners could receive up to \$175 781 in royalties (this figure has not been discounted) if Blocks A, C and D are logged.
3. The environmental costs and externalities have not been taken into account in this financial analysis. The next step is to include them in the equation.

TABLE 1. Cash Flows for Timber Resource - Aorangi Awarua Block

BLOCKS	AREA HA	SPECIES VOLUME CUBIC METRES					TOTAL \$ VALUE PER BLOCK
		RIMU M/3	KAHIKITEA M/3	MATAI M/3	TOTARA M/3	MAIRE M/3	
A	95.6	1014	3795	2698	2108	961	869330
B	14.6	352	0	50	163	16	54315
C	17.4	414	872	154	151	100	147505
D	191.6	3422	933	486	117	461	519474
E	64.8	3118	78	533	0	299	395770
TOTAL	384.0	8320	5678	3921	2539	1837	1986394

TABLE 2. TIMBER VALUE BY SPECIES

SPECIES	\$/CUBIC METRE	BLOCK A M/3	\$ VALUE	BLOCK B M/3	\$ VALUE	BLOCK C M/3	\$ VALUE	BLOCK D M/3	\$ VALUE	BLOCK E M/3	\$ VALUE
Rimu	105	1014	106470	352	36960	414	43470	3422	359310	3118	327390
Kahikatea	85	3795	322575	0	-	872	74120	933	79305	78	6630
Matai	85	2698	229330	50	4250	154	13090	486	41310	533	45305
Totara	75	2108	158100	163	12225	151	11325	117	8775	0	0
Maire	55	961	52855	16	880	100	5500	461	25355	299	16445
TOTAL			869330		54315		147505		519474		395770

TOTAL VALUE OF TIMBER RESOURCE = 51,986,394

TABLE 3. ROYALTIES TO BE PAID TO MAORI OWNERS - AORANGI AWARUA BLOCK

ROYALTY SPECIES	\$/CUBIC METRE	BLOCK A M/3	ROYALTY	BLOCK B M/3	ROYALTY	BLOCK C M/3
RIMU 6458.4	15.6	1014	15818.4	352	5491.2	414
OTHER 9960.6	7.8	9562	74583.6	229	1786.2	1277
TOTAL 16419		10576	90402	581	7277.4	1691
SPECIES	BLOCK D M/3	ROYALTY	BLOCK E M/3	ROYALTY		
RIMU	3422	53383.2	3118	48640.8		
OTHER	1997	15576.6	910	7098		
TOTAL	5419	68959.8	4028	55738.8		
TOTAL ROYALTIES	238797					

TABLE 4. Cost Benefit Analysis of Native Timber Resource - Aorangi Awarua Block

Years	0	1	2	3	4	5	6	7
<b>BENEFITS</b>								
Income A,C,D		218698	218698	218698	218698	218698	218698	282996
Income B,E		64298	64298	64298	64298	64298	64298	64298
<b>Total Income</b>		<b>282996</b>	<b>282996</b>	<b>282996</b>	<b>282996</b>	<b>282996</b>	<b>282996</b>	<b>347294</b>
<b>COSTS</b>								
<b>Capital Costs</b>								
Bridge	70000							
Roading	104000							
Road Maint.		6000	6000	6000	6000	6000	6000	6000
Royalties A,C,D		25111.6	25111.6	25111.6	25111.6	25111.6	25111.6	25111.6
Royalties B,E		9002.3	9002.3	9002.3	9002.3	9002.3	9002.3	9002.3
Extraction A,C,D		60009.5	60009.5	60009.5	60009.5	60009.5	60009.5	60009.5
Extraction B,E		70452.0	70452.0	70452.0	70452.0	70452.0	70452.0	70452.0
<b>MILL BLOCKS A,B,C,D,E</b>								
<b>Total Cost</b>	<b>174000</b>	<b>170575.4</b>	<b>170575.4</b>	<b>170575.4</b>	<b>170575.4</b>	<b>170575.4</b>	<b>170575.4</b>	<b>170575.4</b>
<b>Net Benefit</b>	<b>-174000</b>	<b>112420.6</b>	<b>112420.6</b>	<b>112420.6</b>	<b>112420.6</b>	<b>112420.6</b>	<b>112420.6</b>	<b>176718.6</b>
<b>PV</b>	<b>-89289.51</b>	<b>57689.544</b>	<b>57689.544</b>	<b>57689.544</b>	<b>57689.544</b>	<b>57689.544</b>	<b>57689.544</b>	<b>90684.584</b>
<b>NPV @ 10%</b>	<b>369368.73</b>	<b>IRR</b>		<b>0.2308964</b>				
<b>MILL BLOCKS A,C,D</b>								
<b>Total Cost</b>	<b>174000</b>	<b>91121.1</b>	<b>91121.1</b>	<b>91121.1</b>	<b>91121.1</b>	<b>91121.1</b>	<b>91121.1</b>	<b>91121.1</b>
<b>Net Benefit</b>	<b>-174000</b>	<b>127576.9</b>	<b>127576.9</b>	<b>127576.9</b>	<b>127576.9</b>	<b>127576.9</b>	<b>127576.9</b>	<b>191874.9</b>
<b>PV</b>	<b>-89289.51</b>	<b>65467.122</b>	<b>65467.122</b>	<b>65467.122</b>	<b>65467.122</b>	<b>65467.122</b>	<b>65467.122</b>	<b>98462.163</b>
<b>NPV @ 10%</b>	<b>436448.02</b>	<b>IRR</b>		<b>0.270787</b>				

#### 8.4.8.5 *A Regional Perspective*

As the Aorangi Awarua example illustrates, there are many deficiencies of CBA in terms of adequately taking account of intrinsic environmental values and ecological sustainability. However, it can still be useful for advancing environmental goals. Rather than abandoning CBA, environmental and other social costs should be explicitly taken into account (Goodland and Ledec, 1987, p.24).

In order to take account of the environmental costs and externalities associated with logging of the Aorangi Awarua Block it is necessary to subtract them from the total Net Benefits associated with the proposal.

The assumption is made that Reeves will log only blocks A, C, and D.

$$\begin{aligned} \text{Regional Benefits} &= (\text{Net Benefits} - \text{Environmental Costs}) \\ &= ([\$436\ 448] - [\text{Unquantified}]) \end{aligned}$$

Factors contributing to environmental costs (unquantified) include:

- i. Soil Erosion
- ii. Down Stream Effects - Water Quality
- iii. Loss of Ecological Values - Wildlife and Their Habitat,  
Botanical Values
- iv. Decline of Fisheries
- v. Loss and/or Decline of Intrinsic Values
- vi. Loss of Existence Values
- vii. Loss of Bequest Values and Option Values
- viii. Opportunity Costs Associated with Existing and Potential  
Tourism and Recreation Industry
- ix. Effect on Maori Cultural and Spiritual Values
- x. Effect on Historical and Archaeological Values.

The question becomes: Is \$436 448, which Reeves will profit by, worth more to the region than the total environmental cost?

Reeves Contractors Limited are a Rotorua Company, and will be bringing three of the six employees with them. The region will therefore receive very little benefit from the net income derived. Yet the region will have to pay for the environmental costs involved.

Although the Maori land owners will receive approximately \$175 781, this payment is over seven years and will be spread among many people. By the time outstanding rate bills are settled, the royalties are unlikely to contribute in any significant way to the regional economy and will do nothing to alleviate the problem of deriving long term sustained income for the owners.

The opportunity costs (income foregone) to the region (and to the Maori owners) of existing and potential recreation and tourism industry should not be underestimated. However, although logging together with the bridge will diminish the natural character of the area, this will not necessarily preclude all future recreation. The opportunity cost may therefore not be as high as the decline of all the other values would suggest. This particular issue will need careful economic analysis before an appropriate weighting or dollar value can be given.

From a regional point of view the costs associated with logging the Aorangi Awarua Block appear to be greater than the net benefits. However the economic analysis undertaken is only a very preliminary exercise.

## 8.5 DISCUSSION AND CONCLUSIONS

The objectives of this Chapter were to develop a process for environmental evaluation of the potential effects of major resource consent applications, and to utilise this process to identify the social, economic and environmental costs and benefits associated with the Aorangi Awarua proposal, using PBS, EIA and CBA.

A Process has been developed, and the first eight steps applied to the Aorangi Awarua proposal. The results clearly indicate that while PBS, EIA and CBA go some way to identifying the impacts of the proposal and the financial costs and benefits involved, without non-market valuation it is very difficult to incorporate the true environmental cost of the proposal into decision making.

While the contractors will make a net profit of \$436 448, the environmental costs, which have not yet been calculated, are likely to be far greater. While non-market valuation will not provide economic values for all of these costs, for example the cost to the region of increased soil erosion or the opportunity costs associated with the loss of tourism potential, they will give an indication of how the regional population value the forest (Chapters Five and Six).

Chapter Nine will therefore involve the application of Step 9 of the Process which is a CV survey, to determine the WTP of the regional population, for the preservation of the Aorangi Awarua Forest.

CHAPTER NINE  
APPLICATION OF THE CONTINGENT VALUATION METHOD

### 9.1 PURPOSE AND BACKGROUND

Steps 1 to 8 of the Process for Environmental Evaluation developed in Chapter Eight, have been applied to the Aorangi Awarua Case Study. It was concluded that the more traditional methods for environmental evaluation (PBS, EIA and CBA) were useful for identifying the likely impacts of proposed development. However, because the adverse effects of the proposal impact on non-market environmental "goods and services", traditional techniques on their own are not enough.

While decision makers (Regional Councillors and/or members of the Planning Tribunal) can be advised of the significance of these adverse effects, it is very difficult to compare these intangible environmental "costs" with the economic and social "benefits" of profit and employment.

What is required is a technique which will enable these effects to be included in the decision making process. Such a technique will have to translate the non-economic values associated with the natural environment, into economic terms in order that the true environmental costs of a proposal can be compared with the economic benefits. Non-market valuation of environmental "goods and services" may be the only way to ensure that the adverse environmental effects of proposals are given enough consideration in the decision making process (Chapter Six).

The contingent valuation method was selected in Chapter Five as an appropriate technique for the non-market valuation of the Aorangi Awarua Block. It was therefore included as Step 9 of the Process for Environmental Evaluation developed in Chapter Eight.

The purpose of this Chapter is to discuss the methodology and the results of a CV survey applied to the Aorangi Awarua Case Study. In addition, recommendations and conclusions will be made as to the practicality of the method for use by resource managers faced with having to resolve complex resource allocation and use issues/conflicts.

For the purposes of this Thesis, CVM has been applied from a planning perspective, as opposed to an economic one, and therefore focuses on obtaining useful indications and guidelines for decision making rather than on testing the validity and robustness of the method.

The methodology adopted recognises the time and financial constraints of the "real world". The sample size is relatively small, and the "open-ended question" format selected. Zero bids are counted as valid responses and included in the analysis. It is accepted that many people in the regional community will not be willing to pay, despite the importance they place on preserving the forest.

### *Objective*

To carry out a non-market valuation of the Aorangi Awarua Block.

## **9.2 METHODOLOGY**

The procedure for applying CVM described by Cummings, Cox and Freeman (1986); Cummings, Brookshire and Schulze (1986); and Mitchell and Carson (1989), was adopted. This procedure was discussed in some detail in Chapter Six.

### 9.2.1. Determine Sample

The Aorangi Awarua forest is located on private land within the Manawatu-Wanganui Region. It was assumed that although important to the Region, it could not be considered a resource of national significance.

The sample was therefore drawn from the population living within the Manawatu-Wanganui Region.

### 9.2.2. Design of the Questionnaire

The work of Mitchell and Carson (1989), Kerr (1986) and Kirkland (1988) was used to develop a suitable questionnaire.

The format of the questionnaire was designed to include a description of the Aorangi Awarua Block and the background to the logging application. This was followed by Part One of the actual questionnaire which asked questions relating to awareness and use of the Aorangi Awarua Forest; the importance of preserving the forest; and reasons for preservation. Part Two of the Questionnaire related to valuing the Aorangi Awarua Forest. Respondents were asked what the maximum amount of money their household would be willing to pay annually to preserve the forest. Part Three of the questionnaire asked questions about respondents characteristics (number in household; age; sex; income; occupation; whether they belonged to an environmental organisation; whether they used other native forests).

The **payment vehicle** was described as a special regional rate that would be used solely for the purpose of preserving the forest.

The **elicitation method** used was an **open ended question** ("What is the maximum amount of money your household would pay annually for this special rate?").

While it is acknowledged that there are problems with open ended questions, particularly in terms of respondents finding it difficult to select a value, there are also problems with other methods (refer Chapter Eight). Consideration was given to adopting the **dichotomous choice** method, however this method requires a much larger sample. Time and financial constraints meant that for the purposes of this Thesis, this was not a viable option.

It should be noted that the work of Loomis (1988) showed that reliable estimates of willingness to pay for the preservation of natural resources can be obtained using either open ended or dichotomous choice questions.

In practice, it is likely that resource managers will be similarly constrained by time and resources. Therefore the reality is the open ended question format represents a realistic and feasible option.

In designing the questionnaire, particular attention was given to ensuring that the appropriate questions were asked in a clear manner, using simple and non-technical language or jargon. It was important that the reason for the survey was explained, that it was not difficult to complete, and emphasis given to the importance of responding. The description of the Forest had to be unbiased, and a credible contingent market created. The potential for biases (refer Chapter Eight) had to be minimised (pers. comm., Weber, 1991).

### 9.2.3. Pilot Survey

Prior to sending out the final surveys, it was necessary to test the design of the questionnaire in order to ensure that the questions can be understood by

respondents, and are capable of securing useable responses.

A preliminary questionnaire was prepared, along with a covering letter (Appendix F1) and sent to 50 households around the Manawatu-Wanganui Region. For the purpose of the pilot survey it was not necessary to ensure that the selection was completely random, and the sample was picked indiscriminantly from the relevant telephone directories. Twenty respondents were selected from Palmerston North City and Manawatu Districts combined; ten from Wanganui; and five each from Ruapehu, Rangitikei, Tararua and Horowhenua.

The response rate was very low (14%) however it was assumed that this was due to the fact that a follow up letter was not sent. As there were only seven responses, the results have not been included for discussion as part of this Thesis.

#### **9.2.4. Select Final Survey Design**

From the results of the Pilot Survey (which have not been presented as part of this Thesis), areas of the questionnaire which needed simplifying/clarifying were amended and the final survey design selected (Appendix F2).

#### **9.2.5. Draw Random Sample**

##### **9.2.5.1 *Sample Size***

To obtain an acceptable degree of precision in determining the mean WTP amount, contingent valuation studies require large sample sizes because of the large variation in the WTP responses (Mitchell and Carson, 1989).

This is due to the estimated standard error of the mean decreasing as the sample size increases. The researcher needs to identify the likely magnitude of the relative error (the percentage deviation from the true mean). Therefore a prior estimate of the coefficient of variation is required.

The following formulas and guidelines were taken from Mitchell and Carson (1989, p.224 - 229) and used to determine the necessary sample size.

From the pilot survey, a mean willingness to pay of \$14.60, with a standard deviation of 26.93, was calculated. The coefficient of variation was then estimated as being 1.85, and rounded up to 2.0.

The estimated coefficients of variation (V), almost always fall between 0.75 and 6.0, and an initial estimate for V of at least 2 is advisable. Sample sizes between 200 and 2 500 are appropriate for this size of V. The percentage difference between the true willingness to pay and the estimated willingness to pay can reasonably be expected to lie between 0.05 and 0.30.

The necessary sample size,  $n_0$ , can be determined from the formula:

$$\frac{[ Z\hat{\sigma} ]}{[ \Delta \overline{RWTP} ]} = \frac{[ Z\hat{V} ]^2}{[ \Delta ]}$$

where  $\Delta$  is the percentage difference between the true willingness to pay ( $\overline{TWTP}$ ) and the estimated Real Willingness to Pay ( $\overline{RWTP}$ ).

It is necessary to then inflate the necessary sample size, by the expected number of unusable responses.

In this case the coefficient of variation ( $V$ ) has been estimated at 2; it was determined that a  $\Delta$  of .30, and a two-sided 90% ( $1-\sigma$ ) confidence level ( $t = 1.69$ ) would be acceptable.

Therefore, the sample needs to be large enough to ensure that at the very least 171 useable responses are received (refer to Appendix F4 which provides a copy of Table 10.1, taken from Mitchell and Carson, 1989, p.225). It is acknowledged that this is a relatively small number of responses, and that the results would be more statistically accurate if a larger sample were drawn.

It was then assumed that a response rate of between 40% and 50% would be achievable, based on:

- i. the examples cited in Mitchell and Carson (p.279-282);
- ii. the fact that the list of names and addresses used for the sampling frame is up-to-date, the questionnaire is well-designed and pre-tested, that a follow-up letter will be sent, and that the survey is sponsored by the University (a non-commercial sponsor), as suggested by Dillman 1978; and
- iii. recent contingent valuation work in New Zealand indicates a 50% response rate is probable, given follow up letters (pers. comm., Weber, 1991).

Although the preliminary survey resulted in only 14% of usable responses, it was anticipated that the use of follow up letters and telephone calls would significantly improve this result.

A decision was therefore made to limit the sample size to 500, but to concentrate on ensuring at least a 40% response rate by way of follow-up letters.

It is acknowledged that a larger sample size would give a more statistically accurate result. However, given financial and time constraints, a conscious decision was made to sample only enough to ensure results which are statistically defensible.

#### 9.2.5.2 *Sampling Procedure*

Several sources of household listings within the Region were examined. These included the Manawatu-Wanganui Region (Scheme Rates) Valuation Roll, Valuation Department of New Zealand Valuation Roll, and telephone directories for the Region.

It was decided that telephone directories would provide the most representative sample as the other two sources related to property owners only, therefore excluding those households in rental accommodation.

The Region is covered by five different telephone directories, all of which are up to date. These are Waikato 1991, Wanganui 1990, Manawatu 1991, Wairarapa 1991, and Hawkes Bay 1990.

Each Directory is divided up into Telecom districts. While the Directory Boundaries themselves do not match the Regional Council Boundaries, it was possible to link Department of Statistics area unit boundaries with Telecom districts and therefore ensure that the sample was drawn from within the Manawatu-Wanganui Region.

It was assumed that the majority of households within the Region would be telephone subscribers. Provisional 1991 Census Data used to determine the number of households within the Region, and the proportion of these within each Telecom District. It was therefore possible to ensure that the sample across the Region was in proportion to the number of households (refer to Tables 5 and 6).

**Table 5. Distribution of Sample**

DISTRICT COUNCILS	HOUSEHOLDS	% OF REGION	SAMPLE NUMBERS
Ruapehu	5 474	7%	35
Taranua	4 500	6%	28
Wanganui	16 397	21%	105
Rangitikei	5 664	7%	35
Manawatu	7 235	10%	50
Horowhenua	12 628	16%	80
Palmerston North	26 178	33%	167
<b>REGION</b>	<b>78 076</b>	<b>100%</b>	<b>500</b>

Palmerston North City and Manawatu District fall within the same Telecom district. Rather than trying to differentiate between the two local authority areas, a total sample of 217 households was taken from this Telecom District (including Bulls). An assumption was made that combining Manawatu and Palmerston North would not effect the overall results of the survey, which would be regional in nature and did not have to be specific to District Council areas. Once the questionnaires were returned it was possible to determine whether they were from Manawatu District or Palmerston North City by matching the code number on the questionnaire with the address on the original sample list.

**Table 6. Telecom Districts and Sample Size**

DISTRICT COUNCIL	TELEPHONE DIRECTORIES	TELECOM DISTRICTS	NO. OF PAGES	SAMPLE SIZE
Ruapehu	Waikato 1991	Taumarunui	38	32
	Wanganui 1990	Ohakune	6	3
Tararua	Wairarapa 1991	Pahiatua	12	14
	Hawkes Bay 1990	Dannevirke	12	14
Wanganui	Wanganui 1990	Wanganui	52	105
Rangitikei	Wanganui 1990	Marton	23	31
		Taihape	7	4
Manawatu	Manawatu 1991	Bulls	4	7
Palmerston North		Palmerston North	124	210
<b>TOTAL</b>			<b>322</b>	<b>500</b>

It was estimated that the number of household listings on each page was approximately 300. For each district (d), the number of listings (L) = 300 x the number of pages (p). The sampling interval (I) was calculated where:

$$I(d,p) = \frac{L(300,p)}{N}$$

N is the number to be sampled from each Telecom district.

For each Telecom district, a random start ( $R$ ) was selected, using ordinary random number tables, from the range  $[1,2,3 \dots I(d,p)]$ . A sequence of numbers was then generated where:  $R(d,p)$ ,  $R(d,p)+I$ ,  $R(d,p)+2I$ ,  $R(d,p)+3I \dots R(d,p)NI$ . This procedure is shown in Table 7.

**Table 7. Sampling Interval**

(d)	(p)	L(300,p)	(N)	I(d,p)
Taumarunui	38	11 400	32	356
Ohakune	6	900	3	300
Pahiatua	12	3 600	14	257
Dannevirke	12	3 600	14	257
Wanganui	52	15 600	105	149
Marion	23	6 900	31	223
Taihape	7	2 100	4	525
Bulls	4	1 200	7	1 193
Palmerston North	124	37 200	210	177
Levin	44	13 200	80	165

Where businesses and/or otherwise inappropriate listings were selected, the next suitable listing was used.

For Taumarunui and Levin Telecom districts, a small proportion of the subscribers actually reside outside the Manawatu-Wanganui Region. Where the sampling procedure selected these households, which were identifiable from the telephone number sequence, they were discarded and the next suitable listing used. An assumption was made during the development of the survey procedure, that the effect that these subscribers from outside the Region would have on the results would be minimal due to the relatively small number involved. It would have been very difficult to separate them out from the total sample prior to the selection process as they are included within the total Taumarunui and Levin Telecom districts.

#### **9.2.6. Implementation of the Survey**

The questionnaire and covering letter were mailed to the 500 households throughout the Region. Approximately ten days after the initial contact, a follow-up letter was sent to non-respondents encouraging them to respond. In all cases a postage-paid reply envelope was included. Ideally a second follow up letter should have been sent however time and budget constraints precluded this.

### **9.3 ANALYSIS OF SURVEY RESULTS**

#### **9.3.1 Response Rate**

Of the 500 surveys sent out around the Region, 35 were "returned to sender", thereby reducing the sample size to 465. The number of questionnaires which were completed and returned was 235. The response rate was therefore 51%.

Follow-up letters were sent out 10 days after the original questionnaire. Of the respondents, 70% responded prior to receiving the follow up, with 30% after

the follow up.

Of the 235 responses, 225 were useable. Ten responses had to be rejected because the WTP question was not answered. Most CV surveys reject zero bids as either protest bids or non-responses (pers. comm. Kerr, 4.2.1992). However, for the purposes of this survey, zero bids were counted as valid responses. They were seen as important indicators of the validity and usefulness of the CV method; and of public opinion/perception with respect to placing economic values on the environment. While 128 respondents (59%) were not prepared to pay anything to preserve the Aorangi Awarua Forest, these responses were counted as valid.

It is important to note that approximately two to three weeks after the initial questionnaire was sent out, there was some publicity in the regional newspapers and on radio concerning the purchase of the logging rights to the block by the Department of Conservation. Obviously this would have had an effect on the survey, both in terms of the response rate as the publicity would have had a similar effect to a second follow up letter, and also in terms of the responses given to the survey questions.

### **9.3.2 Location**

One of the objectives of the survey was to determine whether the attitudes and values of respondents was related to location. Table 8 shows the response rates for each District in the Region, and the percentage of those respondents who were aware of the Aorangi Awarua Forest prior to reading the questionnaire.

Table 8 indicates that there is no relationship between response rate, location (as determined by local authority boundaries), and awareness of the Aorangi Awarua Forest (refer to Appendices F4 for the correlation coefficients). This

could be due to the fact that the location was determined by political boundaries. Although in most cases these correspond with proximity to the Forest; actual distance from the Forest may have been a more meaningful way to determine the relationship between the answers respondents gave and location. However, this was difficult to calculate, and for the purposes of this Thesis an assumption was made that local authority boundaries would give enough of an indication as to whether location effected response.

**Table 8. Response Rate**

District	Number Sampled	Returned to Sender	Number Responded	% Response*	% Aware
Ruapehu	35	4	13	42	33
Rangitikei	35	1	18	53	56
Tararua	28	1	18	67	65
Manawatu	50	1	34	69	41
Wanganui	105	9	44	46	39
Horowhenua	80	7	30	41	28
Palm. Nth	167	12	68	44	35
<b>Total</b>	<b>500</b>	<b>35</b>	<b>225</b>	<b>51</b>	<b>38</b>

\* Calculated as :

$$\text{Num. Responded}/(\text{Num. Sampled} - \text{Ret. to Sender}) \times 100$$

### 9.3.3 Awareness and Use

The first question of the survey asked respondents whether they were aware of the existence of the Aorangi Awarua Block prior to reading the questionnaire; 38% of respondents answered yes, 61% answered no, 1% gave no answer.

Respondents were also asked whether they had ever visited the Aorangi Awarua Forest; 11% answered yes (24 respondents), compared to 52% who have used other native forest within the region. Of the respondents, 25% belonged to an environmental group.

Table 9 indicates the types of activities that respondents had used the Aorangi Awarua Block for, the percentage of respondents who undertook each activity; and the percentage of the 24 users who undertook each activity.

**Table 9. Use of the Aorangi Awarua Forest**

ACTIVITY	% OF RESPONDENTS	% OF USERS
Tramping	4	33
Hunting	2	21
Fishing	3	25
Canoeing	2	17
Nature Appreciation	8	71

#### **9.3.4 Future Use of the Aorangi Awarua Forest**

Respondents were also asked what activities they would like to use the block for in the future. The results were significantly higher than actual use responses (refer Table 10), indicating that strategic bias may have influenced the survey responses.

**Table 10. Future Use of the Aorangi Awarua Forest**

ACTIVITY	% OF RESPONDENTS
Tramping	35
Hunting	11
Fishing	18
Canoeing	21
Nature Appreciation	61

### 9.3.5 Importance of Preservation

Respondents were asked to rate the importance of preserving the Aorangi Awarua Forest. The results are shown in Table 11.

**Table 11. Importance of Preservation**

IMPORTANCE OF PRESERVATION	% OF RESPONDENTS
Very Important	52
Moderately Important	24
Slightly Important	7
Not Important at All	5
Dont Know	8
No Response	11

It is interesting to note that 83% of respondents felt that preserving the block was of some importance to them. This may be an indication of strategic bias in that only those who feel strongly about preservation were sufficiently motivated to complete and return the questionnaire.

An important objective of the survey was to determine why people value the forest. Respondents were asked to prioritise different reasons for preserving the forest, from 1 (most important) to 5 (least important). These reasons given relate to the values discussed in Chapter Four. The responses are presented in Table 12.

It is significant to note that non-use values, in particular those associated with ecological and option values, were considered more important than use values. Protecting wild-life and their living areas was considered the most important reason for preserving the block. While existence values were not rated as high, this is probably because the majority of respondents perceived the forest as having value because it provides an important habitat for flora and fauna, rather than simply because it exists.

Given that the forest is on private land, the low priority given to use values is understandable. However, it is important to note that this same factor did not deter the majority of respondents from stating that it was important that the forest be preserved. This is interesting given the significance that most New Zealanders place on private property rights.

**Table 12. Reasons For Preservation**

TYPE OF VALUE	REASON FOR PRESERVATION	% OF RESPONDENTS *					
		PRIORITY					
		1	2	3	4	5	No Resp.
Use Value	Conserving Natural Areas for Educational and Scientific Study	24%	20%	30%	10%	9%	10%
	The Forest Provides Recreation Opportunities	17%	20%	24%	16%	7%	17%
	The Forest Provides Scenic Beauty (Amenity)	24%	21%	20%	9%	11%	15%
	The Forest Provides Spiritual Inspiration	14%	8%	14%	10%	22%	32%
EXISTENCE VALUE	Knowing the Forest Exists	24%	11%	16%	8%	15%	26%
ECOLOGICAL VALUE	Protecting Wildlife and their Living Areas	66%	14%	4%	3%	6%	8%
	Soil Conservation	43%	20%	13%	5%	8%	11%
OPTION VALUE	Knowing that in the Future, You or Future Generations have the Option of Going There	43%	14%	16%	8%	5%	12%

\* Note that total % does not always add up to 100% due to rounding.

### 9.3.6 Characteristics of Respondents

Part Three of the Survey asked respondents to give demographic, occupation and income information about their household. The objective of this part of the questionnaire was to determine whether any relationships exist between the answers given in Parts One and Two of the Survey, and the respondents characteristics. In addition, it makes it possible to determine the characteristics

of respondents and compare these to the characteristics of the population of the Region.

The average number of people per household was 2.6 compared to the regional average of 2.9 (Department of Statistics, 1991). Of those who filled in the questionnaire on behalf of their households, 65% were male, with an average age of 49. (Refer to Table 13 which shows the age of respondents).

**Table 13. Age Distribution of Respondents and Population**

AGE DISTRIBUTION	SAMPLE (%)	POPULATION (%) (Dept. of Statistics, 1991)
0-14	0.0	24.1
15-24	2.2	17.8
25-44	36.0	28.9
45-59	26.7	13.5
60 +	31.1	15.6
Not Specified	4.0	-
Average Age	49	27 (Calculated)

Retired superannuitants comprised approximately 30% of respondents but the remaining 70% were spread fairly evenly across all other occupational types (including unemployed and beneficiaries) with a range of 2 - 8% (Table 14).

Household income ranged from less than \$10 000 to over \$75 000, with the majority of respondents earning between \$15 000 and \$20 000, reflecting the higher proportions of superannuitants (Table 15). The proportion of respondents with a household income of over \$75 000 per year was

surprisingly high (8%). When this was checked against the responses to the other questions it was found that this was a result of the majority of farmers who responded putting down gross farm income rather than net income, and did not therefore reflect a response bias in favour of high income earners.

**Table 14. Occupation of Respondents**

OCCUPATION	% OF RESPONDENTS
Home Duties	6.22
Retired/Superannuitant	28.89
Social Welfare Beneficiaries/ Unemployed	4.44
Semi-skilled Worker	4.89
Clerical/Sales Employee	4.44
Technical or Skilled	2.67
Business Proprietor/Self Employed	8.0
Business Manager/Executive	7.11
Teaching/Nursing/Police/Armed Services/Other Trained Service Worker	7.56
Professional/Senior Government	7.56
Labourer, Manual, Agricultural, Domestic	4.0
Farm Owner/Manager	6.67
Student	1.78
No Response	5.78
<b>Total</b>	<b>100</b>

**Table 15. Income Distribution of Respondents**

HOUSEHOLD INCOME (\$)	% OF RESPONDENTS
0 - 9 999	3.56
10 000 - 14 999	13.33
15 000 - 19 999	7.56
20 000 - 24 999	9.78
25 000 - 29 999	6.22
30 000 - 34 999	6.22
35 000 - 39 999	8.00
40 000 - 44 999	4.00
45 000 - 49 999	5.33
50 000 - 54 999	2.67
55 000 - 59 999	1.78
60 000 - 64 999	3.11
65 000 - 69 999	0.00
70 000 - 74 999	1.33
Over 75 000	8.00
No Response	19.11
Total	100.00

Ideally, the characteristics of the respondents should have been compared with the characteristics of the regional population. It would then have been possible to determine the validity of aggregating the survey results across the Regional Population. However, statistics relating to occupation, household income or

membership of environmental groups are not available at the Regional Level (pers. comm Kent Richardson, Information Consultant, Department of Statistics, 1991).

### 9.3.7 Willingness to Pay

The mean willingness to pay to preserve the Aorangi Awarua Block was calculated at \$13.12, with a standard deviation of 26.1, and a standard error of 1.77.

Three points in relation to this mean WTP are important to note:

- i. the elicitation method used was an open ended question;
- ii. respondents were asked what they were willing to pay per year for the preservation of the block. The mean WTP is therefore an annual figure and not a one off bid; and
- iii. zero bids were counted as valid responses.

Contingent valuation surveys are particularly vulnerable to outliers (extreme WTP bids) because WTP amounts are unbounded at the upper end. Therefore the mean WTP amount is sensitive to outliers. For example, one respondent expressing a WTP of a million dollars will dominate the mean WTP amount for an amenity which is valued by 600 other respondents at \$100 or less. However, most outliers will be less obvious and while the researcher can delete these on an ad hoc basis, a more defensible approach is the use of robust statistical estimators (Mitchell and Carson, 1989, p.226).

Both the mean and the median are members of a family of estimators known as the  $\alpha$ -trimmed mean. The median is the  $\alpha$ -trimmed mean with  $\alpha$  equal to .5,

and the mean is the  $\alpha$ -trimmed mean with  $\alpha$  equal to zero. Statisticians recommend  $\alpha$ -levels of .05 to .25 for a robust estimator of the expected value of a distribution.

Mitchell and Carson (1989, p.229) recommend the alpha-trimmed mean as a substitute for the sample mean as a summary WTP statistic. In this instance a trimmed mean of .05 was equal to \$8.73.

Of the respondents, 59% were not prepared to pay anything to preserve the block, and while 53% of these did not give a reason why, 24% said they could not afford to pay anything. The WTP ranged from 0 to 200, with \$10, \$50 and \$100 scoring the most bids. The highest bid of \$200 was checked for validity and accepted as a valid response.

The mean WTP was then calculated for each of the Districts to try and determine whether a relationship exists between WTP and proximity to the Block. It was expected that mean WTP would be highest for the Rangitikei District, where Aorangi Awarua is located. The results are included in Table 16.

The mean WTP for Rangitikei District is lower than the mean WTP for all Districts which is unexpected in that it was assumed that the Block would be utilised and therefore worth more to those who are in closer proximity. However, as already mentioned a more accurate measure of proximity would have been actual distance from the Forest, rather than proximity based on political boundaries. For this reason further analysis of whether the mean WTP for each District is significantly different has not been carried out.

A comparison was made between WTP and awareness of the Aorangi Awarua Block for all respondents. The mean WTP for those that were aware of the Block prior to receiving the questionnaire was \$12.63, while for those that were unaware of it was \$13.95. A further comparison between WTP and use

of the Block showed a mean WTP of users as \$16.74, compared with non-users with a mean WTP of \$13.05. This analysis is presented in Table 17.

**Table 16. Willingness to Pay**

DISTRICT	AWARE OF AA (% of Respondents)	USE OF AA (% of Respondents)	MEAN WTP (\$)	TRIMMED MEAN (.05) WTP (\$)
Ruapehu	33	17	23.00	17.05
Palmerston North	35	9	16.55	13.20
Manawatu	41	13	13.19	9.71
Rangitikei	56	17	11.70	6.88
Wanganui	39	6	11.43	5.07
Tararua	65	18	10.12	4.80
Horowhenua	28	10	9.10	7.85
<b>REGION</b>	<b>40</b>	<b>11</b>	<b>13.12</b>	<b>8.73</b>

**Table 17. Two Sample T Test**

VARIABLE	N*	MEAN WTP (\$)	STDEV*	SE MEAN*	P*
Aware	86	12.6	25.4	2.37	0.78
Not Aware	136	13.6	27.7	2.73	
Use	24	16.0	34.5	7.05	0.68
Non-Use	197	13.0	25.8	1.84	

N\* = Number of Respondents (These do not add up to 225 due to non-responses to these questions.)

Stdev\* = Standard Deviation

Se Mean\* = Standard Error of the Mean

P\* = Level of Significance

A two sample T test was carried out to determine whether the mean WTP of those respondents who were aware of the Forest prior to the survey was significantly different to the mean WTP of those who were not aware of the Forest. At a 5% error level (95% confidence level) it was found that the level of significance (p) was equal to 0.78. This is less than the difference between the two means (1.00). The difference between the two means is therefore statistically significant at a confidence level of 95%.

Similarly, the mean WTP of respondents who had visited/used the Forest was compared with the mean WTP of those who had not. The difference between the two means was 3.0, and the level of significance was equal to 0.68. The

difference between the two means is therefore statistically significant at a confidence interval of 95%.

These results show that mean WTP is higher for those who were aware of the Forest, and who had visited/used the forest, and that this difference is statistically significant (refer Table 17).

However, when WTP was correlated against all other variables no relationships were found (refer to Appendices F4 for correlation coefficients). This may be a function of the relatively small sample size, or it may be due to the fact that values associated with the natural environment are held by people irrespective of sex, age, income, occupation, proximity or whether they use that particular environment.

This hypothesis is strengthened by the fact that results indicated over 80% of respondents felt preservation of the forest was important for ecological and option reasons as opposed to direct use, and given that there was no correlation between WTP and the reasons given for preservation. This suggests that people are willing to pay for the preservation of native forest in general, rather than the Aorangi Awarua Block in particular. This is related to the fact that people perceive native forest as having intrinsic environmental value, such as ecological and option value, rather than because they use it directly.

Despite the fact that 59% of respondents were not willing to pay anything to preserve the Aorangi Awarua Forest, a mean WTP of \$13.12 per year was calculated, with a trimmed mean of \$8.73. While comparison with the Regional population was difficult due to a lack of available data, analysis of respondent's characteristics showed that no one group influenced the results. The respondents were therefore assumed to be representative of the regional population.

It is therefore valid to aggregate the sample mean WTP across the Region as a whole. This gives a total WTP for the Region of \$1,024,357 (mean WTP multiplied by number of households in the Region) per year. If the trimmed mean WTP value is taken (as recommended by Mitchell and Carson), which eliminates the top and bottom 5% of bids, the total WTP for the Region is \$681,603 per year. This implies that, at least in the short term (the seven years required for logging, Section 8.4.8), the Forest is worth more to the Region if it is preserved, with a NPV at 10% of \$3,318,329, compared with the NPV of logging (also at 10%) of \$436,448.

The implication is that by describing even some of the environmental values associated with the block in monetary terms, it is possible to compare the environmental costs of the proposal against the financial benefit, and to see immediately that the costs of the proposal are far greater.

For the purposes of this thesis it is not necessary to complete Steps 10 and 11 of the Process for Environmental Evaluation.

#### **9.4 DISCUSSION AND CONCLUSIONS**

This Chapter describes the methodology and results from the application of CVM to the Aorangi Awarua Case Study, in accordance with Step 9 of the Process for Environmental Evaluation proposed in Chapter Eight.

The overall objective of Chapter Nine was to utilise CVM as a tool in order to determine the non-market value of the Aorangi Awarua Forest; and to make some recommendations and conclusions as to the usefulness and practicality of the method for assisting resource managers to resolve complex resource allocation/use issues and conflicts.

It should be noted that there are a number of limitations associated with this CV survey which affect the reliability and validity of the results discussed above. These include the small survey size, the inability to compare the characteristics of respondents with the regional population, and the lack of correlation between willingness to pay and any of the other variables (possibly a function of small sample size). However, while these limitations are significant from the point of view of an economist, they do not detract from the value of the survey results in terms of providing an insight into public opinion with respect to preserving the Aorangi Awarua Block, and indigenous forest in general.

In relation to non-market valuation of the Aorangi Awarua Forest it is possible to make the following conclusions and recommendations.

Although a sample size of 500 is sufficient to give some indication of how the regional population feel about a particular resource/issue, a larger sample will increase the reliability of the results. Mitchell and Carson (1989) argue that 600 useable responses are required for policy analysis. However, given resource and time constraints faced by most regional councils, it a sample size of 1000 to 1500 for a regional survey is probably sufficient, as with a 50% response rate, which is possible given follow-up letters, a sample size of 1500 will ensure 750 useable responses.

With the use of one follow-up letter it was possible to secure a 51% response rate (although timely publicity over the Forest may have helped to boost the response in a manner similar to a second follow up). A 51% response rate is far higher than that of any other public participation exercise carried out by the Manawatu-Wanganui Regional Council, and for the first time a representative response has been secured.

There was no relationship between response rates and location of respondents. Only 38% of respondents were aware of the Aorangi Awarua Forest prior to receiving the questionnaire, and only 11% had ever visited (used) the Forest; yet 83% of respondents felt that preserving the block was of some importance (52% felt preservation was very important). Non use values, in particular ecological and option values were seen as the most important reasons for preserving the Forest.

While comparison with the regional population was difficult due to a lack of available data, because of the range of respondents characteristics, it was assumed that the respondents were representative of the regional population.

The mean WTP to preserve the forest was \$13.12 per household per annum, with a trimmed mean of \$8.73. This gives a total WTP for the Region of \$681 603 (taking the trimmed mean) per year. This implies that at least in the short term (the seven years required for logging) the Forest is worth more to the regional population if it is preserved, with a NPV at 10% of \$3,318,329, compared with the NPV of logging (also at 10%) of \$436 448.

The results show that the WTP part of the questionnaire is only one aspect of the survey. The results of Part Two and the positive feed back from most respondents indicate that surveys may in fact be the most useful way of securing public involvement in resource management decision making.

From these results, it is possible to conclude that:

- i. As one step in the Process for Environmental Evaluation, CVM is a useful and practical tool which can assist with resource management decision making.
- ii. Non-market valuation enables at least some of the environmental costs of resource use to be quantified in economic terms and

incorporated into the decision making process.

- iii. CV surveys are a useful tool for securing representative public participation, and enabling some insight as to public opinion relating to a particular resource management issue.

It is recommended that:

- i. regional councils only undertake a CV survey for those resource management issues where the effects on non-market values are likely to be significant;
- ii. sample sizes should be no less than 1 000, and preferably closer to 1 500;
- iii. two follow-up letters, or one follow-up letter and one phone call be undertaken to ensure a response rate of at least 50% is secured;
- iv. regional councils give consideration to the use of CV surveys as a way of securing effective public participation relating to specific resource management issues;
- v. regional councils only undertake a CV survey where there are sufficient resources and time to ensure that the results are reliable and valid; and
- vi. where regional councils decide to undertake a CV survey, suitable "sponsors" (such as a university) should be selected to avoid some of the problems associated with bias.

## CHAPTER TEN

### THESIS DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

#### **10.1 DISCUSSION**

The issues discussed throughout this thesis are the real issues faced by resource managers grappling with the RMA. It is extremely difficult for regional councils to translate the theoretical concepts into reality. While sustainable resource management requires a commitment to ecological sustainability, political decision makers (regional councillors) represent the social and economic aspirations of their constituents. In addition, private property rights severely limit the influence regional councils can have on changing land use or restricting unsustainable land use practices. The scope of regional councils is constrained by legislation, politics and economic realities, making the implementation of sustainable resource management a daunting task.

However, provided regional councils ensure ecological sustainability provides the underlying ethic to all decision making, and provided realistic targets are set which will facilitate the transformation from unsustainable to sustainable resource use, then sustainable resource management will be achieved in the long term.

#### **10.2 CONCLUSIONS**

A review of the legislative and institutional framework for resource management within New Zealand was undertaken (Chapter Two). The relevant parts of the RMA were identified and discussed, and the roles of regional councils in implementing sustainable resource management were examined.

It was concluded that sustainable resource management, as defined in Section 5 of the RMA, comprises two things:

- i. recognising more fully the environmental costs of activities and policies in order to protect our natural and physical resources; and
- ii. better consideration of the earth's resources, with a view to conserving the potential of resources for future generations.

The implementation of Section 5, and by implication sustainable resource management within the New Zealand context, centres around the existence of some sort of regional organisation responsible for managing natural resources.

Following a review of the recent literature on sustainability (Chapter Three), it was concluded that the concepts associated with sustainability fall generally into one of three schools of thought; economic, ecological, and social. What is required for the implementation of sustainable resource management is the integration of these three schools.

In this context, sustainability refers to the overall concept of society living within the self-perpetuating limits of the environment and is implicit in the definitions of sustainable development and sustainable resource management. Sustainable development refers to world economic progress within the biophysical limits imposed by nature, together with a concern for the global redistribution of wealth and future generations.

Sustainable resource management, as embodied in the RMA, refers to ecological sustainability as the fundamental principle. The economic, social and cultural needs of people and communities must be met within the context of sustainability of the environment. This definition has the potential to provide for integration of the concepts associated with the three schools of

thought.

It was also concluded that, with the exception of the work by Gow (1991) and (Kuik and Verbruggen, 1991), the literature does not go far enough to assist regional councils in the implementation of sustainable resource management. While very rich in terms of providing discussion and debate at the theoretical level, the literature fails to make the link between the understanding of what sustainable resource management is and how to put it into practice.

A framework for the implementation of sustainable resource management was therefore developed (Chapter Four). It was concluded that what is required, within the context of the legislative mechanisms provided for by the RMA, is the integration of the three schools of thought, and the development of a set of guiding principles for resource management decision making. These principles must take into account the economic, social and political realities and constraints faced by regional councils, while at the same time ensuring a commitment to a policy of ecological sustainability.

The framework therefore includes the following six components:

- i. Regional Policy Statements;
- ii. Regional Plans;
- iii. a "Model for Sustainable Resource Management", which will provide for the integration of the social, economic and ecological objectives within the constraints of ecological sustainability; and will provide a set of principles for resource management decision making;
- iv. a programme for environmental and performance monitoring including the development of a set of environmental indicators;

- v. the identification of environmental limits; and
- vi. a process for the assessment and prediction of the effects of current and proposed resource use on the environment - a process for "environmental evaluation".

If the true environmental costs of development are to be incorporated into the decision making process, there is firstly a need to identify the types of use, non-use, and intrinsic values associated with natural resources. Implementing sustainable resource management implies a commitment to ecological sustainability. Such a commitment requires the identification of all of the values associated with the natural environment, and the incorporation of these values in resource management decision making (Chapter Five).

EIA, CBA, Extended CBA incorporating SMS's, and PBS provide a useful starting point for the identification of some of the costs and benefits associated with a proposal. However, to provide a comprehensive analysis of any resource management decision which involves a choice between the preservation or development of a natural ecosystem, the decision maker must be able to measure the benefits which arise from both options. Non-market valuation, by simulating markets for environmental goods and services and deriving estimates of intrinsic values and environmental damage costs, enables the environmental impacts of policy and development proposals to be directly compared with the economic and social benefits associated with development. While it may be questionable to place monetary values on non-economic intangibles, such as the intrinsic values associated with natural resources, at least by attempting to value them they are explicitly considered in any analysis (Chapter Five).

CVM is theoretically and practically superior to alternative methods of non-market valuation. CVM is applicable to measuring all types of non-market values, and is the most useful method for determining non-use and intrinsic

values. Provided certain design and methodology criteria are met, CVM is able to provide sufficiently accurate monetary values for environmental goods and services to be useful for resource management decision making. CV surveys have the ability to reach a representative sample and respondents are able to make informed decisions. However, CV will not provide exact values, and it will not provide all the answers needed for correct decision making and efficient resource allocation (Chapter Six).

Nevertheless, CV will provide the decision maker with considerably more objective and quantitative information on which to base his/her judgements than has been the case to date. A review of some recent applications shows that CVM has been successfully used to derive the WTP for the preservation or enhancement of a variety of environments and resources. The findings of even a flawed CV survey may provide some insights into the way a community feels about a particular resource use or resource issue. CVM was therefore selected for use as one step in a broader process for environmental evaluation, and applied to the Aorangi Awarua Case Study (Chapter Six).

The proposal by Reeves Contractors Ltd to carry out selective logging of the Aorangi Awarua Forest, and to construct a bridge across the Rangitikei River at the Narrows, was selected as an appropriate case study for the application of a "Process for Environmental Evaluation". The proposal raises many complex resource management issues, and has the potential to cause significant adverse effects to the Aorangi Awarua Block and surrounding environs (Chapter Seven).

A Process for Environmental Evaluation has been developed and applied to the Aorangi Awarua Case Study. The results of the application of the first eight steps clearly indicate that while PBS, EIA and CBA go some way to identifying the impacts of the proposal and the financial costs and benefits involved, without non-market valuation, it is very difficult to incorporate the true environmental cost of the proposal into decision making (Chapter Eight).

CVM was utilised as a tool in order to determine the non-market value of the Aorangi Awarua Forest, and to make some recommendations as to the usefulness and practicality of the method for assisting resource managers to resolve complex resource allocation/use issues and conflicts.

Although a sample size of 500 is sufficient to give some indication of how the regional population feel about a particular resource/issue, a larger sample will increase the reliability of the results. This CV survey secured a 51% response rate. This is far higher than that of any other public participation exercise carried out by the Manawatu-Wanganui Regional Council, and for the first time a representative response has been secured. The majority of respondents felt that preserving the forest was very important to them, with non use values, in particular intrinsic and option values, being the most important reason. What the results show is that surveys may in fact be the most useful way of securing public involvement in resource management decision making.

As one of the steps in the Process for Environmental Evaluation, CVM is a useful and practical tool which can assist with resource management decision making. Non-market valuation enables at least some of the environmental costs of resource use to be quantified in economic terms and incorporated into the decision making process. The usefulness of CV surveys as a method to gain an insight into public opinion towards particular resource management issues should not be underestimated.

The Process for Environmental Evaluation provides for the comprehensive assessment of the effects of significant resource consent applications. It is a practical process which enables the more sophisticated techniques of CBA and CVM to be included where necessary. The existence of such a process for environmental evaluation will ensure that all of the costs and benefits associated with resource use are included in the decision making process, and will therefore help to overcome the problems of adhoc and often incomplete analysis that has led to unsustainable resource management in the past.

This Process has been successfully applied to the Aorangi Awarua Case Study. The results indicate that the application by Reeves Contractors to 'selectively' log the Aorangi Awarua Forest is not a sustainable use of resources.

The native forest of the Aorangi Awarua Block represents only one of a number of resources and values associated with the Block (Chapter Seven). It is therefore important to balance the true environmental costs against the financial benefits of logging. This Process ensured that the adverse and irreversible effects of the application on the environment were identified (Steps 1 - 8 of the Process, Chapter Eight); and that the non-market values associated with the Aorangi Awarua Forest and its environs, could be included for consideration in the decision making process (Step 9 of the Process, Chapter Nine).

### **10.3 Recommendations**

This Thesis has provided a detailed examination of a number of concepts and techniques relating to the implementation of sustainable resource management. As a result, it is recommended that regional councils:

- i. adopt (at the political level) ecological sustainability as the fundamental principle for resource management decision making;
- ii. develop a set of guiding principles for resource management decision making;
- iii. establish a programme for environmental and performance monitoring, including the development of a set of environmental indicators;

- iv. where-ever possible, identify, monitor, and review environmental limits for resources and ecosystems;
- v. avoid, remedy or mitigate resource use which transgresses or is likely to transgress these limits; and
- vi. develop a formal process for environmental evaluation, rather than relying on informal and often incomplete analysis that has led to unsustainable resource management in the past.

#### 10.4 CONCLUDING COMMENT

This Thesis has taken the conceptual issues associated with sustainability and developed some practical guidelines for the implementation of sustainable resource management. The underlying ethic can be best summarised as:

***"TUKINO AO; TUKINO KOE"***  
***DESTROY NATURE; DESTROY YOURSELF.***

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APPENDIX A1

ITEM 4  
 REPORT NO: 91/278  
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PROPOSED REGIONAL MONITORING STRATEGYPURPOSE

1. The purpose of this paper is to provide the Council with the framework for a Draft Regional Monitoring Strategy.

BACKGROUND

2. Under the Resource Management Act this Council has a responsibility to monitor:
  - a. its performance as a resource manager;
  - b. the "state of the environment" - i.e. the quality/quantity of the resource; and
  - c. compliance with the legislation and with Council policy.
3. The 1991/92 Corporate Plan states that the Policy and Planning Department will:
  - Co-ordinate the formulation of a draft regional monitoring strategy for the Council by 30 September 1991.
  - Develop a methodology for compiling the resource inventory to describe the physical resource stocks of the Region for the Council to consider by the 30 September 1991.
4. The Draft Regional Monitoring Strategy (DRMS) proposed in this paper will enable the Council to meet the statutory requirements of the Resource Management Act for monitoring and information provision; and the objectives laid out in the 1991-1992 Corporate Plan.
5. Item 12 of the 17 September Environment and Planning Agenda provided the Council with a methodology for the compilation of the Regional Resource Inventory (RRI), which is an integral part of the DRMS. The DRMS, together with the RRI, will provide a tool for investigating and monitoring the natural resources of the Region; and for determining and monitoring MWRC policy. Annex A shows the relationships of the DRMS the RRI and the requirements of the Resource Management Act.
6. The purpose and goals of the Regional Monitoring Strategy are at Annex B.

COMMENT

Why have a Regional Monitoring Strategy?

7. Section 35 of the Resource Management Act requires Councils to gather information which is necessary to enable it to carry out its functions effectively; and to monitor:
  - (2)(a) "The state of the whole or any part of the environment of its region ....;
  - (b) The suitability and effectiveness of any policy statement or plan ....;
  - (c) The exercise of any functions, powers, or duties ....; and
  - (d) The exercise of the resource consents ...."

8. To meet these legislative requirements, an overall monitoring strategy is required to ensure that monitoring is carried out efficiently, effectively and in a fully integrated way.
9. A Regional Monitoring Strategy will ensure that the monitoring responsibilities (performance, environment and compliance) will be cost-effective, efficient, and targeted.
10. This Draft Regional Monitoring Strategy has been designed to provide the answers to the following six questions. It also provides the basis for the development of Detailed Monitoring Regimes relating to specific resources and related Council policy.

#### Why Monitor ?

11. As outlined above, this Council has legislative and corporate responsibilities to monitor which are embodied in the:
  - a. Resource Management Act (Section 35);
  - b. MWRC Corporate Plan;
  - c. Regional Policy Statement (Section 62 (i)); and
  - d. Regional Plans (Section 67(i))
12. Monitoring is an essential prerequisite for achieving sustainable resource management. The Council must have information on the regional environment to set appropriate policies for the management of natural resources and to monitor the impacts of both Council policies and resource use.

#### What to Monitor?

13. The Regional Council has a legislative responsibility to monitor three main functional areas:
  - a. The environment. This includes:
    - i. areas of significant indigenous vegetation and significant habitats of indigenous fauna, which have high intrinsic value and which provide an "unmodified" environmental baseline;
    - ii. the present state of resources within the Region; and
    - iii. The impacts of use on specific resources.
  - b. The effectiveness (performance) of Council policy and related activities. This is measured in terms of achieving the goal of sustainable management of the Region's resources, as well as specific goals and objectives set out in the Corporate Plan, the Regional Policy Statement, and Regional Plans.
  - c. Compliance with resource consents.
14. Some monitoring will be needed for those natural resources and Regional Council policies/activities which will be identified in the Regional Policy Statement as being significant resource management issues. Monitoring programmes will be developed for aspects such as:
  - land resource management (includes soil conservation);
  - weeds;
  - pests;

- water resource management; and
- solid and hazardous wastes.

15. Each monitoring programme will determine:
- a. what (if any) parameters are currently being monitored?
  - b. whether the existing parameters are suitable and appropriate;
  - c. suitable parameters which can be standardised and applied consistently across the Region; and
  - d. the appropriate level and frequency of monitoring.
16. A Social and Economic Monitoring Programme is being developed, which will form a part of the RMS. The primary purpose of this is to provide information on the social and economic impacts of Regional Council policies, plans and rules. It will also enable the Council to have a better knowledge of the characteristics of the Region, leading to more informed decision making.

#### Where should Monitoring Occur?

17. Each monitoring programme will include the location and number of sites to be monitored.

Historical data bases and existing monitoring activities will be examined and reviewed for base line information. Historical monitoring will also give an indication of where monitoring should continue, cease or be increased.

There will be a need to prioritise all monitoring activities. This may lead to the development of "representative sites" to give some information on areas or resources which might otherwise be passed over in favour of specific monitoring of problem areas.

18. Sites will be determined by need and include:
- i. environmental baseline sites;
  - ii. key (special purpose) sites; and
  - iii. representative sites.
19. A network approach is the most effective way of building up a monitoring programme. A monitoring network involves key sites or representative areas which are monitored on an ongoing basis, together with the identification of sites for future more comprehensive monitoring of that particular resource or activity.

#### When Should Monitoring Occur?

20. The frequency of monitoring will have to be determined for each resource/issue and site within the monitoring programmes.

#### Who Monitors?

21. For each resource/issue identified above it will be determined whether the monitoring will be most effectively carried out by Council staff or external agencies.

Departmental responsibilities for the monitoring programme will be included as committed objectives in the Corporate Plan.

#### How will Monitoring be Implemented?

22. The monitoring programmes will specify budget and staff requirements, which will be included in the Corporate Planning process.

Means of cost-recovery, together with the use of economic instruments must be examined and adopted where appropriate. The effectiveness of "self monitoring" by industries/organisations will be examined.

23. Data gathered will be translated into useful information. The monitoring programmes will therefore include a process for:

- i. turning the raw data into information for inclusion in the Regional Resource Inventory (RRI);
- ii. reporting this information to the Policy and Planning Department to allow policy review;
- iii. incorporating this policy review into the Corporate Planning Process;
- iv. incorporating any other requirements which become apparent through monitoring, (such as detailed resource reports or measures for pollution reduction), into the Corporate Planning Process.

24. As part of the DRMS, a methodology for the compilation of the RRI has been developed and was endorsed by Council at their September meeting. A diagram is included at Annex A which shows the relationships between the RRI, the DRMS and the Resource Management Act.

#### Detailed Monitoring Programme - Case Study

25. A review of existing water quality monitoring is currently being undertaken as part of a Water Quality Management Project. The results of the review will be a revised Water Quality Monitoring Programme.

#### CONCLUSIONS

26. The Draft Regional Monitoring Strategy (DRMS) proposed in this paper will enable the Council to meet the statutory requirements of the Resource Management Act with respect to monitoring and information provision; and the objectives laid out in the 1991-1992 Corporate Plan.
27. The value of monitoring as a tool for resource management should not be underestimated. In particular a Regional Monitoring Strategy will enable the link between Regional Council policies and activities, and the subsequent environmental outcomes, to be identified.

RECOMMENDATIONS

28. It is recommended that the Committee:
- a. notes the legislative requirements and corporate objectives which provide the basis for the Regional Monitoring Strategy;
  - b. notes at Annex A the simplified diagram which shows the relationship between the DRMS, Detailed Monitoring Programmes, and the requirements of the Resource Management Act;
  - c. notes at Annex B the Purpose and Goals of the DRMS;
  - d. adopts the draft framework for the RMS as outlined in this report; and
  - e. delegates to the General Manager responsibility for the implementation of the DRMS.

BRENT COWIE  
DIRECTOR OF ENVIRONMENT AND PLANNING

ANNEXES

- A. Regional Monitoring Strategy - Relationship with Requirements Under the Resource Management Act.
- B. Purpose and Goals of the DRMS.

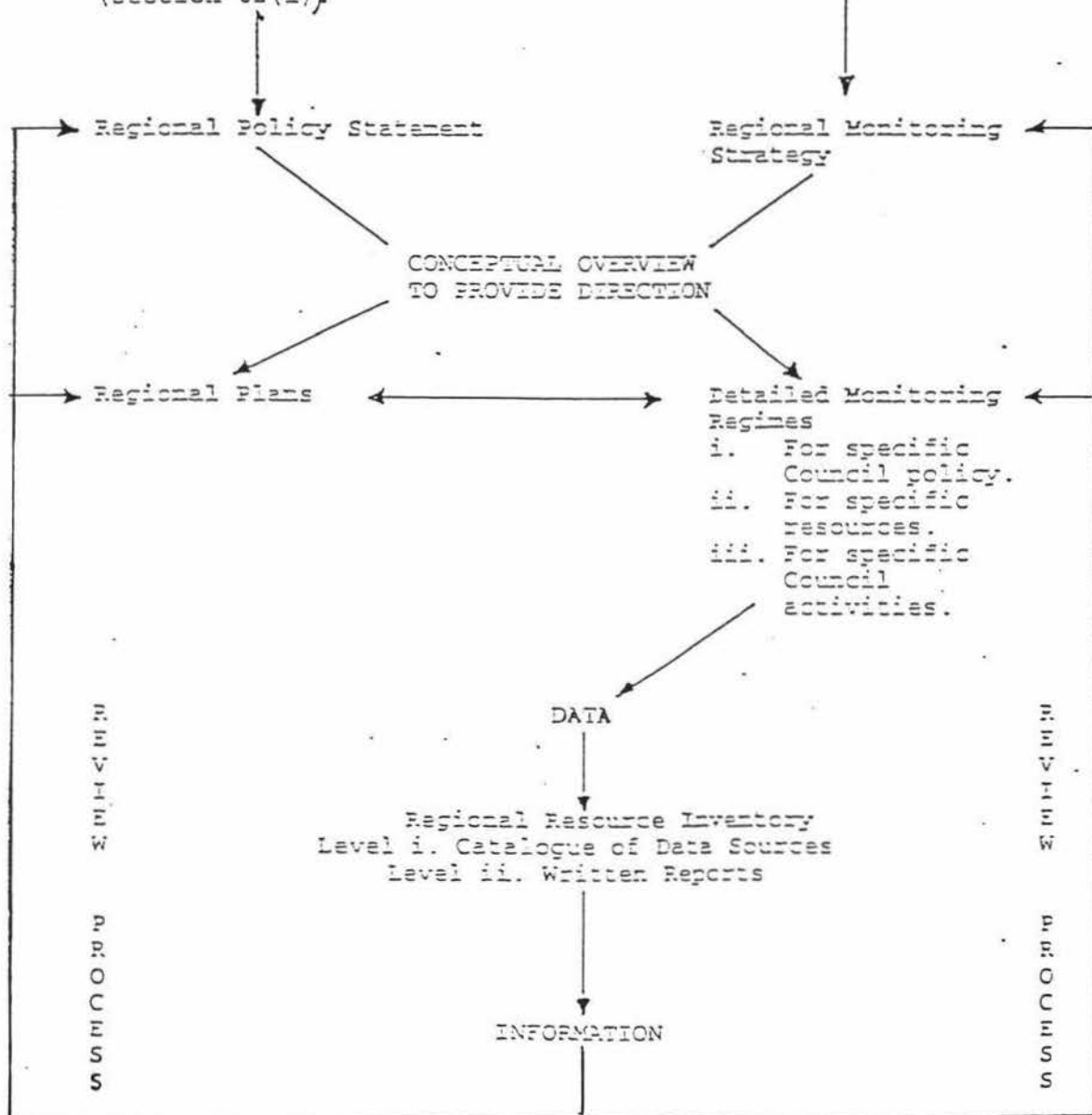
REGIONAL RESOURCE INVENTORY  
RELATIONSHIP WITH REQUIREMENTS UNDER THE  
RESOURCE MANAGEMENT ACT

Resource Management Act

Requirement to prepare  
RMS (Section 60).

Duty to provide information  
and to monitor (Section  
35).

Requirement to include  
in RMS the procedure to  
be used to review and monitor  
the effectiveness of policies  
(Section 62(i)).



PURPOSE AND GOALS OF THE REGIONAL MONITORING STRATEGY

## Purpose

To provide the overriding principles and guidelines for all MWRC investigations and monitoring activities, to enable the broader goal of sustainable resource management to be achieved.

## Goals

To provide scientifically defensible information on the environment which will enable the Council to:

- i. Determine the "state of the environment";
- ii. Identify environmental trends;
- iii. Forecast/predict the likely outcomes which result from incremental "changes" (effects) to the environment;
- iv. Determine the environmental impacts/outcomes of particular resource uses;
- v. Determine the environmental outcomes of Council policy, plans and activities.
- vi. Prepare, implement and review Policies and Plans as per legislative responsibilities and functions;
- vii. Be fully accountable;
- viii. Monitor compliance with resource consents; and
- ix. Carry out its legislative monitoring requirements in the most cost-effective and efficient manner.

## APPENDIX B1

### ENVIRONMENTAL IMPACT ASSESSMENT

#### METHODOLOGY

The general methodology outlined below has been taken from Meister (1990) who quotes PADC 1983, Cullen 1987, Wright and Greene 1987).

The method involves six steps. In the first step, the "scoping" stage, temporal and spatial boundaries are set. This determines which effects of the project and aspects of the environment will be considered. The scope will often be constrained or determined by the legislative and institutional framework.

In the second and third steps a check-list of environmental interactions are developed; and flow diagrams generated. This identifies how the environmental interactions, may be manifested as environmental effects.

Step four involves the identification of appropriate environmental indicators of the possible effects highlighted in step three. These indicators are measurable parameters of environmental change. Such indicators allow evaluation of the magnitude of an effect, that is, the degree of change in the environment with the project, as compared to the future state of the environment without the project.

Steps one to four will identify the information needed, step five involves obtainment of this information. The following approaches can be used: literature reviews, field surveys, computer modelling, comparative analysis, consultation with experts.

Once all the information has been gathered, the next step is to summarise it in a format that is suitable for decision makers to use. Unless there is a

substantial amount of economic information already available, either from the people behind the proposal or from comparable projects, this summary tends to take the form of a table, indicating the impact, given whatever quantitative information is available, and indicating the severity of the effect.

There are five techniques available for ranking and assessing the impacts, Environmental evaluation system, Planning Balance Sheet (PBS), Goal Achievement Matrix, Multi-attribute Utility Analysis, and Multi-criteria Decision Making. However, given the difficulty of estimating the relative importance of individual impacts, without further economic analysis - the most practical technique is the Planning Balance Sheet.

## APPENDIX B2

### COST BENEFIT ANALYSIS

#### METHODOLOGY

##### **i. Identification of Costs and Benefits**

CBA centres around the identification of all the costs and benefits resulting from a particular programme or project.

Several issues have to be dealt with before this can occur.

Firstly, is the accounting stance global, national, regional or individual. This will have an impact on assessing which benefits and costs are included in the analysis. Until recently the choice was only between the last three, however as the transnational effects of pollution are becoming increasingly apparent, global analysis of some projects has become necessary in order to prevent some serious environmental and political problems.

Determining the accounting stance is very important because it determines the specific area over which benefits and costs are to be counted and what constitutes a benefit and a cost.

A second issue in determining costs and benefits is the base situation. Or the with-without situation. Is the base from which we assess the costs and benefits constant or does it change?. In some cases the base will change, and this can lead to over or under estimation of the benefits. It is therefore very important to carefully determine the without situation.

A third conceptual issue is to clearly distinguish between primary (direct/real) economic benefits and costs; and secondary (indirect/transfer effects) benefits and costs.

Secondary benefits and costs are often omitted from CBA at the national level.

At the regional level however, these benefits and costs can be very important. Similarly financial transactions, such as loans, interest, taxes and subsidies are all financial transfer payments and are omitted from CBA.

Secondary benefits can be divided into two main groups:  
technological externalities (or spill-overs); and  
economic linkages.

Technological externalities alter the physical production possibilities of those outside the project area and they lead to net additional costs or benefits. These externalities can be positive, for example improved wildlife recreation habitats; or negative, for example pollution downstream.

As these technological externalities lead to changes in consumers satisfaction or to changes in the amounts of resources required to produce goods and services, they are real benefits and should be accounted for in the analysis. Ideally an attempt should be made to internalise as primary benefits as many externalities as possible.

Linkage effects are more difficult to define. They can be forward linkages when the production of an industry for example, logging, stimulates the activity of other industries that use the outputs of the former, such as paper mills. There can also be backward linkages. Also in this category we have the 'multiplier effects' and 'cost-saving effects'.

All these possible effects can be real or pecuniary. A pecuniary effect represents a change in some people's well-being at the expense of the well-being of others; that is it represents a redistribution of income. So while this effect is a benefit to some, it is a dis-benefit, or a cost to others.

It is not necessary to attempt to quantify linkage effects in the analysis, but they should be identified.

**ii. Identify Distribution of Benefits and Costs**

This is very important when the object of the evaluation is more than just determining the economic efficiency of the project. In practice it is extremely difficult to incorporate income redistribution into the analysis, however, by weighting it can be done, and knowing this can give an indication of why Governments approve some projects which are highly uneconomic. Large scale projects are often a politically convenient way to redistribute income.

**iii. Express as many of the costs and benefits in terms of a common measure (normally a monetary measure) using information on values.**

To value all benefits and costs in terms of a common denominator, information on prices is required. There are three possible situations.

- i. Market prices exist (for outputs and inputs) and accurately present social values.
- ii. Market prices exist but do not present social values and therefore have to be adjusted (shadow prices).
- iii. Market prices do not exist. Proxy values can be determined in some cases using non-market valuation techniques.

Another issue that needs to be dealt with is the incorporation of inflation.

**iv. Adjust for the differences in timing of costs and benefits:  
Discounting**

The basis of CBA is to compare the costs and benefits of a project(s).

However, since most projects last more than one year, benefit and cost flows extending over a number of years must be compared. Discounting is the usual method used for handling benefit and cost flows over time, that is, to allow for the time value of money. (Meister 1990, Mishan 1975, Forbes 1984, Wright 1988 and 1990).

The simplest explanation is that if money is lent, the possibility of using that money now by the lender is deferred until the future. Interest is the reward for this deferment.

Another explanation is that interest is related to current income foregone. For example, if a farmer lends money to his neighbour the farmer is foregoing the opportunity to use that money himself for some productive use such as fertiliser use. The reward in this case is the interest received for foregoing the use of the money himself. The higher the farmer values the income foregone, the higher the rate of interest that the neighbour has to pay.

On a national basis, the same principle applies. The interest rate becomes the discount rate.

A net benefit flow is reduced to a single **present worth (PW)** when a chosen discount rate is applied.

The choice of discount rate is an extremely controversial issue in CBA as it has important consequences for the results of the analysis. That is, the discount rate is a critical piece of data for the evaluation of any project. The choice of discount rate may make the difference between acceptance and rejection of a project.

Higher discount rates will result in fewer proposals being accepted according to the CBA criteria, and higher rankings for proposals that would generate substantial benefits in early years, whereas the major costs would come later.

However, discount rates do not necessarily act to the detriment of the environment. A high rate reduces the overall level of investment, which means more natural areas are likely to be preserved and more environmentally desirable land use will be maintained. On the other hand, the higher the rate, the faster natural resources will be exploited and the less weight will be given to future costs of present projects.

As well as disagreement over the magnitude of the discount rate, there is considerable disagreement over the proper derivation of a social discount rate.

There are two schools of thought expressed in the literature for determining the social discount rate, the **social time preference rate (STPR)** and the **social opportunity cost rate (SOCR)**. It is generally considered that STPR is less than SOCR. (Mishan 1975, Forbes 1984).

STPR is a measure of the relative value of present and future consumption or, the degree to which society as a whole, is prepared to forego future consumption. That is, the social discount rate should reflect society's feelings about providing for the future as opposed to current consumption.

SOCR is the average rate of return at the margin, of investments foregone in the private sector. That is, the social discount rate should represent the pre-tax rate of return foregone on physical investments in the private sector when funds are transferred to the public sector to finance public activities.

The advocates for the STPR have an underlying concern for issues of inter-generational equity with regard to resource use.

The advocates for the SOCR are predominantly concerned about the current resource allocation.

In attempting to combine the advantages of both schools of thought three

alternatives which use a synthetic discount rates made up of weighted mixes of both STPR and SOCR have been advocated (Forbes, 1984).

In New Zealand the debate over the basis for a public sector discount rate (PSDR) has mirrored the overseas debate. The opportunity cost of capital argument has dominated official policy. The current discount rate for use in Economic Cost Benefit Analysis has been set by the Government at 10%. This is a cut-off rate, representing the opportunity cost of capital.

**v. Apply a decision criterion: e.g. Net Present Value; Internal Rate of Return or Benefit/Cost Ratio.**

Forbes (1984) presents an examination of the alternative decision criterions which is outlined below.

### **Net Present Value Criterion**

Net Present Value criterion is the most straight forward discounted measure of project worth. It is the present worth (PW) of the net benefit flow which is the flow obtained by subtracting on a yearly basis, total costs from total benefits. Alternatively it can be computed by finding the difference between the sum of the present values of the benefits, less the sum of the present values of the costs.

The formal selection criterion for the PW measure of project worth is to accept all projects with a positive PW when discounted at the social discount rate.

The selection criterion cannot be applied unless there is a relatively satisfactory estimate of the social discount rate, and no budget constraint.

Ranking of independent projects is not possible using the PW criterion unless the projects have similar cost and benefit flows. The criterion does, however, give the most suitable ranking of mutually exclusive projects and alternatives of the same project, since it is an absolute, not a relative measure.

In practice, it is desirable to have a ranking of independent projects as well as the yes/no criterion provided by the PW measure. For this reason the Internal Rate of Return Criterion is often used (Forbes 1984).

### **Internal Rate of Return Criterion**

This method of using the discounted net benefit flow for measuring the worth of a project, involves finding the discount rate (the IRR) which makes the PW of the net benefit flow equal zero.

The IRR is a very useful measure of project worth. The IRR represents the earning power of the capital invested in a project. Its correct interpretation is the rate of return on capital outstanding per period while it is invested in the project.

The normal selection criterion for the IRR measure is to accept all projects having an IRR above the social discount rate.

Independent projects can be ranked in order of their IRR value, but this ranking does not necessarily reflect their contribution to national wealth. However, in the case of mutually exclusive projects and alternatives of the same project, direct comparison of IRRs can lead to erroneous investment choices. This danger can be avoided either by discounting the differences in the benefit and cost flows of alternatives and obtaining the IRR of this new flow, or by using the PW criterion.

A criticism of the IRR criterion is that more than one solution can be possible. Multiple solutions may occur where the net benefit flow has very large negative components late in the life of the project.

A further point worth noting is that IRR calculations can be computed from any point in time and all points will give the same result.

### **Benefit/Cost Ratio Criterion**

The Benefit/Cost Ratio measure (B/C) can be represented generally as the Present Value (PV) of the benefits divided by the present value of the costs.

When the B/C measure is used to evaluate projects, the formal economic decision criterion is to accept all projects with a ratio of one or greater, except in the case of mutually exclusive projects and alternatives, and in situations where capital is constrained.

The measure discriminates against projects with relatively high gross returns and operating costs, even though these may be shown to have a greater wealth generating capacity than alternatives with a higher B/C ratio (Forbes 1984).

**vi. Use the result in the decision making process**

## APPENDIX B3

### NON-MARKET VALUATION TECHNIQUES

#### **i. Travel Cost Approach**

The basic philosophy of this technique rests on the assumption that the use of a site is dependent upon the costs incurred in that use, which for free access public recreation sites, are usually limited to the costs of travel. The technique involves surveying the users of a particular site and determining the cost involved in getting to the site. The results reflect the value to the current users, i.e. use value. It does not measure other possible values associated with the site such as option and existence values. For these reasons the results should be treated as a minimal estimate of the total benefits derived from the site. There are major difficulties in adjusting results to reflect multi-purpose trips and the results also reflect the current distribution of income. (Meister 1990, Cummings, Brookshire and Schulze, 1986).

#### **ii. The Contingent Valuation Approach**

This is a survey method which creates a hypothetical market for otherwise non-market goods. In the survey, people are asked directly what they would be willing to pay or accept as compensation, for suggested changes in supply or quality, of the good in question. The summation of their answers provides an estimate of society's willingness to pay (or value) for the good in question. This is a flexible approach which, although labour and time intensive, allows the evaluation of option and existence values. (Meister 1990, Cummings, Brookshire and Schulze, 1986).

Mitchell and Carson (1989:2, Pp 2-3) describe contingent valuation as a technique which relies on surveys to:

"... elicit people's preferences for public goods by finding out what they would be willing to pay for .... them. The method is thus aimed at eliciting peoples willingness to pay (WTP) in dollar amounts. It circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the good in question ..... Because the elicited WTP values are contingent upon the particular hypothetical market described to the respondent, this approach came to be called the contingent valuation method".

Contingent valuation has been found to be the most appropriate for determining non-use (intrinsic) values such as bequest and existence values (Kerr, 1986).

### **iii. Hedonic (or Implicit) Pricing Method**

The hedonic pricing method establishes a relationship between, for example, the price/value of a house and certain environmental characteristics in a particular area. That is, the method involves efforts to impute public good values from observed market prices. The relationship allows the calculation of the marginal value of these characteristics. This marginal value can then be used to value changes in the quality or quantity of the environmental good of interest. (Meister 1990, Cummings, Brookshire and Schulze, 1986).

## APPENDIX C1

### TYPOLOGY OF POTENTIAL RESPONSE EFFECT BIASES IN CV STUDIES

(Source: Mitchell and Carson, 1989, Pp.236-237)

#### **1. Incentives to Misrepresent Responses**

Biases in this class occur when a respondent misrepresents his or her true willingness to pay (WTP).

A. Strategic Bias: where a respondent gives a WTP amount that differs from his or her true WTP amount (conditional on the perceived information) in an attempt to influence the provision of the good and/or the respondent's level of payment for the good.

#### B. Compliance Bias

i. Sponsor Bias: where a respondent gives a WTP amount that differs from his or her true WTP amount in an attempt to comply with the presumed expectations of the sponsor (or assumed sponsor).

ii. Interviewer Bias: where a respondent gives a WTP amount that differs from his or her true WTP amount in an attempt to either please or gain status in the eyes of a particular interviewer.

#### **2. Implied Value Cues**

These biases occur when elements of the contingent market are treated by

respondents as providing information about the "correct" value for the good.

A. Starting Point Bias: where the elicitation method or payment vehicle directly or indirectly potential WTP amount that influences the WTP amount given by a respondent. This bias may be accentuated by a tendency to yea-saying.

B. Range bias: where the elicitation method presents a range of potential WTP amounts that influences a respondent's WTP amount.

C. Relational Bias: where the description of the good presents information about its relationship to other public or private commodities that influences a respondent's WTP amount.

D. Importance Bias: where the act of being interviewed or some feature of the instrument suggests to the respondent that one or more levels of the amenity has value.

E. Position Bias: where the position order in which valuation questions for different levels of a good (or different goods) suggest to respondents how those levels should be valued.

### 3. Scenario misspecification

Biases in this category occur when a respondent does not respond to the correct contingent scenario. Except in A, in the outline that follows it is presumed that the intended scenario is correct and that the errors occur because the respondent does not understand the scenario as the researcher intends it to be understood.

A. Theoretical Misspecification Bias: where the scenario specified by

the researcher is incorrect in terms of economic theory or the major policy elements.

B. Amenity Miss-specification Bias: where the perceived good being valued differs from the intended good.

i. Symbolic: where a respondent values a symbolic entity instead of the researcher's intended good.

ii. Part-Whole: where a respondent values a larger or a smaller entity than the researcher's intended good.

a. Geographical Part-Whole where a respondent values a good whose spatial attributes are larger or smaller than the spatial attributes of the researchers intended good.

b. Benefit Part-Whole: where a respondent includes a broader or narrower range of benefits in valuing a good than intended by the researcher.

c. Policy-Package Part- Whole: where a respondent values a broader or narrower policy package than the one intended by the researcher.

iii. Metric: where a respondent values the amenity on a different (and usually less precise) metric or scale than the one intended by the researcher.

iv. Probability of Provision: where a respondent values a good whose probability of provision differs from that intended by the researcher.

C. Context Misspecification Bias: where the perceived context of the market differs from the intended context.

i. Payment Vehicle: where the payment vehicle is either misperceived or is itself valued in a way not intended by the researcher.

ii. Property Right: where the property right perceived for the good differs from that intended by the researcher.

iii. Method of Provision: where the intended method of provision is either misperceived or is itself valued in a way not intended by the researcher.

iv. Budget Constraint: where the perceived budget constraint differs from the budget constraint the researcher intended to invoke.

v. Elicitation Question: where the perceived elicitation question fails to convey a request for a firm commitment to pay the highest amount the respondent will realistically pay before preferring to do without the amenity. (In the discrete-choice framework, the commitment is to pay the specified amount.)

vi. Instrument Context: where the intended context or reference frame conveyed by the preliminary non-scenario material differs from that perceived by the respondent.

vii. Question Order: where a sequence of questions, which should not have an effect, does have an effect on a respondent's WTP amount.

APPENDIX D1 CURRENT AND PROPOSED CV RESEARCH FROM  
AROUND THE WORLD

STOCKHOLM SCHOOL OF ECONOMICS

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9 december, 1991

Mr. B. Kirkland  
Manager Policy and Planning  
Manawatu-Wanganui Regional Council  
Private Bag  
Palmerston North  
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Dear Mr. Kirkland,

Let me begin this newsletter with an excuse. Various co-ordination problems and other things have delayed this newsletter to an undesirable degree. Nevertheless, I do think that this newsletter will prove to be very interesting and useful for anyone interested in the development of the contingent valuation method. The material that each country correspondent has compiled is an up-to-date account of current issues and applications of the contingent valuation method. I think they have done an excellent job and I am sure that you will find their reports of interest.

Whether or not contingent valuation will be routinely applied in order to obtain information about peoples' preferences is still too early to say. The American experience alone provides some evidence to the fact that such studies can provide useful information. I do believe that the country-studies you will find in this newsletter help contingent valuation practitioners to further substantiate their arguments in favor of this method of preference revelation. As experience accumulates in various countries we will learn more about the weaknesses and strength of the contingent valuation method. In what direction this process will ultimately lead is still too early to say, I believe. Nevertheless, an armchair meta-analysis indicates that it is difficult to reject the null-hypothesis that people who are confronted with CV-questions do make a substantial effort when trying to answer them.

I shall soon leave you with the country reports. Let me mention some administrative business and some other news before I leave you. We discussed in Stockholm at the EAERE-conference the possibility of organizing the network through computermail. However, this option is not easily available in some countries. Thus, for the moment I will stick to ordinary mail. Maybe next year we can start a fully organized computerized network.

The screening mechanism that deletes those who are not really interested in this newsletter is perhaps not very effective, although I have deleted (and added) some people to the current list of members. There are roughly 100 members currently. My current mailing-system is not going to be sustainable in the longer run, because of the costs. The optimal solution may well be computer mail. Please send me e-mail so that I can organize a distribution list smoothly.

Several new books and articles have appeared, and some are under publication, that should be of interest. Robert Mitchell covers the American scene nicely. For the European scene it might be of interest to know that Ståle Navrud (Norway) is editing a book on (basically) European contingent valuation studies. This Oxford University Press book will be out next year. In case you do not have a copy of the mandatory Mitchell/Carson book on contingent valuation, you can get a discount by contacting Richard Carson (Department of Economics, University of California, San Diego, La Jolla, CA 92093, USA).

With regard to current controversies and hot topics you will get a good coverage of those in the individual reports. Benefit-transfers, i.e. translating results from one study to another area, is currently an area of interest and will be treated soon in Water Resources Research. My own pet – design of discrete CV-studies – has been the focus of some articles (one by Hans Nyquist is forthcoming in the Review of Economics and Statistics. Richard Carson has also written on this topic. Barbara Kanninens dissertation covers this topic from a Bayesian point of view.) The part/whole bias issue was discussed in Stockholm to a great extent. To my mind this issue is rather trivial from an economic theory point of view, because we never forget the budget-constraint in our models. The provocative paper by Kahnemann & Tversky (see Robert Mitchell's piece below for details) has inspired some people to respond rather vigorously. It might be good to air this topic, since it will be useful to have an account of the evidence when debating the CVM with non-enthusiasts. Incidentally, Kristin Magnussen from Norway will cover some of the part/whole stuff in her forthcoming dissertation (1992). Current areas of interest also includes how to include uncertainty in the scenario as well as how (and if) to use the CVM in developing countries.

Finally, I hope those of you who were in Stockholm in June for the EAERE-meeting enjoyed your stay. We certainly enjoyed having you over. I hope the meeting in Krakow 1992 will be as successful and that it may attract non-European friends to the same degree as did Stockholm.

All the best and best wishes for 1992,



Bengt Kriström

P.S. Don't forget to send me e-mail! D.S.

## COUNTRY REPORTS for the CVM NETWORK

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University College  
The University of New South Wales  
Australian Defence Force Academy

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Department of Economics and Management

25 September, 1991

Dr Bengt Kristrom  
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Box 6501  
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Dear Bengt,

Thank you for your letter of June 18. I have waited until now to reply in the hope that some information of new CV studies in Australia would come to hand. However, none of the contacts I wrote to regarding the network have reported any work in progress.

The implication of this is that Australian CV work is very much in abeyance after the Kakadu experience. Only the forestry study that Marc Carter and I are working on is still active, albeit at a very cautious pace given the fears of the powers that be in the Resource Assessment Commission which is commissioning the study.

Proof of an active CV group around the world, I'm sure, give some impetus to the technique here and I look forward to receiving information from you. I have arranged an e-mail address:

j-bennett@adfa.oz.au

Yours sincerely,

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24.9.1991

#### Summary of current CVM research in Finland

THE POTENTIALITY OF SCENIC AGRICULTURE IN FINLAND - THE  
VALUE OF AGRICULTURAL LANDSCAPE ESTIMATED BY MEANS OF WTP  
AND WTA

RESEARCHER: Jyrki Aakkula

#### METHODOLOGICAL AND PHILOSOPHICAL FOUNDATIONS OF THE CV METHOD

The project evaluates the discrepancy between WTA and WTP from the methodological point of view. The main argument to be constructed is that in connection with hypothetical market structure this discrepancy is possible to be reasoned from the inside factors of neoclassical consumer choice theory without any need of references to the cognitive psychology.

RESEARCHER: Ilkka Eisto

#### ESTIMATING OPTION PRICES AND EXISTENCE VALUES IN A CV FRAMEWORK

The case in the study is Saimaa Seal (*phoca hispida saimensis*), which lives in Lake Saimaa in Finland. The existence of the seal population is threatened. The purpose of of this study is to estimate existence value of Saimaa Seal and to improve CVM by using behavioral knowledge.

RESEARCHER: Eija Moisseinen

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## GERMANY AND SWITZERLAND

by  
Anselm U. Römer

## I. Current CVM Activities in Germany

## I.1 Projects (papers available):

The German Environmental Secretary of the Federal Government has published results of a mayor project in September 1991: 'Costs of Environmental Protection - Benefits of Environmental Protection'. Within this project the CVM has been applied to several problems in order to get some estimates of the respective benefits. For the following two studies abstracts were made available for the NEWSLETTER in time.

(1) Authors: Stefan Klokow and Ulrike Mathes

Address: Prognos AG  
Steingraben 42  
CH 4011 Basel/ Switzerland

Title: Economic costs incurred in the Federal Republic of Germany by the reduction of the recreation value of the environment brought about by pollution

Summary: The subject of this study is the interrelationship between environmental pollution, recreation value and recreation demand, as well as the estimation of the economic costs of pollution in the leisure and recreation branch. The first part of the study gives an overview of the theoretical background and the level of research in order to show how suitable evaluation procedures were developed. In the second part of the study, the situation of the recreation areas and their future development are presented. By means of examples, the basic qualitative and quantitative aspects of the impact of pollution on the environment as well as on those seeking recreation will be documented in part three. In the fourth part of the study the results of the private household survey and the willingness to pay analysis are presented. In the fifth part of the study the economic costs are estimated for the main fields of impact: For the leisure and tourism industry and for nature itself.

(2) Authors: Wolf Schluchter, Ulla Egler and Herbert Königsberger

Address: IST GmbH, Gesellschaft für angewandte Sozialwissenschaft und Statistik  
Hauptstr.24  
D-6900 Heidelberg / Germany

Title: The Psycho Social Costs of Environmental Pollution

Summary: (shortened from the abstract provided by the authors) The aim of the project was to determine costs resulting from an impairment of the sense of well being because of environmental pollution. For this pupose a model to pin down

individual wtp but also shows a statistically significant impact of related private or political activities aiming at a risk reduction.

## I.2 Planned or Current Projects (yet no papers available):

(1) Authors: R. Friedrich and B. Staiger

Address: Institute for Energy Economics and the Rational Use of Energy,  
Heßbrühlstr. 49a,  
D-7000 Stuttgart 80 / Germany

Project Summary (from AUR, based on information provided by the authors): The project tries to quantify the external cost connected with different types of energy production. It will be investigated under which circumstances the quantitative results of previously undertaken CV studies, evaluating the respective environmental effects, can be transferred to and generalized for this study.

(2) Authors: Anselm U. Römer and Werner W. Pommerehne

Address: Institute of Public Sector Economics  
Dept. of Economics  
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Title: (preliminary) Buying Out a Hazardous Waste Facility: An Ex Post Analysis of Individuals Real World Contributions to Provide a Public Good

Project Summary: The German community of Kleinblittersdorf collected some million DM in order to prevent a hazardous waste incinerator to be build in the French neighbour community Großblitterstroff. With the help of a structured survey applied to a random sample of citizens of Kleinblittersdorf peoples motives for the participation (or non participation) are investigated. Particular attention is payed to the impact of public information and moral suasion. Furthermore determinants of the sum actually donated (fairness criteria, expected damage, income) should be detected.

Remark: Project still in progress (approximately up to the end of 1992). Anyone who has some information about similar cases as the Kleinblittersdorf one should get in contact with the authors.

Project Summary (from AUR based on the above publication): With the help of conjoint analysis the economic benefit of a noise reduction for 50 % in the city of Zurich is computed. It is found that the average household would be prepared to pay 80 SFR per month for such an improvement. In addition the economic benefit derived from a nearby forest recreation area are derived with the help of the CVM as well as with the Travel Cost Method. The use value is calculated between 125 and 345 SFR per square meter of wood, while the total resource value (including non-use values) is estimated to amount to 600 to 826 SFR.

## II.2 Planned or Current Projects (yet no papers available)

(1) Authors: Werner W. Pommerehne, Bruno S. Frey, Reiner Eichenberger, Albert Hart, Felix Oberholzer, Anselm U.Römer und Angel Serna

Address for correspondence: Werner W. Pommerehne  
Institute of Public Sector Economics  
Dept. of Economics  
University of the Saarland  
D-6600 Saarbrücken / Germany

Project Title (preliminary): Siting Hazardous Waste Facilities in Switzerland

Project Summary: Many countries face the problem how to locate facilities with locally concentrated cost and dispersed benefits, like hazardous waste facilities. Experience from the past tells us that the difficulties associated with getting a potential host community to accept such a facility are numerous: should this community be compensated and how? What alternative decision mechanisms apart from compensation are available? Are there circumstances under which a siting decision is considered as fair? How can strategic behaviour during the decision process and the siting be minimized? These and other questions will be studied both theoretically and empirically.

Remark: Information about the design of the decision mechanism used in other countries and the experience with these mechanisms would be very welcome.

CVM - NETWORK  
NEWSLETTER FROM NORWAY

National correspondent: Ståle Navrud, Agricultural University of Norway  
October 1991.

In Norway there are several ongoing and just completed projects on both empirical and methodological aspects of CVM. Below you will find a list of the projects completed and/or started in 1991:

1) VALUING REDUCED POLLUTION TO THE NORTH SEA

Project leader: Kristin Magnussen / Ståle Navrud  
Norwegian Agricultural Resource Economics Institute /  
Agricultural University of Norway (AUN).

Purpose: a) Use CVM to find the Norwegian population's WTP for increased water quality (i.e. reduced eutrophication) in freshwater and salt water due to a 50 % reduction in the Norwegian emissions of nitrogen and phosphorous to the North Sea.  
b) Methodological tests, focusing on "part-whole bias" / "mental accounts" / "focusing effects" / "amenity misspecification"

Publications: Magnussen, K. 1991: Valuation of reduced water pollution using the Contingent Valuation method - Testing for mental accounts and amenity misspecification". Paper presented at the EAERE conference in Stockholm June 1991. Forthcoming in Navrud, S. 1992 (ed.): Pricing the the European environment (Preliminary title). Oxford University Press.  
Magnussen, K. & Navrud, S. 1991: Valuing reduced pollution to the North Sea. (In Norwegian). Report to the Norwegian Ministry of Environment. July 1991.

2) VALUING ENVIRONMENTAL COSTS - METODOLOGICAL STUDIES

Project leader: Jon Strand / Ståle Navrud  
Center for Research in Economics and Business  
Administration (CREBA) / AUN.

Purpose: Carry out methodological tests of "mental account / ammenity misspecification" of the CV method, and experiments with actual payments following CV surveys.

Publications: Løyland, K, S. Navrud & J. Strand: Willingness to pay for

Preliminary table of content:

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PART I: THE SETTING

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- \* CHAPTER 1 : VALUING ENVIRONMENTAL BENEFITS AND COSTS -  
IMPLICATIONS FOR THE ENVIRONMENTAL POLICY IN  
EUROPE

Ståle Navrud

PART II: REVIEW AND EVALUATION OF EUROPEAN CASE STUDIES  
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- \* CHAPTER 2: FRANCE

Francois Bonnieux, Birgitte Desaignes & Dominique  
Vermersch

- \* CHAPTER 3: GERMANY AND SWITZERLAND

Anselm U. Römer & Werner W. Pommerehne

- \* CHAPTER 4: ITALY

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- \* CHAPTER 5: NETHERLANDS

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Per-Olof Johansson & Bengt Kriström

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Ian Bateman, R. Kerry Turner & David W. Pearce

PART III: THE VALIDITY OF CONTINGENT VALUATION SURVEYS

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- \* CHAPTER 9: AN ASSESSMENT OF CONTINGENT VALUATION  
SURVEYS

Ruud Hovenagel

## 5) OTHER STUDIES

Apart from these projects there are also some ongoing M.Sc thesis work at AUN using the CV method to estimate the recreational value of fishing in Norway (In Norwegian) and wildlife viewing in Kenya (In English).

Another interesting valuation study , but which does not use CVM, should also be mentioned. This is a study of the politicians' implicit willingness to pay for different interests affected by hydropower development

Strand, J. & F. Wenstøp 1991: Implicit willingness-to-pay to avoid negative consequences of hydroelectric development in the "Master Plan for Water Resources". Chapter 7 in "Environmental costs and the national economy" (In Norwegian). Report to the Norwegian Water Resources and Energy Administration (NVE). English paper is also forthcoming.



In 1988, the project was reconsidered with major modifications in its design through Nou Barris. Most of the road was to be covered and the available surface devoted to open space and public facilities.

The aim of the CV study has been to evaluate externalities, favouring the Nou Barris neighbourhood, that could be attributed to the modifications embodied in the new version of the project.

To apply the method, a questionnaire was submitted to a random sample of 400 neighbours, over 18, living in Nou Barris.

The good to be valued was the set of modifications, 1988 vs. 1968 project versions. The modifications were detailed as follows:

- (i) an extra access/exit to the ring road.
- (ii) the covering of two thirds of the road.
- (iii) public facilities and green open spaces.
- (iv) provision of 1,000 parking spaces.

To increase familiarity with the good to be valued, relevant pictures were presented to the respondents and a previous score about the importance of the four items was demanded from the interviewed sample.

The emphasis on specificity of the questions and the support of graphical information was aimed at avoiding "part-whole" and "symbolic" biases.



**Author:** María del Mar Isla

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Major de Gracia , 71 2nd 1a  
08012 Barcelona.  
Spain.  
Phone (34)(3)-2188198. Fax (34)(3)-2185366.

**Title:** Applying The Contingent Valuation Technique  
to the Economic Assessment of Nordic Ski  
Activities in L'Alt Urgell-Cerdanya.

**Abstract:**

An approximate CV analysis was conducted to have some insights into the value of Nordic skiing activities in the municipally managed natural sports area of L'Alt Urgell-Cerdanya, in northern Catalonia.

The survey was aimed at increasing knowledge about the characteristics and behaviour of the user population and to research into an acceptable entrance fee, were it to be applied in the future (there was no price charged at the time of the study).

Concerning the willingness to pay question the idea was to suggest the possibility of a closure of the skiing resort if revenues were not enough to outweigh the maintenance and operating costs of the area. Data on costs of alpine skiing stations were used as implicit break-point.

A total of 83 responses, to an open question on willingness to pay, was obtained, with an average value for the entrance fee of about 500 pesetas.

Due to the small number of completed questionnaires there was no further analysis on bias and related topics.

Studies no. 4 & 7 are based on interviews. All other studies are based on mail surveys. TCM=Travel cost method.

There are three different hunting studies, all based on the contingent valuation technique. Mattsson has undertaken two surveys in which Swedish hunters are asked of their willingness to pay WTP for a hunting permit. In both these studies, hunters are asked of their willingness to pay for a hunting permit conditional on the outcome of this year's hunting being almost identical to the outcome of last year's hunting. Johansson 1990 asked a sample of hunters of its willingness to pay for a hunting permit for the forthcoming season.

There are other land use conflicts in which Swedish forestry is involved. In March 1983 it was suggested that a Nature Reserve, protected from forest harvesting, be created in the Vålå Valley in Northern Sweden. For this reason, the Swedish Environment Protection Agency initiated a social cost-benefit analysis of the two scenarios, i.e. preservation vs forestry; see Bojō 1985. To estimate the benefits of preserving the area, 282 visitors were interviewed about, among other things, their willingness to contribute to preservation (compensation of economic losses to the forest owners), and their travel costs. Kriström 1990 investigated methods for assessing the value people place on preserving fragile and virgin forests. This study is primarily an econometric analysis of the referendum technique. A random sample of Swedes were shown a map depicting 11 such areas, and were informed that the areas are important for recreation (for present and future generations) as well as for many endangered species. Johansson 1989 asked a small sample of Swedes (200 people out of which 122 replied) about their willingness to pay for measures taken to save endangered species. The respondents were told that about 300 endangered species - animals, birds, and flowers - are living in Swedish forests. The respondent was asked to make contributions towards programmes that would save some or all of the species. Four different programmes that would save some or all of the species were suggested. It turns out that the reported results are in accordance with the predictions of economic theory. For example, the willingness to pay is an increasing function of the number of species preserved.

Katz & Sterner 1990 investigated consumers' willingness to pay for reduction in gasoline vapors at filling stations. The study was commissioned by the Health and Environmental Department of Gothenburg City Council, the aim being to explore the benefits and costs of reducing vapour from gasoline at filling stations. The sample consisted of 800 people, where 200 were polled at a local gasoline company who already had installed vapour recovery systems, while 600 people were randomly drawn from a register of people in Gothenburg. Katz & Sterner 1990 asked the respondents to state how much more they would maximally be willing to pay for gasoline at filling stations already equipped with vapour recovery systems.

Silvander 1991 completed two contingent valuation studies to address the potential benefits of reducing excess nitrogen loss from agriculture. One study concerned the value of improving fishing conditions for anglers, while the other study addressed the value of improving ground water quality by reducing nitrogen loss.

Johansson & Zavisic 1989 studied what has been called the environmental budget, by some people. They asked people to support various public programs, including environmental programs. Their results support the hypothesis that people can meaningfully state their willingness to pay for various public sector programmes.

Of the studies reported here, at least one has had a direct effect on decision-making. According to the study of the Vålå-valley, the benefits of preserving the valley unspoiled far exceed the costs (i.e. loss of timber). After the study had been completed in 1985, the Swedish government decided to protect the valley. Therefore, a Nature Reserve was created in the area, implying that the valley will be protected from forest harvesting.

CVM NETWORK NEWSLETTER: UK  
1.10.1991

Growing interest and activity in the the CVM in the U.K is indicated by the number of conferences and workshops which have taken place or which are planned for the near future at which the CVM is discussed and by the number of CVM projects funded by governmental or quasi-governmental bodies.

Ian Bateman, University of East Anglia, Norwich in consultation with Ken Willis, University of Newcastle upon Tyne and Middlesex Polytechnic has mounted a major CVM survey this summer as part of the 'Broadland Flood Alleviation Study'. Values have been obtained for water based recreation and wildlife in on-site personal interviews with over 2000 visitors to an important National Park area. Discrete and continuous WTP questions were used with separate samples. Interestingly, an extensive piloting period showed a tax based vehicle to be the least biased. This conflicts with some US studies and may be evidence of a cultural difference in response to payment vehicles. Regression equations will be estimated for the bid function and simple travel cost and opportunity cost estimates used for comparison. A national follow-up study using postal methods is planned in order to obtain non-use values.

A CVM survey, undertaken by Kerry Turner, University of East Anglia as part of a case study of the Aldeburgh Sea Defence Scheme has been completed and a report prepared. A large sample of visitors to sites on the coast at Aldeburgh were interviewed and WTP for the preservation of the coast was elicited.

Nick Hanley and colleagues at the University of Stirling have continued their active involvement in CVM research following earlier studies. A study of WTP for heathland conservation in Dorset was undertaken in 1990 for the nature Conservancy Council and a report has been prepared. 237 personal interviews were conducted on site and 3 different WTP scenarios and vehicles were used. The impact of 4 different information sets was tested for.

Nick Hanley's current CVM work includes number CVM case studies valuing diverse environments undertaken for the Scottish Office and the Scottish Development Agency in a project on 'Valuation of Environmental Effects'. A further CVM study is being undertaken for the Nature Conservancy Council (now English Nature) in which WTP and WTA estimates for not routing a new road through Birkham Wood, a Site of Special Scientific Interest in North Yorkshire. Nick Hanley is currently visiting at Queen's University, Kingston, Ontario, Canada.

In March 1991, the Flood Hazard Research Centre, Middlesex Polytechnic hosted an informal workshop of UK CVM researchers to review the state of the art of the CVM and the lessons from UK experience. In conjunction with Ian Bateman and Kerry Turner, University of East Anglia, a report has been prepared for the Department of Transport's Traffic and Road Research Laboratory on the methodological issues involved in the CVM. This was prepared as the first part of a proposed study to apply the CVM to the effects of new roads. A second report has been prepared by Colin Green, Middlesex Polytechnic, for the National Rivers

To: Bengt Kristrom, Department of Economics, Stockholm School of Economics  
From Robert C. Mitchell November 11, 1991

In 1991 Resources for the Future will publish Valuing Natural Assets, a new book, edited by Raymond J. Kopp and V. Kerry Smith. The book examines the economic issues involved in valuing natural resource damages under the CERCLA legislation. The papers were originally presented at a conference held several years ago and were revised for the book. Virtually all the papers discuss contingent valuation because it is an important methodology for use in CERCLA cases which involve significant existence value benefits. In addition to the editors, the authors include Gardner Brown, K. E. McConnell, Robert Mendelsohn, William Schulze, Richard Carson, Robert C. Mitchell, Ralph C. d'Arge and A. Myrick Freeman, Fred Anderson, Howard Kenison and Willie Taylor.

Several formal cases and disputes about the value of natural resources were recently settled. The most recent and the most prominent in the U.S. was the settlement of the suits brought by the federal government and the State of Alaska against the EXXON Corporation over the damages caused by the Exxon Valdez oil spill in Prince William Sound, Alaska. The settlement amount was approximately one billion dollars (although considerably less in present value 1991 dollars) in addition to the several billion dollars Exxon says it has already spent to cleanup the spill. Prior to the settlement, more than a few U.S. CV practitioners were conducting CV related research for the parties in the case. To date none of this research has been made public.

Another recently resolved case involving the use of CV concerned sulphur dioxide emissions from a large coal-fired power plant in the Southwest near the Grand Canyon National Park. The parties in this dispute (it was not a legal case as such, but involved an administrative decision that was contested) were the National Parks Service and the Salt River Project, the utility which runs the very large coal-fired power plant in question. At issue was the size of the visibility improvement that would be achieved by requiring this plant to use scrubbers (disputed by scientists, but involving 20 to 40 days in the winter) and the value of this improvement. Both parties relied on their own contingent valuation estimates, based on pilot studies, to measure the economic benefits. The two studies reached very different estimates; the differences being the subject of critiques and counter-critiques submitted as part of the administrative proceedings. The methodological debate, which involves such issues as the quality of mail surveys for this type

Is it a Dead-End for Nonmarket Valuation?" Those giving papers are: Raymond Kopp; Richard Bishop and Michael Welsh; Richard Carson and Robert Mitchell; and William Desvousges and Reed Johnson.

Two other papers on the Southern Meetings program appear to be relevant to those interested in CV: Mark Dickie and Shelby Gerking, "Protective Behavior and the Value of Reduced Risk: The Case of Skin Cancer," and Richard Ready, Glenn Blomquist and John Whitehead, "Polychotomus Choice Valuation Questions."

Several papers on natural resource damage assessment and contingent valuation will be presented by the following at the January AEA Meetings in New Orleans and the AERE sessions at these meetings. Among the authors are Carson, Flores and Hanemann and Opaluch. One by Jakus and Smith is described below.

Another current controversy involves the attack on the CV method's validity by psychologist Daniel Kahneman and economist Jack L. Knetsch (KK) in a forthcoming (late 1991 or early 1992) issue of the Journal of Environmental Economics and Management. Their paper, "Valuing Public Goods: The Purchase of Moral Satisfaction," reports on the findings of telephone survey experiments which show an embedding effect "in which WTP for a good varies depending on whether it is evaluation on its own or as part of a more inclusive category." They argue that CV responses "reflect the WTP for the moral satisfaction of contributing to public goods, not the economic value of these goods." In the same issue of the journal will appear two spirited critiques, one by V. Kerry Smith "Arbitrary Values, Good Causes and Premature Verdicts" and another by Glenn Harrison, "Valuing Public Goods with the Contingent Valuation Method: A Critique of Kahneman and Knetsch" along with a rebuttal by KK.

Richard Carson recently published a chapter, "Constructed Markets," in Measuring the Demand for Environmental Quality edited by John B. Braden and Charles D. Kolstad (Elsevier, 1991). This chapter discusses a number of methodological issues in constructing hypothetical markets.

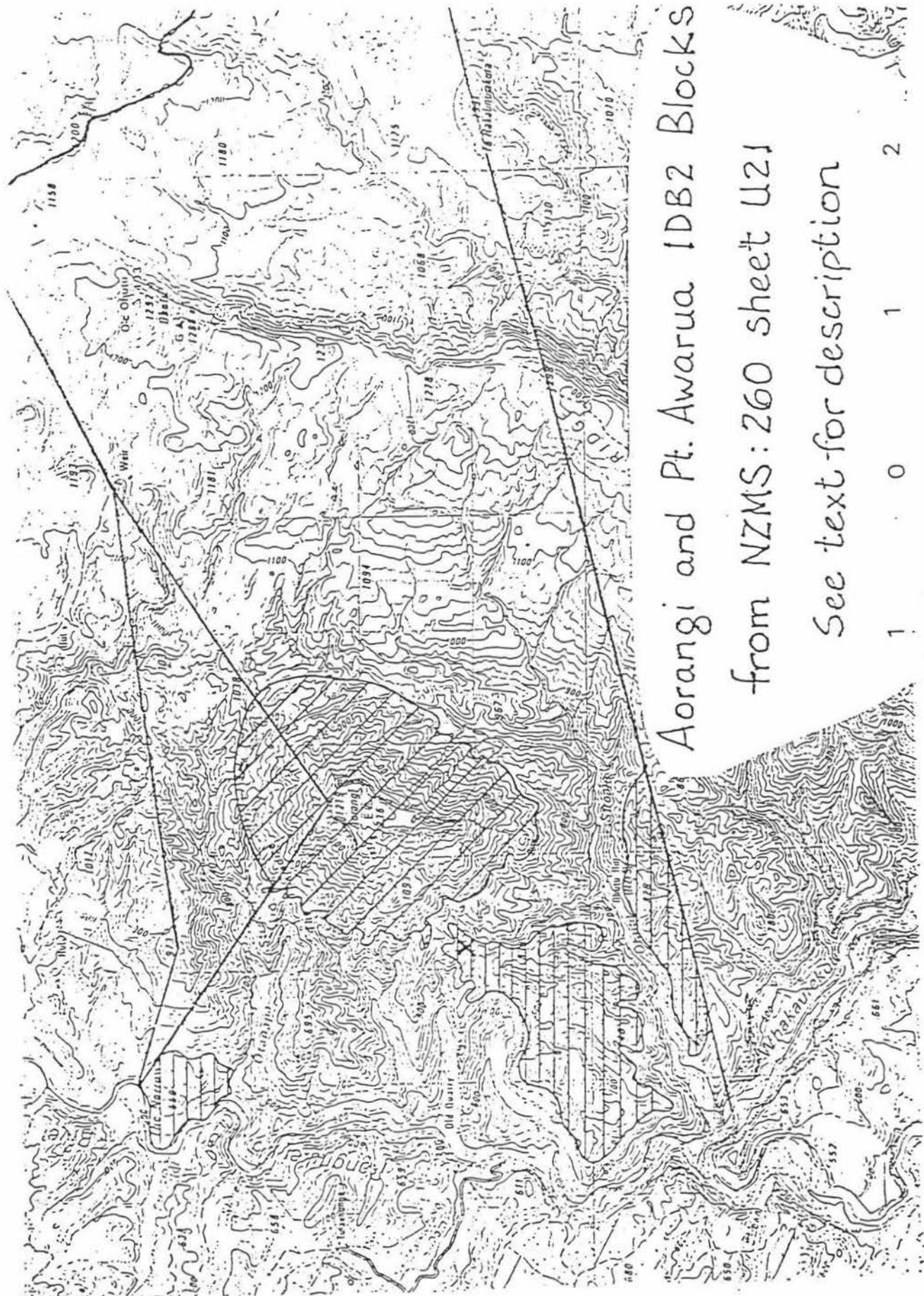
John Loomis and Michael King have a discussion draft of a paper in circulation entitled: "Comparison of Mail and Telephone-Mail Combination Contingent Valuation Surveys." The paper is based on a survey of Californians regarding their WTP for wetlands in the San Joaquin Valley, California. The telephone-mail method is one where the researcher sends material for the respondent to read by mail in advance of a telephone interview. WTP amounts from the mail survey were substantially higher than from the telephone-mail survey.

Another draft paper based on data from this survey in circulation is Michael Hanemann, John Loomis and Barbara

Young Sook Eom and V. Kerry Smith have completed a jointly estimated discrete CV and market demand model that uses actual produce purchases together with households' selections between different types of produce to evaluate how the presence of information about pesticide residues influences their purchasing decisions. This paper, entitled "Linking Revealed and Stated Preference Data in Describing Consumer Responses to Risk: Pesticide Residues on Food," will also be presented at the ASSA meetings in January. Both papers will be available December, 1991 through the Resource and Environmental Economics Program at North Carolina State University (Raleigh, NC, 27695).

Kerry Smith reports that there are efforts underway at EPA, NOAA, US Forest Service and the Department of Agriculture to develop an Environmental Benefits Data Base. There will be a workshop on procedures for summarizing existing studies in mid-November. Contact persons for results of the workshop are Bob Leeworthy and Mary Jo Kealy.

APPENDIX E1 MAP OF AORANGI AWARUA FOREST BLOCK



APPENDIX E2 NWASCA DECISION

Accordingly, the Tribunal has decided that Reeves Contractors shall be permitted to extract timber from the Aorangi-Awarua blocks west of the 940 metre contour as shown on the attached map under the following conditions:

- 1 Logging shall be excluded from the Aorangi Mountain Reserve set aside by the Maori Land Court as shown on the attached map.
- 2 Logging shall proceed on a compartment-by-compartment basis, each compartment's size not to exceed 50 hectares. No more than two compartments shall be logged in any one year. Each and every operation shall conform to the NWASCA Forest Operations Guidelines attached. In addition:
- 3 Logging, skid trails and landings shall be excluded from within 30 metres of any watercourse.
- 4 Logging shall be excluded from land where the average slope exceeds 26 degrees as shown on the attached map.
- 5 No trees with a diameter at breast height of less than 450 mm shall be extracted.
- 6 A logging plan shall be produced for each compartment by Reeves Contractors, and shall be discussed with staff of the Rangitikei-Wanganui Catchment Board prior to logging, to ensure that it complies with the conditions of this consent.
- 7 Access roads and associated features including cuts, batter slopes, side-casts, culverts, and bridges shall conform to the NWASCA Forest Operations Guidelines attached. In addition:
- 8 Access roads shall be restricted to 4.5 metres in width except where changing direction, and to grades not exceeding 1 in 8.
- 9 Spoil from access roads shall be placed at sites where it will not enter watercourses.
- 10 A roading plan shall be produced for each access road by Reeves Contractors, and shall be discussed with staff of the Rangitikei-Wanganui Catchment Board prior to construction, to ensure that it complies with the conditions of this consent.
- 11 Logging of any compartment, and construction of any access road, shall cease immediately on direction from the Rangitikei-Wanganui Catchment Board, if in the opinion of board staff, operations fail to conform to NWASCA's Forest Operations Guidelines or with the general conditions of this consent listed above.

APPENDIX E3 DECISION OF RANGITIKEI DISTRICT COUNCIL

JUN-05-1990 TUE 17:41 ID:RANGITIKEI DI MARTON TEL NO:0652 0652 7436

#173 P02

*Return to Kathy Bills*

TELEPHONE (0652) 8174

IN REPLY PLEASE QUOTE  
THIS REFERENCE

P.10

CORRESPONDENCE TO  
CHIEF EXECUTIVE OFFICER  
ATTENTION

J.B. Fraser

JBF:MAG  
468:REG**RANGITIKEI DISTRICT COUNCIL**

PRIVATE BAG, MARTON

Fax (0652) 6970

Fax (0652) 7436 Marton Public Office

5 June 1990

The General Manager  
 Manawatu Wanganui Regional Council  
 Private Bag  
PALMERSTON NORTH

Attention : Ms K. Bills

Dear Sir,

Town and Country Planning Act 1977 : Planning Application P.10 - Aorangi  
 Awarua Block - Reeves Contractors Limited

I advise that the above planning application was considered at a meeting of the Planning and Regulatory Services Committee on 5 June 1990.

The application was declined in terms of the following resolution:

1. The Committee considered the scope of the application and was satisfied that it included the felling and removal of trees, the construction of roads and tracks, and the construction of a bridge over the "Narrows". However, the Committee considered that any other proposed use of the site (e.g. for a portable mill) would require a further planning application.
2. (a) The Committee considered the type of application and found that it was in two parts. The first was the proposal to "selectively log" parts of the site, incorporating the construction of roads and tracks, and the Committee was of the opinion that the proposal as described by the applicant's counsel and witnesses could not be defined as "production forestry". The committee decided that production forestry is the "manufacturing" of a forest by mans planting, management and subsequent logging of it. This application relates solely to the logging of an unmanaged, naturally grown forest. Accordingly this part of the application was deemed to be a specified departure from the provisions of the Scheme.

- 2 -

- (b) The second part was the proposal to bridge the "Narrows". The Te Papa a Tarinuku River Narrows are listed in the Scheme in Ordinance 8 as a place of historical and archeological interest to be preserved. The Committee is of the opinion that Ordinance 8.2 makes it clear that any application to alter or add to a registered place shall be by way of a conditional use application.

Accordingly the application was determined in accordance with the provisions of Sections 74 and 72 of the Town and Country Planning Act respectively.

3. The Committee decided that Subsecs (1)(a)(b)(c) and (g) of S.3 of the Town and Country Planning Act were applicable to the proposal within the application.

- (1)(a) The Committee found that the weight of evidence showed that the proposal would have a detrimental effect on the physical environment both on the site and on the adjacent river and that the social and cultural environment would not be enhanced.

It was accordingly determined that the application did not recognise or provide for the provisions of S.3(1)(a) of the Act.

- (1)(b) The Committee noted that there was no proposal from the applicants to manage the resource but that they intended only to extract it. There was no recognition of the concept of "sustainability" or any other provision for the future and accordingly the Committee decided that the wise use and management of this resource had not been recognised and provided for.

- (1)(c) The Committee considered whether recognition and provision had been made for the preservation of the natural character of the margins of the rivers and the protection of them from unnecessary development. The committee felt that this had been recognised, particularly by the adoption of the NAWASCA conditions, but the weight of evidence, led them to believe that the proposal would lead to significant alteration by construction works and slips of the margins and thus change their character.

- (1)(g) The Committee received conflicting evidence of the effect of the proposal on the culture and traditions of the Maori people and accordingly was unable to reach a conclusion on this matter while noting the importance of this ancestral land to Maori.

- 3 -

Overall the Committee was of the opinion that the proposal contained within the application was contrary to the provisions of Section 3 (1)(a)(b)(c) of the Act.

4. The Committee considered that part of the application related to logging under Section 74 of the Act. Evidence was given by the applicant that the proposal would employ 6 persons in the bush and 6 persons in the mill and that the current estimated value by the applicant of the trees at stumpage was \$2.1 million. Evidence was also given of the established and growing tourist industry related to the Rangitikei River which would be put at threat by the proposal. A great deal of the evidence placed before the Committee by the objectors was directed towards the "special" qualities of the area including the fauna found there. It was claimed that it was in the public interest to conserve this and that the proposal would endanger these qualities and in some cases destroy the rare fauna.

Having considered all of the evidence on this issue the Committee decided that the proposal would be contrary to the public interest.

It was also noted that the purpose of the zone as specified in the Scheme was to reduce the movement of detritus into the main waterways and to ensure that a high level of water quality is maintained. On the evidence presented the Committee believed that this proposal will increase the amount of detritus and silt moving into the Rivers and accordingly the Scheme could not remain without change if its integrity is to be preserved.

5. The Committee considered the proposal to bridge the "Narrows". The Committee acknowledged that the proposal for the bridge submitted with the application was considerably amended and the plans can only be taken as indicative of the type of construction proposed. It was accepted that the bridge would be erected only with the approval of the Regional Council and that it would not obstruct the waterway in any way. However, the Committee noted that the "Narrows" has been registered in terms of Ordinance 8 of the Scheme since 1978 and that no objection was made to its continued registration at the review in 1986, and was therefore of the opinion that any bridge erected over the "Narrows" would be inappropriate given the classification of the place and that the evidence did not warrant the cancellation or modification of the registration.

In view of all of the above factors the Committee has resolved to decline the application.

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The applicant and every body or person which or who objected to the application may within one month after notification of the decision appeal to the Planning Tribunal against the Council's decision or against any condition, restriction or prohibition imposed in respect of that decision.

Yours faithfully,



J. B. Fraser

DIRECTOR OF PLANNING AND REGULATORY SERVICES

APPENDIX E4 REEVES CONTRACTORS - GROUNDS FOR APPEAL

IN THE MATTER of the Town and Country  
Planning Act 1977

AND

IN THE MATTER of the Rangitikei  
District Council

APPEAL BY OWNERS AORANGI AWARUA BLOCK AND  
REEVES CONTRACTORS LIMITED PURSUANT TO SECTION  
69 OF THE TOWN AND COUNTRY PLANNING ACT 1977

TAKE NOTICE that the owners of the Aorangi Awarua Block and Reeves Contractors Limited care of Trotter McKechnie Quirke & Morrison, The Exchange Building, Corner Fenton and Pukaki Streets, Rotorua, HEREBY APPEAL against the decision of the Rangitikei District Council delivered on 5 June 1986 and received by the Appellants on 5 June 1986.

1. The decision was made in respect of an application for selective logging of the Aorangi Awarua Block and the Appellants were the applicants. A copy of the application is attached hereto.
2. The description of the land affected by the application is Aorangi Awarua Block rural A Rangitikei District Scheme (plan attached).
3. The full text of the decision in respect of which this appeal is made and the reasons given for the decision as conveyed to the Appellants by the Respondent is attached.
4. The grounds on which the appeal is based are that the decision of the Rangitikei District Council was wrong in fact and in law and contrary to sound town and country planning principles. In particular the application to selectively log the indigenous forest on the Aorangi Awarua Block was a conditional use in the rural A zone and the respondent was wrong in its application of Section 3 of the Town and Country Planning Act 1977.

- 2 -

5. The Appellants seek the following relief; namely that the application be granted.

DATED at Rotorua this 21st day of June 1990.

The owners Aorangi Awarua Block and Reeves Contractors Limited by their solicitors and duly authorised agents Trotter McKechnie Quirke & Morrison

per ..... M.S. McKechnie .....  
Murray Stuart McKechnie

Address for Service:

The address for service of the Appellants is at the law offices of Trotter McKechnie Quirke & Morrison, The Exchange Building, Corner Fenton and Pukaki Streets, Rotorua. (Telephone (073) 476.138: Fax (073) 478-150: P.O. Box 242)

ANNEXURES

1. Copy of application dated 22.12.87. Copy letter to respondent 22.1.88. Application was not heard and was renewed in October 1989. Copy letter to respondent 25.10.89. Copy respondent's Notice of Application 3.1.90.
2. Full text of decision appealed from.
3. Copy plan. (Areas coloured green are those approved by decision of National Water and Soil Conservation Authority).
4. Decision of National Water and Soil Conservation Authority.
5. Decision of High Court on appeal by Rangitikei-Wanganui Catchment Board.

APPENDIX E5 RANGITIKEI DISTRICT COUNCIL REPLY

<u>IN THE MATTER</u>	of The Town & Country Planning Act 1977
<u>A N D</u>	
<u>IN THE MATTER</u>	of an Appeal under Section 69 of the Act
 <u>BETWEEN</u>	
	<u>THE OWNERS OF THE AORANGI AWARUA BLOCK and REEVES CONTRACTORS LIMITED</u>
	<u>Appellants</u>
<u>AND</u>	<u>RANGITIKEI DISTRICT COUNCIL</u>
	<u>Respondent</u>

REPLY OF THE RESPONDENT COUNCIL TO THE APPEAL  
BY THE OWNERS OF THE AORANGI AWARUA BLOCK & REEVES  
CONTRACTORS LIMITED

1. THE Appellants have appealed against the decision of the Respondent Council delivered on the 5th June 1990. This is incorrectly stated in the Applicant's Notice of Appeal as 5th June 1986. A copy of the Respondent's decision is annexed hereto and marked with the letter "A".
  
2. BY Application dated 22nd December 1987 and subsequently renewed by the Appellants in October 1989 the Appellants applied to the Respondent for consent to conduct selective logging of the area known as the 'Aorangi Awarua Block' and following a further amendment to the Application on the 22nd day of December 1989, to erect a bridge across "The Narrows". The final form of the Application is attached hereto and marked with the letter "B".
  
3. THE legal description of the land is the land east of the Rangitikei River and described as Aorangi

- 2 -

Block in Awarua 1 DB, Nos. 1 & 2 Blocks. A copy plan of the land subject to this appeal is attached and marked with the letter "C".

4. UNDER the Respondents Operative District Scheme the subject land is in a Rural A zone in which the proposed selective logging is not a permitted use. The application in respect thereof was treated as an application under Section 74 of the Town and Country Planning Act 1977.
5. UNDER the Respondent's District Scheme the area known as 'The Narrows' is designated as an object and place of historical and archeological interest and therefore the application in respect thereof was treated as an application under s72 of the Town and Country Planning Act pursuant to the provisions of Ordinance 8.2 of the said Scheme.
6. A total of 53 objections were received in all. The names and addresses of the objectors received are attached and marked with the letter "D".
7. THE Application was duly heard by the Respondent. The decision of the Respondent Council was delivered on the 5th day of June 1990 and received by the Appellants on the 5th June 1990.
8. CONSENT to conduct selective logging and erect a bridge across 'The Narrows' was refused. The details and reasons are set out in the Respondent's Decision which is attached and marked with the letter "A".

- 3 -

9. THE Respondent takes issue with the Appellants as to the grounds set forth in their Notice of Appeal and replies to each of those objections as follows:

(a) (i) The Council correctly determined that the Application to selectively log the indigenous forest was to be considered pursuant to the provisions of Section 74 of The Town and Country Planning Act as a specified departure and not as a conditional use in the Rural A zone.

(ii) The Council correctly determined that the Application to erect a bridge across 'The Narrows' was a conditional use application and was to be considered pursuant to the provisions of s72 of the Town and Country Planning Act 1977.

(b) In reaching its decision the Respondent considered on the evidence available that the Applicant had not satisfied the onus in terms of section 74 of the Town & Country Planning Act 1977.

(c) That the Respondent was not wrong in its application of section 3 of the Town and Country Planning Act 1977.

(d) That the Rangitikei District Council's decision was not wrong in fact and in law and was not contrary to sound town and country planning principles.

10. THE Respondent seeks the dismissal of the Appeal.

- 4 -

11. THE Respondent's opinion is that the only other local authority likely to be affected by this appeal is the Manawatu-Wanganui Regional Council.

DATED at Wanganui this 23<sup>rd</sup> day of July 1990.

.....  
Solicitor for Respondent

This reply was filed by ANDREW FRANK DAVID CAMERON whose address for service is at the offices of Armstrong Barton, Solicitors, 8 Bell Street, Wanganui.

Telephone (064) 58 389.

TO: The Planning Tribunal

AND TO: The Appellants

AND TO: The Manawatu Regional Council

AND TO: The Minister of Conservation

AND TO: All other objectors as set out in the list of objectors attached hereto and marked with the letter "D".



APPENDIX E7 DRAFT NATIONAL CONSERVATION ORDER FOR  
THE MIDDLE AND UPPER RANGITIKEI RIVER

RANGITIKEI RIVER DRAFT NATIONAL WATER CONSERVATION ORDER

Pursuant to section 203(7) (a) of the Water and Soil Conservation Act 1967 the National Water and Soil Conservation Authority hereby gives notice that it has prepared a draft national water conservation order in respect of the Rangitikei River. The draft order has been prepared following an application made jointly by the Wellington Acclimatisation Society, the Hawke's Bay Acclimatisation Society, the Council of North Island Acclimatisation Societies and the National Executive of New Zealand Acclimatisation Societies; and consideration by the Authority of submissions and objections made in respect of that application.

Submissions on or objections against this draft order or any part of it may be made by:

- (a) any body or person who made submissions on or objected to the applications;
- (b) any body or person who may be affected by the draft order.

All submissions or objections must be made within 28 days after the date of the publication of this notice and must be lodged with the Registrar, Planning Tribunal, Justice Department, Private Bag, Postal Centre, Wellington.

RECOMMENDED DRAFT WATER CONSERVATION ORDER

The National Water Conservation (Rangitikei River) Order 1986.

1 Title and Commencement

- (1) This order may be cited as the National Water Conservation (Rangitikei River) Order 1986.
- (2) This order shall come into force on the 14th day after the date of its notification in the Gazette.

2 Interpretation - In this order, unless the context otherwise requires, -

"Act" means the Water and Soil Conservation Act 1967.

"Middle River" means -

- (a) the Rangitikei River itself from its confluence with the Makahikatoa Stream (approximate map reference NZMS 1 N123/519432) to the Mangarere Bridge (approximate map reference NZMS 1 N139/266996), and
- (b) the Whakaurekau River plus all its Tributaries and the Kawhatau River plus its following Tributaries: The Pouranaki River, the Mangakokeke Stream

"River" means the Rangitikei River and its tributaries.

"River Flow" means for any given point on the river -

- (a) the mean daily flow occurring at that point; plus
- (b) the sum of abstractions from the river and its tributaries upstream of that given point expressed as a daily mean, but not including any abstraction from the Moawhango River at the Moawhango Dam (approximate map reference NZMS 1 N122/238504) for hydro electric power generation purposes.

"Upper River" means -

- (a) the Rangitikei River itself from its source (approximate map reference NZMS 1 N113/506891) to its confluence with the Makahikatoa Stream (approximate map reference NZMS 1 N123/519432)
- (b) all rivers and streams contributing water to the Rangitikei River upstream of that confluence.

### 3 Outstanding Characteristics and Features

- (1) It is hereby declared that the Upper River includes:
  - (a) outstanding wild and scenic characteristics and
  - (b) outstanding recreational, fisheries, and wildlife habitat features.
- (2) It is hereby declared that the middle river includes:
  - (a) outstanding scenic characteristics and
  - (b) outstanding recreational and fisheries features.

### 4 Retention of Natural Waters in Natural State

Because of the outstanding characteristics and features specified in clause 3 (1) of this order the upper river shall be preserved as far as possible in its natural state.

### 5 Rate of Flow of Natural Water

Because of the outstanding characteristic and features specified in clause 3(2) of this order, the rate of flow of natural water to be retained at any point in the middle river shall be not less than 95 percent of the river flow at that point.

### 6 Right to Dam not to be Granted

A right to dam the upper river or the middle river shall not be granted under Sections 21 or 23 of the Act.

7 Water Rights

- (1) A water right under Sections 21, 23 or 24 of the Act may not be granted by the National Water and Soil Conservation Authority or by the Regional Water Board (as appropriate) and a general authorisation under Section 22 of the Act may not be made by the Regional Water Board in respect of the upper river or the mid river if the combined effect of the grant or authorisation and of existing rights would be that the provisions of this order cannot remain without change or variation.
- (2) Notwithstanding anything in this order, it shall be lawful for water rights to be granted, and general authorisations to be made, in respect of the upper river or the middle river for the purposes of research into, and enhancement of, fisheries and wildlife habitats.
- (3) Nothing in this order shall be construed as limiting the effect of the second proviso to section 21(1) of the Act relating to the use of water for domestic needs, for the needs of animals, and for or in connection with fire fighting purposes.

G Knowles  
Secretary/Chief Executive  
National Water and Soil Conservation Authority

APPENDIX E8 CONTRACT BETWEEN REEVES AND MAORI OWNERS

THIS DEED made this *28th* day of *February* 1936

BETWEEN IRA KARAITIANA, CHARLIE TAITE, PETER WIAREHU STEEDMAN, TAMA WIPAKI, MAKA BARRETT as Trustees of the AORANGI AWARUA TRUST (hereinafter together with their successors called "the Owner") of the one part

A N D REEVES CONTRACTORS LIMITED a duly incorporated Company having its registered office at Rotorua, Logging Contractors (hereinafter together with its successors and permitted assigns called "the Company") of the other part

WHEREAS:

- A. The Owner is registered as proprietors of all that parcel of land more particularly described in the First Schedule hereto (hereinafter called "the land"), and
- B. The Company wishes to have the exclusive right to cut, fell, log, extract, remove and sell all live and dead millable timber but excluding therefrom what is in trade usage described as "firewood" (hereinafter called "the timber") growing or being on that land (excluding the reserve hereinafter described) on a selective logging basis as defined in the Third Schedule hereto.

NOW THEREFORE THIS DEED WITNESSETH:

1. THE Owner so far as he may lawfully do HEREBY GRANTS to the Company, subject always to the terms and conditions hereinafter appearing, and subject always to compliance by the Company with any relevant Statute, Regulation, By-Law or Ordinance and with all lawful requirements of any Government or Local Government or Statutory Authority or any Catchment Board having jurisdiction in respect of the land, the full right, liberty and licence during the period of 15 years from and including the date of Rangitikei-Wanganui Catchment Board approval to the company carrying out selective logging on the

-2-

land by its workmen, servants and agents and at its own cost and expense in all things to cut, fell, log, extract, remove and sell the timber growing or being on the land on a selective basis as defined in the Third Schedule hereto and for that purpose subject to the terms and conditions herein contained to do all or any of the following acts, deeds, or things on the land :

- (a) To make, install and maintain at its expense and use all roadways, tracks, tramways and skids, on the land, and/or providing access to it, as may be necessary for the purposes of cutting, felling, logging, extracting, removing and selling the timber and from time to time alter and remove from the land any such roadways, tracks, tramways and skids, subject to Clause 4 hereof.
- (b) To erect, place or bring onto the land (and thereafter alter or remove) buildings, engines, machinery, vehicles, plant implements and chattels, as may be necessary or convenient for the purposes specified in this Deed.

2. SUBJECT to Clause 3 hereof, the Company shall pay royalties to the Owner at the rate and in the manner calculated as set out in the Second Schedule hereto on all the timber won and carried away from the land area under and by virtue of this Deed, such royalties to be paid in full in cash to the Owner's Solicitors for the time being monthly on the 30th day of every month in each year during the term hereof, in respect of the previous month's working.

3. ON the first anniversary of the commencement of this Licence and annually thereafter the rate of royalties payable hereunder shall be reviewed by the parties and fixed having regard to the market conditions then prevailing and if the parties fail to reach agreement thereon by the 30th day after each anniversary then the same shall be fixed in accordance with Clause 10 hereof.

4. IT is agreed by and between the parties that:

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- (a) It is the company's obligation to obtain, construct and maintain at its expense access to the land by a route or routes to the satisfaction of and in accordance with the lawful requirements of the Crown or any department or agency of the Crown or any central or Local Government or Statutory Authority or Catchment Board having jurisdiction in the matter.
- (b) The company shall ensure that any access to the land obtained by the company over land owned by third parties shall be taken in the name of the Owner and shall include and incorporate the right of the Owner, its servants, agents and permitted invitees in common with the company and any other person lawfully entitled so to do to pass and repass with or without vehicle and/or any animals over that access.
- (c) The company shall at the time of negotiating access to the land for the purposes of this agreement over land owned by third parties involve the Owner in such negotiations and shall use its best endeavours to negotiate long term access to the land over land owned by third parties by way of an easement in perpetuity permitting. The Owner, the persons they represent and their successors in title access to the land.
- (d) Any bridge constructed on the land or for the purposes of providing access to the land shall not be removed on the termination of this agreement whether by effluxion of time or otherwise and such bridge or bridges shall revert to the Owner without compensation being payable to the company or otherwise.
- (e) Live and dead timber which is in trade usage described as "firewood" shall not form part of this grant and shall at all times be available for cutting, extraction and removal by the Owner its servants, agents, contractors or licencees provided

-4-

however that the company is entitled to cut extract and remove firewood for the personal use of its employees whose names and addresses shall be supplied to the Owner six monthly and on request.

- (f) The Company shall from time to time confine its operations on the land to certain defined Sections of the land (herein called "compartments") which shall be from time to time defined by the Company in consultation with the Catchment Board and other central or Local Authorities having jurisdiction over the land.

5. THE Company hereby covenants with the Owner as follows :

- (a) To pay the royalties in cash in full at the time and in the manner specified in Clauses 2 and 3 hereof.
- (b) To cut, fell, log, extract and remove the timber on a selective logging and compartment basis efficiently and safely and according to the most approved manner of so doing the same in undertakings of a like nature and so as to do as little damage as necessary to the surface of the land.
- (c) To cut out each compartment and deal with the timber therein in terms of this Deed before commencing on another compartment, the intention being that the land so worked in compartments and as each compartment is worked out it shall cease to form part of the area over which rights hereunder are granted and all further rights of the Company in respect thereof shall cease PROVIDED THAT the Company shall have a right of access across any such worked out compartment as may be necessary for Company's operations on the land.
- (d) To obtain and maintain any and every consent, licence and permit necessary to give full effect to this Deed, whether

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from the Crown or any department or agency of the Crown, or any central or Local Government or Statutory Authority or Catchment Board under any statute, regulation, by-law or ordinance and whenever called upon by the Owner so to do, to produce all such consents, licences and permits for inspection and copying.

- (e) To comply with and be solely responsible in respect of, and to indemnify the Owners at all times in respect of, any and every liability and obligation under all statutes, regulations, by-laws or ordinances and all other Government and Local Government or Statutory Authority or Catchment Board requirements from time to time and for the time being applicable to the operations of the company.
- (f) To ensure all gates opened by the company's workmen, servants and agents are closed after them and not to allow any dogs or firearms to be brought onto the land by such workmen, servants and agents.
- (g) Not to disturb or remove existing fences without the consent of the Owner and then only subject to any conditions they may impose.
- (h) To make all damaged gates and fences good not later than one month after they are damaged.
- (i) Not to cut, fell, log, extract and remove the timber or carry out any act deed or thing permitted by this Deed on the Aorangi Mountain Reserve which has a boundary 1000 feet (measured vertically) below the height of the Trig Station on Aorangi Mountain as the same is for the purposes of identification shown outlined in green on the attached map.
- (j) In exercising the rights conferred hereunder the company will

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not in any manner interfere with the use or occupation of the land by the Owners or their tenants or licencees or permitted invitees.

- (k) To take all statutory and other reasonable and proper precautions against fire arising in any manner out of the exercise by the company of the rights herein conferred and shall comply with the requirements of any fire authority or Rural Fire Officer or the Conservator of Forests or any person authorised by them in that regard.
- (l) That it will immediately on obtaining all consents necessary to exercise the rights granted herein commence cutting operations on the land under and in terms of this Deed and continue with all reasonable diligence and continuity the work of cutting, felling, logging, extracting and removing the timber until all the timber hereby authorised to be milled that can be obtained has been so obtained or until expiration of this Deed whichever shall be the earlier.
- (m) The company shall not transfer, assign, sublet or underlet the rights hereby granted which are personal to the company.
- (n) The company will at all times comply with the provisions of the Bush Workers Act 1945 and any Regulations for the time being in force thereunder.
- (o) The company shall not put, throw or place or allow to be put thrown or placed into any river, stream or watercourse or into any place where it may be washed into any river stream or watercourse any slush or debris from the falling and cutting of trees or any sawfust shavings chips bark edgings slabs or other sawmill refuse and the company shall remove from all stream beds on the land all logs tree-heads and other debris deposited in such stream-beds as a result of the

- 7 -

operations of the company and shall be liable to make good or pay compensation for any damage by flooding or erosion caused or aggravated by any failure to comply with this clause.

(p) The Company at all times shall conduct its operations under this Deed with care and skill and make the best use of the land and the timber permitted to be taken pursuant to this Deed so as to ensure a minimum of waste and as far as possible avoid damage to the Owner and without limiting the generality of this provision. The Company will when felling timber and timber trees leave as little amount of heads and rubbish on the land as is reasonably practicable and will take all proper steps to prevent avoidable damage to seedling trees, young trees and green trees under twelve inches in diameter at breast height.

(q) The company will permit any person who is able to produce written authority from the Owners and will permit only such persons to cut up or saw any tree heads or branches for fencing strainers, fencing posts, battens or firewood.

6. THE Owner covenants to pay all rates, charges and assessments levied, charged, imposed upon or made payable in respect of the land excepting land tax (if any) which shall be the responsibility of the Company.

7. IT is hereby expressed agreed and declared as follows:

(a) If and whenever any of the royalties as hereby reserved or any part thereof shall be in arrear or unpaid for one (1) month whether the same shall have been legally demanded or not the Owner may enter upon the milling area and may seize and destrain and sell as landlords may do for rent in arrear all or any of the timber then won and the engines, machinery, plant implements and chattels belonging to the Company within

- 9 -

under and/or upon the land and out of the moneys arising from the sale of such distress may retain and pay all arrears of the royalties and also the costs and expenses incidental to the distress and sale rendering the surplus (if any) to the Company.

- (b) If the royalties reserved hereby or any part thereof shall be in arrear and unpaid for the space of one (1) month next after the days herein appointed for payment (whether the same shall or shall not have been legally demanded) or if breach shall be made in the observance or performance of any covenant, condition or agreement herein contained or implied and on the part of the Company to be observed or performed and continue for fourteen (14) days or if the Company shall become insolvent or make any assignments for the benefit of or composition with its creditors then and in any and every such case and notwithstanding the waiver of any previous right of re-entry it shall be lawful for the Owners by notice in writing addressed to the Company at its registered Office or last known place of business to cancel this Grant and thereupon the Grant shall absolutely determine but without prejudice to :
- (i) The rights of the Owner to royalty accrued or accruing; and
  - (ii) The rights and claims of either party in respect of any prior breach of covenant, condition or agreement contained herein.
- (c) In respect of any loss or damage by fire for which neither party is responsible or by flood or other inevitable accident, the risk shall be borne :
- (i) by the Owner until the severance cutting, felling or

- 9 -

extraction of live timber and until the extraction or assignment to the contract of dead timber ;.

(ii) by the Company after the severance, cutting, felling, extraction or assignment as aforesaid.

(d) Subject to the rights, powers and privileges conferred on the Company by this Deed nothing herein contained shall be deemed to prevent or restrict the power of the Owner to dispose of or deal with the land or any part or parts of it to any persons or persons whomsoever.

8. IF the Company at all times punctually and faithfully carries out observes and performs all the covenants conditions and agreements herein contained or implied and on the part of the Company to be carried out observed and performed and shall have given notice in writing to the Owner at least six (6) calendar months before the expiration of the term of this Licence of its desire to take a new Licence then the Owner will, subject to Catchment Board and other central or Local Government consent, at the cost of the Company grant to the Company a new Licence for a further period of fifteen (15) years paying such Royalties as may be mutually agreed upon between the parties or failing agreement by arbitration but not in any case to be less than the Royalties payable in the last year of the Licence granted by this Deed AND UPON AND SUBJECT TO the like covenants conditions and agreements as are contained in this Deed but excluding this right of option of a new Licence to the intent that the total period available to the Company and this Deed and any new Licence be thirty (30) years.

9. THE Company not being in any way in breach hereof or in default hereunder may within six (6) months of the expiration hereof remove all buildings, engines, machinery, vehicles, plant implements and chattels with the exception of roads, bridges, fences, cattlestops and culverts as shall have been erected or placed upon or

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in the land by the company or any of its servants or agents.

10. IF any doubt, difference or dispute shall arise between the parties hereto concerning the royalties hereby reserved or any other matter or thing arising out of this Grant then the same shall be referred to a single arbitrator, if the parties can agree upon one in writing, and if they cannot then two arbitrators one to be appointed by each party in writing and in the case of the arbitrators disagreeing then an umpire to be chosen and appointed by the arbitrators in writing before entering upon the consideration of the matter referred to them and the arbitrator or the arbitrators or their umpire shall also have full power to determine by whom the costs of the arbitration shall be borne and every such reference shall be deemed to be in arbitration within the meaning of the Arbitration Act 1908 or any Act passed in amendment thereof or in substitution therefor.

11. THIS Deed is subject inter alia to confirmation by the Maori Land Court of New Zealand and to Catchment Board approved on or before three (3) years from the date of this Deed (time being of the essence) and failing such approval within that time, this Agreement shall be at an end.

IN WITNESS WHEREOF these presents have been executed the day and year first hereinbefore written.

FIRST SCHEDULE

AORANGI BLOCK and AWARUA LDB NUMBERS 1 and 2 BLOCKS being those land generally described by the black etching within the lighted in red ball point pen marking on the attached map.

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SECOND SCHEDULE

The Company shall pay to the Owner a royalty of \$5.00 for every 100 feet Haakon Dahl (0.32 cubic metres) of Rimu and \$2.50 for other species of timber felled, logged, or extracted and removed from the land during the term.

For the purposes of computation of the amounts of royalty the Company shall keep true and accurate accounts and records of all timber cut, felled, logged or extracted from the land; and the Company shall not remove or permit to be removed from the land or to be sawn or milled any timber unless first measured as set out below.

On Wednesday in each week during the term the Company or its duly authorised agent shall furnish to the Owner a copy of the accounts and records for all timber so cut, felled, logged or extracted from the land; and the parties or their agents shall together measure the timber according to the middle girth of the log inside bark making due allowance for any rotten, shaken or drawn timber contained in any log.

The parties shall at the time or place of measurement record in duplicate all such measurements of the timber as are agreed upon and sign the records and all logs of which the measurement may be in dispute shall be set aside and measured as soon as possible by an officer nominated by the District Forest Ranger of the New Zealand Forest Service or alternatively by a single arbitrator nominated by the parties.

The measurements of logs contained in the records so made and signed by or on behalf of the parties or by an officer nominated by the District Forest Ranger or their arbitrator shall be the basis of the calculation of the instalments of the royalty and for which purpose one copy of the records shall belong to each of the parties.

APPENDIX F1 PRELIMINARY COVERING LETTER AND  
QUESTIONNAIRE



MASSEY  
UNIVERSITY

Private Bag  
Palmerston North  
New Zealand  
Telephone 0-6-356 9099  
Facsimile 0-6-350 5627

FACULTY OF  
SOCIAL SCIENCES

DEPARTMENT OF  
GEOGRAPHY

12 September 1991

Dear Householder,

I am carrying out a survey to determine how people of the Manawatu-Wanganui Region feel about the preservation of native forest. The information you give will be used, in the context of a Masters thesis, to develop recommendations for an indigenous forest policy for the Manawatu-Wanganui Region.

To conduct this survey we need your help and would be very grateful if you would answer the enclosed questionnaire and return it in the postage-paid envelope provided. The answers you give will be strictly confidential. The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

Thank you for your co-operation and assistance. We look forward to receiving your completed questionnaire as soon as possible.

Yours sincerely,

Ruth Beanland  
Researcher  
Department of Resource and Environmental Planning  
Massey University

Supervised by:  
Johanna Rosier  
Department of Resource and Environmental Planning  
Massey University  
Ph. (06) 3569099

### Aorangi Awarua Block

Over the past six years there have been several applications made to authorities for permission to log parts of the Aorangi-Awarua Block of native forest.

The forest block lies 25 kilometres east of Taihape, in the north western corner of the Ruahine Range (see Map). It is bounded by the Rangitikei River to the west, the Ohutu Stream to the South and the Ikawatea River to the east. Its most distinctive feature is the flat topped limestone cap of Mount Aorangi.

The Aorangi Awarua forest ecosystem is a nationally significant resource. This is because nearly all such ecosystems have been lost from the southern North Island. Logging of the Aorangi Awarua Block can not be carried out without significant, irreversible change to this unique ecosystem.

Employment opportunities generated by logging are expected to be around six to twelve persons to be employed on a seasonal basis, six of which will be long term employees of the Rotorua based Company.

While logging of the block will provide some income to both owners and contractors; it will also reduce recreational, scientific, scenic, wildlife, and botanical values associated with the forest; and may also cause significant erosion problems, with a detrimental affect on the water quality and fisheries of the Rangitikei River.

QUESTIONNAIREPART 1 AWARENESS AND USE OF THE AORANGI AWARUA FOREST

1. Before reading this letter were you aware of the existence of the Aorangi-Awarua Forest?

Yes

No

2. Have you been to the Aorangi Awarua Forest?

Yes

No

3. If you answered yes to Question 2, which of the following activities did you do?

Tramping

Hunting

Fishing

Canoeing/Rafting  
(on the Rangitikei River)

Nature Appreciation  
(walking, picnicking, sightseeing,  
photography)

Others (Please Specify)

4. Show any activities you may wish to use the forest for in the future?

Tramping

Hunting

Fishing

Canoeing/Rafting  
(on the Rangitikei River)

Nature Appreciation  
(walking, picnicking, sightseeing,  
photography)

Others (Please Specify)

5. How important is the preservation of the native forest on the Aorangi-Awarua Block to you? (Please tick appropriate box).

Very Important	<input type="checkbox"/>
Moderately Important	<input type="checkbox"/>
Slightly Important	<input type="checkbox"/>
Not Important at All	<input type="checkbox"/>
Dont Know	<input type="checkbox"/>

6. Many reasons have been given for preserving remaining native forest. These reasons have been listed below. In the boxes provided, please place a score from 1 (most important) to 5 (least important) according to how you feel about each of these reasons.

Protecting  
wildlife  
and  
their living areas:

Soil  
Conservation:

Conserving  
natural areas for  
educational and  
scientific study:

The forest  
provides  
recreation  
opportunities:

The forest  
provides scenic  
beauty:

The forest  
provides  
spiritual  
inspiration:

Knowing that  
the forest  
exist:

Knowing that in  
the future, you  
or future  
generations have  
the option of going  
there if you choose:

PART TWO VALUING THE AORANGI-AWARUA FOREST

The Aorangi-Awarua Block is privately owned. The owners would stand to gain financially with a profit of approximately half a million dollars (1988 timber prices), if the block is logged. There would also be benefits to the Regional population in terms of increased income and jobs (six to twelve on a seasonal basis).

However, the negative effects (or costs) would be an irreversible change in the forest ecosystem, which would have an effect on all the plants and wildlife of the Forest. Very serious soil erosion would also occur, leading to a decline in water quality of the Rangitikei river. Fisheries will also therefore be affected.

Assume that the only way to prevent logging of the Aorangi-Awarua Block is for all households within the Manawatu-Wanganui Region to pay a special rate. Assuming that the owners are willing, the money provided by this special rate will be used to lease the land and to preserve the forest. The forest will then be able to be used by recreationists and tourists interested in low impact recreation such as tramping, hunting, fishing or the 'out-doors'. This special rate will allow the forest ecosystem to be protected.

This money would not be used for any other purposes except for the preservation of the Aorangi-Awarua Forest.

7. What is the maximum amount of money your household would pay annually for this special rate?

\$ \_\_\_\_\_ per year

8. If your household is not willing to pay into this fund, please explain why.

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PART THREE      INFORMATION ABOUT YOUR HOUSEHOLD

The following questions ask for some information about your household. The information will be strictly confidential and will not be personally identifiable in the study. The reason we ask you these questions is to make sure that we have surveyed a sample of people which represents the Manawatu-Wanganui Region.

8. How many people are there in your household?

\_\_\_\_\_

9. How many of these are children under the age of 15?

\_\_\_\_\_

10. Please describe yourself and members of your household in terms of the following characteristics:

HOUSEHOLD MEMBER	SEX	AGE	OCCUPATION
e.g.	male	45	builder
Yourself	1		
and other	2		
members of	3		
your	4		
household	5		
	6		
	7		

11. What was the total income of everyone in your household (before tax) last year (1990/91)?

(Circle number please)

1. \$0 to \$9 999
2. \$10 000 to \$14 999
3. \$15 000 to \$19 999
4. \$20 000 to \$24 999
5. \$25 000 to \$29 999
6. \$30 000 to \$34 999
7. \$35 000 to \$39 999
8. \$40 000 to \$44 999
9. \$45 000 to \$49 999
10. \$50 000 to \$54 999
11. \$55 000 to \$59 999
12. \$60 000 to \$64 999
13. \$65 000 to \$69 999
14. \$70 000 to \$74 000
15. More than \$75 000

APPENDIX F2 FINAL COVERING LETTER AND QUESTIONNAIRE

MASSEY  
UNIVERSITY

Private Bag  
Palmerston North  
New Zealand  
Telephone 0-6-356 9099  
Facsimile 0-6-350 5627

FACULTY OF  
SOCIAL SCIENCES

DEPARTMENT OF  
GEOGRAPHY

24 October 1991

Dear Householder,

I am carrying out a survey to determine how people of the Manawatu-Wanganui Region feel about the preservation of native forest. The information you give will be used, in the context of a Masters thesis, to develop recommendations for an indigenous forest policy for the Manawatu-Wanganui Region.

To conduct this survey we need your help and would be very grateful if you would answer the enclosed questionnaire and return it in the postage-paid envelope provided. The answers you give will be strictly confidential. The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off the mailing list when your questionnaire is returned. Your name will never be placed on the questionnaire.

Thank you for your co-operation and assistance. We look forward to receiving your completed questionnaire as soon as possible.

Yours sincerely,

A handwritten signature in cursive script that reads "Ruth Beanland".

Ruth Beanland  
Researcher  
Department of Geography  
Massey University

Supervised by:  
Johanna Rosier  
Department of Geography  
Massey University  
Ph. (06) 356 9099

#### Aorangi Awarua Block

Over the past six years there have been several applications made to authorities for permission to log parts of the Aorangi-Awarua Block of native forest.

The forest block lies 25 kilometres east of Taihape, in the north western corner of the Ruahine Range (see Map). It is bounded by the Rangitikei River to the west, the Ohutu Stream to the South and the Ikawatea River to the east. Its most distinctive feature is the flat topped limestone cap of Mount Aorangi.

The Aorangi Awarua forest ecosystem is a nationally significant resource. This is because nearly all such ecosystems have been lost from the southern North Island. Logging of the Aorangi Awarua Block can not be carried out without significant, irreversible change to this unique ecosystem.

Employment opportunities generated by logging are expected to be around six to twelve persons to be employed on a seasonal basis, six of which will be long term employees of the Rotorua based Company.

While logging of the block will provide some income to both owners and contractors; it will also reduce recreational, scientific, scenic, wildlife, and botanical values associated with the forest; and may also cause significant erosion problems, with a detrimental affect on the water quality and fisheries of the Rangitikei River.

QUESTIONNAIREPART 1 AWARENESS AND USE OF THE AORANGI AWARUA FOREST

1. Before reading this letter were you aware of the existence of the Aorangi-Awarua Forest?

Yes   
 No

2. Have you been to the Aorangi Awarua Forest?

Yes   
 No

3. If you answered yes to Question 2, which of the following activities did you do?

Tramping

Hunting

Fishing

Canoeing/Rafting  
 (on the Rangitikei River)

Nature Appreciation  
 (walking, picnicking, sightseeing,  
 photography)

Others (Please Specify)

4. Show any activities you may wish to use the forest for in the future?

Tramping

Hunting

Fishing

Canoeing/Rafting  
 (on the Rangitikei River)

Nature Appreciation  
 (walking, picnicking, sightseeing,  
 photography)

Others (Please Specify)

5. How important is the preservation of the native forest on the Aorangi-Awarua Block to you? (Please tick appropriate box).

Very Important	<input type="checkbox"/>
Moderately Important	<input type="checkbox"/>
Slightly Important	<input type="checkbox"/>
Not Important at All	<input type="checkbox"/>
Dont Know	<input type="checkbox"/>

6. Many reasons have been given for preserving remaining native forest. These reasons have been listed below. In the boxes provided, please place a score from 1 (most important) to 5 (least important) according to how you feel about each of these reasons.

Protecting  
wildlife  
and  
their living areas:

Soil  
Conservation:

Conserving  
natural areas for  
educational and  
scientific study:

The forest  
provides  
recreation  
opportunities:

The forest  
provides scenic  
beauty:

The forest  
provides  
spiritual  
inspiration:

Knowing that  
the forest  
exist:

Knowing that in  
the future, you  
or future  
generations have  
the option of going  
there if you choose:

PART TWO VALUING THE AORANGI-AWARUA FOREST

The Aorangi-Awarua Block is privately owned. The owners would stand to gain financially with a profit of approximately half a million dollars (1988 timber prices), if the block is logged. There would also be benefits to the Regional population in terms of increased income and jobs (six to twelve on a seasonal basis).

However, the negative effects (or costs) would be an irreversible change in the forest ecosystem, which would have an effect on all the plants and wildlife of the Forest. Very serious soil erosion would also occur, leading to a decline in water quality of the Rangitikei river. Fisheries will also therefore be affected.

Assume that the only way to prevent logging of the Aorangi-Awarua Block is for all households within the Manawatu-Wanganui Region to pay a special rate. Assuming that the owners are willing, the money provided by this special rate will be used to lease the land and to preserve the forest. The forest will then be able to be used by recreationists and tourists interested in low impact recreation such as tramping, hunting, fishing or the 'out-doors'. This special rate will allow the forest ecosystem to be protected.

This money would not be used for any other purposes except for the preservation of the Aorangi-Awarua Forest.

7. What is the maximum amount of money your household would pay annually for this special rate?

\$ \_\_\_\_\_ per year

8. If your household is not willing to pay into this fund, please explain why.

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11. What was the total income of everyone in your household (before tax) last year (1990/91)?

(Circle number please)

1. \$0 to \$9 999
2. \$10 000 to \$14 999
3. \$15 000 to \$19 999
4. \$20 000 to \$24 999
5. \$25 000 to \$29 999
6. \$30 000 to \$34 999
7. \$35 000 to \$39 999
8. \$40 000 to \$44 999
9. \$45 000 to \$49 999
10. \$50 000 to \$54 999
11. \$55 000 to \$59 999
12. \$60 000 to \$64 999
13. \$65 000 to \$69 999
14. \$70 000 to \$74 000
15. More than \$75 000

12. Do any members of your household:

- (a) belong to an environmental organisation (e.g. Greenpeace, Maruia or Forest and Bird Society)?

Yes

No

- (b) use native forests within the Manawatu-Wanganui Region (other than the Aorangi Awarua Forest) for sport and recreation?

Yes

No

13. Do you have any further comments on the management or use of privately owned native forests within the Manawatu-Wanganui Region?

THANK YOU VERY MUCH FOR YOUR HELP

PLEASE RETURN YOUR COMPLETED QUESTIONNAIRE  
IN THE ENVELOPE PROVIDED (NO STAMP IS NEEDED).

APPENDIX F3 FOLLOW UP LETTER

14 November 1991

Dear Householder,

**AORANGI-AWARUA FOREST SURVEY**

You should have received in the mail a copy of a questionnaire in regard to a study of the Aorangi-Awarua Block of native forest. To date we have not received any reply from you so this letter is to kindly urge you to fill in the questionnaire and return it in the postage-paid envelope as soon as possible.

Your reply is very important to both the success of the survey and the development of policy for the management of native forests within the Manawatu-Wanganui Region. Your opinions and views are needed to help assess the values people hold for native forest.

If you have already returned your questionnaire please ignore this letter.

Thank you very much for your co-operation,.

Yours sincerely,



Ruth Beanland  
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Department of Geography  
Massey University

For: Johanna Rosier  
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FACULTY OF  
SOCIAL SCIENCES

DEPARTMENT OF  
GEOGRAPHY

APPENDIX F4 CORRELATION COEFFICIENTS

RESPO	.063								
AWAR E	.111	.121							
USE	.085	.134	.365						
PRESE	.023	.052	.137	.098					
INCOM	.060	-.009	-.012	.151	-.048				
OCCUP	-.148	.038	.123	.105	.056	.367			
SEX	.099	.137	.046	.066	-.202	.001	-.091		
AGE	-.002	.070	.007	-.159	-.076	-.176	-.244	.198	
WTP	.009	-.025	.024	-.042	-.051	.037	.133	.074	-.118
	LOCAT	RESPO	AWAR E	USE	PRESE	INCOM	OCCUP	SEX	AGE

Key

LOCAT = Location; RESPO = Response; AWARE = Awareness;  
 PRESE = Preservation; INCOM = Income; OCCUP = Occupation;  
 WTP = Willingness To Pay.

APPENDIX F5 SAMPLE SIZE

Source: Mitchell and Carson (1989, p.225).

Table 10-1. Sample Sizes Needed (usable responses)

V, $\alpha$	$\Delta$						
	.05	.10	.15	.20	.25	.30	.50
V = 1, $\alpha$ = .10	1,143	286	127	72	46	32	12
V = 1, $\alpha$ = .05	1,537	385	171	97	62	43	16
V = 1.5, $\alpha$ = .10	2,571	643	286	161	103	72	26
V = 1.5, $\alpha$ = .05	3,458	865	385	217	139	97	36
V = 2.0, $\alpha$ = .10	4,570	1,143	508	286	183	127	46
V = 2.0, $\alpha$ = .05	6,147	1,537	683	385	246	171	62
V = 2.5, $\alpha$ = .10	7,141	1,786	794	447	286	199	72
V = 2.5, $\alpha$ = .05	9,604	2,401	1,608	601	385	267	97
V = 3.0, $\alpha$ = .10	10,282	2,570	1,143	643	412	286	103
V = 3.0, $\alpha$ = .05	13,830	3,458	1,537	865	554	385	139

V is the coefficient of variation,  $\frac{\sigma}{\overline{RWTP}}$

$\Delta$  is the possible deviation as percentage of  $\overline{RWTP}$

$\alpha = .05$  indicates that 95% of the time estimated  $\overline{WTP}$  will be within  $\Delta$  of  $\overline{TWTP}$

$\alpha = .10$  indicates that 90% of the time estimated  $\overline{WTP}$  will be within  $\Delta$  of  $\overline{TWTP}$