STRATEGIC FLOOD HAZARD MANAGEMENT

- A PLANNING PROCESS -

- CASE STUDY HOROWHENUA -

A thesis presented in fulfilment of
the requirements for the degree of
Master of Regional Planning at Massey University

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ABSTRACT

This thesis uses the strategic planning process as a framework to derive a practical planning process for flood hazard management in the Horowhenua.

The broad goal of the study is 'To Provide a Better Planning Process for Mitigating Flood Hazards in the Study Area of the Horowhenua.'

The strategic planning process is used to develop an action plan for one particular organisation, the Manawatu Wanganui Regional Council, to help mitigate flood hazards in the Horowhenua. However, the principles identified in the process are of use to other organisations and for other geographic areas.

A large part of achieving the broad goal of the study was to increase understanding of the flood hazard problem of the Horowhenua area. A large component of this thesis is therefore, the scanning of the environments relevant to the flood hazard problems. These environments include the physical, institutional and behavioural components of the flood hazard problem. From this scanning 'key issues' which help to further understand the problem are identified. These issues are taken into consideration in an action plan for one organisation. The action plan provides a process whereby the issues and the interrelationships between these issues are identified for consideration in flood hazard management. Planners of the organisation can link into the process, as resources become available, with the knowledge that the information they produce and subsequent action taken will link into an overall process.

Although the thesis attempts to identify all the issues that need to be considered in a flood hazard management planning process, it still acknowledges that there will always be problems and uncertainties such as political and financial constraints limiting the process.

PREFACE AND ACKNOWLEDGEMENTS

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INTRODUCTION

INTRODUCTION

GENERAL

This thesis uses the strategic planning process to derive a pragmatic planning process for the Manawatu Wanganui Regional Council to undertake flood hazard management in the Horowhenua, and thereby mitigate potential hazards.

MOTIVATION

The prime motivation for this thesis is a result of the authors working involvement in flood hazard mitigation in the Horowhenua area. The author felt that attempts to mitigate flood hazards in the Horowhenua where generally ad hoc, with key organisations responsible for flood hazard management working in isolation, and often departments within these organisations working in isolation. This isolated work resulted in only certain aspects of the problem being considered. There seemed to be a need to 'stand back' and assess the full range of issues influencing the problem and develop a process for dealing with the problem.

Other, more general, motivating forces for the thesis include the recent reorganisation of local government in New Zealand and the redrafting of many diverse resource management laws into one Resource Management Bill. These two activities have resulted in a wide spread analysis and debate of the role and responsibility of local government in New Zealand. These two activities have also offered an increased opportunity to reassess and change the way flood hazard mitigation is dealt with by local government in New Zealand.

Review of local government structures and changing central government policy has resulted in an increasing emphasis on local government responsibility for effective hazard mitigation. Central government's financial assistance to regional government for resource management is increasingly emphasising regional adjustment to achieve sustainable solutions for resource management problems. Central government is directing regions to become self sufficient in dealing with resource management problems as soon as practicable, but is prepared to offer financial assistance to achieve this ends where the total

programme of regional adjustment is beyond the region's ability to pay in the medium term. (Deputy Secretary for the Environment letter 5 September 1990 refer Appendix B)

It is therefore increasingly important that regional government direct their limited financial resources into the most effective long term and sustainable methods to achieve flood hazard mitigation. A planning process which regional government could use to consider the wider range of issues relevant to effective flood hazard mitigation is therefore needed to help make better decisions about investment of resources to achieve flood hazard mitigation.

The Horowhenua area was selected for case study due to the rapid increase in intensive rural land use and associated subdivision and development. Increasing development and investment within floodable areas results in an increasing potential hazard. For this reason, it seemed important to assess how flood hazard mitigation should be dealt with in Horowhenua promptly, before the potential hazard expanded.

OBJECTIVES OF THIS THESIS

The broad goal of this thesis is **'to provide a better planning process for mitigating flood hazards in the study area.'**

To achieve this broad goal the thesis takes a number of steps. These steps can be translated into a series of objectives of the thesis or strategic planning process.

1. To assess the various theoretical frameworks of the planning process and their suitability to form the base of this study.

2. To examine a range of planning literature and approaches to flood hazard management to identify useful information for this study.

3. To enable a better understanding of the problem. Not only the physical flood problem, but also the behavioural and institutional aspects of the problem and the interrelationships between these aspects.

4. To provide a pragmatic action plan for the Manawatu Wanganui Regional Council to help mitigate and manage the flood hazard in the Horowhenua. The action plan should include contingency options, where appropriate, and enable planners to link into the process as resources become available.

5. A more personal objective is to provide an opportunity for the author to 'stand back' from the 'sharp edge' of day-to-day plan implementation and think through a process to help improve the existing planning approach.

OUTLINE OF CHAPTERS

Chapter One

Chapter One examines theoretical frameworks of the planning process and identifies the suitability of the strategic planning process as the main basis for this study. Varying approaches to flood hazard mitigation are reviewed so that this thesis can incorporate the benefits and problems of other approaches. General assumptions and limitations of flood hazard planning are identified.

Chapter Two

Chapter Two begins by explaining the process of the study, it explains the information sources used in the study and introduces the study area, the Horowhenua. The chapter then proceeds to examine the institutional, behavioural and physical environments of flood hazard mitigation identifying 'key issues' within these environments that need to be addressed in an 'action plan' for flood hazard mitigation by the Manawatu Wanganui Regional Council.

Chapter Three

Chapter Three presents the action plan for flood hazard mitigation by the Manawatu Wanganui Regional Council. The plan is presented in a series of steps. These steps are then further elaborated on in a breakdown and explanation of each step.

Chapter Four

Chapter Four discusses the thesis, and the use of the strategic planning process in the thesis to achieve the broad goal of **'providing a better planning process for mitigating flood hazards in the study area of the Horowhenua.'**

CHAPTER ONE - REVIEW OF RELATED LITERATURE

CHAPTER ONE - REVIEW OF RELATED LITERATURE

1.1 GENERAL

This chapter aims to achieve the following four objectives:

1) theoretical frameworks of the planning process will be analysed to determine their suitability to form a basis for this study.
2) flood mitigation and planning literature will be reviewed to identify how this literature is useful to this study.
3) general assumptions suitable for flood hazard planning will be identified.
4) general limitations of flood hazard planning studies will be identified.

1.2 THEORETICAL FRAMEWORK

1.2.1 Background

'Planning' as a discipline has been given numerous definitions by various theorists. Definitions of planning include statements such as **"planning linking knowledge to action"** (Friedmann 1976) and **"planning is a process"** (Friend and Jessop 1969), which are very general definitions. Other definitions go further in attempting to identify the extreme complexity of planning as a discipline;for example Buchanan, (1963) identified planning as being:

> **" a ruthless bargaining process.....concerned with conflicts of interest and the distribution of limited resources....deals with interrelationships of and between social, economic, physical and political issues."**

Grigg (1985) reinforces the view that planning is an extremely complex discipline in his identification of five main areas which require knowledge if water resource planning is to be effective. The areas requiring knowledge include the diverse topics of 'politics, finance, procedures, techniques and evaluation.'

An overview of the history of planning theory illustrates how planning theory evolved to explicitly recognize the complexities and uncertainties inherent in all

planning work. This overview will also provide the reader with an understanding of the theoretical framework for this thesis.

The evolution of theoretical approaches to planning has been marked by realizations of the limitations or inadequacies of existing approaches and a change towards more appropriate frameworks. In this sense planning theory has itself evolved in a crisis-reaction motion, ie. as one approach is obviously not taking account of the complexities of the real world, another approach is advocated by the theorist. The development of planning theory is therefore similar to the development of most theories. Theories develop in response to their perceived adequacy of testing hypotheses against the 'real world'.

Due to such realisations, the general theme of planning theory has moved away from centralised action, or control, to decentralised action; and an increasing amount of political involvement and less technical involvement. Batty (1979) identifies three main approaches to planning:

1) The technical process of the golden age.
2) The systems approach.
3) The social learning paradigm.

The technical process of the golden age (pre 1960's) is marked by such planning pioneers as Ebenezer Howard who based his planning approach on master minding a plan or a 'blueprint' for a city. This type of planning is still very much the public's perception or understanding of planning. Some early planning pioneers such as Geddes (1923) identified the need for an understanding, or survey, of the city system prior to planning or action. It is these thoughts of Geddes that resulted in the catch phrase 'survey analysis plan' becoming popular prior to the 1960's. The Geddes approach acknowledged the complexities associated with the physical environment, however, the complexities of the planning system and behavioural environment were not acknowledged.

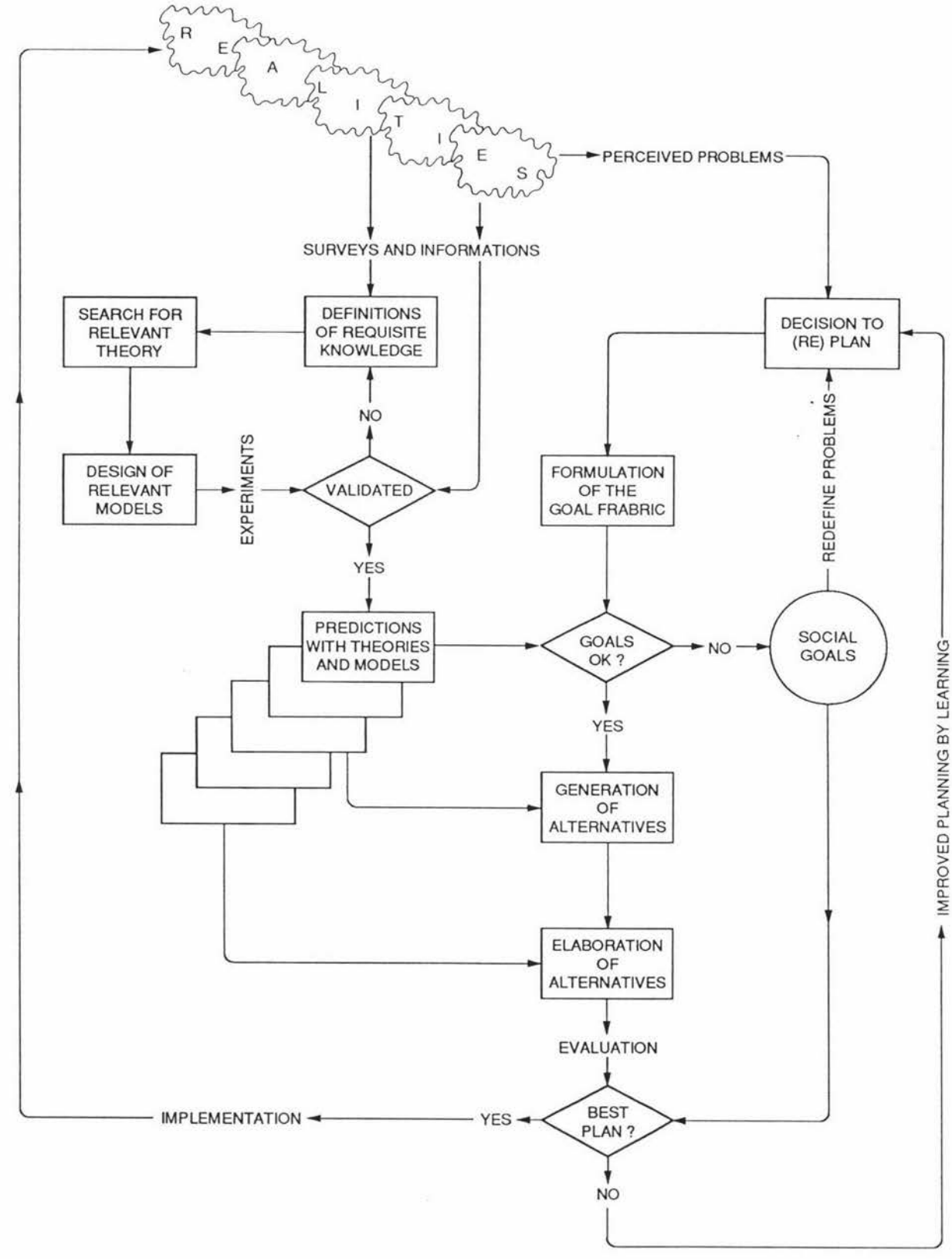
The systems approach to planning emphasised the interrelationship between the physical system or 'city system' and the 'planning system'. The systems

approach to planning attempted to make the process of decision making explicit. The 'rational decision making model' is perhaps the most commonly used model within the systems theories. The rational decision making model involved an awareness of a wide range of social objectives, ie. not just the intuitive objectives of the planner as in the 'master plan' approach. The rational decision making approach aims to identify a range of objectives and goals against which politicians could measure the alternatives offered to them. (refer figure 1)

In its simplest form this type of decision making did not take account of changing times and social learning. Hence, the goals and objectives were soon outdated and 'learning by previous action' was not explicitly included in the plan. More complex models of the planning process were developed to take account of feedback and the uncertainty of the real world. However, the rational decision making model relied on the assumption that a rational decision or 'output' could be made with good, if not perfect knowledge, ie. inputs by way of some transformation (rules or regulations) created the plan or output. Inherently, this was the weakness of the model. Theorists accounted for the complexities of the real world and the wide range of values by considering multiple goals and solutions against which politicians could explicitly assess alternatives. However, the complexities of the real world were boundless and frequently long term goals were abandoned in favour of ad hoc or incremental action. ie, the circular motion of problem-reaction-problem developed.

Theorists such as Etzioni (1967 and 1968) explained this by arguing that systems have at least two major decision making functions, a higher order one maintaining progress involving long term goals, and a lower order one, involving muddling through by day to day problem solving.

The 'rational decision making model' was one way of explicitly showing the varying values of society in the planning process. However, it is difficult to take account of the huge array of society's values. Typically the theory has been applied in the real world without explicitly taking account of the goals of the planning bureaucracy, the elected representatives and the wider community.



Source: Batty, M. 1979, p35.

Figure 1. The Rational Decision Making Process

The 'rational decision making process' has tended to be applied in a scientific way where a range of goals were presented which 'generally' seemed acceptable or rational. The planners, bureaucrats or politicians did not acknowledge their own goals or the full range of community goals which are all based on differing perspectives of 'rationality'.

Realisations of the complex interactions of the planning process and the social system led to planning theories which accommodated further turbulence of the real world. Examples of this type of theory include Friend and Jessop's (1969) **'planning as strategic choice'**, and Battey's (1979) **'social learning paradigm'**. These types of theories accepted that plans are doomed to failure if they try to control complexity by more rules and greater bureaucracies because these structures themselves increase the complexities of the real world thereby creating a 'vicious cycle'. However, the theories realise that to allow less control, less centralised action and to account for uncertainty, society must become more responsive and responsible, less reliant on state control and take responsibility for its actions, ie. social learning. Put another way by Battey (1979) the move in:

> **" planning from technics to politics, from individual action to collective action, from passive science to active science all impress the need for increased participation and understanding to overcome the endemic uncertainty."** ie. social learning.

Further Battey (1979) states:

> **"planning processes which meet the challenge of infinite complexity promote open systems which are adaptive ie. they acknowledge total comprehension of the problem is not possible, they accept the political, financial, and structural limitations of the plan."**

The concept of 'social learning' as planning may be seen to acknowledge the necessity both for planning to move closer to the realities of society and for society to have a greater understanding of the need for planning. Bolan (1967) makes this point:

> **"...no matter how we improve our substantive knowledge of how cities function, and no matter how we improve our capabilities in information handling, operations research and prediction, if there is not a corollary development of the community's capacity for improved decision-making within the framework of**

democratic processes, there is the real possibility that heavy investment in the current forms of city planning technique will have been in vain."

ie. we have to encourage and increase public awareness of planning and the role of the public in planning.

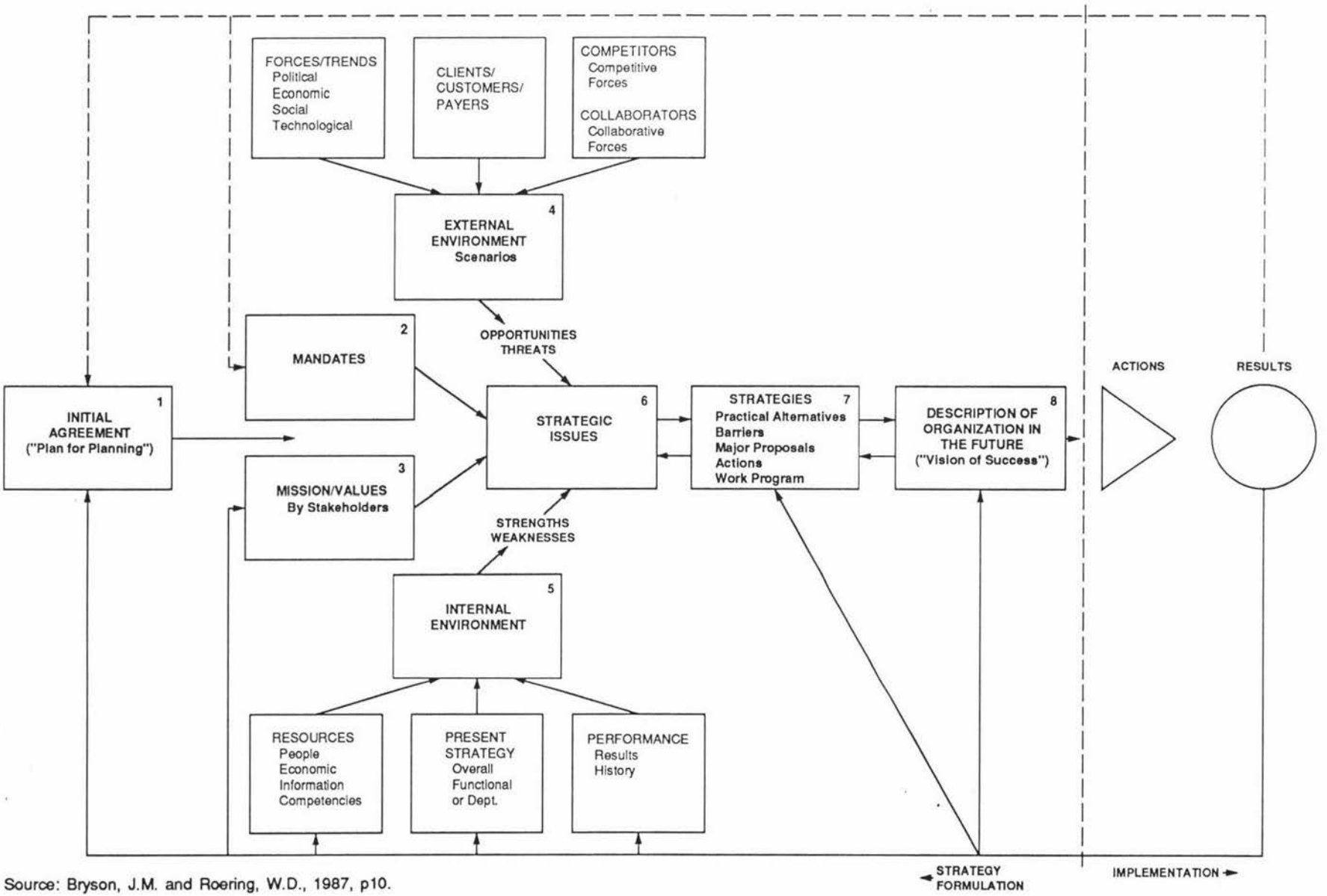
1.2.2 Strategic Planning

The strategic planning process is the main approach adopted for this study. The strategic planning process does not discard previous planning theories but adds a new emphasis, taking into account the structure and potential for action of the organisation which is undertaking the planning. It is therefore a very pragmatic approach to planning. The process includes practical alternative or contingency plans. (Lang, R. 1986)

Bryson and Roering (1987); and Kaufman and Jacob (1987) have written on the application of private-sector type strategic planning in the public sector. The writers see strategic planning as differing from long term traditional planning especially, comprehensive or master planning, in that the emphasis in strategic planning is on:

1. Action.
2. Consideration is of a broad or diverse set of 'stakeholders' (ie. involvement of key decision makers outside and within the organisation as well as public participation.)
3. There is more emphasis on external opportunities and threats, and internal strengths and weaknesses.
4. There is more attention on actual/potential competitors (particularly applicable to private sector strategic planning).
5. Recognition that the support and commitment of chief executives and politicians is necessary if the plan is going to succeed.
6. There is a need to identify the 'musts' and 'wants'.
7. Recognition of politics, personalities and funding.

Figure 2 shows the strategic planning process to incorporate the complexities of the real world in the planning framework.



Source: Bryson, J.M. and Roering, W.D., 1987, p10.

Figure 2. The Strategic Planning Process

Figure 3 provides a more simplistic illustration of the strategic planning process.

Table 1 Provides a comparison between the strategic planning process and conventional planning.

1.2.3 Conclusion

The review of planning theory has shown an evolution in the emphasis of planning theories through time. Geddes (1923) recognised the complexity of the physical environment in his proposal to survey the physical environment before designing a plan. The systems theorists emphasised a process in which decisions were made by explicitly presenting the process of decision making. The 'rational decision making model' was the most commonly used decision making model of the systems era, however, it was and still is commonly applied without explicitly acknowledging some of the most influential perspectives of rationale, such as political and professional motivation.

The strategic planning option which has been adopted from the private sector emphasises action by a particular organisation. It is a pragmatic approach to planning which acknowledges the politics, personality and funding constraints impinging on the problem.

In this thesis the author has attempted to integrate the afore-mentioned theoretical approaches with an overall emphasis on strategic planning. The physical environment is surveyed and acknowledged as an important factor in understanding the problem and deriving a solution. The varying motivating values of 'stakeholders' are seen as important in understanding the problem and these are examined in the 'behavioural environment' section. The 'institutional environment' is examined to explicitly acknowledge and understand the complexities of the planning system.

This is all undertaken in the context of a strategic planning framework where the emphasis is on an action plan for a particular organisation. The value of the strategic planning process approach to this thesis is that it provides a framework for deriving a practical planning process for flood hazard

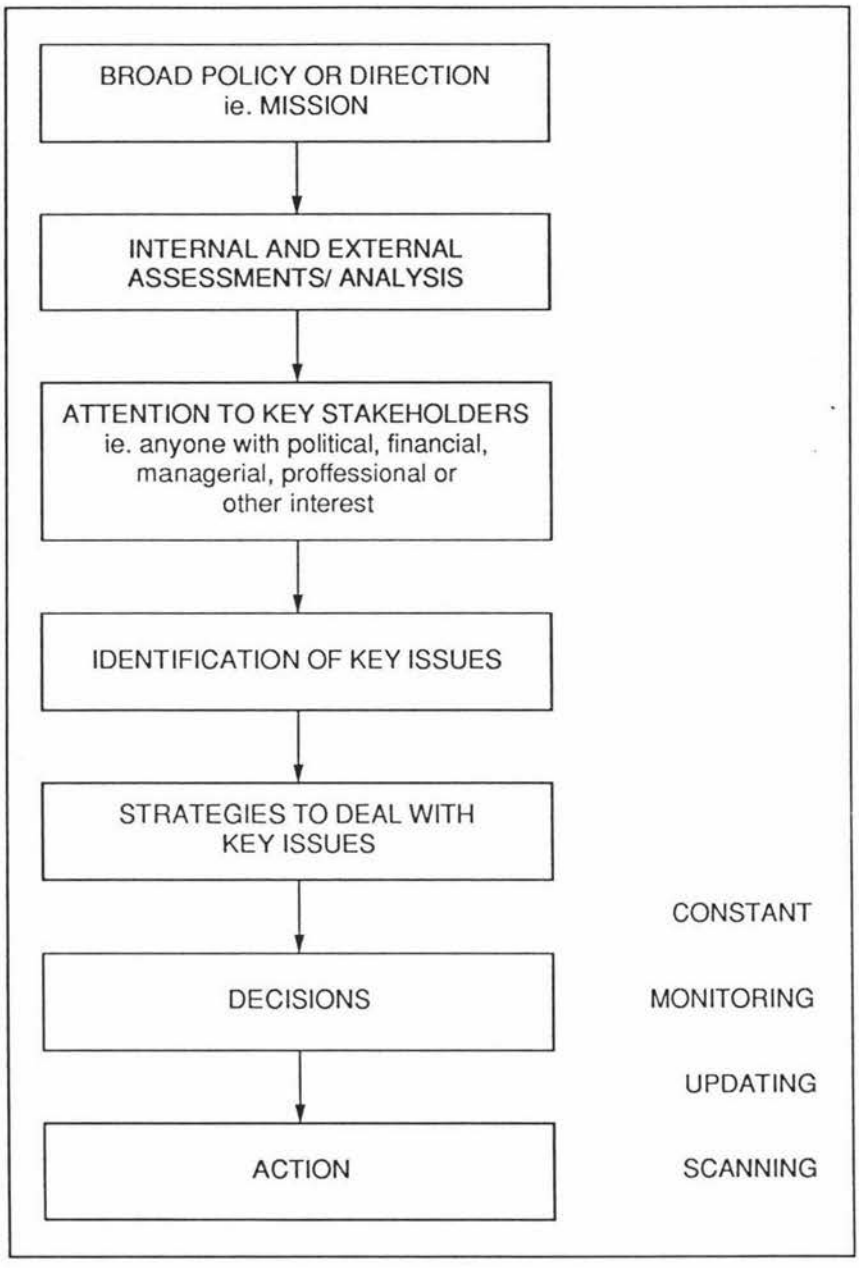


Figure 3. Simplistic Model of the Strategic Planning Process

Table 1. Comparison of Strategic and Conventional Planning Approaches

Strategic Planning	Conventional Planning
Action - oriented; planning and implementation as a single process	Plan - oriented; planning separated from implementation
Oriented to the organization's mandate and its internal/external environment	Oriented to substantive issues; organizational issues are suppressed
Focused and selective	All - encompassing
Situational analysis includes examination of organization values and critique of its performance	Organization's values not considered and its performance not examined critically
Environmental scan considers factors in external environment affecting achievement of objectives	Environmental scan rarely done
Explicit mission statement, fully cognizant of implementation capability	Vague goals not tested for consistency or implementability in a shared action space
Proactive, with contingency planning	
Strongly oriented to allocation organizational resources; budget is key integrator	Preactive often separated from budgeting
Planning process is ongoing	Planning process is periodic
Builds capacity for planning and organizational learning	Capacity - building not an explicit objective
Values intuition and judgement highly	Values analysis highly

Source: Lang, R., 1986, p5.

management in the Horowhenua. It acknowledges the constraints of time and information and is committed to the outcome of action.

Flood hazard management is inherently complex, it is traditionally thought of as a physical problem, however the problem includes several other components. Not only does the physical flood problem involve all the uncertainties of a natural event, but the institutional and behavioural environments of floodplain management are complicated by politics, funding, legislation and personalities. To ignore these 'realities' that impinge on floodplain management would make any plan worthless. To emphasise the importance of one particular environment would be at the danger of losing sight of the full problem at hand. It is important to understand all the issues that make up the problem including the interrelationships between the issues. Only after an examination of the wider context in which existing planning takes place, is it possible to develop a strategic action plan for flood hazard mitigation. Grigg (1985) states in his book relating to water resources planning that the first step in the planning process is to:

> **"Identify the problem"**

this he says:

> **" is often a larger part to identifying a solution than one might think, if the planning team can think clearly about the real problem to be faced, the solution will come into view faster."**

The strategic approach of identifying the problem will therefore involve answering the following questions:

What are we trying to do?

How is it going so far?

Why isn't it going so well?

By using the strategic planning process and applying it to floodplain management in the Horowhenua this thesis aims to provide a more practical planning process for floodplain management. The thesis will identify all the issues that need to be considered in floodplain management, but still acknowledge that there will always be problems such as political and financial constraints limiting the process. Planners will be able to concentrate on aspects of the process, as resources come available, with the knowledge that the information produced links into the strategic process.

1.3 FLOOD HAZARD MITIGATION AND PLANNING LITERATURE.

1.3.1 Background

A review of existing literature which proposes planning frameworks and analyses the success of them in certain situations provides some valuable lessons in preparing a floodplain planning process.
This section will firstly overview some approaches taken in different countries and then compare them against each other and against the strategic planning process. (outlined in section 1.2.2)

1.3.2 Australia (NSW)

New South Wales Government 'Floodplain Development Manual December 1986'

The purpose of the manual is to assist consent authorities in dealing with flood prone land in accordance with the government's policy. The policy aimed to reduce flood hazards but in doing so recognised that flood prone land had value, and that development proposals on such land should be based on their merits, taking account of social, economic and ecological, as well as flooding considerations. The manual considers a large range of floodplain management measures including:

1) Structural measures (land use control, building control)
2) Financial Relief (flood insurance, voluntary purchase)
3) Disaster Avoidance (public education)

The manual acknowledges 'intangible' costs of flooding such as: social disruption, inconvenience, anxiety, trauma, and physical ill-health. The manual also plays an important role in the statutory liability of local government for flood hazard mitigation. The Local Government (flood liable land) Amendment Act 1985, makes local authorities immune from liability associated with flooding provided they have acted (by way of information provision and activities), **"in good faith"**. The Act states that a Council can be considered as acting **"in good faith"** if it acts substantially in accord with this manual. The Manual even goes as far as setting out a standard procedure for local authorities to establish a

'Draft Local Government Floodplain Management Policy' and a 'Draft Flood Proofing Code'. These types of standard procedures represent an example of the 'blue print' or 'master plan' approach to planning.

The process proposed by the manual is illustrated in figure 4.

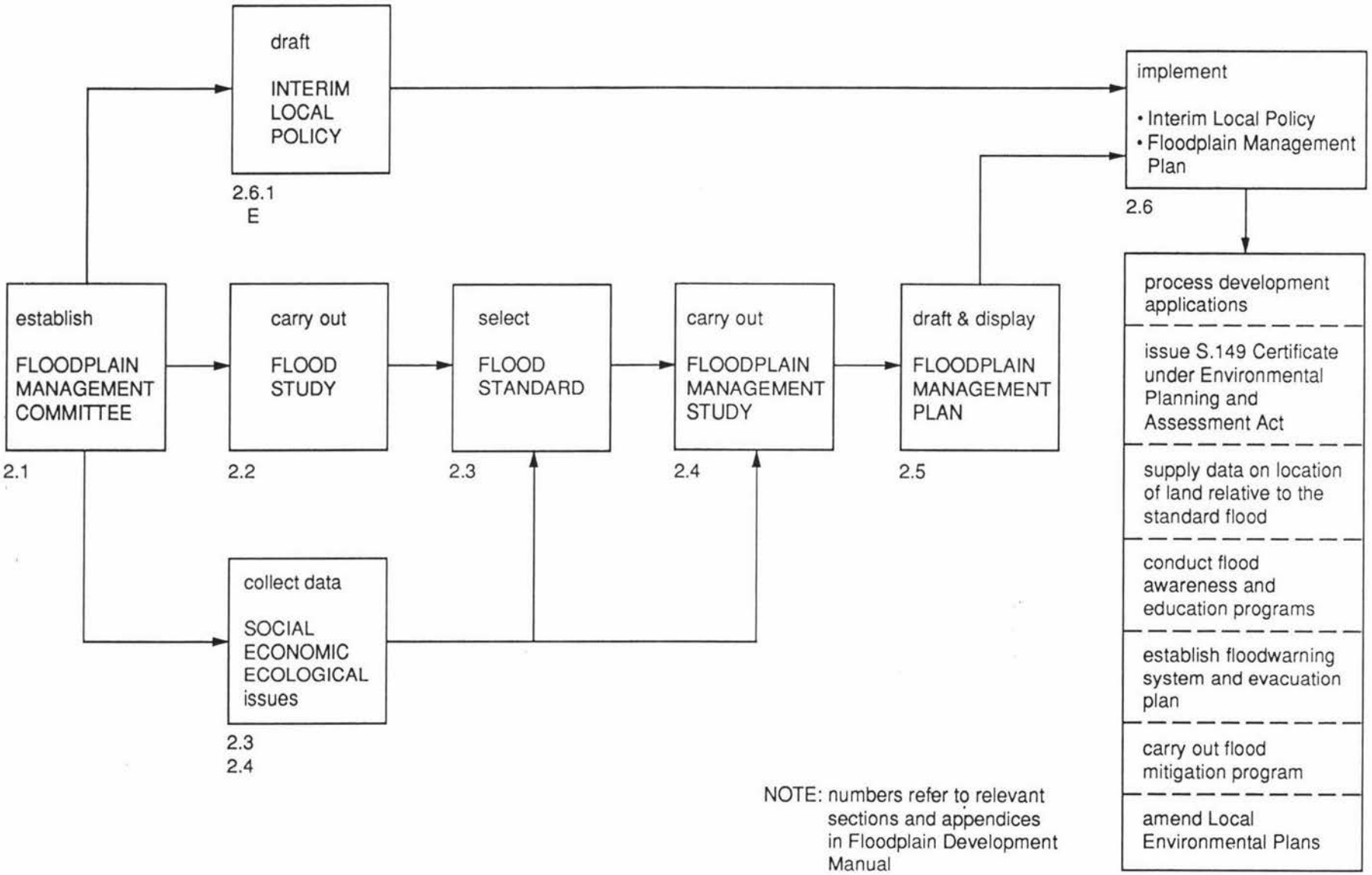
In May 1989, a discussion paper: 'Review of Floodplain Management Practice in New South Wales', was published. The review was undertaken by the Government as a result of the considerable suffering and financial losses resulting from the widespread flooding in NSW during 1986, 1987 and 1988. Major problems in the effectiveness of the 1986 policy and manual were identified by the review, these included: lack of funding; there was no acknowledgement of urban drainage problems; impact of upstream development was not considered; there was a lack of coordination between Councils; there was a lack of attention to helping people help themselves, (eg. by house raising); the area of flood insurance options has been ignored; the merit principle was not working; Councils tended to adopt the 1% flood frequency criterion automatically without analysing the consequences of various flood frequencies; and few Councils had resources or the political will to follow the principles set out in the manual.

1.3.3 New Zealand

National Water and Soil Conservation Authority

In December 1987 the National Water and Soil Conservation Authority (NWASCA) adopted a Floodplain Management Policy (refer Appendix C) with the aim that the policy would apply to all new activities from 1 April 1988. The policy identified three ways of dealing with flood hazards:

a) Keep man away from water, eg. by zoning, minimum floor levels.
b) Keep water away from man, eg. by stopbanks, catchment treatment.
c) Deal with the consequences of flooding, eg. by flood warning, insurance.



Source: New South Wales Government, 1986.

Figure 4. The New South Wales Floodplain Management Planning Process

The policy goals included:

(1) The persuasion of all agencies whose decisions affected floodplain development to take account of flood hazards in their policies.

(2) Pursuing the desirability of central government departments and State Owned Enterprises to take a financial share in the cost of flood losses.

(3) The encouragement of catchment authorities to formulate and carry out plans for floodhazard areas in their district; provision of tools and techniques for use in floodplain management planning; instigation of technical and social research.

(4) Promotion targeted at floodplain dwellers to increase their understanding of how to deal with flood hazards.

The policy was to be made implementable by way of subsidising those catchment authorities whose activities are justifiable in terms of this policy. The policy further stated that as from 1 April 1991, subsidy for expenditure on flood elevation measures will be conditional upon proposals being consistent with a Floodplain Management Plan.

The main problems with the policy were that was no acknowledgement of the general lack of control NWASCA had over any activities of local authorities and other government departments. The only real power NWASCA had over catchment authorities was through the provision of money in the way of catchment grants. The policy was in fact never implemented as the demise of NWASCA along with the Ministry of Works and Development (MOWD) occurred at the same time the policy was to become operational. Had such a policy been in place earlier more detailed assessments would have been made as to effective spending of catchment grant money. However, the policy did not really require any specific analysis of best spending areas. The policy indicated a move away from emphasising structural solutions such as stopbanking, and other engineering works, and a greater concentration on alternative educational and regulatory mechanisms. However, there were some

inherent problems within catchment boards which would impede adoption this policy. For example, catchment authorities had little planning or regulatory authority or expertise to implement the policies.

David Bewick of the Water and Soil Directorate of MOWD simultaneously was preparing a paper called 'Guidelines for Floodplain Management Planning Studies' which was in its second draft by March 1988. The guide aimed to assist territorial local authorities and catchment authorities in conducting floodplain management planning studies, by providing background information on the theory and techniques involved in flood hazard assessment and management planning. The manual draws heavily on the NSW Floodplain Development Manual.

Similar to the previous examples of frameworks, this draft guide provided a useful reference for local authorities but was based very much on a rational decision making model which emphasised the physical problem and a series of alternatives for addressing or controlling it. Institutional, political and financial problems were not recognised within the process.

Bewick did, however, propose a clear process and range of alternatives for dealing with the physical flood problem which an organisation could 'pick up' and apply to a particular geographical area.
The process advocated in Bewick's manual can be summarized as:

1) Set up a floodplain management working group to co-ordinate the study.

2) Undertake a flood hazard assessment study (with flood mapping).

3) Selection of a base flood (a suitable flood level to plan for).

4) Evaluate Options.

5) Prepare a Management Plan.

1.3.4 USA

The United States approach to floodplain management is very much influenced by the National Flood Protection Insurance Program (NFIP). Unlike New Zealand, USA home owner insurance does not ordinarily cover losses caused by flooding, however, communities can participate in the NFIP. Premium rates for the program are based on the type of house, its elevation and location on the Community's Flood Insurance Rate Map (a map showing the potential flood risk of the area), ie. the greater the potential for flood damage, the higher the premium rate.

Local Authority eligibility for the NFIP relies on the local authority having floodplain development regulations and specific flood damage reduction programmes. The minimum ordinances required by the NFIP rely more than anything on structural mechanisms of controlling activities on the floodplain, eg. raised floor levels, mounding, levees, flood walls. This type of floodplain management has already been identified by many researchers, eg. Burby and French 1986, as not the most efficient type of floodplain management.

The NFIP program regulations concentrate on influencing design of new development and location within the floodplain rather than discouraging or preventing floodplain use.

The American approach to floodplain management reflects the Americans' belief that the individual has the right to control his or her private property and if a floodplain problem exists the owner will need to choose whether to pay for insurance to protect the property. This is very much a market approach. In fact, Laska (1986) found in her survey of the people of Slidell, Louisiana, who had recently been flooded or were at risk from flooding, that still 20% of those surveyed believed in the statement:

> **" A developer has the right to develop land he or she owns. It is up to the buyer to beware of possible problems."**

Burby and French (1981), studied 16 500 local authorities involved in the NFIP who had development pressure on their floodplain. They found the interesting paradox that those authorities who were paying the most attention to floodplain land use management programs (both structural and non-structural) were also

the places where encroachment on floodhazard areas was the biggest problem. This limited the programs' effectiveness. This was because communities were not becoming concerned with floodplain land use management and consequently were not adopting vigorous management programs until after they had created a problem by allowing floodplain invasion. Once extensive floodplain development has occurred, land use management may not be the appropriate management approach.

At the conclusion of their study Burby and French made a number of pragmatic recommendations which are of high relevance in considering the approach taken in this thesis.

Summary of the Recommendations made by Burby and French (Burby and French 1981)

1) Where considerable development on the floodplain has taken place, a mix of structural and land use management measures is necessary. However, care must be taken to strictly enforce land use regulations to ensure the floodway is free of new urban development. If local land use management measures are to be most effective they must be in place well before pressures for floodplain development begin to mount.

   Where flood free sites are available the management program may try to protect existing development through relocation, eg. Insurance is paid in full if the property owner is prepared to relocate.

2) Local Authorities should look at protection of natural areas subject to flooding by way of reserve contributions, covenants and land swaps.

3) The NFIP program regulations concentrate on influencing design of new development and its location within the floodplain rather than discouraging or preventing floodplain use. Burby and French

identified a need for more stringent regulations and concentration on non-regulatory measures, eg. information programmes to increase public knowledge. These programmes should be aimed at consumers, lending institutions, realters and insurers, (ie. those people in whose interest it is to avoid hazardous areas). The voluntary approach relies on the premise that 'no rational person would place themselves in a hazard' and has often proven to be unsuccessful. However, Burby and French concluded that there was still room to experiment with voluntary mitigation avenues.

4) Burby and French's final recommendation was that all floodplain management policies and plans need to take account of the local context.

The USA example illustrates the inadequacies of leaving hazard mitigation up to the 'market'. This is confirmed in the research of Bollons (1989) and Platt (1986). The conclusion seems to indicate that some community intervention is necessary.

1.3.5 Comparison of Approaches in Australia (NSW), New Zealand and the USA.

1) All three approaches involve an incentive approach to floodplain management. The NSW example uses legislation to influence local authorities to follow prescribed guidelines for floodplain management so that they will be exempt from liability. The New Zealand (NWASCA) example uses central government's 'catchment grant scheme' to influence floodplain management. The United States use membership of a national insurance program as an incentive for local government to apply certain floodplain management techniques.

2) The NSW and New Zealand (NZ) approaches to floodplain management are primarily based on the assumed rational decision making model. The NSW approach went one step further to

prescribe guidelines or a 'blueprint' for local authority planning. Neither approach takes explicit account of the institutional, financial or political realities. This is evident in the problems identified in both examples. The review of the NSW policy identified the major problems of the policy as including lack of funding, a tendency of Councils to ignore the merit principle (ie. automatically accept the 1% flood as the flood standard) and a lack of political will to manage the floodplain. The potential of the New Zealand (NWASCA) policy was untested because of drastic institutional changes that occurred in 1988 as a result of the Labour Government's policies.

3) The basis of the NSW and NZ approaches can be contrasted with the USA approach. The USA approach is very much based on a 'market philosophy'. Property owners pay insurance premiums related to the degree of risk their property is subject to. However, this approach was not successful in that generally local authorities only joined the insurance scheme and started taking action once a problem existed. There was no proactive awareness of the problem. (Burby and French, 1981). As a consequence the scheme relied very much on structural solutions to floodplain management. The behaviour of property owners was to favour structural options as these were perceived as a management technique that reasonably maintained their property rights (Laska 1986). In general the USA approach did little to alleviate flood hazards. Some type of community intervention is necessary to mitigate potential hazards.

Table 2 looks at the interrationships between the approaches taken and the environments analysed in this thesis.

1.3.6 Other Research

Kartez and Lindell's (USA,1989) paper assessed whether effective planning compensates for lack of experience when promoting the adoption of good

Table 2. Interrelationships Between Approaches Taken and the Environments

Country	Behavioural	Institutional	Physical
New Zealand	• Little acknowledgement of qualitative risk. eg. public risk perception. • Process relies on technical assessment of risk. • Based on Rational Decision Making Model.	• Impacts on Central Government and Catchment Authorities only. • No acknowledgement of forthcoming structural changes. • No acknowledgement of power and limitations of NWASCA and Catchment Authorities. • Catchment Authorities would have a financial incentive to follow the process.	• Acknowledge landuse and floodtype affects risk assessment.
Australia (New South Wales)	• Some acknowledgement of qualitative risk perception. • Primarily based on technical assesment of risk • Based on Rational Decision Making Model.	• Funding problems not acknowledged. • Acknowledges statutory liability of institutions. • Lacks coordination between Councils. • Lacks acknowledgement of political impacts. • Local Authorities have an incentive in terms of their liability to follow the process.	• Acknowledges land use and multiple flood characteristics in determining flood standard.
USA	• Based on philosophy that people will pay premium relative to risk potential. • Based on Market Model. • Based on 'buyer beware' philosophy	• Institutions especially local authorities take a reactive approach. The initial decision to develop floodable land lies with individuals. Once development on the floodplain is a problem local authorities become involved. • Local authorities have the incentive of eligibility to join an insurance program if adequate flood mitigation measures are undertaken.	• Mitigation measures implemented once development on the floodplain already exists. ie. reaction to an existing problem.

practices in disaster planning. The paper concludes that standard procedures have limited effectiveness in planning to avoid disasters:

"plans often appear to rely too much on a vision of normal community needs".

Kartex and Lindell state that lessons learnt from past disaster experiences are extremely important when planning for a disaster.

Research by Laska (1986) challenges the view that involving home owners in floodplain management has discouraging results. Laska interviewed 716 people in the town of Slidell, Louisiana, a town which had experienced large floods in 1979, 1980, and 1983. The results indicated that home owners whose properties have been flooded recently are interested in mitigation and ready to participate. Laska's research raised some interesting evidence regarding the effectiveness of flood mitigation measures.

In particular she found that:

a) It was extremely important to educate home owners so they understand mitigation measures. Home owners need to feel as if they are part of the system. Any social change depends on the support of home owners. This supports the principles of the social learning paradigm (refer Chapter One, 1.2.1).

b) Timing of Mitigation measures is crucial. After a disaster home owners interest in mitigation is high, however it declines quickly. Home owners tend to only understand structural mitigation measures.

1.3.7 Key Issues from Literature Review

1. None of the floodplain management approaches investigated adequately takes account of the internal and external environments relating to floodplain management. This has resulted in 'key issues' of relevance to success being ignored in the planning process, eg. behaviour of stakeholders, financial constraints, institutional reorganisation and authority of institutions to take certain action.

2. Standard Planning Procedures or 'blueprint' planning have limited relevance to real world cases. Communities and flood hazards differ in each locality. The local context needs careful consideration when formulating a plan (Kartez and Lindell 1989).

3. The existing level of floodplain development needs to be considered when deciding on floodplain management techniques (Burby and French 1981).

4. Beliefs, attitudes and behaviour of the current target population need consideration when formulating a plan (Laska 1986).

5. The 'market' approach does not effectively control floodplain development to mitigate potential hazards.

1.3.8 Application of Key Issues from Literature Review to Present Study.

In light of the key issues raised in section 1.3.7 (1-5) above, this study will need to recognize:

1) The limitations of planning according to a standard management plan.
2) The consequences of recent institutional changes in New Zealand.
3) The imperfections of information.
4) The behavioural attributes of key stakeholders.
5) Political and financial constraints.
6) The local context of the Horowhenua.
7) The role of the public in floodplain management.
8) The importance of the timing of plan implementation.
9) The need to learn from past experience.

1.4 GENERAL LIMITATIONS OF THE PRESENT STUDY

The scope of this study is limited by uncertainties and complexities inherent in the present situation, in particular:

1. **Time frame** for the study. There is always a trade-off between achieving some sort of plan or framework and awaiting further information on which to base a plan: information can never be comprehensive, we can only ever plan on what information we have available, however, we should constantly be striving for improved information on which to base action.

2. There remains some **uncertainty about the legislation guiding resource management** in New Zealand, ie. this is a political reality which influences the clarity of varying levels of governments responsibility in hazard management.

3. There is a level of uncertainty about the **future of regional government**. This is a political reality and consequence of central government's three year election cycle; it also impinges on the attitudes and decisions of regional and territorial government politicians.

4. **Funding** of regional and territorial government is under review. This raises questions about the authority of regional and territorial government to achieve a funding base and the future of central government funding of regional and district council activities.

5. There is a limited amount of technical information available on Horowhenua flooding.

6. The very nature of flood hazard planning is difficult due to the uncertainty of natural events. Planning for flood hazards could be expressed as trying to plan for a **moving target.** No two floods are going to be exactly the same. Flood hazards have many contributing factors which are constantly changing, eg. climate change and catchment vegetation. This means that we cannot predict exactly what a certain flood will do.

7. The level of community awareness/acceptance with regard to flood hazards is another unknown quantity.

1.5 GENERAL ASSUMPTIONS ADOPTED IN THIS RESEARCH

As a result of the limitations imposed on the scope of this study (refer section 1.4) it is necessary to make a series of assumptions in order to proceed. These are:

1. Flooding is a hazard when the natural event has a spatial overlap with actual or potential human activity and therefore causes a problem.

2. Flooding is perceived by the stakeholders as detrimental and generally unacceptable to human occupation. Problems in relation to health, welfare and access result from flooding.

3. A modified Capitalist System is predominant in New Zealand. 'Profit' is the aim of most rural occupants. 'Profit' in the study area is primarily obtained from primary production.

4. There are three structures of government in place. Each has varying mechanisms which enable them to influence land use.

5. There is a great deal of uncertainty regarding the legislative basis for resource management.

6. Regional and territorial government will continue to function as established in November 1, 1989.

7. Climate change will increase flood hazard problems as a result of sea level rise and increased storm events.

CHAPTER TWO - THE STUDY

CHAPTER TWO - THE STUDY

2.1 MISSION AND PROCESS

In line with the strategic planning process (refer figure 2 and 3) a basic goal has been identified.

" TO PROVIDE A BETTER PLANNING PROCESS FOR MITIGATING FLOOD HAZARDS IN THE STUDY AREA OF THE HOROWHENUA"

2.1.1 Identification of Key Issues

The next step in the process is the identification of **'key issues'** or a further identification of components of the problem. This can be achieved by internal and external assessments or scanning the environment, including attention to **'key stakeholders'**.

In scanning the environment it is proposed to concentrate on three main spheres of environment, **the physical, the institutional and the behavioural environment**.

In scanning these environments the relevant questions to have in mind include:
1. What are we trying to do?
2. How is it going so far?
3. Why isn't it going so well?

2.1.2 Action Plan

There is then a need to prepare an **action plan** to deal with the problems and thus mitigate the hazard.

The action plan will be for a particular organisation but will include proposals which impinge on the institutional, behavioural and physical environments.

The action plan will concentrate on the role of the Manawatu Wanganui Regional Council in flood hazard mitigation for the Horowhenua area. The Regional Council is the organisation which the author of this thesis works for and the study has the dual aim of providing a pragmatic planning process for that organisation and an academic thesis for a masters degree in Regional Planning.

The environmental scanning will also be done from the perspective of the Manawatu-Wanganui Regional Council.

2.1.3 Information Sources

In scanning the environment the following information sources have been used:

1. Detailed comments of Manawatu and Central Districts Catchment authority planning staff on individual development applications referred to the Boards for comment by the Horowhenua County Council. These comments were researched back to March 1963. A synthesis of these comments provided a good description of the physical/spatial flood problem.

2. Historical newspaper cuttings from local newspapers.

3. Discussions with local residents.

4. Working knowledge of the officers of the Regional Council and Horowhenua District Council. In the absence of adequate resources to carry out formal studies, this knowledge is important and spans several disciplines.

5. Drainage contour information provided by drainage engineer, Manawatu-Wanganui Regional Council.

6. Literary sources of relevant research from periodicals and journals (refer bibliography).

Table 3 lists the sources of information for this thesis and their applicability in analysing the three environments.

2.2 THE STUDY AREA - HOROWHENUA

2.2.1 Background

The study area is shown in Figure 5. The area includes those areas of Horowhenua District from its southern boundary to the Manawatu River.

The Horowhenua area is typified by a mix of soil types which include large areas of highly fertile soils (refer section 2.4.2 (iii)).

As a result of the fertile soils, climate and geographic location there has been great pressure for small rural lot subdivision in the Horowhenua. These lots are primarily being developed for horticultural and rural lifestyle purposes. Often small lot development is located on fertile alluvial soils which also are subject to the most risk from flood or drainage problems. Existing flood and land drainage problems are becoming more acute due to increased intensity of primary production. This will result in a potentially increased hazard.

2.2.2 The Three Environments

A strategic analysis of the physical, institutional and behavioural environment is needed to identify the key issues of the problem which need to be addressed in an action plan.

An assessment of the **institutional environment** is necessary to acknowledge and identify 'key issues' associated with the political, financial, legislative and structural problems within the existing planning process for floodplain management.

Table 3. Sources of Information and Their Use in Environmental Scanning

Sources of Information	Types of Information	Use in Environmental Analysis		
		Behavioural	Physical	Institutional
Manawatu and Central Districts Catchment Board comments on developments.	Historical information.		*	
	Staff perceptions.		*	
	Hydrological data.		*	
	Depth, location, velocity of floods.		*	
	River Control Scheme Areas.			*
Newspaper Cuttings.	Public Perceptions.	*		
	Dates of floods.		*	
	Public Reaction.	*		
	Depth, location, velocity of floods.		*	
Working knowledge of the officers in the Horowhenua County Council and Manawatu Wanganui Regional Council.	Institutional Processes.			*
	Institutional Conflicts.			*
	Political Motivators.	*		
	Professional Motivators.	*		
	Financial Constraints.			*
	Information Constraints.	*		*
	Public Perceptions.	*		
Drainage Contour	Contours.			*
	Ponding Area.			*
	Drainage Scheme Areas.			*
Literary Sources	New Zealand, USA and Australian examples of floodplain management.	*	*	*
	Research on risk perception.	*		*

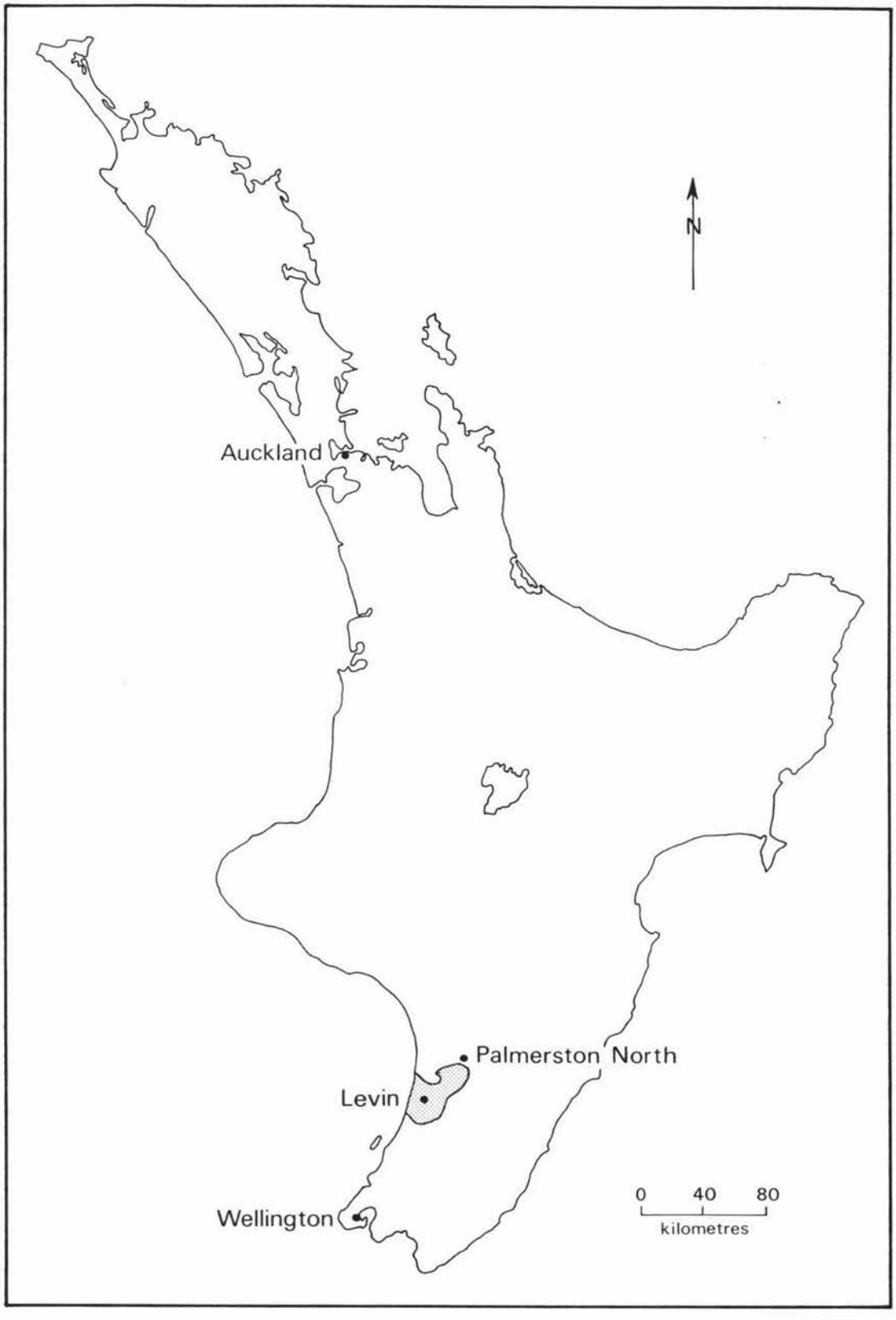


Figure 5. The Study Area

The assessment of the **physical environment** will essentially aim to collate a variety of information on flood hazards and drainage limitations within the Horowhenua. It is hoped that it will provide an assessment of these limitations which is more descriptive of the types of flood/drainage and land use than what is currently available. This will enable a planning strategy that takes better account of the complexities of flood/drainage problems and land use of the Horowhenua.

Finally the **behavioural environment** which revolves mainly around stakeholders' (eg. politicians, landowners, planners), perceptions of the environment, such as risk acceptance and social learning, and includes key issues relevant to the success or otherwise of the planning process.

2.2.3 Interrelationships Between the Three Environments

The three environments that have been identified, the institutional, physical and behavioural environment, are not mutually exclusive. Components of each environment infringe on the others. An example of this is the structural activities of a the Manawatu Catchment Board which have been determined as a result of its institutional parameters, such as funding, politics; and by the behavioural environment, such as the public's ready acceptance of structural solutions to flood problems.

These environments manifest themselves in the physical environment, eg. stopbanks on the Ohau and Manawatu rivers, and the Koputaroa and Makerua drainage systems.

Another example of the overlap of these environments is the effect the internal behavioural environment of an institution has on its activities, eg. engineers and planners may inherently have differing biases when attempting to solve a problem and this can result in internal friction.

Therefore, an examination of each of these three environments separately is somewhat artificial. It does, however, serve as a valuable tool to break down

sectors of the environment and identify 'key issues' affecting any floodplain management.

Key problems may be evident within each environment or they may be as a result of inadequate recognition of the interrelationships between the environments.

2.3 INSTITUTIONAL ENVIRONMENT

2.3.1 Background

Currently mechanisms in the Horowhenua area to control floodplain development tend to take an ad hoc reactionary stance. Land drainage and river schemes involving engineering works are undertaken to reduce/rectify inundation of land. District Scheme controls are implemented once a demand for development on the floodplain has arisen. There is little in the way of long term incentives or strategies to reduce the hazard. There is no attempt to be proactive in the education of key stakeholders regarding floodplain management practices.

There is a need for planners to stand back and assess current strategies in floodplain management and how they relate to the hazard of flooding.

2.3.2 Government Structures

There are three main structures of government in place. These are; central government, regional government and territorial government (district and city councils). Each has various mechanisms which enable them to influence land use. The three governmental structures have varying powers over different sized areas of land.

2.3.3 Central Government

Central government creates policy which is reflected in the form of legislation. Legislation is both permissive and prescriptive in the policy parameters it provides for regional and territorial government.

There has been a lot of comment throughout the recent local government reform process about the problems of prescribing within legislation the duties, functions and tasks to be performed by subordinate levels of government. It is said to stifle innovation in dealing with issues. However, contrary to this point of view, prescriptive legislation ensures a certain minimum of functions are undertaken by local government and it can be argued to be very necessary especially when resources for local government are tight.

The legislation set by central government not only attempts to set out the role of the levels of government but also the relationships between the levels of government.

The main legislation and a description of the way it impinges on how the Manawatu Wanganui Regional Council deals with hazard mitigation is as follows:

(i) Town and Country Planning Act 1977.

The Regional Council's role under the Town and Country Planning Act can be separated into three main areas:

a. The Town and Country Planning Act 1977 and associated regulations require that District Councils have a District Planning Scheme which regulates land use. District Schemes are required to deal with several matters including the avoidance or reduction of damage associated with natural hazards. All notified applications for planning consent under the regulations of the District Scheme are required by the act to be notified to the Regional Council to give the Regional Council the opportunity to make an objection or

submission on them. In these circumstances a formal objection or submission, which is represented by an officer at a hearing, is the way the Regional Council has input into the planning process. It provides the only opportunity to formally have the hearing authority consider the Regional Council's opinion on the proposal.

b. The Regional Council has responsibilities under this act for Regional Planning and to prepare a Regional Scheme. Although the Resource Management Bill proposes to replace this requirement with Regional Policy Statements and subsequent Regional Plans, many of the amalgamating United Councils had schemes in existence which regional councils are now responsible for. Included in this regional planning function is responsibility for natural resource management and responsibility of identification of areas to be excluded from urban development which have natural hazards associated with them. District Schemes administered by district councils cannot be inconsistent with Regional Schemes.

c. The role of the now obsolete catchment boards which has been transferred to the Regional Council is linked to the Town and Country Planning Act by Section 4(3) of the act which states:
"In the preparation, implementation, and administration of regional, district, and maritime planning schemes ..... regard shall be had to the principles and objectives of the Soil Conservation and Rivers Control Act 1941 and the Water and Soil Conservation Act 1967."

(ii) Water and Soil Conservation Act 1967

The Regional Council has a role under this Act as part of those functions and responsibilities transferred from the former Catchment and Regional Water Boards. These functions are summarised by the long title of the act:

".... to make better provision for the conservation, allocation, use and quality of natural water, and for promoting soil conservation and preventing damage by flood and erosion, and for promoting and controlling multiple uses of natural water and the drainage of land, and for ensuring that adequate account is taken of the needs of primary and secondary industry, ..."

(iii) Soil Conservation and Rivers Control Act 1941

This act sets out specific functions for catchment boards in making provision for the conservation of soil resources and for prevention of damage by erosion, and protection of property from damage by floods. These functions have been transferred by way of local government reform to regional councils.

(iv) Local Government Act 1974

This act specifies under Section 274(1)(f) that:

"The council (ie. the territorial local authority) shall refuse to approve any scheme plan where it is satisfied that -

i. The land or any part of the land in the subdivision is subject to erosion or subsidence or slippage or inundation by the sea or by a river, stream, or lake or by any other source; or

ii. The subdivision of the land is likely to accelerate, worsen, or result in erosion or subsidence or slippage or inundation by the sea or by a river, stream, or lake, or by any other source, of land not forming part of the subdivision:

Provided that this paragraph shall not apply if provision to the satisfaction of the council has been made or is to be made for the protection of the land (whether part of the subdivision or not) from erosion or subsidence or slippage or inundation; ..."

The Act also specifies in Section 641 (2)(b-d)

" The Council shall refuse to grant a permit for the erection or alteration of any building where:-

"2. Notwithstanding anything in any bylaw made under Section 648 of this Act the Council shall refuse to grant a permit for the erection or alteration of any building where -

b. The proposed building or alteration is, or within the useful life of the building or alteration is likely to be, to damage arising directly or indirectly from -

i. Erosion, subsidence, or slippage of the land on which the building or alteration is proposed to be erected or any other; or

ii. Inundation arising from such erosion,
subsidence or slippage - unless the Council is satisfied that adequate provision has been made or is to be made for the prevention of that damage; or

c. Any residential building (as defined in Section 644 of this Act) or any alteration to such a building is, or within the useful life of the building or alteration is likely to be, subject to damage arising directly or indirectly from inundation unless the Council is satisfied that adequate provision has been made or is to be made for the prevention of that damage; or

d. The erection or alteration of the building is likely to accelerate, worsen, or result in erosion, subsidence, slippage, or inundation of the land on which it is proposed to be erected or any other land on which it is proposed to be erected or any other land unless the council is satisfied that adequate provision has been made or is to be made for the protection of that land from erosion, subsidence, slippage, or inundation."

(v) General

In addition to legislation influencing hazard mitigation, the distribtion of central government funding also influences how hazard mitigation is dealt with. Funding to regional/district government and government departments influences their performance. Other government policies which have a direct effect on scale and intensity of flood problems as they affect overall catchment management but which are often not perceived as directly linked include policy towards: agriculture, land development, forestry, forest parks, national parks, tax incentives, trade tariffs etc.

These policies which influence and affect severity of flood problems are less able to be influenced by local authority 'planners'.
Each government department/ministry has differing goals/aims and its performance is directly affected by levels of funding. Particular government departments which through their policies have an affect on flood problems include Department of Conservation, Ministry for the Environment and Ministry of Forestry.

2.3.4 Regional Government

Regional councils in their present form were brought into existence on 1 November 1989, as a result of local government reform. The purpose of local government reform was to create a more effective and efficient local government structure. This involved a more holistic approach to managing the environment and provision of services at the appropriate community of interest.

The Manawatu Wanganui Regional Council is an amalgamation of 40 former ad hoc authorities. These authorities include pest boards, drainage boards, noxious plants authorities, catchment authorities and united councils. The Horowhenua District is included within the administrative area of the Manawatu Wanganui Regional Council.

The Manawatu Wanganui Regional Council, being a relatively new organisation, has done little since its formation to amend the policy approach of its former authorities to mitigate hazards. Rather it has amalgamated the approach of the two major former authorities involved in hazard mitigation, the catchment board and the united council. An examination of the approach of these two authorities is therefore necessary to understand the institutional environment. However, section 2.3.5 (iii) of this thesis shows how the amalgamation of these two hazard mitigation roles has somewhat strengthened the role of the Regional Council, ie. catchment boards have a stronger rating base/public understanding and united councils have clear planning mandate under the Town and Country Planning Act 1977.

(i) Catchment Authorities

Catchment boards were established under the 1941 Soil Conservation and Rivers Control Act. Although section 126 of the 1941 Act sets out the Board's principal function as preventing damage within its district by floods and erosion, the Act provides little in the way of statutory teeth in the area of land use planning.

Similarly, the Water and Soil Conservation Act 1967 required Boards to **"prevent damage by flood and erosion"**.

Catchment boards, including the Boards that administered the Horowhenua area, ie. The Manawatu Catchment Board and later the Central Districts Catchment Board, have taken 'action' in relation to these roles in the form of structural remedial measures for existing flood problems, ie. bandaging the wound rather than preventing the accident. There has been a tendency to ignore other approaches in fulfilling this responsibility in areas such as land use management and education.

Ratepayers identify more easily with structural solutions to flood problems and are less willing to pay for long term mitigation measures which they cannot easily identify. This has tended to encourage the structural approach and reactive stance taken by catchment boards. The Manawatu and Central Districts Catchment Boards have undertaken flood warning and monitoring work but this is primarily associated with structural catchment management schemes.

The Manawatu and Central Districts Catchment Boards' did however in more recent years employ some planning staff. The role of these planners was primarily to make submissions and objections on regional and district planning matters which affected soil and water management.

This advocacy role was enabled by the public participation procedures of the Town and Country Planning Act 1977. The Catchment Authority therefore had little more power than any other interest group in making an objection.

In the case of the former Horowhenua County Council, the Central Districts Catchment Boards' comments were requested on all subdivision and notified planning applications. Comment was requested to ensure the development was not at risk from flooding or erosion. This was a direct transfer of responsibility regarding hazard mitigation and associated liability from one authority to the other. If a clearance in terms of any flood hazard from the Board was received the Horowhenua County Council had covered its responsibility in terms of liability under the Local Government Act 1974. However, this was transferred

to the Catchment Board who was consequently very cautious about the information that was provided.

These applications are still referred by the Horowhenua District Council to the Manawatu Wanganui Regional Council for comment.

In some cases catchment board advocacy, at the district scheme preparation stage, has resulted in requirements to liaise with catchment boards being written into certain sections of the district scheme. This liaison role has now been transferred to the Regional Council.

Some catchment authorities have written Catchment Management Plans, however, these plans lack any statutory backing and in most instances have become technical research documents with little real impact on land use planning.

An example of this type of plan is the Water and Soil Resource Management Plans (WASRMPS). These plans were promoted by the Water and Soil Division of the MOWD (since abolished) through central government funding. WASRMPS had little impact other than their use as general background information by Catchment Board officers in advocacy of general water and soil principles under the procedures provided by the Town and Country Planning Act 1977, and as general guides for the management of catchments by Catchment Authorities. The Manawatu Catchment Board and later the Central Districts Catchment Board didn't have any Management Plans other than engineering scheme reviews for the Horowhenua area. The Manawatu Catchment Board staff did start some management planning work for the Horowhenua area but it was never finished.

(ii) United Councils

United councils were established by the Local Government Act 1974. The mandatory functions of united councils were regional planning and civil defence. United councils primarily consisted of representatives of constituent

local authorities, and they had no direct rating powers or means of funding other than levies from constituent authorities.

The Town and Country Planning Act 1977 requires that united councils produce Regional Planning Schemes. Matters to be dealt with in Regional Schemes are set out in the First Schedule of the Act. Of particular relevance is:

> **4 (c) "General identification of areas to be excluded from future urban development including land subject to hazards such as flooding and earth movement".**

Section 17 of the Act requires that the Crown and every local authority and public authority shall adhere to the provisions of an approved regional planning scheme.

What promised, in legislation, to be a very powerful and influential mechanism of planning, lacked any real impact due to its limited funding base and lack of motivation for Regional Plans to be established and implemented.

The Horowhenua United Council's Regional Planning Scheme (Section One - Objectives) was forwarded to the Minister of Works and Development in August 1985 for approval and has never been approved. The closest statement the Proposed Regional Planning Scheme makes with regard to hazard mitigation is in Key Goal 2.1 (p 35):

> **"To ensure that development in the region is carried out with regard to environmental conditions which are potentially hazardous and to conserve and enhance those environmental qualities which can or do contribute significantly to the general welfare of the region."**

Responsibility for pursuing Regional Planning under the Town and Country Planning Act is now that of regional councils. Regional councils including the Manawatu Wanganui Regional Council are tending to minimise the function for Regional Planning as prescribed in the Town and Country Planning Act 1977 as the pending Resource Management Bill is likely to amend the procedures and scope of Regional Planning.

(iii) The New Regional Councils

Although all Resource Management legislation is currently under review in the Resource Management Bill (refer section 2.3.6) the current amalgam of legislation which sets out regional councils' planning functions in respect to natural hazard mitigation is complex. The land use management function of both united councils and catchment authorities has been strengthened with reorganisation, united councils bringing to regional councils the statutory planning mechanism of the Town and Country Planning Act 1977 and catchment authorities bringing clear responsibility for hazard mitigation under the Water and Soil Conservation Act 1967 and the Soil Conservation and Rivers Control Act 1941, combined with rating power which provides for an autonomous body which has independence from territorial and central government. This reorganisation also provides increased scope for 'holistic' or integrated catchment management. That is, a new recognition that soil conservation is related to engineering works, planning and pest management, eg. possums eat the trees planted in the catchment by soil conservators which has a down stream effect in terms of flooding.

This strengthened planning role which regional councils now have is combined with clear responsibility for Civil Defence, ie. the Regional Council's role also includes responsibility for emergency action plans relating to natural hazards.

Problems associated with information provision on flooding include a political need to keep land values at a maximum. Provision of this type of information can cause a decline in land values, which also means a loss in rating base for the Council.

In general the infancy of the Manawatu Wanganui Regional Council has meant that little in the way of planning policy has as yet been developed. However, an organisational structure is in place which will enable a more integrated planning approach. For example a Land Resource Management Department deals with the interrelated functions of soil conservation, weed management and pest management and this department is incorporated in the Operations Directorate of the Council which also has responsibilities for river control works

and schemes. The Council has a Policy and Planning Department responsible for policy development, analysis and integration for the organisation as a whole; this provides for a more coordinated approach to resource management. The organisational structure is shown in figure 6.

The implications and direction of the new organisation are little understood by stakeholders, both internal and external to the organisation; this is a major problem which needs to be overcome in progressing with integrated planning.

Currently, responsibility for the planning function of the Manawatu Wanganui Regional Council lies with two main departments. These departments are the Policy and Planning Department and the Consents Department.

The Policy and Planning Department is responsible for analysing and developing environmental policy and implementation procedures for the Council and thereby coordinating the Council's departments in achieving their overall mission which is:

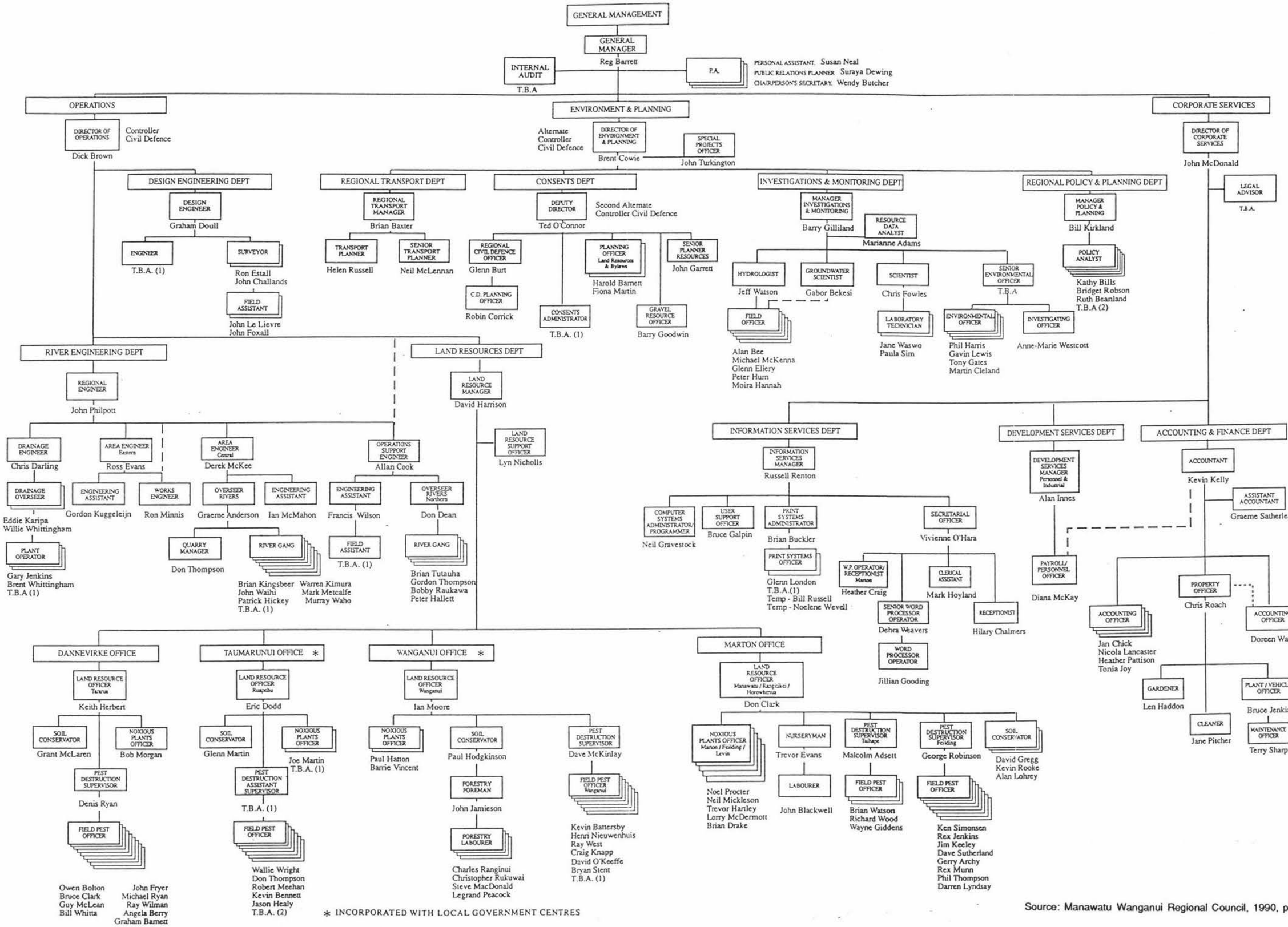
> **" To ensure natural and physical resources of the Region are managed to sustain and enhance environmental quality, and social, economic and cultural well-being"**
>
> **Manawatu Wanganui Regional Council Corporate Plan 1990/91**

The Consents Department has a more 'hands on' function in land use regulation by advocating:

> **"the Council's objectives for sustainable resource management and mitigation of natural hazards through subdivision and land consent processes and through input to District Plans."**
>
> **(Manawatu Wanganui Regional Council Corporate Plan 1990/91).**

The advocacy work of the Consents Department can be divided into two main types: 'reactive' and 'proactive'.

Proactive activities include advocacy of hazard mitigation and sustainable resource management policies and implementation techniques in District Schemes by way of liaison and consultation with District Planners.



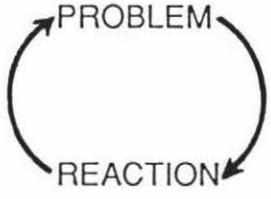
Source: Manawatu Wanganui Regional Council, 1990, p42.

Figure 6. The Organisational Structure of the Manawatu Wanganui Regional Council

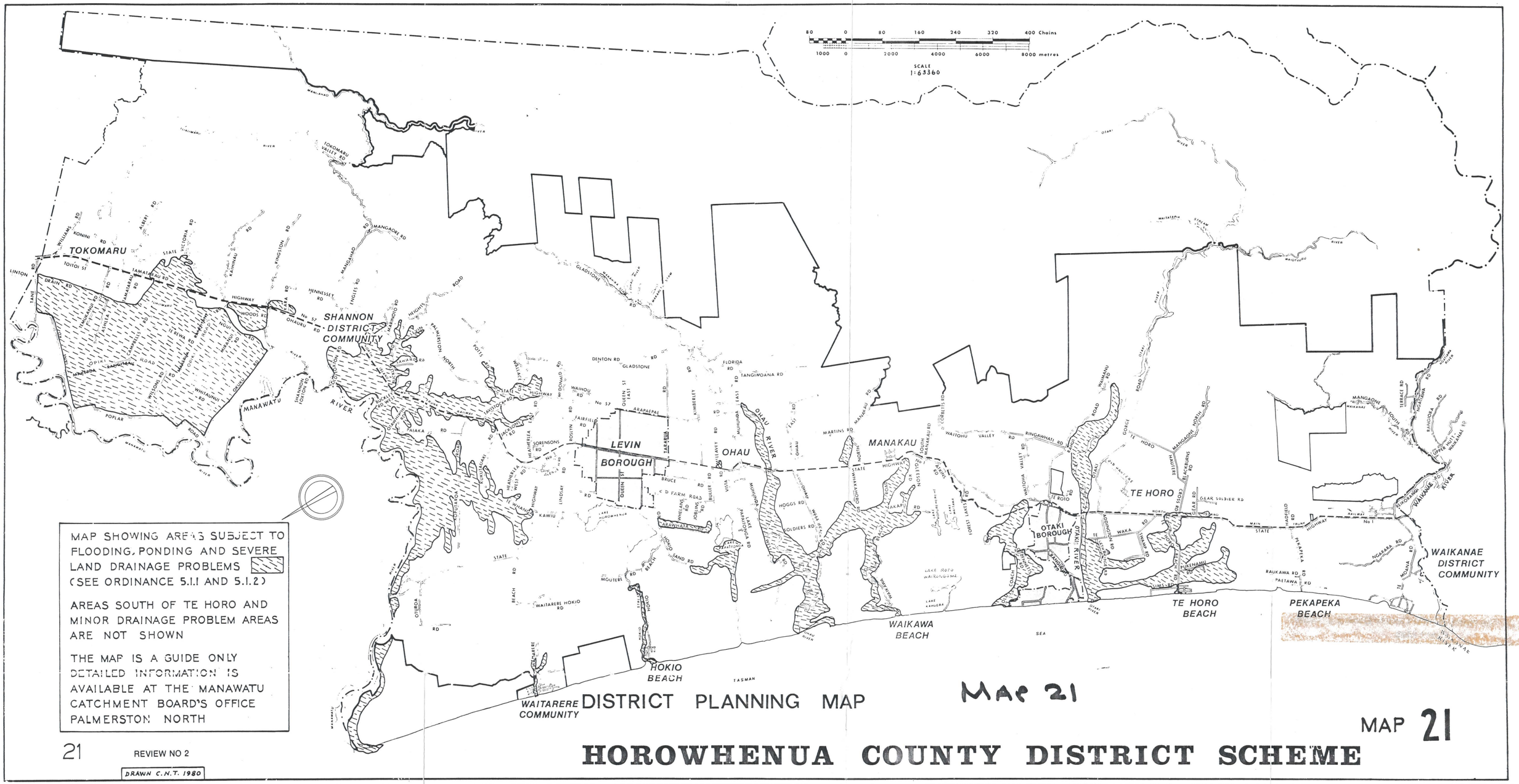
Reactive planning techniques include objections to and submission of comments on development proposals (ie. to build, subdivide or undertake some action; as well as changes or reviews of District Schemes) which compromise the objectives of the Regional Council. While the proactive planning approach is the most favoured alternative, the reactive approaches are still very necessary and are an integral part of the planning process. This is because there will always be a 'trade-off' between development and environmental concerns, and there will always be areas of land where the hazard is not identified until a specific development occurs. (ie. it is not possible to be totally comprehensive).

2.3.5 Territorial Government

Territorial authorities have the most immediate responsibility for land use planning. Their planning responsibilities are currently identified in the Town and Country Planning Act 1977. The policy and regulatory statements of District Schemes are the direct mechanism for Local Authorities to deal with land use issues. Unfortunately, in many cases the day to day implementation of schemes overshadows an overview approach to planning. Long term strategic planning is a casualty of work stress.
The planning framework in the real world is too frequently reaction to problems in an ad hoc way.



Sections 274 and 641A of the Local Government Act 1974 place requirements on territorial authorities to refuse approval to subdivisions and building permits where the development site is prone to flooding or erosion problems. These clauses have proven through recent case law to put a liability (accountability) on territorial authorities and to some extent remove the traditional 'buyer beware' philosophy. Recent case law has made territorial authorities



DISTRICT PLANNING MAP

Map 21

MAP 21

HOROWHENUA COUNTY DISTRICT SCHEME

Source: Horowhenua County District Scheme, 1980, Map 21.

increasingly aware of the requirements of sections' 274 and 641A and this awareness has resulted in increasing consultation with regional government on known hazards. The necessity of further research into hazard identification and planning strategies for hazard avoidance is increasingly evident. It is also evident that local government in total will continue with the overall role of Hazard Mitigation.

The Horowhenua County District Scheme Review No. 2 identifies in Planning Map No. 21 areas subject to flooding, ponding and severe land drainage problems. This map gives a very general indication of floodable areas. (refer figure 7). The map does not reflect any variances in the level, velocity or duration of flood and drainage problems.

The District Scheme text makes direct reference to the problem of physical hazard when carrying out land use planning in ordinance 5.1.1. This ordinance states:

> **" Not withstanding conformity with the zoning requirements of these Ordinances, no building shall be established on any land which is not suitable for the use proposed. For the purpose of determining whether any land is suitable for any particular use, regard shall be had to the best use of the land and its economic servicing and development and redevelopment, to earthquake fault lines and other geological conditions, to liability to flooding, erosion or land slip, to stability of foundations and to safety, health and amenities of the land and adjoining properties or roads of water supply.**
>
> **Provision for control of development likely to affect natural watercourses or in areas liable to flooding or landslip will be made in consultation with the appropriate Catchment or Water Board."**

In determining whether a proposed use meets this criterion the District Council frequently makes use of the Regional Councils comments on a proposal.

2.3.6 Changes as a Consequence of the Resource Management Bill

The Resource Management Bill is draft legislation to replace the current statutes pertaining to resource management, including the Town and Country

Planning Act 1977, the Water and Soil Conservation Act 1967, the Soil Conservation and Rivers Control Act 1941 and parts of the Local Government Act 1974. The Bill does not help to distinguish the roles and responsibilities of regional and district councils in the area of natural hazard mitigation. In fact, the Bill tends to make the division of responsibility even more confusing. The Bill gives regional councils much wider powers, similar to the existing powers which district councils have under their planning schemes. That is, the ability to regulate for all their functions including hazard mitigation.

Section 27 of the bill states:

> **"Functions of regional councils under this Act....**
>
> **.....**
>
> **(c) the control of the use of land for the purpose of-**
>
> **(i).....**
>
> **(ii) The avoidance or mitigation of natural hazards:**
>
> **(iii)....."**

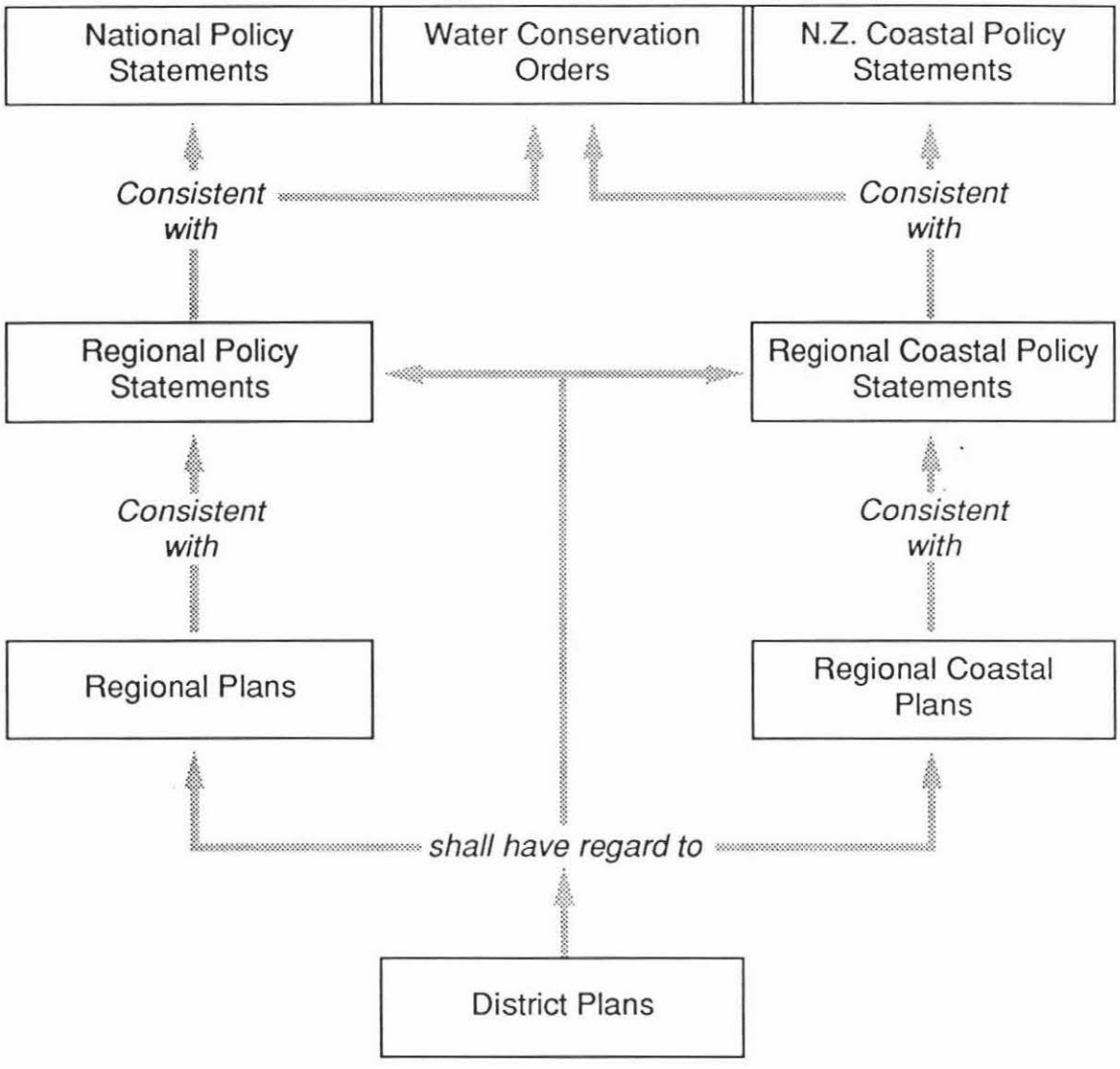
Section 28 of the bill states:

> **"Functions of territorial authorities under this Act-.....**
>
> **.....**
>
> **(a).....**
>
> **(b) The control of any actual or potential effects of the use of land, including the implementation of rules for the avoidance or mitigation of natural hazards....."**

The implementation mechanisms the Bill proposes to give regional government are the mechanisms of Regional Policy statements and Regional Plans (which can include rules). District councils have the mechanism of District Plans which can include 'rules'. District Plans are required 'not to be inconsistent with' regional policy statements and regional plans.

The Bill also makes provision for National Policy Statements (s41) from central government. These are optional but can be delivered at any time by central government. Regional policy statements, regional plans and district plans are required to be not inconsistent with these national policies.

The general interrelationships between the planning mechanisms provided for in the Resource Management Bill are shown in figure 8.



Source: Adapted from Manawatu Wanganui Regional Council Regional Policy Discussion Document, 1990, p3.

Figure 8. Policy and Plan Hierachy as in the Resource Management Bill

In summary, the Bill does not help to distinguish responsibility for hazard mitigation. However, it does clearly identify local government as having a major role in hazard mitigation.

The Bill also gives much wider powers to regional councils and emphasises **sustainable resource management** as a primary objective for both regional and district councils.

2.3.7 Corporate Planning Procedures Under the Local Government Amendment Act No. 2 1989

The Corporate Planning procedures under the Local Government Amendment Act No.2 1989 provide a additional tool for local government institutional planning.

The Corporate Plan sets the Council's objectives and budget for the Council for the financial year and in doing so commits the Council to certain activities. The Corporate planning procedure also involves public participation procedures.

Figure 9 summarizes the current institutional approach to flood hazard mitigation.

2.3.8 Summary of Key Issues Associated with the Current Institutional Environment

1) Local government in total has responsibility for hazard mitigation.

2) Existing legislation regarding hazard mitigation is complex which causes confusion of responsibility between regional and territorial government.

3) Proposed reformed legislation gives no distinction of responsibility for hazard mitigation between regional government and territorial government.

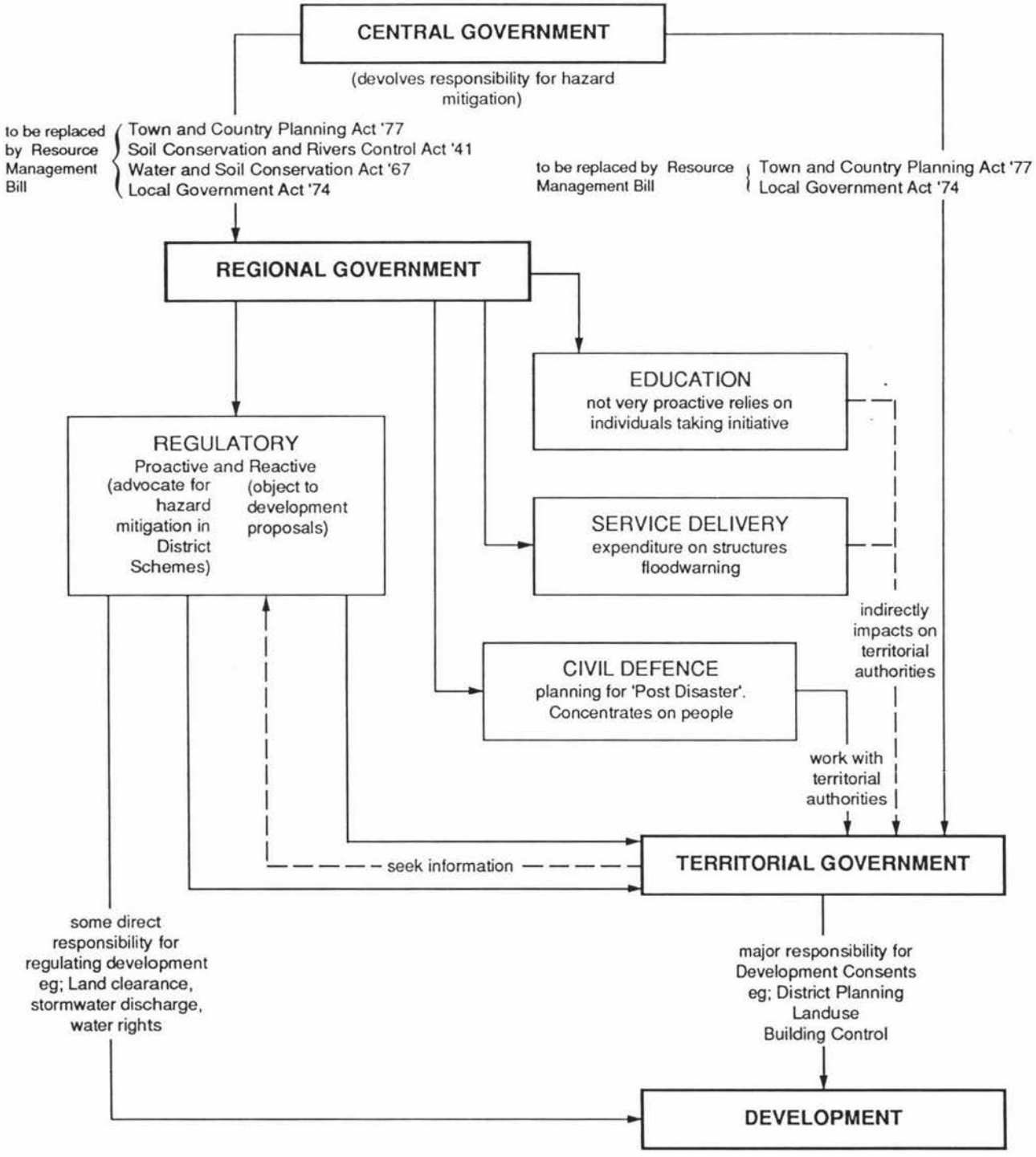


Figure 9. The Current Institutional Approach to Hazard Mitigation

4) Funding of local government is subject to change and uncertainty. There is a tendency for increased functions to be devolved to regional government and a decrease in devolution of money to perform the functions. Lack of funds is a major problem for both regional and territorial government.

5) Local government relies on central government to define its functions. Prescriptive legislation provides the minimum framework but can inhibit innovations in addressing issues. This has in the past resulted in, for example, an emphasis on structural solutions to flood hazard mitigation.

6) There is a tendency for democratic institutions to be subject to political and financial pressure. This results in preference for short term remedial solutions (reactive solutions) which ratepayers can easily identify with, compared to longer term and often more proactive mitigation techniques. eg. concentration on stopbanking compared to education and land use planning.

7) Due to vagueness or lack of definition of local government functions there has developed some distrust between the tiers of government. This vagueness has resulted in either 'buck passing' of responsibility or resentment of authorities invading what is perceived as another's area of responsibility. This is destructive in terms of achieving long term mitigation measures.

8) The legislative responsibility and associated liability of local government for hazard mitigation has diminished any potential 'buyer beware' philosophy of the public.

9) Recent local government reorganisation has further confused the public and institutions' perceptions of the roles of various tiers of government.

10) Legislation does not make it clear to what extent local government is liable for hazard mitigation. It cannot be assumed that liability necessarily stops at protection of lives and domestic dwellings.

11) Political problems of identification of hazards exist because of the consequential devaluation in land prices, local authorities' rating base and subsequent reduction in development.

12) There is little or no analysis of 'best' measures in floodhazard mitigation by institutions, ie. alternative allocation of resources. Most policies are developed as a result of reactions to crisis situations.

13) Vagueness of responsibility between regional councils and district councils in hazard mitigation leads to duplication of activities.

14) There is little acknowledgement of complexities of the behavioural environment by institutions, eg. the varying perceptions of risk are not taken into account in planning activities.

15) There is little acknowledgement of the complexities of the physical environment by institutions. eg. the large variances in types of flooding and land use are not taken into account in institutional plans.

2.4 PHYSICAL ENVIRONMENT

2.4.1 Background

This section assesses the physical environment and physical or spatial aspects of the flood/drainage problems of the study area. The history of flooding in certain areas and their likelihood to flood in the future is discussed.

It is hoped that assessment of the physical flood environment will provide an assessment of these limitations which is more comprehensive than what is currently available, identifying the key issues about the physical environment and how these need to be addressed in the planning process and thereby allow a strategy which takes better account of the complexities of flood/drainage problems.

2.4.2 Horowhenua Flood Risk Report

Much of the physical flood problem of the Horowhenua area is detailed in a Draft 'Horowhenua Flood Risk Report' written by K P Bills and attached as appendix D to this thesis. The report divides the study area into six management areas (refer figure 10). These areas form natural catchments within the study area. Most of the management areas involve natural streams flowing from the ranges into rivers or major streams. However, in the northern areas of Tokomaru, Koputaroa and Opiki extensive man-made drainage systems comprise a large part of the Catchment.

An assessment of the physical flood environment (refer appendix D) identifies some key physical components which directly affect the spatial flood problem in the Horowhenua. These include:

(i) Land tenure/subdivision
(ii) Land use
(iii) Soil type
(iv) Flood/Drainage control structures
(v) Flood type - velocity, depth, duration.

(i) Land Tenure/Subdivision

The trend towards intensive horticultural development and rural-residential land use has meant a sharp increase in the number of small rural lot subdivisions that have been approved by the Horowhenua County Council.

Increasing pressure for small lot subdivision in the Horowhenua is reflected in two changes to the operative Horowhenua District Scheme Review No. 2 (Change No. 8, operative 1 August 1983 and Change No 24, operative 1 June 1988). Both these district scheme changes liberalise the standards for subdivision of small rural lots.

The following table (table No. 4) shows the dramatic increase in small rural lots that have been created over the last six years. This increasing intensity of

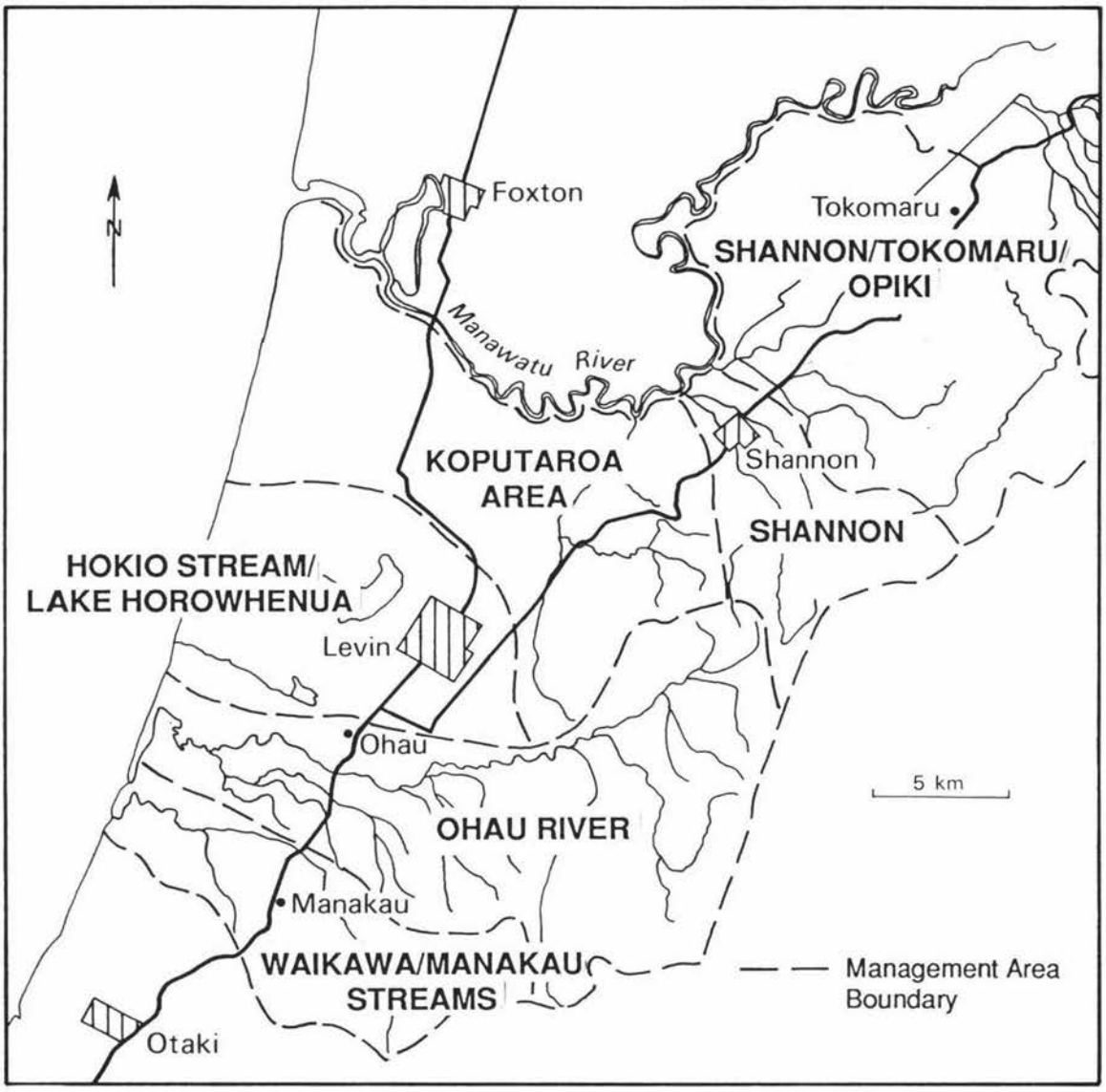


Figure 10. Management Areas of the Horowhenua

TABLE 4 Rural Lots Created within Horowhenua County Council

Year	Total	0 - 4 ha	4 - 10 ha	10+ ha
88/89	191	92	70	29
87/88	136	50	47	39
86/87	214	66	95	53
85/86	114	42	53	19
84/85	91	31	33	27
83/84	107	13	66	28

development is frequently on the floodplain as these areas represent very fertile areas. Such development on the floodplain increases the potential damage from floods.

(ii) Land Use

There is a wide variety of land use in the Horowhenua area, including those areas subject to periodic flooding. Generally in the area studied, few urban type settlements were at risk from flooding.

Land use types established on floodable land included:

* Pastoral Farming
* Dairy Farming
* Permanent Horticulture
* Market Gardening
* Rural-Residential Lifestyle
* Farmers' Residential buildings

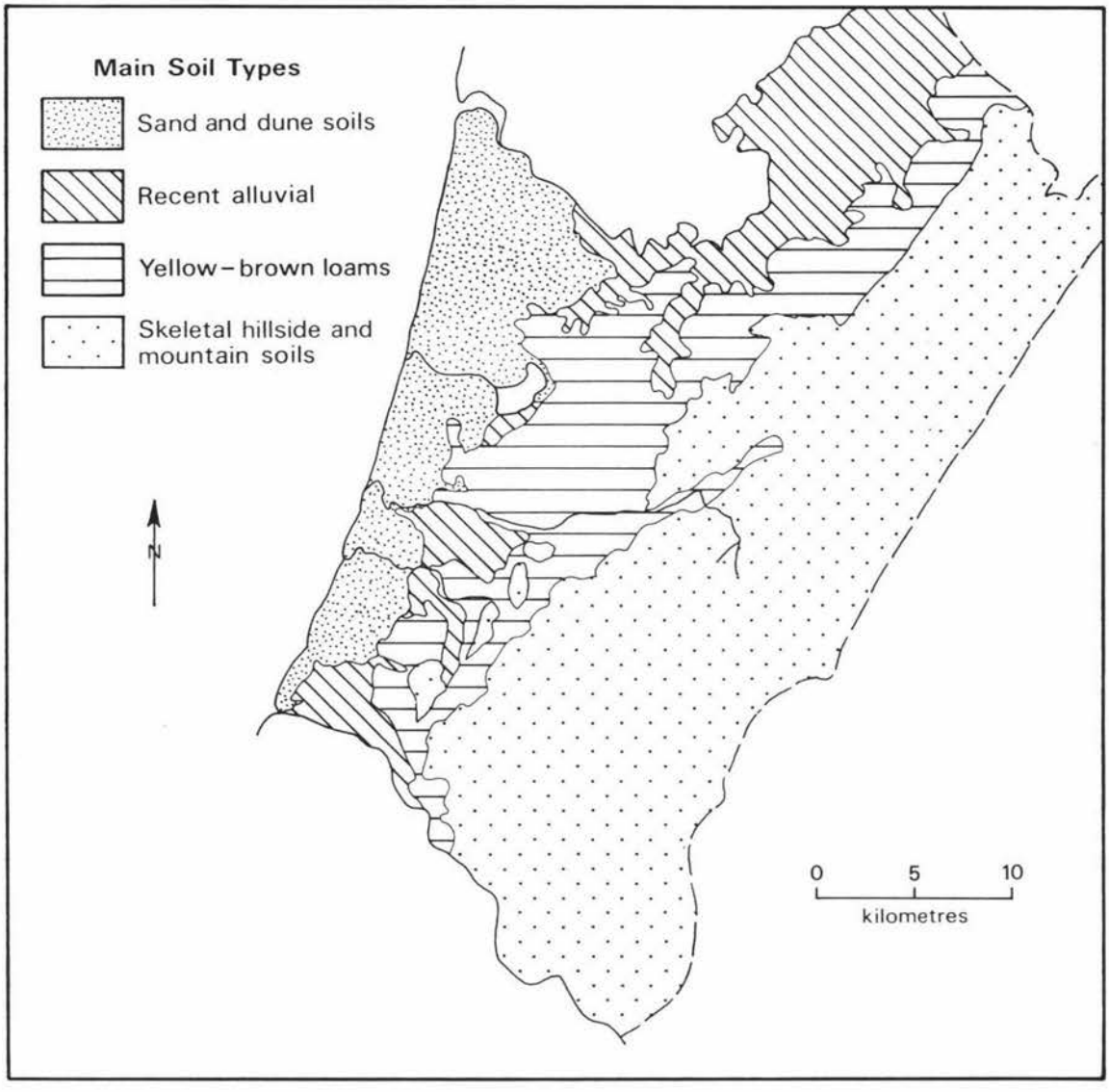
Damage from flooding, therefore, varied from temporary loss of grazing, siltation of land, stock loss, and loss of production because dairy sheds were inaccessible, to damage to residential buildings. Generally the more intensive the land use the greater the potential loss from flooding.

(iii) Soils Type

The soils of the study area provide an indication of flood and drainage problems within the area.

Generally peat/swamp areas have significant drainage problems and alluvial soils indicate floodplain areas.

Figure 11 shows the main soil types within the Horowhenua Study area. There is greatest pressure for increased development on the alluvial soils (ie. floodplain areas) as they represent the most fertile areas. Figure 12 shows a



Source: Adapted from Molloy, L., 1988.

Figure 11. The Main Soil Types of the Horowhenua

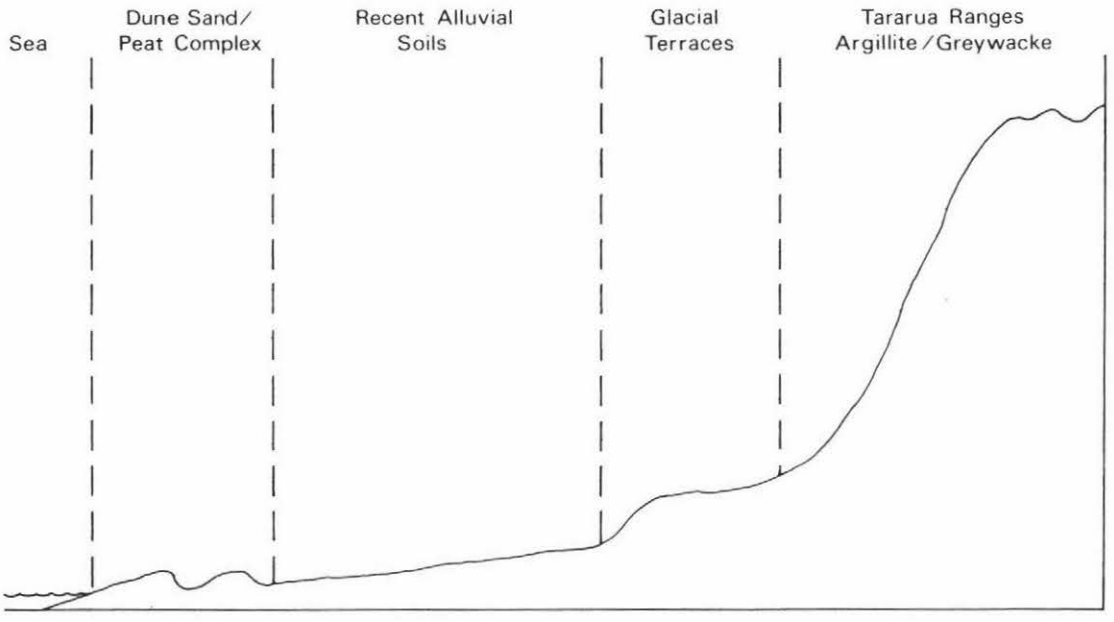


Figure 12. Typical Cross-Section of the Horowhenua showing Soil Types

typical cross-section of the types of soils in the Horowhenua. The soils typically are greywacke and argillite ranges in the east which have shallow mountain soils, followed by glacial terrace land covered in high terrace soils, followed by recent alluvial soils and near the west coast a complex of sandy and peaty soils.

(iv) Flood/Drainage Control Schemes

A number of river control and drainage schemes which have been implemented by past catchment authorities and drainage boards (ie. institutions) have had an effect on physical flood problems.

The main schemes in the areas are:

1. Koputaroa; affecting the Koputaroa Management area.
2. Hokio; affecting the Hokio stream/Lake Horowhenua Management area.
3. Ohau-Manakau; affecting the Waikawa/Manakau and Ohau River Management areas.
4. Lower Manawatu; affecting the Shannon/Tokomaru/Opiki Management Area, the Shannon Management area and the Koputaroa Management area.

Many of the schemes were established with the assistance of government subsidies. The schemes are maintained with scheme rate money. Land owners in the scheme areas are rated, according to their benefit from the scheme, by the Manawatu Wanganui Regional Council.

The Lower Manawatu Scheme involves mainly stopbank maintenance and river control works and the Ohau-Manakau Scheme involves major flood and river control works. The Koputaroa and Hokio schemes consist mainly of drainage works. The study area also includes the Makerua Drainage District which was administered by its own drainage board and is now under the authority of the Manawatu Wanganui Regional Council.

The above-mentioned schemes and their maintenance affect the potential hazard of flooding in the study area. A more detailed explanation of the schemes and their effect on flood hazard/drainage problems is included in the Horowhenua Flood Risk Report (Draft) (refer Appendix D).

(v) Flood Type

In the study area there is a wide variety of flood types, ie. velocity, depth, and duration of floods. For example, floods of the Ohau River tend to be fast, deep and of a shorter duration. This is especially so when stopbanks are overtopped or break which can cause debris and boulders to be strewn across surrounding land and water of 1 to 2 metres depth to flow across farmland. This can be contrasted to the Opiki Basin and Koputaroa areas where banks of a greater design protect land from floods of 1% or greater frequency, however, flooding can still occur as a result of the inability of the drainage system to discharge water. This sort of flooding is often expressed as 'ponding', ie. water in drains backs up and spills slowly onto land where it may lie at a shallow depth for some time. In these areas there is however potential for a catastrophic flood should the banks be overtopped or break because people have become complacent that they are protected from a flood hazard.

Kates (1981) comments that technology may make the everyday more secure but the exceptional is often less so.

> **" Medical advances, improvements in safety, engineering devices to protect against natural hazards, while they prove effective in eliminating much of the day to day environmental threats of life, nonetheless serve to increase the magnitude and frequency of the catastrophic."**

The variety of flood types is not acknowledged in the institutional documents, eg. The Horowhenua County district Scheme flood map No 21 shows a general area subject to risk from flooding or drainage problems and the legislation makes no attempt to take account of the varying types of flood problems.

2.4.3 Summary of 'Key Issues' associated with the Physical Flood Environment

1. There are several physical key components in the spatial or physical flood problem. These include:
   - (i) Land tenure/subdivision
   - (ii) Land use
   - (iii) Soil type
   - (iv) Flood/drainage control structures
   - (v) Flood Type

2. There are no major existing urban areas in the study area subject to risk from severe flooding.

3. There are a large number of new small lot subdivisions being approved by the Horowhenua District Council and prior to its existence the Horowhenua County Council approved many small lot subdivisions.

   These lots are being subdivided for the purpose of intensive horticulture and rural-residential development. Some of the pressure for small lot development is in floodable areas.

4. Existing structural solutions have problems associated with them,
   eg. Ohau-Manakau Scheme,
   Lower Manawatu Scheme.

5. There are large variations in the types of flooding in the study area;
   eg. Major river flooding/small stream flooding
   Fast flowing water/insidious ponding
   Deep Water/Shallow ponding

6. No major urban development in floodable areas means it is more appropriate to use land use and educative mechanisms to achieve flood hazard mitigation. (Burby and French 1981)

7. There are a wide range of land uses in the floodplain; these include pastoral farming, seasonal cropping, permanent horticulture, rural-residential homes.

8. Flooding can result not only in loss of personal property and domestic property but also commercial investment. eg. Stock loss, loss of permanent horticultural structures, crop loss, inability to milk cows. The losses associated with intensive primary production such as market gardening and permanent horticulture, which are common in the Horowhenua are significantly greater than losses associated with traditional pastoral farming. Other consequences of flooding include isolation and phycological problems.

9. Generally more fertile soils are close to river systems and these soils are both subject to the most pressure for development and at greatest risk from flooding.

2.5 BEHAVIOURAL ENVIRONMENT

2.5.1 Background

The behavioural attributes of key stakeholders, ie. those people/institutions which have a particular interest (whether it be political, financial, managerial or professional) in the planning process, have a major influence on the success of the process. Brown (1989) states in her thesis that although technical risk assessment and economic analysis are worthwhile, they are incomplete and should be supplemented by qualitative risk analysis.

2.5.2 Identification of Key Stakeholders in the Horowhenua Floodplain

There are many stakeholders in the Horowhenua floodplain these include:

Planners	District
	Regional
Politicians	Regional
	District
Public	Rural-Residential
	Horticulturist
Commercial Interests	Lawyers
	Real Estate Agents
	Insurance Companies/ Brokers
	Banking, Financial Institutions
	Development Companies
	Surveyors
Engineers	District
	Regional

2.5.3 Comments on the Behavioural Environment of Floodplain Management

The attributes or subjective judgements of people about risk have a major influence on the planning process. Not only do the public or lay people have their own subjective perceptions or so called 'irrational' attitudes about risk, there is also a certain element of subjective judgement in scientific or technical analysis of risk.

> **"The 'objective' framework floats on a sea of subjective commitments and assumptions which have to be more openly expressed and negotiated in risk assessment processes."**
>
> **Brian Wynne (1989)**

An example of this type of bias could be the tendency for planners to favour regulatory means of mitigating flood hazards, while engineers inherently may favour structural methods of mitigating a flood hazard.

Brown (1989) states in her thesis that technical valuations alone provide an insufficient guide to regulation.

> **"No matter how much specialists sneer at an 'irrational' and 'ignorant' public, lay judgements about possible dangers are equally as important as scientific or technical analysis."**

This statement is supported by the reality that public interpretations of the risk and consequent public pressure will dominate political decisions. Public interpretations also manifest themselves in the types of pressure for development on the floodplain. An example of how lay judgements on floodplain development influence physical outcomes is the tendency of the public to more readily accept structural flood mitigation methods, and hence, politicians favour these methods as the public can see a physical outcome from their rates.

Many people do not realise their land is floodable until they approach their local Council to develop their land, where they find they are subject to development controls. This indicates a gap in information transfer between the local Council and the property owner. Some prospective property owners investigate, either directly or through their lawyers, the status of the property in terms of flooding, however, the majority of land is transferred without this information being obtained.

Laska (1986) identified one strong component of peoples' perception of flood risk as being 'how recently a flood event occurred.' This meant that to maximise public acceptance of flood mitigation schemes the implementors need to be aware of the strategic advantage of implementing a scheme soon after a past event.

Caroline Blackford (1989) in her study of the Rakaia River floodplain for North Canterbury Catchment Board identified risk analysis as increasingly important to ensure effective expenditure of the money available in New Zealand's institutional environment.

There is also a tendency for the 'buyer beware' philosophy to be less common in New Zealand. This has resulted from a history of central government assistance in terms of disaster assistance after a major natural hazard has occurred.

Analysis of behaviour patterns and risk perceptions of key stakeholders in the Horowhenua area requires further research and the need for this research will be included in the action plan. There are, however, a number of key observations that can be made about stakeholders' behaviour.

2.5.4 Key Issues about the Behavioural Environment

1. Risk perception varies between groups of stakeholders.

2. Risk perception diminishes quickly after an event. (Laska 1986). (ie. The timing of plan implementation is critical for acceptance.)

3. Risk acceptance will vary considerably with level of investment. eg. pastoral farming compared to commercial horticulture investment.

4. There is an information transfer gap at the crucial time of property sales. Many property owners are unaware of past flood/drainage problems on their property until they wish to develop it.

5. Many people are unaware of flood hazard problems in their area ie. public education is missing.

6. Political support for regulatory methods of floodplain management is difficult to obtain (i.e. it doesn't win votes to regulate land use.)

7. The 'buyer beware' philosophy is not so evident in New Zealand, people expect the community to pick up some of the price of disaster damage.

2.5.5 Questions

Many questions still need to be answered regarding behavioural approach to flooding:

Does the public consider flooding to be as big a problem as planners think they do, or are the public prepared to take a large share of the risk?

Should private insurance companies be more inclined to provide flood risk insurance over crops or animals?

Would the public be happy with the alternative of 'buyer beware' backed up by private insurance?

How aware are people of flood problems when purchasing their property, and how important do they regard this type of information?

What is the public's perception of the protection provided to them by structures?.

What is the public's perception of varying flood hazard management techniques?

CHAPTER THREE - THE FINDINGS

CHAPTER THREE - THE FINDINGS

3.1 ACTION PLAN FOR THE MANAWATU WANGANUI REGIONAL COUNCIL

The following is an action plan for flood hazard mitigation to be carried out by the Manawatu Wanganui Regional Council. The plan is presented in a series of steps. These steps are further elaborated on in a 'breakdown and explanation' of the steps.

Steps:

1. Negotiate areas of responsibility with Horowhenua District Council and attempt to come to some consensus about levels of information provision, regulation, structural protection, and education.

2. If a consensus cannot be established, due to the desire of both organisations to minimise their liability but still maintain some control, then the Manawatu Wanganui Regional Council will need to make an independent decision regarding its accepted level of responsibility for flood hazard mitigation.

3. Define clearly the level of responsibility in the Corporate and Regional Plans.

4. Seek political and staff support from central, regional and territorial government.

5. Lobby central government to provide a policy which will coordinate central government departments' and State Owned Enterprises' policies.

6. Undertake risk assessment analysis with particular attention to key stakeholders.

7. Define acceptable risk level for the Regional Councils' activities.

8. Develop, analyse and prepare policies for inclusion in the Regional Policy Statement and Regional Plan.

9. Seek political, financial and institutional acceptance of these policies. This acceptance should confirmed in the Corporate Plan.

10. Educate key stakeholders as to **why** and **what** action is being taken by the Regional Council.

11. Implement policies.

12. Monitor effectiveness.

3.2 BREAKDOWN AND EXPLANATION OF THE PLAN

A. Negotiate and Define Levels of Responsibility for Flood Hazard Management. (Steps 1-3)

1. Arrange meeting between Senior Planning Staff of Horowhenua District Council and Manawatu Wanganui Regional Council to negotiate levels of responsibility for information provision, regulation, structural protection and education.

   In negotiations understand and acknowledge:

   a) Local government has legislative responsibility for flood hazard mitigation in total.

   b) The Regional and District Council have other responsibilities and these can interrelate with their roles in flood hazard mitigation. eg. district councils have responsibility for building permits, regional councils have responsibility for soil conservation and pest management.

   c) The Regional Council has an existing level of financial commitment to flood protection. eg. hydrological equipment, structural work.

   d) The Regional Council has a potential ability to regulate under the Resource Management Bill provisions.

   e) The District Council has a closer association to the public and is their initial point for contact for development applications such as building permits and subdivision applications.

   f) There may not be a consensus regarding responsibility levels between the Regional and District Council.

g) Existing case law regarding local government liability in flood damage claims.

2. Whether a consensus is possible or not there is a need to clearly define in the Corporate Plan and Regional Policy Statement the Regional Council's accepted level of responsibility. This will provide a clear indication to stakeholders both internal and external to the organisation as to the Regional Council's stance on hazard mitigation.

B. Gaining Political Support to the Level of Responsibility (Steps 4,5)

1. It will be necessary to ensure that the stance of the Regional Council, on its level of responsibility for hazard mitigation, has full internal support.

   The Regional Politicians will approve the statements within the Corporate Plan and Regional Policy Statement. The Politicians must be clear about what they are approving and committed to the necessary action to undertake the responsibility.

   Support from all sectors of the Regional Council staff is essential. A clear understanding of the Regional Council's role in flood hazard management and how it relates to other sectors of the organisation needs to be promoted.

2. The support of central and territorial government politicians and staff should be sought.

3. Lobby central government to provide policies which coordinate central government departments' and State Owned Enterprises' policies.

   This will involve making central government clear about what the Regional Council has undertaken in order to mitigate flood hazards. Persuading central government of the need to take this into account when formulating policies for its departments is necessary.

C. Undertake Risk Assessment Analysis (Steps 6,7)

1. Identify the 'key stakeholders' in the Horowhenua floodplain.

Planners	District
	Regional
Politicians	Regional
	District
Public	Rural-Residential
	Horticulturists
	Farmers
Commercial Interests	Lawyers
	Real Estate Agents
	Insurance Companies/ Brokers
	Banking, Financial Institutions
	Development Companies
	Surveyors
Engineers	District
	Regional

2. Acknowledge varying levels of investment or interest in the floodplain when considering risk analysis.
eg. farmers may have only use of the land for grazing or may have extensive investment in the form of dairy sheds. Engineers may have interest in the floodplain in terms of the effectiveness of their structural mitigation measures.

3. Identify varying flood types. ie. velocity, depth, duration.

4. Account for the time since the last major flood event when considering perceived risk.

5. Agree with central and territorial government on a survey technique/public participation technique to meet the needs of all three organisations. Combine resources of tiers of government to undertake survey.

6. Identify stakeholders' preference for certain management techniques.

7. Define an acceptable risk level for Regional Council action determined by understanding the technical and perceived risk.

8. Get political, managerial and institutional acceptance for risk level.

9. Define the acceptable risk level in Regional Policy Statement and Plans.

D. Develop, Analyse and Prepare Policies for inclusion in Regional Policy Statements and Plans. (Step 8)

1. Identify options

Service Delivery:

New work
- -banks
- -relocation of buildings
- -detention dams
- -channelling
- -drainage pumps

Maintenance of existing works

Upgrading of existing works

'Green Engineering' options
eg.afforestation

Education:

Advice to people on flood hazard.

Information needed:
- -depth
- -velocity
- -location
- -duration
- -frequency
- -suitable land uses

Target groups eg.
- -lawyers
- -public
- -real estate agents

Target time
-post hazard
-pre-sale

Regulation:

Zoning
Subdivision Regulation
Building Regulation
Land Use Regulation
Land Clearance
Stormwater Management
Land Retirement
-acquisition
-reserves

Other:

Emergency mitigation
-Civil Defence
-Flood warning

Financial Incentives
-afforestation
-relocation

2. In Considering the Options Consider:

- Who benefits/Who pays?
- Most timely implementation
- Most cost-effective mechanism considering:
  -time
  -degree of existing development on floodplain
- Degree/type of flooding
- Balance of long-term, sustainable approach against short-term alleviation methods.

E. Seek Political/Financial and Institutional Acceptance to Policies and Implementation Decisions. (Step 9)

- Ensure adequate budgeting for the time needed for implementing. ie. this may exceed the annual financial planning time frame.

- Ensure full understanding by internal staff of the implications of policy decisions in day to day work.

F. Educate Key stakeholders as to WHY and WHAT action is being taken.

- Advise of advantages and disadvantages of approaches.

- Level of protection from structural mitigation techniques.

- Variation between long and short term mitigation techniques.

CHAPTER FOUR - DISCUSSION AND CONCLUSIONS ABOUT THE THESIS

CHAPTER FOUR - DISCUSSION AND CONCLUSIONS ABOUT THE THESIS

The aim of this chapter is to summarise the major findings of the thesis by evaluating the degree to which the thesis objectives have been met.

OBJECTIVES

Despite the difficulties of reaching absolute conclusions in this type of analysis without implementation and monitoring of the action plan, it is reasonable to state that the thesis provides **'a better planning process for mitigating flood hazards in the study area'** for the following reasons:

a) The thesis proposes an 'action plan' which considers all people and institutions which have a particular interest in the problem.

b) The action plan provides options for long term and short term solutions to the problem.

c) The action plan explicitly recognises there are many changing circumstances in the environments and in particular the organisations associated with flood hazard mitigation.

d) The action plan recognises that there are many components contributing to the flood hazard problem.

For these reasons the action plan has a better chance of solving the problem.

The action plan needs to be implemented and constant monitoring of its success and suitability needs to be undertaken. The process provided in the action plan is flexible enough to enable adjustments to action as the monitoring information determines it is necessary. Much of the success of mitigating flood hazards in the Horowhenua may not become apparent for several decades as a major flood needs to be experienced to determine the overall impact of the action plan on reducing any associated hazard.

Individual objectives are also achieved.

The examination of theoretical frameworks highlights the need to scan a wide range of components of the problem. The physical environment is surveyed and acknowledged as an important factor in understanding the problem. In this way, the frameworks of theorists such as Geddes (1923) are not discarded. The institutional environment or the systems in which planning decisions are made are examined and made explicit. Therefore the systems approach to planning and the realities of planning practice are incorporated and acknowledged. Finally, the behavioural environment is examined, this incorporates aspects of the systems approach to planning, in that, all aspects of the environment in which planning takes place are explicitly acknowledged. Examining the behavioural environment also enables incorporation of the concept of 'social learning', ie. planning must move closer to the realities of society and society must understand the need for planning.

The process undertaken in this thesis draws on many aspects of various planning theories, however, it is welded together in the context of a strategic planning framework where the emphasis is on an action plan for a particular organisation.

The planning literature examined in chapter one is only a sample of what exists. However, it does provide a cross-section of attempts to manage flood hazards both in New Zealand and overseas. The USA approach exhibits the problems associated with relying on the 'market' to mitigate against flood hazards, the Australian (NSW) approach shows the problems associated with a standard management plan and the New Zealand approach did not take account of the wider institutional and behavioural aspects of the problem. An analysis of these approaches and a variety of other research literature on flood hazard management were valuable for identifying successfull and unsuccessfull aspects of flood hazard management proposals. The analysis also enables key issues about targeting flood hazard management techniques to be identified; eg. timing of implementing flood hazard mitigation techniques will influence their effectiveness.

Chapter two scans the physical, behavioural and institutional environments impinging on the flood hazard problem. From this scanning some 'key issues' that need to be incorporated in any action plan for flood hazard management are identified. The scanning of these environments in this thesis does not therefore attempt to fully analyse all components of the environments, rather it identifies aspects of these environments that need to be taken into account or need further research when undertaking an action plan. The thesis enables a better understanding of the wide range of components which impact on the flood hazard problem and therefore it enables these components to be identified for incorporation into a process or action plan. The thesis does not attempt to provide all the detailed technical information necessary for a final solution. The action plan clearly identifies further research that is necessary, particularly with respect to the behavioural and physical environments. At this stage it is important to remember that in this study and in any future research there will always be a trade-off between perfect information and achieving some sort of plan (refer section 1.4)

Chapter three presents the findings of this thesis in the form of an action plan for the Manawatu Wanganui Regional Council. Every attempt has been made to keep the process as pragmatic as possible, however the implementation of the plan in the working environment will be the true test as to its practicality to the Council staff. As stated early the success of the process at mitigating the flood hazard will need to be constantly monitored, however, it must be remembered that many of the options provided for mitigating the hazard are long term and it may be years or decades before the success of these is determined.

The action plan presented in Chapter three is a process for acheiving a result. The thesis does not attempt to provide a 'blueprint' or final plan for flood hazard management in the Horowhenua. Every attempt has been made to identify all the issues impinging on the success or otherwise of a process for flood hazard management. However, there will always be uncertainties and problems such as political and financial constraints limiting the process.

The action plan is tailored for a particular organisation and a particular geographic area. However, the principles in the process and some specific actions may be relevant to other regional councils and to other geographic areas. The general process followed in the thesis and the action plan developed even has relevance to dealing with a wider range of planning issues. For example, the action plan provides guidelines for formulating questions and making choices relevant to environmental planning.

The completion of the thesis has been satisfying in that it has provided an opportunity to 'step back' and develop a new and more suitable planning approach for dealing with flood hazard management. However, the outcome of the thesis is an action plan directly relevant to the New Zealand planning system.

IMPLICATIONS FOR FURTHER RESEARCH

1. Relevance of the Findings in this Thesis to a General Planning Procedure

It is recognised that the action plan presented in this thesis is tailored to a particular organisation and geographic area; and that there are limitations to devising standard management plans for dealing with problems such as flood hazards. However, there is scope to further investigate the relevance of the findings in this thesis to a general planning procedure. The findings in this thesis are an example of a practitioner devising a pragmatic action plan, within the general theoretical framework of strategic planning, from an intimate knowledge of all the components of the problem. In this way it is an example of a process being devised from the 'bottom up'. The theorist or academic may be more inclined to devise a procedure following some theoretical framework. There is value in theorists and practitioners blending their knowledge to devise a general planning procedure. The findings of this thesis could provide a starting point for a closer relationship between the practitioner and theorists or academics in planning.

2. Impacts of the Action Plan on the Manawatu Wanganui Regional Council and other Organisations

The action plan proposed in this thesis will have implications to the working environments of both the Manawatu Wanganui Regional Council and many other organisations in both the private and public sector. For example, the education of key stakeholders of the flood hazard will impact on real estate organisations and law firms as well as local authorities. The Council will need to liaise with these organisations regarding the action plan and monitor the changes to their environments, changes to their environments will in turn impact on the decisions to be made by the Regional Council. These organisations may also need assistance to review their own environments due to the impacts as a result of the Manawatu Wanganui Regional Councils actions and make necessary adjustments, ie. if clients of real estate companies have a much greater awareness of flood hazards in their area, the real estate companies will need to take account of this in their own information transfer role.

3. Behavioural Information

The action plan proposed in Chapter three highlighted the need for a greater understanding of the behavioural environments in which stakeholders' decisions are made. Many of the questions raised in Section 2.5.5 need answering so that the Council has a better information base on which to base its 'risk assessment analysis' (refer step 6 of the action plan). Behaviour, and how it relates to 'risk assessment' is an important area of research for the Council to pursue. As discussed in Section 2.5.3 the technical evaluations alone provide an insufficient guide to risk assessment, perceptions will dominate political decision making and therefore have a significant impact on how a flood hazard is dealt with.

4. Physical Flood Information

Appendix D of this thesis provides some physical information on types of floods experienced in the Horowhenua. The physical information in Appendix D is

however, not complete enough for the decisions to be made in the action plan. Further hydrological data and other technical data is needed to provide a better technical assessment of the flood risk.

APPENDIX A

GLOSSARY AND ACRONYMS

GLOSSARY

Behaviourial Environment: the behavioural attributes of key stakeholders eg. their perceptions of risk, their reactions to floods.

Catchment Schemes: flood mitigation schemes initiated by catchment authorities for a given catchment. These schemes concentrate on structural measures to limit floods and are now the responsibility of regional councils.

Drainage Problems: when water floods due to the inadequacy of the land to drain freely ie. the water cannot get away quick enough.

Flood: relatively high stream flow which overtops the natural or artificial banks in any part of a stream or river.

Floodplain: the portion of a river valley adjacent to the river channel which is covered with water when the river overflows during floods.

Flood Frequency: the chance that a flood will occur in any given year, eg. 1% flood probability means the flood has a one percent chance of occurring in any given year or is expected to occur on average once in 100 years.

Flood Hazard: potential for damage to property or persons due to flooding.

Flood Hazard Management: the management of a potential or existing flood hazard (refer earlier definition) by people or institutions involving people for the purpose of mitigating the hazard.

Flood Hazard Mitigation: to reduce the severity of existing or potential flood hazards.

Institutional Environment: the types of institutions involved in flood mitigation. The institutional environment includes the political, financial, legislative and structural characteristics of these institutions.

Key Issues: key components of the problem.

Key Stakeholders: those people/institutions which have a particular interest (political, managerial, professional, financial) in the planning process.

Land Use Management techniques: regulatory techniques which control land use. eg. zoning.

Physical Environment: the physical and spatial attributes of the flood environment including such things as the type of flooding, land use, structures on the floodplain.

Ponding: flood waters which are slow moving and tend to be on land for long periods as a result of inadequate drainage.

ACRONYMS

NFIP - National Flood Insurance Program (USA)

NSW - New South Wales

NWASCA - National Water and Soil Conservation Authority

NZ - New Zealand

MOWD - Ministry of Works and Development

USA - United States of America

WASRMPS - Water and Soil Resource Management Plans

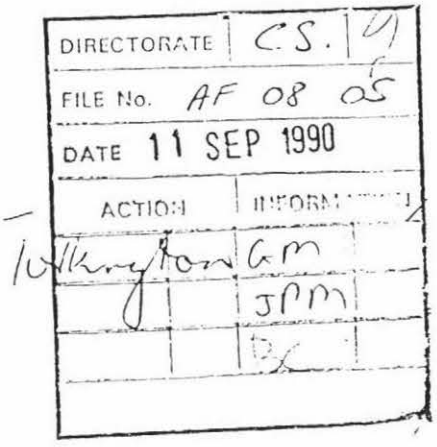
APPENDIX B

LETTER FROM THE DEPUTY SECRETARY FOR THE ENVIRONMENT TO THE CHIEF EXECUTIVE OF THE MANAWATU WANGANUI REGIONAL COUNCIL REGARDING RESOURCE MANAGEMENT GRANTS, 5 SEPTEMBER 1990.

MINISTRY FOR THE ENVIRONMENT
MANATŪ MŌ TE TAIAO
84 Boulcott Street, P.O. Box 10362, Wellington, New Zealand.
Telephone (04) 734-090, Fax (04) 710-195.

our ref:

5 September 1990



Chief Executive
Manawatu-Wanganui Regional Council
Private Bag
PALMERSTON NORTH

Dear Mr Barrett

RESOURCE MANAGEMENT GRANTS

The Government has approved a programme of resource management grants. This replaces the previous block subsidy funding which terminated on 30 June this year.

The grants are designed to ensure that national interest outcomes are achieved. The grants programme will complement other means of achieving national outcomes such as those provided in current legislation and particularly, those that will be available when the Resource Management Bill is enacted.

Resource management grants will be available through three programmes:

minimum environmental quality standards,

regional adjustment in cases of special need, and

start up funding for new and devolved functions, and innovative activities for resource management that can be applied to other regions.

The basic purpose of the grant is to ensure that solutions to environmental degradation are sustainable in the long term.

Grant Programme for Minimum Environmental Quality Standards

These grants are to assist local authorities achieve minimum standards of environmental quality where these are in the national interest. An example of past assistance for achieving minimum standards of environmental quality in the national interest was for the programme to improve the quality of Lake Rotorua.

The national interest is to be identified by a process satisfactory to the Minister for the Environment. This process will look at issues identified in a region's Annual Plan and also in planning schemes under the Town and Country Act and other documents such as water and soil management plans.
When the Resource Management Bill is enacted, Statements of Government Policy and regulations specifying National Minimum Standards will help identify matters for which grant assistance may be available.

Regions are expected to achieve standards of environmental quality based on their own policy processes. Funding assistance will be considered where it is necessary to raise the standard to the national minimum.

Grant Programme for Regional Adjustment in Cases of Special Need

Regional adjustment includes dealing with natural hazards (floods, landslip), non-sustainable resource use (soil erosion), past environmental degradation (contaminated sites), and disasters which regions cannot financially support or undertake from their resources.

Evidence will be required that the regional adjustment programme will achieve sustainable solutions, including measures that deal with contingencies. Councils will be expected to direct these funds to those projects that have high priority in their Annual Plans.

The case for special need exists where the total programme of regional adjustment measures is beyond the region's ability to pay in the medium term. The aim is for regions to become self sufficient in dealing with these resource management problems as soon as practicable.

Regions will be required to provide full initial funding up to a threshold level set by the Minister. The threshold level will be a common percentage of rateable capital value. Cost sharing beyond that threshold will also be set by the Minister according to a region's ability to pay.

Start Up Grant Programme

Start up grants are to assist local authorities:

i perform resource management functions previously undertaken by central government where there are short term constraints on charging and other funding sources, that would result in those functions being inadequately performed.

ii adopt new or changed resource management functions where there are short term constraints to obtaining or developing the required skills, which will limit their uptake for those functions which are critical for good resource management;

iii develop innovative resource management measures which can be applied in other regions and produce outcomes that are important to the nation.

Funding assistance for start up grants will be determined on the merits of each case, will be for a term no greater than three years, and must be of high priority in the region's Annual Plan.

Transition

The Minister of the Environment is to decide the transitional arrangements in the 1990/91 financial year for moving from current programmes to programmes under the resource management grants policy.

Pre-1987 Catchment Grants Schedule

The Government has reaffirmed that there is to be no change to completion dates, and no transfers of grant between projects in the pre-1987 Catchment Grants Schedule, except in exceptional circumstances. Councils that have requested changes to their Catchment Grants Schedule over the last few months will be advised of the Minister's decision by a separate letter.

Transition Issues

Projects previously funded by block subsidy and which continue into this financial year will be able to be assisted under the Regional Adjustment policy. The preferential and standard block subsidy grant rates are replaced. The transition period applies to the activity, not its grant rate.

The Minister wants to direct grants into the new activities of the resource management policy as quickly as possible. To encourage this the Minister will allow regional councils to transfer grants from existing pre-1987 commitments to activities under the new policy with no clawback penalty. You are asked to advise the Ministry for the Environment of transfers you might consider.

Your Annual Plan generally provides all the details relevant to the Minister's consideration of the activities he might wish to assist over the next year.

Please forward a copy of your approved Annual Plan by return mail if you have not already done so.

Transition Process

Ministry staff will meet with the NZLGA Works and Finance Committee shortly to determine an agreed process for dealing with transitional issues and an equitable basis for grant allocation to each Council for this financial year. The Minister for the Environment will advise you of your Council's grant allocation for 1990/91 in mid October.

Yours faithfully

Lindsay Gow

Lindsay Gow
Deputy Secretary for the Environment

MINISTER FOR THE ENVIRONMENT

Press Statement

29 August 1990

Resource Management grant scheme replaces catchment grants

A new programme of resource management grants was announced today by Minister for the Environment Rt Hon Geoffrey Palmer.

"The programme replaces the present block subsidy funding of local and regional authorities for water and soil conservation activities, otherwise known as catchment grants," said Mr Palmer.

"The grants will now be available for a much wider range of resource management issues.

"They will not only be available for the normal day-to-day activities such as flood protection works, but would also be available for activities such as the clean-up of a polluted area, or disaster recovery.

"The grants are to enable local authorities to fund works which are in the interests of the whole country, such as flood protection, which they could not normally do.

Mr Palmer said the new programme complemented the Resource Management Bill's provisions for recognising that Government should take responsibility for areas in the interest of the whole country.

"But the funds must be used wisely, and in the interests of the nation.

"For example, building stop banks is only one answer to protecting a community from floods. Education and planning development away from the risk area may be better alternatives for long term community protection."

Mr Palmer said resource management grants would be given through three programmes.

Firstly, there would be grants to assist local government to meet nationally established minimum environmental quality standards.

"A recent example of this is Lake Rotorua. A grant was given to clean up the lake, and an alternative sewage treatment plant was established. The lake water quality has since improved noticeably."

Secondly, there would be a Regional Adjustment grants programme, for regions with special needs," said Mr Palmer.

"The aim is to offer assistance to the region to get it to a position of self sufficiency.

The term "adjustment" included measures for dealing with natural hazards like floods or landslips, disasters and situations of non-sustainable resource use.

An example of non-sustainable use was land practices which caused soil erosion. Adjustment could also include work to clean up contaminated sites or other environmentally degraded areas.

"There is a case for special need when the region cannot pay for measures needed within a time acceptable to Government."

"At present Government is put in the position of paying the bill for disaster recovery because regions haven't adjusted to likely hazards.

"Some regions face severe soil erosion. Some are at constant risk from flood.

"A grant, given on the basis of the region's ability to pay, would top up the region's contribution.

The third programme in the Resource Grants administration would be the "Start up Grant Programme",designed to assist local authorities in three areas:

- where a local authority is carrying out a function previously done by a central government agency.

- where a local authority is undertaking new or changed resource management functions,

- where a local authority has developed an innovative idea for resource management that could be applied in other areas.

"Funding assistance for start up grants is available for up to three years maximum. Each case will be decided on its merits."

Mr Palmer said the Government anticipated a number of local authority functions would deserve assistance through the start up grants programme once the Resource Management Bill was enacted.

Ends

For further information, please contact Dick Burgess, Senior Environmental Analyst, Ministry for the Environment Ph (04)734-090. or Wayne Bethjeman

APPENDIX C

NATIONAL WATER AND SOIL CONSERVATION AUTHORITY
POLICY STATEMENT ON FLOODPLAIN MANAGEMENT
Circular No. 1987/12 December 1987.

NATIONAL WATER AND SOIL CONSERVATION AUTHORITY

PLEASE QUOTE
74/2/4

Address replies to:
The Secretary
National Water & Soil Conservation Authority
P.O. Box 12-191
Wellington North
New Zealand
Telephone 729 929

NWASCA Circular No 1987/12

9 December 1987

To : New Zealand Catchment Authorities Association
All Catchment Authorities
District Commissioners of Works
Ministry for the Environment
Department of Conservation
Ministry of Internal Affairs
County Councils Association
Municipalities Association

FLOODPLAIN MANAGEMENT POLICY

The National Authority has adopted a Floodplain Management Policy which will provide a new direction and emphasis to the manner in which river control and flood control is undertaken and how associated matters are addressed.

This new policy is now being distributed for application and/or information. It will become wholly operative as ongoing commitments made under previous policies terminate and will apply to all new activities from 1 April 1988.

A copy of the Discussion Paper, considered over a period of time by the Authority's Policy Committee, which led to the development of the policy, is attached to the policy for background information.

D G Knowles
Secretary/Chief Executive Officer

NATIONAL WATER AND SOIL CONSERVATION AUTHORITY
POLICY STATEMENT ON

FLOODPLAIN MANAGEMENT

Preamble

Floodplains are attractive places for settlement offering many advantages over other sites. Unfortunately, large parts of floodplains are also subject to flood hazard and this entails a cost for development.

There are three ways of dealing with the flood hazard :

a) Keep man away from water: eg zoning, minimum floor levels.

b) Keep water away from man: eg stopbanks, catchment treatment.

c) Deal with the consequences of flooding: eg flood warning, emergency preparedness, insurance.

The rational use of floodprone land will occur when those who make the land use decisions have the right information about the true benefits, costs and risks involved and can choose equally between the three above adjustment options. In this way it will be possible to maximise the difference between the benefits of locating on floodplains and the cost associated with living with the flood hazard.

Policy Aim

The aim of this policy is to reduce the nation's flood losses consistent with the rational use of floodprone land.

NWASCA's prime role in pursuing this aim is to create a policy environment in which communities, organisations and individuals take decisions about the use of floodprone land that are at the same time in their own interest and for the common good.

Secondly, NWASCA has a role in contributing knowledge and understanding of all aspects of the flood hazard and of ways to overcome it

Policy Goals

Group A: The creation of an unbiased policy environment.

A.1 To persuade other agencies (such as territorial local government, Civil Defence, lending agencies, the insurance industry) whose decisions affect floodplain development, to take account of the flood hazard in their own policies.

A.2 To pursue with Government the desirability of ensuring that all government departments and state owned enterprises contribute to the cost of flood alleviation measures in proportion to the benefit they receive.

Group B: Raising the awareness of decision makers and floodplain dwellers of the flood hazard and its solutions.

B.1 To encourage catchment authorities to formulate and carry out plans for the flood hazard areas in their district, where required.

B.2 To provide catchment and territorial local authorities with tools and techniques for use in floodplain management planning.

B.3 To instigate technical and social research where current lack of knowledge and understanding hinder progress towards NWASCA's aim for floodplain management.

B.4 To carry out promotion directed at floodplain dwellers to increase their understanding of the flood hazard and of the different ways to overcome it.

Implementation

The National Water and Soil Conservation Authority will each year determine priorities for the achievement of specific objectives which will be formulated as part of the Floodplain Management Programme, to be carried out by the Water and Soil Directorate. The Programme will be published each year.

Subsidies to catchment authorities

All catchment authority activities that contribute to the rational use of floodprone land will be eligible for subsidy, provided that they are justified in terms of this policy. Such activities include the following:

- Floodplain Management Plans arising out of a study comprising:
  - △ An assessment of the flood hazard,
  - △ the selection of the size of flood to be used for planning purposes,
  - △ the evaluation of the full range of adjustment options available for responding to the flood hazard, and
  - △ the preparation of a Plan including recommendations for the guidance of development within the floodplain.
- All types of flood alleviation measures (regulation, works and their maintenance, floodwarning, etc);
- Promotion.

As from 1 April 1991, any subsidy for expenditure on flood alleviation measures will be conditional upon proposals being consistent with a Floodplain Management Plan.

Policy Evaluation

The effectiveness of this policy, and of the activities carried out under it, will be evaluated each year in the National Authority's Annual Report. Suitable performance measures will be developed to permit consistent reporting over time and across the whole country.

November 1987

Item No .

NATIONAL WATER AND SOIL CONSERVATION AUTHORITY

74/2/4

Submission no 510.11.87

Chairman

FLOODPLAIN MANAGEMENT POLICY

1. INTRODUCTION

1.1 Preamble

This paper explores possible future directions of NWASCA's floodplain management policy(which is to include the current river control policy) in the light of:

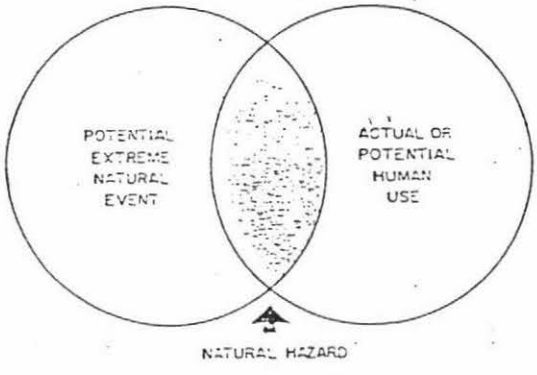
the Government's 1987 budget decisions;
the Hide/Sharp report on subsidy to catchment works.

1.2 Some definitions

In this paper a number of terms are used with a specific meaning which may not exactly coincide with the layman's understanding of those terms. They are therefore defined here to avoid misunderstanding.

Natural hazard

A natural hazard is the relationship between a potential natural event in a given area and the human occupation of that area. It is a social phenomenon created by humans. The figure below illustrates this idea.



The flood hazard is just one of many natural hazards.

Adjustment option

An adjustment option is a way to deal with the threat posed by the flood hazard, ie structural measures, planning measures, floodwarning or insurance.

Bias

We use the word bias to describe an attitude which gives weight to only one particular adjustment option without giving due consideration to all other adjustment options.

Rational use of the floodplain

Floodplains are attractive places for human settlement offering many advantages above alternative sites. Unfortunately, large parts of floodplains are also subject to the flood hazard and this entails a cost for development. It must be society's goal to maximise the difference between the benefits of locating on floodplains and the cost associated with living with the flood hazard. While we will never know whether or not we are achieving such a goal, it is posited that the process of floodplain management, which involves the careful weighing of the risks, merits and costs of all adjustment options, offers the best chance of coming close to it. We will therefore use the term rational use of the floodplain as such use as is the result of the full consideration of all adjustment options appropriate to any particular site.

2. *THE ISSUES*

2.1 The justification for government intervention.

Before considering the goals and objectives that NWASCA may wish to set for itself in the floodplain management area, it is first necessary to discuss the various problems for policy. We must show how government intervention will result in better outcomes for society and decide what type of measures are best suited to overcome the problems identified in the following sections. In general, we can distinguish the following types of measures open to Government:

- fiscal measures, ie incentives, loans, taxes and tax breaks;
- legislation, regulation, policies, etc.
- provision of information through research, education, promotion, etc.

2.2 Who benefits from flood alleviation measures ?

By far the greatest part of the benefits of flood alleviation measures is captured by the people living in the floodprone area and by those in the immediate vicinity. However,this depends to some degree on whether Government departments and SOE's can be made to contribute their share of the costs in accordance with the benefit received. Crown owned property, public utilities, etc share in the benefit of flood alleviation measures but cannot be forced to pay rates(although there are many instances where they contribute in lieu of rates). Government is at present addressing this problem. Until this issue is resolved, there is some justification for funding from Programme II for these central government interests, although NWASCA may have misgivings about the use of "its" funds for such purposes.

The Authority may wish to urge the Government to take action to make Government departments and SOE's subject to rates.

Alternatively, the Authority could approach these various agencies itself and try to negotiate general agreements by which these agencies would agree to make contributions in lieu of rates for the benefits received.

If, on the other hand, the Authority considers it reasonable that funding for these purposes is financed through Programme II, then it needs to address the targetting problem caused by the fact that "national assets" are not evenly distributed throughout the country.

In terms of non-$ values such as freedom from stress, health, the loss of personal memorabilia, etc, an argument would be that these would be completely captured within the region and would therefore not constitute a justification for subsidies to regional flood alleviation measures.

2.3 Who Should Undertake Flood Protection ?

Section 2.1(pages 5 and 6) of the Hide/Sharp report discusses the reasons why individual householders, in the absence of any government intervention, have only limited scope to provide their own flood protection. The report identifies two reasons why this is so: the so-called free- rider problem and the lack of awareness of the flood problem. The report continues to say that both problems are already largely overcome by the existence of catchment authorities and by existing legislation. Catchment authorities have the mandate to collect and collate all relevant data required to develop plans for overcoming the flood hazard. They are based on whole catchments and can reflect a regional community of interest. For a limited number of flood protection measures they have the ability to overcome the problem of individual uncoordinated responses that might transfer or exacerbate the problem for a neighbour. They can also cooperate with other regional or local agencies, such as Civil Defence and the territorial authorities, who have complementary powers. The Hide/Sharp report concludes there is therefore no need for central government financial assistance to overcome these problems.

2.4 Who should pay for flood protection ?

In the "user pays" line of thinking, an appropriate level of investment in a particular activity is achieved when the "funding incidence reflects the distribution of benefits". Or, in simple words: the best chance of achieving the best use of the floodplain occurs when those benefitting from flood protection have to pay for the cost of that protection. In the Hide/Sharp report it was argued that the large government subsidies for flood protection measures may have caused an over-investment if viewed from the national perspective. Scheme ratepayers could also be said to be "free-loading" on the taxpayer, which poses an equity problem.

Therefore, the Authority may wish to question the justification for continued subsidies for flood alleviation measures.

2.5 The problem of ignorance

The population at large is not fully aware of the flood hazard and of the various adjustment options available to overcome that hazard. This is true in a general sense (eg misconceptions about the concept of the "100 year flood") as well as about the risks flooding poses on any particular floodplain.

If floodplain dwellers and local decision makers do not have the necessary information and perceptions about the flood hazard they are living with, they cannot be expected to make rational choices about the best way to overcome those hazards.

The Authority may, therefore, decide that it has a role to play in overcoming the lack of information(through research and promotion).

One particular facet of the lack of awareness of the flood hazard is what we have called "bias" and deserves separate discussion.

2.6 Bias

The source of this bias is manifold. At its most general, one can say that structural measures are the most tangible of all the adjustment options : they form visible proof to

the population that "something is being done". They are therefore much easier to accomplish than other forms of action.

If, at the same time, the population is largely unaware of other forms of action, a strong political pressure for that one particular solution will be brought to bear wherever the flood hazard becomes a public concern. Public attitudes will make themselves felt around the board table at CA and TLA meetings. In the aftermath of flooding disasters there is also great pressure on local MP's and government ministers to back up their expressions of sympathy with the flood victims with commitments to prevent a repeat of the event.

The source of another strong bias lies with NWASCA policies themselves. While various policy statements over the past few years have emphasised the need to look at all options, subsidy policy is still favouring structural measures to the exclusion of solutions such as house raising and shifting.

A third bias is the result of the fact that responsibility for flood alleviation has traditionally been in the hands of engineers with their construction-oriented training and "can do" ethos.

Why is this bias a concern to NWASCA ?

The central thesis underlying Ericksen's study and that of similar overseas work is that bias towards particular adjustment options will not lead to the rational use and development of floodprone land.

It is postulated that rational use of floodprone land will only eventuate if decision makers in catchment and territorial authorities can make equal use of all the available options to meet the flood hazard and if floodplain dwellers in making their locational decisions are faced with the true costs and benefits of living on a floodplain.

If that is accepted, it follows that NWASCA has a role to play in making sure that its own policies are not biased and in fostering an unbiased policy environment in terms of the activities of other agencies.

2.7 Equity issues

If the efforts to create a policy environment where decision makers are faced with the true costs and benefits of living in floodprone areas were to be successful, then presumably floodprone land will be cheaper to buy than "safe" land because purchasers will take the additional cost of insurance, CA rates, resale prospects, etc into account at the time of purchase. In other countries this has led to low-lying areas becoming lower income ghettos so that the very people who presumably are already in the most unfavourable position to absorb financial, social and health stresses will end up with an additional burden. The "freedom of choice" argument will receive little understanding among this group of people. *The Authority could ask itself whether this is a situation likely to be repeated in New Zealand and, if so, to what extent it has a responsibility to avoid it.*

2.8 Current river control policy

Chapter 14 of the NWASCA Manual contains the Authority's river control policy as it existed on Budget night 1987. Its three main elements are:

- a rationale for government subsidy;
- a system of encouragement for a comprehensive approach to catchment control through a graduated scale of grant rates;

- special provisions for the protection of urban assets, ie the exclusion of grant eligibility for urban stormwater works and a sanction against unwise development after 1971.

The rationale for subsidy as presented in the Manual is no longer valid in terms of current economic philosophy and of the Government's Budget decisions, but what about the other two elements of the policy ?

One reason for introducing higher rates of government grant to catchment control schemes than to river schemes and to isolated works no doubt was to encourage the comprehensive approach at a time that was a new concept. It is clear that all catchment authorities have by now been persuaded of the merits of this comprehensive approach. Another reason for the higher rates was the off-site and long term nature of the benefits associated with soil conservation parts of a comprehensive scheme. The discussion paper on soil conservation policy will deal with this issue.

In addition to the fact that the justification for a system of graduated subsidy rates for river control works is not as strong as it used to be, comes the fact that the new subsidy regime does not lend itself easily to such a concept. It will be difficult enough for the Authority to distribute available funds between catchment authorities and between broad policy areas without having to deal with graduated subsidy rates within individual policy areas.

The Authority may therefore wish to re-consider the system of different subsidy rates for the different categories of river control works.

The reason for excluding urban stormwater works from eligibility for NWASCA grants was probably less a matter of principle than inspired by the fear that applications for such works in urban areas would crowd out proposals for more "productive" schemes in the rural areas. The Authority may wish to re-consider this element of current policy in the light of the following two observations:

- the water and soil legislation does not distinguish between the protection of rural and urban assets.
- recent developments in the field of urban drainage management planning. These developments, with their emphasis on non-structural measures(such as creating local storage areas in order to save on piping costs) are in fact an extension of the floodplain management philosophy beyond the floodplain proper. By dropping this element from its policy, NWASCA would allow catchment authorities to exercise the greater autonomy they are now deemed to be ready for. While presumably catchment authorities would be faced with a spate of applications from local councils, it would also provide opportunities for closer links between CAs and TLAs in the floodplain management field. Each catchment authority could develop its own policies for how it wants to deal with such issues to make sure it does not get involved in stormwater matters in places where there are no repercussions for flood hazard issues.

Depending on the choices the Authority makes in response to the issues raised in this section, it could result in the complete withdrawal of the current river control policy as formulated in Chapter 14 of the Manual.

2.9 Minimum standards

If communities have the means(in terms of the institutional framework provided) to provide their own protection and have to make their own choices about the level of protection they are prepared to pay for and, consequently, the residual risk they accept to live with, is there a need for a national agency such as NWASCA to impose a lower limit of protection ?

Before looking at some possible standards, we should perhaps ask what is meant by the term minimum standard. What happens if a community or agency sees no merit in the standard enunciated by the Authority ? There are a number of possible responses:

1. The Authority could carry out itself whatever action is required to meet the standard and pay for it.

2. The Authority could carry out the necessary action and make the "beneficiary" pay for it. New legislation may be required for this option, but there is a precedent with drinking water standards enforced by the Health Department.

3. The Authority could withdraw subsidy given for other purposes. This would only be a sanction if the unwilling party receives any subsidy funds.

4. It could direct a catchment authority to carry out a certain action.

5. The Authority could try persuasion but not undertake any further action. in this case it would be better to speak of guidelines rather than standards.

It could be argued that, as it is likely that the Government will continue to be involved in disaster relief and restoration funding, it makes sense to provide a fence at the top of the cliff so that the ambulance at the bottom of the cliff does not have to be called out so often. A minimum standard of flood protection would be a possible response. Another one would be a system of flood insurance as exists in other countries(voluntary in the USA, compulsory in France). The advantage of insurance would be that it signals the flood risk to every house owner.

In considering the question of a minimum standard, the Authority may wish to distinguish between the safeguarding of life and the protection of property.

Safeguarding of life

The problem of saying that it should be up to each community to choose its own standard of protection lies with the fact that not all individuals(ie children) within each community have a say in that choice. It also does not allow for individual choice on what is the most crucial matterof all. A minimum standard that could be set could be for the Authority to say it wishes to achieve a minimum flood warning time for every dwelling in the country. Say, sufficient to knock on doors and get people out of their houses. Such a standard would require a big effort to collect the required information and put in place. Would the Authority be prepared to carry the costs if a local community were not convinced of the usefulness of what the Authority wanted to achieve ? There will be many situations where this standard would not be able to be met, eg Te Aroha. Relocation would be an option in such cases: would NWASCA then be prepared to force people out of their houses?

Alternatively, the Authority might consider that any minimum standard is, in fact, already achieved in New Zealand , witness the very small numbers of lives lost due to flooding. It could be argued that, if it is the protection of life that is at stake, it would be more efficient to put resources towards lowering the road toll.

Some may wish to argue that the protection of life is not part of NWASCA's mandate and that Government has created the Civil Defence organisations to take care of this aspect. Even if that were so, that does not, of course, rule out NWASCA and catchment authority involvement, but it would mean it is not a major concern.

The protection of property

For many years the 1 : 100 year protection for urban areas and a 1 : 20 year design level for rural areas have been widely applied. If the aim of the rational use and development of the nation's floodplains is accepted by NWASCA, then the setting of minimum standards would interfere with that aim. As long as flood insurance is available to house ownwrs, there seems to be no compelling argument why a nationally set minimum standard is desirable in a policy environment where NWASCA wishes local communities to take responsibility for their own flood protection.

Other standards ?

If the process of floodplain management is the means of deciding the optimum use of the floodprone land, then the Authority could decide to give priority to supporting that activity. *The Authority may wish to adopt the goal of having all major floodplains "covered" by floodplain management plans within the next 10 to 15 years.* Alternatively, the Authority could decide to leave it to catchment authorities to determine the need for floodplain management plans.

As floodplain management plans are a subset of water and soil management plans, any policy the Authority will adopt for the latter would presumably also apply to the former.

2.10 Summary

When discussing the various issues above, for each a number of different options were suggested to the Authority. It is possible to make a consistent set of choices if these choices are viewed from the following perspective:

Given that from now on catchment authorities will have greater autonomy in pursuing their activities, and that with the reduction of central government's share of the total cost of water and soil management in New Zealand NWASCA's ability to influence events directly will also diminish, it would seem that under this new regime *NWASCA's most important task would be to create a policy environment that will ensure that individuals, communities and others take decisions in their own interest that are at the same time also for the common good,* or at least not contrary to it.

In the floodplain management area,as was mentioned earlier in this paper, NWASCA does not have full control over this policy environment. Cooperation is therefore required with other agencies with complementary powers. But even if NWASCA cannot act alone, there is no doubt it is the lead agency in trying to create an appropriate institutional framework for floodplain management in this country.

Another ingredient in the recipe for getting the desired outcomes is the information that must be available to decision makers about the possible consequences of their actions(or lack of them). *The second leg of NWASCA's approach could be in this area of the collection of knowledge and making sure it gets to the right people, be they individual homeowners, technical staff of catchment authorities or elected local body politicians.*

It is possible, of course, that decision makers have all the required information but do not act in accordance with it. That would be the case where long established attitudes are being challenged and people do not perceive new ways of doing things as "practical" or "realistic". It is likely that floodplain management falls in this category. One response would be to introduce new legislation or regulation, ie change the policy environment, to enforce a certain direction. While there is a place for this, it might provoke resistance and lead to a rejection of the new philosophy. An alternative response would be to provide incentives for a limited period in the hope that "the proof is in the eating". While such a response might be contrary to the "user pays" principle in the short term, it would be more effective in the long term. A combination of the two responses is also possible.

3. AIM, GOALS AND OBJECTIVES

3.1 Aims and Goals

In Section 2 we have seen that the two main problems in achieving a rational use and development of floodprone land are :

A. A policy environment which does not provide decision makers with the right signals about the true risks, costs and advantages of settling on floodprone land.

B. Lack of awareness and information about the flood hazard and its possible solutions leading to biased decision making.

Society's aim must be the rational use of the nation's floodplains as it was defined earlier in this paper. NWASCA's aim must be consistent with this, even though its mandate is more limited and has to do with the prevention of damage and the land use compatible with that. The latter could then be formulated as follows:

> *To reduce the nation's flood losses to the extent consistent with the rational use of floodprone land.*

From the above *aim* , which only provides a very general policy direction, and having identified the main obstacles that stand in the way of progress towards that aim, we can derive a number of *goals* , which are more specific statements about the sort of things that NWASCA may want to pursue to overcome these problems. For example:

A. GOALS WHICH PURSUE THE CREATION OF AN UNBIASED POLICY ENVIRONMENT

A.1 To ensure that NWASCA's own policies allow regional and local decision makers an unbiased choice between all available adjustment options.

A.2 To persuade other national agencies(such as the local government associations, Civil Defence, lending agencies and the insurance industry) whose decisions affect floodplain development, to take account of the flood hazard in their own policies.

A.3 To pursue with Government the desirability of ensuring that all government departments and state owned enterprises contribute to the cost of flood alleviation measures in proportion to the benefits they receive.

B. GOALS WHICH RAISE THE AWARENESS OF DECISIONMAKERS AND FLOODPLAIN DWELLERS OF THE FLOOD HAZARD AND OF ITS SOLUTIONS

B.1 To encourage catchment authorities, where required, to formulate and carry out floodplain management plans for the flood hazard areas in their district.

B.2 To provide catchment and territorial local authorities with tools and techniques for use in floodplain management planning.

B.3 To promote social and technical research where current lack of knowledge and understanding hinder progress towards NWASCA's aim for floodplain management.

B.4 To carry out promotion directed at floodplain dwellers to increase their understanding of the flood hazard and of all the different ways to overcome it.

For each of the above goals it is then possible to formulate a number of *objectives* , which are statements which define precise results and the time by which these are to be achieved. We will discuss some of those objectives below; many of them are already included in the Floodplain Management Programme considered by NWASCA last April and to be reviewed next April. However, special attention needs to be given now to those objectives that involve the paying of subsidy money to catchment authorities because decisions must be taken soon to enable catchment authorities to plan for the next financial year.

3.2 Objectives for Goal A.1

What means does NWASCA have at its disposal to achieve this first goal ? There are two aspects to consider:

a. Legislation and regulation
b. Fiscal measures

Existing legislation makes provision for both methods(sections 34 and 35, the power to strike rates) and these can be used in an unbiased way, but changes in the legislation may be considered useful to make these particular powers better suited to floodplain management issues. Some specific objectives might be adopted to investigate such issues, for example:

> *To report, by 1 September 1988, on the applicability of Sections 34 and 35 to control development on floodplains.*

Other, similar objectives can be set and will be presented to NWASCA next April , but of more immediate concern to the catchment authorities will be the position of the subsidy policy as it is applied to flood alleviation measures. The following considerations need to be taken into account:

- At present, policy allows the payment of subsidy for structural measures but not for any of the other adjustment options.This is the main bias of current policy that needs to be removed.

- We have seen that from one perspective the only justification for NWASCA subsidies to individual flood alleviation measures is the absence of an adequate mechanism through which government departments and SOE's can be made to pay for the benefits they receive from these measures. If Government introduces such a mechanism, there is no further need for NWASCA subsidies for individual schemes.

- The taxpayer has for many years contributed to the cost of flood protection works, resulting in a very substantial capital investment across the country. A sudden withdrawal of subsidy money for maintenance may result in a deterioration of the condition of these works. This is, of course, not an argument in favour of continuing subsidy assistance for new flood alleviation measures.

- Another argument put forward was that, for reasons of promoting acceptance of the various alternative adjustment options, there is merit in providing subsidies for the application of these measures. This would be for a limited period only, to allow reasonable time for such acceptance to be gained, and in spite of the fact that it runs contrary to the "user pays" philosophy that Government requires us to adopt.

- It is undesirable to impose instant and drastic changes that would not receive the immediate understanding of the client community. It is better to signal the intent of future changes to give people the opportunity to make adaptations. A period of transition would also enable the effects of changes to be monitored and course corrections to be introduced.

Depending on the weight that is given to the above and other considerations, a number of options present themselves. These are listed in the table on the next page, together with their merits and drawbacks.

3.3 Objectives for Goal A.2

Where other agencies have powers which affect the use of the nations's floodplains, NWASCA can seek to influence the policies and actions of those agencies. For example, the following objectives could be adopted:

To promulgate, by 1 September 1988, a joint policy statement with the Municipal and Counties Associations encouraging local authorities to carry out floodplain management planning for all areas where this is warranted by the size of the flood hazard.

or

To seek amendment, by 1989, of Section 641 of the Local Government Act in order to give territorial local authorities greater control of the use of land subject to natural hazards.

or

To persuade Government, by 1988, to promulgate a natural disaster relief policy that is consistent with the floodplain management philosophy.

3.4 Objectives for Goal A.3

To pursue with Government the rating of national assets to pay for their share of the cost of flood alleviation measures. By 1 April 1989.

or

To negotiate agreements with government departments that have assets in floodplains to pay contributions in lieu of rates for the cost of flood alleviation measures. By 1 April 1989.

or

To target subsidy funds to pay for the benefits received by Crown assets from flood alleviation schemes. Ongoing.

3.5 Objectives for Goal B.1

While the Authority will in future be less directly involved in whatever flood alleviation measures local communities choose to adopt, it will still be concerned that in the decision making process these communities consider the full range of adjustment options.

Consequently, the Authority may attach high priority to encouraging local communities to carry out floodplain management planning and may consider subsidies to make that happen.

It was suggested before that the Authority may wish to see all major floodplains covered with an FMP over the next 15 years or so. The Authority also may wish to formulate criteria by which some sort of priority order could be established, for example in terms of the number of people affected(eg Christchurch), or of the severity of the hazard(eg Paeroa, Thames), and could target subsidy money accordingly.

	Justification	Advantages	Disadvantages
--Option A : Subsidies for structural works only			
A1: without sunset	No change from status quo	No further thinking needed. Would find easy acceptance from CAs.	Does nothing to overcome the problems identified.
A2: next 5 years only	Gives prior warning of future changes	Future cost saving to the taxpayer	Perpetuates present problems for next 5 years
NB THIS OPTION ASSUMES AVAILABILITY OF SUBSIDIES FOR EXECUTION OF FLOODPLAIN MANAGEMENT PLANS			
--Option B: Subsidies for structural works only, but only to extent shown appropriate by completion FMP			
B1: without sunset	Acknowledges current bias to a minimal degree	Goes a little way towards removing bias	Would perpetuate over-investment in flood alleviation measures. Does little to encourage local communities to adopt alternative adjustments.
B2: next 5 years only	As for B1 and gives warning of further change	As for B1 and gives future savings to taxpayer.	As for B1, but only for the next 5 years.
NB THIS OPTION ASSUMES AVAILABILITY OF SUBSIDIES FOR EXECUTION OF FLOODPLAIN MANAGEMENT PLANS			
--Option C : extend eligibility to all adjustment options as recommended by floodplain management plan			
C1: without sunset	Gives unbiased policy.	Encourages consideration of all adjustment options. Easy acceptance from CAs.	Still encourages over-vestment in flood alleviation measures
C2: next 5 years only	As for C1 and gives warning of further change	As for C1 and gives future savings to taxpayer.	As for C1, but only for a limited period.
NB THIS OPTION ASSUMES AVAILABILITY OF SUBSIDIES FOR EXECUTION OF FLOODPLAIN MANAGEMENT PLANS			
--Option D : Subsidies for floodplain management plans, but not for any alleviation measures			
D1: without sunset	Addresses bias problem + ignorance problem	Provides unbiased policy environment. Cheaper for taxpayer than C1.	May not be strong enough incentives for local communities to consider all options.
D2: next 5 years only	As for D1	As for D1 with further savings after 5 years	As for D1
--Option E : Remove all subsidies immediately			
	Consistent application of "user pays" principle	Provides unbiased policy environment	Does nothing to encourage consideration and adoption of alternatives.

To draw up, in cooperation with the catchment authorities, a register of floodprone areas for which FMPs should be carried out and establish a programme and priorities to achieve completion within 15 years.

and

To allocate sufficient funds each year to ensure the completion of the programme.

FMPs, like district schemes, are of course not static and will need to be revised from time to time. The Authority could consider that only the initial FMP for each area would be eligible for subsidy assistance and that communities would from then on be responsible for updating.

3.6 Objectives for Goals B.2 and B.3

The new approach to flood hazard management requires the consideration of a greater number of factors than before, especially in the social and economic area. This is where a central agency could provide information and management tools for use by catchment and local authorities.

To make available to CAs the ANUFLOOD programme which enables floodplain managers to evaluate the economic repercussions of different adjustment options. By 1 December 1987.

To compile and make available to CAs, nationwide stage-damage curves for use in ANUFLOOD as well as conventional economic analysis.By 1 December 1987.

To prepare guidelines for the use of the Town & Country Planning and Local Government Acts in floodplain management. By 1 March 1988.

To develop practical methods to take account of social factors in floodplain management planning.By 1 October 1988.

To develop economic techniques to incorporate non-$ values in the decision making process.By 1 October 1988.

3.7 Objectives for Goal B.4

To promote the floodplain management philosophy amongst floodplain dwellers the Authority could take several approaches.

The Authority could wish to carry out all promotion itself. That way relatively expense methods that would otherwise be out of reach for most catchment and local authorities could be used.The video "Stemming the Flow of Our Flood Problems" is an example of this.

On the other hand,the Authority could decide that the catchment authorities are so much closer to the local communities than a central agency, that they should be responsible for all promotion activities. ***The Authority could also make such activities eligible for subsidy***. Indeed, promotion is an integral part of the floodplain management approach and it would appear inconsistent to exclude it from eligibility if the Authority decides to make the execution of FMPs a subsidisable activity.

It would seem clear there is no point in making this an either/or issue. The Authority could take responsibility for the promotion of issues, the catchment authorities have a role in showing how these issues apply to local situations.

Again, each year NWASCA could make a choice to carry out a number of promotion projects such as have already been carried out(video, WASCO pamphlet, newspaper articles) and suitable objectives can be formulated.

4 PERFORMANCE MEASUREMENT

Unless it is possible to evaluate the effect of policies and activities there seems to be little point to spend money and effort on them. The Government increasingly requires its departments to give account of the results of their activities.

We can conveniently address the problem of performance measurement at the three different levels of the aim, goals and objectives of the NWASCA policies.

Starting at the lowest level, that of the objectives , from the example objectives quoted in this paper it is easy enough to evaluate whether they have been successful or not. If a joint policy statement is promulgated by the time specified, that is success. If a new technique is distributed to all catchment authorities, the objective as formulated has been achieved. But such measures have only limited value(mainly as a check whether certain action have been taken). We still do not know whether anyone takes any notice of the joint policy statement. The catchment authorities might well decide that the new technique is impracticable and not implement it. But even so, even if people do take the policy statement seriously, even if CAs do use the new technique, how do we know whether this actually contributes to reduce flood losses and promotes a rational use of floodprone land?

At the middle level of the goals it is possible to formulate some performance measures that will give at least some indication of what has been achieved.

For example,if the Authority decides to promote the floodplain management philosophy among floodplain dwellers, then it would be useful to know whether and how attitudes do change with time. It would be possible to conduct a public attitude survey now and in 5 years or so and this would give an indication whether promotion is worth continuing or not.

Similarly, it would be easy to evaluate the goal formulated in respect of achieving nationwide coverage of FMPs. At least NWASCA would know whether the issues it wants people to address, are raised. It would also be possible to monitor the contents of the FMPs as they are being produced and keep a tally of how often certain adjustment options are being recommended. It would be more difficult to keep track of the implementation of the various plans. Presumably the catchment authorities, for their own performance measurement purposes, would do this type of monitoring. If nationally consistent performance measures are formulated, individual CA's figures could be collated and a national picture would emerge.

At the most important level, that of the aim of the NWASCA Floodplain Management policy, the situation is not so rosy. Here and abroad, this last question is only beginning to be addressed and certainly no one has answered it in a practical way. For some of the variables involved, such as "damage not prevented" we already have enough information, at least in $-value terms, to give a reasonable estimate. For some other aspects, such as "damage saved through structural works", it would in theory be possible to collect the required data although in practice it may be too cumbersome and costly. Perhaps it would be feasible to make estimates by a sampling method. For intangible values, such as the health effects of the flood hazard, social research promises to be able to express the relative value of these factors as a percentage of direct, tangible damage.

Therefore, it is at this stage not possible to give a meaningful answer to the one question that counts most. Neither can it be said that it will never be possible to answer it. Some work is being done at present in this field, also by the Directorate, and the Authority will be informed of progress.

APPENDIX D

HOROWHENUA FLOOD RISK REPORT (Draft)
by K P BILLS

Note Relating to Appendix D

This report was prepared in 1989 prior to Local Government Reorganisation on 1 November 1989, for this reason some of the organisations referred to in the text of the report no longer exist. The report does however, provide a valuable overview of the physical flood problems associated with the Horowhenua area.

The appendices to this report, which are held separately, have not been attached as a part of Appendix D due to their size, however they are available at the Manawatu Wanganui Regional Council Office.

HOROWHENUA FLOOD RISK REPORT (Draft)

by K P BILLS

1989

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FIGURES

TABLES

PLATES (contd.) FOLLOWING PAGE

1.0 INTRODUCTION AND PURPOSE

The Horowhenua area is experiencing a rapid increase in subdivision of small rural lots. These lots are being developed for horticultural and rural lifestyle use. Existing flood and drainage problems are becoming more acute as a result of increased density of residential development and intensity of primary production. The potential damage from flooding increases with increased development on the flood plain.

This report aims to collate a variety of information on flood hazards and drainage limitations within the Horowhenua. It is hoped that it will provide an assessment of these limitations which is more comprehensive than what is currently available and thereby enable a planning strategy that takes better account of flood/drainage problems of the Horowhenua.

2.0 APPROACH

2.1 Study Scope

This report takes the approach of discussing the history of flooding in certain areas and the likelihood of areas to flood in the future, rather than identifying on a map specific areas which flood in certain flood events. This approach is taken because there is a lack of specific information readily available on land contour and flood scenarios. It is hoped that as more technical information becomes available this report will be modified and extended to include this information.

2.2 Study Area

The study area of this report is shown on figure 1. The area of Horowhenua County south of the Ohau/Manakau Catchment is not included in the study as it will not form part of the Horowhenua District Council following 1 November 1989. (Local Government Commission Final Reorganisation Scheme June 1989). The flood hazard of the Otaki River has been well documented in a letter to the relevant territorial authorities (5 December 1988 Otaki Borough Council; 9 December 1988 Horowhenua County Council), and the flood hazard from the Waikanae River is documented on a map prepared by the Boards engineering staff. [Refer Plan No. 2796, Catchment Board Plan System].

The study area has been divided into six management areas (refer figure 2). These areas form natural catchments within the study area. An explanation of the flood risks of each management area is provided in Section 4.0.

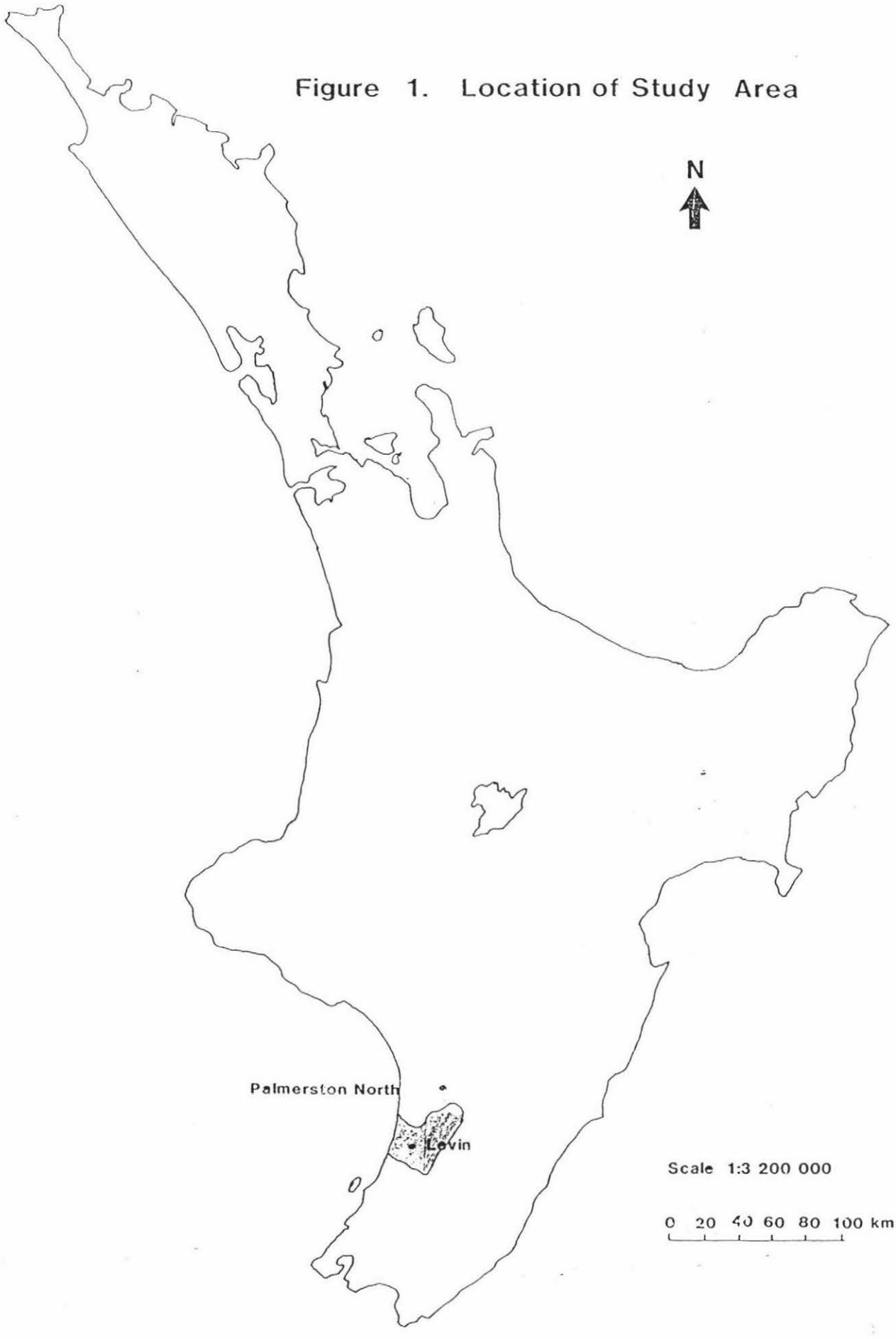
2.3 Information Sources

This report collates information from a number of sources. Of primary importance in this collation is the inclusion of detailed information from the comments of Board staff which have been provided on individual development applications to the Horowhenua County. These comments were researched back until March 1963. A synthesis of these individual comments has provided a good overall description of the flood/drainage hazards of the area. Each item of correspondence is referenced with a letter indicating the file on which it is held and a number indicating the date of correspondence. Copies of the relevant correspondence are held as a seperate appendix to this report (Appendix A).

Secondary sources of information include historical newspaper cuttings, discussions with long standing residents, discussions with Board staff, assessment of Drainage Board contour information and river control scheme reviews which have been prepared by the Board. For ease of reference, the newspaper articles have been given a number (eg. NP/1) and are held in a

separate appendix to this report (Appendix B). Other secondary sources of information are referenced in full in the text.

Figure 1. Location of Study Area



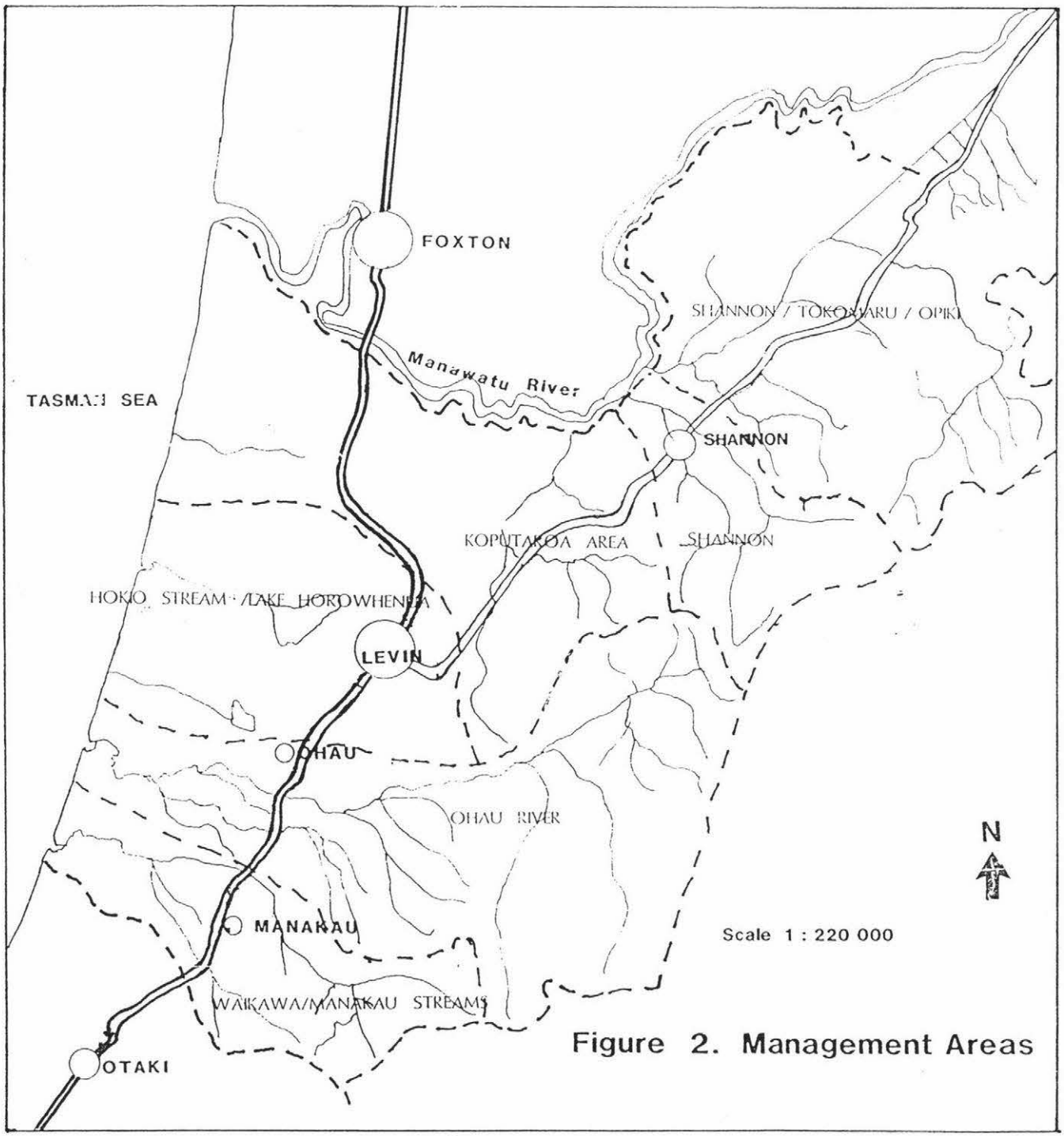


Figure 2. Management Areas

3.0 BACKGROUND

3.1 Horowhenua County District Planning Approach

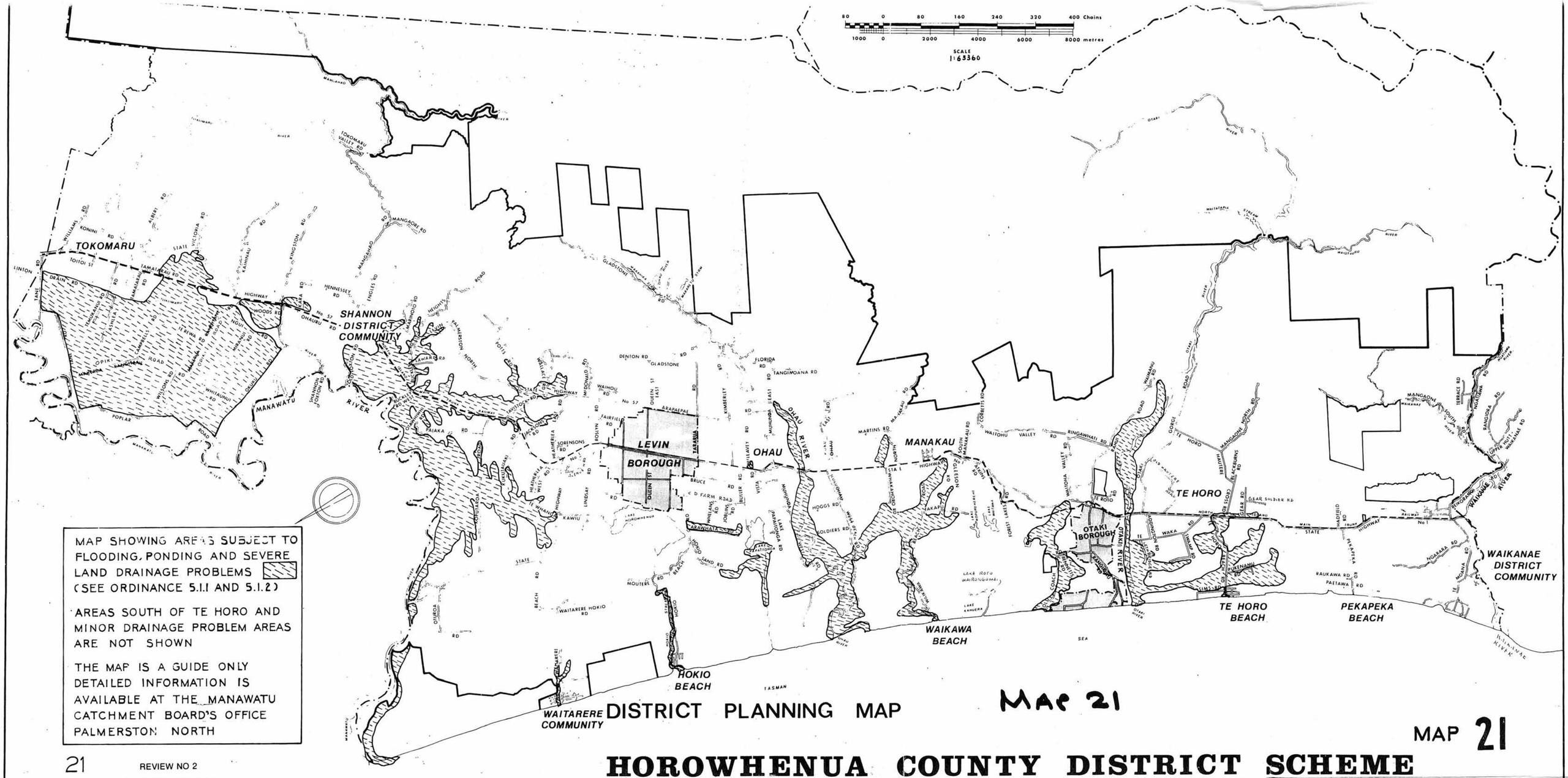
The Horowhenua County District Scheme Review No. 2 identifies in Planning Map No. 21 areas subject to flooding, ponding and severe land drainage problems. This map gives a very general indication of floodable areas. (Figure 3).

The District Scheme text makes direct reference to the problem of physical hazards when carrying out landuse planning in ordinance 5.1.1. This ordinance states:

> "5.1.1 LAND TO BE SUITABLE FOR PROPOSED USE
>
> Not withstanding conformity with the zoning requirements of these Ordinances, no building shall be erected or placed, and no use shall be established on any land which is not suitable for the use proposed. For the purpose of determining whether any land is suitable for any particular use, regard shall be had to the best use of the land and its economic servicing and development and redevelopment, to earthquake fault lines and other geological conditions, to liablility to flooding, erosion or land slip, to stability of foundations and to safety, health and amenities of the land and adjoining properties or roads of water supply.
>
> Provision for control of development likely to affect natural watercourses or in areas liable to flooding or landslip will be made in consultation with the appropriate Catchment or Water Board."

Local Authorities also have general responsibilities under sections 274 and 641 of the Local Government Act 1974 for declining development applications in floodable areas.

However, in recent times, the Horowhenua County Council has been referring almost all subdivision applications and many other development applications to the Central Districts Catchment Boards for comment with regard to flood/drainage problems. These applications are referred to the Boards because it has specialised knowledge on water and soil issues. The Board has statutory responsibilities for river control, soil conservation and the prevention of damage resulting from inundation, under the Soil Conservation and Rivers Control Act 1941. The Board also has statutory responsiblities for soil conservation and preventing damage by flood and erosion under the Water and Soil Conservation Act 1967. These responsibilities overlap with the responsibilities territorial authorities land use planning under the Town and Country Planning Act 1977.



DISTRICT PLANNING MAP

Map 21

MAP 21

HOROWHENUA COUNTY DISTRICT SCHEME

21 REVIEW NO 2

DRAWN C.N.T. 1980

This report will provide the Horowhenua County Planning team with direct access to more detailed information on flooding, thereby providing an aid to informed fast decision making.

3.2 River Control and Drainage Schemes in the Study Area

There are a number of catchment/river control schemes in the study area administered by the Central Districts Catchment Board.

The main scheme areas are:

1. Koputaroa
2. Hokio
3. Ohau-Manakau
4. Lower Manawatu (Tokomaru and Opiki areas)

Landowners in the scheme areas are rated, according to their benefit from the scheme, by the Central Districts Catchment Board.

The Lower Manawatu Scheme involves mainly stopbank maintenance and river control works and the Ohau-Manakau Scheme involves major flood and river control works. The Koputaroa and Hokio Schemes consist mainly of drainage works. The study area also includes the Makerua drainage district administered by the Makerua Drainage Board.

The abovementioned schemes and their maintenance affect the potential hazard of flooding in the study area. A broader explanation of the schemes and their affect on flood hazard/drainage is included in the sections on the relevent Management Areas. (Refer 4.0 Management Areas).

3.3 Soils of the Study Area

The soils of the study area provide an indication of flood and drainage problems within the area.

Generally peat/swamp areas have significant drainage problems and alluvial soils indicate floodplain areas.

Figure 4 shows the main soil types within the Horowhenua Study area. There is greatest pressure for increased development on the alluvial soils (i.e. floodplain areas) as they represent the most fertile areas. Figure 5 shows a typical cross-section of the types of soils in the Horowhenua. The soils typically include greywacke and argillite ranges in the east which have shallow mountain soils, followed by glacial terrace land covered in high terrace soils, followed by recent alluvial soils and near the west coast a complex of sandy and peaty soils.

3.4 Subdivision Trends

The trend towards intensive horticultural development and rural-residential landuse has meant a sharp increase in the number of small rural lot subdivisions that have been approved by the Horowhenua County Council.

Increasing pressure for small lot subdivision in the Horowhenua is reflected in two changes to the operative Horowhenua District Scheme Review No. 2 (Change No. 8 operative 1 August 1983 and Change No 24 operative 1 June 1988). Both these district scheme changes liberalise the standards for subdivision of small rural lots.

The following table (table No. 1) shows the dramatic increase in small rural lots that have been created over the last six years. This increasing intensity of development is frequently on the floodplain as these areas represent very fertile areas. Such development on the floodplain increases the potential damage from floods.

TABLE 1.

Rural Lots Created Within Horowhenua County Council

Year	Total	0 - 4 ha	4 - 10 ha	10+ ha
88/89	191	92	70	29
87/88	136	50	47	39
86/87	214	66	95	53
85/86	114	42	53	19
84/85	91	31	33	27
83/84	107	13	66	28

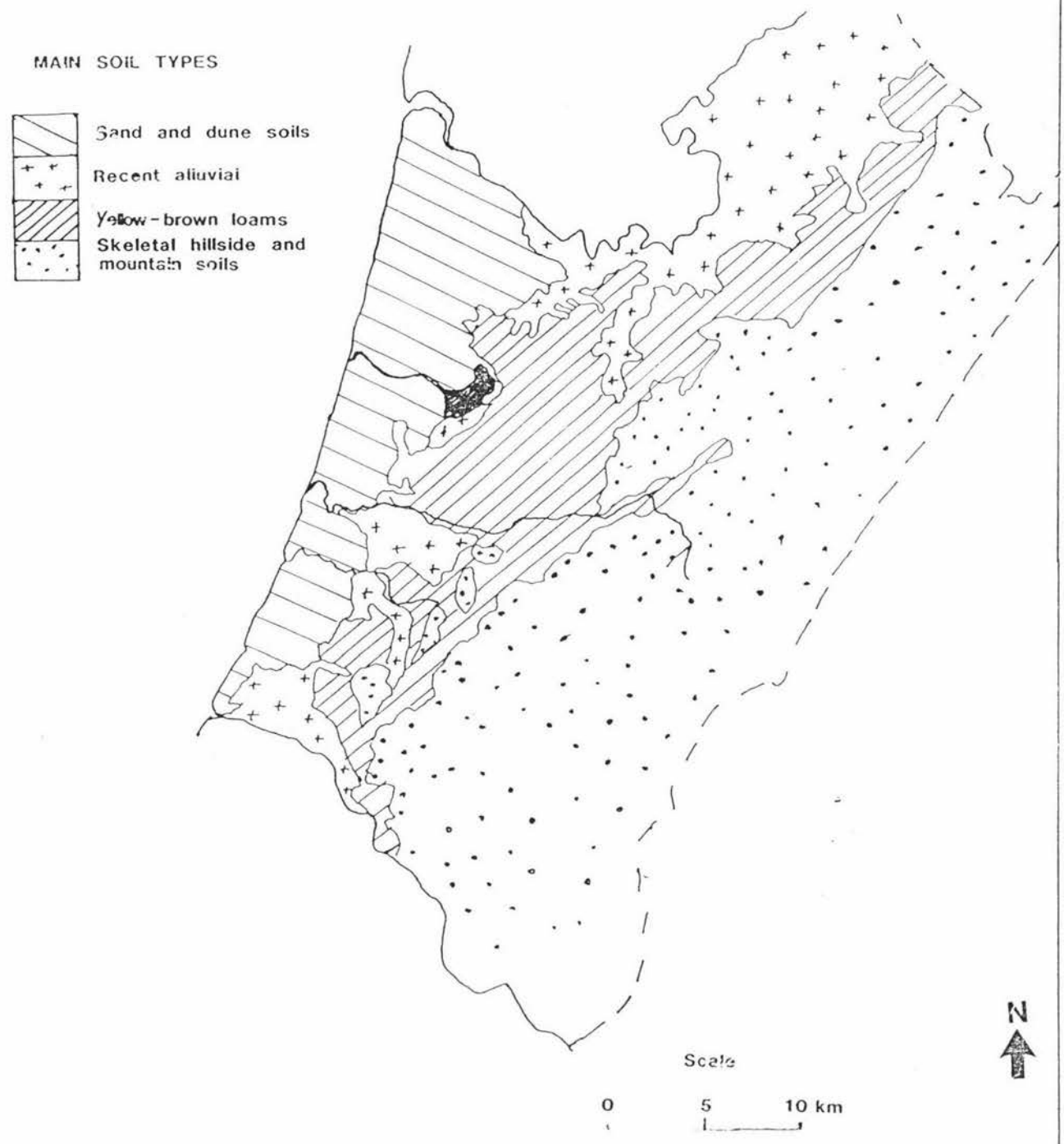


Figure 4. Soil Types of the Horowhenua

Figure 5. Typical Cross-Section Soils of the Horowhenua

4.0 MANAGEMENT AREAS

4.1 Waikawa/Manakau Streams

The Waikawa and Manakau Streams catchment areas are 31.4 square kilometres and 16.4 square kilometres respectively. The streams rise in the Tararua Ranges between Manakau and Otaki townships.

The Manakau Stream flows out from the steep ranges onto the glacial terrace land at the eastern end of South Manakau Road. The streams create narrow well defined channels through this gravelly terrace land. The Manakau Stream joins with its main tributary, the Waiauti Stream just east of State Highway 1 where the enlarged stream flows under the State Highway and onto the rich recent alluvial soils currently used for intensive horticulture (i.e. nursery, flower and market garden production).

The Waikawa Stream flows out onto the gravelly glacial terrace land approximately three kilometres east of the State Highway near Manakau North Road. This area east of the State Highway is used for pastoral farming. The gravelly terrace banks of the streams are easily eroded by force of water. Three kilometres north of where the Manakau Stream crosses State Highway No. 1 the Waikawa Stream crosses under the State Highway to a densely populated rural area in the vicinity of Boulder Road.

The two streams meet halfway between the end of Boulder Road and State Highway No 1 where the enlarged Waikawa Stream meanders its way past the Waikawa Beach settlement and out to sea.

Like many of the streams and rivers of the Horowhenua which have their origins in the Tararua Ranges, these two streams measure a distance of only approximately 18 kilometres from the top of their catchments to the coast. This means that flooding in the streams can occur with very little warning.

Where the gradient of the streams are steep i.e. on the eastern side of the state highway, flooding is generally confined to the immediate and obvious floodplains of the streams. However, as the streams progress towards the sea and the gradient and velocity of streams reduce the floodplains widen.

Near the coast the typical landform consists of wind blown sand dunes with sandy plains behind, receeding to peaty swamp areas where the water table is at ground surface (refer figure 6). At times of flood the water spreads over the relatively even gradient of the lowlying peaky areas and sand plains. The sand hills which line the coast act as a bank retaining ponding water in the lowlying land. Some of the farmland in this lowlying area has networks of drainage systems which help to drain the ponding water after floodwaters in the streams have receeded. This coastal land which is a mix of sand and peat is generally used for pastoral farming of which dairying is the most common form.

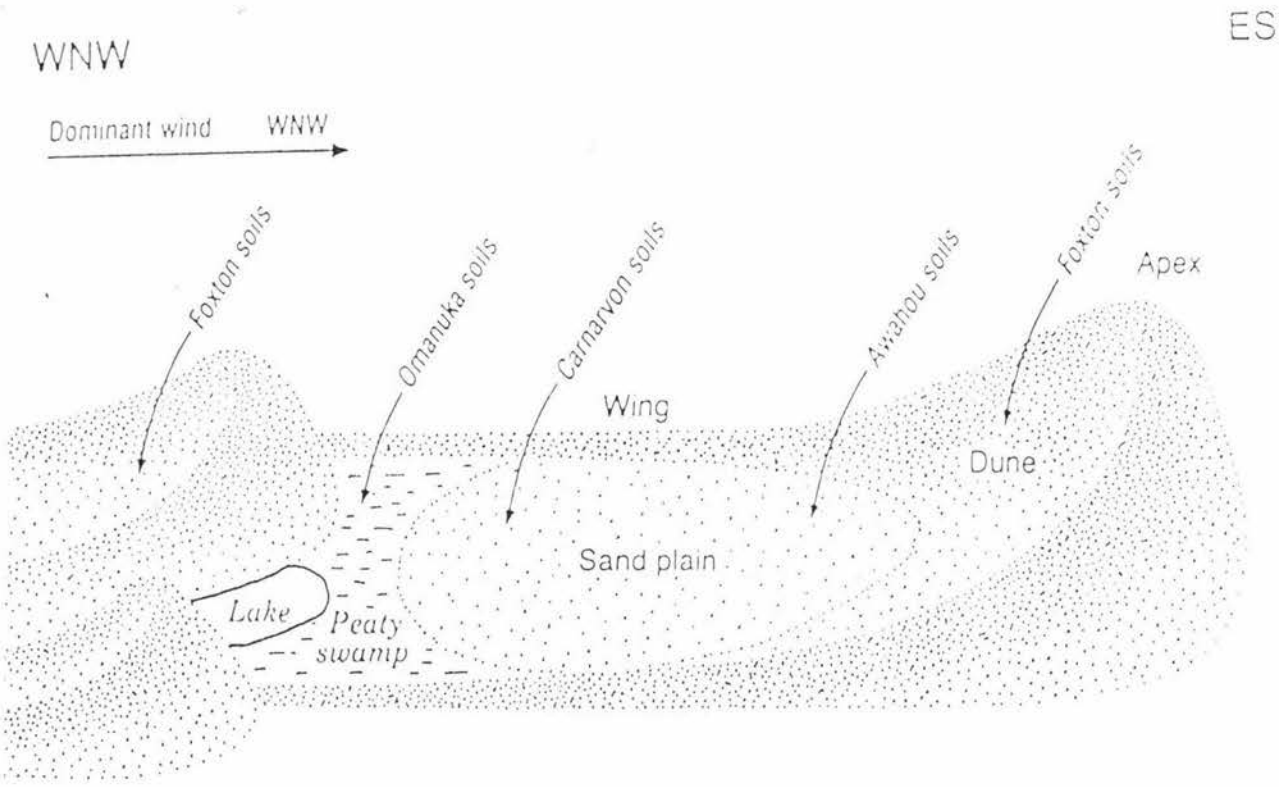


Diagram of Manawatu sand-country landscape unit — dune apex and wings, sand plain and peat swamp. Soils shown are for Foxton dune-building phase.

Source: The Living Mantle

Figure 6. Typical Sand-Country Landscape Unit

4.1.1 Upper Manakau Stream

The Manakau Stream floodplain commences at the South Manakau/Corbetts Road intersection.

Above the floodplain there are a number of small streams with fans at the base of the hill country. Between South Manakau Road and the start of the steeper slopes ground surface and subsurface conditions are frequently very wet.

The Manakau Stream and its tributaries in the vicinity of Corbetts Road can flood seriously. This can affect access to the higher terrace land on the northern side of Corbetts Road. (refer Figure 7, area A; Board Correspondence Ref K/6, J/13).

4.1.2 Gleesons Road/State Highway No. 1

In the vicinity of Gleesons Road floodwaters have been known to reach both sides of State Highway No. 1 and flow down Gleesons Road. (refer figure 8). A newspaper article from the Levin Chronicle describes this occurring in the 13 and 14 May 1972 flood. "There was extensive flooding across the main road between Manakau ramp and Willowbank Tearooms" (refer NP/1).

Subdivision of properties in the Gleesons Road area has resulted in a number of crossings over the Manakau Stream. These structures together with the formation of Gleesons Road have added to the depth of flooding of upstream properties.

Flooding of the Manakau Stream is known to have occurred frequently during the 1940's, however, there is little information held by the Board regarding these flood events.

Little protection can be given from flooding to this area unless comprehensive stopbanking is carried out on both sides of the Manakau Stream. It is likely any such stopbanking would need to extend to State Highway No. 1. (refer Fig 7, area B; Board Correspondence Ref D31, F34, H26).

4.1.3 Takapau Road/Waikawa Beach Road

In the vicinity of Takapu Road lowlying land, suffers from impeded drainage and flooding from drainage channels. Flood waters can be up to one metre deep near drainage channels. (refer Fig 7, area C; Board Correspondence Ref G/41).

On the south western corner of Waikawa Beach Road and Takapu Road the Manakau Stream floods to various depths over the floodplain area and flows in a northerly direction across Waikawa Beach Road. (refer Fig 7, area D; Board Correspondence Ref L/24).

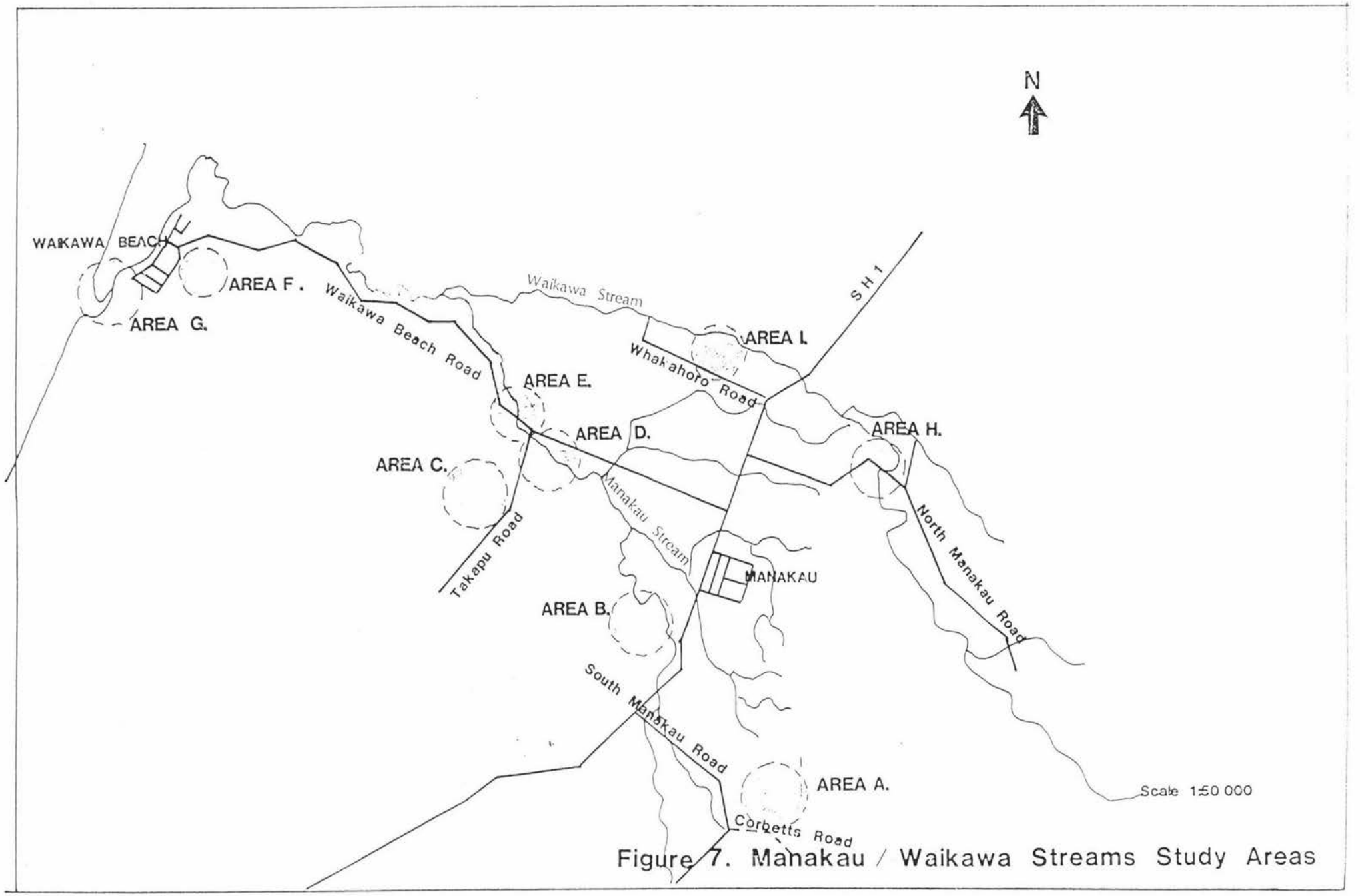


Figure 7. Manakau / Waikawa Streams Study Areas

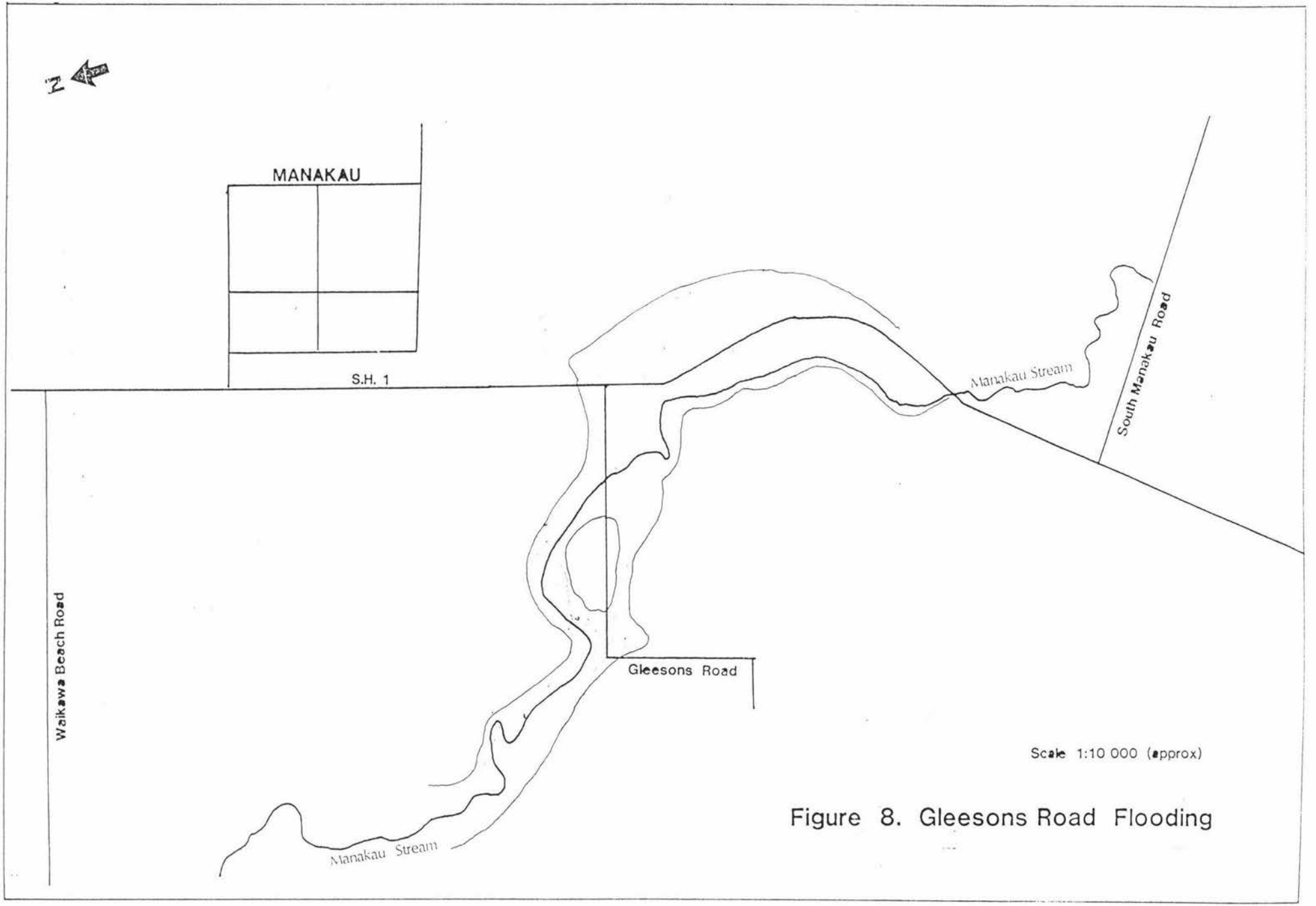


Figure 8. Gleesons Road Flooding

The extreme sensitivity of floodwater to respond to minor variations on the floodplain surface in this area means that the erection of horticultural shelter belts and other permanent cropping may increase the depth and frequency of floodwater across Waikawa Beach Road.

Where the Manakau Stream crosses to the north side of Waikawa Beach Road there are small "stopbanks" which are formed to no specific design. These "stopbanks" were placed in postion to provide some protection from flooding to Waikawa Beach Road when the Manakau Stream was reconstructed. The "stopbanks" are of uneven height, indeterminate stability and are subject to erosion, they cannot be relied on to protect the surrounding land from flooding. Photographs of the 6 October 1986 flood show the extent of flooding that can occur in a moderate flood in vicinity of Waikawa Beach Road. (refer Plate 1, 2 and 3).

Spot heights of some land adjoining the Manakau Stream in the vicinity of Takapu Road were submitted by Foster and Co. (Registered Surveyors) on the 4 November 1988 for the Board's comments with respect to flooding. It was considered that the property contained no suitable building sites (refer Figure 7, area E; Board Correspondence Ref L/7, N/39).

4.1.4 Waikawa Beach Settlement

The land on the south-side of Waikawa Beach Road immediately east of the beach settlement is prone to poor drainage. Water can pond in the flatter areas for brief periods (refer Figure 7, area F; Board Correspondence Ref J/70).

The Waikawa Stream near its mouth has a history of naturally fluctuating river channels through easily erodible sand country. A description of the stream mouth movements is contained in board correspondence (refer figure 7, area G; Board Correspondence Ref F/28 and L/20).

4.1.5 Upper Waikawa Stream

The Boards Ohau-Manakau Scheme does not involve river control works on the Waikawa Stream any further upstream than approximately 1 kilometre from State Highway 1. Above the river control works land up to 50m from the stream bank can be classified as having extreme erosion potential (refer figure 7, area H; Board Correspondence Ref F/18).

4.1.6 Whakahoro Road, Manakau

Board correspondence regarding a proposed subdivision of the northern side of Whakahoro Road indicates that floodwaters from the Waikawa Stream in this vicinity move overland in a southwest direction. (refer figure 7, area I; Board Correspondence Ref N/68).

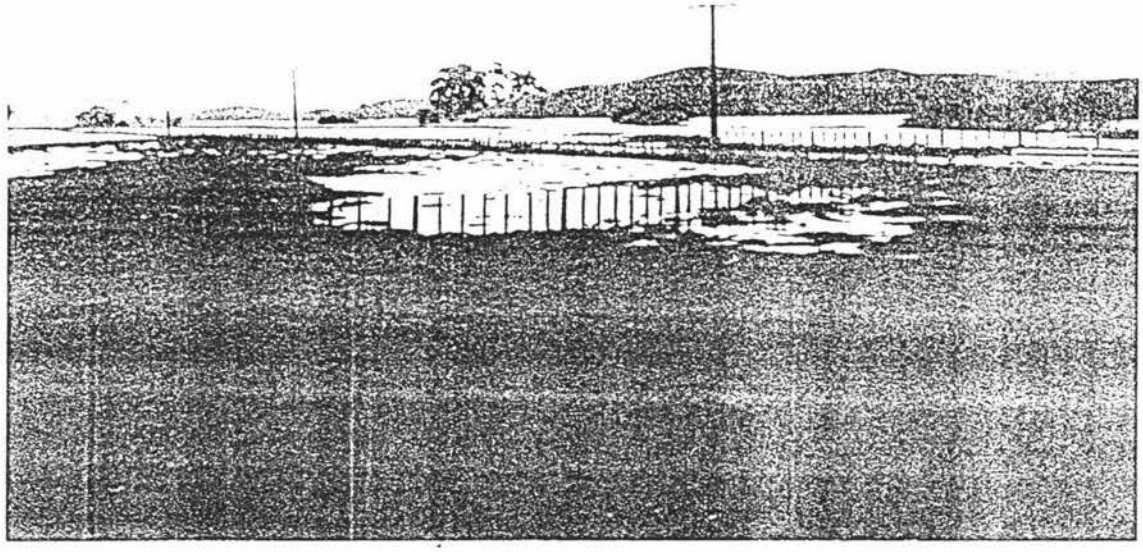


Plate 1. Floodwaters in vicinity of Waikawa Beach Road 6 October 1986.

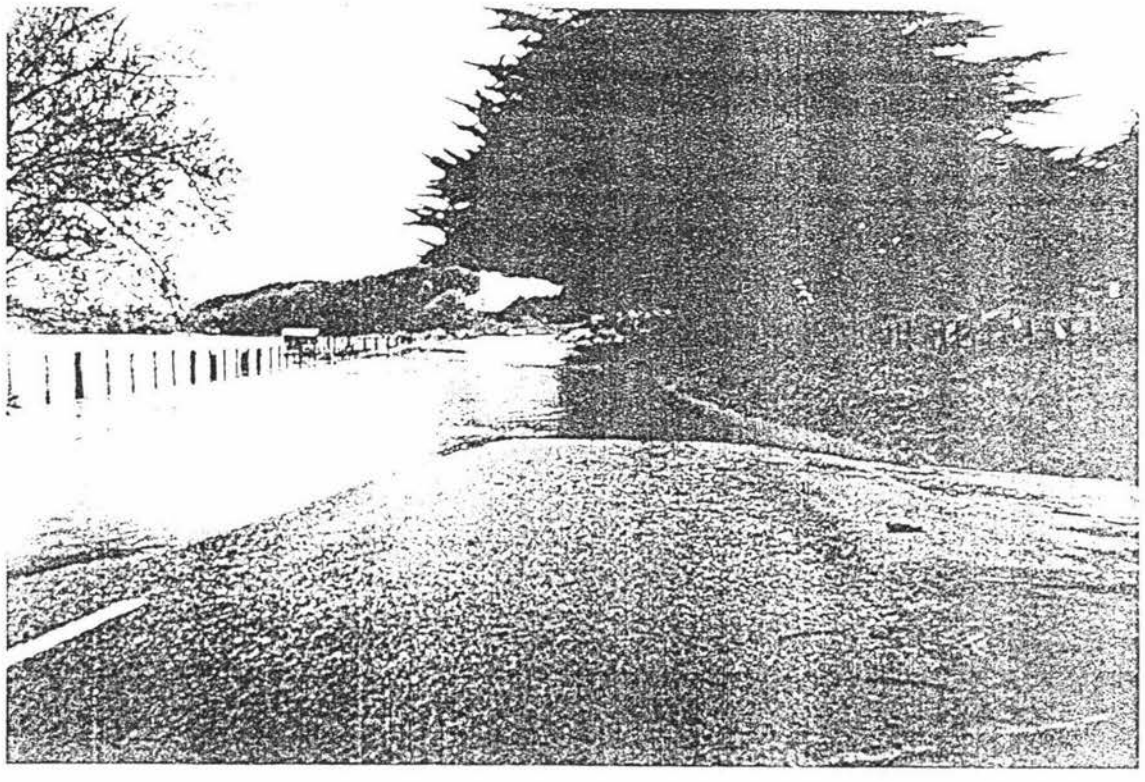


Plate 2 Floodwaters across Waikawa Beach Road in vicinity of McArley property 6 October 1986.

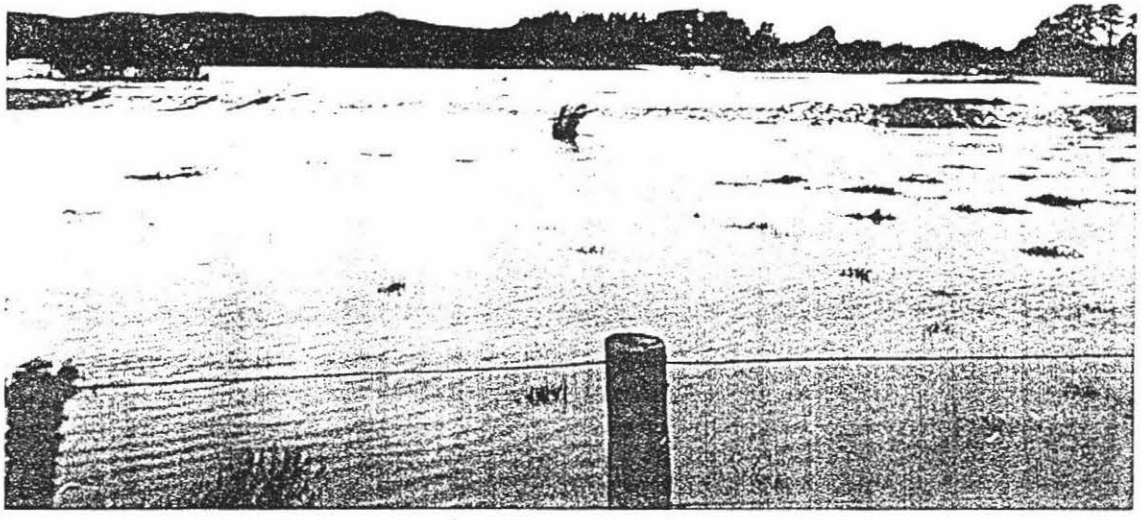


Plate 3 Floodwaters in vicinity of Waikawa Beach Road McArley property 6 October 1986.

4.2 Ohau River

The Ohau River originates in the Tararua ranges behind Levin. The main tributaries of the river are the Makeretu Stream, Ohauiti (Blackwater) Stream, South Ohau River, Ohau North River, Waiti Stream and Makahika Stream. Most of these tributaries combine with the Ohau River in the valley east of Kohitere Forest. The land in this area consists of gravelly terraces which are prone to erosion by water of high velocity. Where the Ohau River emerges from the foothills of the Tararuas the water for the Levin Borough water supply is drawn into a reservoir.

The large alluvial fan of the Ohau River starts approximately two kilometres east of Arapaepae Road, it spreads approximately four kilometres to the north and meets with the alluvial deposits of the Waikawa Stream to the south. The alluvial deposits from the Ohau River provide much of the high quality soil surrounding Levin where intensive market gardening and other forms of horticulture are common landuses.

Parts of the alluvial land east of the State Highway are prone to flooding in moderately frequent floods, i.e. up to one in 30 years mean frequency, however, west of the State Highway flooding by the Ohau River over its alluvial land is extensive even in moderately frequent floodevents.

West of Soldiers Road and Lake Papaitonga the Ohau River meanders through the dune/sand plain/peat swamp complex of the coast. Lake Papaitonga is an example of one of the coastal lakes behind the sand dune complex. (refer figure 6). The sand dune/peat land is commonly used for dairy farming as is some of the highly fertile yet floodable alluvial land close to the Ohau River.

The Ohau River Scheme was commenced in the early 1970's. Works included channel diversion (to reduce channel length), associated floodway and stopbanks which were completed 1972. Later works included the construction of return banks on the downstream area of the Kuku Stream and stopbanks on the left and right banks of the Ohau River to 12.5 kilometres from the mouth. These banks are designed to protect pastoral farmland in flood up to 566 cumecs, i.e. estimated recurrence of once every 20 years. Other scheme works have included rock and stone riprap protection and planting of banks.

4.2.1 Upper Ohau River Catchment

The Makahika Stream is one of the major tributaries of the Ohau River. At the point where Gladstone Road crosses the Makahika Stream (approximately 2.5 km upstream from the swingbridge) floodwaters from the stream inundate the road and surrounding floodplains. Floodwaters reach depths of 1.5 metres in the lower areas of the floodplain. The steep gradient of the Makahika Stream in this vicinity means that "flash flooding" and bank erosion is reasonably common. Velocities of floodwaters in this vicinity can approach approximately 5 metres/second. (refer figure 9, area A; Board Correspondence Ref 6/37).

A newspaper article in the Levin Chronicle reports how the October 6, 1986 flood scoured out the abutments of the bridge over the Makahika Stream. (Refer NP/2). This is also reported to have occured in the November 30, 1959 flood. (refer NP/3).

4.2.2 Florida Road (Kimberley Reserve)

At the end of Florida Road in the vicinity of Kimberley Scenic Reserve. Lowlying areas are prone to 10 year recurrence flooding. At this point Florida Road has been washed out and relocated on several occasions due to "flash" flood waters which reach high velocities. Floodwaters generally reside in the area for a period of one day. (refer figure 9, area B, Board Correspondence Ref P69, G7, G12).

The Levin Chronicle Newspaper articles dated May 7, 1973 and October 6, 1986 describe Florida Road being washed out in these two floodevents. (refer NP/4, NP/2).

4.2.3 Muhunoa East Road/Arapaepae Road

Flooding occurs on the terrace land in the vicinity of the Arapaepae Road and Muhunoa East Road intersection when water overtops the right bank upstream of the Muhunoa East Road Bridge. The frequency of flooding on the low terrace land to the south of the intersection varies from annual up to 10 years.

In floods of 10-20 year frequency flooding from the Ohau River spills across Muhunoa East Road and Arapaepae Road, however, the duration of floods is brief and the floodwaters are mainly located in old flood channels. Two channels cross the road just west of the road bridge and floodwaters in these channels prohibit access to properties further east. Floodwaters at the house site located within the bush area west of the road bridge during the floods of 10-20 year frequency have a depth of approximately 0.45 metres (levels taken at May 15, 1972 floodevent). During the May 15, 1972 flood event (approximately 10-20 year frequency) flood water was reasonably shallow at the Arapaepae/Muhunoa East Road intersection, however, it did flow through the foundations of the house situated directly opposite the intersection. The depth of water increased considerably towards the river channel, the lower terrace land being inundated to a depth of two metres. During the May 15, 1972 floodevent the river occupied the northern most channel in this vicinity of the river.

During large floods of frequency approaching 100 years (such as the June 19, 1936 floodevent) floodwaters are extensive in the area of Muhunoa East Road and Arapaepae Road. When such floods are coupled with high winds the floodwater velocity would be approximately 1 metre/second. The estimated depth of flooding at the dwelling site located in bush west of the road bridge during such an event is approximately 0.9 metres.

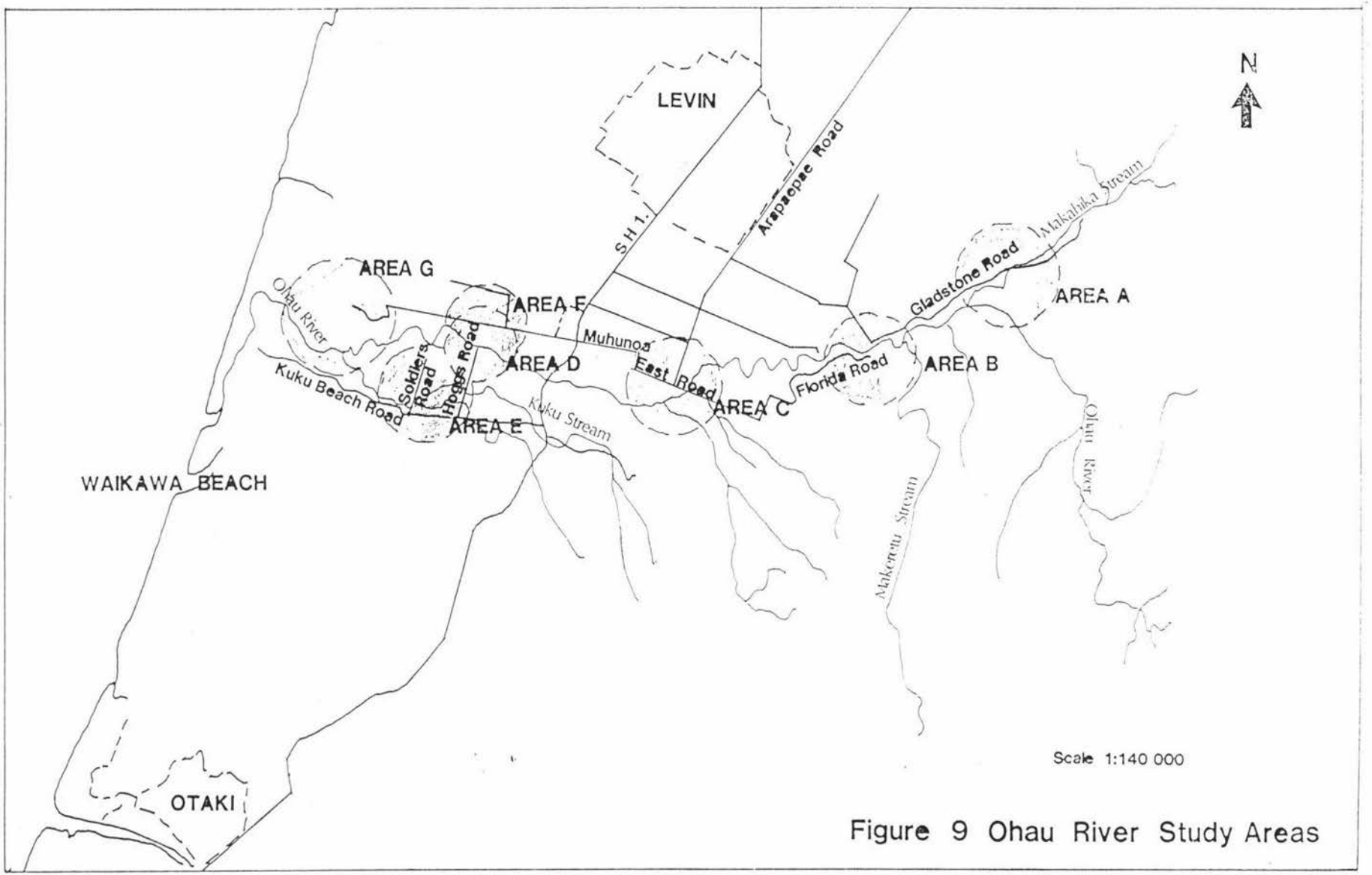


Figure 9 Ohau River Study Areas

During the December 7, 1968 and May 15, 1972 floodevents a blockage at the Muhunoa East Bridge caused water upstream to overtop the low right bank and the land west of the bank was inundated.

Small stream channels east of the Muhunoa East Road bridge fill with water and cause surface flooding during floodevents. (refer figure 9, area C; refer figure 10; Board Correspondence Ref E/18, H/52).

4.2.4 Hoggs Road, Kuku Stream and Ohau River

The Kuku Stream tends to flood over the State Highway at Kuku in moderately significant floodevents. This is reported to have occurred during the October 6, 1986 floodevent (refer NP/5).

Properties at the end of Hoggs Road, Ohau are liable to flood from waters associated with the Ohau River stopbank exceedence (spillway upstream), Kuku Stream overflow, localised surface ponding of rainwater, and overflow of the Spring Creek drainage channel.

Ohau River stopbanks are designed to contain a 566 cubic metres per second floodevent (estimated frequency of 20-40 years). Some overtopping of the banks was evident during the 4-5 October 1986 floodevent. The bank spillway upstream causes properties at the end of Hoggs Road to be at extreme risk from floodwaters of 20-40 year recurrence.

The Kuku Stream is also inclined to overflow its channel during high rainfall period. This occured during the 1972 floodevent and is likely to occur during flood events with a 10-20 year or more recurrence. During the May 15, 1972 floodevent, floodwaters moved over land and along old watercourses (low areas) to the east and north of Hoggs Road and connected with floodwaters of the Spring Creek drainage channel.

Spring Creek has a floodgated outlet to the Ohau River and when the river is in flood drainage and stormwater will pond on the surrounding farmland. (refer Fig 9, area D; Figure 11, Ref N/70).

4.2.5 Kuku Stream in the vicinity of Kuku Beach Road/Soldiers Road

Floodwaters from the Kuku Stream tend to leave the stream along its right bank and flow in a northwest direction causing flooding between the Kuku Stream and Soldiers Road. The floodwaters are not known to be of high velocity. Some old 'levee' ridges in this vicinity provide higher ground which is suitable for building, however, the more lowlying areas can be completely inundated.

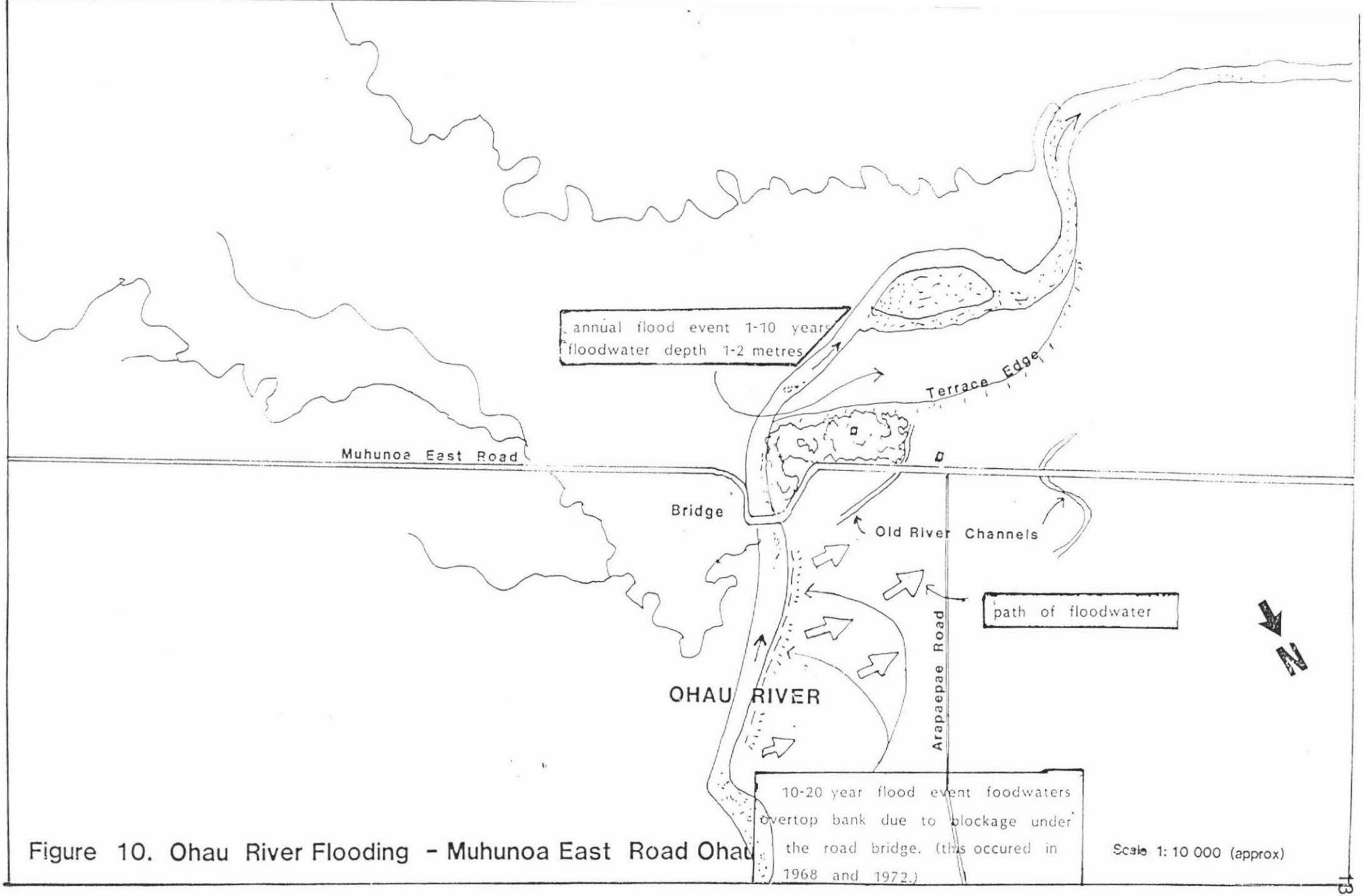


Figure 10. Ohau River Flooding - Muhunoa East Road Ohau

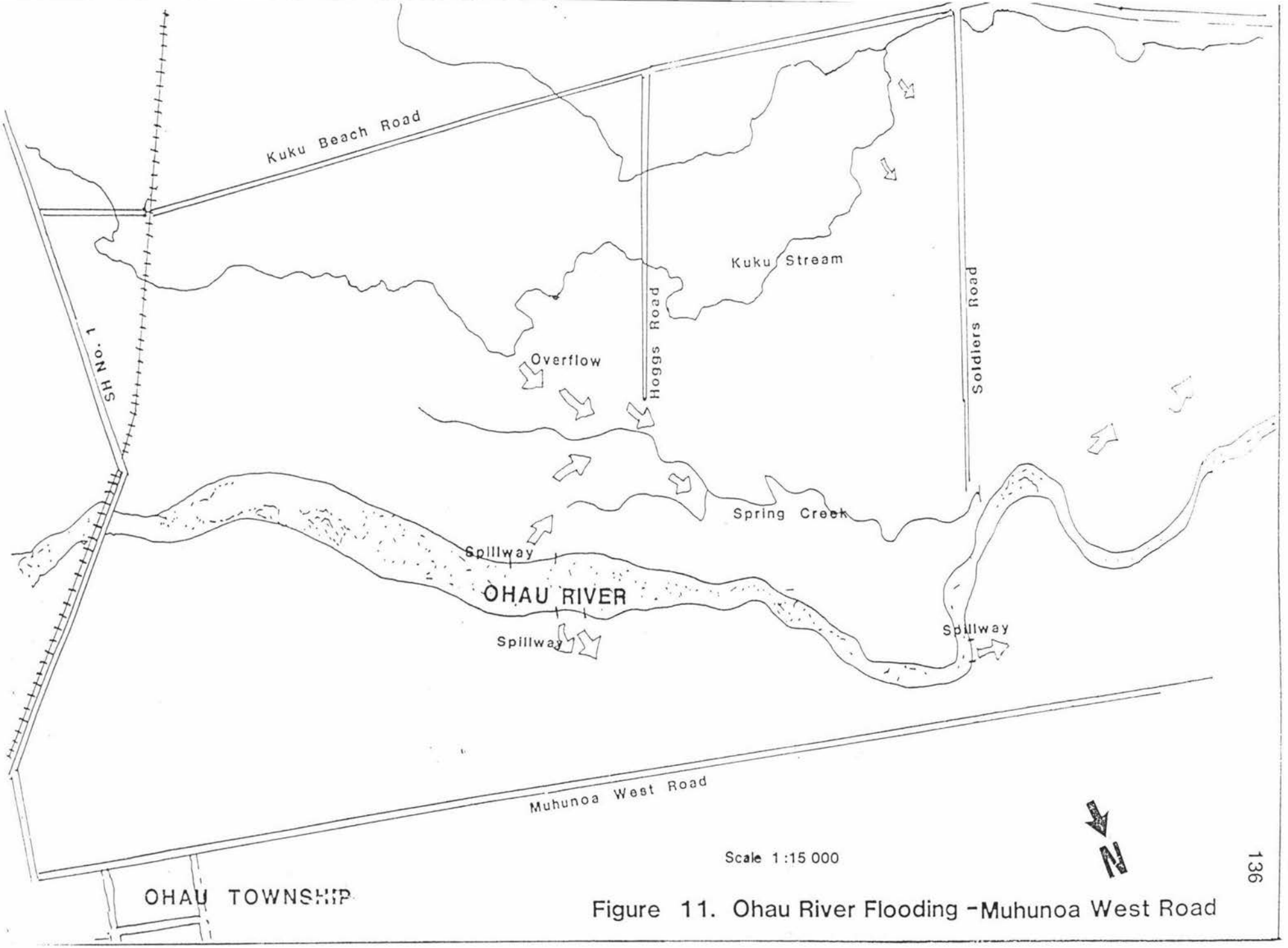


Figure 11. Ohau River Flooding - Muhunoa West Road

In floods exceeding the present Ohau Scheme channel design (566 cubic metres per second), such as the November 29, 1959,floodwaters from the Ohau river entered the land between Soldiers Road and the small side road to the west.

West of Soldiers Road various areas along the Kuku Stream adjacent to Kuku Beach Road are known to flood. These floodwaters are not generally of a long duration or a significant depth. (refer figure 9, area E; Ref I/27, L/29).

4.2.6 Muhunoa West Road

The Ohau River stopbank is designed to protect pastoral farmland not dwelling houses from frequent flooding (2-6 times per annum). Its design capacity is for 566 cubic metres per second flood event which has an estimated recurrence of 20 years. In large floods floodwater will spill over low areas of the banks. When overspill occurs the banks, which are formed from the gravel and silt available on the floodplain, have little cohesion and will erode and disintegrate. The banks were only consolidated by a bulldozer and not key trenched in some areas. This means that the ground beneath the banks can become saturated increasing the likelihood of bank break.

Approximately 2.5 kilometres downstream from State Highway No. 1 even minor floods in the Ohau River attain levels of one metre in the floodplain within the stopbanks. The stopbanks on the right bank are therefore two metres high in some points. When a two metre bank breaks the results are cataclysmic. Debris and boulders can be strewn across the surrounding land for a distance of approximately 100 to 200 metres. In such event water could flow across Muhunoa West Road to the land to the north at a depth of 1-2 metres.

Floods in November 29, 1959, December 7, 1968 and May 15, 1972 inundated the land north of the Ohau River. The water level was at fence height along Muhunoa West Road during these events. The 1968 flood has had an estimated frequency between 12 and 15 years. Photographs of the December 7, 1968 flood event from the Levin Chronicle newspaper show the extent of flooding in the Ohau and Kuku areas (refer NP/6, NP/7, NP/8).

Newspaper articles from the Dominion and Manawatu Standard newspapers describe how floodwaters covered Muhunoa West Road to a depth of 4 feet during the November 29, 1959 flood. Residents at the time did not recall flooding covering such a large area in the last 20 to 30 years. The river was estimated to have been 15 feet above its normal level during the flood. (refer NP/9, NP/10).

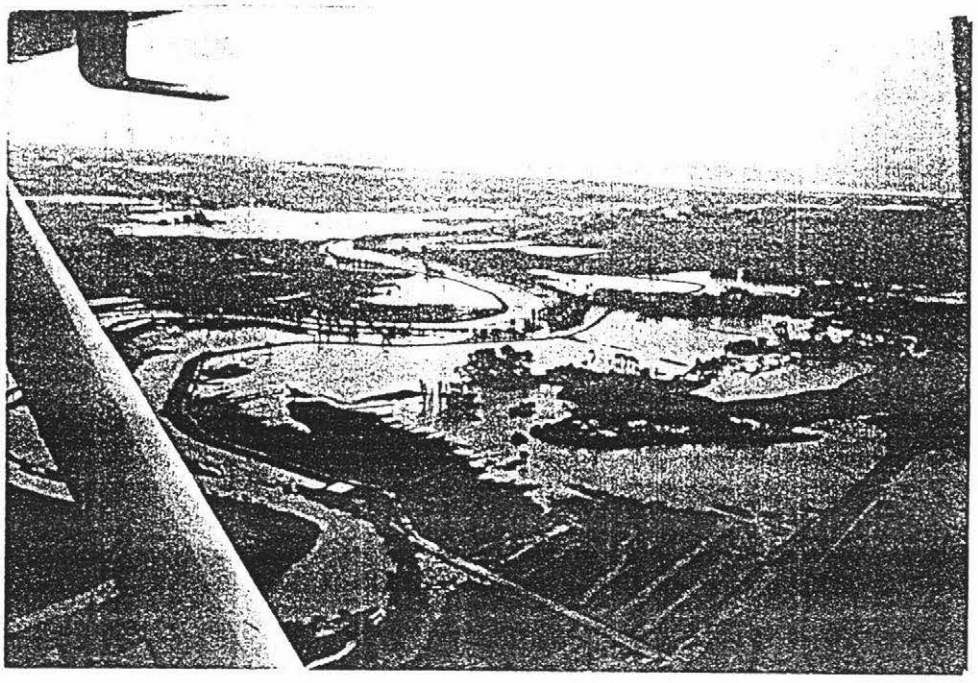


Plate 4 Floodwaters in the vicinity of Muhunoa West Road, Ohau River flooding 6 October 1986.

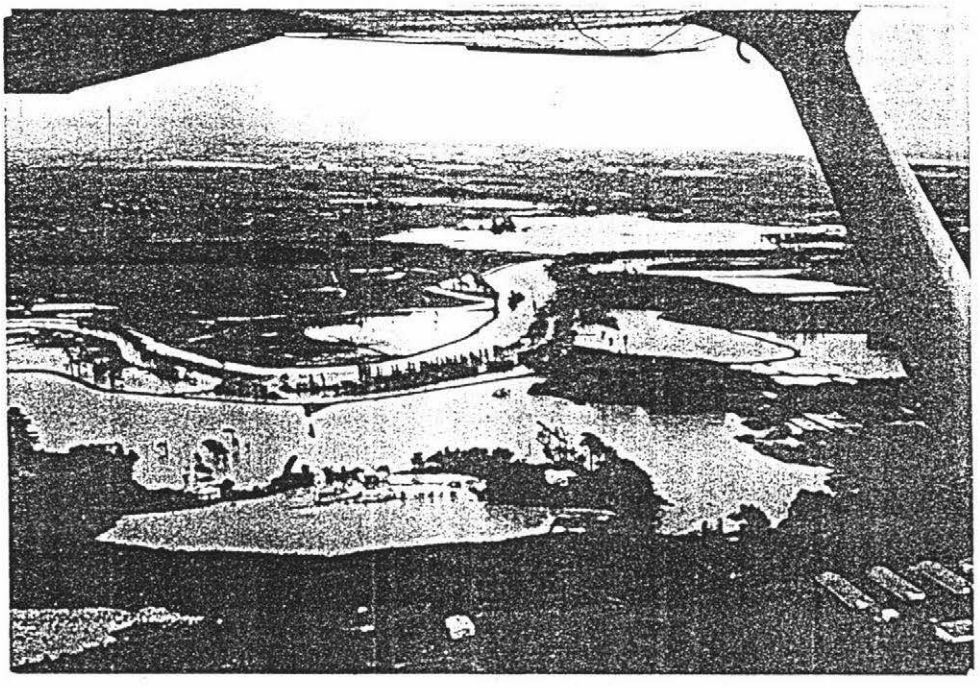


Plate 5 Floodwaters in the vicinity of Muhunoa West Road, Ohau River flooding 6 October 1986.

Plate 6 Floodwaters of the Ohau River (Parkins property) 6 October 1986.

The most significant flood in the Ohau River, since the Ohau River Scheme was completed, occured on 4-5 October 1986. During the flood water poured over the spillways of the Ohau River bank and inundated the land to the north and south of the river. Muhunoa West Road was impossible to drive on in one place and residents were advised to be ready in case banks broke. (refer NP/11, NP/12, NP/13, NP/14). (refer Plates 4, 5 and 6).

The Levin Chronicle also reports on a severe flood in the Ohau River in an article dated February 13, 1950. The article states residents bordering the Ohau River considered it the worst flood for 27 years. Unfortunately the article is not very descriptive of the extent of flooding. (refer NP/15).

4.2.7 Muhunoa West Road - Coastal Area

Towards the coast the terrain consists of sand hills and lowlying peat areas. Flooding of lowlying areas occurs when high rainfall and floodwaters in the Ohau River cause build up in local drainage systems. Flooding in this area also occurs when the Ohau River stopbanks are exceeded in large floodevents.

Immediately west of the large bend near the end of Muhunoa West Road the lowlying areas on the north side of the road flood when water backflows up drainage channels due to Ohau River flooding. Flooding of this land would occur with about a 6.7% annual probability (1 in 15 year recurrence) and would cover the land to approximately 30 centimetres. (refer figure 9, area G; Board Correspondence Ref N/58).

4.3 Hokio Stream/Lake Horowhenua

Lake Horowhenua is an example of a lowlying peaty-swamp lake situated behind the dune complex. (refer figure 6). The lake has a small catchment area which mainly includes the land drained by the Arawhata drain, Mairua drain and Bryants drain. The Hokio Stream is the outlet from the lake to the sea.

4.3.1 General

Flooding occurs in the vicinity of Lake Horowhenua when prolonged or intense periods of rain cause lake levels to raise so that drainage into the lake is impeded and drainage systems from the lake are overburdened. (refer Figure 12, NP/16).

4.3.2 Lake Horowhenua

A newspaper article from the Manawatu Evening Standard dated Tuesday, August 7, 1962 describes dramatic rises in the level of Lake Horowhenua due to heavy rain. The article

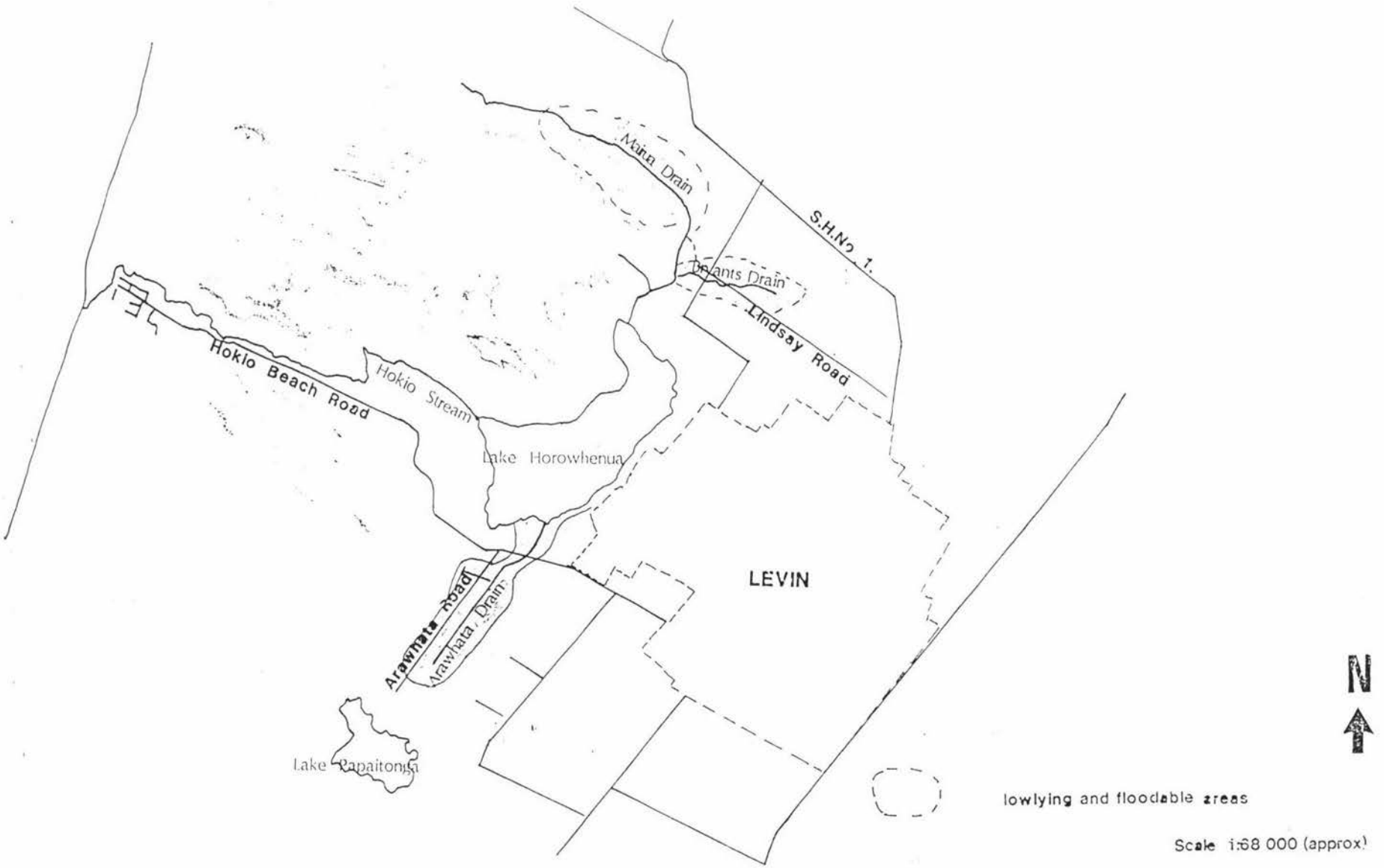


Figure 12. Hokio Stream/ Lake Horowhenua Area

reports "waters invaded more than 50 acres on one property and rendered a further 100 acres useless".

The installation of a weir on the stream and improvement work to the Hokio Stream was undertaken between 1965 and 1967 in order to maintain the lake level at 30 feet above mean low water spring tides at Foxton heads. Maintenance of this level is dependent on regular clearing of the Hokio stream. (refer NP/17).

4.3.3 Arawhata Drain

The Arawhata Drain and associated small drains in the vicinity of Arawhata Road can be exceeded during severe rainstorms and prolonged wet periods. Floodwaters from the drain inundate lowlying areas in the vicinity of Lake Horowhenua, Arawhata Road and Hokio Beach Road. (refer figure 12, area A; Board Correspondence L/37, N/32).

4.3.4 Mairua Drain

On the north side of Lake Horowhenua the Mairua Drain also floods surrounding lowlying areas during times of intense or prolonged rainfall. Of particular note is the land to the western end of Lindsay Road where water tends to pond over a wide area. (refer figure 12, area B).

4.3.5 Bryants Drain

Bryants drain intersects Kawiu and Lindsay Roads. Flooding from Bryants drain is not severe and tends to be confined to the lowlying depression surrounding the drain. The terrace edges adjacent to the drain should however, be avoided when locating buildings as these areas may be subject to seepage or erosion problems. (refer Figure 12, Area C).

4.3.6 Hokio Stream

High lake levels and/or rough sea conditions can result in the Hokio Stream exceeding its banks and the flooding of surrounding areas. The likelihood of Hokio Stream flooding is increased by the congestion of the stream by weed.

Floodwaters from the stream have been known to flow over Hokio Beach Road west of the Golf Course Road and cause periodic surface flooding in several of the Hokio Beach settlement properties including the Department of Social Welfare School. (Manawatu Catchment Board (Brougham and Schuppar) "Hokio Catchment Control Scheme, Review 1965-1978 and proposed works 1979-1984" December 1978) (NP/18).

4.4 Koputaroa Area

The two main streams in the Koputaroa area are the Koputaroa Stream and the Waoku Stream (Potts Stream). These streams originate in the Tararua Ranges between Levin and Shannon. The

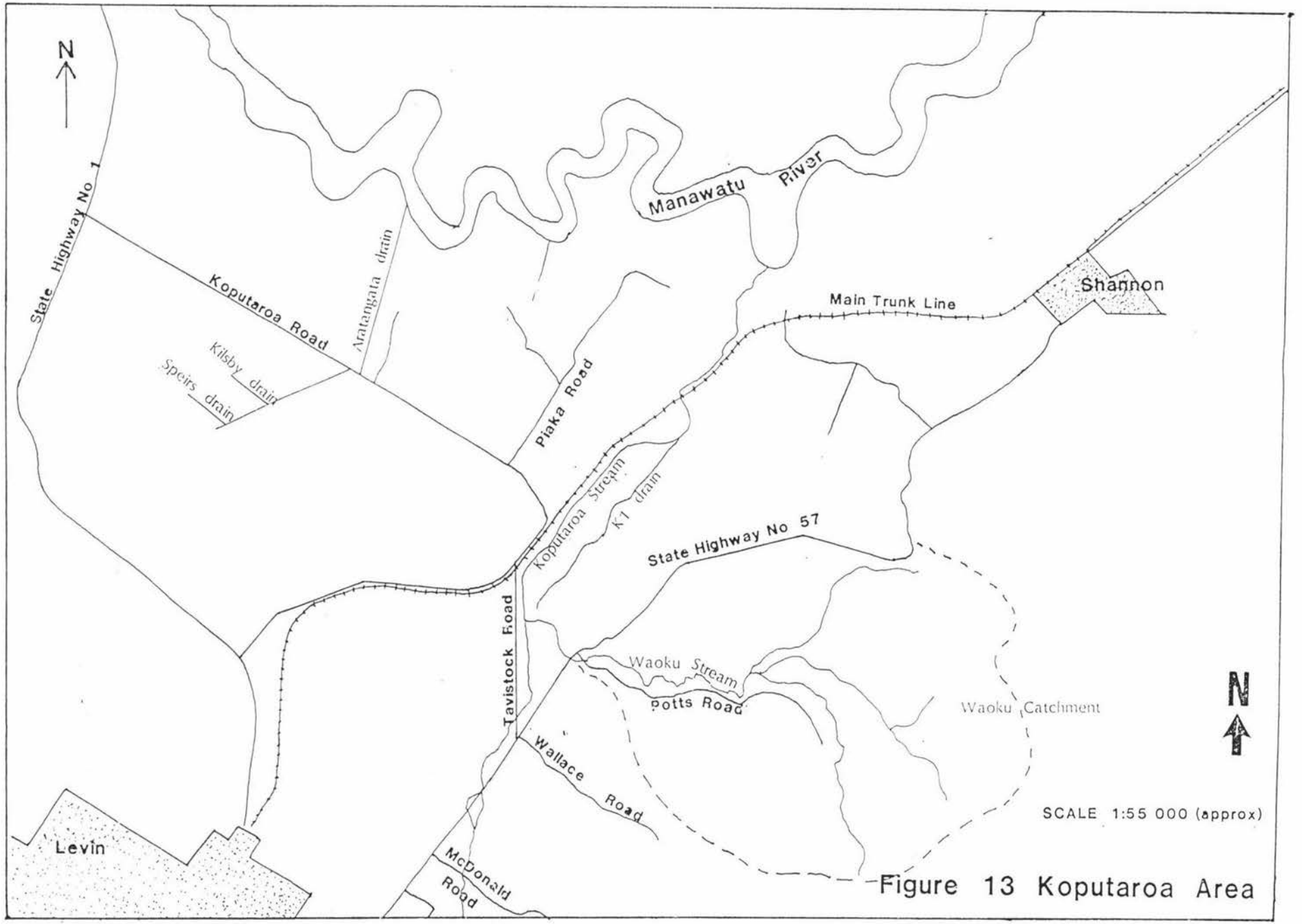


Figure 13 Koputaroa Area

two streams meet to form an enlarged Koputaroa Stream west of State Highway No. 1 about halfway down Taoistock Road. The Koputaroa Stream has a floodgated outlet into the Manawatu River. The Koputaroa drainage district is a large area of lowlying peat/siltloam land between State Highway 1, State Highway 57 and the Manawatu River. (refer figure 14). The drainage scheme is administered and rated for by the Central Districts Catchment Boards.

The drainage scheme has helped to create this area into a useful, highly productive area for pastoral farming, of which dairy farming is a common type.

4.4.1 Waoku Stream

The catchment of the Waoku Stream is shown in figure 13. Relative to the size of the Waoku Stream the Catchment is extensive. Localised rainstorms can therefore result in flash flooding of the Waoku Stream floodplain. This occurred in 1983 when roaring floodwaters caused several livestock deaths. The floodplain is also dissected by many smaller tributaries.

On the lowlying land between Potts Road and State Highway 57, flooding from the Waoku Stream is extensive (refer plate 7). This flooding is intensified by the inability of the culvert under Potts Road to cope with floodwaters. During recent years further subdivision on the northern side of Potts Road has resulted in almost all flood-free highland being used for building sites.

Depth of floodwaters along the Waoku Stream floodplain north of Potts Road exceed fence height in many instances. (refer plate 8).

To the south of Potts Road the land is undulating. Lowlying areas suffer from flooding.

In more extreme events water will flow over Potts Road.

Flooding of the area north of Potts Road by the Waoku Stream occurred during 1972-74, with smaller flood in 1976. The flood in 1972 had a frequency of between 10 and 20 years. More recent flood events occurred in October 1986 and 14 September 1988. The October 1986 event is estimated to be a 10 year recurrence storm event.

At the junction of Waoku and Koputaroa Stream flooding can be extremely severe (refer NP/19).

4.4.2 Koputaroa Stream

Floodwaters from the Koputaroa Stream pond on State Highway No. 1 in the vicintiy of Apple Point orchard and the cottage opposite. (refer plates 9 and 10).

Many of the small tributaries of the Koputaroa Stream which run out of the Tararua Mountain Range between Potts Road and

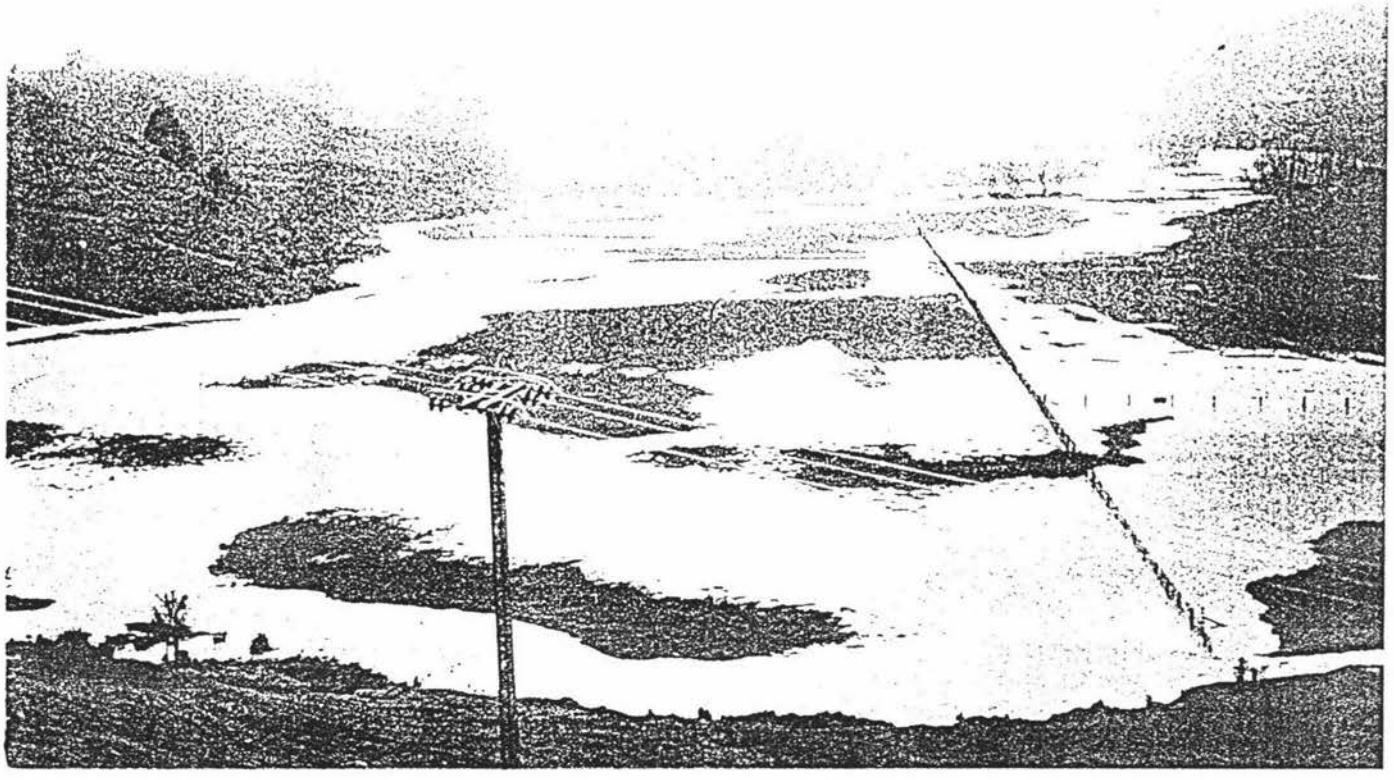


Plate 7 Floodwaters of the Waoku Stream on the lowlying north-east corner of Potts Road and State Highway No. 57 intersection. 14 September 1988.

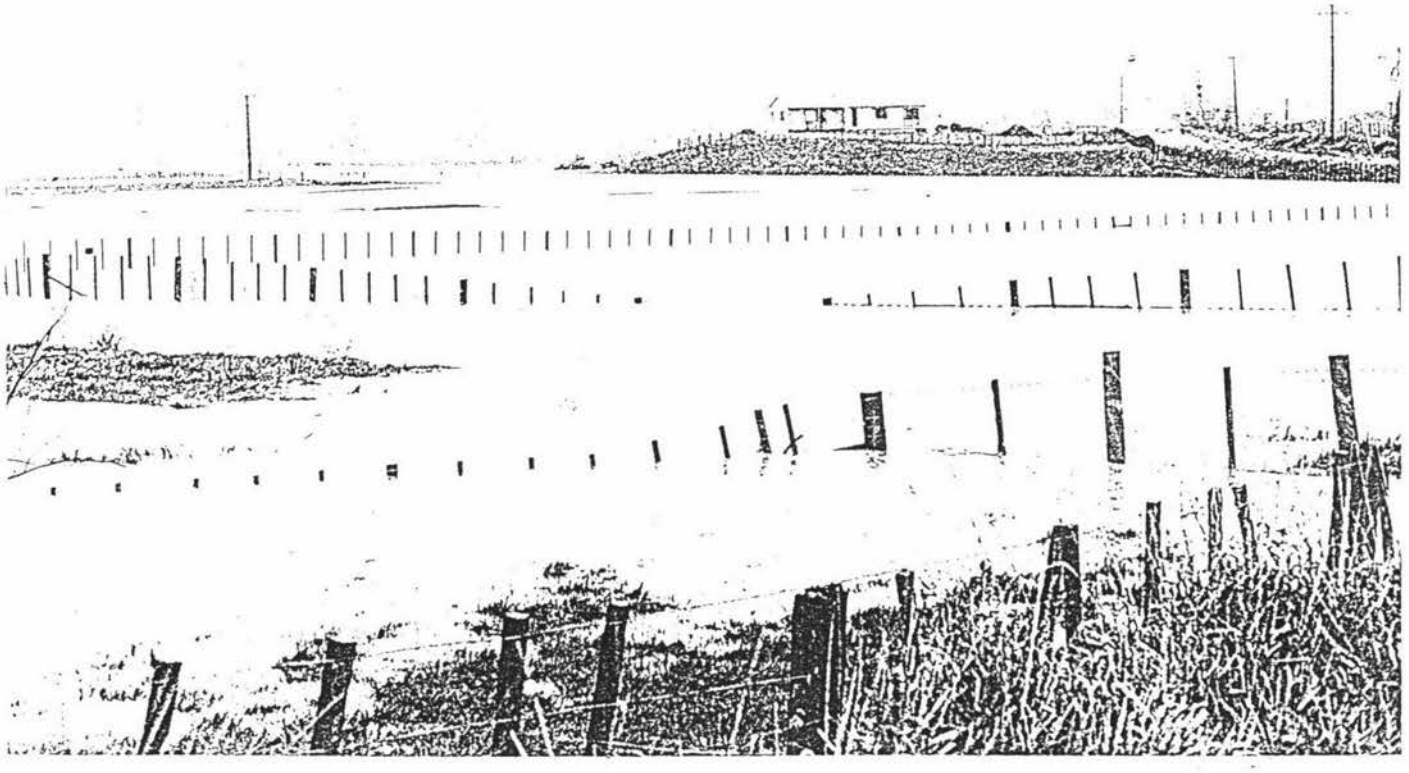


Plate 8 Floodwaters of the Waoku Stream exceeding fence height on the north - east corner of Potts Road State Highway No. 57 intersection. 14 September 1988

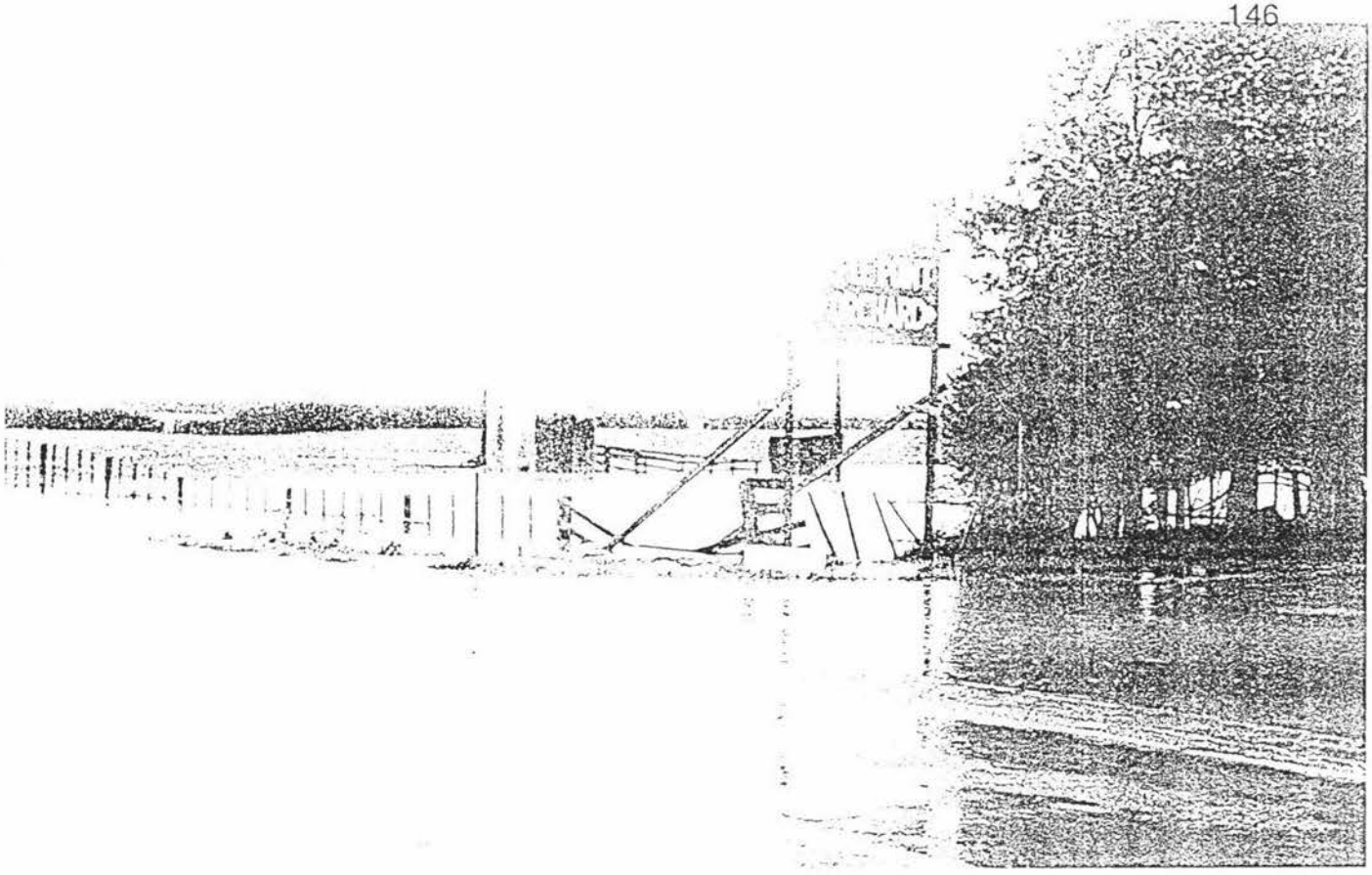


Plate 9 Floodwaters of the Koputaroa Stream at Apple Point Orchard on the west side of State Highway No. 57. 14 September 1988.

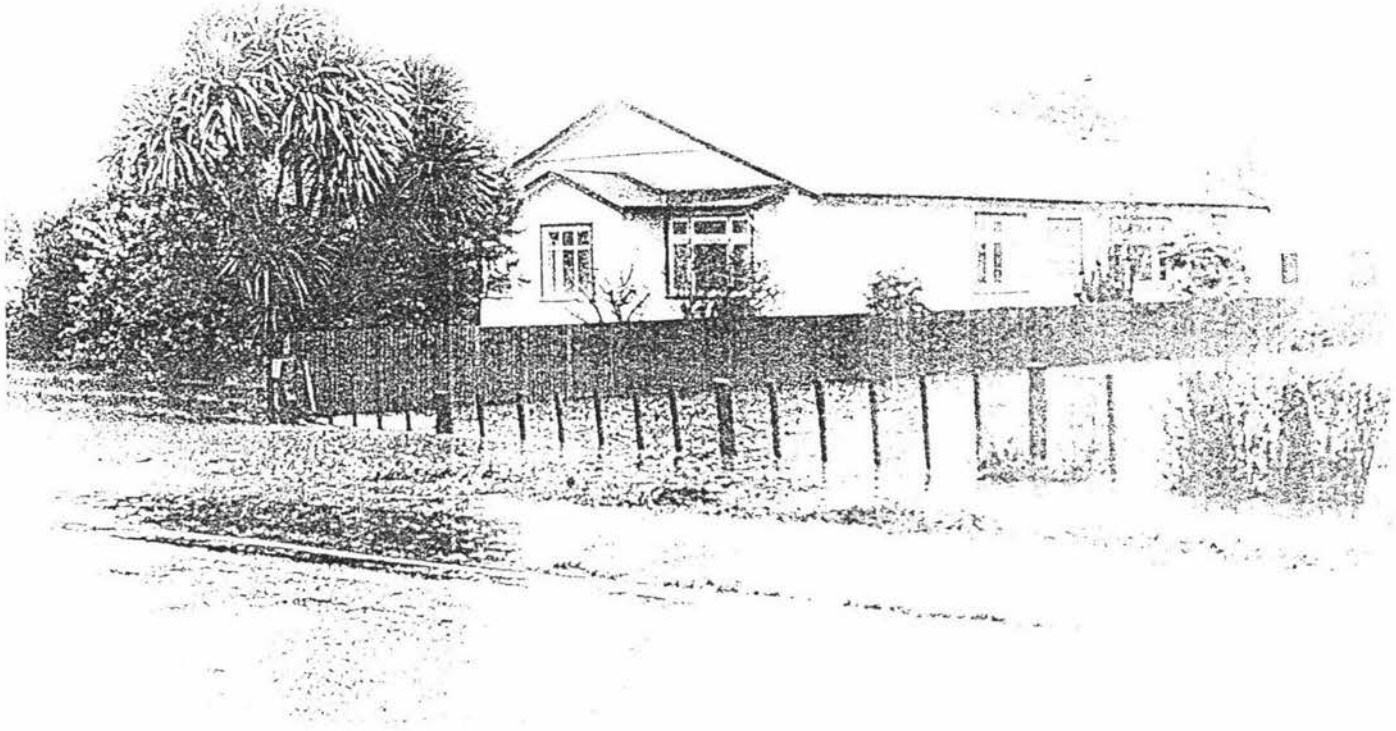


Plate 10 Floodwaters of the Koputaroa Stream in [illegible] of State Highway No. 57. 14 September 1988.

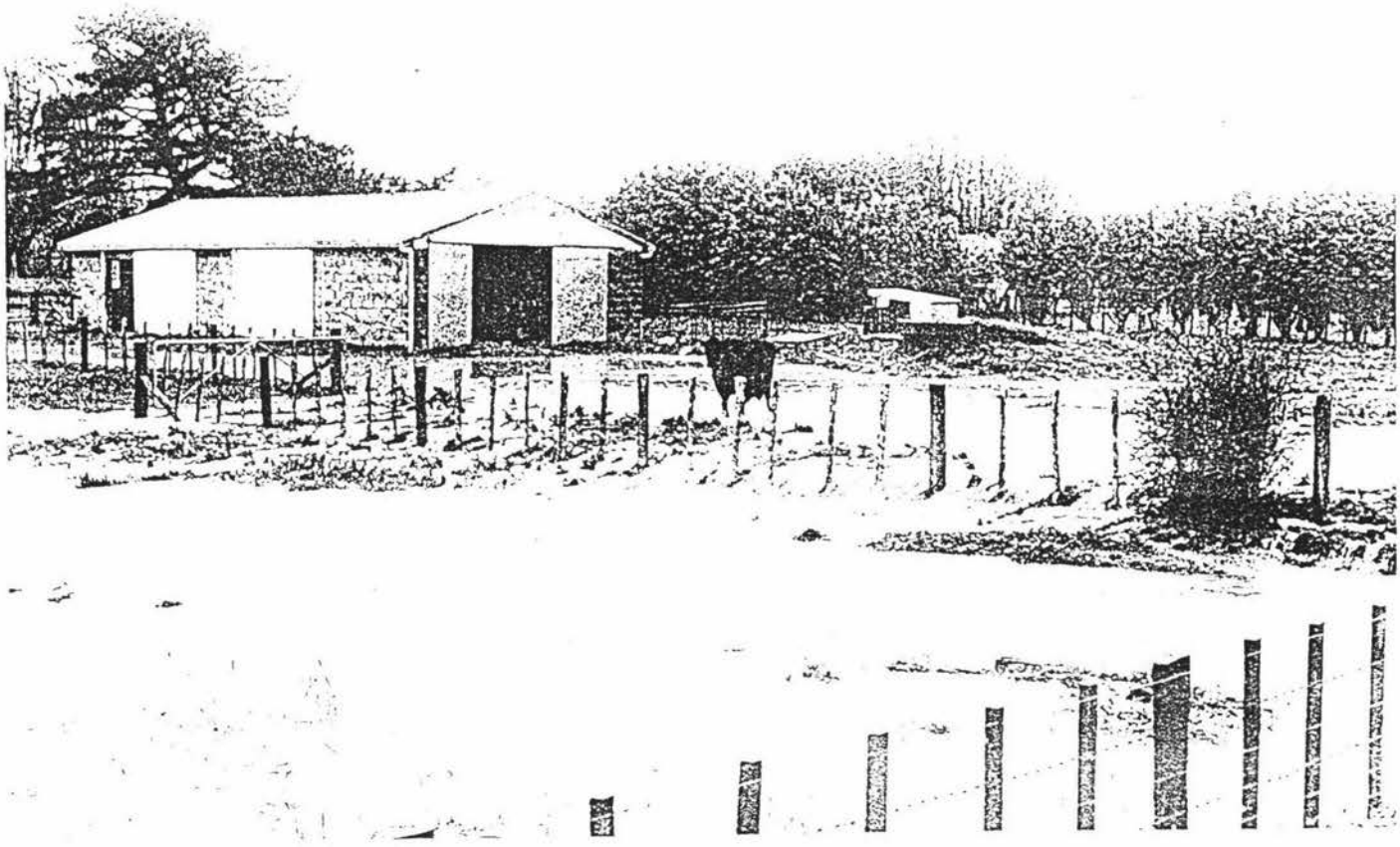


Plate 11 Floodwaters of the Koputaroa Stream and its tributaries flowing over lowlying land on the easter side of State Highway No. 57 14 September 1988.

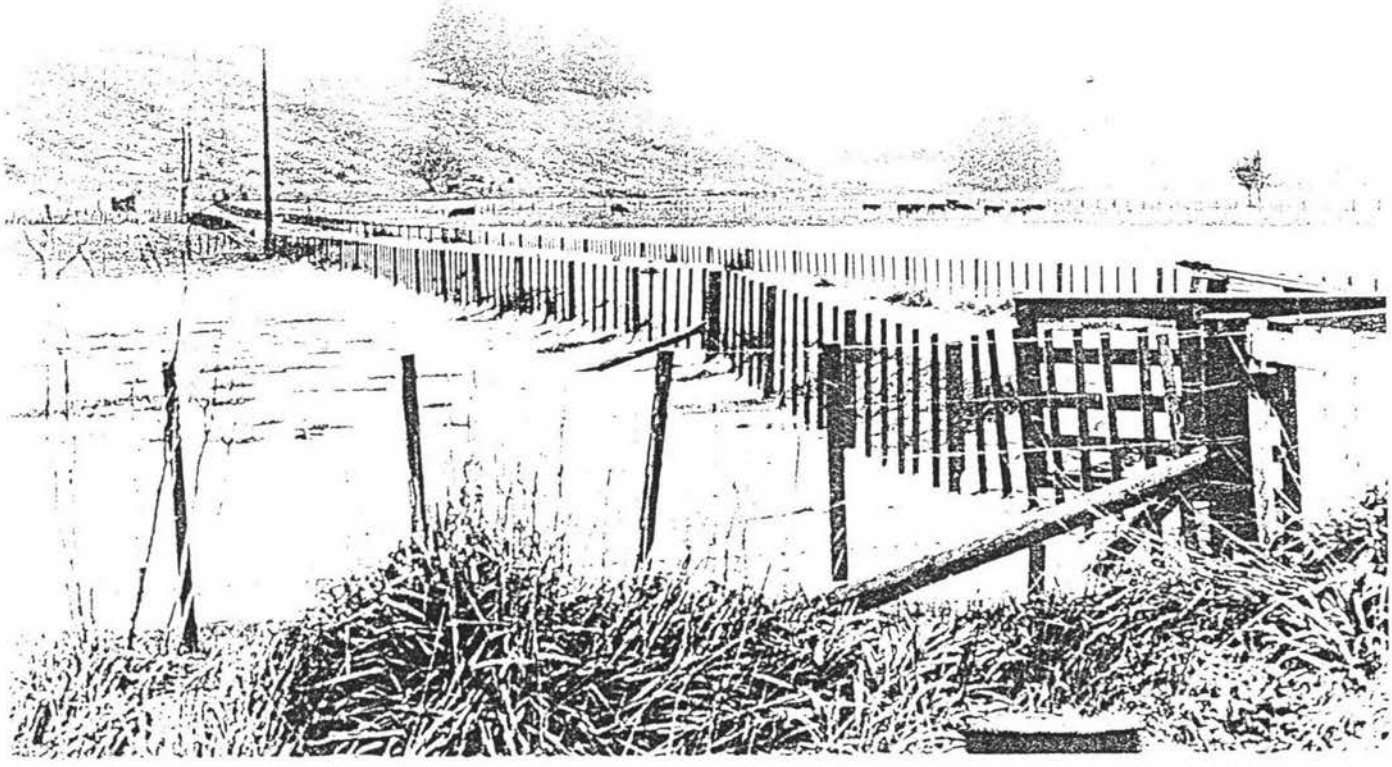


Plate 12 Floodwaters of the Koputaroa Stream and its tributaries flowing over lowlying land on the eastern side of State highway No.57 between Wallace Road and Potts Road.

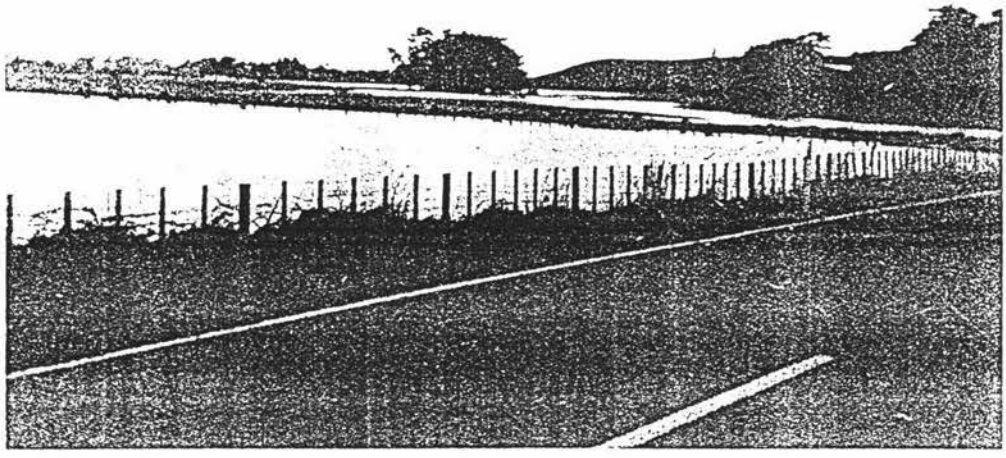


Plate 13 Floodwaters of the Koputaroa Stream on the west side of State Highway No. 57 near Ihakara Hall 4 October 1986.

Plate 14 Floodwaters of the Koputaroa Stream in the vicinity of Ihakara Hall, State Highway no. 57 14 September 1988.

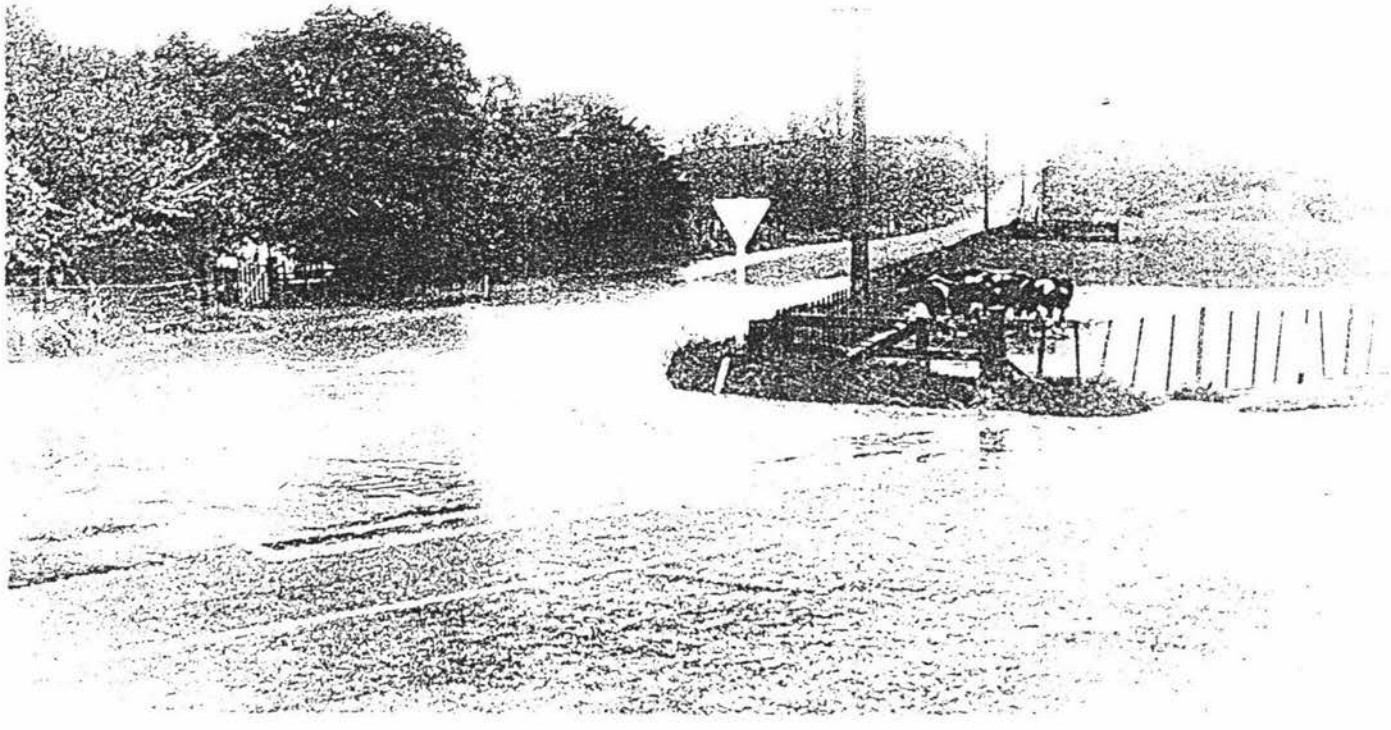


Plate 15 Floodwaters of the Koputaroa Stream in the vicinity of Tavistock Road and State Highway No. 57 intersection, 14 September 1988.

McDonald Road flood over lowlying land at a reasonably fast rate. (refer plates 11 and 12).

During floods of moderate frequency floodwaters pond outside Ihakara Hall on State Highway 57 and Tavistock Road. (refer plates 13, 14 and 15).

During the 1972, 1974-76 floodwater has inundated the gardens around the dwelling on the corner of Tavistock Road and State Highway 57. These floods are estimated as having a 10-20 year frequency. Larger floods may have entered this dwelling.

Areas known to be floodable from the Waoku Stream and the Koputaroa Stream above their junction are illustrated in figure 13.

4.4.3 Koputaroa Drainage Scheme

Koputaroa Stream

In the lower reaches of the Koputaroa Stream floodwaters frequently inundate lowlying areas. The area most likely to flood, surrounding the Koputaroa Stream, is situated between the Railway and the K1 drain. (refer figure 13).

The Koputaroa Stream banks are lower than the Manawatu stopbanks, however, a floodgate at the mouth of the stream aims to avoid back flows when the Manawatu River is in flood. There have been reported occasions when the gate has been jammed open causing inundation of all the lowlying land (peat areas) in the vicinity.

Aratangata Drain

The aratangata Drain is a gravity feed drain. Similarly to the Koputaroa stream the drain has banks lower than the Manawatu River stopbank and a floodgate outlet to the Manawatu River to avoid back flow during times of flood. During times of flood the lowlying land south of Koputaroa Road surrounding the Speirs and Kilsby drains is the first land to be inundated (refer figure 13). All the surrounding lowlying peat land in the vicinity is inundated in more severe events or when the floodgates are jammed open.

Surrounding Drainage Areas

There are four small pump drainage systems draining the Koputaroa drainage system.
The following is a table of the various pumps capacities:

TABLE 2

Pump Capacities of the Koputaroa Drainage System

Pump	Catchment Area (Ha)	Pump Capacity (Cumecs)	Rainfall Capacity per 24 hours
Pump 1	1214 ha	1.13 m3/s	8 mm
Pump 2	376 ha	0.45 m3/s	10 mm
Pump 3	587 ha	0.76 m3/s	11 mm
Pump 4	700 ha	0.76 m3/s	9 mm

This only gives a very general idea of the types of rainfall events which may inundate lowlying areas. Several additional factors will influence the floodability of the land i.e. level of Manawatu River, intensity of rainfall within the 24 hour period and absorbtion capability of land and drainage network within Catchment. In view of these other contributing factors it is considered that a storm event would have to be very much greater than the rainfall capacity of the pump system before any flooding occurs.

4.5 Shannon

Shannon is bounded by streams to the north and south. The Otaura Stream flows from the foothills of the the Tararua ranges along the southern boundary of Shannon township and the Mangaore Stream, which carries waters diverted for the Mangahao power station as well as waters from its own catchment in the Tararua ranges. These two streams join west of Shannon and flow into the Manawatu River.

4.5.1 Otaura Stream

This stream has its head waters in the hills behind Pretoria Road. The tributaries and drainage channels which feed into the stream are prone to flooding. Many lowlying areas not normally carrying water are inundated during times of flood. This occured during the 14 September 1988 flood event when the property owners on the northern side of Pretoria Road experienced a small lake in the middle of their section. A Levin Chronicle

newspaper report dated February 13, 1950 indicates that following heavy rainstorms, of 4 inches of rain between 4pm and 8am all streams leading from the hills in the vicinity of Shannon were flooded and they overflowed their banks in many places.

The Otaura Stream has been known to flood across State Highway No. 57. This was reported to have, occurred in February 1950 and December 1959. (refer NP/20 and NP/21).

The 1959 newspaper report states that "Cars, proceedings with extreme caution, were able to get through the water. The position was worse on the northern side of the bridge, where the water was nearly three feet high at its peak". Roading improvements in this area may have increased the level of the State Highway therefore decreasing its likelihood to flood. Board staff do, however, recall this occurring during the 3 July 1974 floodevent.

In its lower reaches the Otaura Stream combines with the Mangaore Stream to flood the lowlying land adjacent to the Manawatu River. Photographs showing the inundation of the large area between the Otaura Stream and the Mangaone Stream were taken during the June 1976 floodevent. (refer plate 16).

4.5.2 Mangaore Stream

The flow of the Mangaore Stream is influenced by its natural catchment and by the water diverted from the Mangahao catchment and upper Tokomaru Catchment for the generation of hydro electric power. The maximum discharge from the power project is 11 cumecs, however this can be controlled.

Flooding by the Mangaore Stream above Shannon township is mainly confined to the low terrace land obviously forming part of the flood channel.

Immediately upstream of State Highway No. 57, water has been known to flow overland in a northerly direction. This is reported to have occured in 1972, however, the floodwater was not of significant depth or velocity.

Downstream of State Highway 57 floodwaters covered the land between Mangaore Stream and Otaura Stream in 1976.

4.6 Shannon - Tokomaru - Opiki

A large number of small streams flow from the foothills of the Tararua Ranges. Many of these streams in the vicinity of Linton form the headwaters of the Linton Main Drain. This drain collects water from many small catchments and meets up with the Tokomaru Stream in the approximate vicinity of Tamatarau Road, Tokomaru. Further downstream, towards Shannon, the Kara Stream joins the Tokomaru Stream before it meets with

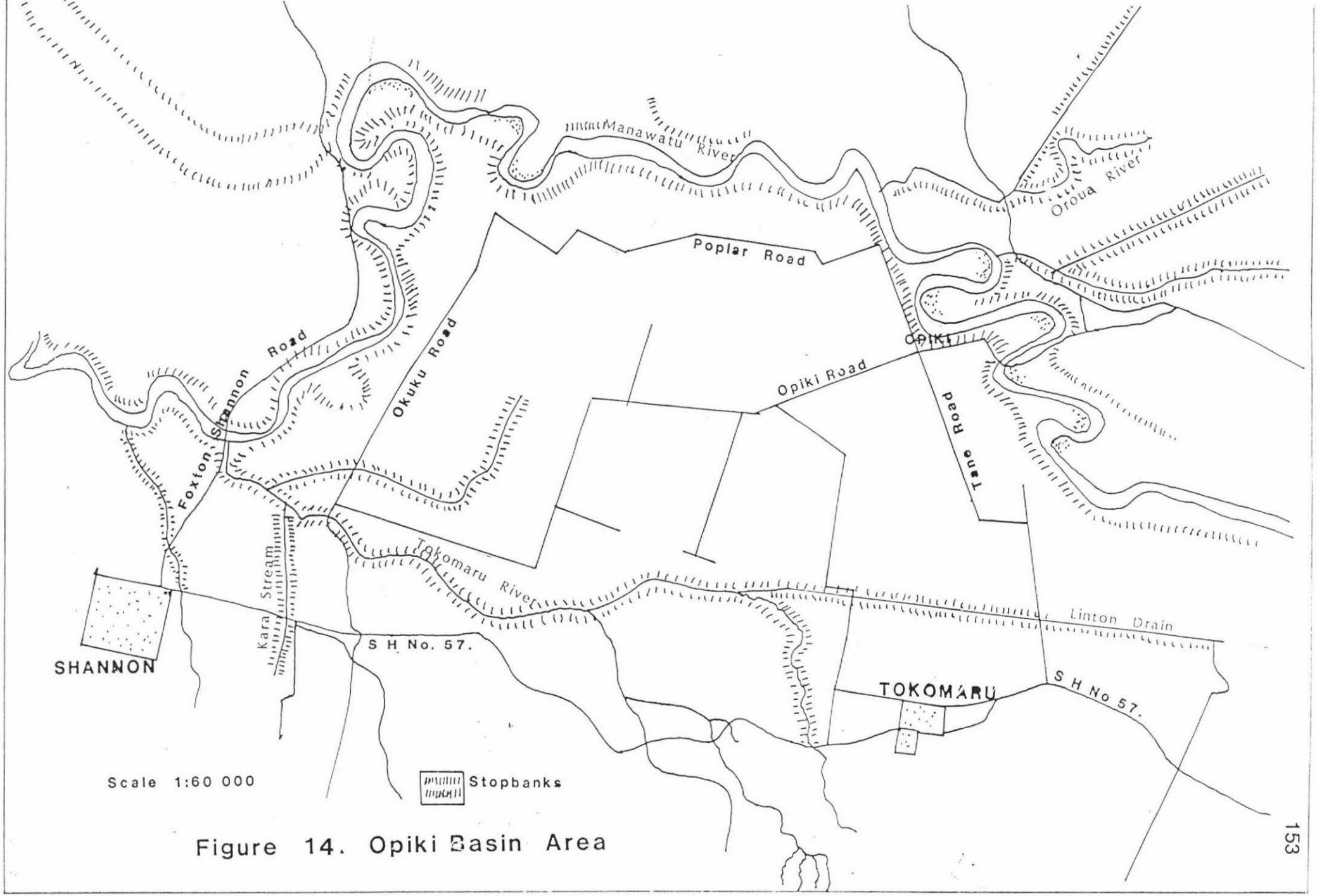


Figure 14. Opiki Basin Area

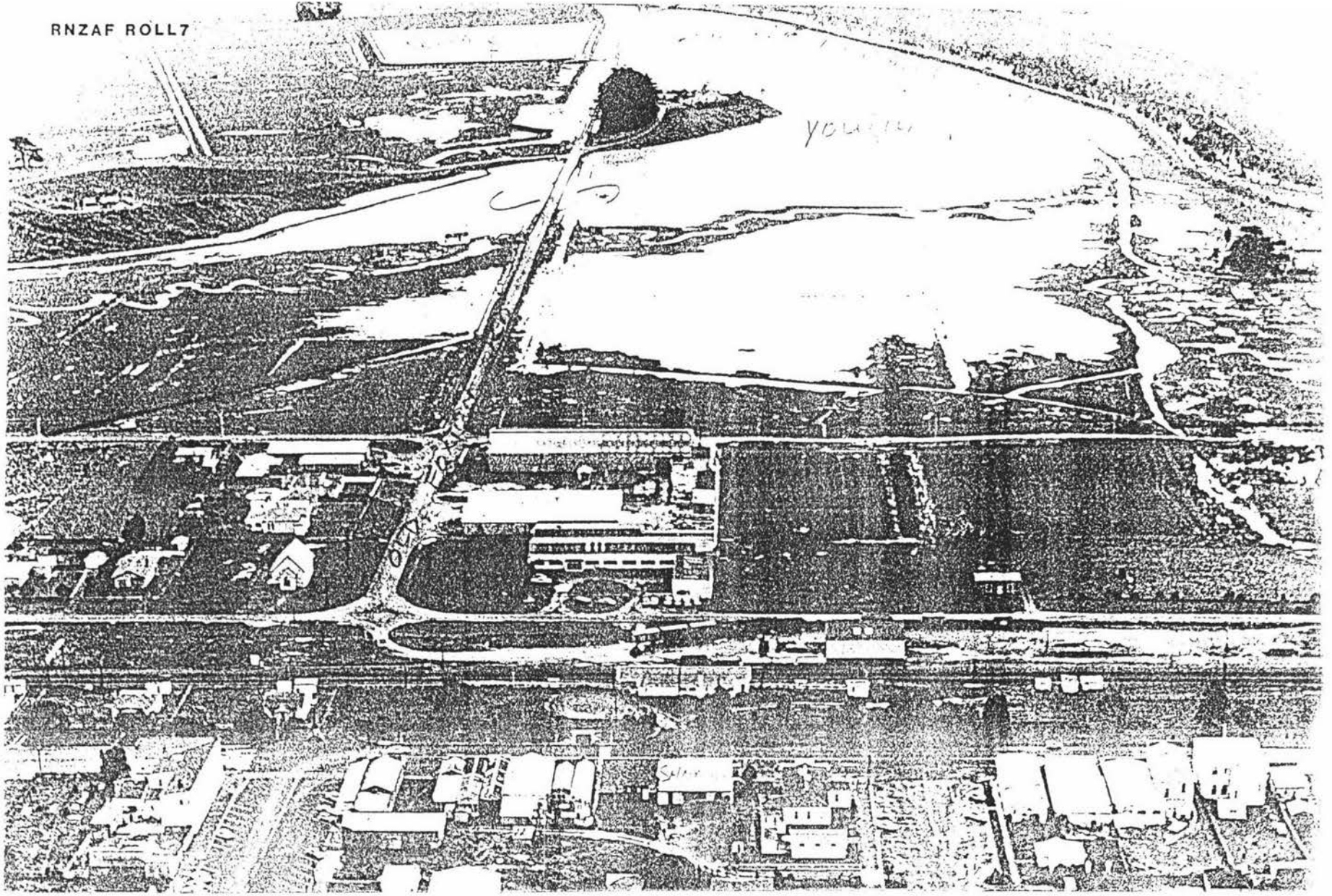


Plate 16 Floodwaters of the Otaura Stream and Mangaone Stream west of Shannon township, June 1976 floodevent.

the Manawatu River. The high marine terrace land running along the Tararua Ranges is sharply dissected. The soils on this marine terrace land are known as Tokomaru silt loam. This soil type has a high clay content which tends to cause drainage problems in winter and drying out/compaction in summer.

On the western side of the Tokomaru Stream and Linton Main Drain is the extensive Opiki Basin Area. This area forms part of the Makerua Drainage District which has a drainage system which pumps water into the Linton Main Drain and Tokomaru Stream. The drainage of this land has rendered it a valuable cropping (mainly potatoes) and dairy farming area. For a general map of this area refer to figure 14.

4.6.1 Kara Stream

The Kara Stream is return stopbanked to prevent flooding in the Manawatu River backing up. In flood events of approximately one-in-ten year frequency or more, drainage water ponds on the flat land beside the stopbanks. Drains into the Kara Stream are floodgated and during times of flood the water cannot escape. This occurred during the September 1988 floodevent when lowlying land immediately surrounding the stream was inundated. The more severe 1976 flood event resulted in inundation of a much wider area. All lowlying land in the vicinity of the Kara Stream is subject to poor drainage and should not be used for building sites. (refer NP/22 and NP/23) (refer Plate 17).

4.6.2 Makerua Area

This area includes the foothills to the east of State Highway No. 57. Several streams in this area discharge into drains within the Makerua drainage district. These drains have floodgated outflows into the Tokomaru River. During periods of high rainfall water builds up in the drainage system to the extent of covering the lowlying land on the western side of State Highway No. 57. During the 1976 flood event, estimated to have a one in forty year recurrence, water covered the lowlying area to the west of State Highway No. 57 and inundated some very lowlying gully land to the east of the state highway. (refer plate 18).

4.6.3 Makerua Drainage District

The Opiki Basin forms the main part of this drainage district. The Basin is surrounded by major watercourses which are stopbanked out of the basin area. The Manawatu River forms the north and western boundaries and the Tokomaru Stream the eastern and southern boundaries. The Tokomaru Stream and Linton Main Drain also collect all water from catchments in the Tararua Ranges and their foothills that formerly entered the Basin. (See section 4.6.2 'Makerua Area' and 4.6.4 'Tokomaru Area').

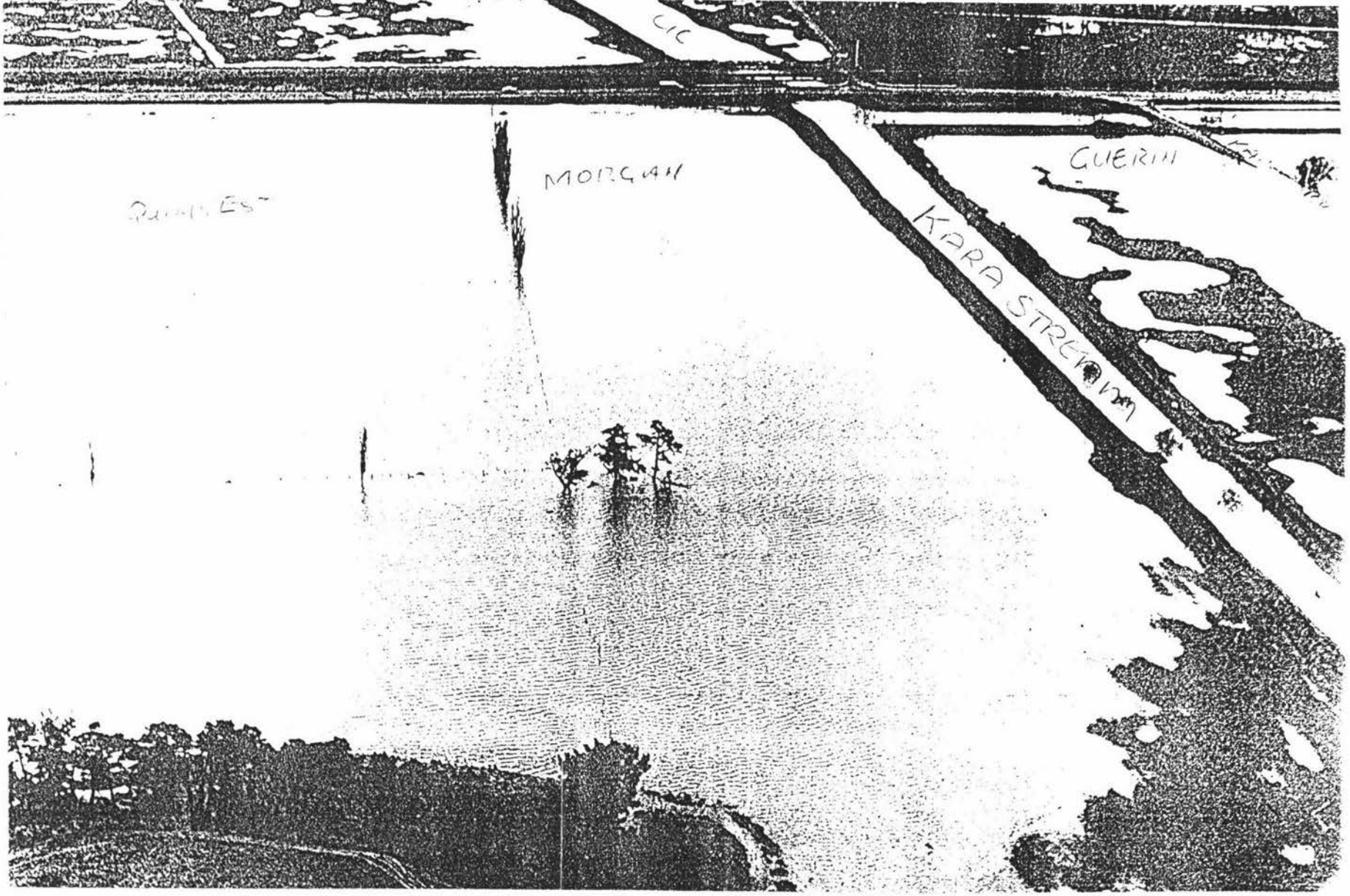


Plate 17 Floodwaters of the Kara Stream and its tributaries, north of Shannon township, June 1976 floodevent.

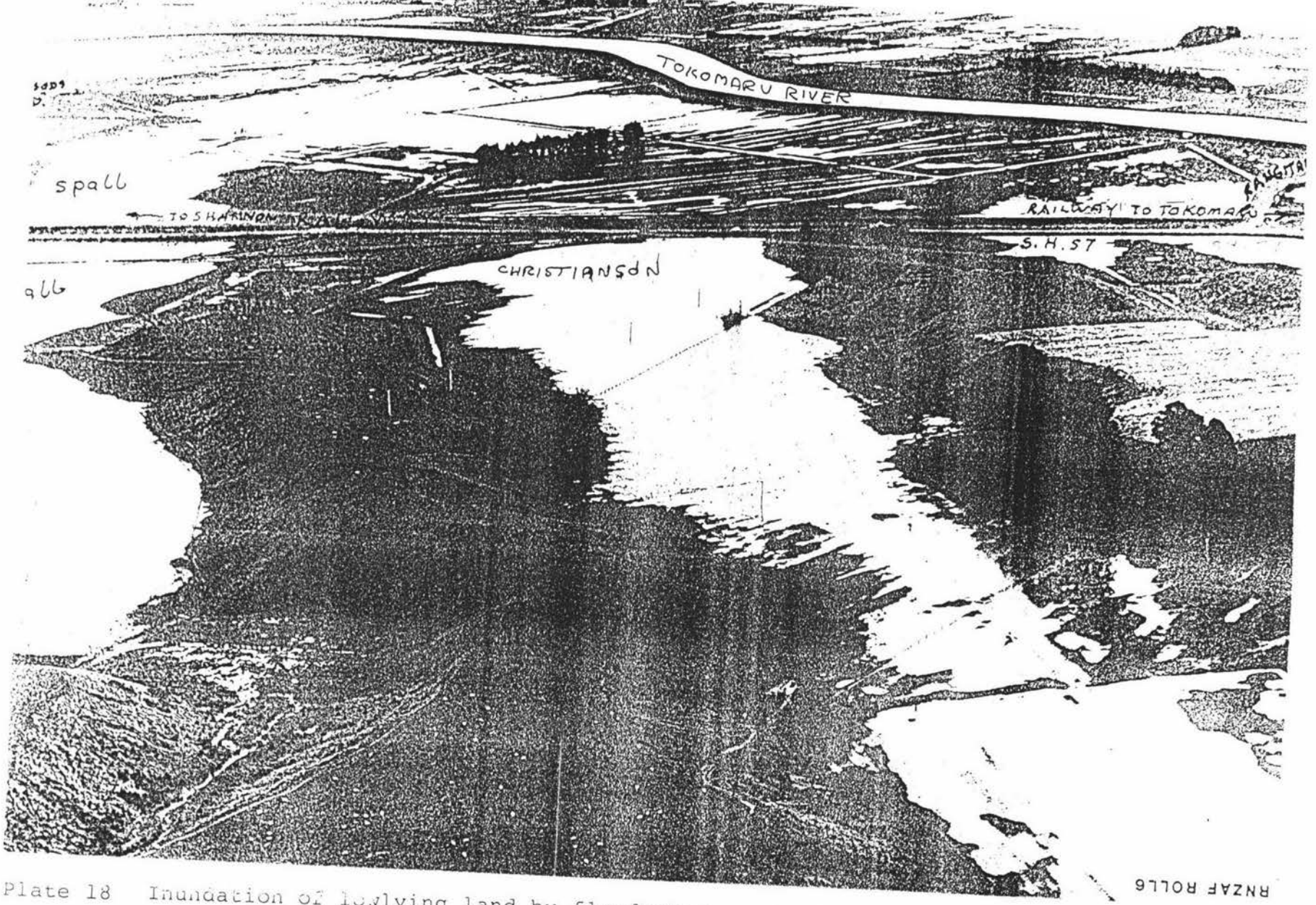


Plate 18 Inundation of lowlying land by floodwaters east of State Highway No 57, Makerua, June 1976 floodevent.

There are numerous floodgated drain outlets into the Manawatu River, Tokomaru Stream and Linton Main Drain, however, these all close off when water levels raise in the watercourse. During such events drainage of the Opiki Basin is dependent on a limited number of pump stations. When the pump capacities are exceeded flooding occurs. This flooding is initially adjacent to the main pump drains and then it occurs generally in all lowlying areas. (The drainage plan of this area shows the contours of the Opiki Basin together with the location of pump outlets).

Generally the peat and alluvial soils of the Opiki area are not free-draining and during prolonged wet periods localised ponding occurs. Some areas in close vicinity to Opiki settlement (i.e. the school, church, etc) are less susceptible to ponding as they form the higher 'natural levie' area of the floodplain. However, even in this area there are old lagoon drain areas which are affected by ponding problems.

The Opiki Basin is also vulnerable to 'bank break' situations in any of the surrounding stopbanks. The stopbanks along the Manawatu River are designed to accommodate a flood of 100 year frequency (at this time this design is not met in some areas), however, those along the Tokomaru Stream and Linton Main Drain may fail in a flood of this size as not all the banks are "key trenched" into the peat land in which they have been placed. Bank breaks could have disasterous results. The velocity and depth of water would do serious damage to buildings and life.

Allotments in the Opiki area should be of sufficient size to include areas of slightly higher ground which are less susceptible to ponding. It is recommended that all dwellings in the Opiki area be raised at least 0.3 metres off ground level in order to raise them above water ponding levels. In some areas greater floor level heights may be required.

Some peat areas in the Opiki Basin are still undergoing consolidation. In these areas buildings may require specific foundation requirements.

During the 29 July 1976 flood event several lowlying areas of Opiki experienced floodwater ponding, however the depth was generally a maximum of 0.3 metres.

4.6.4 Tokomaru Area

The land between the Tokomaru Stream and Linton Main Drain is subject to periodic inundation and poor drainage. This occurs when high flows in the Linton Main Drain prevents internal drainage water from entering it.

It is possible for both the Tokomaru Stream and the Linton Main Drain to overtop their stopbanks in extreme

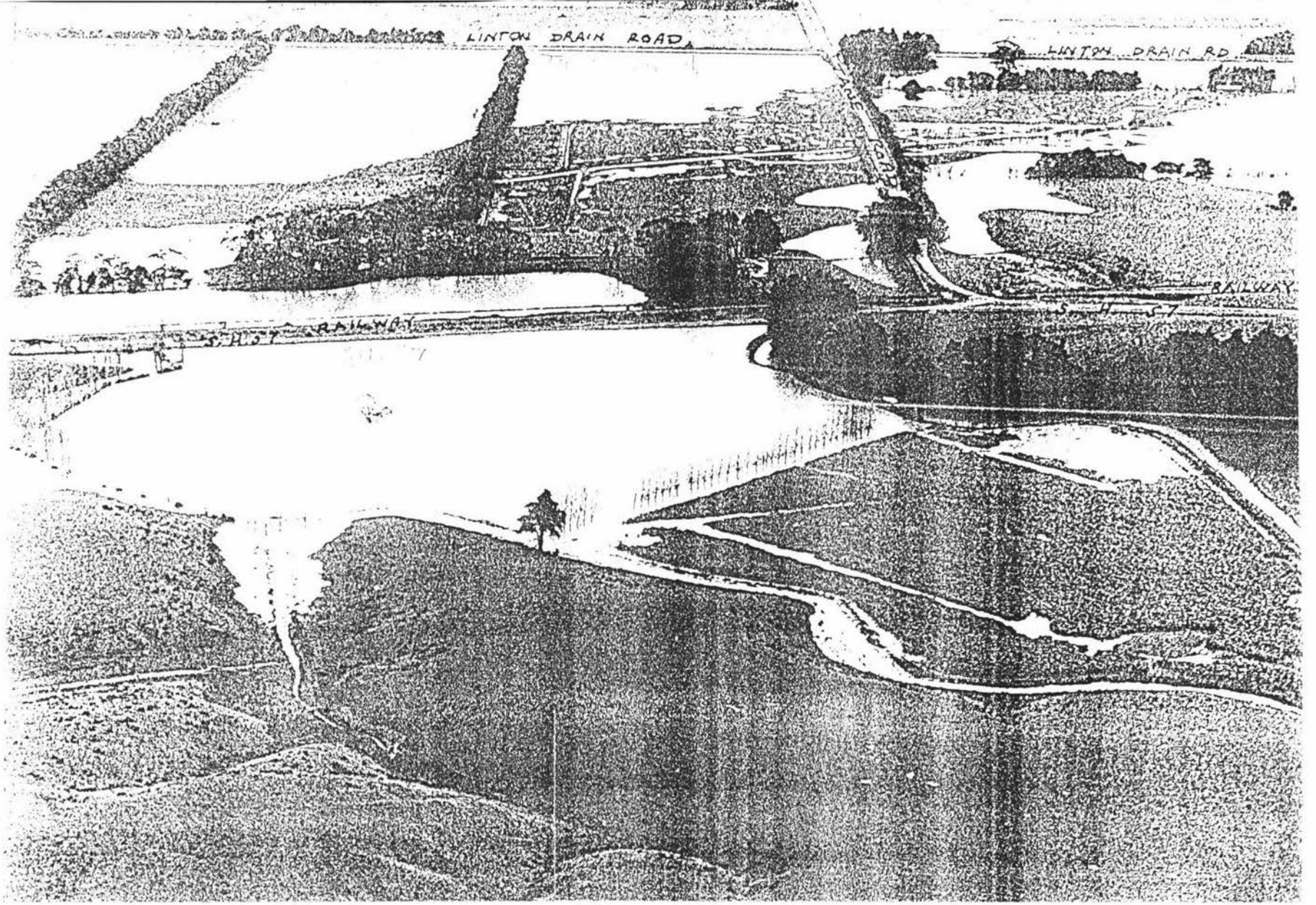


Plate 19 Ponding floodwaters from the Linton Drain and surrounding drains in the vicinity of the Tane Road and State Highway No. 57 intersection, Tokomaru, June 1976.

conditions i.e. methods with a frequency of approximately 30 years. In the Tokomaru Stream such flooding usually occurs where the Tokomaru Stream takes a sharp turn prior to its junction with the Linton Drain.

Ponding of floodwaters during extreme wet periods occurs on the lowland adjacent to the Linton Drain north of its junction with the Tokomaru Stream. Water ponds across Tane Road at a low point west of the Railway Line and on the low flat land on the eastern side of the state highway immediately south of the Tane Road intersection. This occured in the 29 July 1976 floodevent and is very evident in the RNZAF photographs held by the Board. (refer plate 19).

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