

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

**An evaluation of the ecology and riparian management  
of the south branch of the Whareroa Stream,  
Paekakariki**

A thesis presented in partial fulfilment of the requirements for the  
degree of  
Master of Applied Science  
in  
Natural Resource Management  
at Massey University, Palmerston North,  
New Zealand

**Karen Thelma Palmer**

**2008**

---

## Abstract

Whareroa Farm, Mackays Crossing, Paekakariki, was bought by the Department of Conservation in 2005. The goal was to effect the restoration of a corridor for flora and fauna from the Akatarawa Forest in the east to Queen Elizabeth Park and the sea in the west. The south branch of the Whareroa Stream, which arises as a series of tributaries from a ridge 272m above sea level, traverses Whareroa Farm and the adjacent Queen Elizabeth Park. It was thought likely that the stream had been severely affected ecologically during a century of cattle and sheep farming, though the degree to which the ecological degradation had occurred was unknown. Obvious deforestation and land use changes suggested that, in concert with many other New Zealand hill country farms, the ecological changes would be significant.

To establish and quantify the degree of degradation, the Auckland Regional Council (ARC) Stream Environment Valuation (SEV) protocol was applied to the Whareroa Stream and its tributaries. Five sites were selected for valuation, varying from open pasture to bush covered and open parkland. The resulting SEV scores showed losses of ecological value ranging from 32% to 46% across the sites.

The Macroinvertebrate Community Index (MCI) and the fish Index of Biological Integrity (IBI) were measured at each site. Results indicated that aquatic habitats were unable to sustain adequate assemblages at four of the five sites.

The valuations of the riparian zones at each site used the River Environment Classification (REC) and Riparian Management Classification (RMC) protocols. The results indicated that current riparian characteristics showed poor to absent effective riparian zones from the headwaters to the sea at all sites. Riparian zones are pivotal to the provision of stream ecological integrity and are responsible for maintaining the longitudinal, lateral and vertical connectivity between a stream, its network and its surrounding land. The loss of in-stream organic matter from lack of riparian vegetation together with the loss of effective temperature control from lack of shade, impacts negatively on the habitats for macroinvertebrates and fish. This was highlighted in the Whareroa Stream network.

While the SEV and RMC evaluations showed that, with best practice management plans, there was great potential for improvement of the Whareroa Stream ecology, any riparian restoration would require sympathetic and improved fencing, withdrawal of stock from stream access and the retirement of headwater land from pastoral use. The loss of ecological integrity that occurs as a result of prolonged land use changes from forest to agriculture is well illustrated by the situation in the south branch of the Whareroa Stream and its tributaries.

---

## **Explanation of text**

This thesis will be presented as two papers with a general introduction. Some of the information will be presented in both Chapters 2 and 3 where this is relevant. Inevitably this will lead to some repetition.

## **Acknowledgements**

Particular thanks to Dr Mike Joy, my supervisor, who suggested this study and then advised, encouraged and supported me for its duration, including the statistical manoeuvres and computing errors I seemed to attract.

My thanks also to Ian Cooksley, DOC regional manager for Kapiti; Chris Wootton and Michelle Bird, rangers for the West Coast with Greater Wellington Regional Council; Nikki Lamonica, ranger at Queen Elizabeth Park; the Whareroa Guardians Community Trust; and Don Webster, shepherd at Whareroa Farm, for their support and assistance with access and fieldwork.

I appreciated the support of the Ecology Department personnel who allowed me to use the Ecology Laboratory and provided the equipment required for the fieldwork, and to fellow students who included me in the 'Stream Team' and kept me encouraged when times were 'tough'.

I am grateful to Massey University Scholarships Committee for awarding me financial assistance towards the fieldwork from the Albert & Alexis Dennis Donation.

## Table of Contents

	<b>Page</b>
<b>Abstract</b> .....	i
<b>Explanation of text</b> .....	iii
<b>Acknowledgements</b> .....	iii
<b>Table of Contents</b> .....	iv
<b>Indices of Tables, Maps, Figures</b> .....	v
 <b>Chapter One</b> .....	 1
General Introduction .....	1
 <b>Chapter Two</b> .....	 12
The Whareroa Streams – an ecological valuation .....	12
 <b>Chapter Three</b> .....	 69
The Whareroa Streams – a riparian assessment .....	69
 <b>Chapter Four</b> .....	 110
General discussion .....	110
 <b>Appendices</b> .....	 115

## Index of Tables

	Page
1. Key functions of a stream ecosystem with functional indicators that comprise their assessment .....	28
2. MCI/QMCI. Degradation categories with Macroinvertebrate Community Index (MCI) and Quantative Macroinvertebrate Community Index (QMCI) (from Stark, 1998).....	33
3. Definitions of Turbidity .....	35
4. Definitions of Conductivity .....	35
5. Ecological function scores for the Whareroa stream study reaches (after Rowe <i>et al</i> , 2006) .....	38
6. Summary of Functional scores for each reach (as percentages) and the final SEV score as per the ARC stream valuation protocol (after Rowe <i>et al</i> , 2006) .....	39
7. MCI & QMCI & water quality .....	43
8. Comparison of MCI, QMCI and EPT scores in spring 2006 and autumn 2007 at each site .....	43
9. Distribution of macroinvertebrates according to season and elevation .....	44
10. Metrics calculated for invertebrate communities collected at each site in Nov 2006 and March 2007.....	45
11. Simpson's Diversity Score data .....	47
12. Distribution of fish and decapods at study sites.....	48
13. Fish IBI .....	49
14. Results of 1985 days of temperature recordings .....	52
15. Results of turbidity survey .....	55
16. pH and conductivity measurements .....	56
17. REC definitions.....	83
18. Effective shade from various stream widths .....	85
19. River Environment Classification of the Whareroa Streams in order of impact on environment (Snelder & Biggs, 2004) .....	87
20. Summary of stream and riparian characteristics .....	89

21.	Summary of current (_C) and potential (_P) riparian activity at study sites on the Whareroa Stream. Scores range from 0 = not active to 5 = very highly active (Quinn, 2003).	91
22.	Potential for change - average improvements of function expected across the five sites.	92
23.	RMC-C and RMC-P associated with channel width	93
24.	Dominant riparian vegetation list	97
25.	Summary of sites' riparian ratings	100

### **Index of Maps**

1.	Whareroa Farm 1983	9
2.	Study sites 2006-2007	20
3.	Proposed retirement of land by DOC, May 2007.	76
4.	2006 proposal for Whareroa Farm and Queen Elizabeth Park	113

## Index of Figures

	Page
1. Whareroa Farm from SH1 at Mackays Crossing.....	3
2. Remnant bush in central valley, Whareroa Farm.....	7
3. Site A, Queen Elizabeth Park.....	23
4. Site B, Queen Elizabeth Park.....	24
5. Site C, Whareroa Farm.....	25
6. Site D, Whareroa Farm.....	26
7. Site E, Ramaroa Stream, Whareroa Farm.....	27
8. NMDS ordination of Axis 1 against Axis 2 for the 5 sites using macroinvertebrate communities.....	40
9. Biplot graph showing the SEV factors that affected the macroinvertebrate assemblages.....	41
10. A biplot graph showing the NMDS ordination of invertebrate communities with individual species with correlation coefficient >0.5 as the biplot.....	42
11. The spring distribution of the top 10 macroinvertebrates.....	46
12. The late summer distribution of the top 10 macroinvertebrates.....	47
13. Simpson's Diversity Index.....	47
14. Longfin eels ( <i>Anguilla dieffenbachia</i> ) at site A.....	50
15. Koura ( <i>Paranephrops</i> ) from site B.....	50
16. Koara ( <i>Galaxias brevipinnis</i> ) from site D.....	51
17. Redfin bully ( <i>Gobiomorphus huttoni</i> ) from site B.....	51
18. Temperature variations at sites A, B, D & E.....	53
19. Temperature Amplitude at site A, B, D, & E.....	54
20. Site A riparian zone.....	78
21. Site B riparian zone.....	79
22. Site C riparian zone.....	80
23. Site D riparian zone.....	81
24. Site E riparian zone.....	82
25. <i>Carex secta</i> near site C.....	88
26. Site C bank damage.....	90
27. Maximum-minimum temperatures and amplitudes.....	94
28. Variegated thistle ( <i>Sybilum marianum</i> ).....	96
29. Dominant riparian vegetation.....	98